

## **Ecological site F026XY093NV**

### **Very Shallow Loamy Hills PIMO/ARAR8/ACTH7-POA**

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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): 026X—Carson Basin and Mountains

The area lies within western Nevada and eastern California, with about 69 percent being within Nevada, and 31 percent being within California. Almost all this area is in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. Isolated north-south trending mountain ranges are separated by aggraded desert plains. The mountains are uplifted fault blocks with steep side slopes. Most of the valleys are drained by three major rivers flowing east across this MLRA. A narrow strip along the western border of the area is in the Sierra Nevada Section of the Cascade-Sierra Mountains Province of the Pacific Mountain System. The Sierra Nevada Mountains are primarily a large fault block that has been uplifted with a dominant tilt to the west. This structure leaves an impressive wall of mountains directly west of this area. This helps create a rain shadow affect to MLRA 26. Parts of this eastern face, but mostly just the foothills, mark the western boundary of this area. Elevations range from about 3,806 feet (1,160 meters) on the west shore of Pyramid Lake to 11,653 feet (3,552 meters) on the summit of Mount Patterson in the Sweetwater Mountains.

Valley areas are dominantly composed of Quaternary alluvial deposits with Quaternary playa or alluvial flat deposits often occupying the lowest valley bottoms in the internally drained valleys, and river deposited alluvium being dominant in externally drained valleys. Hills and mountains are dominantly Tertiary andesitic flows, breccias, ash flow tuffs, rhyolite tuffs or granodioritic rocks. Quaternary basalt flows are present in lesser amounts, and Jurassic and Triassic limestone and shale, and Precambrian limestone and dolomite are also present in very limited amounts. Also of limited extent are glacial till deposits along the east flank of the Sierra Nevada Mountains, the result of alpine glaciation.

The average annual precipitation in this area is 5 to 36 inches (125 to 915 millimeters), increasing with elevation. Most of the rainfall occurs as high-intensity, convective storms in spring and autumn. Precipitation is mostly snow in winter. Summers are dry. The average annual temperature is 37 to 54 degrees F (3 to 12 degrees C). The freeze-free period averages 115 days and ranges from 40 to 195 days, decreasing in length with elevation.

The dominant soil orders in this MLRA are Aridisols and Mollisols. The soils in the area dominantly have a mesic soil temperature regime, an aridic or xeric soil moisture regime, and mixed or smectitic mineralogy. They generally are well drained, are clayey or loamy and commonly skeletal, and are very shallow to moderately deep.

This area supports shrub-grass vegetation characterized by big sagebrush. Low sagebrush and Lahontan sagebrush occur on some soils. Antelope bitterbrush, squirreltail, desert needlegrass, Thurber needlegrass, and Indian ricegrass are important associated plants. Green ephedra, Sandberg bluegrass, Anderson peachbrush, and several forb species also are common. Juniper-pinyon woodland is typical on mountain slopes. Jeffrey pine, lodgepole pine, white fir, and manzanita grow on the highest mountain slopes. Shadscale is the typical plant in the drier parts of the area. Sedges, rushes, and moisture-loving grasses grow on the wettest parts of the wet flood plains and terraces. Basin wildrye, alkali sacaton, saltgrass, buffaloberry, black greasewood, and rubber rabbitbrush grow on the drier sites that have a high concentration of salts.

Some of the major wildlife species in this area are mule deer, coyote, beaver, muskrat, jackrabbit, cottontail, raptors, pheasant, chukar, blue grouse, mountain quail, and mourning dove. The species of fish in the area include trout and catfish. The Lahontan cutthroat trout in the Truckee River is a threatened and endangered species.

LRU notes

The Sierra Influenced Ranges LRU is characterized by wooded great basin mountains with climatic and biotic affinities to the Sierra Nevada mountain range. The Sierra Influenced Ranges LRU receives greater precipitation than the mountain ranges of central Nevada. Amount of precipitation varies in relation to the local strength of the Sierra Nevada rain shadow, characterized by pinyon and juniper trees. The White, Sweetwater, Pine Nut, Wassuk, and Virginia ranges of Nevada support varying amounts of Sierra Nevada flora, such as ponderosa pine. Elevations range from 1610 to 2420 meters and slopes range from 5 to 49 percent, with a median value of 22 percent. Frost free days (FFD) ranges from 92 to 163.

Ecological site concept

The Very Shallow Loamy Hills occurs on hills on all aspects and is typically associated with areas of rock outcrop. Slopes range from 15 to over 50 percent, but slopes are generally 15 to 30 percent. Elevations are from about 5000 to 6400 feet. The soils associated with this site are typically very shallow to bedrock. The dominant plants are singleleaf pinyon (*Pinus monophylla*), little sagebrush (*Artemisia arbuscula*), Thurber's needlegrass (*Achnatherum thurberianum*), and bluegrass (*Poa* spp.).

Table 1. Dominant plant species

Tree	(1) <i>Pinus monophylla</i>
Shrub	(1) <i>Artemisia arbuscula</i>
Herbaceous	(1) <i>Achnatherum thurberianum</i> (2) <i>Poa</i>

Physiographic features

Very Shallow Loamy Hills occurs on hills on all aspects and is typically associated with areas of rock outcrop. Slopes range from 15 to over 50 percent, but slopes are generally 15 to 30 percent. Elevations are from about 5000 to 6400 feet.

Table 2. Representative physiographic features

Landforms	(1) Hill
Elevation	5,000–6,400 ft
Slope	15–50%
Aspect	Aspect is not a significant factor

Climatic features

The climate associated with this site is semiarid, characterized by cool, moist winters and warm, dry summers. Average annual precipitation is about 10 to over 12 inches. Mean annual air temperature is 45 to 48 degrees F. The average growing season is 70 to 100 days.

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).

Table 3. Representative climatic features

Frost-free period (average)	85 days
Freeze-free period (average)	
Precipitation total (average)	12 in

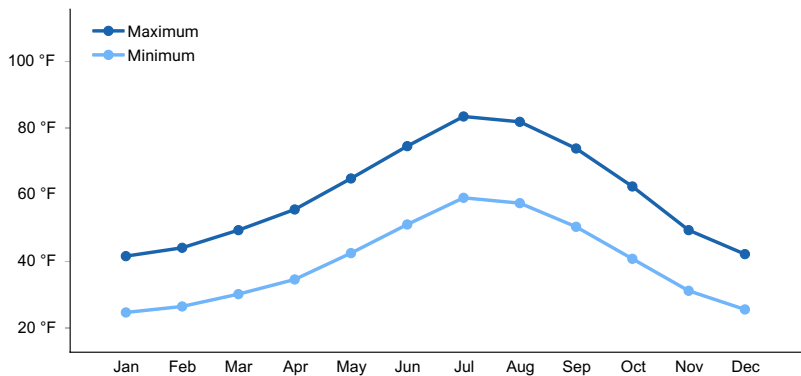


Figure 1. Monthly average minimum and maximum temperature

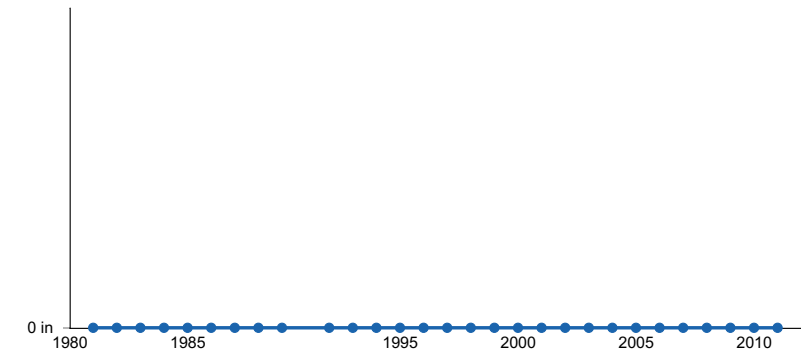


Figure 2. Annual precipitation pattern

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils associated with this site are typically very shallow to bedrock or a heavy textured subsoil. Available water capacity is very low, but trees and shrubs extend their roots into fractures in the bedrock allowing them to utilize deep moisture. Rock fragments on the soil surface provide a stabilizing affect on surface erosion conditions. Runoff

is medium and the potential for sheet and rill erosion is low to moderate depending on slope and amount of rock fragments on the soil surface. The soil associated with this site includes Xeric Torriorthents.

**Table 4. Representative soil features**

Parent material	(1) Alluvium
Surface texture	(1) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	4–10 in
Surface fragment cover <=3"	11%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	0.6–0.7 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

## Ecological dynamics

The pinyon-juniper forest is generally a climax vegetation type throughout its range, reaching climax about 300 years after disturbance, with an ongoing trend toward increased tree density and canopy cover and a decline in understory species over time. Singleleaf pinyon seedling establishment is episodic. Population age structure is affected by drought, which reduces seedling and sapling recruitment more than other age classes. The ecotones between singleleaf pinyon communities and adjacent shrublands and grasslands provide favorable microhabitats for singleleaf pinyon seedling establishment since they are active zones for seed dispersal, nurse plants are available, and singleleaf pinyon seedlings are only affected by competition from grass and other herbaceous vegetation for a couple of years.

Several natural and anthropogenic processes can lead to changes in the spatial distribution of pinyon-juniper forests over time. These include 1) tree seedling establishment during favorable climatic periods, 2) tree mortality (especially seedlings and saplings) during periods of drought, 3) expansion of trees into adjacent grassland in response to overgrazing and/or fire suppression, and 4) removal of trees by humans, fire, or other disturbance episodes. Specific successional pathways after disturbance in singleleaf pinyon stands are dependent on a number of variables such as plant species present at the time of disturbance and their individual responses to disturbance, past management, type and size of disturbance, available seed sources in the soil or adjacent areas, and site and climatic conditions throughout the successional process.

### Major Successional Stages of Forest Development:

**HERBACEOUS:** Vegetation is dominated by grasses and forbs under full sunlight. This stage is experienced after a major disturbance such as wildfire. Skeleton forest (dead trees) remaining after fire or other disturbances have little or no affect on the composition and production of the herbaceous vegetation.

**SHRUB-HERBACEOUS:** Herbaceous vegetation and woody shrubs dominate the site. Various amounts of tree seedlings (less than 20 inches in height) may be present up to the point where they are obviously a component of the vegetal structure.

**SAPLING:** In the absence of disturbance, the tree seedlings develop into saplings (20 inches to 4½ feet in height) with a canopy cover generally of about 15 percent. Vegetation consists of grasses, forbs and shrubs in association with tree saplings.

**IMMATURE FOREST:** Singleleaf pinyon greater than 4½ feet in height form a major constituent of the visual aspect and vegetal structure of the plant community. The upper crown of dominant and codominant trees are cone- or pyramidal-shaped. Seedlings and saplings of singleleaf pinyon are prevalent in the understory. Understory vegetation is moderately influenced by a tree overstory canopy of about 15 to 20 percent.

**MATURE FOREST:** The visual aspect and vegetal structure are dominated by singleleaf pinyon that have reached or are near maximal heights for the site. Dominant trees average greater than five inches in diameter at one-foot stump height. Tree canopy cover averages about 20 to 25 percent. Understory vegetation is strongly influenced by tree competition, overstory shading, duff accumulation, etc. This stage of development is assumed to be representative of this site in a pristine environment.

**OVER-MATURE FOREST:** Dominant and codominant trees average greater than five inches in diameter at one-foot stump height. Upper crowns of most trees are typically irregularly flat-topped or rounded. Understory vegetation is sparse to absent due to tree competition. Tree canopy cover is commonly greater than 30 percent.

#### Fire Ecology:

On high-productivity sites where sufficient fine fuels existed, singleleaf pinyon communities burn every 15 to 20 years, and on less productive sites with patchy fuels, fire return intervals may be in the range of 50 to 100 years or longer. Thin bark and lack of self pruning make singleleaf pinyon very susceptible to intense fire. Mature singleleaf pinyon can survive low-severity surface fires but is killed by more severe fires. Most tree seedlings are killed by fire, but cached seeds may survive. Low sagebrush is very susceptible to fire damage. Low sagebrush is usually killed by fire and does not re-sprout. The recovery in burned areas is usually via small, light, wind-dispersed seed for all low sagebrush subspecies. Partially injured low sagebrush may re-grow from living branches, but sprouting does not occur. Thurber's needlegrass is classified as moderately resistant, but depending on season of burn, phenology, and fire severity, this perennial bunchgrass is moderately to severely damaged by fire. Burning has been found to decrease the vegetation and reproductive vigor. Early season burning is more damaging to this needlegrass than late season burning. Muttongrass is unharmed to slightly harmed by light-severity fall fire. Muttongrass appears to be harmed by and slow to recover from severe fire.

#### Description of MLRA 26 DRG 18:

Disturbance Response Group (DRG) 18 consists of four ecological sites; F026XY062NV, F026XY064NV, F026XY092NV, and F026XY093NV (Stringham et al. 2021). The group falls in the 8 to 14 inch precipitation zone. Elevations range from 4,500 to 8,000 feet and these sites are found on slopes ranging from 2 to 75 percent. The soils in this group are typically shallow to very shallow and available water holding capacity is low. These soils usually have high amounts of rock fragments at the soil surface which help to reduce evaporation and provide a stabilizing effect on erosion conditions. This group is dominated by singleleaf pinyon (*Pinus monophylla*) and/or Utah juniper (*Juniperus osteosperma*) with Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*) or low sagebrush (*Artemisia arbuscula*) as the primary understory shrub. Other shrubs in the group include antelope bitterbrush (*Purshia tridentata*), Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), green ephedra (*Ephedra viridis*), and currant (*Ribes* spp.). The dominant understory grass of the group is Thurber's needlegrass (*Achnatherum thurberianum*). Other understory grasses include muttongrass (*Poa fendleriana*), Sandberg bluegrass (*Poa secunda*), and Indian ricegrass (*Achnatherum hymenoides*). Under medium canopy cover (11-30 percent, dependent on ecological site), understory production ranges from 75 to 400 lbs/ac.

#### Potential Resilience Differences with other Ecological Sites in this Group

##### F026XY093NV:

This site is very similar to the modal site but with low sagebrush as the dominant shrub. The dominant grass is

mutton grass and Sandberg's bluegrass is subdominant. It occurs on lower mountain summits and sideslopes. The site, in its reference state, has a much lower pinyon-juniper canopy overstory of 10 to 15 percent. It has the same amount of production as the modal site with 300 lbs/acre in a normal year and has more precipitation at 10 to 14 inches per year.

#### State and Transition Model Narrative for Group 18:

This is a text description of the states, phases, transitions, and community pathways possible in the State and Transition model for the MLRA 26 disturbance response group 18.

##### Reference State 1.0:

The Reference State 1.0 is representative of the natural range of variability under pristine conditions. This reference state has four general community phases: an old-growth tree phase, a shrub-herbaceous phase, an immature tree phase, and an infilled tree 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. Fires within this community are infrequent and likely small and patchy due to low fuel loads. This fire type will create a plant community mosaic that will include all/most of the following community phases within this state.

##### Community Phase 1.1:

This phase is characterized by widely dispersed old-growth pinyon and juniper trees with a low sagebrush, perennial bunchgrass understory. The visual aspect is dominated by singleleaf pinyon and Utah juniper with over 15 percent canopy cover (USDA 1997). Trees have reached maximal or near maximal heights for the site and many tree crowns may be flat- or round-topped. Thurber's needlegrass is most prevalent grass in the understory. Low sagebrush is the primary understory shrub. Forbs such as phlox, and eriogonum are minor components. Overall, the understory is sparse with production ranging between 200 to 400 pounds per acre.

##### Community Phase Pathway 1.1a, from Phase 1.1 to 1.2:

A high-severity crown fire will eliminate or reduce the singleleaf pinyon and Utah juniper overstory and the shrub component. This allows for the perennial bunchgrasses to dominate the site.

##### Community Phase Pathway 1.1b, from Phase 1.1 to 1.4:

Time without disturbances such as fire, drought, or disease will allow for the gradual infilling of singleleaf pinyon and Utah juniper.

##### Community Phase 1.2:

This community phase is characterized by a post-fire shrub and herbaceous community. Thurber's needlegrass and other perennial grasses dominate. Forbs may increase after a fire but will likely return to pre-burn levels within a few years. Pinyon and juniper seedlings up to 4 feet in height may be present. Low sagebrush may be present in unburned patches. Burned tree skeletons may be present; however, these have little or no effect on the understory vegetation.

##### Community Phase Pathway 1.2a, from Phase 1.2 to 1.3:

Time without disturbances such as fire, drought, or disease will allow for the gradual maturation of the singleleaf pinyon and Utah Juniper component. Low sagebrush reestablishes. Excessive herbivory may also reduce perennial grass understory.

##### Community Phase 1.3:

This community phase is characterized by an immature woodland, with pinyon and juniper trees averaging over 4.5 feet in height. Tree canopy cover is between 10 to 20 percent. Tree crowns are typically cone- or pyramidal-shaped. Understory vegetation is dominated by low sagebrush and perennial bunchgrasses as well as smaller tree seedling and saplings.

##### Community Phase Pathway 1.3a, from 1.3 to 1.4:

Time without disturbances such as fire, drought, or disease will allow for the gradual maturation of singleleaf pinyon

and Utah juniper. Infilling by younger trees continues. Excessive herbivory may also reduce the perennial grass understory.

Community Phase Pathway 1.3b, from Phase 1.3 to 1.2:

Fire reduces or eliminates tree canopy, allowing perennial grasses to dominate the site.

Community Phase 1.4 (at-risk):

This phase is dominated by singleleaf pinyon and Utah juniper. The stand exhibits mixed age classes and canopy cover may be 30percent or greater. The density and vigor of the low sagebrush and perennial bunchgrass understory is decreased. Bare ground areas are likely to increase. Mat-forming forbs such as phlox may increase. This community is at risk of crossing a threshold; without proper management this phase will transition to the infilled tree state 3.0. This community phase is typically described as early Phase II woodland (Miller et al. 2008).

Community Phase Pathway 1.4a, from Phase 1.4 to 1.1:

Low intensity fire, insect infestation, or disease kills individual trees within the stand reducing canopy cover to less than 30percent. Over time young trees mature to replace and maintain the old-growth woodland. The low sagebrush and perennial bunchgrass community increases in density and vigor.

Community Phase Pathway 1.4b, from Phase 1.4 to 1.2:

A high-severity crown fire will eliminate or reduce the singleleaf pinyon and Utah juniper overstory and the shrub component which will allow for the perennial bunchgrasses to dominate the site.

T1A: Transition from Reference State 1.0 to Current Potential State 2.0:

Trigger: Introduction of non-native annual species.

Slow variables: Over time the annual non-native plants 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.

T1B: Transition from Reference State 1.0 to Infilled Tree State 3.0

Trigger: Time and a lack of disturbance allow trees to dominate site resources; may be coupled with inappropriate herbivory that favors shrub and tree dominance.

Slow variables: Over time the abundance and size of trees will increase.

Threshold: Pinyon and juniper canopy cover is greater than 40percent. Little understory vegetation remains due to competition with trees for site resources.

Current Potential State 2.0:

This state is similar to the Reference State 1.0, with four general community phases: an old-growth tree phase, a shrub-herbaceous phase, an immature tree phase, and an infilled tree phase. Ecological function has not changed, however the resiliency of the state has been reduced by the presence of non-native species. These non-natives, particularly cheatgrass, 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 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. Fires within this community with the small amount of non-native annual species present are likely still small and patchy due to low fuel loads. This fire type will create a plant community mosaic that will include all/most of the following community phases within this state.

Community Phase 2.1:

This phase is characterized by a widely dispersed old-growth pinyon and juniper trees with a Wyoming big sagebrush perennial bunchgrass understory. The visual aspect is dominated by singleleaf pinyon and Utah juniper with canopy cover of 15 percent or more (USDA 1997). Trees have reached maximal or near maximal heights for the site and many tree crowns may be flat- or round-topped. Thurber's needlegrass is the most prevalent grass in the understory. Low sagebrush is the primary understory shrub. Forbs such as phlox and eriogonum are minor components. Overall, the understory is sparse with production ranging between 200 to 400 lbs. per acre.

Community Phase Pathway 2.1a, from Phase 2.1 to 2.2:

A high-severity crown fire will eliminate or reduce the singleleaf pinyon and Utah juniper overstory and the shrub component. This allows for the perennial bunchgrasses to dominate the site.

Community Phase Pathway 2.1b, from Phase 2.1 to 2.4:

Time without disturbances such as fire, drought, or disease will allow for the gradual infilling of singleleaf pinyon and Utah juniper.

Community Phase 2.2:

This community phase is characterized by a post-fire shrub and herbaceous community. Thurber's needlegrass and other perennial grasses dominate. Forbs may increase post-fire but will likely return to pre-burn levels within a few years. Pinyon and juniper seedlings up to 4 feet in height may be present. Low sagebrush may be present in unburned patches. Burned tree skeletons may be present; however, these have little or no effect on the understory vegetation. Annual non-native species generally respond well after fire and may be stable or increasing within the community.

Community Phase Pathway 2.2a, from Phase 2.2 to 2.3:

Time without disturbances such as fire, drought, or disease will allow for the gradual maturation of the singleleaf pinyon and Utah Juniper component. Low sagebrush reestablishes. Excessive herbivory may also reduce perennial grass understory.

Community Phase 2.3:

This community phase is characterized by an immature woodland, with pinyon and juniper trees averaging over 4.5 feet in height. Tree canopy cover is between 10 to 20 percent. Tree crowns are typically cone- or pyramidal-shaped. Understory vegetation is dominated by low sagebrush and perennial bunchgrasses as well as smaller tree seedling and saplings. Annual non-native species are present.

Community Phase Pathway 2.3a, from Phase 2.3 to 2.4:

Time without disturbances such as fire, drought, or disease will allow for the gradual maturation of singleleaf pinyon and Utah juniper. Infilling by younger trees continues.

Community Phase Pathway 2.3b, from Phase 2.3 to 2.2:

Fire reduces or eliminates tree canopy, allowing perennial grasses to dominate the site.

Community Phase 2.4 (at-risk):

This phase is dominated by singleleaf pinyon and Utah juniper. The stand exhibits mixed age classes and canopy cover exceeds 30 percent. The density and vigor of the Wyoming big sagebrush and perennial bunchgrass understory is decreased. Bare ground areas are likely to increase. Mat-forming forbs may increase. Annual non-native species are present primarily under tree canopies. This community is at risk of crossing a threshold, without proper management this phase will transition to the infilled tree state 3.0. This community phase is typically described as early Phase II woodland (Miller et al. 2008).

Community Phase Pathway 2.4a, from Phase 2.4 to 2.1:

Low intensity fire, insect infestation, or disease kills individual trees within the stand reducing canopy cover to less than 30 percent. Over time young trees mature to replace and maintain the old-growth woodland. The low sagebrush and perennial bunchgrass community increases in density and vigor. Annual non-natives present in trace amounts.

Community Phase Pathway 2.4b, from Phase 2.4 to 2.2:

A high-severity crown fire will eliminate or reduce the singleleaf pinyon and Utah juniper overstory and the shrub component which will allow for the perennial bunchgrasses to dominate the site. Annual non-native grasses typically respond positively to fire and may increase in the post-fire community.

T2A: Transition from Current Potential State 2.0 to Infilled Tree State 3.0:

Trigger: Time and a lack of disturbance allow trees to dominate site resources; may be coupled with inappropriate grazing management that favors shrub and tree dominance.

Slow variables: Over time the abundance and size of trees will increase.

Threshold: Singleleaf pinyon and Utah juniper canopy cover is greater than 40 percent. Little understory vegetation remains due to competition with trees for site resources.



T2B: Transition from Current Potential State 2.0 to Annual State 4.0:

Trigger: Catastrophic crown fire facilitates the establishment of non-native, annual weeds.

Slow variables: Increase in tree crown cover, loss of perennial understory and an increase in annual non-native species.

Threshold: Cheatgrass or other non-native annuals dominate understory. Loss of deep-rooted perennial bunchgrasses changes spatial and temporal nutrient cycling and nutrient redistribution, and reduces soil organic matter. Increased canopy cover of trees allows severe stand-replacing fire. The increased seed bank of non-native, annual species responds positively to post-fire conditions facilitating the transition to an Annual State.

Infilled Tree State 3.0:

This state has two community phases that are characterized by the dominance of Utah juniper and singleleaf pinyon in the overstory. This state is identifiable by over 40 percent cover of Utah juniper and singleleaf pinyon, exhibiting a mixed age class. Older trees are at maximal height and upper crowns may be flat-topped or rounded. Younger trees are typically cone- or pyramidal-shaped. Understory vegetation is sparse due to increasing shade and competition from trees.

Community Phase 3.1:

Singleleaf pinyon and Utah juniper dominate the aspect. Understory vegetation is thinning. Perennial bunchgrasses are sparse and low sagebrush skeletons are as common as live shrubs due to tree competition for soil water, overstory shading, and duff accumulation. Tree canopy cover is greater than 40 percent. Annual non-native species are present or co-dominate in the understory. Bare ground areas are prevalent. This community phase is typically described as a Phase II woodland (Miller et al. 2008).

Community Phase Pathway 3.1a, from Phase 3.1 to 3.2:

Time without disturbances such as fire, drought, or disease will allow for the gradual maturation of singleleaf pinyon and Utah juniper. Infilling by younger trees continues.

Community Phase 3.2 (at risk):

Singleleaf pinyon and Utah juniper dominate the aspect. Tree canopy cover exceeds 40 percent. Understory vegetation is sparse to absent. Perennial bunchgrasses, if present exist in the drip line or under the canopy of trees. Low sagebrush skeletons are common or the sagebrush has been extinct long enough that only scattered limbs remain. Mat-forming forbs or Sandberg bluegrass (*Poa secunda*) may dominate interspaces. Annual non-native species are present and are typically found under the trees. Bare ground areas are large and interconnected. Soil redistribution may be extensive. This community phase is typically described as a Phase III woodland (Miller et al. 2008).

T3A: Transition from Infilled Tree State 3.0 to Annual State 4.0:

Trigger: Canopy fire reduces the pinyon and juniper overstory and facilitates the annual non-native species in the understory to dominate the site.

Slow variables: Over time, cover, production and seed bank of annual non-native species increases.

Threshold: Loss of deep-rooted perennial bunchgrasses and shrubs changes temporal and spatial nutrient capture and cycling within the community. Increase in canopy cover of trees increases rainfall interception and reduces soil moisture for understory species. Increased canopy cover of trees increases the risk for severe stand-replacing crown fire. The increased seed bank of non-native, annual species responds positively to post-fire conditions facilitating the transition to an Annual State.

R3A: Restoration from Infilled Tree state 3.0 to Current Potential State 2.0:

Manual or mechanical thinning of trees coupled with seeding. Probability of success is highest from community phase 3.1.

Annual State 4.0:

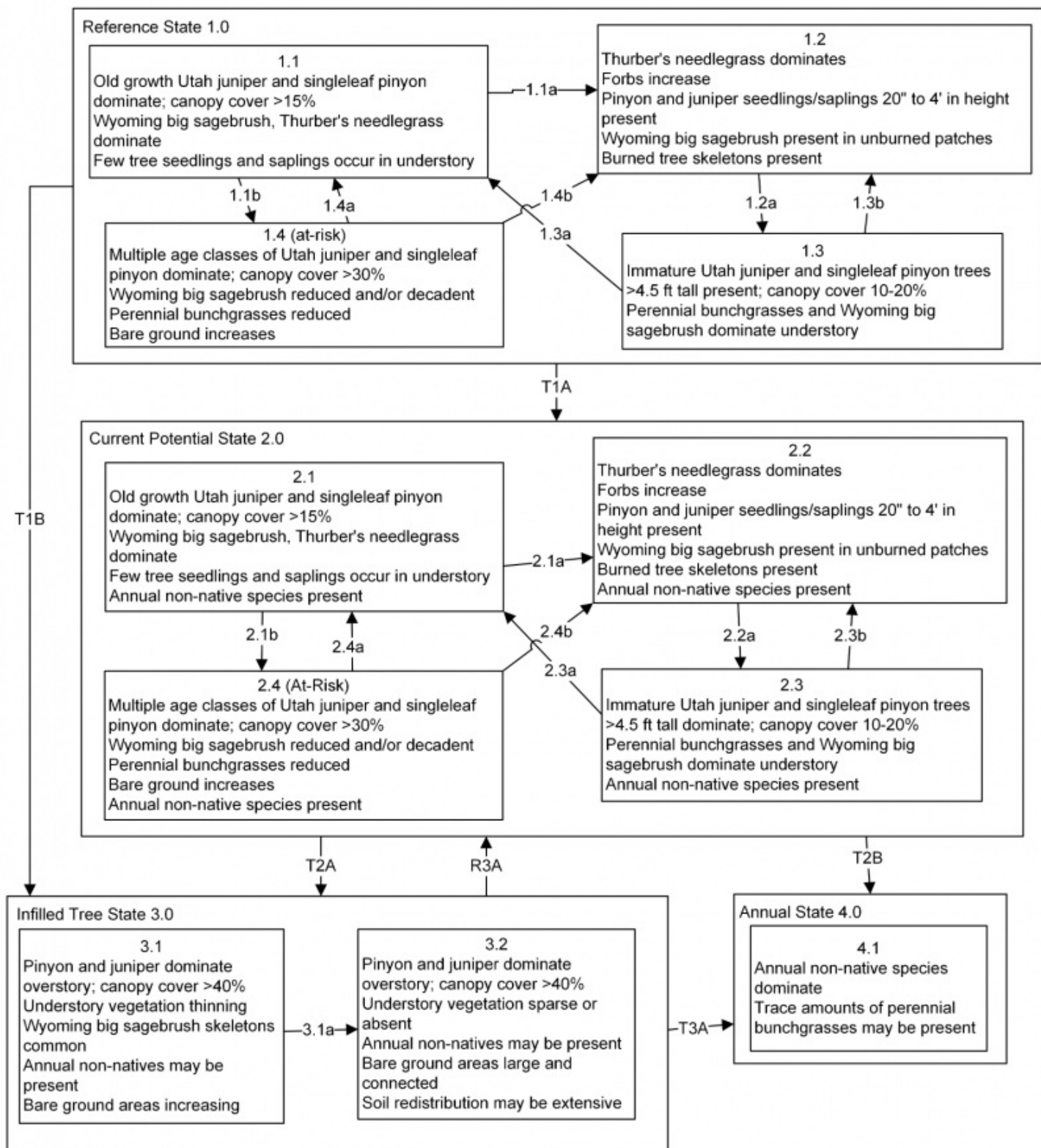
This state has one community phase that is characterized by the dominance of annual non-native species such as cheatgrass and tansy mustard in the understory. Time since fire may facilitate the maturation of sprouting shrubs such as rabbitbrush. Ecological dynamics are significantly altered in this state. Annual non-native species create a highly combustible fuel bed that shortens the fire return interval. Nutrient cycling is spatially and temporally

truncated as annual plants contribute significantly less to deep soil carbon. This state was not seen in MLRA 26 during field work for this project, however it is possible given increased fire activity in these sites and their proximity to known annual states of sagebrush ecological sites. We refer the reader to the report for Disturbance Response Group 21 for MLRA 28A and 28B.

Community Phase 4.1:

Cheatgrass, mustards and other non-native annual species dominate the site. Trace amounts of perennial bunchgrasses may be present. Sprouting shrubs may increase. Burned tree skeletons present.

## **State and transition model**



**MLRA 26  
Group 18  
PIMO/JUOS/ARTRW8/ACTH7  
026XY062NV  
KEY**

**Reference State 1.0 Community Pathways**

- 1.1a: High severity crown fire reduces or eliminates tree cover.
- 1.1b: Time and lack of disturbance such as fire, disease, or drought allows younger trees to infill.
- 1.2a: Time and lack of disturbance such as fire or drought. Excessive herbivory may also reduce perennial grass understory.
- 1.3a: Time and lack of disturbance such as fire or drought. Excessive herbivory may also reduce perennial grass understory.
- 1.3b: Fire.
- 1.4a: Low severity fire, insect infestation, or disease removes individual trees and reduces total tree cover.
- 1.4b: High severity crown fire reduces or eliminates tree cover.

Transition T1A: Introduction of non-native annual species.

Transition T1B: Time and a lack of disturbance allows for trees to dominate site resources; may be coupled with inappropriate grazing management that favors shrub and tree dominance.

**Current Potential State 1.0 Community Pathways**

- 2.1a: High severity crown fire reduces or eliminates tree cover.
- 2.1b: Time and lack of disturbance such as fire, disease, or drought allows younger trees to infill.
- 2.2a: Time and lack of disturbance such as fire or drought. Excessive herbivory may also reduce perennial grass understory.
- 2.3a: Time and lack of disturbance such as fire or drought. Excessive herbivory may also reduce perennial grass understory.
- 2.3b: Fire.
- 2.4a: Low severity fire, insect infestation, or disease removes individual trees and reduces total tree cover.
- 2.4b: High severity crown fire reduces or eliminates tree cover.

Transition T2A: Time and a lack of disturbance allows for trees to dominate site resources; may be coupled with inappropriate grazing management that favors shrub and tree dominance.

Transition T2B: Catastrophic fire.

**Infilled Tree State 3.0 Community Pathways**

- 3.1a: Time and lack of disturbance such as fire, disease, or drought allows younger trees to infill.

Transition T3A: Catastrophic fire.

Restoration Pathway R3A: Thinning of trees coupled with seeding. Success unlikely from phase 3.2.

**Annual State 4.0 Community Pathways**

None.

## **State 1**

### **Reference Plant Community**

#### **Community 1.1**

##### **Reference Plant Community**

The reference state is the interpretative state for this site. The reference plant community is dominated by singleleaf pinyon. Utah juniper may comprise up to 15 percent of total overstory canopy cover. Low sagebrush and antelope bitterbrush are the principal understory shrubs. Muttongrass, Sandberg's bluegrass and Thurber's and desert needlegrass are the most prevalent understory grasses. Balsamroot, tapertip hawksbeard, and rockcress are common understory forbs. Cheatgrass and thistle are species likely to invade this plant community after disturbance. An overstory canopy of about 20 to 25 percent is assumed to be representative of tree dominance on this site in the natural environment.

**Forest overstory.** The visual aspect and vegetal structure are dominated by singleleaf pinyon that have reached or are near maximal heights for the site. Dominant trees average greater than five inches in diameter at one-foot stump height. Tree canopy cover averages about 20 to 25 percent. Understory vegetation is strongly influenced by tree competition, overstory shading, duff accumulation, etc. This stage of forest development is assumed to be representative of this site in a pristine environment.

**Forest understory.** Understory vegetative composition is about 40 percent grasses, 5 percent forbs and 55 percent shrubs and young trees when the average overstory canopy is medium (15 to 25 percent). Average understory production ranges from 100 to 300 pounds per acre with a medium canopy cover. Understory production

includes the total annual production of all species within 4½ feet of the ground surface.

**Table 5. Annual production by plant type**

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	34	68	112
Grass/Grasslike	30	60	100
Forb	7	15	25
Tree	4	7	13
<b>Total</b>	<b>75</b>	<b>150</b>	<b>250</b>

## Additional community tables

**Table 6. Community 1.1 plant community composition**

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
<b>Grass/Grasslike</b>					
1	<b>Primary Perennial Grasses</b>			31–64	
	muttongrass	POFE	<i>Poa fendleriana</i>	15–36	–
	desert needlegrass	ACSP12	<i>Achnatherum speciosum</i>	8–14	–
	Thurber's needlegrass	ACTH7	<i>Achnatherum thurberianum</i>	8–14	–
2	<b>Secondary Perennial Grasses</b>			2–12	
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	2–8	–
	mountain brome	BRMA4	<i>Bromus marginatus</i>	0–2	–
	basin wildrye	LECI4	<i>Leymus cinereus</i>	0–2	–
<b>Forb</b>					
3	<b>Perennial Forbs</b>			0–4	
	balsamroot	BALSA	<i>Balsamorhiza</i>	0–2	–
	tapertip hawksbeard	CRAC2	<i>Crepis acuminata</i>	0–2	–
<b>Shrub/Vine</b>					
4	<b>Primary Shrubs</b>			16–28	
	little sagebrush	ARAR8	<i>Artemisia arbuscula</i>	8–14	–
	antelope bitterbrush	PUTR2	<i>Purshia tridentata</i>	8–14	–
5	<b>Secondary Shrubs</b>			2–14	
	mormon tea	EPVI	<i>Ephedra viridis</i>	2–8	–
	buckwheat	ERIOG	<i>Eriogonum</i>	0–2	–
	currant	RIBES	<i>Ribes</i>	0–2	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	0–2	–
<b>Tree</b>					
6	<b>Trees</b>			8–16	
	singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	8–14	–
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	0–2	–

## Animal community

Livestock Interpretations:

This site is not well suited to cattle or sheep grazing due to extreme surface rockiness and low forage production. Grazing management should be keyed to muttongrass and Thurber's needlegrass. Muttongrass is excellent forage

for domestic livestock especially in the early spring. Muttongrass begins growth in late winter and early spring, which makes it available before many other forage plants. Thurber's needlegrass species begin growth early in the year and remain green throughout a relatively long growing season. This pattern of development enables animals to use Thurber's needlegrass when many other grasses are unavailable. Cattle prefer Thurber's needlegrass in early spring before fruits have developed as it becomes less palatable when mature. Thurber's needlegrasses are grazed in the fall only if the fruits are softened by rain. These grasses are highly nutritious and remain palatable throughout the grazing season. New plants of these grasses are established entirely from seed and grazing practices should allow for ample seed production and seedling establishment. Domestic sheep and to a much lesser degree cattle consume low sagebrush, particularly during the spring, fall and winter. Many areas are not used because of steep slopes or lack of adequate water.

Stocking rates vary with such factors as kind and class of grazing animal, season of use and fluctuations in climate. Actual use records for individual sites, a determination of the degree to which the sites have been grazed and an evaluation of trend in site condition offer the most reliable basis for developing initial stocking rates.

The forage value rating is not an ecological evaluation of the understory as is the range condition rating for rangeland. The forage value rating is a utilitarian rating of the existing understory plants for use by specific kinds of grazing animals.

The amount and nature of the understory vegetation in a forestland is highly responsive to the amount and duration of shade provided by the overstory canopy. Significant changes in kinds and abundance of plants occur as the canopy changes, often regardless of grazing use.

#### Wildlife Interpretations:

This site has high value for mule deer year around. The trees provide shade and cool environments during the summer and protection from winter storms. The pinyon jay is dependent on sites supporting pinyon pine trees. This site is also used by upland game species and various song birds, rodents, reptiles and associated predators natural to the area. Black bear use this site in the fall foraging on pinyon nuts. Feral horses will use this site in the late spring, summer and fall. 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. Thurber needlegrass and Muttongrass are also valuable forage for wildlife.

### Recreational uses

Steep slopes and stony surfaces inhibit many forms of recreation. This site has limited potential for hiking, big game hunting and nature study.

### Wood products

Pinyon wood is rather soft, brittle, heavy with pitch, and yellowish brown in color. Singleleaf pinyon has played an important role as a source of fuelwood and mine props. It has been a source of wood for charcoal used in ore smelting. It still has a promising potential for charcoal production. Very low quality site for tree production.

Site index ranges from less than 20 to about 35 (Howell, 1940).

Productivity Class: 0.1

CMAI\*: <1.3 to 2.7 ft<sup>3</sup>/ac/yr;

<0.1 to 0.2 m<sup>3</sup>/ha/yr.

\*CMAI: is the culmination of mean annual increment highest average growth rate of the stand in the units specified.

### LIMITATIONS AND CONSIDERATIONS

a. Moderate to severe equipment limitations due to extreme surface stoniness and on sites with steep slopes.

### ESSENTIAL REQUIREMENTS

a. Protect soils from accelerated erosion.

b. Apply proper grazing management.

### SILVICULTURAL PRACTICES

Silvicultural treatments are not reasonably applied on this site due to poor site quality and severe limitations for

equipment and tree harvest.

## Other products

Singleleaf pinyon trees serve as a food source, as well as providing medicinal, cultural, and spiritual values for Native Americans.

## Other information

Other important uses for this tree are for Christmas trees and as a source of nuts for wildlife and human food. Thousands of pounds of nuts are gathered each year and sold throughout the United States. Diseases of singleleaf pinyon include infestations of dwarf mistletoe (a parasite), and blister rust. The mountain pine beetle attacks singleleaf pinyon.

## Inventory data references

NASIS data from soil survey area NV772.

## Type locality

Location 1: Storey County, NV	
Township/Range/Section	T18N R21E S27
General legal description	About 2 miles northeast of Lousetown fire station, Virginia Range, Storey County, Nevada.

## References

Stringham, T.K., D. Snyder, P. Novak-Echenique, K. O'Neill, A. Lyons, and M. Johns. 2021. Great Basin Ecological Site Development Project: State-and-Transition Models for Major Land Resource Area 26, Nevada and Portions of California..

## Other references

Fire Effects Information System (Online; <http://www.fs.fed.us/database/feis/plants/>).

USDA-NRCS Plants Database (Online; <http://www.plants.usda.gov>).

Howell, J. 1940. Pinyon and juniper: a preliminary study of volume, growth, and yield. Regional Bulletin 71. Albuquerque, NM: USDA, NRCS; 90p.

Jordan, M. 1974. An Inventory of Two Selected Woodland Sites in the Pine Nut Hills of Western Nevada. Master's Thesis, UNReno.

USDA-NRCS. 1998. National Forestry Manual - Part 537. Washington, D.C.

## Contributors

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## Approval

Kendra Moseley, 4/10/2024

## Rangeland health reference sheet

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

Author(s)/participant(s)	
Contact for lead author	
Date	05/05/2024
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

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

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

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

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

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

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

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

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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):**

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

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



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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):**

---

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:

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

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

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

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17. **Perennial plant reproductive capability:**

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