Ecological site R025XY012NV
LOAMY SLOPE 12-16 P.Z.

Last updated: 4/24/2024
Accessed: 05/05/2024

General information

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

MLRA notes

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

The Owyhee High Plateau, MLRA 25, lies within the Intermontane Plateaus physiographic province. The southern half is found in the Great Basin while the northern half is located in the Columbia Plateaus. The southern section of the Owyhee High Plateau is characterized by isolated, uplifted fault-block mountain ranges separated by narrow, aggraded desert plains. This geologically older terrain has been dissected by numerous streams draining to the Humboldt River. The northern section forms the southern boundary of the extensive Columbia Plateau basalt flows. Deep, narrow canyons drain to the Snake River across the broad volcanic plain.

This MLRA is characteristically cooler and wetter than the neighboring MLRAs of the Great Basin. Elevation ranges from 3,000 to 7,550 feet on rolling plateaus and in gently sloping basins. It is more than 9,840 feet on some steep mountains. The average annual precipitation in most of this area is typically 11 to 22 inches. It increases to as much as 49 inches at the higher elevations. Precipitation occurs mainly as snow in winter. The supply of water from precipitation and streamflow is small and unreliable, except along major rivers. Streamflow depends largely on accumulated snow in the mountains.

The dominant soil orders in this MLRA are Aridisols and Mollisols. The soils in the area dominantly have a mesic or frigid temperature regime and an aridic, arid bordering on xeric, or xeric moisture regime. Most of the soils formed in mixed parent material. Volcanic ash and loess mantle the landscape. Surface soil textures are loam and silt loam, and have ashy texture modifiers in some cases. Argillic horizons occur on the more stable landforms.

Ecological site concept

This ecological site is on side slopes of hills and mountains on all aspects. Soils associated with this site are deep, well drained, and formed in residuum and colluvium derived from volcanic rock and chert. Slopes are less than 30 percent and elevations range from 5,800-8,0000 feet (1,768 -2,438 meters). Important abiotic factors contributing to the presence of this ecological site include soils 39 inches (100cm) deep or less, a soil profile characterized by less than 28 percent clay in the particle size control section, and relatively gentle slopes. The reference plant community is dominated by mountain big sagebrush, Idaho fescue, and bluebunch wheatgrass.

Associated sites

R025XY003NV	**LOAMY BOTTOM 8-14 P.Z.** Loamy Bottom 8-14
R025XY009NV	**SOUTH SLOPE 12-14 P.Z.** South Slope 12-14
R025XY014NV	**LOAMY 10-12 P.Z.** Loamy 10-12

R025XY017NV	**CLAYPAN 12-16 P.Z.** Claypan 12-16
R025XY027NV	**LOAMY 12-14 P.Z.** Loamy 12-14
R025XY051NV	**ERODED CLAYPAN 12-16 P.Z.** Eroded Claypan 12-16

Similar sites

R025XY014NV	**LOAMY 10-12 P.Z.** PSSPS-ACTH7 codominant grasses.
R025XY007NV	**GRAVELLY LOAM 12-16 P.Z.** PUTR2 dominant shrub; more productive site.
R025XY056NV	**LOAMY 14-16 P.Z.** FEID dominant grass.
R025XY010NV	**STEEP NORTH SLOPE** FEID, when present, is a minor species.
R025XY042NV	**SHALLOW LOAM 14-16 P.Z.** PSSPS dominant grass; less productive site.
R025XY009NV	**SOUTH SLOPE 12-14 P.Z.** PSSPS dominant grass; FEID, when present, is a minor species.
R025XY027NV	**LOAMY 12-14 P.Z.** ARTRT dominant shrub.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata var. vaseyana* (2) *Purshia tridentata*
Herbaceous	(1) *Festuca idahoensis* (2) *Pseudoroegneria spicata*

Physiographic features

This ecological site is associated side slopes of mountain and hill landscapes. Slopes range from 15 to 30 percent with elevations of 5,800-8,0000 feet (1,768 -2,438 meters). This site is characterized by rapid runoff and slow to moderate permeability.

Table 2. Representative physiographic features

Landforms	(1) Mountains > Mountain slope (2) Hills > Hillside (3)
Runoff class	High to very high
Elevation	5,800–8,000 ft
Slope	15–30%
Aspect	Aspect is not a significant factor

Climatic features

The climate associated with this site is defined by hot dry summers and cold snowy winters. There are 75 frost free-days and an 81 day freeze-free period. Mean annual precipitation is 15 inches (38cm), with the highest rainfall occurring in May 2.2 inches (5.6cm) and the lowest in August 0.6 inches (1.5cm). Averages snowfall is around 35 inches (89cm) per year. Air temperatures average 26 degrees F in January (coldest) and 66 degrees F in July

(warmest).

*The above data is averaged from the MTN CITY RS, JACKPOT, and Silver City 5 W climate stations, NASIS and Western Regional Climate Center.

Table 3. Representative climatic features

Frost-free period (characteristic range)	50-95 days
Freeze-free period (characteristic range)	61-116 days
Precipitation total (characteristic range)	11-18 in
Frost-free period (actual range)	50-95 days
Freeze-free period (actual range)	40-118 days
Precipitation total (actual range)	11-20 in
Frost-free period (average)	75 days
Freeze-free period (average)	81 days
Precipitation total (average)	15 in

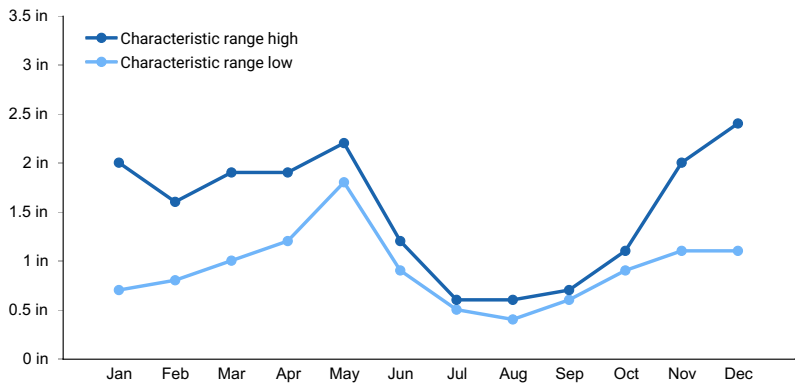


Figure 1. Monthly precipitation range

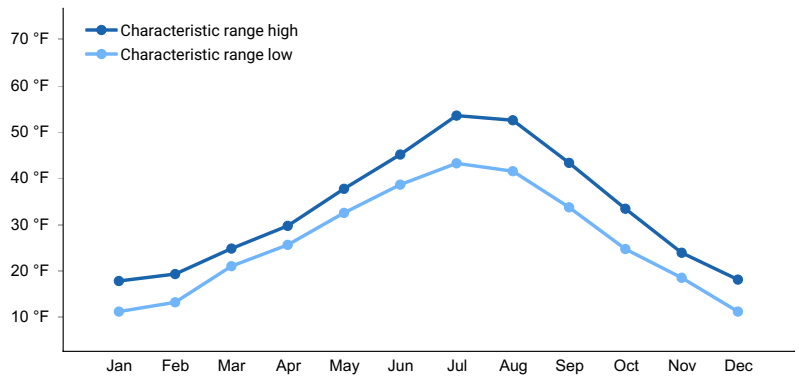


Figure 2. Monthly minimum temperature range

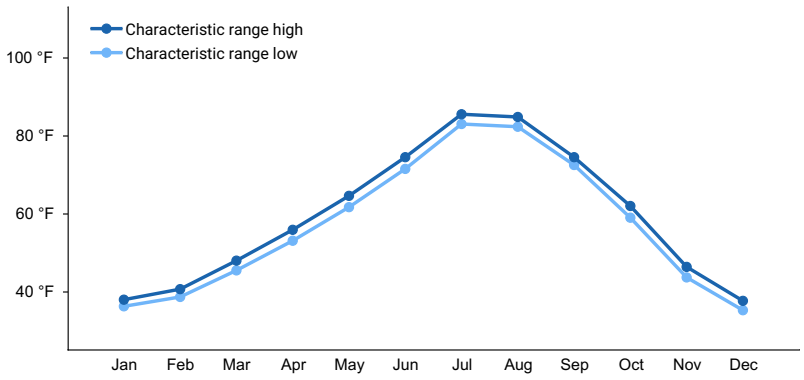


Figure 3. Monthly maximum temperature range

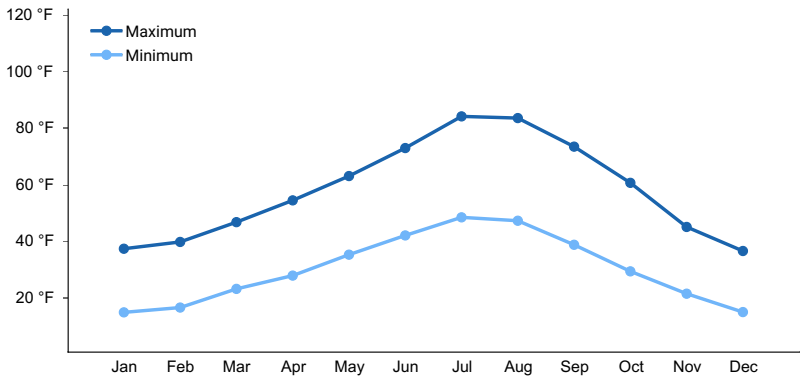


Figure 4. Monthly average minimum and maximum temperature

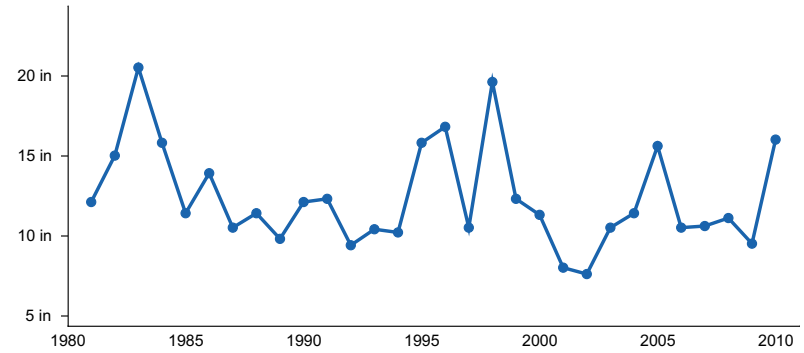


Figure 5. Annual precipitation pattern

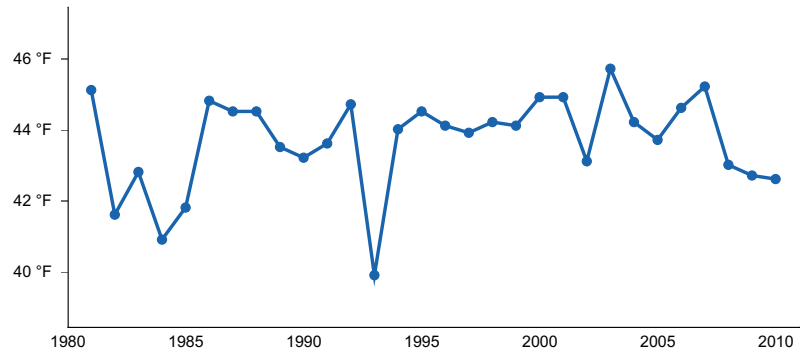


Figure 6. Annual average temperature pattern

Climate stations used

- (1) MTN CITY RS [USC00265392], Mountain City, NV
- (2) SILVER CITY 5 W [USC00108412], Murphy, ID
- (3) JACKPOT [USC00264016], Jackpot, NV

Influencing water features

This ecological site is not influenced by adjacent wetlands, streams or run-on. No water table is present.

Wetland description

N/A

Soil features

The soils associated with this site formed in residuum and colluvium derived from volcanic rock and chert. Soils are characterized by a gravely loam or very gravely loam surface. Depth to bedrock is less than 39 inches (100 cm) with an average clay content in the particle size control section of 18 to 27 percent. These soils are well drained with slow to moderate permeability. The soil profile is characterized by a very gravelly loam texture throughout (no accumulation of clay) and greater than 50 percent rock fragments by volume.

Representative soil components associated with this ecological site include the Loncan, Mclvey, Graley, Pernty, Reluctan, Alyan, Nirac, Softscrabble, Duff, Pequop, and Tusk.

Table 4. Representative soil features

Parent material	(1) Residuum–volcanic rock (2) Colluvium–chert
Surface texture	(1) Loam (2) Gravelly loam (3) Very gravelly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to moderate
Depth to restrictive layer	20–40 in
Soil depth	20–40 in
Surface fragment cover <=3"	20–35%
Surface fragment cover >3"	2–8%
Available water capacity (0-40in)	1.7–5.4 in
Soil reaction (1:1 water) (Depth not specified)	6.6–7.3
Subsurface fragment volume <=3" (Depth not specified)	20–35%
Subsurface fragment volume >3" (Depth not specified)	4–20%

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	14–40 in
Soil depth	14–40 in
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-40in)	Not specified

Soil reaction (1:1 water) (Depth not specified)	Not specified
Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

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

This ecological site is dominated by deep-rooted cool season, perennial bunchgrasses and long-lived shrubs (50+ years) with high root to shoot ratios. The dominant shrubs usually root to the full depth of the winter-spring soil moisture recharge, which ranges from 1.0 to over 3.0 m (Dobrowolski et al. 1990). Root length of mature sagebrush plants was measured to a depth of 2 meters in alluvial soils in Utah (Richards and Caldwell 1987). These shrubs have a flexible generalized root system with development of both deep taproots and laterals near the surface (Comstock and Ehleringer 1992). Tap roots of antelope bitterbrush have been documented from 4.5 to 5.4 m in length (McConnell 1961). These shrubs have a flexible generalized root system with development of both deep taproots and laterals near the surface (Comstock and Ehleringer 1992).

Periodic drought regularly influences sagebrush ecosystems and drought duration and severity has increased throughout the 20th century in much of the Intermountain West. Major shifts away from historical precipitation patterns have the greatest potential to alter ecosystem function and productivity. Species composition and productivity can be altered by the timing of precipitation and water availability within the soil profile (Bates et al. 2006).

Mountain big sagebrush and antelope bitterbrush are generally long-lived; therefore it is not necessary for new individuals to recruit every year for perpetuation of the stand. Infrequent large recruitment events and simultaneous low, continuous recruitment is the foundation of population maintenance (Noy-Meir 1973). Survival of the seedlings is dependent on adequate moisture conditions.

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

The Great Basin sagebrush communities have high spatial and temporal variability in precipitation both among years and within growing seasons. Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition or can increase resource pools by the decomposition of dead plant material following disturbance. The invasion of sagebrush communities by cheatgrass (*Bromus tectorum*) has been linked to disturbances (fire, abusive grazing) that have resulted in fluctuations in resources (Chambers et al. 2007).

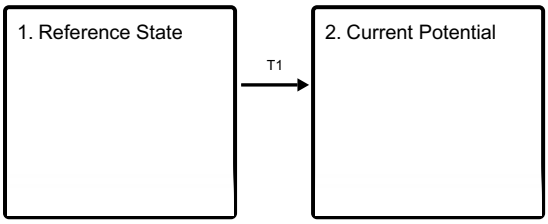
The perennial bunchgrasses that are dominant on this site includes Idaho fescue and bluebunch wheatgrass. These species generally have shallower root systems than the shrubs, but root densities are often as high as or higher than those of shrubs in the upper 0.5 m but taper off more rapidly. Differences in root depth distributions between grasses and shrubs result in resource partitioning in these shrub/grass systems.

Pre-settlement fire return intervals in mountain big sagebrush communities varied from 15 to 25 years (Burkhardt and Tisdale 1969, Houston 1973, Miller 2000). Mountain big sagebrush is killed by fire (Neuenschwander 1980, Blaisdell et al. 1982), and does not resprout (Blaisdell 1953). Post fire regeneration occurs from seed and will vary depending on site characteristics, seed source, and fire characteristics. Mountain big sagebrush seedlings can grow rapidly and may reach reproductive maturity within 3 to 5 years (Bunting et al. 1987). Mountain big sagebrush may return to pre-burn density and cover within 15-20 years following fire, but establishment after severe fires may proceed more slowly and can take up to 50 years (Bunting et al. 1987, Ziegenhagen 2003, Miller and Heyerdahl 2008, Ziegenhagen and Miller 2009).

This ecological site has moderate to high resilience to disturbance and resistance to invasion. Increased resilience increases with elevation, aspect, increased precipitation and increased nutrient availability. Two possible stable states have been identified for the Loamy Slope 12-16” ecological site.

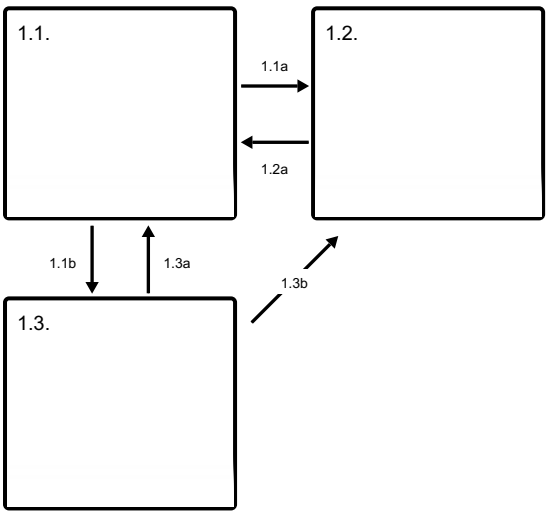
State and transition model

Ecosystem states

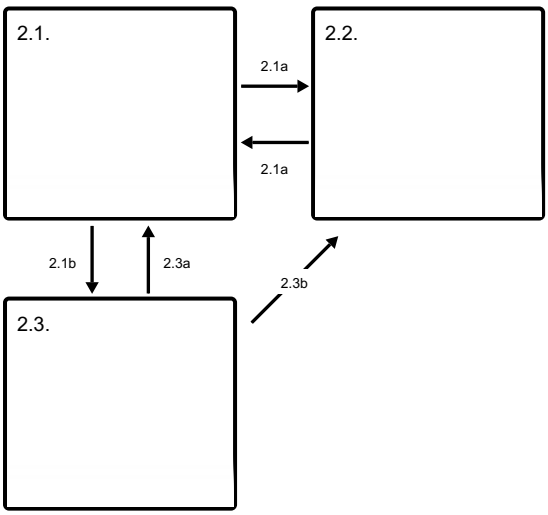


T1 - Introduction of annual non-native species.

State 1 submodel, plant communities



State 2 submodel, plant communities



State 1
Reference State

The Reference State is a representative of the natural range of variability under pristine conditions. 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.

Characteristics and indicators. Pre-settlement fire return intervals in mountain big sagebrush communities varied from 15 to 25 years (Burkhardt and Tisdale 1969, Houston 1973, Miller 2000). Mountain big sagebrush is killed by fire (Neuenschwander 1980, Blaisdell et al. 1982), and does not resprout (Blaisdell 1953). Post fire regeneration occurs from seed and will vary depending on site characteristics, seed source, and fire characteristics. Mountain big sagebrush seedlings can grow rapidly and may reach reproductive maturity within 3 to 5 years (Bunting et al. 1987). Mountain big sagebrush may return to pre-burn density and cover within 15-20 years following fire, but establishment after severe fires may proceed more slowly and can take up to 50 years (Bunting et al. 1987, Ziegenhagen 2003, Miller and Heyerdahl 2008, Ziegenhagen and Miller 2009). South-facing slopes will generally express a higher abundance of bluebunch wheatgrass, while north-facing slopes will contain more Idaho fescue.

Dominant plant species

- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- Sandberg bluegrass (*Poa secunda*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- Idaho fescue (*Festuca idahoensis*), grass

Community 1.1

This community phase is characteristic of a mid-seral plant community and is dominated by mountain big sagebrush, bluebunch wheatgrass and Idaho fescue. Thurber's needlegrass, antelope bitterbrush and rabbitbrush are also common on this site.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	420	600	840
Shrub/Vine	175	250	350
Forb	105	150	210
Total	**700**	**1000**	**1400**

Community 1.2

This community phase is characterized by a post-disturbance, early seral, plant community. Sagebrush and other shrubs are reduced, or patchy. Perennial bunchgrasses and forbs dominate the visual aspect of the plant community. Disturbance tolerant shrubs such as rabbitbrush and antelope bitterbrush will sprout from the root-crown following low and medium intensity wildfire and may begin to dominate the plant community 2 to 5 years post-disturbance.

Resilience management. Antelope bitterbrush is moderately fire tolerant (McConnell and Smith 1977). It regenerates by seed and resprouting (Blaisdell and Mueggler 1956, McArthur et al. 1982), however sprouting ability is highly variable and has been attributed to genetics, plant age, phenology, soil moisture and texture and fire severity (Blaisdell and Mueggler 1956, Blaisdell et al. 1982, Clark et al. 1982, Cook et al. 1994). Bitterbrush rarely sprouts if the root crown is killed by fire (Blaisdell and Mueggler 1956). Low intensity fires may allow for bitterbrush to sprout; however, community response also depends on soil moisture levels at time of fire (Murray 1983). Depending on fire severity, rabbitbrush, Utah serviceberry (*Amelanchier utahensis*) and mountain snowberry (*Symphoricarpos orbiculatus*) may increase after fire. Douglas' rabbitbrush is top-killed by fire, but sprouts vigorously after fire (Kuntz 1982, Akinsoji 1988). Mountain snowberry is also top-killed by fire, but resprouts after fire

from rhizomes (Leege and Hickey 1971, Noste and Bushey 1987). Snowberry has been noted to regenerate well and exceed pre-burn biomass in the third season after a fire (Merrill et al. 1982). Utah serviceberry resprouts from the root crown. If balsamroot is common before fire, they will increase after fire or with heavy grazing (Wright 1985). The effect of fire on bunchgrasses relates to culm density, culm-leaf morphology, and the size of the plant. The initial condition of bunchgrasses within the site along with seasonality and intensity of the fire all factor into the individual species response. For most forbs and grasses the growing points are located at or below the soil surface providing relative protection from disturbances which decrease above ground biomass, such as grazing or fire. Thus, fire mortality is more correlated to duration and intensity of heat which is related to culm density, culm-leaf morphology, size of plant and abundance of old growth (Wright 1971, Young 1983)

Community 1.3

Absence of disturbance allows sagebrush to mature and dominate the plant community. Perennial bunchgrasses and forbs are reduced in both vigor and productivity due to competition for light, moisture and nutrient resources. As grass cover declines, the potential for invasion by annual non-native species likely cheatgrass (*Bromus tectorum*) as well as invasion by singleleaf pinyon (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) will increase.

Resilience management. This community phase is at-risk of crossing additional threshold(s) to less desirable stable states. Without fire, sagebrush will increase and the potential for encroachment by pinyon and juniper also increases. If present, without fire or changes in management, pinyon and juniper will dominate the site and mountain big sagebrush will be severely reduced. The herbaceous understory will also be reduced; however Idaho fescue may remain underneath trees on north facing slopes. The potential for soil erosion increases as the woodland matures and the understory plant community cover declines. Catastrophic wildfire in these tree controlled sites may lead to an annual weed dominated site.

Pathway 1.1a
Community 1.1 to 1.2

Wildfire. Low severity fire creates sagebrush/grass mosaic; higher intensity fires significantly reduce sagebrush cover and lead to early seral community dominated by grasses and forbs. Frequency and intensity of wildfire is primarily driven by cover and amount of herbaceous vegetation. Under pre-Eurosettlement conditions fire return interval is estimated to be between 20 and 50 years.

Pathway 1.1b
Community 1.1 to 1.3

Time, absence of disturbance and natural regeneration over time allows sagebrush to dominate site resources. This community phase pathway may be coupled with drought and/or herbivory further reducing herbaceous understory.

Pathway 1.2a
Community 1.2 to 1.1

Time, absence of disturbance and natural regeneration over time allows sagebrush to recover. Recovery of sagebrush depends on the availability of a local seed source (patches of mature shrubs) as well as precipitation patterns favorable for germination and seedling recruitment. Sagebrush seedlings are susceptible to less than favorable conditions for several years. Completion of this community phase pathways may take decades.

Pathway 1.3a
Community 1.3 to 1.1

Low intensity, patchy wildfire or insect infestation would reduce sagebrush overstory creating a mosaic on the landscape. Perennial bunchgrasses and forbs dominate disturbed patches due to an increase in light, moisture and nutrient resources.

Pathway 1.3b
Community 1.3 to 1.2

Wide spread wildfire removes sagebrush and allows perennial bunchgrasses and forbs to dominate.

State 2
Current Potential

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.

Characteristics and indicators. The introduction of annual weedy species, like cheatgrass, may cause an increase in fire frequency. Without targeted management actions state is at-risk of crossing a threshold to an annual dominated community.

Resilience management. Best management options would be to maintain high diversity of desired species to promote organic matter inputs and prevent the dispersal and seed production of the non-native invasive species. Inappropriate grazing management by livestock and feral horses will cause a decrease in deep-rooted perennial bunchgrasses, mainly Idaho fescue and bluebunch wheatgrass. Long-term inappropriate grazing management may result in an increase in Sandberg bluegrass (*Poa secunda*), balsamroot, lupine, sagebrush, and rabbitbrush (*Chrysothamnus viscidiflorus*).

Dominant plant species

- mountain big sagebrush (*Artemisia tridentata ssp. vaseyana*), shrub
- cheatgrass (*Bromus tectorum*), grass
- Idaho fescue (*Festuca idahoensis*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass

Community 2.1

This community phase is similar to the Reference State Community Phase 1.1, with the presence of non-native species in trace amounts.

Resilience management. The presence of non-native annuals has reduced site resilience. Management actions should focus on maintaining the presence of all functional and structural groups and minimizing wildfire and soil disturbing practices.

Community 2.2

This community phase is characteristic of a post-disturbance, early seral community where annual non-native species are present. Perennial bunchgrasses and forbs recover rapidly following wildfire. Annual non-native species are stable or increasing within the community. Disturbance tolerant shrubs typically recover 2 to 5 years post fire and may dominate the sites for many years.

Resilience management. Low intensity fires may allow for bitterbrush to sprout; however, community response also depends on soil moisture levels at time of fire (Murray 1983). If cheatgrass is present, bitterbrush seedling success is much lower. The factor that most limits establishment of bitterbrush seedlings is competition for water resources with the invasive species cheatgrass (Clements and Young 2002).

Community 2.3

This community phase is characterized by decadent sagebrush, reduced perennial bunchgrass and increasing bare ground. Annual non-natives species are stable or increasing due to lack of competition from perennial bunchgrasses.

Resilience management. Without fire, sagebrush will increase and the potential for encroachment by pinyon and juniper also increases. Without fire or changes in management, pinyon and juniper will dominate the site and mountain big sagebrush will be severely reduced. The potential for soil erosion increases as the woodland matures and the understory plant community cover declines. Catastrophic wildfire in these tree controlled sites may lead to an annual weed dominated site. Prescribed burring is not recommended in this community phase.

Pathway 2.1a
Community 2.1 to 2.2

Fire reduces the shrub overstory and allows for perennial bunchgrasses to dominate the site. Fire may be patchy resulting in a mosaic pattern with patches of mature sagebrush remaining. Annual non-native species are likely to increase after fire.

Pathway 2.1b
Community 2.1 to 2.3

Time and lack of disturbance allows for sagebrush to increase and become decadent. Mature sagebrush is controlling the spatial and temporal distribution of moisture, nutrient and light resources. Native perennial bunchgrasses are reduced due to competition for these resources. Non-native annuals are stable to increasing.

Pathway 2.1a
Community 2.2 to 2.1

Time, lack of disturbance and natural regeneration of sagebrush. The establishment of little sagebrush depends on presence of seed source and favorable weather patterns. It may take decades for sagebrush to recover to pre-disturbance levels.

Pathway 2.3a
Community 2.3 to 2.1

Low intensity wildfire, insect infestation, or brush management with minimal soil disturbance reduces sagebrush overstory and releases herbaceous understory.

Pathway 2.3b
Community 2.3 to 2.2

Fire reduces or eliminates the overstory of sagebrush and allows for the understory perennial grasses and forbs to increase. Annual non-native species respond well to fire and may increase post-burn.

Transition T1
State 1 to 2

Trigger: Introduction of annual non-native species Slow variable: Over time the annual non-native plants increase within the community. 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 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				420–840	
	Idaho fescue	FEID	*Festuca idahoensis*	300–400	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	150–300	–
	basin wildrye	LECI4	*Leymus cinereus*	20–100	–
	western needlegrass	ACOC3	*Achnatherum occidentale*	20–50	–
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	3–10	–
	oniongrass	MEBU	*Melica bulbosa*	3–10	–
	mountain brome	BRMA4	*Bromus marginatus*	3–10	–
	sedge	ABILD	*Abildgaardia*	3–10	–
Shrub/Vine					
2				175–350	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	100–200	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	50–100	–
	Utah serviceberry	AMUT	*Amelanchier utahensis*	3–8	–
	snowberry	GAULT	*Gaultheria*	3–8	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	3–8	–
Forb					
3				105–210	
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	20–50	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	20–50	–
	lupine	LUPIN	*Lupinus*	3–10	–
	helianthella	HELIA	*Helianthella*	3–10	–
	western stoneseed	LIRU4	*Lithospermum ruderale*	3–10	–

Animal community

Livestock/Wildlife Grazing Interpretations:
This site is suited to grazing by cattle and sheep during late spring, summer and fall. Livestock water is usually adequate as this site normally occurs at higher elevations where flowing streams and springs are common. Attentive grazing management is required due to steep slopes and erosive soil surface conditions. Considerations for grazing management include timing, intensity and duration of grazing.

Overgrazing leads to an increase in sagebrush and a decline in understory plants like bluebunch wheatgrass and Idaho fescue. Squirreltail or Sandberg bluegrass will increase temporarily with further degradation. Invasion of annual weedy forbs and cheatgrass could occur with further grazing degradation, leading to a decline in squirreltail and bluegrass and an increase in bare ground. A combination of overgrazing and prolonged drought leads to soil erosion, increased bare ground, and a loss in plant production. Wildlife in sites with cheatgrass present could transition to cheatgrass-dominated communities, and without management, cheatgrass and annual forbs are likely to dominate.

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. Sandberg bluegrass increases under grazing pressure (Tisdale and Hironaka 1981) and is capable of co-existing with cheatgrass. Excessive sheep grazing favors Sandberg bluegrass; however, where cattle are the dominant grazers, cheatgrass often dominates (Daubenmire 1970). Thus, depending on the season of use,

the grazer and site conditions, either Sandberg bluegrass or cheatgrass may become the dominant understory with inappropriate grazing management.

Long-term disturbance response may be influenced by small differences in landscape topography. Concave areas hold a little more moisture and may retain deep-rooted perennial grasses whereas convex areas are slightly less resilient and may have more Sandberg bluegrass present.

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.

Antelope bitterbrush is important browse for livestock. Domestic livestock and mule deer may compete for antelope bitterbrush in late summer, fall, and/or winter. Cattle prefer antelope bitterbrush from mid-May through June and again in September and October. Antelope bitterbrush is most commonly found on soils which provide minimal restriction to deep root penetration such as coarse textured soil, or finer textured soil with high stone content (Driscoll 1964, Clements and Young 2002). Grazing tolerance is dependent on site conditions (Garrison 1953) and the shrub can be severely hedged during the dormant season for grasses and forbs.

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

Bluebunch wheatgrass is moderately grazing tolerant and is very sensitive to defoliation during the active growth period (Blaisdell and Pechanec 1949, Laycock 1967, Anderson and Scherzinger 1975, Britton et al. 1990). Herbage and flower stalk production was reduced with clipping at all times during the growing season; however, clipping was most harmful during the boot stage (Blaisdell and Pechanec 1949). Tiller production and growth of bluebunch was greatly reduced when clipping was coupled with drought (Busso and Richards 1995). Mueggler (1975) estimated that low vigor bluebunch wheatgrass may need up to 8 years rest to recover. Although an important forage species, it is not always the preferred species by livestock and wildlife.

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.

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

Wildlife Interpretations:
Idaho fescue is an important source of 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, and because it remains green throughout early summer, it remains available for other small mammal forage for longer time than other grasses.

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.

Pronghorn antelope, mule deer, elk, and bighorn sheep utilize antelope bitterbrush extensively. Mule deer use of

antelope bitterbrush peaks in September, when it may compose up to 91 percent on their diet. Winter use is greatest during periods of deep snow. Antelope bitterbrush seed is a large part of the diets of rodents, especially deer mice and kangaroo rats.

Hydrological functions

The potential for sheet and rill erosion is typically low to moderate and will vary with slope. Water flow patterns are typically non-existent. Water flow patterns may rarely be observed on steeper slopes in areas recently subjected to summer convection storms or rapid spring snowmelt. Pedestals are rare. Occurrence is usually limited to areas of water flow patterns. Frost heaving of shallow rooted plants should not be considered a "normal" condition. Gullies are non-existent in areas of this site that occur on stable landforms. Fine litter (foliage from grasses and annual and perennial forbs) is expected to move the distance of slope length during intense summer convection storms or rapid snowmelt events. Persistent litter (large woody material) will remain in place except during catastrophic events. Perennial herbaceous plants (especially deep-rooted bunchgrasses) slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact and provide opportunity for snow catch and accumulation on site.

Recreational uses

Aethestic value is derived from the diverse floral and fauna composition and the colorful spring wildflowers found on this site. Steep slopes and erosive surface soils prohibit many forms of recreation. Off-road vehicles can destroy the fragile vegetation and develop severe erosion problems. This site has potential for deer and upland game hunting and wildlife photography.

Other products

Native peoples used big sagebrush leaves and branches for medicinal teas, and the leaves as a fumigant. Bark was woven into mats, bags and clothing. Basin wildrye was used as bedding for various Native American ceremonies, providing a cool place for dancers to stand.

Other information

Mountain big sagebrush is easily propagated from seed under greenhouse, nursery, and common garden conditions and has been successfully seeded directly into field sites. In many areas where Idaho fescue is a late seral community dominant, grasslands are currently occupied by non-native species or have species compositions that deviate from historical communities and favor less desirable species. The practice of seeding with native species in restoration efforts has had mixed results, with some non-native species establishing more rapidly and having better longevity than native species.
Antelope bitterbrush has been used extensively in land reclamation. It is a pioneer species on some harsh sites. Antelope bitterbrush enhances succession by retaining soil and depositing organic material, and, in some habitats and with some ecotypes, by fixing nitrogen. Idaho fescue is slow to establish, but once established, has abundant growth of fine leaves that provide effective ground cover, and high yields of tough, fine, fibrous roots that control erosion and improve soil structure. Bluebunch wheatgrass seeds are not easily harvested and can be expensive, which, along with some of its botanical characteristics, makes the plant a less desirable choice for reclamation projects.

Inventory data references

Old SS Manuscripts, Range Site Descriptions, etc.

Type locality

Location 1: Elko County, NV	
Township/Range/Section	T35N R54E S34

General legal description	Approximately 6 miles north of Elko, across from Barrel Springs along the west side of Highway 51, Elko County, Nevada. Also occurs in Humboldt County, Nevada.

Other references

Akinsoji, A. 1988. Postfire vegetation dynamics in a sagebrush steppe in southeastern Idaho, USA. Vegetatio 78:151-155.

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

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

Bates, J. D., T. Svejcar, R. F. Miller, and R. A. Angell. 2006. The effects of precipitation timing on sagebrush steppe vegetation. Journal of Arid Environments 64: 670-697.

Bentz, B., D. Alston, and T. Evans. 2008. Great Basin insect outbreaks. In: J. Chambers, N. Devoe, A. Evenden [eds]. Collaborative management and research in the Great Basin -- Examining the issues and developing a framework for action. Gen. Tech. Rep. RMRS-GTR-204. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO. p. 45-48.

Blaisdell, J. P. 1953. Ecological effects of planned burning of sagebrush-grass range on the Upper Snake River Plains. US Dept. of Agriculture.

Blaisdell, J. P. and W. F. Mueggler. 1956. Sprouting of bitterbrush (Purshia tridentata) following burning or top removal. Ecology 37: 365-370.

Blaisdell, J. P., R. B. Murray, and E. D. McArthur. 1982. Managing intermountain rangelands - sagebrush-grass ranges. USDA Forest Serv. Intermountain Forest and Range Exp. Sta. Gen. Tech. Rep. INT-134.

Blaisdell, J. P. and J. F. Pechanec. 1949. Effects of herbage removal at various dates on vigor of bluebunch wheatgrass and arrowleaf balsamroot. Ecology 30: 298-305.

Bradley, A. F. 1984. Rhizome morphology, soil distribution, and the potential fire survival of eight woody understory species in western Montana. University of Montana.

Britton, C. M., G. R. McPherson, and F. A. Sneva. 1990. Effects of burning and clipping on five bunchgrasses in eastern Oregon. Great Basin Naturalist 50:1 15-120.

Bunting, S. C., B. M. Kilgore, and C. L. Bushey. 1987. Guidelines for prescribed burning sagebrush-grass rangelands in the northern Great Basin. US Department of Agriculture, Forest Service, Intermountain Research Station Ogden, UT, USA.

Burkhardt, J. W. and E. Tisdale. 1969. Nature and successional status of western Juniper vegetation in Idaho. Journal of Range Management:264-270.

Busse, D., A. Simon, and M. Riegel. 2000. Tree-growth and understory responses to low-severity prescribed burning in thinned Pinus ponderosa forests of central Oregon. Forest Science 46: 258-268.

Caudle, D., J. DiBenedetto, M. Karl, H. Sanchez, and C. Talbot. 2013. Interagency Ecological Site Handbook for Rangelands. Available at: http://jornada.nmsu.edu/sites/jornada.nmsu.edu/files/InteragencyEcolSiteHandbook.pdf. Accessed 4 October 2013.

Chambers, J., B. Bradley, C. Brown, C. D'Antonio, M. Germino, J. Grace, S. Hardegree, R. Miller, and D. Pyke. 2013. Resilience to stress and disturbance, and resistance to *Bromus tectorum* L. invasion in cold desert shrublands of western North America. Ecosystems 17: 1-16.

Chambers, J. C., B. A. Roundy, R. R. Blank, S. E. Meyer, and A. Whittaker. 2007. What makes Great Basin sagebrush ecosystems invasible by *Bromus tectorum*? Ecological Monographs 77:117-145.

Clark, R. G., M. B. Carlton, and F. A. Sneva. 1982. Mortality of bitterbrush after burning and clipping in eastern Oregon. Journal of Range Management 35: 711-714.

Clements, C. D. and J. A. Young. 2002. Restoring antelope bitterbrush. Rangelands 24: 3-6.

Comstock, J. P. and J. R. Ehleringer. 1992. Plant adaptation in the Great Basin and Colorado plateau. Western North American Naturalist 52:195-215.

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

Cook, J. G., T. J. Hershey, and L. L. Irwin. 1994. Vegetative response to burning on Wyoming mountain-shrub big game ranges. Journal of Range Management 47: 296-302.

Daubenmire, R. 1970. Steppe vegetation of Washington. 131 pp.

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

Driscoll, R. S. 1964. A relict area in the central Oregon juniper zone. Ecology 45:345-353.

Dobrowolski, J. P., M. M. Caldwell, and J. H. Richards. 1990. Basin hydrology and plant root systems. In: C. B. Osmand, L. F. Pitelka, G. M. Hildy [eds]. Plant biology of the basin and range. Ecological Studies. 80: 243-292.

Eckert Jr, R. E. and J. S. Spencer. 1986. Vegetation response of allotments grazed under rest-rotation management. Journal of Range Management: 166-174.

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

Fire Effects Information System [Online]. http://www.fs.fed.us/database/feis.

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

Gaffney, W. S. 1941. The effects of winter elk browsing, South Fork of the Flathead River, Montana. The Journal of Wildlife Management 5:427-453.

Ganskopp, D., L. Aguilera, and M. Vavra. 2007. Livestock Forage Conditioning Among Six Northern Great Basin Grasses. Rangeland Ecology & Management 60: 71-78.

Garrison, G. A. 1953. Effects of clipping on some range shrubs. Journal of Range Management 6:309-317.

Houghton, J.G., C.M. Sakamoto, and R.O. Gifford. 1975. Nevada's weather and climate, special publication 2. Nevada Bureau of Mines and Geology, Mackay School of Mines, University of Nevada, Reno, NV.

Houston, D. B. 1973. Wildfires in northern Yellowstone National Park. Ecology 54:1111-1117.

Johnson, C. G., R. R. Clausnitzer, P. J. Mehringer, and C. Oilver. 1994. Biotic and abiotic processes of eastside ecosystems: The effects of management on plant and community ecology, and on stand and landscape vegetation dynamics. Forest Service General Technical Report. Forest Service, Portland, OR (United States). Pacific Northwest Research Station.

Kasworm, W. F., L. R. Irby, and H. B. I. Pac. 1984. Diets of ungulates using winter ranges in northcentral Montana. Journal of Range Management 37:67-71.

Kerns, B. K., W. G. Thies, and C. G. Niwa. 2006. Season and severity of prescribed burn in ponderosa pine forests: Implications for understory native and exotic plants. Ecoscience 13:44-55.

Krall, J. L., J. R. Stroh, C. S. Cooper, and S. R. Chapman. 1971. Effect of time and extent of harvesting basin wildrye. Journal of Range Management 24: 414-418.

Kuntz, D. E. 1982. Plant response following spring burning Plant in an Artemisia tridentata subsp. vaseyana/Festuca Idahoensis habitat type. University of Idaho.

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

Leege, T. A. and W. O. Hickey. 1971. Sprouting of northern Idaho shrubs after prescribed burning. The Journal of Wildlife Management: 508-515.

Majerus, M. E. 1992. High-stature grasses for winter grazing. Journal of Soil and Water Conservation 47: 224-225.

McArthur, E. D., A. Blaner, A. P. Plummer, and R. Stevens. 1982. Characteristics and hybridization of important intermountain shrubs: 3. sunflower family. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. Research Paper INT-177 43.

McConnell, B. R. 1961. Notes on some rooting characteristics of antelope bitterbrush. PNW Old Series Research Note No. 204:1-5.

McConnell, B. R. and J. G. Smith. 1977. Influence of grazing on age-yield interactions in bitterbrush. Journal of Range Management 30: 91-93.

Merrill, E. H., H. Mayland, and J. Peek. 1982. Shrub responses after fire in an Idaho ponderosa pine community. The Journal of Wildlife Management 46: 496-502.

Miller, R. F. and E. K. Heyerdahl. 2008. Fine-scale variation of historical fire regimes in sagebrush-steppe and juniper woodland: An example from California, USA. International Journal of Wildland Fire 17:245-254.

Miller, R. F. R. J. T. 2000. The role of fire in juniper and pinyon woodlands: A descriptive analysis. Pages p. 15-30 in Proceedings of the Invasive Species Workshop: The Role of Fire in the Control and Spread of Invasive Species. Tallahassee, Florida.

Miller, R. F. C., Jeanne C.; Pyke, David A.; Pierson, Fred B.; Williams, C. Jason 2013. A review of fire effects on vegetation and soils in the Great Basin region: Response and ecological site characteristics. Gen. Tech. Rep. RMRS-GTR-308. Fort Collins CO: U.S. Department of Agriculture, United State Forest Service, Rocky Mountain Research Station. p. 126.

Mueggler, W. F. and J. P. Blaisdell. 1951. Replacing wyethia with desireable forage species. Journal of Range Management 4:143-150.

Murray, R. 1983. Response of antelope bitterbrush to burning and spraying in southeastern Idaho. Tiedemann, Arthur R.; Johnson, Kendall L., compilers. Research and management of bitterbrush and cliffrose in western North America. General Technical Report INT-152. Ogden, UT: US Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 142-152.

National Oceanic and Atmospheric Administration. 2004. The North American Monsoon. Reports to the Nation. Weather Service, Climate Prediction Center. Available online: http://www.weather.gov/

Neuenschwander, L. 1980. Broadcast burtning of sagebrush in the winter. Journal of Range Management: 233-236.

Noste, N. V. and C. L. Bushey. 1987. Fire response of shrubs of dry forest habitat types in Montana and Idaho. General technical report INT.

Noy-Meir, I. 1973. Desert ecosystems: Environment and producers. Annual Review of ecology and systematics. Vol. 4:25-51.

Personius, T.L., C. L. Wambolt, J. R. Stephens and R. G. Kelsey. 1987. Crude terpenoid influence on mule deer preference for sagebrush. Journal of Range Management, 40:1 p. 84-88.

NRCS Plants Database. (http://plants.usda.gov/)

Richards, J. H. and M. M. Caldwell. 1987. Hydraulic lift: Substantial nocturnal water transport between soil layers by Artemisia tridentata roots. Oecologia 73: 486-489.

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

Sheehy, D. P. and A. Winward. 1981. Relative palatability of seven Artemisia taxa to mule deer and sheep. Journal of Range Management 34: 397-399.

Smith, J. K. and W. C. Fischer. 1997. Fire ecology of the forest habitat types of northern Idaho. US Department of Agriculture, Forest Service, Intermountain Research Station.

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

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

Whisenant, S. G. 1990. Changing fire frequencies on Idaho's Snake River Plains: Ecological and management implications. Pages 4-10 in Symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management. General Technical Report, Intermountain Research Station, USDA Forest Service.

Wood, M. K., Bruce A. Buchanan, & William Skeet. 1995. Shrub preference and utilization by big game on New Mexico reclaimed mine land. Journal of Range Management 48: 431-437.

Wright, H. A. 1971. Why squirreltail is more tolerant to burning than needle-and-thread. Journal of Range Management 24: 277-284.

Wright, H. A. 1985. Effects of fire on grasses and forbs in sagebrush-grass communities. Pages 12-21 in Rangeland Fire Effects; A Symposium: Boise, ID, USDI-BLM.

Wright, H.A., L.F. Neuenschwander, and C.M. Britton. 1979. The role and use of fire in sagebrush-grass and pinyon-juniper plant communities: a state-of-the-art review. Gen. Tech. Rep. INT-58. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 48 p.

Young, R.P. 1983. Fire as a vegetation management tool in rangelands of the intermountain region. In: Monsen, S.B. and N. Shaw (eds). Managing intermountain rangelands - improvement of range and wildlife habitats: Proceedings of symposia; 1981 September 15-17; Twin Falls, ID; 1982 June 22-24; Elko, NV. Gen. Tech. Rep. INT-157. Ogden, UT. U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. Pgs 18-31.

Ziegenhagen, L. L. 2003. Shrub reestablishment following fire in the mountain big sagebrush (Artemisia tridentata Nutt. ssp. vaseyana (Rydb.) Beetle) alliance. M.S. Oregon State University.

Ziegenhagen, L. L. and R. F. Miller. 2009. Postfire recovery of two shrubs in the interiors of large burns in the intermountain west, USA. Western North American Naturalist 69:195-205.

Zschaechner, G. A. 1985. Studying rangeland fire effects: A case study in Nevada. Pages 66-84 in Rangeland Fire Effects, a Symposium. Bureau of Land Management, Boise, Idaho.

Contributors

RK/GKB
Trevor Crandall/Erin Hourihan

Approval

Kendra Moseley, 4/24/2024

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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

Indicators

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

---

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

---

3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare. Occurrence is usually limited to areas of water flow patterns. Frost heaving of shallow rooted plants should not be considered a "normal" condition.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground ± 35%; surface rock fragments ±25%; shrub canopy 15 to 25%; foliar cover of perennial herbaceous plants ± 40%.

---

5. **Number of gullies and erosion associated with gullies:** None

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** None

7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter (foliage from grasses and annual & perennial forbs) is expected to move the distance of slope length during intense summer convection storms or rapid snowmelt events. Persistent litter (large woody material) will remain in place except during large rainfall events.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil stability values should be 3 to 6 on most soil textures found on this site. (To be field tested.)

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Surface structure is typically thin to thick platy, subangular blocky or massive. Soil surface colors are dark and the soils are typified by an mollic epipedon. Organic matter of the surface 2 to 4 inches is typically 1.25 to 3 percent dropping off quickly below. Organic matter content can be more or less depending on micro-topography

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial herbaceous plants (especially deep-rooted bunchgrasses [i.e., Idaho fescue & bluebunch wheatgrass] slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact and provide opportunity for snow catch and accumulation on site.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Compacted layers are none. Platy or massive sub-surface horizons, or subsoil argillic horizons are not to be interpreted as compacted.

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

    Dominant: Reference Plant Community: Deep-rooted, cool season, perennial bunchgrasses >> tall shrubs (big sagebrush & antelope bitterbrush)(By above ground production)

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

    Other:

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Dead branches within individual shrubs are common and standing dead shrub canopy material may be as much as 25% of total woody canopy; some of the mature bunchgrasses (<10%) have dead centers.

14. **Average percent litter cover (%) and depth (in):** Between plant interspaces (35-50%) and litter depth is ± ½ inch.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season (through mid-June) ± 1000 lbs/ac; Spring moisture significantly affects total production. Favorable years ± 1400 lbs/ac and unfavorable years ± 700 lbs/ac.

---

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

---

17. **Perennial plant reproductive capability:** All functional groups should reproduce in average (or normal) and above average growing season years. Little growth or reproduction occurs during extreme drought years.
