Ecological site R025XY075NV
MAHOGANY SAVANNA 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

This site occurs on gently rolling to very steep mountain sideslopes. Slopes range from 8 to 50 percent, but slope gradients of 15 to 50 percent are most typical. Elevations range from 6,400 to over 10,000 feet.

The soils associated with this site are typically shallow to deep and well drained to somewhat excessively drained. These soils have high volumes of rock fragments throughout the profile. Available water holding capacity is moderate. Runoff is very high.

The reference plant community is dominated by curlleaf mountainmahogany. Mountain snowberry is the principal understory shrub. Idaho fescue, basin wildrye, mountain brome and needlegrass are the most prevalent understory grasses.

Associated sites

F025XY065NV	**Backslope Aspen**
R025XY004NV	**LOAMY SLOPE 16+ P.Z.**
R025XY030NV	**MAHOGANY THICKET**

Similar sites

R025XY030NV	**MAHOGANY THICKET** More productive overstory canopy; overstory conopy cover greater than or equal to 50 percent

R025XY031NV	**STONY MAHOGANY SAVANNA** Less productive site; associated with rock outcrop; overstory canopy cover less than or equal to 25 percent
R025XY075NV	**MAHOGANY SAVANNA 16+ P.Z.** FEID-PSSPS codominant understory grasses; lower elevations

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Cercocarpus ledifolius* (2) *Artemisia tridentata subsp. vaseyana*
Herbaceous	(1) *Festuca idahoensis*

Physiographic features

This site occurs on gently rolling to very steep mountain sideslopes. Slopes range from 8 to 50 percent, but slope gradients of 15 to 50 percent are most typical. Elevations are 6400 to over 10000 feet.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	1,951–3,048 m
Slope	8–50%
Water table depth	183 cm
Aspect	Aspect is not a significant factor

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 14 or more inches. Mean annual air temperature is typically <45 degrees F. The average growing season is about 60 to 90 days.

Mean annual precipitation across the range in which this ES occurs is 18.58".

Monthly mean precipitation: January 1.65”; February 1.68”; March 1.98”; April 2.43”; May 2.41”; June 1.62”; July 0.61”; August 0.63”; September 0.84”; October 1.41”; November 1.51”; December 1.79”.

*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)	90-93 days
Precipitation total (characteristic range)	356-406 mm
Frost-free period (actual range)	52-56 days
Freeze-free period (actual range)	89-94 days
Precipitation total (actual range)	356-432 mm

Frost-free period (average)	54 days
Freeze-free period (average)	92 days
Precipitation total (average)	381 mm

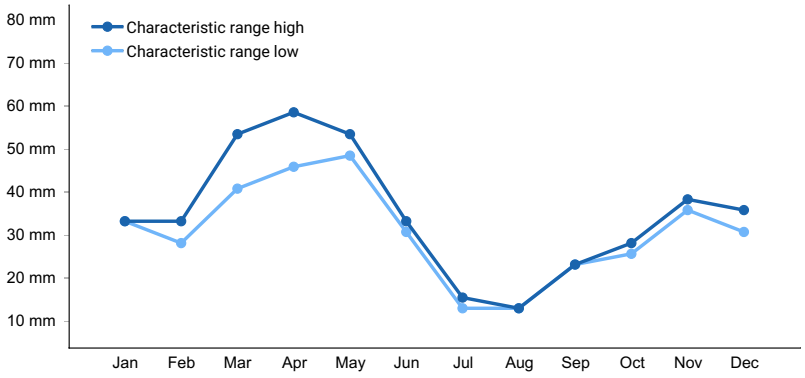


Figure 1. Monthly precipitation range

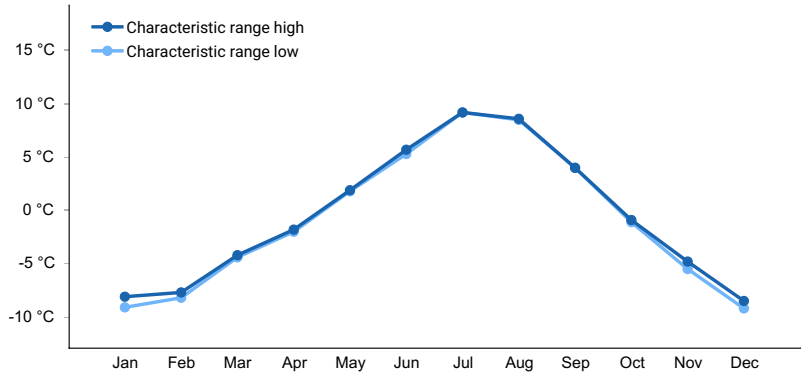


Figure 2. Monthly minimum temperature range

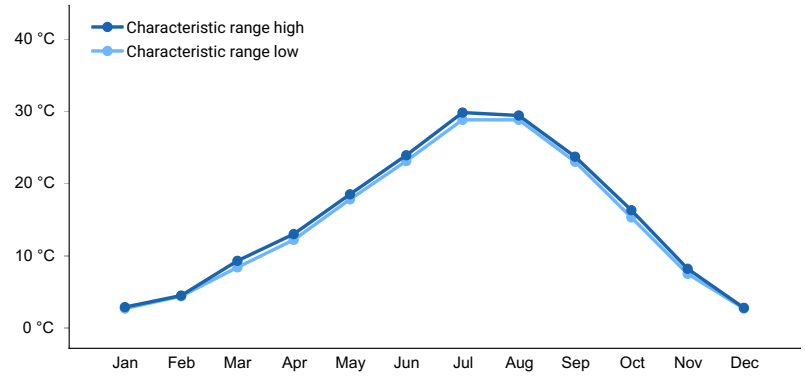


Figure 3. Monthly maximum temperature range

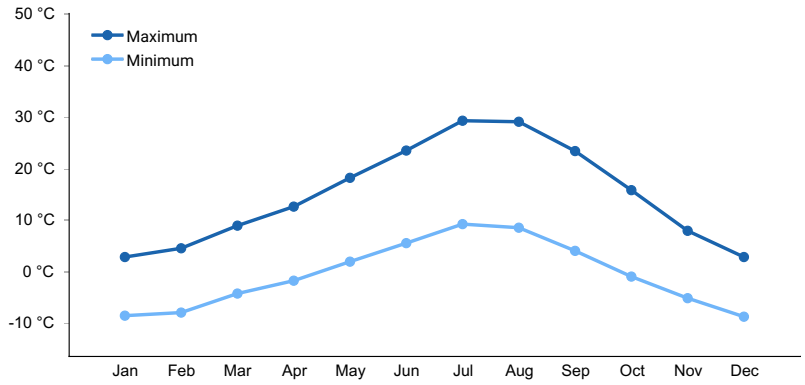


Figure 4. Monthly average minimum and maximum temperature

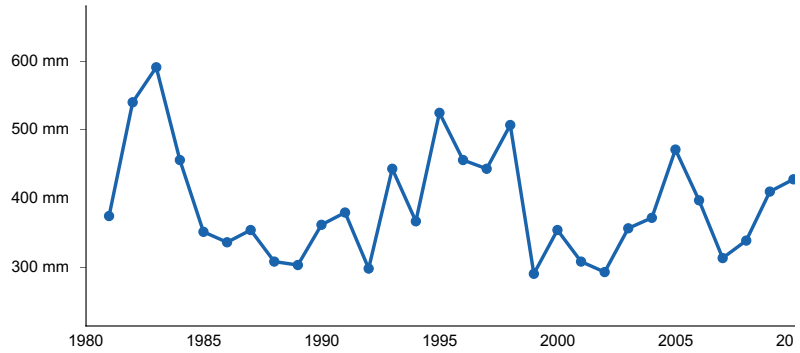


Figure 5. Annual precipitation pattern

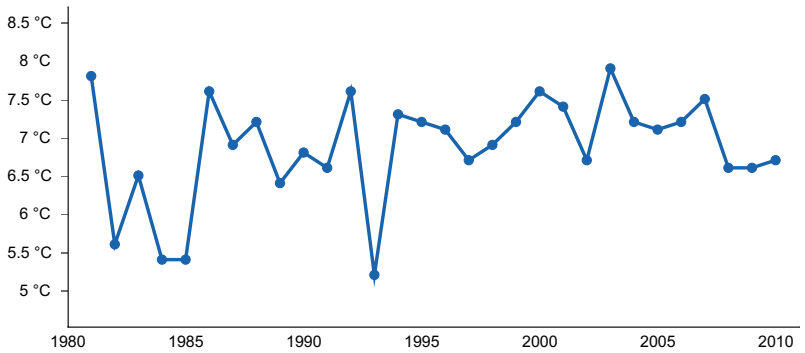


Figure 6. Annual average temperature pattern

Climate stations used

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

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils are typically shallow to deep and well drained to somewhat excessively drained. These soils have high volumes of rock fragments throughout the profile. Available water holding capacity is moderate. Runoff is very high.

The soil series correlated to this site include: Alta, Denihler, Labshaft and Udelope.

Table 4. Representative soil features

Parent material	(1) Colluvium (2) Residuum
Surface texture	(1) Very stony loam (2) Bouldery sandy loam (3) Sandy loam
Family particle size	(1) Loamy (2) Loamy-skeletal (3) Sandy-skeletal
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	20–152 cm
Soil depth	20–152 cm

Surface fragment cover <=3"	0–31%
Surface fragment cover >3"	2–29%
Available water capacity (0-101.6cm)	4.32–7.11 cm
Calcium carbonate equivalent (0-101.6cm)	0%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	5.6–9
Subsurface fragment volume <=3" (Depth not specified)	5–32%
Subsurface fragment volume >3" (Depth not specified)	4–25%

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).

The Great Basin vegetative 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 the 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 uptake via the decomposition of dead plant material following disturbance. The invasion of cheatgrass has been linked to disturbances (fire, abusive grazing) that have resulted in fluctuations in resources (Chambers et al. 2007). Dobrowolski et al. (1990) cite multiple authors on the extent of the soil profile exploited by the competitive exotic annual cheatgrass. Specifically, the depth of rooting is dependent on the size the plant achieves and in competitive environments, cheatgrass roots were found to penetrate only 15 cm whereas isolated plants and pure stands were found to root at least one meter in depth with some plants rooting as deep as 1.5 to 1.7 meters.

This ecological site is dominated by the long-lived curl-leaf mountain mahogany, deep-rooted cool season perennial bunchgrasses, and long-lived shrubs (50+ years) with high root to shoot ratios. The dominant shrubs in this ecological site 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). Though perennial bunchgrasses generally have somewhat shallower root systems than the shrubs, root densities are often as high as or higher than those of shrubs in the upper 0.5 meters. General differences in root depth distributions between grasses and shrubs results in resource partitioning in this system.

Curl-leaf mountain mahogany is a multi-branched, evergreen shrub or tree extending from 3 to over 20 feet in height. The rooting of mountain mahogany is spreading and limited by the depth to bedrock. Youngberg and Hu (1972) reported in an Oregon study that curl-leaf mountain mahogany produces nitrogen-fixing root nodules. They also reported that nodulated plants had the highest amounts of nitrogen in the leaves. Most often, curl-leaf mountain mahogany stands occur on warm, dry, rocky ridges or outcrops where fire would be an infrequent occurrence

(USDA 1937). Dealy (1975) and Scheldt (1969) found that mahogany trees were larger and older on fire-resistant rocky sites and were the seed source if fire destroyed the non-rocky portion of the site.

Curl-leaf mahogany plants are long-lived and can reach 1,300+ years of age (Schultz 1987, Schultz et al. 1990). As mahogany stands increase in average age, average canopy volume and height of the individuals present also increases. As average canopy height and volume increase, stand density declines (Schultz et al 1991). Stands with a closed, or nearly closed canopy often have few or no young curl-leaf mahogany (i.e., recruitment) in the understory (Schultz et al. 1990, 1991), despite high seed density beneath trees (Russell and Schupp 1998, Ibanez and Schupp 2002). Intraspecific competition reduces the growth rates of all age classes below the potential growth rates for the species. Competition may also increase mortality in the younger plants.

Curl-leaf mahogany plants are very self-compatible for pollination and most developing seed matures and is viable (Russell et al. 1998). The deep litter throughout stands with high canopy cover appears to facilitate seed germination but retard seedling survival due to poor contact between the root and the soil (Schultz et al. 1996, Ibanez and Schupp 2001). Reproduction in large stands with high canopy cover occurs most often in canopy gaps where a tree has died and an increase in exposure of bare ground occurs, or around the perimeter of the stand under sagebrush plants where there is less, typically shallow litter cover (Schultz 1987, Schultz et al. 1991).

Mahogany seeds require bare mineral soil to germinate and litter depths over 0.25 inches can impede recruitment (Gruell 1985, Schultz et al. 1991, Ibáñez et al. 1998, Ibáñez 2002). Once germination occurs, the seedlings exhibit rapid growth in relation to top growth, providing some resistance to drought and competition with invasive species (Dealy 1975). Multiple sources (Schultz et al. 1996, Ibáñez et al. 1999) found that mahogany seedlings germinate abundantly under the canopy of adult plants but rarely successfully establish there due to shading and higher litter amounts. In addition, Schultz et al. (1996) found that seedlings had significantly higher long-term success in areas dominated by sagebrush canopy than in areas under mahogany canopy or in interspaces. Some hypothesize that the light shading and hydraulic lift provided by sagebrush may create a microsite facilitating mahogany recruitment (Gruell 1985, Ibáñez et al. 1999). Dealy (1975) reported that curl-leaf mahogany seedlings have a mean taproot length of 0.97 meters after 120 days. The mean top height was slightly less than 2.5 centimeters. Multiple sources (Schultz et al. 1996, Ibáñez et al. 1998) found that mahogany seedlings germinate abundantly under the canopy of adult plants but rarely successfully establish there due to shading and higher litter amounts. In addition, Schultz et al. (1996) found that seedlings had significantly higher long term success in areas dominated by sagebrush canopy than in areas under mahogany canopy or in interspaces.

Mountain big sagebrush is generally long-lived; therefore it is unnecessary for new individuals to recruit every year for perpetuation of the stand. Simultaneous low, continuous recruitment and infrequent large recruitment events and is the foundation of population maintenance (Noy-Meir 1973). Survival of the seedlings is dependent on adequate moisture conditions.

The perennial bunchgrasses that are dominant includes Idaho fescue. This species generally have shallower root systems than the shrubs, but root densities are often as high as or higher than those of shrubs in the upper 0.5 m of the soil profile. General differences in root depth distributions between grasses and shrubs results in resource partitioning in these shrub/grass systems.

Idaho fescue is a perennial cool-season bunchgrass. It produces an extensive and deep root system (Ogle et al. 2008). It is fairly drought tolerant and is moderately shade tolerant (Ogle et al. 2008). It is capable of persisting under dense canopies of mountain mahogany for longer periods of time than other bunchgrasses.

Basin wildrye is weakly rhizomatous and has been found to root to depths of up to 2 meters and to exhibit greater lateral root spread than many other grass species (Reynolds and Fraley 1989, Abbott et al. 1991). Basin wildrye is a large, cool-season perennial bunchgrass with an extensive deep coarse fibrous root system (Reynolds and Fraley 1989). Clumps may reach up to 6 feet in height (Ogle et al. 2012). Basin wildrye does not tolerate long periods of inundation; it prefers cycles of wet winters and dry summers and is most commonly found in deep soils with high water holding capacities or seasonally high water tables (Perryman and Skinner. 2007, Ogle et al. 2012).

Mahogany stands are susceptible to drought, frost, and invasion by non-native species, especially cheatgrass (*Bromus tectorum*). Cheatgrass affects mahogany seedling growth by competing for water resources and nutrients in an area (Ross 1999).

This ecological site has moderate to high resilience to disturbance and resistance to invasion. Resilience increases with elevation, aspect, precipitation, and nutrient availability. Long-term disturbance response may be influenced by small differences in landscape topography. Two possible states have been identified for this ecological site.

Fire Ecology
The fire return interval in curl-leaf mountain mahogany dominated sites is not well documented, however, a study conducted by Arno and Wilson (1986) suggested sites of curl-leaf mountain mahogany with ponderosa pine had fire return intervals of 13 to 22 years before 1900. Fire frequency most likely depends on surrounding vegetation. Most often curl-leaf mountain mahogany stands occur on warm, dry, rocky ridges or outcrops where fire would be an infrequent occurrence (USDA Forest Service 1937). Dealy (1974) and Scheldt (1969) found that mahogany trees were larger and older on fire-resistant rocky sites and were the seed source if fire destroyed the non-rocky portion of the site. Mahogany will persist longest in rocky areas where it is protected from fire. Because of their thicker bark, mature trees can often survive low-severity fires (Gruell 1985). Curl-leaf mountain mahogany is considered a weak sprouter after fire. It is usually moderately to severely damaged by severe fires and the recovery time of these sites is variable; some measurements show that stands lack recruitment for up to 30 years post-fire (Gruell 1985).

Mountain big sagebrush is killed by fire (Neuenschwander 1980, Blaisdell et al. 1982), and does not resprout (Blaisdell 1953). Post-fire regeneration occurs from seed and will vary depending on site characteristics, seed source, and fire characteristics. Mountain big sagebrush seedlings can grow rapidly and may reach reproductive maturity within 3 to 5 years (Bunting et al. 1987). Mountain big sagebrush may return to pre-burn density and cover within 15 to 20 years following fire, but establishment after severe fires may proceed more slowly (Bunting et al. 1987).
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 factor into individual species' responses. For most forbs and grasses, the growing points are located at or below the soil surface, providing relative protection from disturbances which decrease above ground biomass such as grazing or fire. Thus, fire mortality is more correlated to duration and intensity of heat which is related to culm density, culm-leaf morphology, size of plant and abundance of old growth (Wright 1971, Young 1983).

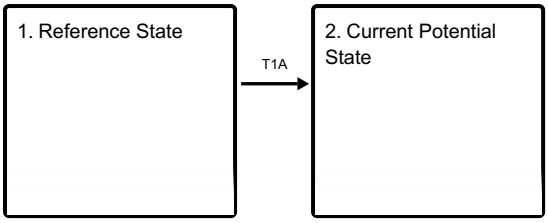
Idaho fescue's response to fire varies with condition and size of the plant, season and severity of fire, and ecological conditions. Idaho fescue can generally survive light-severity fires, but can be severely damaged by fire in all seasons (Wright et al. 1979, Wright 1985). Rapid burns have been found to leave little damage to root crowns, and new tillers are produced with onset of fall moisture (Johnson et al. 1994). However, another study found the dense, fine leaves of Idaho fescue provided enough fuel to burn for hours after a fire had passed, thereby killing or seriously injuring the plant regardless of the intensity of the fire (Wright et al. 1979). Rapid tillering can occur after fire when root crowns are not killed and soil moisture is favorable (Johnson et al. 1994, Robberecht and Defossé 1995). Initial mortality may be high (in excess of 75%) on severe burns, but usually varies from 20 to 50% (Barrington et al. 1989). Basin wildrye is relatively resistant to fire, particularly dormant season fire, as plants sprout from surviving root crowns and rhizomes (Zschaechner 1985).

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, Rau et al. 2008). 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 facilitate the establishment of an annual weed community with varying amounts of Sandberg bluegrass and rabbitbrush.

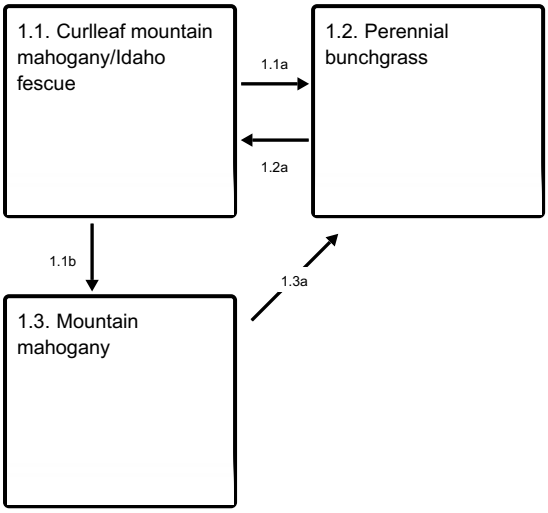
Depending on fire severity, snowberry and other sprouting shrubs may increase after fire. Snowberry is top-killed by fire, but resprouts after fire from rhizomes (Leege and Hickey 1971, Noste and Bushey 1987). Snowberry has been noted to regenerate well and exceed pre-burn biomass in the third season after a fire (Merrill et al. 1982). Yellow rabbitbrush has a large taproot root system and is known to be shorter lived and less competitive than sagebrush. Seedling density, flower production, and shoot growth decline as competition from other species increases (McKell and Chilcote 1957, Miller et al. 2013). Yellow rabbitbrush is top-killed by fire, but sprouts vigorously after fire (Kuntz 1982, Akinsoji 1988). If balsamroot or mules-ears are common before fire, these plants will increase after fire or with heavy grazing (Wright 1985).

State and transition model

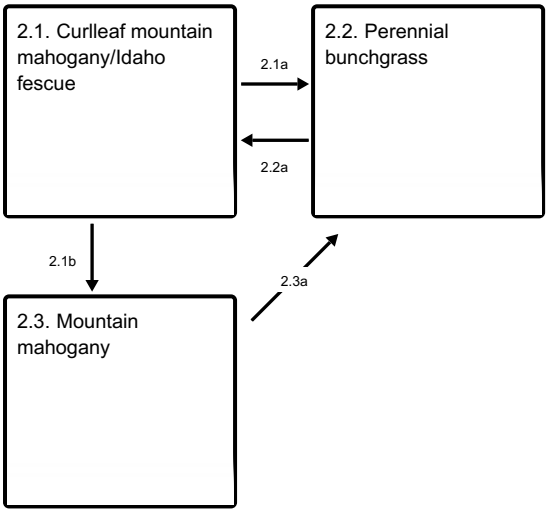
Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



State 1
Reference State

The Reference State represents the natural range of variability under pristine conditions. The reference state has three general community phases: a mahogany/shrub/grass-dominant phase, a perennial grass-dominant phase and a mahogany 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 long-term drought and/or insect or disease attack.

Community 1.1
Curlleaf mountain mahogany/Idaho fescue

The reference plant community is dominated by curlleaf mountain mahogany. Mountain snowberry is the principal understory shrub. Idaho fescue, basin wildrye, mountain brome and needlegrass are the most prevalent understory grasses. Total overstory canopy cover is less than 50 percent (±35 percent). Understory vegetation comprises

about 20 percent of the total site production. Potential vegetative composition for the understory is about 60 percent grasses, 10 percent forbs and 30 percent shrubs. Total annual air-dry production for all trees, shrubs and herbaceous plants in the understory to a height of 4.5 feet is 600 pounds for an unfavorable year, 800 pounds for a normal year and 1000 pounds for a favorable year. Overstory trees and tree-like shrub composition is about 80 percent of the total site production.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	1765	2012	2259
Grass/Grasslike	278	426	574
Shrub/Vine	152	300	448
Forb	45	90	135
Total	**2240**	**2828**	**3416**

Community 1.2
Perennial bunchgrass

Perennial bunchgrasses such as Idaho fescue, basin wildrye, needlegrasses and others dominate this community phase. Sprouting shrubs such as mountain snowberry, Utah serviceberry and rabbitbrush make up the overstory. Mountain big sagebrush may occur in unburned patches. Forbs are also present in the understory. Mountain mahogany may or may not be present.

Community 1.3
Mountain mahogany

Figure 8. Mahogany Savanna 16+" (R025XY075NV) Phase 1.3. T. Stringham August 2011

Figure 9. Mahogany Savanna 16+" (R025XY075NV) Phase 1.3. P. Novak-Echenique August 2011

Mountain mahogany increases to greater than 50 percent of the total canopy cover of the site. Mountain big sagebrush and Idaho fescue in the understory decrease. Mountain snowberry may be increasing.

Pathway 1.1a
Community 1.1 to 1.2

Low-severity fire can reduce the mahogany overstory and allow for the understory species to dominate the site. Due to low fuel loads, fires will typically be low severity, resulting in a mosaic pattern.

Pathway 1.1b
Community 1.1 to 1.3

Time and lack of disturbance such as fire allows the mountain mahogany to increase. The shrub and herbaceous understory components decline due to increased shading from the trees. Excessive herbivory may also decrease the perennial grass understory.

Pathway 1.2a
Community 1.2 to 1.1

Time and lack of disturbance such as fire or excessive herbivory allows the mountain mahogany to increase. The shrub and herbaceous understory components decline due to increased shading from the trees. Excessive herbivory may also decrease the perennial grass understory.

Pathway 1.3a
Community 1.3 to 1.2

A low-severity fire, snow loading, or insect damage will decrease the overstory and allow for the herbaceous plants in the understory to increase.

State 2
Current Potential State

This state is similar to the Reference State 1.0. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. This state has the same three general community phases. 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 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
Curlleaf mountain mahogany/Idaho fescue

This community phase is similar to the Reference State Community Phase 1.1, with the presence of non-native species in trace amounts. This community phase is characterized by mountain big sagebrush, mountain snowberry, Idaho fescue and basin wildrye with a curl-leaf mountain mahogany overstory.

Community 2.2
Perennial bunchgrass

This community phase is characteristic of a post-disturbance, early seral community where annual non-native species are present. Mahogany and sagebrush are present in trace amounts. Snowberry and rabbitbrush are sprouting or increasing; perennial bunchgrasses may dominate the site. Annual non-native species are stable or increasing within the community.

Community 2.3
Mountain mahogany

Curl-leaf mountain mahogany dominates the overstory. Big sagebrush, snowberry and rabbitbrush increase. Perennial bunchgrass understory is reduced. Annual non-native species are stable to increasing. Bare ground may be increasing. Mahogany may have a "hedged" or tree-like appearance from many years of browsing by deer. Scattered Utah juniper trees may be present and increasing on the site.

Pathway 2.1a
Community 2.1 to 2.2

Fire reduces the overstory and allows for the understory species to dominate the site. Due to low fuel loads, fires are typically low severity resulting in a mosaic pattern of shrubs and grasses. A fire may be more severe following an unusually wet spring or a change in management favoring an increase in fine fuels. Annual non-native species generally respond well after fire and may be stable or increasing within the community.

Pathway 2.1b
Community 2.1 to 2.3

Time and lack of disturbance allows the mountain mahogany component to increase. The shrub and herbaceous understory components decline due to increased shading and competition from the trees. Inappropriate grazing management may also decrease the perennial 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 woody species allows Curl-leaf mountain mahogany and understory shrubs to re-establish. Inappropriate grazing management may also decrease the perennial understory.

Pathway 2.3a
Community 2.3 to 2.2

Low-severity fire, damage from snow loading, or insects will reduce the overstory and allow for the perennial bunchgrasses in the understory to increase. A fire may be more severe following an unusually wet spring or a change in management favoring an increase in fine fuels. Annual non-native species generally respond well after fire and may be stable or increasing within 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 thistle. Slow variables: Over time annual non-native species increase within the community and organic matter inputs are decreased. 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.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			278–574	
	Idaho fescue	FEID	*Festuca idahoensis*	179–269	–
	basin wildrye	LECI4	*Leymus cinereus*	45–90	–
	mountain brome	BRMA4	*Bromus marginatus*	18–72	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	18–72	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	9–36	–
	western needlegrass	ACOC3	*Achnatherum occidentale*	9–36	–
2	**Secondary Perennial Grasses/Grasslikes**			18–90	
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	20–118	–
	sedge	CAREX	*Carex*	20–118	–
	big squirreltail	ELMU3	*Elymus multisetus*	20–118	–
	bluegrass	POA	*Poa*	20–118	–
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	20–118	–
Forb					
3	**Perennial**			45–135	
	western yarrow	ACMIO	*Achillea millefolium var. occidentalis*	20–118	–
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	20–118	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	20–118	–
	mule-ears	WYAM	*Wyethia amplexicaulis*	20–118	–
	sedge	CAREX	*Carex*	3–18	–
Shrub/Vine					
4	**Primary Shrubs**			135–359	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	90–224	–
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	45–135	–
5	**Secondary Shrubs**			18–90	
	Utah serviceberry	AMUT	*Amelanchier utahensis*	39–118	–
	yellow rabbitbrush	CHVIL4	*Chrysothamnus viscidiflorus ssp. lanceolatus*	39–118	–
	rockspirea	HODU	*Holodiscus dumosus*	39–118	–
Tree					
6	**Evergreen**			1765–2158	
	curl-leaf mountain mahogany	CELE3	*Cercocarpus ledifolius*	1765–2158	–
7	**Deciduous**			1–101	
	quaking aspen	POTR5	*Populus tremuloides*	20–39	–

Animal community

Livestock Interpretations:
This site is suited for livestock grazing. Considerations for grazing management include timing, intensity and duration of grazing.

Overgrazing by livestock and/or wildlife will cause a reduction in deep-rooted perennial bunchgrasses in the understory. Bluebunch wheatgrass and needlegrasses may be particularly affected. As perennial grass cover

declines, the potential for invasion by annual non-native species is increased. With the reduction in competition from these grasses bunchgrasses, shallower-rooted grasses such as bluegrass and forbs may increase (Smoliak et al. 1972). Bare ground also increases in this scenario.

The early growth and abundant production of basin wildrye make it a valuable source of forage for livestock. It is important for cattle and is readily grazed by both cattle and horses in the early spring and fall. Though coarse-textured during the winter, it may be utilized more frequently by livestock and wildlife when snow has covered low shrubs and other grasses.

Mountain big sagebrush is eaten by domestic livestock but has long been considered to be of low palatability, and a competitor to more desirable species.

Stocking rates vary over time depending upon season of use, climate variations, site, and previous and current management goals. A safe starting stocking rate is an estimated stocking rate that is fine-tuned by the client by adaptive management through the year and from year to year.

Wildlife Interpretations:
This site provides breeding and hunting grounds for mountain lions, Puma concolor (Steele et al. 1981, Gucker 2006). Lions utilize curl-leaf mountain mahogany vegetation as an important site for caching kills; one study showed that of 52 mountain lion caches, 33 percent were located in curl-leaf mountain mahogany vegetation (Logan and Irwin 1985).
Bird species utilize mountain mahogany habitat types heavily. Virginia's warblers (Oreothylypis virginae) were recorded in their second highest densities in the state in mountain mahogany habitats. This habitat type also provides important nesting sites for dusky flycatchers (Empidonax oberholseri), rock wrens (Salpinctes obsoletus), and American kestrels (Falco sparverius) (Wildlife Action Plan Team 2012).

Idaho fescue provides important forage for several wildlife species. It is reported to be good forage for pronghorn, and deer in ranges of northern Nevada. Basin wildrye provides winter forage for mule deer, though use is often low compared to other native grasses. Basin wildrye provides summer forage for black-tailed jackrabbits. Because basin wildrye remains green throughout early summer, it remains available for small mammal forage for longer time than other grasses.

Curl-leaf mountain mahogany is an important cover and browse species for big game such as elk (Cervus canadensis), mule deer (Odocoileus heminous), pronghorn antelope (Antilocarpra americana), and bighorn sheep (Ovis canadensis) (Lanner 1983, Furniss 1988, Sabo et al. 2005). Sampson and Jespersen (1963) state that curl-leaf mountain mahogany is excellent browse for mule deer, and domestic livestock will browse this plant to varying degrees in all seasons except summer. It is not uncommon for these trees to develop a "hedged" appearance after years of regular browsing by wildlife. Curl-leaf mountain mahogany is consumed widely by mule deer throughout the year (Olsen 1992). In fact, mule deer fecal pellets were observed to contain curl-leaf mountain mahogany year-round, with the highest frequency of leaves found in winter (Gucker 2006). Mule deer will use curl-leaf mountain mahogany for cover as well (Steele et al. 1981). In addition, a variety of small mammals consume curl-leaf mountain mahogany seeds (Gucker 2006, Wildlife Action Plan Team 2012). Curl-leaf mountain mahogany leaves and fruits have also been found in bushy-tailed woodrat (Neotoma cinerea) middens (Gucker 2006).

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.

Common snowberry is considered important browse for many types of wildlife. Bighorn sheep use common snowberry regularly during the summer. Forage value to elk is fair. Common snowberry is important as both cover and food for bird and small mammal populations. These include sharp-tailed, ruffed, and blue grouse, wild turkey and, several non-game species of bird including the kingbird, western flycatcher, and western bluebird. Among

small mammals that rely on common snowberry are fox squirrels, desert cottontails, and pocket gopher.

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

Basin wildrye was used as bedding for various Native American ceremonies, providing a cool place for dancers to stand. 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.

Other information

Curlleaf mountainmahogany may be planted to help stabilize soil in disturbed areas such as roadcuts and mine spoils. Basin wildrye is useful in mine reclamation, fire rehabilitation and stabilizing disturbed areas. Its usefulness in range seeding, however, may be limited by initially weak stand establishment.

Inventory data references

NV-ECS-1 - 2 records

Soils and Physiographic features were gathered from NASIS.

Type locality

Location 1: Elko County, NV	
Township/Range/Section	T34 N R60 E S6
General legal description	NW¼SE¼ Section 6, T34N. R60E. MDBM. About 2 miles west of Secret Pass on trail leading to Secret Peak, Ruby Mountains, Humboldt-Toiyobe NF, Elko County, Nevada.
Location 2: Elko County, NV	
Township/Range/Section	T32 N R58 E S19
General legal description	Elko County, Nevada about 2.5 miles up Lamoille Canyon from Powerhouse picnic area in the Ruby Mountains; about 420 feet south and 770 feet east of the northwest corner section 16, T. 32 N., R. 58 E
Location 3: Elko County, NV	
Township/Range/Section	T47 N R63 E S16
General legal description	NE¼NE¼ Section 16, T47N. R63E. MDBM. About 8 miles west of Jackpot, Brown's Bench area, Elko County, Nevada.

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Contributors

GKB

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	11/27/2024
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:**

_____

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

_____

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant:

    Sub-dominant:

    Other:

    Additional:

_____

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

_____

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

_____

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

16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

17. **Perennial plant reproductive capability:**