USDA Natural Resources Conservation Service

Ecological site R025XY054NV CLAYEY 12-14 P.Z.

Accessed: 07/18/2024

General information

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

MLRA notes

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

MLRA 25 lies within the Intermontane Plateaus physiographic province. The southern half is in the Great Basin Section of the Basin and Range Province. This part of the MLRA is characterized by isolated, uplifted fault-block mountain ranges separated by narrow, aggraded desert plains. This geologically older terrain has been dissected by numerous streams draining to the Humboldt River. The northern half of the area lies within the Columbia Plateaus geologic province. This part of the MLRA forms the southern boundary of the extensive Columbia Plateau basalt flows. Deep, narrow canyons drain to the Snake River which incise the broad volcanic plain. The Humboldt River, route of a major western pioneer trail, crosses the southern half of this area. Reaches of the Owyhee River in this area have been designated as National Wild and Scenic Rivers.
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.

Ecological site concept

This site occurs on inter-plateau basins. Slopes range from 0 to 8 percent, but slope gradients of less than 4 percent are most typical. Elevations range from 5,500 to 6,500 feet. The average growing season is about 60 to 90 days.

The soils associated with this site are typically formed in alluvium from basalt parent material. There are high amounts of volcanic ash in the soil profile. Soils are moderately deep to a duripan or bedrock. Surface soils are loam or silt loams with depth to a thick, clay, subsoil at less than 15 inches. Permeability is very slow and runoff is slow.

The reference plant community is dominated by Idaho fescue and early sagebrush. Potential vegetative composition is about 65% grasses, 15% forbs and 20% shrubs. Approximate ground cover (basal and crown) is 35 to 50 percent.

Associated sites

R025XY017NV	**CLAYPAN 12-16 P.Z.**
R025XY048NV	**CLAY BASIN**
R025XY049NV	**WET CLAY BASIN**

Similar sites

R025XY017NV	**CLAYPAN 12-16 P.Z.** PSSPS-FEID codominant; different landscape positions

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia arbuscula var. longiloba*
Herbaceous	(1) *Festuca idahoensis*

Physiographic features

This site occurs on inter-plateau basins. Slopes range from 0 to 8 percent, but slope gradients of less than 4 percent are most typical. Elevations are 5500 to 6500 feet.

Table 2. Representative physiographic features

Landforms	(1) Plateau
Elevation	1,676–1,981 m
Slope	0–8%
Aspect	Aspect is not a significant factor

Climatic features

The climate associated with this site is semiarid, characterized by cold, moist winters and warm, dry summers. The average annual precipitation ranges from 10 to 12 inches. Mean annual air temperature is about 45 to 50 degrees F.

Mean annual precipitation across the range in which this ES occurs is 12.20".

Monthly mean precipitation: January 1.22”; February 0.92”; March 1.17”; April 1.20”; May 1.54”; June 1.11”; July 0.44”; August 0.45”; September 0.73”; October 0.86”; November 1.26”; December 1.29”.

*The above data is averaged from the Deeth and Tuscarora WRCC climate stations.

Table 3. Representative climatic features

Frost-free period (average)	79 days
Freeze-free period (average)	102 days
Precipitation total (average)	330 mm

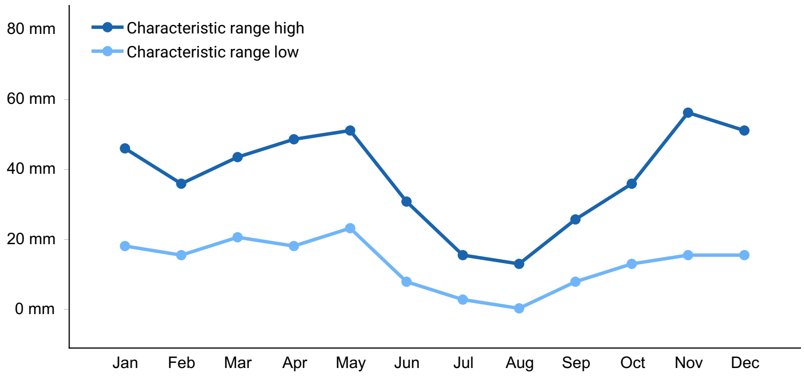

Figure 1. Monthly precipitation range

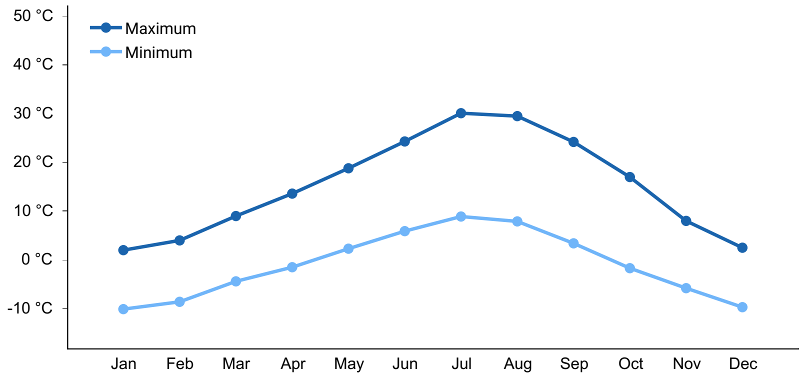

Figure 2. Monthly average minimum and maximum temperature

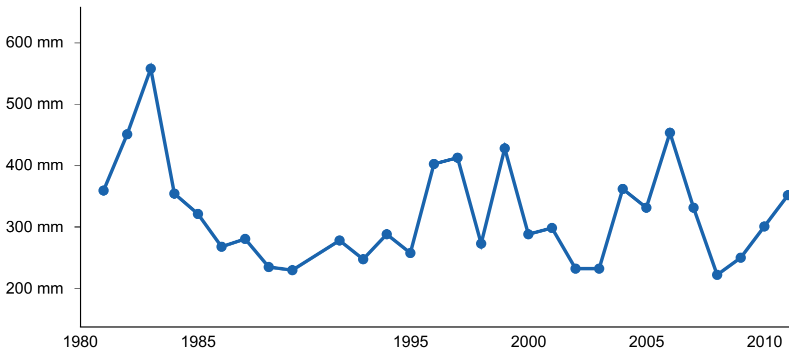

Figure 3. Annual precipitation pattern

Climate stations used

- (1) TUSCARORA [USC00268346], Tuscarora, NV
- (2) DEETH [USC00262189], Deeth, NV

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are typically formed in alluvium from basalt parent material. There are high amounts of volcanic ash in the soil profile. Soils are moderately deep to a duripan or bedrock. Surface soils are loam or silt loams with depth to a thick, clay, subsoil at less than 15 inches. Permeability is very slow and runoff is slow. Soil profiles are typically saturated during the early spring due to run-in from higher landscapes.

Ecological dynamics

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

This ecological site is dominated by deep-rooted cool season, perennial bunchgrasses and long-lived shrubs (50+ years) with high root to shoot ratios. The dominant shrubs usually root to the full depth of the winter-spring soil moisture recharge, which ranges from 1.0 to over 3.0 meters (Dobrowolski et al. 1990). Root length of mature sagebrush plants was measured to a depth of 2 meters in alluvial soils in Utah (Richards and Caldwell 1987). 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 centimeters 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).

Periodic drought regularly influences sagebrush ecosystems and drought duration and severity have 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 includes Idaho fescue and bluebunch wheatgrass. These species generally have shallower root systems than the shrubs, but root densities are often as high as or higher than those of shrubs in the upper 0.5 m but taper off more rapidly. Differences in root depth distributions between grasses and shrubs result in resource partitioning in these shrub/grass systems.

The Great Basin sagebrush communities have high spatial and temporal variability in precipitation both among years and within growing seasons. Nutrient availability is typically low but increases with elevation and closely follows moisture availability. The invasibility of plant communities is often linked to resource availability. Disturbance can decrease resource uptake due to damage or mortality of the native species and depressed competition. It can also increase resource pools via 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.

As ecological condition declines. Idaho fescue and bluebunch wheatgrass decrease in abundance as early sagebrush, rabbitbrush, mat-forming forbs, and Sandberg’s bluegrass increase.

This ecological site has low to moderate resilience to disturbance and resistance to invasion. Increased resilience increases with elevation, aspect, increased precipitation and increased nutrient availability. Five possible alternative stable states have been identified for this ecological site.

Fire Ecology:
Fire return intervals have recently been estimated at 100 to 200 years in black sagebrush-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. Fine fuel loads generally average 100 to 400 pounds per acre (110- 450 kg/ha) but are occasionally as high as 600 pounds per acre (680 kg/ha) in low sagebrush habitat types (Bradley et al. 1992).

Low sagebrush is killed by fire and does not sprout (Tisdale and Hironaka 1984). Establishment after fire is from seed that is 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). The 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; 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 et al. 1982).

Antelope bitterbrush, a minor component on this site, is moderately fire tolerant (McConnell and Smith 1977). It regenerates by seed and resprouting (Blaisdell and Mueggler 1956, McArthur et al. 1982), though sprouting ability is highly variable and has been attributed to genetics, plant age, phenology, soil moisture and texture, and fire severity (Blaisdell and Mueggler 1956, Blaisdell et al. 1982, Clark et al. 1982, Cook et al. 1994). Bitterbrush sprouts from a region on the stem approximately 1.5 inches above and below the soil surface; the plant rarely sprouts if the root crown is killed by fire (Blaisdell and Mueggler 1956). Low intensity fires may allow for bitterbrush to sprout; however, community response also depends on soil moisture levels at time of fire (Murray 1983). Lower soil moisture allows more charring of the stem below ground level (Blaisdell and Mueggler 1956), thus sprouting will usually be more successful after a spring fire than after a fire in summer or fall (Murray 1983, Busse et al. 2000, Kerns et al. 2006). If cheatgrass is present, bitterbrush seedling success is much lower. The factor that most limits establishment of bitterbrush seedlings is competition for water resources with cheatgrass, an invasive species (Clements and Young 2002).

Idaho fescue responds to fire variably depending on condition and size of the plant, season and severity of fire, and ecological conditions. Mature Idaho fescue plants are commonly reported to be severely damaged by fire in all seasons (Wright et al. 1979). Initial mortality may be high (in excess of 75%) on severe burns, but usually varies from 20 to 50% (Barrington et al 1988). Rapid burns have been found to leave little damage to root crowns, and new tillers are produced with onset of fall moisture (Johnson et al. 1994). However, Wright and others (1979) found the dense, fine leaves of Idaho fescue provided enough fuel to burn for hours after a fire had passed, thereby seriously injuring or killing the plant regardless of the intensity of the fire (Wright et al. 1979). Idaho fescue is commonly reported to be more sensitive to fire than bluebunch wheatgrass, the other prominent grass on these sites (Conrad and Poulton 1966). Robberecht and Defosse (1995), however, suggested the latter was more sensitive. They observed culm and biomass reduction with moderate fire severity in bluebunch wheatgrass, whereas a high fire severity was required for this reduction in Idaho fescue. In addition, given the same fire severity treatment, post-fire culm production was initiated earlier and more rapidly in Idaho fescue (Robberecht and Defosse 1995). The effect of fire on bunchgrasses relates to culm density, culm-leaf morphology, and the size of the plant.

Bluebunch wheatgrass has coarse stems with little leafy material, therefore the aboveground biomass burns rapidly and little heat is transferred downward into the crowns (Young 1983). Bluebunch wheatgrass was described as fairly tolerant of burning, other than in May in eastern Oregon (Britton et al. 1990). Uresk et al. (1976) reported burning increased vegetative and reproductive vigor of bluebunch wheatgrass and is thus considered to experience slight damage to fire but is more susceptible in drought years (Young 1983). Most authors classify the plant as undamaged by fire (Kuntz 1982).

Thurber's needlegrass, a minor component on this site, is very susceptible to fire-caused mortality. Burning has been found to decrease the vegetative and reproductive vigor of Thurber's needlegrass (Uresk et al. 1976). Fire also reduces basal area and yield of Thurber's needlegrass (Britton et al. 1990). The fine leaves and densely tufted growth form make this grass susceptible to subsurface charring of the crowns (Wright and Klemmedson 1965). Although timing of fire highly influences the response and mortality of Thurber's needlegrass, smaller bunch sizes are less likely to be damaged by fire (Wright and Klemmedson 1965). Thurber's needlegrass often survives fire, however, and will continue growth when conditions are favorable (Koniak 1985).

Sandberg bluegrass, a minor component of this ecological site, has been found to increase following fire likely due to its low stature and productivity (Daubenmire 1975) and may retard reestablishment of more deeply-rooted bunchgrasses.

State and transition model

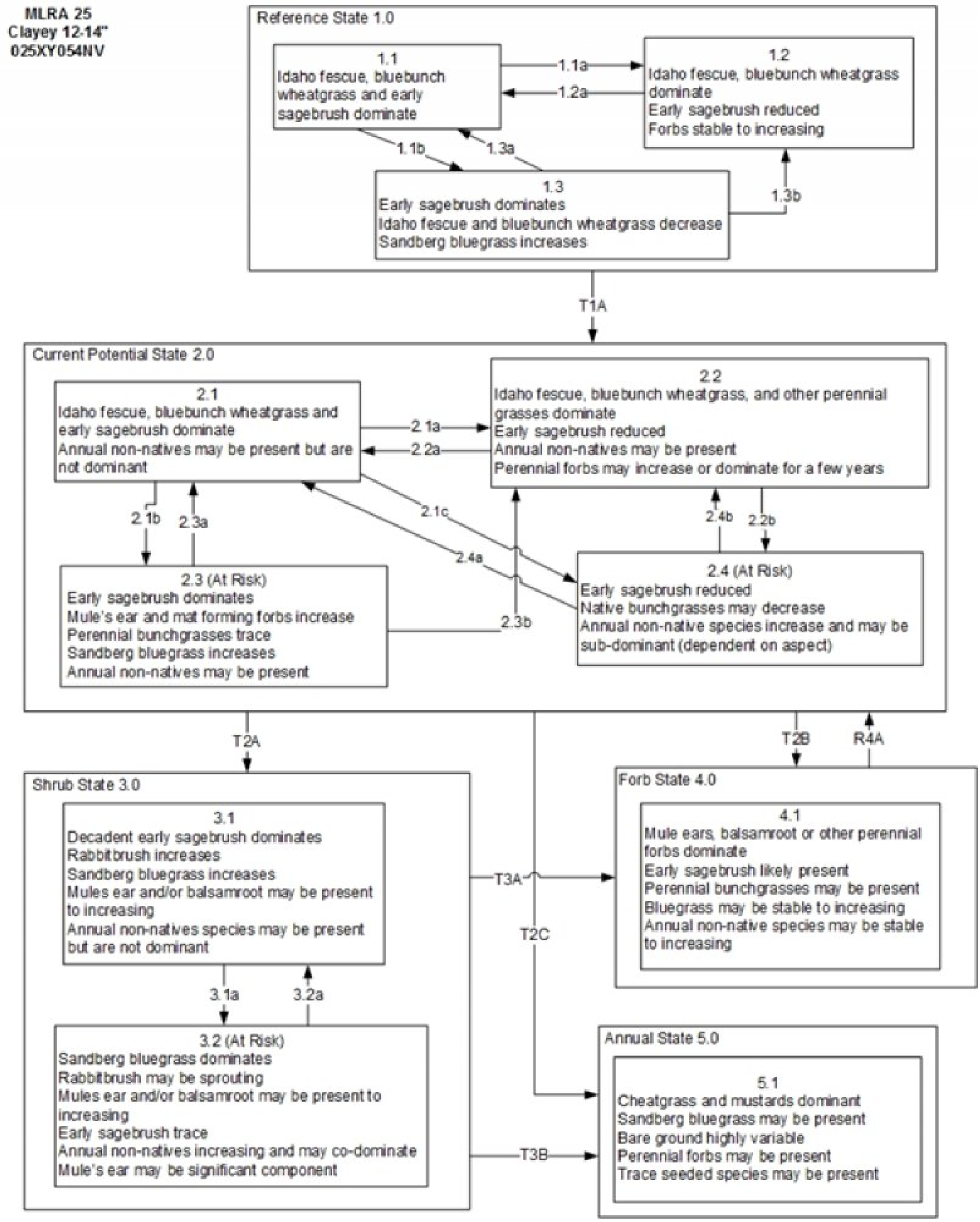

Figure 5. T. Stringham July 2015

MLRA 25
Clayey 12-14"
025XY054NV
Legend

Reference State 1.0 Community 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. Excessive herbivory and/or long-term drought may also reduce perennial understory.
1.2a: Time and lack of disturbance allows for shrub regeneration.
1.3a: Low severity fire creates sagebrush/grass mosaic.
1.3b: High severity fire significantly reduces sagebrush cover leading to early/mid seral community.

Transition T1A: Introduction of non-native species

Current Potential State 2.0 Community 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.
2.1b: Time and lack of disturbance. Inappropriate grazing management and/or long-term drought may also reduce perennial understory.
2.1c: Heavy spring precipitation.
2.2a: Time and lack of disturbance allows for shrub regeneration.
2.2b: Heavy spring precipitation.
2.3a: Low severity fire creates sagebrush/grass mosaic. Brush treatments with minimal soil disturbance; late-fall/winter grazing causing mechanical damage to sagebrush would reduce the shrub overstory.
2.3b: High severity fire significantly reduces sagebrush cover leading to early/mid seral community.
2.4a: Normal winter precipitation followed by a dry spring.
2.4b: Normal winter precipitation followed by a dry spring.

Transition T2A: Grazing management favoring shrubs and/or Mule's ear/balsamroot.
Transition T2B: Inappropriate grazing management that promotes dominance of forbs; this may be coupled with fire (4.1).
Transition T2C: Catastrophic fire and/or soil disturbing treatments such as drill seeding, roller chopper, Lawson aerator etc. Probability of success of seeding on this site is low (5.1).

Shrub State 3.0 Community Pathways
3.1a: Fire.
3.2a: Time without disturbance.

Transition T3A: Inappropriate grazing management promotes dominance of forbs; this may be coupled with fire (4.1).
Transition T3B: Catastrophic fire or multiple fires. Bare ground levels depend on variations in annual precipitation (5.1)

Forb State 4.0 Community Pathways
None

Restoration R4A: Herbicide treatment may be coupled with seeding of desired species.

Annual State 5.0 Community Pathways
None

Figure 6. T. Stringham July 2015

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.

Community 1.1
Community Phase

The reference plant community is dominated by Idaho fescue and early sagebrush. Potential vegetative composition is about 65% grasses, 15% forbs and 20% shrubs. Approximate ground cover (basal and crown) is 35 to 50 percent.

Table 4. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	364	583	874
Shrub/Vine	112	179	269
Forb	84	135	202
Total	**560**	**897**	**1345**

Community 1.2
Community Phase

This community phase is characteristic of a post-disturbance, early/mid-seral community. Idaho fescue, bluebunch wheatgrass, Thurber's needlegrass and other perennial bunchgrasses and forbs dominate. Depending on fire severity patches of intact sagebrush may remain. Rabbitbrush and other sprouting shrubs may be sprouting. Perennial forbs may be a significant component for a number of years following fire.

Community 1.3
Community Phase

Sagebrush increases in the absence of disturbance. Early 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 1.1a
Community 1.1 to 1.2

Fire will decrease or eliminate the overstory of sagebrush and allow for the perennial bunchgrasses and forbs 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.

Pathway 1.1b
Community 1.1 to 1.3

Time and lack of disturbance such as fire allows for sagebrush to increase and become decadent. Long-term drought, herbivory, or combinations of these will 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 1.2 to 1.1

Time and lack of disturbance will allow sagebrush to increase.

Pathway 1.3a
Community 1.3 to 1.1

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

Pathway 1.3b
Community 1.3 to 1.2

Fire will decrease or eliminate the overstory of sagebrush and allow for the perennial bunchgrasses to dominate the site. Fires may be high severity in this community phase due to the dominance of sagebrush resulting in removal of overstory shrub community.

State 2

Current Potential State

This state is similar to the Reference State 1.0. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of invasive weeds. This state has the same three general community phases. These non-native species can be highly flammable, and 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.

Community 2.1
Community Phase

This community phase is compositionally similar to the Reference State Community Phase 1.1 with the presence non-native species in trace amounts. This community is dominated by Idaho fescue with a large component of early sagebrush and bluebunch wheatgrass. Bluegrass and antelope bitterbrush are common within the community. An assortment of perennial forbs is present and may comprise a significant portion of total production.

Community 2.2
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 and forbs 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 2.3
Community Phase (at risk)

This community is at risk of crossing a threshold to another state. Early sagebrush dominates the overstory and perennial bunchgrasses in the understory are reduced, either from competition with shrubs or from inappropriate grazing management, or from both. Rabbitbrush may be a significant component. 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 inappropriate grazing management, drought, and fire.

Community 2.4
Community Phase (at risk)

This community is at risk of crossing into an annual state. Native bunchgrasses dominate; however, annual non-native species such as cheatgrass may be sub-dominant in the understory. Annual production and abundance of these annuals may increase drastically in years with heavy spring precipitation. Seeded species may be present. Early sagebrush is a minor component. This site is susceptible to further degradation from grazing, drought, and fire.

Pathway 2.1a
Community 2.1 to 2.2

Fire reduces the shrub overstory and allows for perennial bunchgrasses and forbs 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 or a change in management favoring an increase in fine fuels may be more severe and reduce sagebrush cover to trace amounts. Annual non-native species are likely to increase after fire.

Pathway 2.1b
Community 2.1 to 2.3

Time and lack of disturbance allows for sagebrush to increase and become decadent. Long-term drought reduces fine fuels and leads to a reduced fire frequency, allowing big 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 2.1c
Community 2.1 to 2.4

Higher than normal spring precipitation favors annual non-native species such as cheatgrass. Non-native annual species will increase in production and density throughout the site. Perennial bunchgrasses may also increase in production.

Pathway 2.2a
Community 2.2 to 2.1

Time and/or grazing management that favors the establishment and growth of sagebrush allow the shrub component to recover. The establishment of sagebrush may take a very long time.

Pathway 2.2b
Community 2.2 to 2.4

Higher than normal spring precipitation favors annual non-native species such as cheatgrass. Non-native annual species will increase in production and density throughout the site. Perennial bunchgrasses may also increase in production.

Pathway 2.3a
Community 2.3 to 2.1

A change in 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. A low severity fire would decrease the overstory of sagebrush and low for the understory perennial grasses to increase. Due to low fuel loads in this State, fires will likely be small creating a mosaic pattern. Annual non-native species are present and may increase in the community.

Pathway 2.3b
Community 2.3 to 2.2

Fire eliminates/reduces the overstory of sagebrush and allows for the understory perennial grasses and forbs to increase. Fires may be high severity in this community phase due to the dominance of sagebrush resulting in removal of overstory shrub community. Annual non-native species respond well to fire and may increase post burn.

Pathway 2.4a
Community 2.4 to 2.1

Rainfall patterns favoring perennial bunchgrasses. Less than normal spring precipitation followed by higher than normal summer precipitation will increase perennial bunchgrass production.

Pathway 2.4b
Community 2.4 to 2.2

Rainfall patterns favoring perennial bunchgrasses. Less than normal spring precipitation followed by higher than normal summer precipitation will increase perennial bunchgrass production.

State 3

Shrub State

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

Community 3.1
Community Phase

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. Sandberg bluegrass and annual non-native species increase. Bare ground is significant. Mule's ear, balsamroot and other perennial forbs may make up a significant component of the understory. Some excessive pedestalling of grasses may be seen. Bare ground may be increasing.

Community 3.2
Community Phase (at risk)

Bluegrass dominates the site; annual non-native species may be present but are not dominant. Rabbitbrush may be sprouting. Mule's ear, balsamroot and other perennial forbs may make up a significant component of the understory. Trace amounts of early sagebrush may be present.

Pathway 3.1a
Community 3.1 to 3.2

Fire, heavy fall grazing causing mechanical damage to shrubs, and/or brush treatments with minimal soil disturbance, will greatly reduce the overstory shrubs to trace amounts and allow for Sandberg bluegrass to dominate the site.

Pathway 3.2a
Community 3.2 to 3.1

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 early sagebrush can take many years.

State 4
Forb State

The Forb State has one community phase. Native, deep-rooted perennial, cool-season forbs dominate. This State is a result of heavy use by sheep bedding and grazing. Negative feedbacks enhance ecosystem resilience and contribute to the stability of the state. These include the presence of all structural and functional groups, low fine fuel loads and retention of organic matter and nutrients. Positive feedbacks decrease ecosystem resilience and stability of the state. These include the presence of a competitive functional group that possesses deep-rooted taproots and strong lateral roots, sprouting ability of roots or root crown, high seed production, and the ability to monopolize soil moisture. This may occur as "pockets" or inclusions within other states of the same site, and can appear to be localized.

Community 4.1
Community Phase

Balsamroot (Balsamorhiza sagittata), Mule's ear (Wyethia amplexicaulis), and/or other perennial forbs dominate the site. Early sagebrush is likely present. Sandberg bluegrass may be stable to increasing, and perennial bunchgrasses are a minor component.

State 5
Annual State

An abiotic threshold has been crossed and state dynamics are driven by fire and time. The herbaceous understory is dominated by annual non-native species such as cheatgrass and mustards. Resiliency has declined and further degradation from fire facilitates a cheatgrass and sprouting shrub plant community. Fire return interval has shortened due to the dominance of cheatgrass in the understory and is a driver in site dynamics.

Community 5.1
Community Phase

Non-native annual species are dominant. Sandberg bluegrass may still be present in trace amounts. Perennial forbs and seeded species may be present in trace amounts.

Transition T1A
State 1 to 2

Trigger: This transition is caused by the introduction of non-native annual plants, such as cheatgrass, mustards, and bur buttercup. 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 T2A
State 2 to 3

Trigger: To Community Phase 3.1: Inappropriate grazing management will decrease or eliminate deep rooted perennial bunchgrasses, increase Sandberg bluegrass and muttongrass and favor shrub growth and establishment. To Community Phase 3.2: Severe fire in community phase 2.3 will remove sagebrush overstory, decrease perennial bunchgrasses and enhance Sandberg bluegrass and muttongrass. Annual non-native species will increase. Slow variables: Long term decrease in deep-rooted perennial grass density and reduction in organic matter. Threshold: Loss of deep-rooted perennial bunchgrasses changes nutrient cycling, nutrient redistribution, and reduces soil organic matter and results in decreased soil moisture.

Transition T2B
State 2 to 4

Trigger: Inappropriate grazing management and/or fire promotes mule ears and other perennial forbs to dominate the site. Persistent spring grazing after a fire will suppress perennial grasses and promote forb production. Slow variable: Increasing density of perennial forbs, soil erosion. Threshold: Loss of deep-rooted perennial bunchgrasses and shrubs changes nutrient capture and cycling within the community.

Transition T2C
State 2 to 5

Trigger: Fire or soil disturbing treatment would transition to Community Phase 5.1. Slow variables: Increased production and cover of non-native annual species. Threshold: Loss of deep-rooted perennial bunchgrasses and shrubs changes temporal and spatial nutrient capture and cycling within the community. Increased, continuous fine fuels modify the fire regime by increasing frequency, size and spatial variability of fires.

Transition T3A
State 3 to 4

Trigger: Inappropriate grazing management and/or fire can eliminate Sandberg bluegrass understory and transition to 4.1. Slow variable: Increasing density of perennial forbs and soil erosion. Threshold: Loss of deep-rooted perennial bunchgrasses and shrubs changes nutrient capture and cycling within the community

Transition T3B
State 3 to 5

Trigger: Fire and/or treatments that disturb the soil and existing plant community. Slow variables: Increased seed production (following a wet spring) 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.

Restoration pathway R4A
State 4 to 2

Herbicide treatment to reduce perennial forbs may be coupled with seeding of perennial bunchgrasses (Mueggler and Blaisdell 1951).

Conservation practices

Range Planting
Herbaceous Weed Control

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Primary Perennial Grasses**			511–852	
	Idaho fescue	FEID	*Festuca idahoensis*	404–538	–
	bluebunch wheatgrass	PSSPS	*Pseudoroegneria spicata ssp. spicata*	90–224	–
	Cusick's bluegrass	POCU3	*Poa cusickii*	9–45	–
2	**Secondary Perennial Grasses**			18–72	
	Thurber's needlegrass	ACTH7	*Achnatherum thurberianum*	4–27	–
	sedge	CAREX	*Carex*	4–27	–
	onespike danthonia	DAUN	*Danthonia unispicata*	4–27	–
	squirreltail	ELEL5	*Elymus elymoides*	4–27	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	4–27	–
	Sandberg bluegrass	POSE	*Poa secunda*	4–27	–
Forb					
3	**Primary Forbs**			18–45	
	Hooker's balsamroot	BAHO	*Balsamorhiza hookeri*	7–16	–
	cutleaf balsamroot	BAMA4	*Balsamorhiza macrophylla*	6–15	–
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	6–15	–
4	**Secondary Forbs**			45–135	
	aster	ASTER	*Aster*	4–27	–
	milkvetch	ASTRA	*Astragalus*	4–27	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	4–27	–
	buckwheat	ERIOG	*Eriogonum*	4–27	–
	desertparsley	LOMAT	*Lomatium*	4–27	–
	phlox	PHLOX	*Phlox*	4–27	–
	clover	TRIFO	*Trifolium*	4–27	–
	mule-ears	WYAM	*Wyethia amplexicaulis*	4–27	–
Shrub/Vine					
5	**Primary Shrubs**			45–179	
	little sagebrush	ARARL	*Artemisia arbuscula ssp. longiloba*	45–179	–
6	**Secondary Shrubs**			18–45	
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	4–18	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	4–18	–

Animal community

Livestock Interpretations:
This site is suited for livestock grazing. Considerations for grazing management include timing, intensity, and duration of grazing. Targeted grazing could be used to decrease density of non-natives.

In general, bunchgrasses best tolerate light grazing after seed formation. Britton and others (1979) observed the effects of harvest date on basal area of 5 bunchgrasses in eastern Oregon, including Idaho fescue, and found grazing from August to October (after seed set) has the least impact on these bunchgrasses. Therefore, abusive grazing during the growing season will reduce perennial bunchgrasses, with the exception of Sandberg bluegrass

(Tisdale and Hironaka 1981). Abusive grazing by cattle or horses will likely increase low sagebrush, rabbitbrush and some forbs such as arrowleaf balsamroot. Annual non-native weedy species may invade, such as cheatgrass and mustards, and potentially medusahead.

Reduced bunchgrass vigor or density provides an opportunity for Sandberg bluegrass expansion and/or cheatgrass and other invasive species to occupy interspaces. Bluegrass is a widespread, palatable forage grass that is one of the earliest grasses in the spring and is sought by domestic livestock and several wildlife species. Its production is closely tied to weather conditions; little forage is produced in drought years, making it a less dependable food source than other perennial bunchgrasses. Sandberg bluegrass increases under grazing pressure (Tisdale and Hironaka 1981) and is capable of co-existing with cheatgrass or other weedy species. Excessive sheep grazing favors Sandberg bluegrass; however, where cattle are the dominant grazers, cheatgrass often dominates (Daubenmire 1970). Thus, depending on the season of use, the grazer and site conditions, either Sandberg bluegrass or cheatgrass may become the dominant understory with inappropriate grazing management.

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. Idaho fescue tolerates light to moderate grazing (Ganskopp and Bedell 1980) and is moderately resistant to trampling (Cole 1987). Heavy grazing may lead to replacement of Idaho fescue with non-native species such as cheatgrass (Mueggler 1984).

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

Domestic sheep and, to a much lesser degree, cattle consume low sagebrush, particularly during the spring, fall, and winter (Sheehy and Winward 1981). Heavy dormant season grazing by sheep will reduce sagebrush cover and increase grass production (Laycock 1967). Severe trampling damage to supersaturated soils may occur if sites are used in early spring when there is abundant snowmelt. Trampling damage, particularly from cattle or horses, in low sagebrush habitat types is greatest when high clay content soils are wet. In drier areas that contain more gravelly soils, no serious trampling damage occurs, even when the soils are wet (Hironaka et al. 1983).

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

Wildlife Interpretations:
Idaho fescue is an important source of forage for pronghorn and deer in ranges of northern Nevada.

Low sagebrush is considered a valuable browse plant for wildlife 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.

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

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.

Inventory data references

NRCS-RANGE-417 - 1 record
NV-ECS-1 - 4 records

Type locality

Location 1: Elko County, NV	
Township/Range/Section	T47N R50E S16
General legal description	About 500 feet west of Reservation Boundary Reservoir, just west of Duck Valley Indian Reservation boundary fence, Elko County, Nevada.

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Contributors

GKB

Rangeland health reference sheet

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

Author(s)/participant(s)	
Contact for lead author	
Date	
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

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

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

    Dominant:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

17. **Perennial plant reproductive capability:**