USDA Natural Resources Conservation Service

Ecological site R024XY016NV
Mountain Ridge

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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): 024X–Humboldt Basin and Range Area

Major land resource area (MLRA) 24, the Humboldt Area, covers an area of approximately 8,115,200 acres (12,680 sq. mi.). It is found in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. Elevations range from 3,950 to 5,900 feet (1,205 to 1,800 meters) in most of the area, some mountain peaks are more than 8,850 feet (2,700 meters).
A series of widely spaced north-south trending mountain ranges are separated by broad valleys filled with alluvium washed in from adjacent mountain ranges. Most valleys are drained by tributaries to the Humboldt River. However, playas occur in lower elevation valleys with closed drainage systems. Isolated ranges are dissected, uplifted fault-block mountains. Geology is comprised of Mesozoic and Paleozoic volcanic rock and marine and continental sediments. Occasional young andesite and basalt flows (6 to 17 million years old) occur at the margins of the mountains. Dominant soil orders include Aridisols, Entisols, Inceptisols and Mollisols. Soils of the area are generally characterized by a mesic soil temperature regime, an aridic soil moisture regime and mixed geology. They are generally well drained, loamy and very deep.
Approximately 75 percent of MLRA 24 is federally owned, the remainder is primarily used for farming, ranching and mining. Irrigated land makes up about 3 percent of the area; the majority of irrigation water is from surface water sources, such as the Humboldt River and Rye Patch Reservoir. Annual precipitation ranges from 6 to 12 inches (15 to 30 cm) for most of the area, but can be as much as 40 inches (101 cm) in the mountain ranges. The majority of annual precipitation occurs as snow in the winter. Rainfall occurs as high-intensity, convective thunderstorms in the spring and fall.

Classification relationships

N/A

Ecological site concept

This ecological site is on convex-convex landform positions, such as mountain ridges, summits and shoulders. Soils associated with this site are shallow, well drained, and formed in colluvium or residuum derived from igneous and/or sedimentary rocks. They are characterized by a mollic epipedon and more than 40 percent rock fragments throughout the profile.
Important abiotic factors associated with this ecological site include low water holding capacity and reduced effective moisture due to high runoff, reduced snow accumulation, shallow depth and high amounts of rock fragments throughout the profile. The reference plant community is dominated by low sagebrush (ARAR8), black sagebrush (ARNO4) and Idaho fescue (FEID).

Associated sites

R024XY042NV	**STEEP GRAVELLY LOAM 14+ P.Z.** Soils are moderately deep, well drained and formed in residuum. The soil profile is characterized by a mollic epipedon, a calcic horizon and greater than 35 percent rock fragments by volume.
R024XY032NV	**LOAMY SLOPE 14+ P.Z.** The soil profile is characterized by a mollic (pachic) epipedon and greater than 35 percent rock fragments by volume.
R024XY021NV	**Loamy Slope 12-14 P.Z.** Soils are moderately deep, well drained, and formed in residuum/colluvium derived from volcanic parent material. The soil profile is characterized by a dark surface horizon (mollic epipedon), a horizon of clay accumulation (argillic horizon) within 12 inches (30 cm), and 18-35 percent clay in the particle size control section.
R024XY023NV	**NORTH SLOPE 14+ P.Z.** The soil profile is characterized by a pachic epipedon and greater than 35 percent rock fragments in the particle size control section. The north aspect and the thick mollic epipedon reflecting the increased vegetative production due to increased available soil moisture. Site dominated by Mountain big sagebrush (ARTRV)/ Idaho fescue (FEID); soils very deep, higher AWC.
R024XY027NV	**CLAYPAN 12-16 P.Z.** Soils are moderately deep, well drained and formed in residuum derived from volcanic parent material. Sites include an abrupt boundary in the upper soil profile that results in wet non-satiated conditions during the spring and early summer. Under natural conditions the reference state is dominated by low sagebrush (ARAR8), Idaho fescue (FEID), and bluebunch wheatgrass (PSSPS).

Similar sites

R024XY018NV	**Claypan 10-12 P.Z.** Bluebunch wheatgrass (PSSPS)- Thurbers needlegrass (ACTH7) codominant grasses; more productive site; soil characterized by an ochric epipedon, less than 40 percent rock fragments by volume.
R024XY027NV	**CLAYPAN 12-16 P.Z.** More productive site; Bluebunch wheat grass (PSSPS) codominant grass; deeper soil; site typically found on backslopes of mountains.
R024XY042NV	**STEEP GRAVELLY LOAM 14+ P.Z.** Black sagebrush (ARNO4) dominant shrub; Low sagebrush (ARAR8) absent; more productive site; soil characterized by accumulation of calcium carbonates.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia arbuscula* (2) *Artemisia nova*
Herbaceous	(1) *Festuca idahoensis* (2) *Poa*

Physiographic features

This ecological site is on convex-convex summits, ridges and shoulders of mountains. Elevations typically range from 6,500 to 9,500 feet (1,981 to 2,896 m) but may occur as high as 10,000 feet (3,048m) in some mountain ranges. Slopes range from 4 to 30 percent, but slope gradients of 8 to 15 percent are typical. Runoff on this site is high to very high.

Table 2. Representative physiographic features

Hillslope profile	(1) Shoulder (2) Summit
Landforms	(1) Mountains > Ridge
Runoff class	High to very high

Elevation	6,500–9,500 ft
Slope	4–30%
Aspect	Aspect is not a significant factor

Climatic features

Average annual precipitation is estimated to be greater than 14 inches (36cm). Precipitation occurs mainly as snow in winter and summers are dry. The average growing season is less than 80 days. Representative weather stations are not available for this site.

Table 3. Representative climatic features

Frost-free period (characteristic range)	60-100 days
Freeze-free period (characteristic range)	50-80 days
Precipitation total (characteristic range)	14-20 in
Frost-free period (average)	80 days
Freeze-free period (average)	60 days
Precipitation total (average)	16 in

Influencing water features

Influencing water features are not associated with this ecological site.

Wetland description

N/A

Soil features

Soils associated with this site are very shallow to shallow, well drained, and formed in residuum and colluvium derived from igneous and sedimentary rocks. Important characteristics include a mollic epipedon, greater than 40 percent rock fragments throughout the profile and less than 30 percent clay in the particle size control section. These soils have high amounts of gravels, cobbles or stones on the surface. These coarse fragments occupy plant growing space yet protect the soil from excessive erosion. The available water capacity is very low to low. The surface cover of rock fragments helps to reduce evaporation and conserve soil moisture. Frost heaving is common.

Representative soil components associated with this site include: Cleavage, Bregar, Packer, Halacan, and Layview.

Table 4. Representative soil features

Parent material	(1) Residuum–volcanic breccia (2) Colluvium–tuff
Surface texture	(1) Very gravelly loam (2) Very cobbly loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Slow to moderate
Soil depth	10–20 in
Surface fragment cover <=3"	3–19%
Surface fragment cover >3"	21–59%

Available water capacity (Depth not specified)	1.1–2.7 in
Soil reaction (1:1 water) (Depth not specified)	6.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	31–45%
Subsurface fragment volume >3" (Depth not specified)	10–23%

Ecological dynamics

This ecological site is dominated by deep-rooted cool season, perennial bunchgrasses and long-lived shrubs (50+ years) with high root to shoot ratios. The dominant shrubs usually root to the full depth of the winter-spring soil moisture recharge, which ranges from 1.0 to over 3.0 m (Dobrowolski et al. 1990). However, community types with low sagebrush as the dominant shrub were found to have soil depths and thus available rooting depths of 71 to 81 cm in a study in northeast Nevada (Jensen 1990). These shrubs have a flexible generalized root system with development of both deep taproots and laterals near the surface (Comstock and Ehleringer 1992).

Great Basin sagebrush communities have high spatial and temporal variability in precipitation both among years and within growing seasons. 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 with the soil profile (Bates et al. 2006). Low sagebrush is fairly drought tolerant but also tolerates periodic wetness during some portion of the growing season. Low sagebrush is also susceptible to the sagebrush defoliator, Aroga moth. Aroga moth can partially or entirely kill individual plants or entire stands of big sagebrush (Furniss and Barr 1975), but the research is inconclusive of the damage sustained by low sagebrush populations.

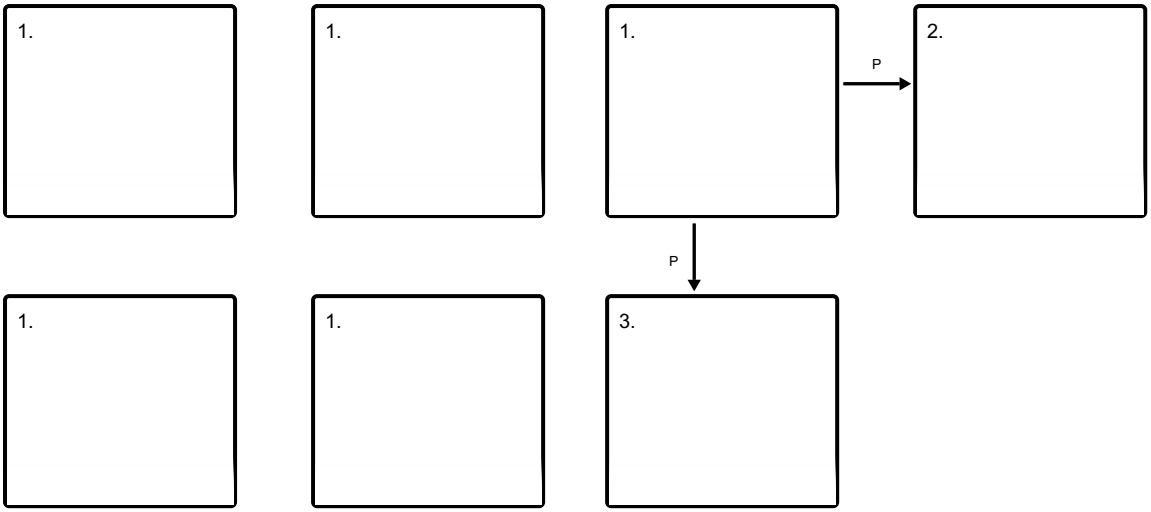
The perennial bunchgrasses that are dominant on this site include Idaho fescue and bluebunch wheatgrass. These species generally have somewhat shallower root systems than the shrubs, but root densities are often as high as or higher than those of shrubs in the upper 0.5 m but taper off more rapidly than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

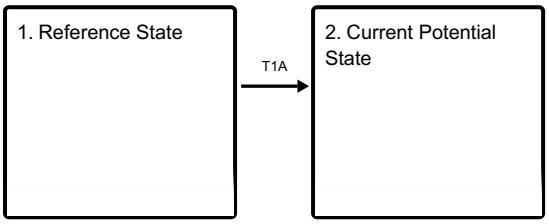
The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition or can increase resource pools by the decomposition of dead plant material following disturbance. The invasion 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.

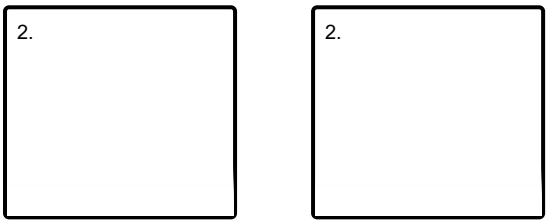
State and transition model

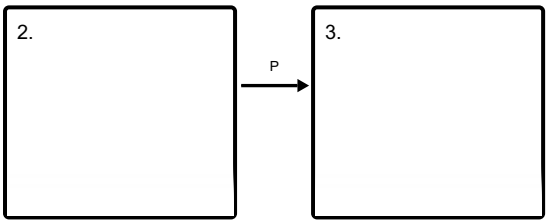
Main model

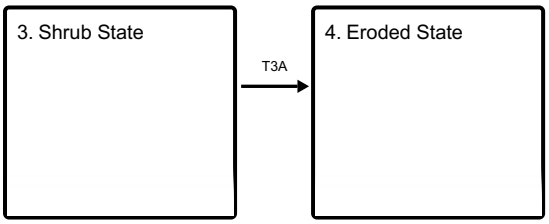
Communities 1, 2 and 3 (additional pathways)

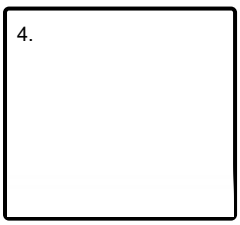




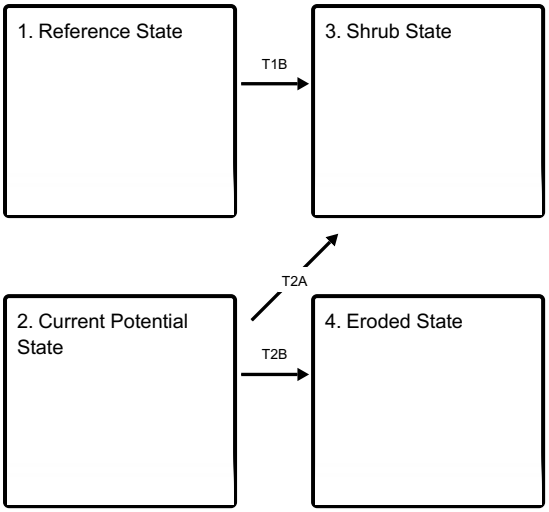




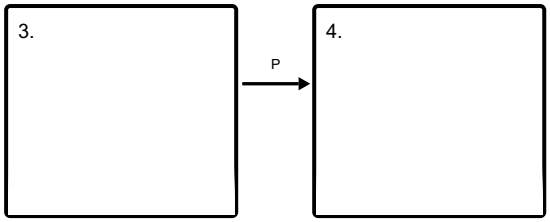




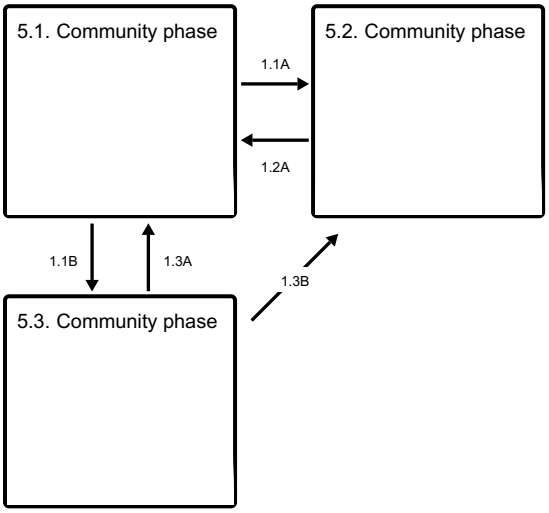
Communities 1, 3, 2 and 4 (additional pathways)



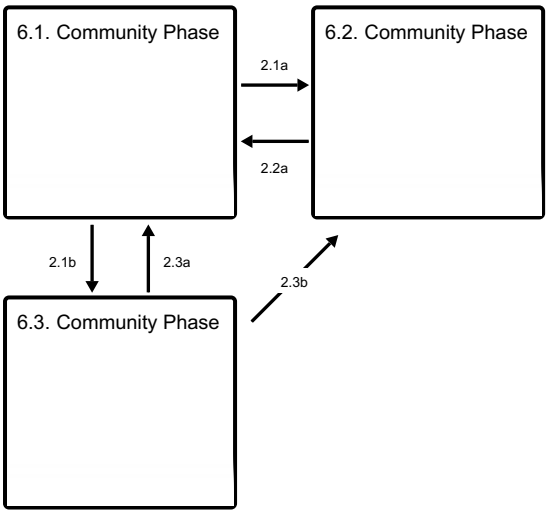
Communities 3 and 4 (additional pathways)



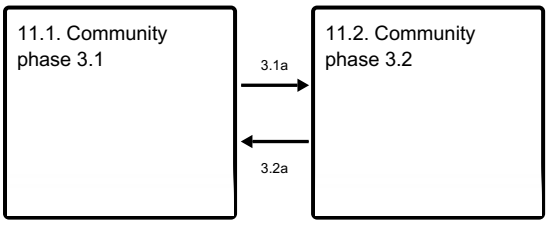
Land use 5 submodel, ecosystem states



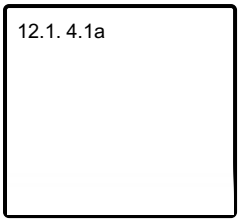
Land use 6 submodel, ecosystem states



Land use 11 submodel, ecosystem states



Land use 12 submodel, ecosystem states



Community 1

Community 2

Community 3

Community 4

State 5
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. Due to the nature and extent of disturbance in this site, multiple community phases would likely occur in a mosaic across the landscape.

Characteristics and indicators. Low sagebrush is killed by fire and does not sprout (Young 1983). Establishment after fire is from seed, generally blown in and not from the seed bank (Bradley et al. 1992). Fire risk is greatest following a wet, productive year when there is greater production of fine fuels (Beardall and Sylvester 1976). Fire return intervals have been estimated at 100-200 years in black sagebrush (*Artemisia nova*) dominated sites (Kitchen and McArthur 2007) and likely is similar in the low sagebrush ecosystem; however, historically fires were probably patchy due to the low productivity of these sites.

Dominant plant species

- little sagebrush (*Artemisia arbuscula*), shrub
- black sagebrush (*Artemisia nova*), shrub
- Idaho fescue (*Festuca idahoensis*), grass

Community 5.1
Community phase

This community phase is representative of a mid-seral plant community. It is dominated by low sagebrush and Idaho fescue. Black sagebrush and bluegrasses are important species associated with this site. Potential vegetative composition is about 45% grasses, 10% forbs and 45% shrubs. Approximate ground cover (basal and crown) is 15 to 20 percent.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	–	–	–
Total	**–**	**–**	**–**

Community 5.2
Community phase

This community phase is characteristic of a post-disturbance, early or mid-seral community. Idaho fescue, sprouting shrubs such as Douglas' rabbitbrush may increase. Depending on fire severity, patches of intact sagebrush may remain. Perennial forbs and perennial bunchgrass may dominate for several years.

Resilience management. Low sagebrush is killed by fire and does not sprout (Young 1983). Establishment after fire is from seed, generally blown in and not from the seed bank (Bradley et al. 1992). Fire risk is greatest following a wet, productive year when there is greater production of fine fuels (Beardall and Sylvester 1976). Fire return intervals have been estimated at 100-200 years in black sagebrush (*Artemisia nova*) dominated sites (Kitchen and McArthur 2007) and likely is similar in the low sagebrush ecosystem; however, historically fires were probably patchy due to the low productivity of these sites.

Community 5.3
Community phase

This community phase is characteristics of a later-seral community phase. Decadent sagebrush dominates the overstory and the deep-rooted perennial bunchgrasses in the understory are reduced from competition with shrubs and/or from herbivory. Sandberg bluegrass may be increasing in the understory and become the dominant grass on the site.

Resilience management. Sagebrush increases in the absence of disturbance.

Pathway 1.1A
Community 5.1 to 5.2

Low severity fire creates grass/sagebrush mosaic; high severity fire significantly reduces sagebrush cover and leads to early/mid seral community, dominated by grass and forbs.

Context dependence. Fire reduces the shrub overstory and allows for perennial bunchgrasses to dominate the site. Fires are typically low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring facilitating an increase in fine fuels may be more severe and reduce sagebrush cover to trace amounts.

Pathway 1.1B
Community 5.1 to 5.3

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

Pathway 1.2A
Community 5.2 to 5.1

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.

Context dependence. Recovery time of low sagebrush following fire is variable (Young 1983). After fire, if regeneration conditions are favorable, low sagebrush recovers in 2 to 5 years, however on harsh sites where cover is low to begin with and/or erosion occurs after fire, recovery may require more than 10 years (Young 1983). Slow regeneration may subsequently worsen erosion (Blaisdell 1982).

Pathway 1.3A
Community 5.3 to 5.1

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

Pathway 1.3B
Community 5.3 to 5.2

High severity fire significantly reduces sagebrush cover leading to early mid-seral community.

Context dependence. Fire will decrease or eliminate the overstory of sagebrush and allow for the perennial bunchgrasses to dominate the site. Fires will typically be high intensity due to the dominance of sagebrush in this community phase.

State 6
Current Potential State

This state is similar to the Reference State 1.0. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. 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.

Characteristics and indicators. 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.

Dominant plant species

- little sagebrush (*Artemisia arbuscula*), shrub
- black sagebrush (*Artemisia nova*), shrub
- Idaho fescue (*Festuca idahoensis*), grass

Community 6.1
Community Phase

This community phase is similar to the Reference State Community Phase 1.1, with the presence of non-native species in trace amounts. Low sagebrush, bluebunch wheatgrass, Idaho fescue and perennial forbs dominate the site. Other shrubs and perennial grasses make up smaller components of this site.

Community 6.2
Community Phase

This community phase is characteristic of a post-disturbance, early to mid-seral community where annual non-native species are present. Sagebrush is present in trace amounts; perennial bunchgrasses dominate the site. Depending on fire severity patches of intact sagebrush may remain. Rabbitbrush may be sprouting or dominant in the community. Perennial forbs may be a significant component for a number of years following fire. Annual non-native species are stable or increasing within the community.

Community 6.3
Community Phase

Low sagebrush dominates the overstory and perennial bunchgrasses in the understory are reduced, either from competition with shrubs or from inappropriate grazing, or from both. Sandberg bluegrass may increase and become co-dominate with deep rooted bunchgrasses. Annual non-natives species may be stable or increasing due to lack of competition with perennial bunchgrasses. This site is susceptible to further degradation from grazing, drought, and fire.

Pathway 2.1a
Community 6.1 to 6.2

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 6.1 to 6.3

Time and lack of disturbance such fire or drought, Inappropriate grazing management may also reduce perennial understory. Chronic drought reduces fine fuels and leads to a reduced fire frequency, allowing low sagebrush to dominate the site. Inappropriate grazing management reduces the perennial bunchgrass understory; conversely Sandberg bluegrass may increase in the understory depending on grazing management.

Pathway 2.2a
Community 6.2 to 6.1

Time and lack of disturbance allows for shrub regeneration.

Context dependence. Time and lack of disturbance and/or grazing management that favors the establishment and growth of sagebrush allows the shrub component to recover. The establishment of low and black 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 6.3 to 6.1

Low severity fire resulting in mosaic pattern. Brush management with minimal soil disturbance, late fall/winter grazing causing mechanical damage to sagebrush.

Context dependence. Grazing management that reduces shrubs will allow for the perennial bunchgrasses in the understory to increase. Heavy late-fall or winter grazing may cause mechanical damage and subsequent death to sagebrush, facilitating an increase in the herbaceous understory. Brush treatments with minimal soil disturbance will also decrease sagebrush and release the perennial understory. Annual non-native species are present and may increase in the community. A low severity fire would decrease the overstory of sagebrush and allow for the understory perennial grasses to increase. Due to low fuel loads in this State, fires will likely be small creating a mosaic pattern.

Pathway 2.3b
Community 6.3 to 6.2

High severity fire significantly reduces sagebrush cover leading to early/mid-seral community.

Context dependence. Fires will decrease or eliminate the overstory of sagebrush and allows for perennial grasses to increase. Fires will typically be high intensity due to the dominance of sagebrush resulting in removal of the overstory shrub community. Annual non-native species respond well to fire and may increase post-burn. Brush treatment would reduce sagebrush overstory and allow for perennial bunchgrasses to increase.

Community 7

Community 8

Community 9

Community 10

State 11
Shrub State

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. Bare ground and soil redistribution may be increasing. Non-natives are stable to increasing.

Characteristics and indicators. Sandberg bluegrass has been found to increase following fire likely due to its low stature and productivity (Daubenmire 1975) and may retard reestablishment of deeper rooted bunchgrass resulting in the development of stable ecological state dominated by Sandberg bluegrass.

Dominant plant species

- little sagebrush (*Artemisia arbuscula*), shrub
- black sagebrush (*Artemisia nova*), shrub
- bluegrass (*Poa*), grass

Community 11.1
Community phase 3.1

Decadent sagebrush dominates the overstory. Rabbitbrush may be a significant component. Deep-rooted perennial bunchgrasses may be present in trace amounts. Sandberg bluegrass and annual non-native species are stable to increasing. Bare ground may be significant and soil redistribution may be occurring.

Community 11.2
Community phase 3.2

Bluegrass dominates the site; annual non-native species may be present but are not dominant. Trace amounts of sagebrush may be present. Sprouting shrubs such as rabbitbrush may dominate the overstory. Annual non-native species may be increasing and bare ground is significant.

Pathway 3.1a
Community 11.1 to 11.2

Removal of shrub canopy. Fire, brush management with minimal soil disturbance, and/or inappropriate sheep grazing.

Context dependence. Fire reduces sagebrush to trace amounts and allows for sprouting shrubs such as rabbitbrush to dominate. Inappropriate or excessive sheep grazing could also reduce cover of sagebrush and allow for sprouting shrubs to dominate the community. Brush treatments with minimal soil disturbance would facilitate sprouting shrubs and Sandberg’s bluegrass.

Pathway 3.2a
Community 11.2 to 11.1

Time and lack of disturbance (unlikely to occur).

Context dependence. Time and lack of disturbance and/or grazing management that favors the establishment and growth of sagebrush allows for the shrub component to recover. The establishment of black and low sagebrush may take many years.

State 12
Eroded State

This state is characterized by the dominance of non-native annuals and active soil redistribution and erosion. Ecological process including hydrology, energy capture and nutrient cycling are spatially and temporally truncated.

Shorter fire return intervals, increase in invasive species and poor reproductive potential of remaining natives are feedbacks contributing to the stability of this site.

Characteristics and indicators. 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.

Dominant plant species

- cheatgrass (*Bromus tectorum*), grass

Community 12.1
4.1a

This community is dominated by annual non-native species, such as cheatgrass, mustard, medusahead, etc. Erosion of the site may be significant; however, stones and cobbles present on the soil surface will help mitigate some erosional processes. Trace amounts of bluegrass remain. There is no known restoration pathway.

Community 13

Pathway P
Community 2 to 9

Transition T1A
State 5 to 6

Trigger: This transition is caused by the introduction of non-native annual plants, such as cheatgrass and mustards. 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.

Context dependence. Fire reduces the shrub overstory and allows for perennial bunchgrasses to dominate the site. Fires are typically low severity resulting in a mosaic pattern due to low fuel loads. A fire following an unusually wet spring facilitating an increase in fine fuels may be more severe and reduce sagebrush cover to trace amounts.

Transition T1B
State 5 to 11

Trigger: Prolonged drought, maybe coupled with repeated, heavy, growing season grazing will decrease or eliminate deep rooted perennial bunchgrasses Slow variables: Long term decrease in deep-rooted perennial grass seed production, reproduction, and density allows for an increase in Sandberg bluegrass and favor shrub growth and establishment. Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter and infiltration.

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

Pathway P
Community 2 to 10

Pathway P
Community 9 to 10

Transition T2A

State 6 to 11

Trigger: Prolonged drought coupled with inappropriate grazing grazing management will decrease or eliminate deep-rooted perennial bunchgrasses. Favoring growth and establishment of Sandberg bluegrass and shrubs. Soil disturbing treatments will reduce sagebrush and favor an increase in Sandberg bluegrass. Slow variables: Long term decrease in deep-rooted perennial grass seed production, reproduction, and density allows for an increase in Sandberg bluegrass and favor shrub growth and establishment. Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter and infiltration.

Constraints to recovery. Fire or brush treatment may be coupled with inappropriate grazing management.

Transition T2B
State 6 to 12

Trigger: Multiple wildfires and/or soil disturbing treatments that remove native species. Slow variables: Increased seed production and cover of annual non-native species. Threshold: Increased, continuous fine fuels modify the fire regime by changing frequency, intensity, size and spatial variability of fires. Changes in plant community composition and spatial variability of vegetation due to the loss of perennial bunchgrasses and sagebrush truncate energy capture and impact the temporal and spatial aspects of nutrient cycling and distribution.

Transition T3A
State 11 to 12

Trigger: Multiple wildfires and/or soil disturbing treatments that remove native species. Slow variables: Increased seed production and cover of annual non-native species. Threshold: Increased, continuous fine fuels modify the fire regime by changing frequency, intensity, size and spatial variability of fires. Changes in plant community composition and spatial variability of vegetation due to the loss of perennial bunchgrasses and sagebrush truncate energy capture and impact the temporal and spatial aspects of nutrient cycling and distribution.

Constraints to recovery. Inappropriate grazing management, soil disturbing treatments, fire or multiple fires, and or drought.

Pathway P
Community 10 to 13

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				68–158	
	Idaho fescue	FEID	*Festuca idahoensis*	38–63	–
	bluegrass	POA	*Poa*	13–25	–
	Webber needlegrass	ACWE3	*Achnatherum webberi*	5–13	–
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	5–13	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–5	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	0–5	–
	needle and thread	HECO26	*Hesperostipa comata*	0–5	–
	squirreltail	ELEL5	*Elymus elymoides*	0–5	–
Forb					
2				22–52	
	goldenweed	PYRRO	*Pyrrocoma*	0–10	–
	lupine	LUPIN	*Lupinus*	0–10	–
	fleabane	ERIGE2	*Erigeron*	0–10	–
	phlox	PHLOX	*Phlox*	0–10	–
	buckwheat	ERIOG	*Eriogonum*	0–10	–
Shrub/Vine					
3				60–140	
	little sagebrush	ARAR8	*Artemisia arbuscula*	20–65	–
	black sagebrush	ARNO4	*Artemisia nova*	35–50	–
	spiny hopsage	GRSP	*Grayia spinosa*	2–8	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	2–8	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	2–8	–

Animal community

Livestock Interpretations:
This site has limited value for livestock grazing, due to the low forage production and steep slopes. Grazing management should be keyed to production of dominant grasses or palatable shrubs. Domestic sheep and to a much lesser degree cattle consume low sagebrush, particularly during the spring, fall and winter. In winter, at lower elevations, black sagebrush is heavily utilized by domestic sheep. Idaho fescue provides important forage for many types of domestic livestock. The foliage cures well and is preferred by livestock in late fall and winter. 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. 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.
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:
Low sagebrush is considered a valuable browse plant during the spring, fall and winter months. In some areas it is of little value in winter due to heavy snow. Mule deer utilize and sometimes prefer low sagebrush, particularly in winter and early spring. Black sagebrush is a significant browse species within the Intermountain region. It is especially important on low elevation winter ranges in the southern Great Basin, where extended snow free periods

allow animal's access to plants throughout most of the winter. In these areas it is heavily utilized by pronghorn and mule deer. Idaho fescue provides important forage for several wildlife species. It is reported to be good forage for pronghorn, and deer in ranges of northern Nevada. Bluebunch wheatgrass is considered one of the most important forage grass species on western rangelands for wildlife. Bluebunch wheatgrass does not generally provide sufficient cover for ungulates, however, mule deer are frequently found in bluebunch-dominated grasslands. Sagebrush-grassland communities provide critical sage-grouse breeding and nesting habitats. Meadows surrounded by sagebrush may be used as feeding and strutting grounds. Sagebrush is a crucial component of their diet year-round, and sage-grouse select sagebrush almost exclusively for cover. Sage-grouse prefer black sagebrush and low sagebush in the winter.

Hydrological functions

Runoff is high to very high. Permeability is very slow to moderately rapid. Hydrologic soil groups are C and D. Rills are none. Gravels and cobbles armor the surface. Water flow patterns are none to rare. Pedestals are none to rare. Frost heaving of shallow rooted plants should not be considered an indicator of soil erosion. Gullies are none. Perennial herbaceous plants (especially deep-rooted bunchgrasses) slow runoff and increase infiltration. Shrub canopy and associated litter break raindrop impact and provide opportunity for snow catch and accumulation on site.

Recreational uses

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 information

Low sagebrush can be successfully transplanted or seeded in restoration. Black sagebrush is an excellent species to establish on sites where management objectives include restoration or improvement of domestic sheep, pronghorn, or mule deer winter range.

Inventory data references

Old SS Manuscripts, Range Site Descriptions, etc.

Type locality

Location 1: Humboldt County, NV	
Township/Range/Section	T44N R42E S30
UTM zone	N
UTM northing	4612486
UTM easting	477069
Latitude	41° 39′ 49″
Longitude	117° 16′ 31″
General legal description	About 17 miles northeast of Paradise Valley, Zymns Butte, Humboldt County, Nevada. This site also occurs in Eureka, Lander, and Pershing Counties, Nevada.

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Contributors

CP/GKB
A. Argullin/E. Hourihan

Approval

Kendra Moseley, 3/07/2025

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)	Patti Novak-Echenique
Contact for lead author	State Rangeland Management Specialist
Date	02/05/2010
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are none. Gravels and cobbles armor the surface.

2. **Presence of water flow patterns:** Water flow patterns are none to rare

3. **Number and height of erosional pedestals or terracettes:** Pedestals are none to rare. Frost heaving of shallow rooted plants should not be considered an indicator of soil erosion

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare Ground ± 5-10% 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 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 fine to medium platy, granular, or massive. Soil surface colors are dark and soils have an ochric or mollic epipedon. Organic matter of the surface 2 to 4 inches is typically 1 to 4 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) 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. Subangular blocky 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: Low shrubs (low sagebrush, black sagebrush) > deep-rooted, cool season, perennial bunchgrasses (Idaho fescue, bluebunch wheatgrass)

    Sub-dominant: deep-rooted, cool season, perennial forbs > shallow-rooted, cool season, perennial bunchgrasses > associated shrubs > > fibrous, shallow-rooted, cool season, perennial forbs = 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 20% of total woody canopy; some of the mature bunchgrasses (<10%) have dead centers.

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14. **Average percent litter cover (%) and depth (in):** Between plant interspaces and under shrubs up to 35% and litter depth is ±¼ 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) ± 250 lbs/ac; ranges from 150 lbs/ac in unfavorable years to 350 lbs/ac in favorable years. Spring moisture significantly affects total production

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

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