USDA Natural Resources Conservation Service

# Ecological site F026XY064NV
# Shallow Clayey Summit 11-14 P.Z. PIMO-JUOS/ARAR8/ACTH7

Last updated: 4/10/2024
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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

MLRA 26 is in western Nevada and eastern California; approximately 69 percent is in Nevada, and 31 percent in California. The area is predominantly 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. The valleys are drained by three major rivers flowing east across MLRA 26; the Truckee, Carson and Walker rivers. A narrow strip along the western border of MLRA 26 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. The structure creates an impressive wall of mountains directly west of the area creating a rain shadow affect to MLRA 26. Parts of the eastern face; the foothills, mark the western boundary of the area. Elevations range from near 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.

In MLRA 26, the valleys are composed dominantly of Quaternary alluvial deposits. Quaternary playa or alluvial flat deposits typically occupy the lowest valley bottoms in the internally drained valleys. Tertiary andesitic flows, breccias, ash flow tuffs, rhyolite tuffs or granodioritic rocks dominate the hills and mountains. Quaternary basalt flows are present in lesser amounts. Jurassic and Triassic limestone and shale, and Precambrian limestone and dolomite are also present in very limited amounts. Glacial till deposits, of limited extent are along the east flank of the Sierra Nevada Mountains; the result of alpine glaciation.

The average annual precipitation in MLRA 26 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 MLRA 26 are Aridisols and Mollisols. The soils in the area typically have a mesic soil temperature regime, an aridic or xeric soil moisture regime, and mixed or smectitic mineralogy. The soils are generally well drained, clayey or loamy and are commonly skeletal. The soils depths are typically very shallow to moderately deep.

This area supports shrub-grass vegetation characterized by big sagebrush. Low sagebrush and Lahontan sagebrush are on some soils. Antelope bitterbrush, squirreltail, desert needlegrass, Thurber needlegrass, and Indian ricegrass are important associated plants. Green ephedra, Sandberg bluegrass, desert peach, and several forb species are also 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.

Wildlife species in the area are mule deer, coyote, beaver, muskrat, jackrabbit, cottontail, raptors, pheasant, chukar, blue grouse, mountain quail, and mourning dove, amongst other species. 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 and 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, like ponderosa pine. Elevations range from 1610 to 2420 meters (5282 to 7940 feet) and slopes range from 5 to 49 percent, with a median value of 22 percent. Frost free days (FFD) range from 92 to 163.

## Ecological site concept

This forest community is on the summits and side slopes of upper plateaus on all aspects. Slopes range from 2 to over 15 percent. Elevations are 2073 to 2301 meters (6800 to 7550 feet). The soils are typically shallow to a heavy textured subsoil and well drained. These soils are typically skeletal with 35 to over 50 percent gravels, cobbles, or stones, by volume, distributed throughout the soil profile. The soil surface texture is stony sandy loam. The dominant plants are singleleaf pinyon (*Pinus monophylla*), Utah juniper (*Juniperus osteosperma*), little sagebrush (*Artemisia arbuscula*), and Thurber's needlegrass (*Achnatherum thurberianum*).

## Similar sites

| | |
|---|---|
| F026XY063NV | **Shallow Sandy Pediment 13-15 P.Z. JUOS/ARTRW8/ACHY-HECO26**<br>Surface soil texture is sand. |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | (1) *Pinus monophylla*<br>(2) *Juniperus osteosperma* |
| Shrub | (1) *Artemisia arbuscula* |
| Herbaceous | (1) *Achnatherum thurberianum* |

## Physiographic features

This forest community is on the summits and side slopes of upper plateaus on all aspects. Slopes range from 2 to over 15 percent. Elevations are 2073 to 2301 meters (6800 to 7550 feet).

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Plateau |
| Runoff class | Medium to very high |
| Elevation | 2,073–2,301 m |
| Slope | 2–15% |
| 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 11 to 14 inches. Mean annual air temperature is 42 to 47 degrees F. The average growing season is 90 to 120 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) | 105 days |
| Freeze-free period (average) | |
| Precipitation total (average) | 305 mm |

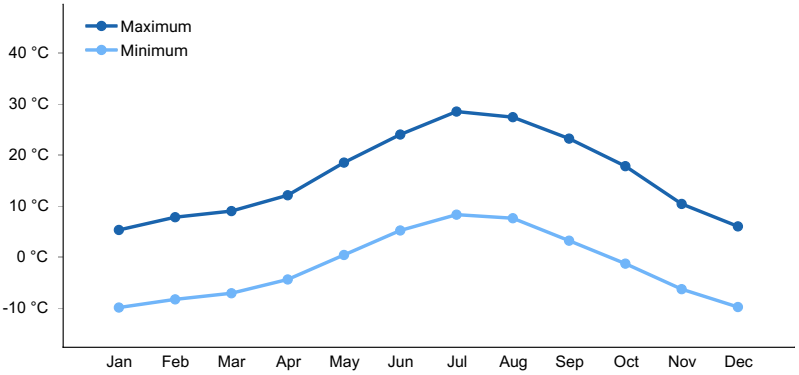



**Figure 1. Monthly average minimum and maximum temperature**

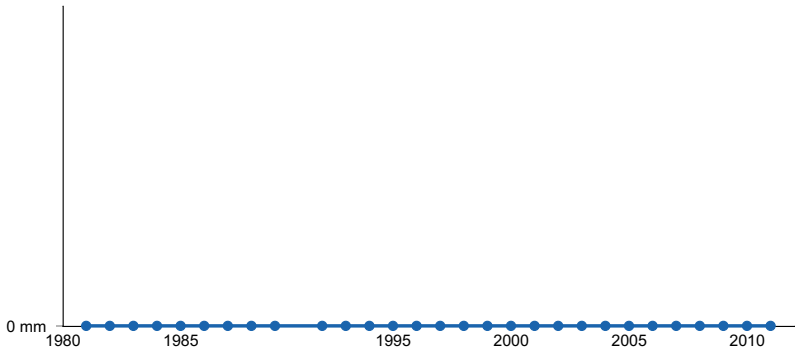



**Figure 2. Annual precipitation pattern**

## Influencing water features

No influencing water features are associated with this site.

## Soil features

The soils associated with this site are typically shallow to a heavy textured subsoil and well drained. These soils are usually skeletal with 35 to over 50 percent gravels, cobbles, or stones, by volume, distributed throughout the soil profile. Available water capacity is very low, but trees and shrubs extend their roots into fractures in the bedrock allowing them to utilize deep moisture. There may be high amounts of cobbles or stones at the soil surface. Runoff is very high and the potential for sheet and rill erosion is low to moderate depending on slope and amount of rock fragments on the soil surface. Soil series associated with this site include: Lunder, Bulake family, and Vinini family.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Residuum–basalt |
| Surface texture | (1) Stony sandy loam |
| Family particle size | (1) Sandy |
| Drainage class | Well drained |
| Permeability class | Very slow to moderate |
| Soil depth | 25–51 cm |
| Surface fragment cover <=3" | 15–33% |
| Surface fragment cover >3" | 2–15% |
| Available water capacity (0-101.6cm) | 2.54–5.84 cm |
| Calcium carbonate equivalent (0-101.6cm) | 0% |
| Electrical conductivity (0-101.6cm) | 0–4 mmhos/cm |
| Sodium adsorption ratio (0-101.6cm) | 0 |
| Soil reaction (1:1 water) (0-101.6cm) | 6.6–7.8 |
| Subsurface fragment volume <=3" (Depth not specified) | 11–42% |
| Subsurface fragment volume >3" (Depth not specified) | 0–10% |

## Ecological dynamics

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.

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.

IMMATURE FOREST: The visual aspect and vegetal structure are dominated by Utah juniper trees greater than 4½ feet in height. The upper crown of dominant and codominant trees are cone or pyramidal shaped. Seedlings and saplings of Utah juniper and pinyon are present in the understory. Dominants are the tallest trees on the site; co-dominants are 65 to 85 percent of the highest of dominant trees. Understory vegetation is moderately influenced by a tree overstory canopy of about 10 to 20 percent.

MATURE FOREST: The visual aspect and vegetal structure are dominated by Utah juniper and 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. Upper crowns of pinyon and juniper trees are typically either irregularly or smoothly flat-topped or rounded. Tree canopy cover ranges from 15 to about 25 percent. This stage of community development is assumed to be representative of this site in the natural environment.

OVER-MATURE FOREST: In the absence of wildfire or other naturally occurring disturbances, the tree canopy on this site can become very dense. This stage is dominated by Utah juniper and single leaf pinyon that have reached maximal heights for the site. Dominant and co-dominant trees average greater than five inches in diameter at one-foot stump height. Upper crowns are typically irregularly flat-topped or rounded.

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.
Utah juniper is not shade tolerant. It is a climax species in harsh areas where stands are open and regeneration can occur without competition for light.

Juniper litter has an allelopathic effect on some understory species. This effect is particularly evident on heavy, poorly drained clay soils. Broadcasting grass seeds over litter appeared to lower the allelopathic effects.

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. Utah juniper is usually killed by fire, especially when trees are small. 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. Antelope bitterbrush is considered a weak sprouter and is often killed by summer or fall fires. Antelope bitterbrush in some areas may sprout after light-severity spring fires. High fuel consumptions increase antelope bitterbrush mortality and therefore favors seedling establishment. Thurber 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. Indian ricegrass can be killed by fire, depending on severity and season of burn. Indian ricegrass reestablishes on burned sites through seed dispersed from adjacent unburned areas. Webber's needlegrass is damaged by burning due to dense plant material that can burn slowly and long, charring to the growing points. Late summer and early fall fires are the least harmful. Desert needlegrass has persistent dead leaf bases, which make it susceptible to burning. Fire removes the accumulation; a rapid, cool fire will not burn deep into the root crown. Most perennial grasses have root crowns that can survive wildfire. Bluegrass is generally unharmed by fire. It produces little litter, and its small bunch size and sparse litter reduces the amount of heat transferred to perennating buds in the soil. Its rapid maturation in the spring also reduces fire damage, since it is dormant when most fires occur.

General 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 Wyoming big 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. Wyoming big 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. Wyoming 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 disturbances such as fire, drought, or disease will allow for the gradual maturation of the singleleaf

pinyon and Utah Juniper component. Wyoming big 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 Wyoming big 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 Wyoming big 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 Wyoming 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 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. Wyoming big 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. Wyoming 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 disturbances such as fire, drought, or disease will allow for the gradual maturation of the singleleaf pinyon and Utah Juniper component. Wyoming 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 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 Wyoming big 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 Wyoming 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 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 Wyoming 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 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. Wyoming big 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.

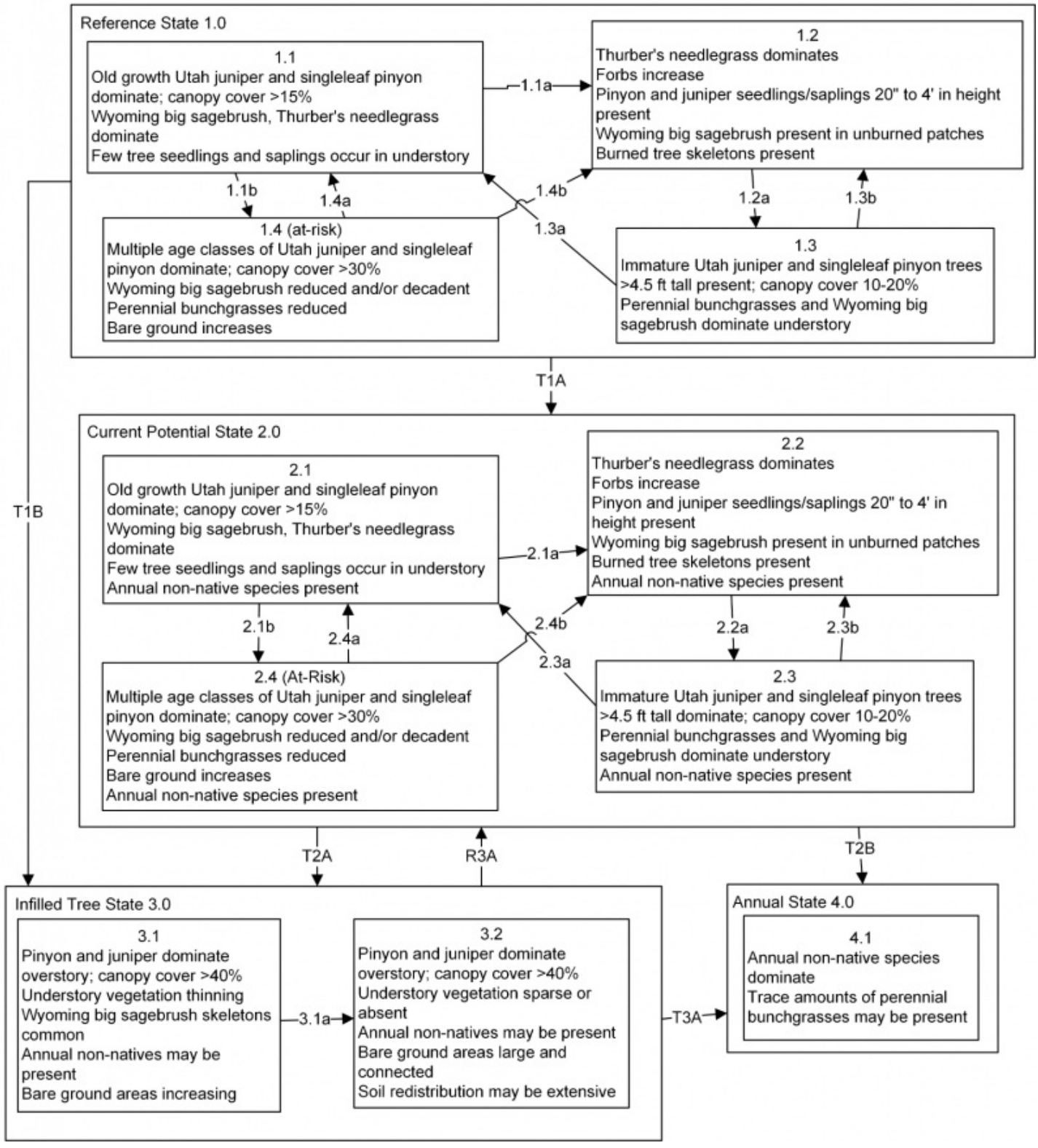
Community Phase 4.1:
Cheatgrass, mustards and other non-native annual species dominate the site. Trace amounts of perennial bunchgrasses may be present. Sprouting shrubs may increase. Burned tree skeletons present.

Potential Resilience Differences with other Ecological Sites in this Group

PIMO-JUOS WSG: 0D0503 (F026XY064NV):
This site is very similar to the modal site but with low sagebrush as the dominant shrub. The subdominant grass on this site is Indian ricegrass. It occurs on upper piedmont slopes at a higher elevation of 6200 to 8000 feet. The site, in its reference state, has a lower pinyon-juniper canopy understory of about 20 percent. It is less productive than the modal site with 150 lbs/acre in a normal year and has more precipitation at 10-14 inches per year.

## State and transition model

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



**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 State

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 or most of the following community phases within this state.

### Community 1.1

This phase is characterized by 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 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. Wyoming big 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.

**Forest overstory.** MATURE FOREST: The visual aspect and vegetal structure are dominated by Utah juniper and

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. Upper crowns of pinyon and juniper trees are typically either irregularly or smoothly flat-topped or rounded. Tree canopy cover ranges from 15 to about 25 percent. This stage of community development is assumed to be representative of this forest site in the natural 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 150 to 350 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 (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Shrub/Vine | 38 | 76 | 101 |
| Grass/Grasslike | 34 | 67 | 90 |
| Tree | 8 | 17 | 22 |
| Forb | 4 | 8 | 11 |
| **Total** | **84** | **168** | **224** |

## Community 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 (1.2 meters) in height may be present. Wyoming 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 1.3

This community phase is characterized by an immature woodland, with pinyon and juniper trees averaging over 4.5 feet (1.4 meters) in height. Tree canopy cover is between 10 to 20 percent. Tree crowns are typically cone- or pyramidal-shaped. Understory vegetation is dominated by Wyoming big sagebrush and perennial bunchgrasses as well as smaller tree seedling and saplings.

## Community 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 Wyoming big 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).

## Pathway 1.1a Community 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.

## Pathway 1.1b Community 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.

### Pathway 1.2a
### Community 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. Wyoming big sagebrush reestablishes. Excessive herbivory may also reduce perennial grass understory.

### Pathway 1.3b
### Community 1.3 to 1.2

This pathway is a result of fire reducing or eliminating tree canopy, allowing perennial grasses to dominate the site.

### Pathway 1.3a
### Community 1.3 to 1.4

This pathway is a result of time without disturbances such as fire, drought, or disease which 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.

### Pathway 1.4a
### Community 1.4 to 1.1

This pathway is a result of low intensity fire, insect infestation, or disease which 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 Wyoming big sagebrush and perennial bunchgrass community increases in density and vigor.

### Pathway 1.4b
### Community 1.4 to 1.2

This pathway is a result of a high-severity crown fire which 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.

## State 2
## Current Potential State

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 2.1

### Community 2.2

### Community 2.3

### Community 2.4

### Pathway 2.1a
### Community 2.1 to 2.2

This pathway is a result of a high-severity crown fire which 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.

### Pathway 2.1b
### Community 2.1 to 2.4

This pathway is a result of time without disturbances such as fire, drought, or disease which will allow for the gradual infilling of singleleaf pinyon and Utah juniper.

### Pathway 2.2a
### Community 2.2 to 2.3

This pathway is a result of time without disturbances such as fire, drought, or disease which will allow for the gradual maturation of the singleleaf pinyon and Utah Juniper component. Wyoming big sagebrush reestablishes. Excessive herbivory may also reduce perennial grass understory.

### Pathway 2.3b
### Community 2.3 to 2.2

This pathway is a result of fire which reduces or eliminates tree canopy, allowing perennial grasses to dominate the site.

### Pathway 2.3a
### Community 2.3 to 2.4

This pathway is a result of time without disturbances such as fire, drought, or disease which will allow for the gradual maturation of singleleaf pinyon and Utah juniper. Infilling by younger trees continues.

### Pathway 2.4a
### Community 2.4 to 2.1

This pathway is a result of low intensity fire, insect infestation, or disease which 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 Wyoming big sagebrush and perennial bunchgrass community increases in density and vigor. Annual non-natives present in trace amounts.

### Pathway 2.4b
### Community 2.4 to 2.2

This pathway is a result of a high-severity crown fire which 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.

## State 3
## Infilled Tree State

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 3.1

### Community 3.2

### Pathway 3.1a
### Community 3.1 to 3.2

This pathway is a result of time without disturbances such as fire, drought, or disease which will allow for the gradual maturation of singleleaf pinyon and Utah juniper. Infilling by younger trees continues.

## State 4
## Annual State

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 which 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 4.1

### Transition T1A
### State 1 to 2

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.

### Transition T1B
### State 1 to 3

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.

### Transition T2A
### State 2 to 3

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.

### Transition T2B
### State 2 to 4

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.

### Restoration pathway R3A
### State 3 to 2

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

### Transition T3A
### State 3 to 4

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.

## Additional community tables

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

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Primary Perennial Grasses** | | | 39–73 | |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 8–15 | – |
| | desert needlegrass | ACSP12 | *Achnatherum speciosum* | 8–15 | – |
| | Thurber's needlegrass | ACTH7 | *Achnatherum thurberianum* | 8–15 | – |
| | Webber needlegrass | ACWE3 | *Achnatherum webberi* | 8–15 | – |
| | bluegrass | POA | *Poa* | 8–15 | – |
| 2 | **Secondary Perennial Grasses** | | | 2–16 | |
| | squirreltail | ELEL5 | *Elymus elymoides* | 1–8 | – |
| | needle and thread | HECO26 | *Hesperostipa comata* | 1–8 | – |
| **Forb** | | | | | |
| 3 | **Perennial** | | | 2–16 | |
| | milkvetch | ASTRA | *Astragalus* | 1–8 | – |
| | phlox | PHLOX | *Phlox* | 1–8 | – |
| **Shrub/Vine** | | | | | |
| 4 | **Primary Shrubs** | | | 34–81 | |
| | little sagebrush | ARAR8 | *Artemisia arbuscula* | 17–40 | – |
| | antelope bitterbrush | PUTR2 | *Purshia tridentata* | 17–40 | – |
| 5 | **Secondary Shrubs** | | | 1–8 | |
| | mormon tea | EPVI | *Ephedra viridis* | 1–8 | – |
| **Tree** | | | | | |
| 6 | **Evergreen** | | | 9–22 | |
| | singleleaf pinyon | PIMO | *Pinus monophylla* | 8–15 | – |
| | Utah juniper | JUOS | *Juniperus osteosperma* | 1–8 | – |

**Table 7. Community 1.1 forest overstory composition**

| Common Name | Symbol | Scientific Name | Nativity | Height (M) | Canopy Cover (%) | Diameter (Cm) | Basal Area (Square M/Hectare) |
|---|---|---|---|---|---|---|---|
| **Tree** | | | | | | | |
| singleleaf pinyon | PIMO | *Pinus monophylla* | Native | – | 50–85 | – | – |
| Utah juniper | JUOS | *Juniperus osteosperma* | Native | – | 15–50 | – | – |

## Animal community

Livestock Interpretations:
This site is suited to cattle and sheep grazing where terrain permits. Grazing management should be keyed to perennial grass production. Thurber's needlegrass provides palatable, nutritious feed during the late spring and early summer. New plants of this grass 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.

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 during the summer, fall and winter. Pinyon trees provide shelter from winter storms. Mule deer utilize and sometimes prefer low sagebrush, particularly in winter and early spring. Sites where water is available offer good quail habitat and are visited seasonally by mourning dove. It is also used by various songbirds, rodents, reptiles and associated predators natural to area. 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. Thurber's needlegrass is an important forage for several wildlife species.

## Hydrological functions

Runoff is very high and permeability is very slow to moderately slow.

## Recreational uses

Surface rock 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.

Utah juniper wood is very durable. Its primary uses have been for posts and fuelwood. It probably has considerable potential in the charcoal industry and in wood fiber products.

PRODUCTIVE CAPACITY
Very low-quality site for tree production. Site index ranges from about 20 to 35 (Howell,1940). Productivity Class: 0.1 to 0.20
CMAI*: ghyu1 to 0.19 cubic meters per hectare per year.
*CMAI: is the culmination of mean annual increment highest average growth rate of the stand in the units specified.

Fuelwood Production: 1 to 4 cords per acre for stands averaging 5 inches (12.7 centimeter) in diameter at 1 foot (30.5 centimeter) height. Approximately 289,000 gross British Thermal Units (BTUs) heat content exist per cubic foot of singleleaf pinyon wood and about 274,000 BTUs per cubic foot of Utah juniper wood. 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 mixed pinyon and juniper.

Posts (7 foot): 8 to 15 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
Silvicultural treatments are not reasonably applied on this site due to poor site quality and severe limitations for equipment and tree harvest.

## Other products

The pitch of singleleaf pinyon is used by Native Americans as an 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. Indian ricegrass has been traditionally eaten by some Native Americans. The Paiutes use the seed as a reserve food source.

## Other information

Low sagebrush can be successfully transplanted or seeded in restoration. Antelope bitterbrush has been used extensively in land reclamation. Antelope bitterbrush enhances succession by retaining soil and depositing organic material and in some habitats and with some ecotypes, by fixing nitrogen.

**Table 8. 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* | 20 | 35 | 1 | 3 | – | – | – | |
| singleleaf pinyon | *PIMO* | 20 | 35 | 0 | 0 | – | – | – | |

## Inventory data references

NASIS data for soil survey area NV774.

## Type locality

| Location 1: Mineral County, NV | |
|---|---|
| Township/Range/Section | T2N R32E S26 |

| | |
|---|---|
| UTM zone | N |
| UTM northing | 378672 |
| UTM easting | 4206756 |
| Latitude | 38° 0′ 1″ |
| Longitude | 118° 22′ 54″ |
| General legal description | About 4 miles northeast of Montgomery Pass, White Mountains, Mineral County, Nevada. This site also occurs in Storey and Washoe County, Nevada. |

## References


. Fire Effects Information System. http://www.fs.fed.us/database/feis/.

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..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Howell, J. 1940. Pinyon and juniper: a preliminary study of volume, growth, and yield. Regional Bulletin 71. Albuquerque, NM: USDA, SCS; 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. 2000 National forestry manual - Part 537. Washington, D.C.

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


## 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 | 05/13/2025 |

| | |
|---|---|
| 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:

---

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

---

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

---

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

---

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

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17. **Perennial plant reproductive capability:**

---