USDA Natural Resources Conservation Service

Ecological site R028AY001NV
SILT FLAT

Accessed: 05/02/2024

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.

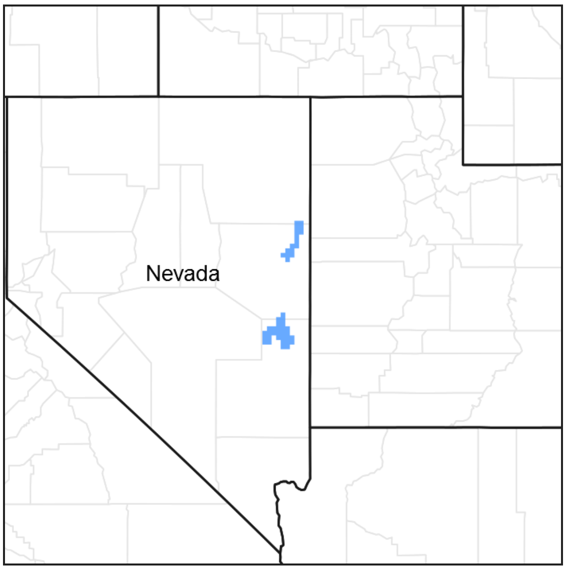

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 028A–Ancient Lake Bonneville

MLRA 28A occurs in Utah (82%), Nevada (16%), and Idaho (2%). It makes up about 36,775 square miles. A large area west and southwest of Great Salt Lake is a salty playa. This area is the farthest eastern extent of the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. It is an area of nearly level basins between widely separated mountain ranges trending north to south. The basins are bordered by long, gently sloping alluvial fans. The mountains are uplifted fault blocks with steep side slopes. They are not well dissected because of low rainfall in the MLRA. Most of the valleys are closed basins containing sinks or playa lakes. Elevation ranges from 3,950 to 6,560 ft. in the basins and from 6,560 to 11,150 ft. in the mountains. Most of this area has alluvial valley fill and playa lakebed deposits at the surface. Great Salt Lake is all that remains of glacial Lake Bonneville. A level line on some mountain slopes indicates the former extent of this glacial lake. Most of the mountains in the interior of this area consist of tilted blocks of marine sediments from Cambrian to Mississippian age. Scattered outcrops of Tertiary continental sediments and volcanic rocks are throughout the area. The average annual precipitation is 5 to 12 ins. in the valleys and is as much as 49 ins. in the mountains. Most of the rainfall occurs as high-intensity, convective thunderstorms during the growing season. The driest period is from midsummer to early autumn. Precipitation in winter typically occurs as snow. The average annual temperature is 39 to 53 °F. The freeze-free period averages 165 days and ranges from 110 to 215 days, decreasing in length with elevation. The dominant soil orders in this MLRA are Aridisols, Entisols, and Mollisols. The soils in the area dominantly have a mesic or frigid soil temperature regime, an aridic or xeric soil moisture regime, and mixed mineralogy. They generally are well drained, loamy or loamy-skeletal, and very deep.

Ecological site concept

This site occurs on alluvial flats and lake plains. Slopes range from 0 to 2 percent. Elevations range from are 5000 to 6400 feet.

Average annual precipitation is 8 to 10 inches. Mean annual air temperature is 45 to 50 degrees F. The average growing season is about 100 to 120 days.

The soils associated with this site are very deep and well drained and are formed in alluvium derived from limestone and welded tuff over mixed lacustrine deposits. Surface soils are medium to fine textured and have abundant vesicular pores. These soils are generally salt and sodium affected throughout the soil profile.

The reference state is dominated by Wyoming big sagebrush, bottlebrush squirreltail and Sandberg bluegrass. Production ranges from 150 to 450 pounds per acre.

Associated sites

R028AY008NV	**SODIC TERRACE 8-10 P. Z.**
R028AY015NV	**LOAMY 8-10 P.Z.**

Similar sites

R028AY015NV	**LOAMY 8-10 P.Z.** ACHY-HECO26 codominant grasses; more productive site

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata var. wyomingensis*
Herbaceous	(1) *Elymus elymoides* (2) *Poa secunda*

Physiographic features

This site occurs on alluvial flats and lake plains. Slope gradients of 0 to 2 percent are most typical. Elevations are 5000 to 6400 feet.

Table 2. Representative physiographic features

Landforms	(1) Alluvial flat (2) Lake plain
Elevation	1,524–1,951 m
Slope	0–2%
Aspect	Aspect is not a significant factor

Climatic features

Nevada's climate is predominantly arid, with large daily ranges of temperature, infrequent severe storms, heavy snowfall in the higher mountains, and great location variations with elevation. Three basic geographical factors largely influence Nevada's climate: continentality, latitude, and elevation. Continentality is the most important factor. The strong continental effect is expressed in the form of both dryness and large temperature variations. Nevada lies on the eastern, lee side of the Sierra Nevada Range, a massive mountain barrier that markedly influences the climate of the State. The prevailing winds are from the west, and as the warm moist air from the Pacific Ocean ascend the western slopes of the Sierra Range, the air cools, condensation occurs and most of the moisture falls as precipitation. As the air descends the eastern slope, it is warmed by compression, and very little precipitation

occurs. The effects of this mountain barrier are felt not only in the West but throughout the state, with the result that the lowlands of Nevada are largely desert or steppes. The temperature regime is also affected by the blocking of the inland-moving maritime air. Nevada sheltered from maritime winds, has a continental climate with well-developed seasons and the terrain responds quickly to changes in solar heating.
Nevada lies within the mid-latitude belt of prevailing westerly winds which occur most of the year. These winds bring frequent changes in weather during the late fall, winter and spring months, when most of the precipitation occurs. To the south of the mid-latitude westerlies, lies a zone of high pressure in subtropical latitudes, with a center over the Pacific Ocean. In the summer, this high-pressure belt shifts northward over the latitudes of Nevada, blocking storms from the ocean. The resulting weather is mostly clear and dry during the summer and early fall, with scattered thundershowers. The eastern portion of the state receives significant summer thunderstorms generated from monsoonal moisture pushed up from the Gulf of California, known as the North American monsoon. The monsoon system peaks in August and by October the monsoon high over the Western U.S. begins to weaken and the precipitation retreats southward towards the tropics (NOAA 2004).

Average annual precipitation is 8 to 10 inches. Mean annual air temperature is 45 to 50 degrees F. The average growing season is about 100 to 120 days.

Mean annual precipitation at the LUND, NEVADA climate station (264745) is 10.04 inches.

January 0.78; February 0.85; March 1; April 0.98: May 0.95; June 0.82; July 0.69; August 0.87; September 0.77; October 0.92; November 0.69; December 0.73.

Table 3. Representative climatic features

Frost-free period (average)	0 days
Freeze-free period (average)	110 days
Precipitation total (average)	229 mm

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are very deep and well drained and are formed in alluvium derived from limestone and welded tuff over mixed lacustrine deposits. Surface soils are medium to fine textured and have abundant vesicular pores. These soils are generally salt and sodium affected throughout the soil profile. The surface layer will normally crust and bake upon drying, inhibiting water infiltration and seedling emergence. The available water holding capacity is low to high. Runoff is very low to medium and ponding occurs in many areas. The soil temperature regime is mesic and soil moisture regime is aridic bordering on xeric. Soil series associated with this site include: Chuffa, Crestline, and Linoyer.

The representative soil component is Chuffa (NV779 MU5060) classified as a fine-silty, mixed, superactive, mesic Xeric Haplocambid. The soils have an ochric epipedon from the soil surface to 7 inches and a cambic horizon from 7 to 13 inches. Clay content in the particle-size control section ranges from 18 to 30 percent. Reaction is moderately alkaline and effervescence is violently effervescent. Lithology consists of limestone and welded tuff over mixed lacustrine deposits.

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone
Surface texture	(1) Silt loam (2) Gravelly sandy loam (3) Very fine sandy loam
Family particle size	(1) Loamy

Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	152–213 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	10.67–19.81 cm
Calcium carbonate equivalent (0-101.6cm)	0–30%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–12
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.6
Subsurface fragment volume <=3" (Depth not specified)	15–35%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

An ecological site is the product of all the environmental factors responsible for its development and 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).

The 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. (Comstock and Ehleringer 1992). Root length of mature sagebrush plants was measured to a depth of 2 meters in alluvial soils in Utah (Richards and Caldwell 1987). These shrubs have a flexible generalized root system with development of both deep taproots and laterals near the surface (Dobrowolski et al. 1990).

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

In the Great Basin, the majority of annual precipitation is received during the winter and early spring. This continental semiarid climate regime favors growth and development of deep-rooted shrubs and herbaceous cool season plants using the C3 photosynthetic pathway (Comstock and Ehleringer 1992). Winter precipitation and slow melting of snow results in deeper percolation of moisture into the soil profile. Herbaceous plants, more shallow-rooted than shrubs, grow earlier in the growing season and thrive on spring rains, while the deeper rooted shrubs lag in phenological development because they draw from deeply infiltrating moisture from snowmelt the previous winter. Periodic drought regularly influences sagebrush ecosystems and drought duration and severity has increased throughout the 20th century in much of the Intermountain West. Major shifts away from historical precipitation patterns have the greatest potential to alter ecosystem function and productivity. Species composition and productivity can be altered by the timing of precipitation and water availability within the soil profile (Bates et al 2006).

Wyoming big sagebrush, the most drought tolerant of the big sagebrushes, is generally long-lived; therefore it is 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 depended on adequate moisture conditions.

The Great Basin sagebrush communities have high spatial and temporal variability in precipitation, both among

years and within growing seasons. Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The moisture resource supporting the greatest amount of plant growth is usually the water stored in the soil profile during the winter. The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition 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 introduction of annual weedy species, like cheatgrass, may cause an increase in fire frequency and eventually lead to an annual state. Conversely, as fire frequency decreases, sagebrush will increase and with inappropriate grazing management the perennial bunchgrasses and forbs may be reduced.
Millions of acres in the arid and semi-arid West have been brush-beaten and planted with crested wheatgrass (*Agropyron cristatum*) in order to benefit both livestock and wildlife and to increase range production (Zlatnik 1999). Crested wheatgrass is a cool-season, medium height, exotic perennial bunchgrass. As a native of Russia, it is adapted to very cold and very dry climates which made it the common choice for range rehabilitation. This site may exhibit an understory of crested wheatgrass in areas where historical seedings have been allowed to return to sagebrush.
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 occurred in the Great Basin in the 1960s, early 1970s, and has 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).
This ecological site has low resilience to disturbance and low resistance to invasion. Historically this site would rarely experience fire due to low fuel loads, however the introduction of fine fuels from non-native annual grasses increases fire risk. Three possible alternative stable states have been identified for this site.

Fire Ecology:
Wyoming big sagebrush is easily killed by fire (Blaisdell 1953). Pre-European settlement fire return intervals for Wyoming big sagebrush vary depending on study source and location from 50-100 years (Wright and Bailey 1982), 100-240 years (Baker 2006), and most recently, Baker (2011) summarized five sources of fire interval estimates and found 200-350 years to be the most common estimate. Wyoming big sagebrush only regenerates from seed. Repeated fires may eliminate the onsite seed source; reinvasion into these areas may be extremely slow (Bunting et al. 1987). Reestablishment after fire may require 50-120 or more years (Baker 2006). Even then, up to 25 years after fire, Wyoming big sagebrush may have less than 5% of pre-fire cover (Baker 2011). The introduction and expansion of cheatgrass has dramatically altered the fire regime (Balch et al. 2013), therefore altering restoration potential of Wyoming big sagebrush communities (Evans and Young 1978).
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). Fire will remove aboveground biomass from bluebunch wheatgrass but plant mortality is generally low (Robberecht and Defossé 1995). However, season and severity of the fire will influence plant response. Plant response will vary depending on post-fire soil moisture availability.
Bottlebrush squirreltail is considered more fire tolerant than Indian ricegrass due to its small size, coarse stems, and sparse leafy material (Britton et al. 1990). Post-fire regeneration occurs from surviving root crowns and from on- and off-site seed sources. Bottlebrush squirreltail has the ability to produce large numbers of highly germinable seeds, with relatively rapid germination (Young and Evans 1977) when exposed to the correct environmental cues. Early spring growth and ability to grow at low temperatures contribute to the persistence of bottlebrush squirreltail among cheatgrass dominated ranges (Hironaka and Tisdale 1973).
A prominent grass on this site, Indian ricegrass, is fairly fire tolerant (Wright 1985), which is likely due to its low culm density and below ground plant crowns. Vallentine (1989) cites several studies in the sagebrush zone that classified Indian ricegrass as being slightly damaged from late summer burning. Indian ricegrass has also been found to reestablish on burned sites through seed dispersed from adjacent unburned areas (Young 1983, West 1994). Thus the presence of surviving, seed producing plants facilitates the reestablishment of Indian ricegrass. Grazing management following fire to promote seed production and establishment of seedlings is important.
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. Reduced deep-rooted bunchgrass vigor or density provides an opportunity for Sandberg bluegrass expansion and/or cheatgrass and other invasive species such as halogeton to occupy interspaces.

State and transition model

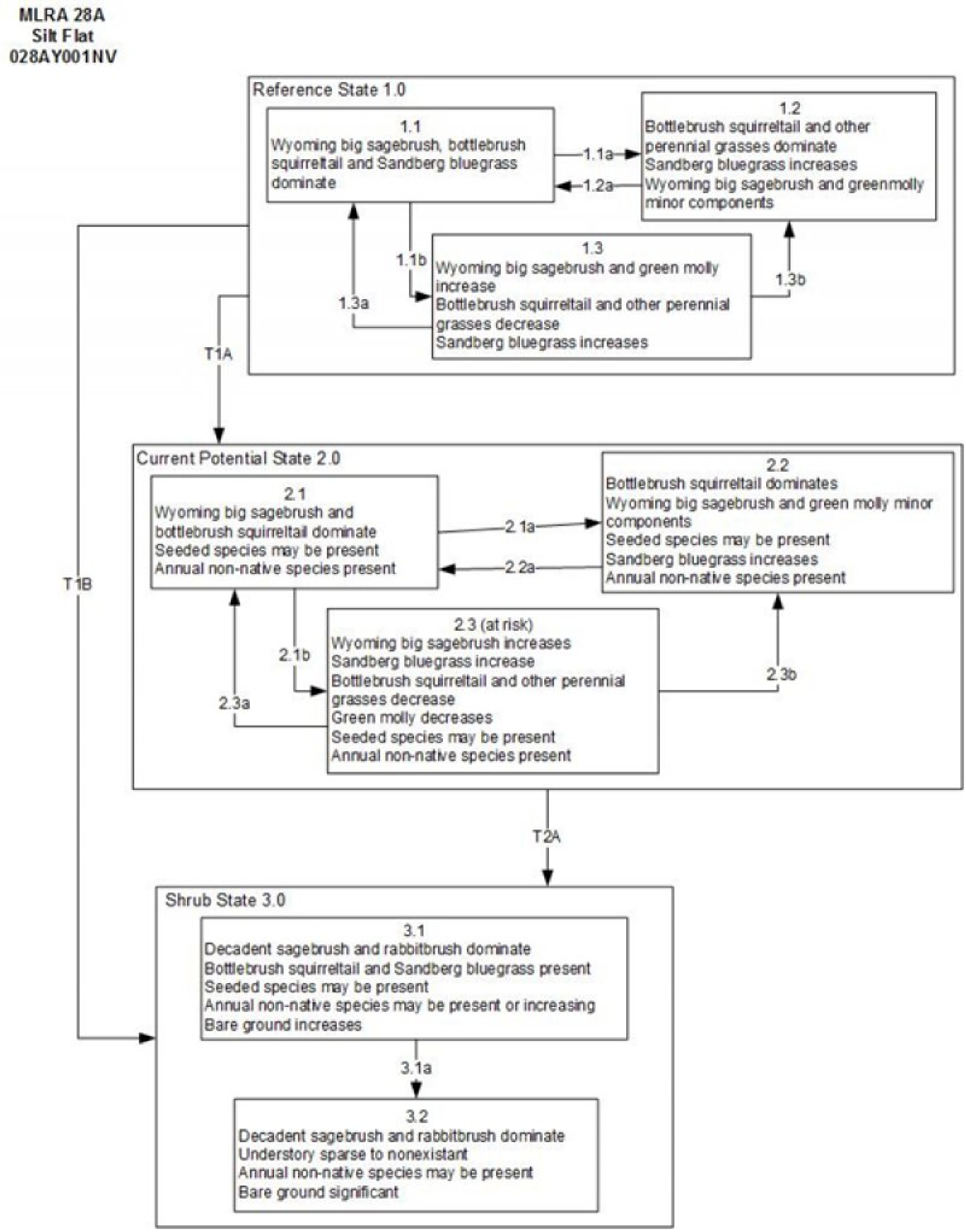

Figure 5. State and Transition Model

MLRA 28A
Silt Flat
028AY001NV

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

Transition T1A: Introduction of non-native species such as bulbous bluegrass, cheatgrass and thistles.
Transition T1B: Time and lack of disturbance coupled with inappropriate grazing management.

Current Potential State 2.0 Community Phase Pathways
2.1a: Low severity fire creates grass/sagebrush mosaic; high severity fire significantly reduces sagebrush cover and leads to early/mid-seral community dominated by grasses and forbs; non-native annual species present.
2.1b: Time and lack of disturbance such as fire or long-term drought. Inappropriate grazing management may also reduce perennial understory.
2.2a: Time and lack of disturbance allows for regeneration of sagebrush.
2.3a: Low severity fire or Aroga moth infestation creates sagebrush/grass mosaic. Brush management with minimal soil disturbance; late-fall/winter grazing causing mechanical damage to sagebrush.
2.3b: High severity fire significantly reduces sagebrush cover leading to early mid-seral community.

Transition T2A: Time and lack of disturbance coupled with inappropriate grazing management.

Current Potential State 3.0 Community Phase Pathways
3.1a: Inappropriate grazing management and or long-term drought.

Figure 6. Legend

State 1
Reference State

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

Community 1.1
Community Phase

This community is dominated by Wyoming big sagebrush, bottlebrush squirreltail, and Sandberg bluegrass. Other species include Indian ricegrass, green molly, shadscale, and rabbitbrush. Forbs and other grasses make up smaller components. Potential vegetative composition is approximately 20% grasses, 5% forbs, and 75% shrubs. Approximate ground cover (basal and crown) is 15 to 25 percent.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	127	273	378
Grass/Grasslike	34	73	101
Forb	8	18	26
Total	**169**	**364**	**505**

Community 1.2
Community Phase

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

Community 1.3
Community Phase

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

Pathway a
Community 1.1 to 1.2

Fire will decrease or eliminate the overstory of sagebrush and allow for the perennial bunchgrasses to dominate the site. Fires will typically be low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring may be more severe and reduce sagebrush cover to trace amounts. A severe infestation of Aroga moth could also cause a large decrease in sagebrush giving a competitive advantage to the perennial grasses and forbs.

Pathway b
Community 1.1 to 1.3

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

Pathway a
Community 1.2 to 1.1

Time and lack of disturbance will allow sagebrush to increase.

Pathway a
Community 1.3 to 1.1

A low severity fire, Aroga moth, or combinations will reduce the sagebrush overstory and create a sagebrush/grass mosaic.

Pathway b
Community 1.3 to 1.2

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

State 2
Current Potential State

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

Community 2.1
Community Phase

This community is dominated by Wyoming big sagebrush, bottlebrush squirreltail and Sandberg bluegrass. Other shrubs include green molly, shadscale, and rabbitbrush. Forbs and other grasses make up smaller components. Seeded species such as crested wheatgrass may be present and/or dominate the understory. Annual non-native species such as halogeton and cheatgrass may also be present. Potential vegetative composition is approximately 20% grasses, 5% forbs, and 75% shrubs. Approximate ground cover (basal and crown) is 15 to 25 percent.

Community 2.2
Community Phase

This community phase is characteristic of a post-disturbance, early-seral community. Bottlebrush squirreltail, Indian ricegrass, and other perennial bunchgrasses dominate. Depending on fire severity or intensity of Aroga moth infestations, patches of intact sagebrush may remain. Seeded species such as crested wheatgrass may be present and/or dominate the understory. Annual non-native species such as halogeton and cheatgrass are may also be present.

Community 2.3
Community Phase

Figure 8. Silt Flat, T. Stringham August 2013, NV779 MU5060

This community phase is at risk of transitioning to another State. Sagebrush increases in the absence of disturbance. Decadent sagebrush dominates the overstory and the deep-rooted perennial bunchgrasses in the understory are reduced either from competition with shrubs and/or from herbivory. Seeded species such as crested wheatgrass may be present and/or dominate the understory. Annual non-native species such as halogeton and cheatgrass may also be present. This site is susceptible to further degradation from inappropriate grazing management and chronic drought.

Pathway a
Community 2.1 to 2.2

Fire will decrease or eliminate the overstory of sagebrush and allow for the perennial bunchgrasses to dominate the site. Fires will typically be low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring may be more severe and reduce sagebrush cover to trace amounts. A severe infestation of Aroga moth could also cause a large decrease in sagebrush giving a competitive advantage to the perennial grasses and forbs.

Pathway b
Community 2.1 to 2.3

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

Pathway a
Community 2.2 to 2.1

Time and lack of disturbance will allow sagebrush to increase.

Pathway a
Community 2.3 to 2.1

A low severity fire, Aroga moth, or combinations will reduce the sagebrush overstory and create a sagebrush/grass mosaic.

Pathway b
Community 2.3 to 2.2

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

State 3
Shrub State

This state is a product of many years of heavy grazing during time periods harmful to perennial bunchgrasses. Sandberg bluegrass will increase with a reduction in deep-rooted perennial bunchgrass competition and become the dominant grass. Sagebrush dominates the overstory and rabbitbrush may be a significant component. Sagebrush cover exceeds site concept and may be decadent, reflecting stand maturity and lack of seedling establishment due to competition with mature plants. The shrub overstory and Sandberg bluegrass understory dominate site resources such that soil water, nutrient capture, nutrient cycling and soil organic matter are temporally and spatially redistributed. Conservation practices to increase site resiliency include brush management and range planting.

Community 3.1
Community Phase

Figure 9. Silt Flat ,Phase 3.1 T. Stringham, July 2014, NV784 MU2060

Figure 10. old crested wheatgrass seeding, P. Novak-E, 7/2014, NV784 MU2060

Decadent sagebrush dominates the overstory. Rabbitbrush may be a significant component. Deep-rooted perennial bunchgrasses may be present in trace amounts or absent from the community. Squirreltail, Sandberg bluegrass, and annual non-native species increase. Bare ground is increasing. Crested wheatgrass may be a significant component in this phase if the site has a history of seeding treatments.

Community 3.2
Community Phase

Decadent sagebrush dominates the overstory. Rabbitbrush may be a significant component. Bare ground is significant. Bunchgrasses may be present in trace amounts or absent from the community. Annual non-native species may increase. Crested wheatgrass may be a significant component in this phase if the site has a history of seeding treatments.

Pathway a
Community 3.1 to 3.2

Chronic drought or repeated heavy growing season grazing will decrease or eliminate the understory herbaceous community and favor shrub growth and establishment.

Transition A
State 1 to 2

Trigger: This transition is caused by the introduction of non-native annual plants, such as cheatgrass, mustards, and halogeton. Slow variables: Over time the annual non-native species will 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 B
State 1 to 3

Trigger: Repeated heavy growing season grazing will decrease or eliminate deep-rooted perennial bunchgrasses, increase Sandberg bluegrass, and favor shrub growth and establishment. Slow variables: Long term decrease in deep-rooted perennial grass density. Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter.

Transition A
State 2 to 3

Trigger: Repeated heavy growing season grazing will decrease or eliminate deep-rooted perennial bunchgrasses, increase Sandberg bluegrass, and favor shrub growth and establishment. Slow variables: Long term decrease in deep-rooted perennial grass density and reduced organic matter inputs resulting in reduced soil moisture. Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			36–92	
	squirreltail	ELEL5	*Elymus elymoides*	18–55	–
	squirreltail	ELEL5	*Elymus elymoides*	18–55	–
	Sandberg bluegrass	POSE	*Poa secunda*	18–37	–
	Sandberg bluegrass	POSE	*Poa secunda*	18–37	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–11	–
2	**Secondary Perennial Grasses**			8–18	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–11	–
	basin wildrye	LECI4	*Leymus cinereus*	2–11	–
	western wheatgrass	PASM	*Pascopyrum smithii*	2–11	–
Forb					
3	**Perennial**			8–29	
	globemallow	SPHAE	*Sphaeralcea*	2–7	–
Shrub/Vine					
4	**Primary Shrubs**			226–330	
5	**Secondary Shrubs**			18–55	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	3–11	–
	sickle saltbush	ATFA	*Atriplex falcata*	3–11	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	3–11	–
	spiny hopsage	GRSP	*Grayia spinosa*	3–11	–

Animal community

Livestock Interpretations:
This site is suited to livestock grazing. Grazing management considerations include duration, timing and intensity of grazing. Overgrazing leads to an increase in sagebrush and a decline in understory plants such as Indian ricegrass

and basin wildrye. Squirreltail and Sandberg bluegrass will increase temporarily with further degradation (Jameson 1962, Tisdale and Hironaka 1981). Invasion of annual weedy forbs and cheatgrass could occur with further grazing degradation, leading to a decline in squirreltail and an increase in bare ground.

Bottlebrush squirreltail is very palatable winter forage for domestic sheep of Intermountain ranges. Domestic sheep relish the green foliage. Overall, bottlebrush squirreltail is considered moderately palatable to livestock. Bottlebrush squirreltail generally increases in abundance when moderately grazed or protected (Hutchings and Stewart 1953). In addition, moderate trampling by livestock in big sagebrush rangelands of central Nevada enhanced bottlebrush squirreltail seedling emergence compared to untrampled conditions. Heavy trampling however was found to significantly reduce germination sites (Eckert et al. 1987). Squirreltail is more tolerant of grazing than Indian ricegrass but all bunchgrasses are sensitive to over-utilization within the growing season.

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

Sandberg bluegrass is a widespread forage grass. It is one of the earliest grasses in the spring and is sought by domestic livestock and several wildlife species. Sandberg bluegrass is a palatable species, but its production is closely tied to weather conditions. It produces little forage in drought years, making it a less dependable food source than other perennial bunchgrasses. 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:

This site provides habitat for a variety of wildlife species. Wyoming big sagebrush is the preferred sub-species of sagebrush among wild ungulates. Pronghorn, elk, mule deer and bighorn sheep will browse Wyoming big sagebrush in winter months. (Bray et al. 1991). Studies have found Wyoming big sagebrush to be an important browse in pronghorn diets, especially in winter. Wyoming big sagebrush, and other big sagebrush varieties comprised approximately 75% to 90% of pronghorn diet in the winter months across western ranges. The shrub is a staple for the pronghorn throughout the year; however, it is not browsed as heavily in the summer months when other browse are more palatable (Beale and Smith 1970, Kinuthia 1992). Mule deer and elk will browse sagebrush intensively in winter. In fact, studies have noted dead sagebrush stands associated with elk (Wambolt 1996). Further, mule deer and elk will browse Wyoming big sagebrush over basin big and black sagebrush, according to a ten year study in Montana (Wambolt 1996).

Pygmy rabbits are sagebrush obligates and a study by Heady and Laundre found the lagamorphs use sites with big sagebrush at a higher intensity than with lower sagebrush (Heady and Laundre 2005). Sagebrush communities are important for maintaining lagomorph populations. A study by Larrison and Johnson (1973) captured Deer mice big sagebrush communities more than any other plant community, suggesting the mice prefer these plant communities for cover over other plant communities. Although, no specific variety of big sage was mentioned in the study.

A study by Welch (1991) found sage grouse prefer to feed on Wyoming big sagebrush over basin big sagebrush. However, sagebrush habitat should be maintained for sage grouse as they prefer to use medium-height sagebrush communities for habitat (Gregg et al. 1994). Birds such as Brewer’s sparrows, are considered dependent on sagebrush communities for cover and will nest in Wyoming big sagebrush. Thus when Wyoming big sage communities are converted to agriculture fields, Brewer’s sparrow populations can decline due to loss of habitat (Knick et al. 2003).

Hydrological functions

Runoff is very low to medium. Permeability is moderately slow to moderately rapid.

Recreational uses

Aesthetic value is derived from the diverse floral and faunal composition and the colorful flowering of wild flowers and shrubs during the spring and early summer. This site offers rewarding opportunities to photographers and for nature study. This site is used for camping and hiking and has potential for upland and big game hunting.

Other products

Native Americans made tea from big sagebrush leaves. They used the tea as a tonic, an antiseptic, for treating colds, diarrhea, and sore eyes and as a rinse to ward off ticks. Big sagebrush seeds were eaten raw or made into meal.

Other information

Bottlebrush squirreltail is tolerant of disturbance and is a suitable species for revegetation. 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.

Type locality

Location 1: White Pine County, NV	
Township/Range/Section	T10N R66E S32
Latitude	38° 41′ 26″
Longitude	114° 35′ 1″
General legal description	This site also occurs in Lincoln County, Nevada.

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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/P.NOVAK-ECHENIQUE
Contact for lead author	State Rangeland Management Specialist
Date	06/22/2006
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** This site is essentially level and rills do not form.

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2. **Presence of water flow patterns:** Water flow patterns are rare to common depending on site location relative to major inflow areas. Water flow patterns are typically short (<2m), meandering and ending in depressional areas where water ponds.

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3. **Number and height of erosional pedestals or terracettes:** A few plants that occur in water flow paths may have small pedestals (1-3"). Terracettes are none.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground >50%; surface rock fragments less than 5%; shrub canopy less than 15%; basal area for perennial herbaceous plants ± 2%.

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

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None - this site may experience severe wind scouring after a wildfire that removes all vegetative cover.

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7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter (foliage of grasses and annual & perennial forbs) expected to move distance of slope length during periods of intense summer convection

storms or run in from early spring snow melt flows. Persistent litter (large woody material) will remain in place except during unusual flooding (ponding) 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 will range from 3 to 6.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Structure of soil surface will be platy or fine granular. Soil surface colors are light browns or grays and soils are typified by an ochric epipedon. Surface textures are fine sandy loams, sandy loams or silt loams. A surface vesicular crust is also common. Organic matter is typically less than 3 percent.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** This site is typically ponded for short periods in the late winter and runoff is not significant. In areas with herbaceous cover (sparse) of deep-rooted perennial herbaceous bunchgrasses (i.e., basin wildrye) and/or rhizomatous grasses (western wheatgrass), these plants can increase infiltration. Moderately fine to fine surface textures and physical crusts result in limited infiltration rates. The surface layer will normally crust and bake upon drying, inhibiting water infiltration and seedling emergence.

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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. Subsurface subangular blocky, massive or calcic subsoil horizons are not to be interpreted as compaction.

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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: Reference State: Tall evergreen shrubs (big sagebrush) >>

    Sub-dominant: shallow-rooted cool season, perennial bunchgrasses (bottlebrush squirreltail & Sandberg""s bluegrass) > low-stature salt-desert shrubs (green molly, shadscale, etc.) > deep-rooted, cool season, perennial bunchgrasses = cool season, rhizomatous grasses = deep-rooted, cool season, perennial forbs = fibrous, shallow-rooted, cool season, perennial and annual forbs.

    Other: microbiotic crusts

    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 35% of total woody canopy.

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14. **Average percent litter cover (%) and depth (in):** Between plant interspaces 5-10% and depth <¼ in.

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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 June) ±325 lbs/ac; Favorable years ±450 lbs/ac and unfavorable years ±150 lbs/ac

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

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