Ecological site R025XY015NV
SOUTH SLOPE 8-12 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

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

The ecological site is on south-facing fan remnant side slopes. Slopes are greater than 15 percent. Soils associated with this ecological site are very deep with a light-colored surface horizon (ochric epipedon) and characterized by greater than 35 percent rock fragments by volume. Important abiotic factors contributing to the presence of this site include droughty landscape positions (southernly aspect and steep slopes) and layer of clay accumulation (argillic horizon) 4 to 12 inches (10 to 30cm) from the soil surface. The reference plant community is dominated by Wyoming big sagebrush and bluebunch wheatgrass..

Associated sites

R025XY014NV	**LOAMY 10-12 P.Z.**
R025XY018NV	**CLAYPAN 10-12 P.Z.**
R025XY019NV	**LOAMY 8-10 P.Z.**
R025XY021NV	**SHALLOW LOAM 8-12 P.Z.**

Similar sites

R025XY014NV	**LOAMY 10-12 P.Z.** PSSPS-ACTH7 codominant grasses; gentler slopes; soils with a dark surface horizon (mollic epipedon)
R025XY021NV	**SHALLOW LOAM 8-12 P.Z.** PSSPS-ACTH7 codominant grasses; less productive site; soils 36-50cm to a duripan
R025XY009NV	**SOUTH SLOPE 12-14 P.Z.** ARTRV dominant shrub; more productive site; higher elevation; soil with a dark surface horizon (mollic epipedon)
R025XY019NV	**LOAMY 8-10 P.Z.** ACTH7-PSSPS codominant grasses; gentler slopes; all aspects

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata subsp. wyomingensis*
Herbaceous	(1) *Pseudoroegneria spicata*

Physiographic features

This is ecological site is on south-facing side slopes of fan remnants, plateaus, and hills. Slopes range from 15 to 75 percent, but are typically greater than 30 percent. Elevations range from 5,500-6,500 feet (1,676 to 1,981meters). This site is characterized by high runoff.

Table 2. Representative physiographic features

Landforms	(1) Piedmont slope > Fan remnant (2) Rock pediment (3) Plateau > Hillslope
Runoff class	Medium to high
Flooding frequency	None
Elevation	5,500–6,500 ft
Slope	15–75%
Water table depth	150 in
Aspect	S

Climatic features

The climate associated with this site is defined by hot dry summers and cold snowy winters. Typically, the site has an estimated 110 frost free-days and 120 freeze-free days. Mean annual precipitation is 11 inches (28cm), with the highest rainfall occurring in April 1.5 inches (3.8cm) and the lowest in August 0.7 inches (1.8cm). Averages snowfall is around 35 inches (89cm) per year. Air temperatures average 23 degrees F in January (coldest) and 67 degrees F in July (warmest).

*The data above is average by the Pine Valley Carlin, Deeth, and Wells climate stations, NASIS, and the Western Regional Climate Center.

Table 3. Representative climatic features

Frost-free period (characteristic range)	90-120 days
Freeze-free period (characteristic range)	100-130 days
Precipitation total (characteristic range)	10-12 in
Frost-free period (actual range)	90-120 days
Freeze-free period (actual range)	100-130 days

Precipitation total (actual range)	7-15 in
Frost-free period (average)	110 days
Freeze-free period (average)	120 days
Precipitation total (average)	11 in

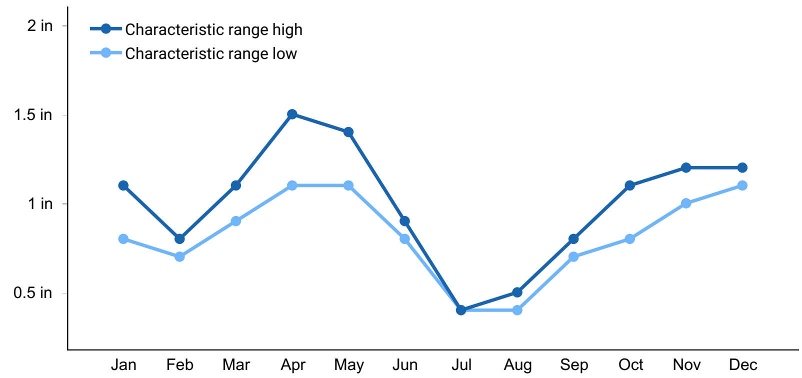


Figure 1. Monthly precipitation range

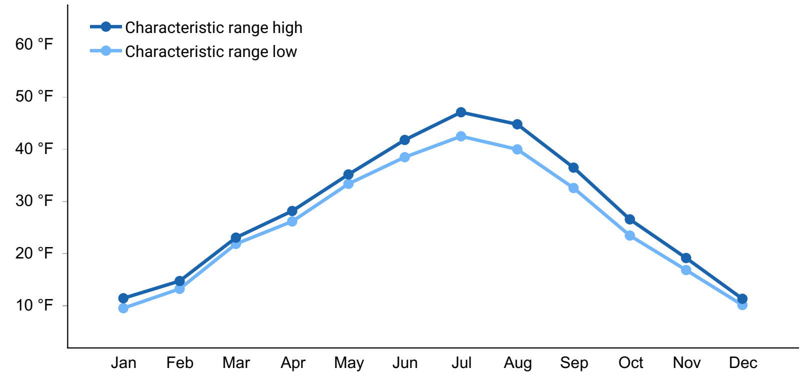


Figure 2. Monthly minimum temperature range

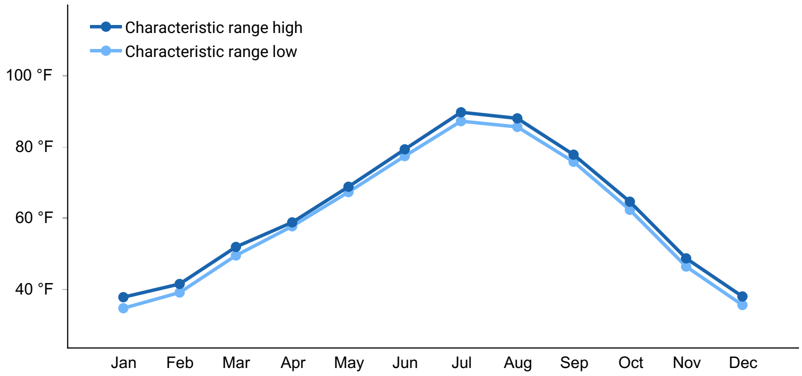


Figure 3. Monthly maximum temperature range

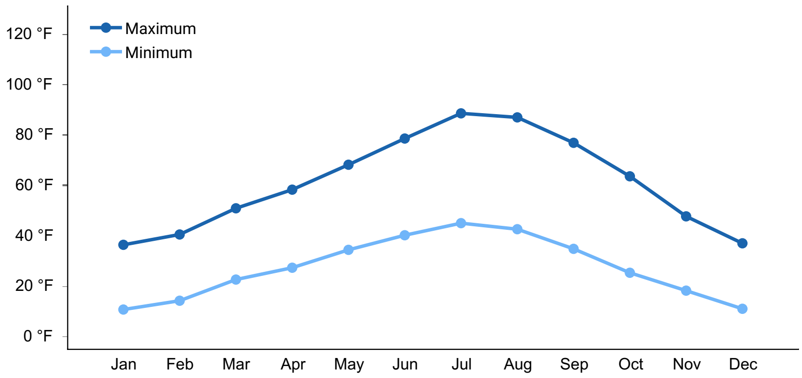


Figure 4. Monthly average minimum and maximum temperature

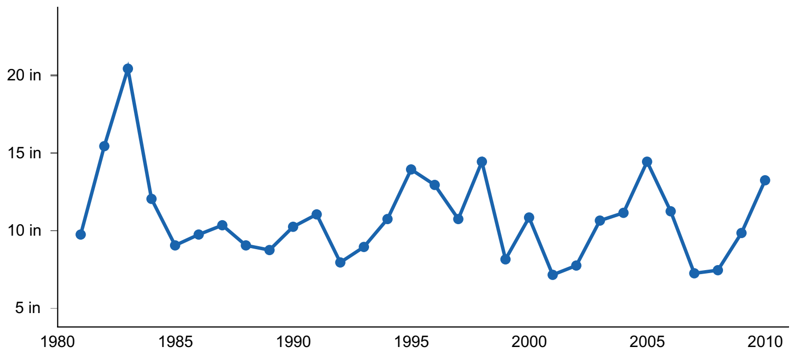


Figure 5. Annual precipitation pattern

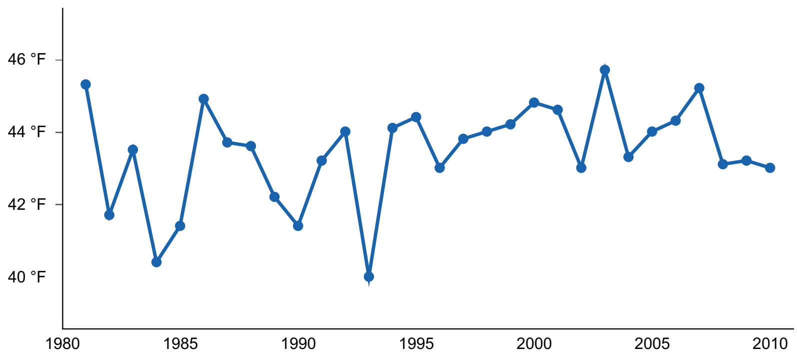


Figure 6. Annual average temperature pattern

Climate stations used

- (1) PINE VALLEY CARLIN 20S [USC00266242], Crescent Valley, NV
- (2) DEETH [USC00262189], Deeth, 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 alluvium and colluvium derived from shale, sandstone and conglomerate. These soils are greater than 39 inches (100cm) deep and well drained with a light colored surface horizon (ochric epipedon). The soil profile is characterized by a horizon of clay accumulation (argillic horizon) 2 - 12 inches (5-30cm) from the soil surface, greater than 35 percent rock fragment by volume distributed throughout the profile, and greater than 28 percent clay in the particle size control section. Rooting depth is limited by hard bedrock or discontinuous silica cementation in the lower soil subsoil.

Representative soil components associated with this ecological site include the Bilbo, Vanwyper, and Short Creek.

Table 4. Representative soil features

Parent material	(1) Alluvium–volcanic rock (2) Colluvium–conglomerate (3) Shale
Surface texture	(1) Loam (2) Gravelly loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow to moderately slow
Depth to restrictive layer	20–60 in
Soil depth	20–60 in
Surface fragment cover <=3"	3–20%
Surface fragment cover >3"	1–6%
Available water capacity (0-40in)	2.1–3.5 in
Soil reaction (1:1 water) (0-40in)	6.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	20–40%
Subsurface fragment volume >3" (Depth not specified)	4–24%

Table 5. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	10–60 in
Soil depth	Not specified
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-40in)	Not specified
Soil reaction (1:1 water) (0-40in)	Not specified
Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

The Reference Plant Community is dominated by bluebunch wheatgrass and wyoming big sagebrush. Subdominant species include basin wildrye, sandberg bluegrass, and bottlebrush squirreltail. Total annual production is 700 lbs/acre in a normal year, 1000 lbs/acre in a favorable year, and 500 lbs/acre in a unfavorable year. Structurally, cool season shallow rooted bunchgrasses are dominant, followed by large shrubs and perennial forbs. The dominant visual aspect of this site is mixed perennial bunch grasses and wyoming big sagebrush. Composition by weight is approximately 80% grasses, 5% forbs and 15% shrubs.

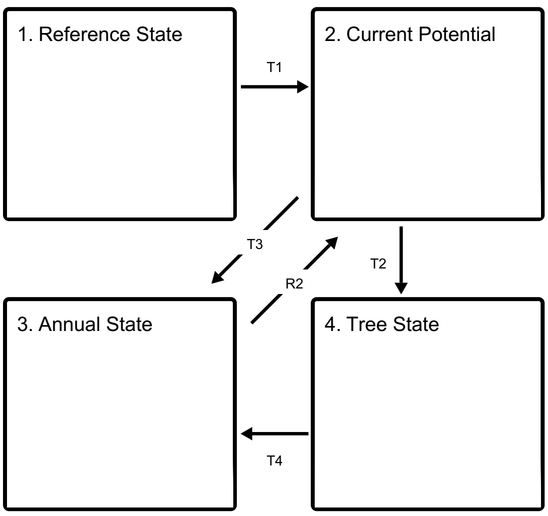
Herbivory has historically occurred on the site at low levels of utilization. Native herbivores include pronghorn antelope, mule deer, sage grouse, lagomorphs and rodents. Livestock grazing has become prevalent across this site. Overutilization of resources due to grazing (from livestock, wildlife, and feral horses) can degrade the site and decrease forage availability and quality. This will lead to a decrease in perennial bunch grasses and an increase of invasive species (Williamson, 2020). Annual and perennial invasive species compete with desirable plants for moisture and nutrients.

Wildfire frequency across this site has historically been low. Sagebrush evolved with low intensity wildfire that left a mosaic of burned and unburned patches (Baker, 2006). Annual species such as cheatgrass can be troublesome invaders on this site after wildfire, preventing perennial grass and shrub re-establishment. Invasive, annual plant communities increase wildfire frequency and intensity (K. Haubensak, 2009). This could cause the dominate shrub population to shift away from wyoming big sagebrush to a shrub population with quicker establishment. Aroga moth infestations have been known to occur in this area (Bentz, 2008). These insects are a defoliator and can decrease shrub abundance. At the upper range of this site, there is potential for infilling by Utah Juniper and singleleaf pinyon pine. These two tree species are known to dominate and could eventually outcompete sagebrush and the understory for resources (Miller and Tausch, 2000)

High annual precipitation will increase the total plant production. Higher wildfire frequency following annual plant production can be expected due to a larger fuel load (Pilliod, 2017). Extended periods of drought significantly impact this site because of the low available water holding capacity and shallow soil. Extended drought reduces the vigor of perennial grasses and shrubs while extreme drought may cause plant mortality. Infiltration can be maintained with a mixed stand of bunchgrasses and shrubs. Runoff potential following large precipitation events is rapid with a moderate erosion risk. Decreased infiltration, increased runoff, and increased erosion occur when sagebrush is removed by frequent wildfires (C.J. Williams, 2018).

State and transition model

Ecosystem states



T1 - Introduction of annual non-native species.

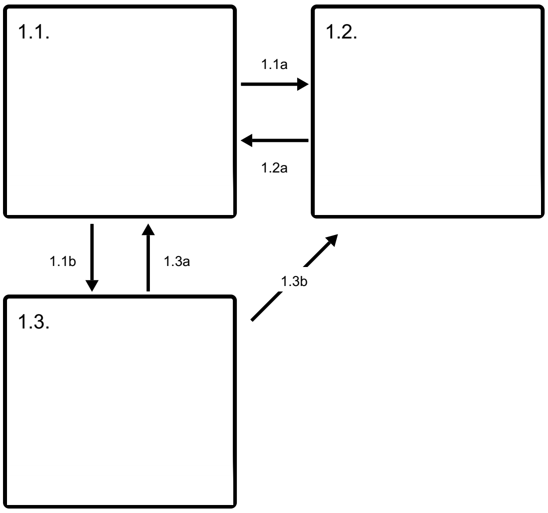
T3 - Repeated, widespread and severe fire.

T2 - Wildfire Suppression

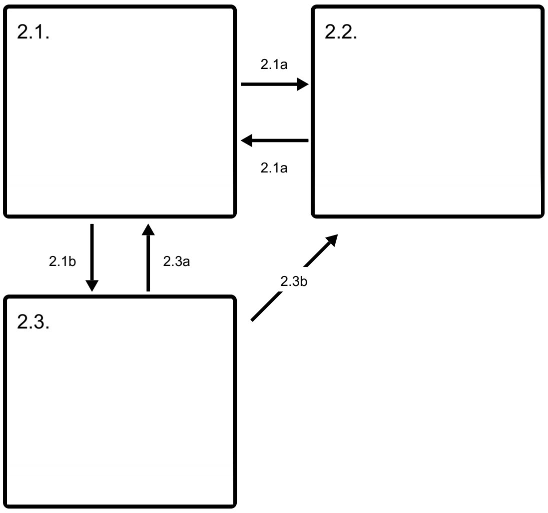
R2 - Seeding with native species/prescribed grazing

T4 - Catastrophic fire or a failed restoration attempt

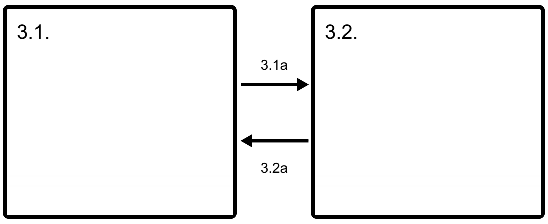
State 1 submodel, plant communities



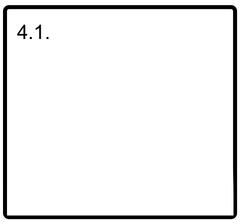
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 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.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- basin wildrye (*Leymus cinereus*), grass
- Thurber's needlegrass (*Achnatherum thurberianum*), grass

Community 1.1

This community phase is characteristic of a mid-seral plant community and is dominated by Wyoming big sagebrush and bluebunch wheatgrass.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	400	575	800
Shrub/Vine	75	90	150
Forb	25	35	50
Total	**500**	**700**	**1000**

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 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. Fire will remove aboveground biomass from bluebunch wheatgrass but plant mortality is generally low (Robberecht and Defossé 1995) because the buds are underground (Conrad and Poulton 1966) or protected by foliage. Uresk et al. (1976) reported burning increased vegetative and reproductive vigor of bluebunch wheatgrass. Thus, bluebunch wheatgrass is considered to experience slight damage to fire but is more susceptible in drought years (Young 1983). Plant response will vary depending on season, fire severity, fire intensity and post-fire soil moisture availability. Depending on fire severity, rabbitbrush and horsebrush may increase after fire. Rubber rabbitbrush is top-killed by fire, but can resprout after fire and can also establish from seed (Young 1983). Yellow rabbitbrush is top-killed by fire, but sprouts vigorously after fire (Kuntz 1982, Akinsoji 1988).

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. Juniper may also be increasing in cover and number of individual trees. Additional field work is need to determine the extent of juniper on this ecological site and determine if correlation to a more appropriate site is warranted.

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. Management 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.

Dominant plant species

- Wyoming big sagebrush (*Artemisia tridentata ssp. wyomingensis*), shrub
- cheatgrass (*Bromus tectorum*), 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.

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. Sandberg bluegrass may increase and become co-dominate with remaining deep-rooted bunchgrasses. Juniper may also be increasing in cover and number of individual trees. Additional field work is need to determine the extent of juniper on this ecological site and determine if correlation to a more appropriate site is warranted.

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 basin big 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.

State 3
Annual State

Annual non-natives dominated site productivity and site resources. The dominance of non-native annuals control the spatial and temporal distribution of soil moisture, soil nutrients and energy resources. Remaining patches of sagebrush and/or perennial bunchgrass suffer from increased competition and narrowed fire return intervals.

Characteristics and indicators. This state experiences frequent fire due to increased cover and continuity of fine fuels. Fire is frequent enough to prevent the recovery of long-lived native perennials like Wyoming big sagebrush. Disturbance tolerant shrubs may be present or increasing depending on time since disturbance. As cheatgrass increases, fire frequencies also increase to frequencies between 0.23 and 0.43 times a year; then even sprouting shrubs such as rabbitbrush will not survive (Whisenant 1990).

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass

Community 3.1

This community phase in dominated by annual non-native plants such as cheatgrass and shallow-rooted perennial grasses like Sandberg bluegrass. Sprouting shrubs such as rabbitbrush may also common. Patches of mature sagebrush may or may not be present.

Community 3.2

This community phase is characteristic of a post-wildfire community where annual non-natives are controlling site resources. Depending on season and/or intensity of fire the visually aspect of the site in dominated annual non-natives and bare ground. Site may be experiencing soil loss.

Resilience management. This community phases is high susceptible to frequent and repeated wildfire. Best management practices prevent sites from reaching this community phase. Management options are extremely limited.

Pathway 3.1a
Community 3.1 to 3.2

Fire reduces or eliminates the overstory shrubs and shallow-rooted perennials and allows for annual non-natives to increase

Pathway 3.2a
Community 3.2 to 3.1

Time and lack of fire allows for sagebrush/rabbitbrush to establish. Probability of sagebrush establishment is very unlikely and dependent on a near-by seed source from unburned patches of sagebrush.

State 4
Tree State

This state is characterized by a dominance of Utah juniper. Sagebrush and perennial bunchgrasses may still be present, but they are no longer controlling site resources. Soil moisture, soil nutrients and soil organic matter distribution and nutrient cycling have been spatially and temporally altered. This state is relatively stable due to rapid growth rate and long life span of juniper.

Characteristics and indicators. The range and density of Utah juniper and singleleaf pinyon has increased since the middle of the nineteenth century (Tausch 1999, Miller and Tausch 2000). Causes for expansion of trees into sagebrush ecosystems include wildfire suppression, historic livestock grazing, and climate change (Bunting 1994).

Dominant plant species

- Utah juniper (*Juniperus osteosperma*), tree

Community 4.1

Juniper dominates overstory and site resources. Trees are actively growing and seedlings may be present. The shrub and grass understory is reduced. Sagebrush is stressed and dying. Trace amounts Sandberg bluegrass and forbs may be found in the interspaces. Annual non-native species are present under tree canopies. Bare ground areas are large and connected.

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.

Transition T3
State 2 to 3

Trigger: Repeated, widespread and severe fire. Slow variables: Increased production and cover of non-native annual species over time. Threshold: Loss of deep-rooted perennial bunchgrasses and shrubs truncates, spatially and temporally, nutrient capture and cycling within the community.

Transition T2
State 2 to 4

Trigger: Presence of juniper Slow variables: Encroachment of juniper is primarily driven by lack of fire. This may also be coupled with prolonged drought and poor grazing management. Threshold: Juniper is now controlling energy, moisture and nutrient resources Dominance of juniper results in decreased infiltration and increased runoff, reducing soil moisture and nutrient cycling. Sagebrush and perennial bunchgrass are reduced both vigor and reproductive capacity.

Restoration pathway R2
State 3 to 2

Seeding with native species followed by prescribed grazing Minimize soil disturbance and maximize non-native annual plant biomass removal during early spring. Combine prescribed grazing with seeding of native species. Continue to protect site from wildfire. Probability of success is extremely low.

Restoration pathway T4
State 4 to 3

Trigger: Catastrophic fire causing a stand replacing event. Or a failed restoration attempt including inappropriate tree removal or rangeland seeding using soil disturbing practices. Slow variables: Increased production and cover of non-native annual species under tree canopies. Threshold: Closed tree canopy with non-native annual species in the understory changes the intensity, size and spatial variability of wildfires. Changes in community composition are driven by temporal changes in energy capture, soil moisture and nutrient cycling and result in the loss of perennial bunchgrasses and sagebrush.

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				400–800	
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	320–640	–
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	35–105	–
	basin wildrye	LECI4	*Leymus cinereus*	14–35	–
	squirreltail	ELEL5	*Elymus elymoides*	2–10	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–10	–
	Sandberg bluegrass	POSE	*Poa secunda*	2–10	–
Forb					
2				25–50	
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	8–16	–
	buckwheat	ERIOG	*Eriogonum*	8–16	–
	lupine	LUPIN	*Lupinus*	8–16	–
Shrub/Vine					
3				75–150	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	35–105	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	30–35	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	2–6	–
	spiny hopsage	GRSP	*Grayia spinosa*	2–6	–
	littleleaf horsebrush	TEGL	*Tetradymia glabrata*	2–6	–
	Utah juniper	JUOS	*Juniperus osteosperma*	2–6	–

Animal community

Livestock/Wildlife Grazing Interpretations:
This site is suited to cattle and sheep use during the spring, early summer and fall. Due to its southerly exposure, this site loses its snow cover earlier in the spring and plant growth is initiated before that of most adjacent sites; therefore, livestock may concentrate on this site during early spring grazing periods. 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 Thurber’s needlegrass. 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. Wildfire in sites with cheatgrass present could transition to cheatgrass-dominated communities. Without management, cheatgrass and annual forbs are likely to invade and dominate the site, especially after fire. Although trees are not part of the site concept, Utah juniper and/or singleleaf pinyon can also invade and eventually dominate this site.

Reduced bunchgrass vigor or density provides an opportunity for Sandberg bluegrass expansion and/or cheatgrass and other invasive species such as saltlover (Halogeton glomeratus), bur buttercup (Ceratocephala testiculata) and annual mustards to occupy interspaces. Sandberg bluegrass increases under grazing pressure (Tisdale and Hironaka 1981) and is capable of co-existing with cheatgrass. 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 more moisture and may retain deep-rooted perennial grasses whereas convex areas are slightly less resilient and may have more Sandberg bluegrass present.

Bluebunch wheatgrass is considered one of the most important forage grass species on western rangelands for livestock. Although bluebunch wheatgrass can be a crucial source of forage, it is not necessarily the most highly preferred species. 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). 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, Britton et al. 1990). Tiller production and growth of bluebunch was greatly reduced when drought was coupled with clipping (Busso and Richards 1995). Mueggler (1975) estimated that low-vigor bluebunch wheatgrass may need up to 8 years rest to recover. Bluebunch wheatgrass does not generally provide sufficient cover for ungulates; however, mule deer were frequently found in bluebunch-dominated grasslands.

Thurber’s needlegrass is an important forage source for livestock and wildlife in the arid regions of the West (Ganskopp 1988). Thurber’s needlegrass species begin growth early in the year and remain green throughout a relatively long growing season. This pattern of development enables animals to use Thurber’s needlegrass when many other grasses are unavailable. Cattle prefer Thurber’s needlegrass in early spring before fruits have developed as it becomes less palatable when mature. Thurber’s needlegrasses are grazed in the fall only if the fruits are softened by rain. Although the seeds are not injurious, grazing animals often avoid them when they begin to mature. Sheep, however, have been observed to graze the leaves closely, leaving the stems untouched (Eckert and Spencer 1987). Heavy grazing during the growing season has been shown to reduce the basal area of Thurber’s needlegrass (Eckert and Spencer 1987), suggesting that both seasonality and utilization are important factors in management of this plant. A single defoliation, particularly during the boot stage, was found to reduce herbage product and root mass, thus potentially lowing the competitive ability of this needlegrass (Ganskopp 1988).

Antelope bitterbrush is often utilized by domestic livestock (Wood 1995). 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. Grazing tolerance is dependent on site conditions (Garrison 1953) and the shrub can be severely hedged during the dormant season for grasses and forbs.

Livestock browse Wyoming big sagebrush, but may use it only lightly when palatable herbaceous species are available.

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:
Wyoming big sagebrush is preferred browse for wild ungulates. Pronghorn usually browse Wyoming big sagebrush heavily. Sagebrush-grassland communities provide critical sage-grouse breeding and nesting habitats. Open Wyoming sagebrush communities are preferred nesting habitat. Meadows surrounded by sagebrush may be used as feeding and strutting grounds. Sagebrush is a crucial component of their diet year-round, and sage-grouse select sagebrush almost exclusively for cover. Leks are often located on low sagebrush sites, grassy openings, dry meadows, ridgetops, and disturbed sites. Sage-grouse prefer mountain big sagebrush and Wyoming big sagebrush communities to basin big sagebrush communities.

Pronghorn antelope, mule deer, elk, and bighorn sheep utilize antelope bitterbrush extensively. Mule deer use of antelope bitterbrush peaks in September, when antelope bitterbrush may compose 91 percent of the 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

Runoff is medium to high. Potential for sheet and rill erosion is moderate to high depending on slope and the amount of gravels and/or cobbles on the soil surface. Water flow patterns are rare but can be expected in areas subjected to summer convection storms or rapid 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 this site.

Recreational uses

Aesthetic value is derived from the colorful flowering of numerous shrubs and forbs backgrounded by the verdure of native grasses in the spring and early summer. On steeper slopes, many forms of recreation are inhibited. The diverse floral and faunal composition of the site provides rewarding opportunities for nature study and photography. This site has potential for deer, antelope and upland game hunting.

Other products

Native Americans made tea from big sagebrush leaves. They used the tea as a tonic, an antiseptic, for treating colds, diarrhea, and sore eyes and as a rinse to ward off ticks. Big sagebrush seeds were eaten raw or made into meal. Basin wildrye was used as bedding for various Native American ceremonies, providing a cool place for dancers to stand.

Other information

Wyoming big sagebrush is used for stabilizing slopes and gullies and for restoring degraded wildlife habitat, rangelands, mine spoils and other disturbed sites. It is particularly recommended on dry upland sites where other shrubs are difficult to establish. Basin 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

NRCS-RANGE-417 - 3 records
NV-4400-13(BLM)- 5 records
Old SS Manuscripts, Range Site Descriptions, etc.

Type locality

Location 1: Elko County, NV	
Township/Range/Section	T43N R50E S13
General legal description	Projected N½ Section 13, T43N. R50E. MDBM. Approximately 2 miles south of Wilson Reservoir, Elko County, Nevada. This site also occurs in Humboldt County, Nevada.

References

Baker, W.L. 2006. Fire and Restoration of Sagebrush Ecosystems. Wildlife Society Bulletin 34:177–185.

Haubensak K. and D'Antonio C. 2009. Effects of fire and environmental variable on plant structure and composition in grazed salt desert shrublands of the Great Basin (USA). Journal of Arid Environment. Elsevier. 643–650.

Michael J. Falkowski and Jeffrey S. Evans. January 2017. Mapping Tree Canopy Cover in Support of Proactive Prairie Grouse Conservation in Western North America. Rangeland Ecology and Management 70:15–24.

Pilliod, D.S. and J.L. Welty. 2017. Refining the cheatgrass–fire cycle in the Great Basin: Precipitation timing and fine fuel composition predict wildfire trends. Ecology and Evolution. Wiley.

Williams, C.J. and F.B. Pierson. 2018. Effectiveness of prescribed fire to re-establish sagebrush steppe vegetation and ecohydrologic function on woodland-encroached sagebrush rangelands, Great Basin, USA: Part I: Vegetation, hydrology, and erosion responses.

Williamson, M.A. and E. Fleishman. 2019. Fire, livestock grazing, topography, and precipitation affect occurrence and prevalence of cheatgrass (Bromus tectorum) in the central Great Basin, USA.

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 50:115-120.

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 on 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.

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.

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 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 desirable 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.

Neuenschwander, L. 1980. Broadcast burning 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.

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.

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Approval

Kendra Moseley, 4/24/2024

Rangeland health reference sheet

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

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

Indicators

1. **Number and extent of rills:** Rills are rare. A few can be expected on steeper slopes in areas recently subjected to summer convection storms or rapid spring snowmelt.

2. **Presence of water flow patterns:** Water flow patterns are rare but can be expected in areas subjected to summer convection storms or rapid snowmelt.

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground ± 50% depending on amount of surface rock fragments

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) expected to move distance of slope length during intense summer convection storms or rapid

snowmelt events. Persistent litter (large woody material) will remain in place except during large rainfall events.

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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.)

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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 or massive. Soil surface colors are light and soils are typified by an ochric epipedon. Organic matter of the surface 2 to 3 inches is typically 1 to 1.5 percent dropping off quickly below. Organic matter content can be more or less depending on micro-topography.

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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., 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.

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

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

    Dominant: Deep-rooted, cool season, perennial bunchgrasses

    Sub-dominant: tall shrubs (Wyoming big sagebrush)>>associated shrubs>shallow-rooted, cool season, perennial grasses>deep-rooted, cool season, perennial forbs=fibrous, shallow-rooted, cool season perennial and annual forbs

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Dead branches within individual shrubs common and standing dead shrub canopy material may be as much as 25% of total woody canopy; some of the mature bunchgrasses (<20%) have dead centers.

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14. **Average percent litter cover (%) and depth (in):** Reference Plant Community; under shrubs and between plant interspaces (30-50%) and litter depth is ±½ inch.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** For normal or average growing season (through mid-June) ± 700 lbs/ac; Spring moisture significantly affects total 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:** Invaders include cheatgrass, snakeweed, Russian thistle and annual mustards.

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