USDA Natural Resources Conservation Service

# Ecological site F026XY071NV
# Gravelly Loamy Slopes 12-16 P.Z. PIMO WSG:1R0601

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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 that 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 Gravelly Loamy Slopes 12-16 P.Z. occurs on mid- to upper hills and mountain sideslopes on all aspects, except at lower elevations where it is only on northerly aspects. Slopes range from 30 to 50 percent. Elevations are 6000 to 7500 feet. The soils of this site are deep and well drained. The soil surface texture is gravelly loam. The dominant plants are singleleaf pinyon (*Pinus monophylla*), mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana), muttongrass (*Poa fendleriana*), and needlegrass (Achnatherum spp.).

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | (1) *Pinus monophylla* |
| Shrub | (1) *Artemisia tridentata ssp. vaseyana* |
| Herbaceous | (1) *Poa fendleriana*<br>(2) *Achnatherum* |

## Physiographic features

The Gravelly Loamy Slopes 12-16 P.Z. occurs on mid- to upper-hills and mountain side slopes on all aspects except at lower elevations. This site is restricted to northerly aspects at the lower elevations of its range. Slopes range from 30 to 50 percent. Elevations are 6000 to 7500 feet.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Mountain slope |
| Runoff class | Medium to high |
| Elevation | 6,000–7,500 ft |
| Slope | 30–50% |
| Aspect | Aspect is not a significant factor |

## Climatic features

The climate associated with this site is subhumid with cool, dry summers and cold, wet winters. Average annual precipitation is about 12 to 16 inches. Mean annual air temperature is 42 to 46 degrees F. The average growing season is 70 to 90 days. Climate data used to support this section were derived from PRISM and is not specifically tied to any dominant climate station.

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) | 80 days |
| Freeze-free period (average) | |
| Precipitation total (average) | 14 in |

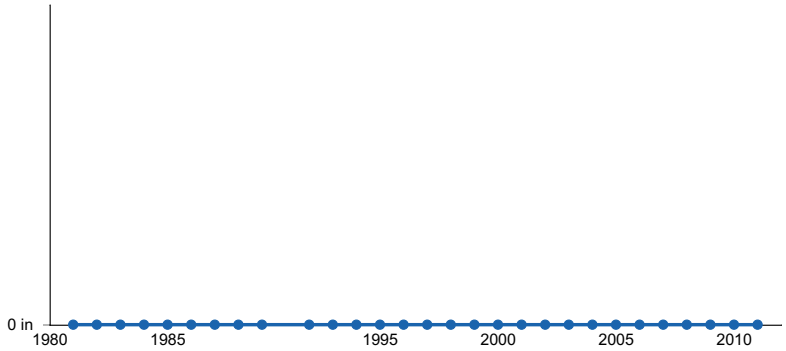



**Figure 1. Annual precipitation pattern**

## Influencing water features

There are no influencing water features associated with this site.

## Soil features

The soils are deep and well drained. Soil reaction throughout the profile is typically slightly acid to neutral. The upper part of these soils has a mollic horizon ranging from 10 to 18 inches in thickness. Some soils have 35 to over 50 percent gravels, cobbles, or stones, by volume, distributed throughout the soil profile. Available water capacity is moderate, 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 high and the potential for sheet and rill erosion is moderate to high depending on slope and amount of rock fragments on the soil surface. The soil temperature regime is mesic and the soil moisture regime is xeric. The mollic epipedon occurs from 14 to 20 inches. Soil series associated with this site includes Nosrac.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Colluvium–andesite<br>(2) Colluvium–schist<br>(3) Residuum–andesite<br>(4) Residuum–schist |
| Surface texture | (1) Gravelly loam |
| Family particle size | (1) Loamy |
| Drainage class | Well drained |
| Permeability class | Moderate to moderately slow |
| Soil depth | 60–80 in |
| Surface fragment cover <=3" | 21% |
| Surface fragment cover >3" | 9% |
| Available water capacity (0-40in) | 3.7–4.8 in |
| Calcium carbonate equivalent (0-40in) | 0% |
| Electrical conductivity (0-40in) | 0 mmhos/cm |
| Sodium adsorption ratio (0-40in) | 0 |
| Soil reaction (1:1 water) (0-40in) | 6.1–7.3 |
| Subsurface fragment volume <=3" (Depth not specified) | 27–29% |
| Subsurface fragment volume >3" (Depth not specified) | 12–13% |

## 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 forests 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.

Fire Ecology:
Wildfire is recognized as a natural disturbance that strongly influenced the structure and composition of the climax vegetation of this forest site. 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.

Mountain big sagebrush is highly susceptible to injury from fire. Plants are readily killed in all seasons, even light severity fires. Mountain big sagebrush plants top-killed by fire will not resprout.

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 25 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 ranges from 25 to 35 percent. Understory vegetation is strongly influenced by tree competition, overstory shading, duff accumulation, etc. Infrequent, yet periodic, wildfire is a natural factor influencing the development and maintenance of these mature forests. This stage of forest development is assumed to be representative of this forest site in a pristine environment.

OVER-MATURE FOREST: In the absence of wildfire or other naturally occurring disturbances, the tree canopy on this site can become very dense. 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 50 percent.

Description of MLRA 26 DRG 19:

Disturbance Response Group (DRG) 19 consists of six ecological sites; F026XY060NV, F026XY044NV, F026XY061NV, F026XY069NV, F026XY104NV, F026XY071NV (Stringham et al. 2021). This group receives 10 to 14 inches of precipitation each year. Elevations range from 5,000 to 9,000 while slopes range from 15 to 75 percent. The soils are typically shallow to moderately deep and well drained and the water holding capacity is low to moderate. The soils are generally skeletal with 35 to 50 percent gravels, cobbles, or stones, by volume, distributed throughout the soil profile. This group is dominated by singleleaf pinyon (*Pinus monophylla*) with mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana) as the primary understory shrub. Utah juniper ( *Juniperus osteosperma*) and curl-leaf mountain mahogany (*Cercocarpus ledifolius*) are minor components. Other subdominant shrubs in the group include Wyoming big sagebrush (*Artemisia tridentata* ssp. wyomingensis) and antelope bitterbrush (*Purshia tridentata*). The dominant understory grass is Thurber's needlegrass (*Achnatherum thurberianum*) or desert needlegrass (*Achnatherum speciosum*). Other grasses in the group include muttongrass (*Poa fendleriana*) and prairie junegrass (*Koeleria macrantha*). Under medium canopy cover (20-30%), understory production ranges from 200 to 450 pounds per acre in a normal year.

Potential Resilience Differences with other Ecological Sites:

Gravelly Loamy Slopes 12-16 P.Z. (F026XY071NV):
This site is very similar to the modal site but with antelope bitterbrush as the subdominant shrub instead of Wyoming sagebrush. The dominant grass on this site is muttongrass with Thurber's needlegrass subdominant. It occurs on mid- to upper mountain sideslopes in a slightly higher elevation range of 6,000 to 9,000 feet. This site also receives more precipitation with 14 to 18 inches annually and is more productive than the modal site with 450 lbs/ac of forage produced in a normal year under medium canopy (26-35%). This site is sometimes found with up

to 10% Utah juniper, Sierra juniper (*Juniperus grandis*), Jeffrey pine (*Pinus jeffreyi*), or curl-leaf mountain mahogany canopy.

General State and Transition Model Narrative for Group 19:

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 19.

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 woodland 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 long-term drought, and/or insect or disease attack. Fires are typically 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 singleleaf pinyon trees with an understory of mountain big sagebrush and perennial bunchgrasses. The visual aspect is dominated by singleleaf pinyon with 15 percent or greater canopy cover (USDA 1997). Utah juniper may be present. Trees have reached maximal or near maximal heights for the site and many tree crowns may be flat- or round-topped. Thurber's needlegrass and bluegrasses are the most prevalent grasses in the understory. Mountain big sagebrush is the primary understory shrub. Forbs such as arrowleaf balsamroot (*Balsamorhiza sagittata*) and tapertip hawksbeard (*Crepis acuminata*) are minor components. Utah juniper may be present.

Community Phase Pathway 1.1a, from Phase 1.1 to 1.2:
A high-severity crown fire will eliminate or reduce the singleleaf pinyon 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 disturbance such as fire, long-term drought, or disease will allow for the gradual infilling of singleleaf pinyon.

Community Phase 1.2:
This community phase is characterized by a post-fire shrub and herbaceous community. Thurber's needlegrass, bluegrasses, and other perennial grasses dominate. Thurber's needlegrass can experience high mortality from fire and may be reduced in the community for several years. Forbs may increase post-fire but will likely return to pre-burn levels within a few years. Singleleaf pinyon seedlings up to 4 feet in height may be present. Mountain big 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 disturbance such as fire, long-term drought, or disease will allow for the gradual maturation of the singleleaf pinyon component. Mountain big sagebrush reestablishes. Excessive herbivory may also reduce perennial grass understory.

Community Phase 1.3
This community phase is characterized as an immature woodland with singleleaf pinyon trees averaging over 4.5 feet in height. Pinyon canopy cover is between 10 to 20 percent. Tree crowns are typically cone- or pyramidal-shaped. Understory vegetation consists of smaller tree seedling and saplings, as well as perennial bunchgrasses and sagebrush.

Community Phase Pathway 1.3a, from Phase 1.3 to 1.2:
Fire reduces or eliminates tree canopy, allowing perennial grasses to dominate the site.

Community Phase Pathway 1.3b, from Phase 1.3 to 1.1:

Time without disturbance such as fire, long-term drought, or disease will allow for the gradual maturation of singleleaf pinyon. Excessive herbivory may also reduce perennial grass understory.

Community Phase 1.4 (at-risk):
This phase is dominated by singleleaf pinyon. The stand exhibits mixed age classes and canopy cover exceeds 30 percent. The density and vigor of the mountain big sagebrush and perennial bunchgrass understory is decreased. Bare ground areas are likely to increase. Mat-forming forbs may increase. Utah juniper may be present. This community is at risk of crossing a threshold; without proper management this phase will transition to the infilled woodland 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 35 percent. Over time young trees mature to replace and maintain the old-growth woodland. The mountain big 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 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 grazing management that favors shrub and tree dominance.
Slow variables: Over time the abundance and size of trees will increase.
Threshold: Singleleaf pinyon canopy cover is greater than 50 percent. 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 woodland 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 singleleaf pinyon trees with an understory of mountain big sagebrush and perennial bunchgrasses. The visual aspect is dominated by singleleaf pinyon with 15 percent or greater canopy cover (USDA 1997). Utah juniper may be present. Trees have reached maximal or near maximal heights for the site and many tree crowns may be flat- or round-topped. Thurber's needlegrass and bluegrasses are the most prevalent grasses in the understory. Mountain big sagebrush is the primary understory shrub. Forbs such as arrowleaf balsamroot and tapertip hawksbeard are minor components. Utah juniper may be present.

Community Phase Pathway 2.1a, from Phase 2.1 to 2.2:
A high-severity crown fire will eliminate or reduce the singleleaf pinyon 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 disturbance such as fire, long-term drought, or disease will allow for the gradual infilling of singleleaf pinyon.

Community Phase 2.2:
This community phase is characterized by a post-fire shrub and herbaceous community. Thurber's needlegrass, bluegrass, and other perennial grasses dominate. Forbs may increase post-fire but will likely return to pre-burn levels within a few years. Pinyon seedlings up to 4.5 feet in height may be present. Mountain big 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 disturbance such as fire, long-term drought, or disease will allow for the gradual maturation of the singleleaf pinyon component. Mountain big sagebrush reestablishes. Excessive herbivory may also reduce perennial grass understory.

Community Phase 2.3:
This community phase is characterized by an immature woodland, with singleleaf pinyon 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 consists of smaller tree seedling and saplings, as well as perennial bunchgrasses and shrubs. Annual non-native species are present.

Community Phase Pathway 2.3a, from Phase 2.3 to 2.2:
Fire reduces or eliminates tree canopy, allowing perennial grasses to dominate the site.

Community Phase Pathway 2.3b, from Phase 2.3 to 2.1:
Time without disturbance such as fire, long-term drought, or disease will allow for the gradual maturation of singleleaf pinyon. Excessive herbivory may also reduce the perennial grass understory.

Community Phase 2.4 (at-risk):
This phase is dominated by singleleaf pinyon and Utah juniper may be present. The stand exhibits mixed age classes and canopy cover exceeds 30 percent. The density and vigor of the mountain 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. Utah juniper may be present. 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 35 percent. Over time young trees mature to replace and maintain the old-growth woodland. The mountain big 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 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: Pinyon canopy cover is greater than 30%. 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 singleleaf pinyon in the overstory. This state is identifiable by greater than 50 percent cover of singleleaf pinyon and 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 dominates the aspect. Understory vegetation is thinning. Perennial bunchgrasses are sparse and mountain big 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 50 percent. Utah juniper may be present. Annual non-native species are present or co-dominate in the understory. Bare ground areas are prevalent and soil redistribution is evident. 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 disturbance such as fire, long-term drought, or disease will allow for the gradual maturation of singleleaf pinyon. Infilling by younger trees continues.

Community Phase 3.2:
Singleleaf pinyon dominates the aspect and Utah juniper may be present. Tree canopy cover exceeds 50 percent. Utah juniper may be present. Understory vegetation is sparse to absent. Perennial bunchgrasses, if present exist in the dripline or under the canopy of trees. Mountain sagebrush skeletons are common or the sagebrush has been extinct long enough that only scattered limbs remain. Mat-forming forbs or Sandberg’s bluegrass 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: Catastrophic fire reduces the tree overstory and allows for the annual non-native species in the understory to dominate the site. Soil disturbing treatments such as slash and burn may also reduce tree canopy and allow for non-native annual species to increase.
Slow variables: Over time, cover and production 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. Increased, continuous fine fuels modify the fire regime by increasing frequency, size, and spatial variability of fires.

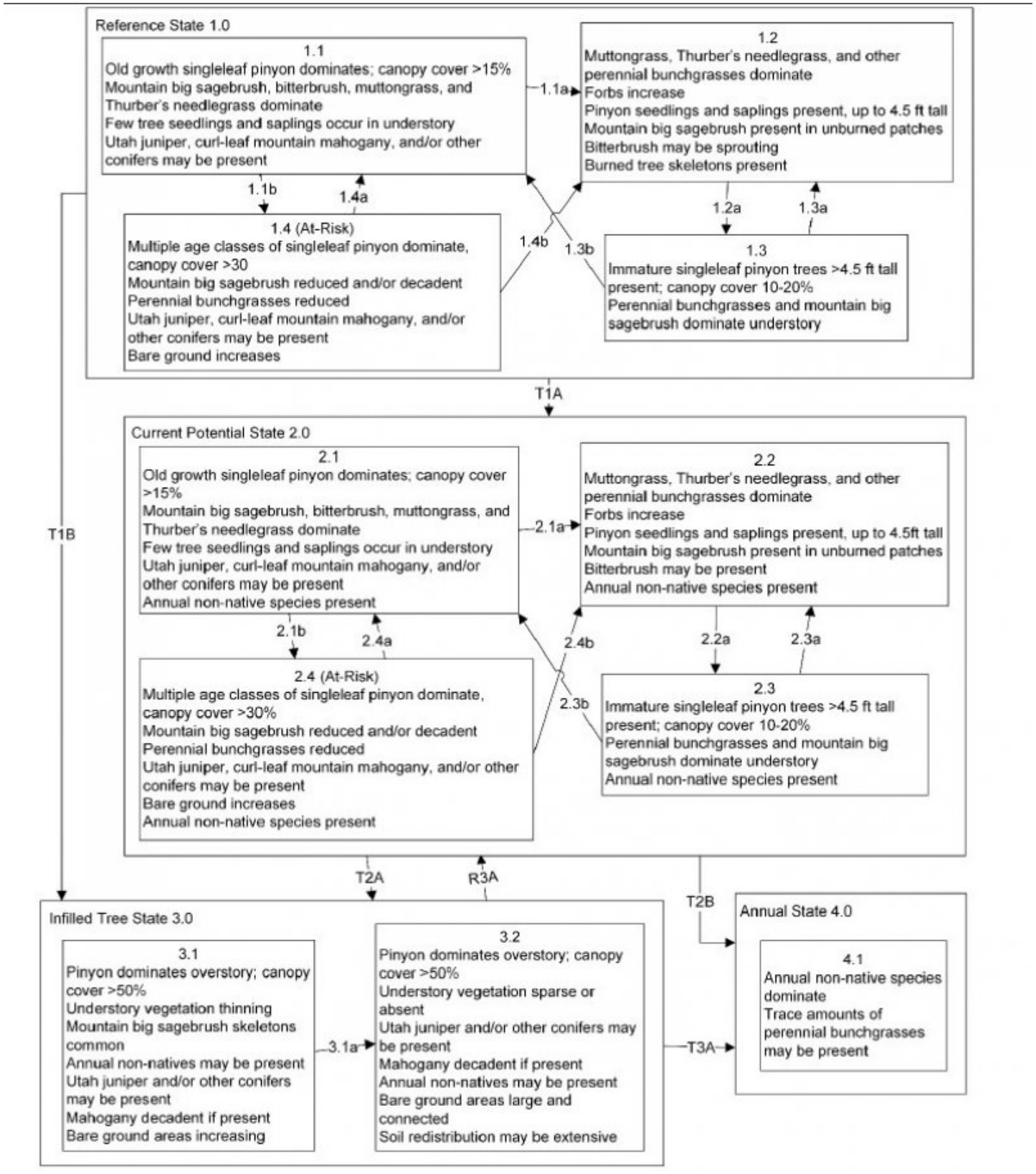
R3A Restoration from Infilled Tree State 3.0 to Current Potential State 2.0:
Manual or mechanical thinning of trees coupled with seeding. Probability of success is highest from community phase 3.1.

Annual State 4.0:

This community is characterized by the dominance of annual non-native species such as cheatgrass and tansy mustard in the understory. Rabbitbrush or other sprouting shrubs may dominate the overstory. Annual non-native species dominate the understory. 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 19**
**PIMO/ARTRV/POFE**
**026XY071NV**
**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: Fire.
1.3b: Time and lack of disturbance such as fire or drought. Excessive herbivory may also reduce perennial grass understory.
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 or inappropriate grazing may also reduce perennial grass understory.
2.3a: Fire.
2.3b: Time and lack of disturbance such as fire or drought. Excessive herbivory or inappropriate grazing may also reduce perennial grass understory.
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 State

## Community 1.1
## Reference State

The reference state is the interpretative state for this site. The reference plant community is dominated by singleleaf pinyon. Muttongrass, Thurber's and western needlegrasses, and basin wildrye are the most prevalent understory grasses. Tapertip hawksbeard, arrowleaf balsamroot, lupine, and rockcress are common understory forbs. Mountain big sagebrush and antelope bitterbrush are the principal understory shrubs. Overstory tree canopy composition is about 90 to 100 percent singleleaf pinyon with less than 10 percent curlleaf mountainmahogany, Utah juniper or Sierra juniper and Jeffery pine mixing in the overstory canopy. Sierra juniper and Jeffery pine occur on this site at the upper elevations of its range and are primarily found in the Sierra Nevada Mountains. An overstory canopy of about 30 percent is assumed to be representative of tree dominance on this site in the natural environment.

**Forest overstory.** 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 ranges from 25 to 35 percent. Understory vegetation is strongly influenced by tree competition, overstory shading, duff accumulation, etc. Infrequent, yet periodic, wildfire is a natural factor influencing the development and maintenance of these mature forests. This stage of forest development is assumed to be representative of this woodland site in a pristine environment.

**Forest understory.** Understory vegetative composition is about 50 percent grasses, 10 percent forbs and 40

percent shrubs and young trees when the average overstory canopy is medium (25 to 35 percent). Average understory production ranges from 300 to 600 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.

## Additional community tables

## Animal community

Livestock Interpretations:
This site is suited to cattle and sheep grazing where terrain permits. Grazing management should be keyed to muttongrass and Thurber's and western needlegrass production. 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. Many areas are not used because of steep slopes or lack of adequate water. Harvesting trees under a sound management program for fuelwood, posts or other wood products can open up the tree canopy to allow increased production of understory species desirable for grazing.

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.
Selection of initial stocking rates for given grazing units is a planning decision. This decision should be made ONLY after careful consideration of the total resources available, evaluation of alternatives for use and treatment and establishment of objectives by the decisionmaker.

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.
Mountain big sagebrush is highly preferred and nutritious winter forage for mule deer. Muttongrass is another important forage for several wildlife species.

## Hydrological functions

Runoff is high. Permeability is moderate to moderately slow.

## Recreational uses

The trees on this site provide a welcome break in an otherwise open landscape. Steep slopes and stony surfaces inhibit many forms of recreation. It has potential for hiking, cross-country skiing, camping, and for big game as well as upland game hunting.

## 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.

PRODUCTIVE CAPACITY
Moderate quality site for tree production.

Site index ranges from about 65 to 90 (Howell,1940).

Productivity Class: 1.0
CMAI*: 6.7 to 12.3 ft3/ac/yr;
0.5 to 0.90 m3/ha/yr.
*CMAI: is the culmination of mean annual increment highest average growth rate of the stand in the units specified.

Fuelwood Production: 15 to 18 cords per acre for stands averaging 5 inches in diameter at 1 foot height. There are about 289,000 gross British Thermal Units (BTUs) heat content per cubic foot of singleleaf pinyon wood. Firewood is commonly measured by cord, or a stacked unit equivalent to 128 cubic feet. Solid wood volume in a cord varies but assuming an average of 75 cubic feet of solid wood per cord, there are about 21 million BTUs of heat value in a cord of singleleaf pinyon wood.

Christmas trees: 15 to 25 trees per acre in stands of medium canopy.

MANAGEMENT GUIDES AND INTERPRETATIONS

1. LIMITATIONS AND CONSIDERATIONS
a. Potential for sheet and rill erosion is moderate to severe depending on slope.
b. Severe equipment limitations due to steep slopes and on sites having extreme surface stoniness.
c. Proper spacing is the key to a well- managed, multiple use and multi-product

2. ESSENTIAL REQUIREMENTS
a. Adequately protect from wildfire.
b. Protect soils from accelerated erosion.
c. Apply proper grazing management.

3. SILVICULTURAL PRACTICES
a. Harvest cut selectively or in small patches size dependent upon site conditions) to enhance forage production.
1) Thinning and improvement cutting - Removal of poorly formed, diseased and low vigor trees for fuelwood.
2) Harvest cutting - Selectively harvest surplus trees to achieve desired spacing. Save large, healthy, full-crowned singleleaf pinyon trees for nut producers. Do not select only "high grade" trees during harvest.
3) Slash Disposal - broadcasting slash improves reestablishment of native understory herbaceous species and establishment of seeded grasses and forbs after tree harvest.
4) Spacing Guide - D+9
b. Prescription burning program to maintain desired canopy cover and manage site reproduction.
c. Mechanical tree removal (i.e. chaining) is usually not recommended on this site due to steep slopes.
d. Pest control - Porcupines can cause
extensive damage and populations should be controlled.
e. Fire hazard - Fire usually not a problem in well-managed, mature stands.

## Other products

Singleleaf pinyon tree ecosystems have had subsistence, cultural, spiritual, economic, aesthetic and medicinal value to Native American peoples for centuries, and singleleaf pinyon has provided food, fuel, medicine and shelter to Native Americans for thousands of years. The pitch of singleleaf pinyon was used as adhesive, caulking material, and a paint binder. It may also be used medicinally and chewed like gum. Pinyon seeds are a valuable food source for humans, and a valuable commercial crop. 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.
Pinyon Nuts: Annual production varies greatly, but mature woodland stage can yield over 250 pounds per acre (600 to 800 cones) per acre in favorable years.

Native peoples used big sagebrush leaves and branches for medicinal teas, and the leaves as a fumigant. Bark was woven into mats, bags and clothing.

**Table 5. Representative site productivity**

| Common Name | Symbol | Site Index Low | Site Index High | CMAI Low | CMAI High | Age Of CMAI | Site Index Curve Code | Site Index Curve Basis | Citation |
|---|---|---|---|---|---|---|---|---|---|
| singleleaf pinyon | *PIMO* | 65 | 90 | 7 | 12 | – | – | – | |

## Inventory data references

NASIS data for soil survey areas CA729 and NV773.

## Type locality

| Location 1: Douglas County, NV | |
|---|---|
| Township/Range/Section | T10N R21E S5 |
| General legal description | About 6½ miles west of Highway 395 along Leviathan Mine road, Douglas County, Nevada. This site also occurs in Carson City, Storey and Washoe Counties, 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, UNR Reno.

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:**

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:

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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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