USDA Natural Resources Conservation Service

# Ecological site R034BY322UT
# Upland Shallow Loam (Two-Needle Pinyon / Utah Juniper)

Last updated: 3/05/2022
Accessed: 05/18/2024

## General information

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

## MLRA notes

Major Land Resource Area (MLRA): 034B–Warm Central Desertic Basins and Plateaus

MLRA 34B occurs in is in Utah (70 percent) and Colorado (30 percent). It makes up about 12,850 square miles (33,290 square kilometers). A small part of the area is in the High Plateaus of Utah Section of the Colorado Plateaus Province of the Intermontane Plateaus. The northern part of the MLRA occurs in the Uinta Basin Section, which is bounded by the Uinta Mountains to the north, the Wasatch Range to the west, the Roan Plateau to the south, and the Rabbit Hills to the east. The southern part of the MLRA occurs in the northern third of the Canyon Lands Section. This section is bounded by the Roan Plateau to the north, the Wasatch Plateau to the west, the southern end of the San Rafael Swell to the south, and the western slope of the Rocky Mountains to the east. Elevation ranges from 4,100 feet (1,250 meters) near Green River, Utah, to 7,500 feet (2,285 meters) at the base of the Wasatch Range and the Roan Plateau.

Most of this area is covered by residual basin-floor materials and materials washed in from the surrounding mountains and plateaus. Shale and sandstone are the dominant rock types. The Tertiary-age Green River, Uinta, and Duchesne Formations dominate the northern part of the MLRA. The southern part is dominated by Cretaceous-age materials with lesser amounts of Jurassic and Triassic materials. The dominant Cretaceous formations are Mancos Shale, Dakota Sandstone, and the members of the Mesa Verde Group. The dominant Jurassic formations are the Morrison, Entrada, and Navajo. The dominant Triassic formations are the Chinle and Moenkopi. Quaternary alluvial, eolian, and glacial deposits occur in both parts of the MLRA.

The average annual precipitation in most of this area ranges from 6 to 10 inches (150 to 255 millimeters). A small part of this area receives as much as 24 inches of annual precipitation.
Much of the precipitation occurs as high-intensity, convective thunderstorms during the period July through September. May and June are usually the drier months. Precipitation is more evenly distributed throughout the year in the northern part of the MLRA than in the southern part, where there is a significant peak in late summer. The northern part of the MLRA receives more precipitation as snow during winter than the southern part. The average annual temperature ranges from 41 to 54 degrees F (5 to 12 degrees C). The freeze-free period averages 170 days and ranges from 110 to 235 days.

The dominant soil orders in this MLRA are Aridisols and Entisols. Mollisols occur at the higher elevations, particularly in the northern part of the MLRA. The dominant soil temperature regime is mesic, and the dominant soil moisture regime is aridic. The soils receiving less than 8 inches (205 millimeters) of precipitation annually have an aridic soil moisture regime. The soils receiving 8 to 12 inches (205 to 305 millimeters) have an aridic soil moisture regime that borders on ustic. The soils receiving 12 to 16 inches (305 to 405 millimeters) generally have an ustic soil moisture regime that borders on aridic. The dominant soil mineralogy is mixed and soils are formed in slope alluvium or residuum derived from shale or sandstone. Many of the soils are shallow or moderately deep to shale or sandstone bedrock. The soils at the lower elevations generally have significant amounts of calcium carbonate, salts, and gypsum.

## Ecological site concept

The soils of this site formed mostly in slope alluvium and colluvium over residuum derived from sandstone and shale. Surface soils are stony sandy loam, channery loam, sandy loam, to very channery silt loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but make up less than 50 percent of the soil volume. These soils are shallow and occasionally moderately deep, well-drained, and have moderate to moderately rapid permeability. pH is slightly to strongly alkaline.. Available water-holding capacity ranges from 1 to 2.5 inches of water in the upper 40 inches of soil. The soil moisture regime is mostly aridic ustic and the soil temperature regime is mesic. Precipitation ranges from 12-16 inches annually.

## Associated sites

| | |
|---|---|
| F048AY330UT | **Upland Shallow Stony Loam (Two-Needle Pinyon /Douglas Fir)** |
| R048AY366UT | **Upland Very Steep Loam (Salina Wildrye)** |
| R048AY443UT | **Mountain Shallow Loam (Mixed Conifer)** |

## Similar sites

| | |
|---|---|
| F048AY330UT | **Upland Shallow Stony Loam (Two-Needle Pinyon /Douglas Fir)** |

**Table 1. Dominant plant species**

| | |
|---|---|
| Tree | (1) *Pinus edulis*<br>(2) *Juniperus osteosperma* |
| Shrub | (1) *Cercocarpus montanus*<br>(2) *Artemisia nova* |
| Herbaceous | (1) *Achnatherum hymenoides*<br>(2) *Leymus salinus* |

## Physiographic features

This ecological site typically occurs on hillslopes, structural benches, and on escarpments. Site are generally found on southerly facing slopes and are associated with rock outcroppings. Slope steepness, aspect and elevation influence the vegetative floristics of this ecological site. Sites are located located between 6,200 to 7,800 feet in elevation. Slopes normally range from 5 to 65 percent but may ccasionally be steeper.

**Table 2. Representative physiographic features**

| | |
|---|---|
| Landforms | (1) Hill<br>(2) Escarpment<br>(3) Structural bench |
| Flooding frequency | None |
| Ponding frequency | None |
| Elevation | 1,890–2,377 m |
| Slope | 5–65% |
| Water table depth | 0 cm |
| Aspect | SE, S, SW |

## Climatic features

The climate of this site is dry subhumid and semiarid. It is characterized by cold, snowy winters and warm, dry summers. The average annual precipitation ranges from 12 to 16 inches. July, August, and October are typically the wettest months with June being the driest. The most reliable sources of moisture for plant growth are the snow that accumulates over the winter and spring rains. Summer thunderstorms are intermittent and sporadic in nature, and

thus, are not reliable sources of moisture to support vegetative growth on this site. The mean annual air temperature ranges from 45 to 49 degrees and averages 44 degrees.

**Table 3. Representative climatic features**

| | |
|---|---|
| Frost-free period (average) | 116 days |
| Freeze-free period (average) | 142 days |
| Precipitation total (average) | 406 mm |

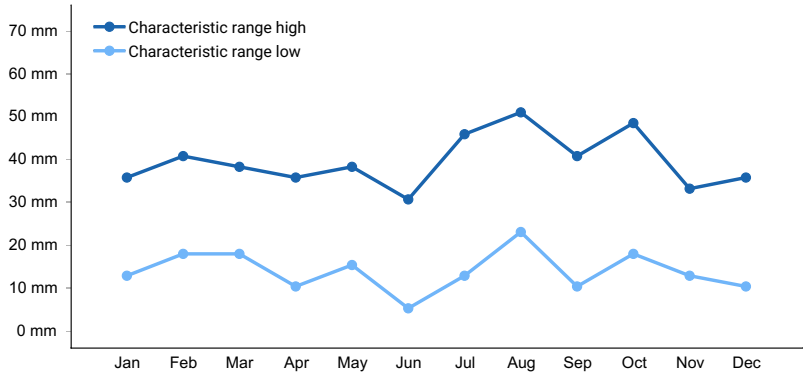



**Figure 1. Monthly precipitation range**

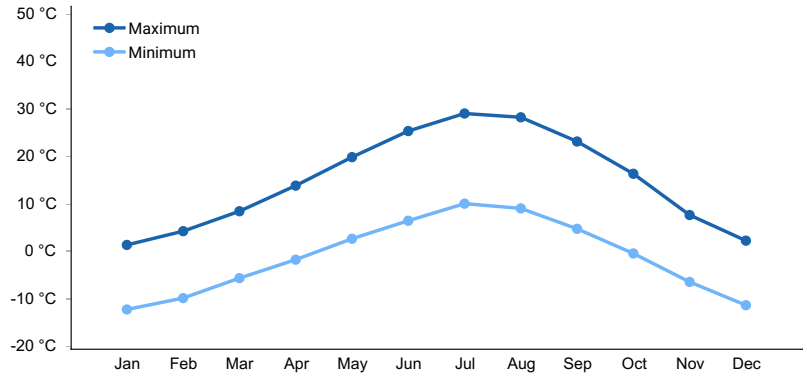



**Figure 2. Monthly average minimum and maximum temperature**

## Influencing water features

There are no influencing water features on this site.

## Soil features

The soils of this site formed mostly in slope alluvium and colluvium over residuum derived from sandstone and shale. Surface soils are stony sandy loam, channery loam, sandy loam, to very channery silt loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but make up less than 50 percent of the soil volume. These soils are shallow and occasionally moderately deep over lithic bedrock, well-drained, and have moderate to moderately rapid permeability. pH is slightly to strongly alkaline.. Available water-holding capacity ranges from 1 to 2.5 inches of water in the upper 40 inches of soil. The soil moisture regime is mostly aridic ustic and the soil temperature regime is mesic. Precipitation ranges from 12-16 inches annually.

This site has been used in the following soils surveys and has been correlated to the following components:

UT013—Duchesne: Sterg; Thudie.
UT653-Uintah and Ouray Indian Reservation: Sterg; Thudie.

Typical Soil Profile: (Thudie).
Oi—0-3 inches; Needles and twigs.

A—3-10 inches; gravelly sandy loam; disseminated calconates; moderately alkaline.
C-15-18 inches; gravelly sandy loam; disseminated calconates; moderately alkaline.
R—18 inches; unweathered sandstone bedrock.

**Table 4. Representative soil features**

| | |
|---|---|
| Parent material | (1) Slope alluvium–sandstone and shale<br>(2) Colluvium–sandstone and shale<br>(3) Residuum–sandstone and shale |
| Surface texture | (1) Stony sandy loam<br>(2) Channery loam<br>(3) Very channery silt loam |
| Family particle size | (1) Loamy<br>(2) Loamy-skeletal |
| Drainage class | Well drained |
| Permeability class | Slow to moderate |
| Depth to restrictive layer | 15–102 cm |
| Soil depth | 15–102 cm |
| Surface fragment cover <=3" | 0–37% |
| Surface fragment cover >3" | 0–15% |
| Available water capacity (Depth not specified) | 2.54–6.35 cm |
| Calcium carbonate equivalent (Depth not specified) | 1–20% |
| Electrical conductivity (Depth not specified) | 0–2 mmhos/cm |
| Sodium adsorption ratio (Depth not specified) | 0–5 |
| Soil reaction (1:1 water) (Depth not specified) | 7.9–9 |
| Subsurface fragment volume <=3" (Depth not specified) | 0–46% |
| Subsurface fragment volume >3" (Depth not specified) | 0–15% |

## Ecological dynamics

This site developed under the Uintah Basin Section of the Southern Rocky Mountain Provence ecological conditions and the natural influences of herbivory, fire and climate. Species composition is generally dominated by an overstory canopy of two-needle pinyon and Utah juniper. Alderleaf mountain mahogany and black sage are common shrub species. Perennial herbaceous species occurrence is directly related to canopy density with Indian ricegrass, Salina wildrye and geyer sedge found most often. This site is the dryer, warmer counterpart of the 048AY322UT site. It is generally found at lower elevations and on warmer south and west slopes than 048AY322UT. Site is mostly found on southerly facing slopes and is usually mixed with rock outcroppings.

Evidence indicates that this site historically maintained a fairly long burn cycle (100 years or more). Very old two-needle pinyon and Utah juniper are common on most undisturbed sites. Over time, their canopies increase in density, reducing understory vegetation dramatically. Following stand removing fire, the understory vegetation flourishes, but over time is again reduced.

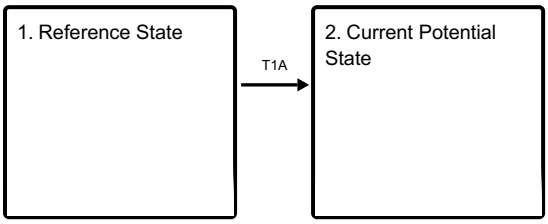
Severe drought and insect damage can affect two-needle pinyon in some locations, causing it die out, often allowing Utah juniper to increase. This event can also allow for an increase in shrubs and herbaceous species during periods when wetter years return.

As vegetative communities respond to changes caused by natural or man-made events that cause them to cross ecological thresholds, a return to previous states may not be possible. The amount of effort needed to affect desired vegetative shifts depends on a sites present biotic and abiotic features and the desired results.

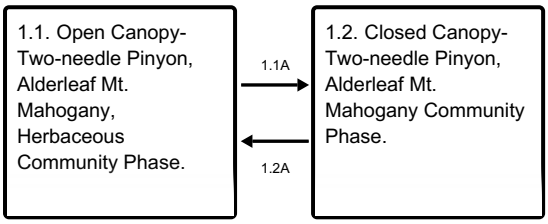
The following State and Transition diagram depicts the most common plant communities found on this ecological site. It does not necessarily depict all the plant communities that can occur, but does show the most prevalent and repeatable. As more data are collected, some of these plant communities may be revised or removed, and new ones added. These descriptions capture the current knowledge and experience at the time of this revision.

## State and transition model

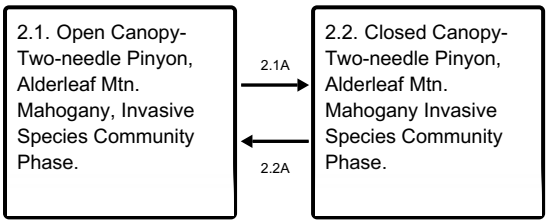
**Ecosystem states**




**State 1 submodel, plant communities**




**State 2 submodel, plant communities**




## State 1
## Reference State

This state describes the biotic communities that may become established on this ecological site if all successional sequences are completed under natural disturbance conditions. The reference state is generally dominated by an overstory canopy of two-needle pinyon with lesser amounts of Utah juniper. Alderleaf mountain mahogany and Black sagebrush are the dominate shrubs. Indian ricegrass and Salina wildrye are the most common grasses. Other native grasses, forbs, and shrubs may produce significant composition in the plant community. The primary disturbance mechanisms are overstory canopy density, weather fluctuation, and fire. The reference state is self-sustaining and resistant to change due to a high resistance to natural disturbances and a high resilience following those disturbances. When natural disturbances occur, the rate of recovery can be quite variable. Typically in the reference state, this ecological site will fluctuate between community phases 1.1 and 1.2. Reference State: Plant communities influenced by canopy density, long term weather fluctuations, and periodic fire. Indicators: A community dominated by two-needle pinyon, Utah juniper and alderleaf mountain mahogany. The density of the overstory canopy determines the amount and composition of the other native perennial grasses and forbs that may be present. Feedbacks: Natural fluctuations in weather patterns that allow for a self-sustaining two-needle pinyon, Utah juniper, alderleaf mountain mahogany and native grass community. Insect herbivory, more frequent fires, or other disturbances that may allow for the establishment of invasive species. At-risk Community Phase: All communities are at risk when native plants are stressed and nutrients become available for invasive plants to establish. Trigger: The establishment of invasive plant species.

## Community 1.1
## Open Canopy-Two-needle Pinyon, Alderleaf Mt. Mahogany, Herbaceous Community Phase.

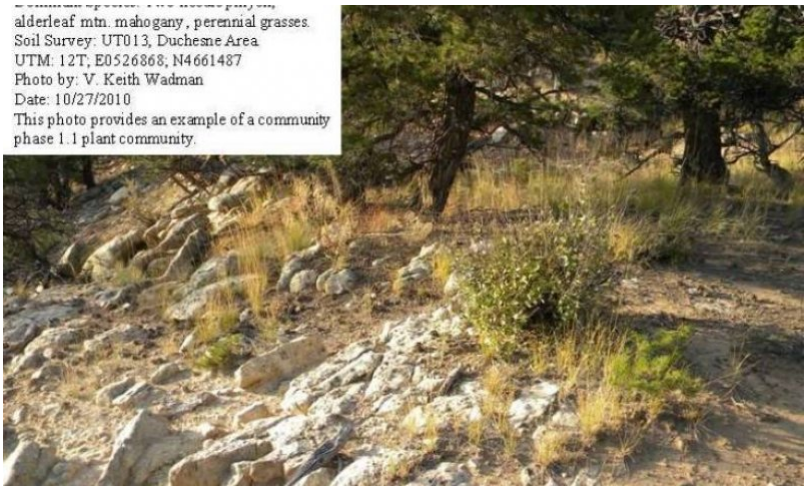



**Figure 3. Community Phase 1.1**

This community phase is characterized by an open canopy of two-needle pinyon and Utah juniper. Alderleaf mountain mahogany and black sage are the most common understory shrubs. Commonly occurring grasses and grasslikes include Indian ricegrass, Salina wildrye and Geyer sedge. Other perennial grasses, shrubs, and forbs are also often present. Air dry composition of this site is approximately 10 percent forbs, 25 percent grasses, and 65 percent shrubs and trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (0-20%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example the typical vegetative floristics of a community phase 1.1 plant community.

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

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Tree | 112 | 196 | 247 |
| Grass/Grasslike | 67 | 112 | 135 |
| Shrub/Vine | 56 | 84 | 112 |
| Forb | 45 | 56 | 67 |
| **Total** | **280** | **448** | **561** |

**Table 6. Ground cover**

| | |
|---|---|
| Tree foliar cover | 20-30% |
| Shrub/vine/liana foliar cover | 20-25% |
| Grass/grasslike foliar cover | 20-25% |
| Forb foliar cover | 10-15% |
| Non-vascular plants | 0% |
| Biological crusts | 0% |
| Litter | 2-5% |
| Surface fragments >0.25" and <=3" | 0% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 30-50% |

## Community 1.2
## Closed Canopy-Two-needle Pinyon, Alderleaf Mt. Mahogany Community Phase.

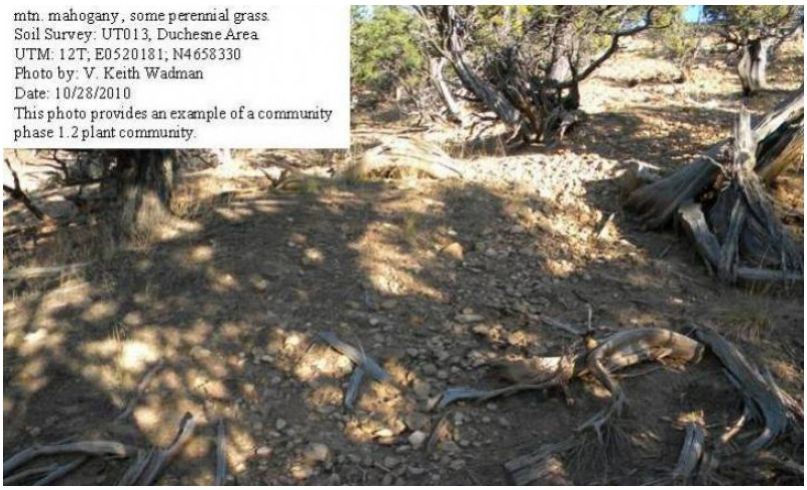



**Figure 5. Community Phase 1.2**

This community phase is characterized by a dense canopy of two-needle pinyon and Utah juniper. Alderleaf mountain mahogany and black sage, where present, are the most common understory shrubs. Herbaceous vegetation is significantly reduced because of shading by the overstory canopy. Where herbaceous species do remain, Indian ricegrass, Salina wildrye and Geyer sedge are found most often. Other perennial grasses, shrubs, and forbs may also occasionally be present. Air dry composition of this site is approximately 5 percent forbs, 10 percent grasses, and 85 percent shrubs and trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (0-20%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example the typical vegetative floristics of a community phase 1.2 plant community.

**Table 7. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Tree | 179 | 303 | 370 |
| Shrub/Vine | 45 | 67 | 90 |
| Forb | 34 | 45 | 56 |
| Grass/Grasslike | 22 | 34 | 45 |
| **Total** | **280** | **449** | **561** |

**Table 8. Ground cover**

| | |
|---|---|
| Tree foliar cover | 40-60% |
| Shrub/vine/liana foliar cover | 5-15% |
| Grass/grasslike foliar cover | 5-10% |
| Forb foliar cover | 5-10% |
| Non-vascular plants | 0% |
| Biological crusts | 0% |
| Litter | 2-5% |
| Surface fragments >0.25" and <=3" | 0% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |

| | |
|---|---|
| Bare ground | 30-50% |

### Pathway 1.1A
### Community 1.1 to 1.2

**Open Canopy-Two-needle Pinyon, Alderleaf Mt. Mahogany, Herbaceous Community Phase.**

**Closed Canopy-Two-needle Pinyon, Alderleaf Mt. Mahogany Community Phase.**

This community pathway occurs when long-term drought and/or extended periods without fire allows canopies of two-needle pinyon and Utah juniper to significantly increase. This closed canopy causes understory vegetation to be reduced or nearly eliminated from the site. Drought alone can also reduce native perennial grass production and eventually eliminate them from the system.

### Pathway 1.2A
### Community 1.2 to 1.1

**Closed Canopy-Two-needle Pinyon, Alderleaf Mt. Mahogany Community Phase.**

**Open Canopy-Two-needle Pinyon, Alderleaf Mt. Mahogany, Herbaceous Community Phase.**

This community pathway occurs when weather patterns return to within normal ranges and fire reduces two-needle pinyon and Utah juniper, significantly opening the sites canopy. Insect damage on two-needle pinyon can also cause it to be reduced on this site. This more open canopy allows understory vegetation to increase and under some circumstances, flourish on the site.

## State 2
## Current Potential State

The current potential state is similar to the reference state, however invasive species are now present in all community phases. This state is generally dominated by two-needle pinyon, with lesser amounts of Utah juniper present. Alderleaf mountain mahogany and black sage are the most common shrubs. Depending on the sites disturbance history, native perennial grasses, forbs, or other shrubs may be common in the sites understory. Primary disturbance mechanisms are thought to include long-term weather fluctuations, insect herbivory, improper livestock grazing, fire interval and surface disturbances such as road and pipeline development and off road vehicle (OHV) use. Few disturbed sites have been located to date and so little data exists regarding them. The current potential state is still self sustaining but has less resistance to change due to lower resistance to disturbances and lower resilience following disturbances. This state will typically fluctuate between community phases 2.1 and 2.2. Current Potential State: Plant communities influenced by livestock grazing, wildlife browsing, insect herbivory, weather fluctuations, fire periods and surface disturbances. Indicators: A community dominated by two-needle pinyon and alderleaf mountain mahogany where other shrubs and native perennial grasses and forbs may also be present. Invasive grasses and forbs are present. Feedbacks: Natural fluctuations in weather that allow for a self sustaining two-needle pinyon, alderleaf mountain mahogany and grass community.

### Community 2.1
### Open Canopy-Two-needle Pinyon, Alderleaf Mtn. Mahogany, Invasive Species Community Phase.

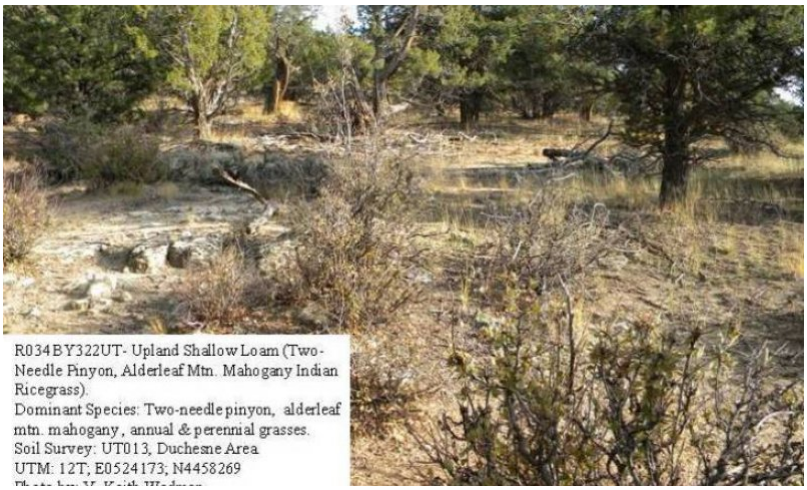



**Figure 7. Community Phase 2.1**

This community phase is characterized by an open canopy of two-needle pinyon and Utah juniper. Alderleaf mountain mahogany and black sage are the most common understory shrubs. Commonly occurring grasses and grasslikes include Cheatgrass, Indian ricegrass, Salina wildrye and Geyer sedge. Other annual and perennial grasses and forbs and various other shrubs are also present. Air dry composition of this site is approximately 5 percent forbs, 25 percent grasses, and 70 percent shrubs and trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (0-20%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example the typical vegetative floristics of a community phase 2.1 plant community.

**Table 9. Annual production by plant type**

| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Tree | 112 | 196 | 247 |
| Grass/Grasslike | 67 | 112 | 135 |
| Shrub/Vine | 56 | 84 | 112 |
| Forb | 45 | 56 | 67 |
| **Total** | **280** | **448** | **561** |

**Table 10. Ground cover**

| | |
|---|---|
| Tree foliar cover | 20-30% |
| Shrub/vine/liana foliar cover | 20-25% |
| Grass/grasslike foliar cover | 20-25% |
| Forb foliar cover | 10-15% |
| Non-vascular plants | 0% |
| Biological crusts | 0% |
| Litter | 2-5% |
| Surface fragments >0.25" and <=3" | 0% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |
| Water | 0% |
| Bare ground | 30-50% |

## Community 2.2
## Closed Canopy-Two-needle Pinyon, Alderleaf Mtn. Mahogany Invasive Species Community Phase.

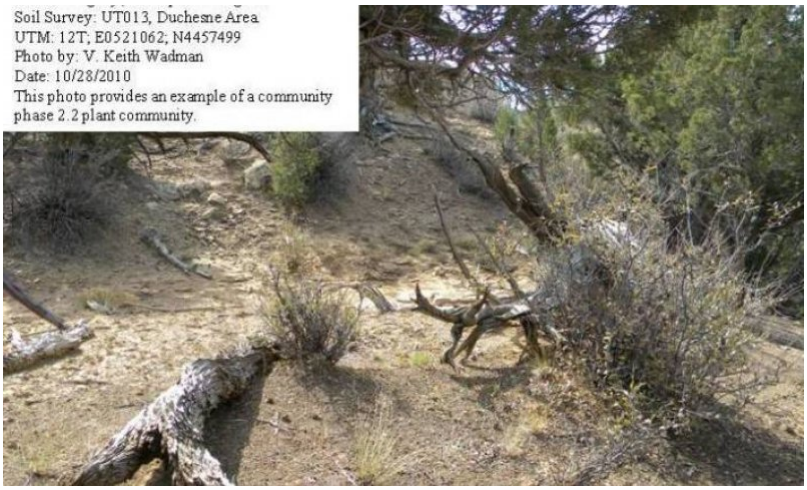



**Figure 9. Community Phase 2.2**

This community phase is characterized by a dense canopy of two-needle pinyon and Utah juniper. Alderleaf mountain mahogany and black sage, where present, are the most common understory shrubs. Herbaceous vegetation is significantly reduced because of shading by the overstory canopy. Where herbaceous species do remain, cheatgrass, Indian ricegrass, Salina wildrye and Geyer sedge are found most often. Other perennial grasses, shrubs, and forbs may also occasionally be present. Air dry composition of this site is approximately 5 percent forbs, 5 percent grasses, and 90 percent shrubs and trees. Bare ground is variable (2-50%) depending on biological crust cover, which is also variable (1-25%) and surface rock fragments (0-20%). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example the typical vegetative floristics of a community phase 2.2 plant community.

**Table 11. Annual production by plant type**

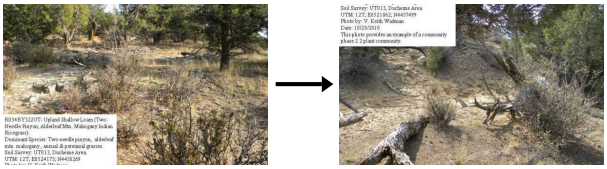
| Plant Type | Low (Kg/Hectare) | Representative Value (Kg/Hectare) | High (Kg/Hectare) |
|---|---|---|---|
| Tree | 179 | 303 | 370 |
| Shrub/Vine | 45 | 67 | 90 |
| Forb | 34 | 45 | 56 |
| Grass/Grasslike | 22 | 34 | 45 |
| **Total** | **280** | **449** | **561** |

**Table 12. Ground cover**

| | |
|---|---|
| Tree foliar cover | 40-60% |
| Shrub/vine/liana foliar cover | 5-15% |
| Grass/grasslike foliar cover | 5-10% |
| Forb foliar cover | 5-10% |
| Non-vascular plants | 0% |
| Biological crusts | 0% |
| Litter | 2-5% |
| Surface fragments >0.25" and <=3" | 0% |
| Surface fragments >3" | 0% |
| Bedrock | 0% |

| | |
|---|---|
| Water | 0% |
| Bare ground | 30-50% |

### Pathway 2.1A
### Community 2.1 to 2.2



**Open Canopy-Two-needle Pinyon, Alderleaf Mtn. Mahogany, Invasive Species Community Phase.**

**Closed Canopy-Two-needle Pinyon, Alderleaf Mtn. Mahogany Invasive Species Community Phase.**

This community pathway occurs when long-term drought and/or extended periods without fire allows canopies of two-needle pinyon and Utah juniper to significantly increase. This closed canopy causes understory vegetation to be reduced or nearly eliminated from the site. Drought and/or improper livestock alone can also reduce native perennial grass production and eventually eliminate them from the system.

### Pathway 2.2A
### Community 2.2 to 2.1

**Closed Canopy-Two-needle Pinyon, Alderleaf Mtn. Mahogany Invasive Species Community Phase.**

**Open Canopy-Two-needle Pinyon, Alderleaf Mtn. Mahogany, Invasive Species Community Phase.**

This community pathway occurs when weather patterns return to within normal ranges and fire reduces two-needle pinyon and Utah juniper, significantly opening the sites canopy. Insect damage on two-needle pinyon can also cause it to be reduced on this site. This more open canopy allows understory vegetation to increase and under some circumstances, flourish on the site.

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

This transitional pathway occurs when improper livestock grazing causes the perennial herbaceous community to become significantly reduced allowing non-native species such as cheatgrass, russian thistle and other invasive weeds to become established. Broom snakeweed may also increase during this time. Once invasive species occupy the site, a threshold has been crossed. Cheatgrass has been known to become established in healthy communities on this site, however.

## Additional community tables

**Table 13. Community 1.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Dominant Grasses** | | | 56–112 | |
| | saline wildrye | LESA4 | *Leymus salinus* | 34–67 | – |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 34–67 | – |
| | Geyer's sedge | CAGE2 | *Carex geyeri* | 22–45 | – |
| 2 | **Sub-Dominant Grasses** | | | 34–67 | |

| | | | | | |
|---|---|---|---|---|---|
| | Letterman's needlegrass | ACLE9 | *Achnatherum lettermanii* | 11–22 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 11–22 | – |
| | squirreltail | ELEL5 | *Elymus elymoides* | 11–22 | – |
| | James' galleta | PLJA | *Pleuraphis jamesii* | 11–22 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 11–22 | – |
| | bluebunch wheatgrass | PSSP6 | *Pseudoroegneria spicata* | 11–22 | – |
| **Forb** | | | | | |
| 3 | **Forbs** | | | 67–101 | |
| | low pussytoes | ANDI2 | *Antennaria dimorpha* | 11–22 | – |
| | Holboell's rockcress | ARHO2 | *Arabis holboellii* | 11–22 | – |
| | woollypod milkvetch | ASPU9 | *Astragalus purshii* | 11–22 | – |
| | aridland goosefoot | CHDE | *Chenopodium desiccatum* | 11–22 | – |
| | narrowstem cryptantha | CRGR3 | *Cryptantha gracilis* | 11–22 | – |
| | roundspike cryptantha | CRHU2 | *Cryptantha humilis* | 11–22 | – |
| | sulphur-flower buckwheat | ERUM | *Eriogonum umbellatum* | 11–22 | – |
| | scarlet gilia | IPAG | *Ipomopsis aggregata* | 11–22 | – |
| | hoary tansyaster | MACA2 | *Machaeranthera canescens* | 11–22 | – |
| | rock goldenrod | PEPU7 | *Petradoria pumila* | 11–22 | – |
| | Whipple's penstemon | PEWH | *Penstemon whippleanus* | 11–22 | – |
| | spiny phlox | PHHO | *Phlox hoodii* | 11–22 | – |
| | longleaf phlox | PHLO2 | *Phlox longifolia* | 11–22 | – |
| | basindaisy | PLIN7 | *Platyschkuhria integrifolia* | 11–22 | – |
| | woolly plantain | PLPA2 | *Plantago patagonica* | 11–22 | – |
| | stemless mock goldenweed | STAC | *Stenotus acaulis* | 11–22 | – |
| | longstalk clover | TRLO | *Trifolium longipes* | 11–22 | – |
| | American vetch | VIAM | *Vicia americana* | 11–22 | – |
| **Shrub/Vine** | | | | | |
| 4 | **Dominant Shrubs** | | | 90–135 | |
| | alderleaf mountain mahogany | CEMO2 | *Cercocarpus montanus* | 45–90 | – |
| | black sagebrush | ARNO4 | *Artemisia nova* | 34–67 | – |
| 5 | **Sub-Dominant Shrubs** | | | 45–90 | |
| | antelope bitterbrush | PUTR2 | *Purshia tridentata* | 22–34 | – |
| | blue elderberry | SANIC5 | *Sambucus nigra ssp. cerulea* | 11–22 | – |
| | narrowleaf yucca | YUAN2 | *Yucca angustissima* | 11–22 | – |
| | yellow rabbitbrush | CHVI8 | *Chrysothamnus viscidiflorus* | 11–22 | – |
| | mormon tea | EPVI | *Ephedra viridis* | 11–22 | – |
| | bastardsage | ERWR | *Eriogonum wrightii* | 11–22 | – |
| | spiny hopsage | GRSP | *Grayia spinosa* | 11–22 | – |
| | broom snakeweed | GUSA2 | *Gutierrezia sarothrae* | 11–22 | – |
| | Mexican cliffrose | PUME | *Purshia mexicana* | 11–22 | – |
| **Tree** | | | | | |
| 6 | **Dominant Trees** | | | 90–179 | |
| | twoneedle pinyon | PIED | *Pinus edulis* | 84–168 | – |

| | | | | | |
|---|---|---|---|---|---|
| | Utah juniper | JUOS | *Juniperus osteosperma* | 28–56 | – |

**Table 14. Community 1.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Dominant Grasses** | | | 22–45 | |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 0–22 | – |
| | Geyer's sedge | CAGE2 | *Carex geyeri* | 0–22 | – |
| | saline wildrye | LESA4 | *Leymus salinus* | 0–22 | – |
| 2 | **Sub-Dominant Grasses** | | | 11–34 | |
| | Letterman's needlegrass | ACLE9 | *Achnatherum lettermanii* | 0–11 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 0–11 | – |
| | squirreltail | ELEL5 | *Elymus elymoides* | 0–11 | – |
| | James' galleta | PLJA | *Pleuraphis jamesii* | 0–11 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–11 | – |
| | bluebunch wheatgrass | PSSP6 | *Pseudoroegneria spicata* | 0–11 | – |
| **Forb** | | | | | |
| 3 | **Forbs** | | | 34–56 | |
| | low pussytoes | ANDI2 | *Antennaria dimorpha* | 6–11 | – |
| | Holboell's rockcress | ARHO2 | *Arabis holboellii* | 6–11 | – |
| | woollypod milkvetch | ASPU9 | *Astragalus purshii* | 6–11 | – |
| | aridland goosefoot | CHDE | *Chenopodium desiccatum* | 6–11 | – |
| | narrowstem cryptantha | CRGR3 | *Cryptantha gracilis* | 6–11 | – |
| | roundspike cryptantha | CRHU2 | *Cryptantha humilis* | 6–11 | – |
| | sulphur-flower buckwheat | ERUM | *Eriogonum umbellatum* | 6–11 | – |
| | scarlet gilia | IPAG | *Ipomopsis aggregata* | 6–11 | – |
| | hoary tansyaster | MACA2 | *Machaeranthera canescens* | 6–11 | – |
| | longstalk clover | TRLO | *Trifolium longipes* | 6–11 | – |
| | American vetch | VIAM | *Vicia americana* | 6–11 | – |
| | rock goldenrod | PEPU7 | *Petradoria pumila* | 6–11 | – |
| | Whipple's penstemon | PEWH | *Penstemon whippleanus* | 6–11 | – |
| | spiny phlox | PHHO | *Phlox hoodii* | 6–11 | – |
| | longleaf phlox | PHLO2 | *Phlox longifolia* | 6–11 | – |
| | basindaisy | PLIN7 | *Platyschkuhria integrifolia* | 6–11 | – |
| | woolly plantain | PLPA2 | *Plantago patagonica* | 6–11 | – |
| | stemless mock goldenweed | STAC | *Stenotus acaulis* | 6–11 | – |
| **Shrub/Vine** | | | | | |
| 4 | **Dominant Shrubs** | | | 90–135 | |
| | alderleaf mountain mahogany | CEMO2 | *Cercocarpus montanus* | 34–67 | – |
| | black sagebrush | ARNO4 | *Artemisia nova* | 22–34 | – |
| 5 | **Sub-Dominant Shrubs** | | | 22–45 | |
| | yellow rabbitbrush | CHVI8 | *Chrysothamnus viscidiflorus* | 6–11 | – |
| | mormon tea | EPVI | *Ephedra viridis* | 6–11 | |

| | | | | | |
|---|---|---|---|---|---|
| | mormon tea | EPVI | *Ephedra viridis* | 6–11 | – |
| | bastardsage | ERWR | *Eriogonum wrightii* | 6–11 | – |
| | spiny hopsage | GRSP | *Grayia spinosa* | 6–11 | – |
| | broom snakeweed | GUSA2 | *Gutierrezia sarothrae* | 6–11 | – |
| | Mexican cliffrose | PUME | *Purshia mexicana* | 6–11 | – |
| | antelope bitterbrush | PUTR2 | *Purshia tridentata* | 6–11 | – |
| | blue elderberry | SANIC5 | *Sambucus nigra ssp. cerulea* | 6–11 | – |
| | narrowleaf yucca | YUAN2 | *Yucca angustissima* | 6–11 | – |
| **Tree** | | | | | |
| 6 | **Dominant Trees** | | | 224–420 | |
| | twoneedle pinyon | PIED | *Pinus edulis* | 196–308 | – |
| | Utah juniper | JUOS | *Juniperus osteosperma* | 84–112 | – |

**Table 15. Community 2.1 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Dominant Grasses** | | | 56–112 | |
| | saline wildrye | LESA4 | *Leymus salinus* | 34–67 | – |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 34–67 | – |
| | Geyer's sedge | CAGE2 | *Carex geyeri* | 22–45 | – |
| 2 | **Sub-Dominant Grasses** | | | 67–112 | |
| | cheatgrass | BRTE | *Bromus tectorum* | 67–101 | – |
| | squirreltail | ELEL5 | *Elymus elymoides* | 11–22 | – |
| | James' galleta | PLJA | *Pleuraphis jamesii* | 11–22 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 11–22 | – |
| | bluebunch wheatgrass | PSSP6 | *Pseudoroegneria spicata* | 11–22 | – |
| | Letterman's needlegrass | ACLE9 | *Achnatherum lettermanii* | 11–22 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 11–22 | – |
| **Forb** | | | | | |
| 3 | **Forbs** | | | 67–101 | |
| | desert madwort | ALDE | *Alyssum desertorum* | 11–22 | – |
| | annual ragweed | AMAR2 | *Ambrosia artemisiifolia* | 11–22 | – |
| | low pussytoes | ANDI2 | *Antennaria dimorpha* | 11–22 | – |
| | Holboell's rockcress | ARHO2 | *Arabis holboellii* | 11–22 | – |
| | woollypod milkvetch | ASPU9 | *Astragalus purshii* | 11–22 | – |
| | aridland goosefoot | CHDE | *Chenopodium desiccatum* | 11–22 | – |
| | narrowstem cryptantha | CRGR3 | *Cryptantha gracilis* | 11–22 | – |
| | roundspike cryptantha | CRHU2 | *Cryptantha humilis* | 11–22 | – |
| | herb sophia | DESO2 | *Descurainia sophia* | 11–22 | – |
| | sulphur-flower buckwheat | ERUM | *Eriogonum umbellatum* | 11–22 | – |
| | scarlet gilia | IPAG | *Ipomopsis aggregata* | 11–22 | – |
| | hoary tansyaster | MACA2 | *Machaeranthera canescens* | 11–22 | – |
| | rock goldenrod | PEPU7 | *Petradoria pumila* | 11–22 | – |
| | Whipple's penstemon | PEWH | *Penstemon whippleanus* | 11–22 | – |

| | | | | | |
|---|---|---|---|---|---|
| | spiny phlox | PHHO | *Phlox hoodii* | 11–22 | – |
| | longleaf phlox | PHLO2 | *Phlox longifolia* | 11–22 | – |
| | basindaisy | PLIN7 | *Platyschkuhria integrifolia* | 11–22 | – |
| | woolly plantain | PLPA2 | *Plantago patagonica* | 11–22 | – |
| | longstalk clover | TRLO | *Trifolium longipes* | 11–22 | – |
| | American vetch | VIAM | *Vicia americana* | 11–22 | – |
| | Russian thistle | SAKA | *Salsola kali* | 11–22 | – |
| | tall tumblemustard | SIAL2 | *Sisymbrium altissimum* | 11–22 | – |
| | stemless mock goldenweed | STAC | *Stenotus acaulis* | 11–22 | – |
| **Shrub/Vine** | | | | | |
| 4 | **Dominant Shrubs** | | | 90–135 | |
| | alderleaf mountain mahogany | CEMO2 | *Cercocarpus montanus* | 56–90 | – |
| | black sagebrush | ARNO4 | *Artemisia nova* | 34–67 | – |
| 5 | **Sub-Dominant Shrubs** | | | 45–90 | |
| | rubber rabbitbrush | ERNA10 | *Ericameria nauseosa* | 22–45 | – |
| | broom snakeweed | GUSA2 | *Gutierrezia sarothrae* | 22–45 | – |
| | antelope bitterbrush | PUTR2 | *Purshia tridentata* | 22–34 | – |
| | blue elderberry | SANIC5 | *Sambucus nigra ssp. cerulea* | 11–22 | – |
| | narrowleaf yucca | YUAN2 | *Yucca angustissima* | 11–22 | – |
| | bastardsage | ERWR | *Eriogonum wrightii* | 11–22 | – |
| | spiny hopsage | GRSP | *Grayia spinosa* | 11–22 | – |
| | yellow rabbitbrush | CHVI8 | *Chrysothamnus viscidiflorus* | 11–22 | – |
| | mormon tea | EPVI | *Ephedra viridis* | 11–22 | – |
| | Mexican cliffrose | PUME | *Purshia mexicana* | 11–22 | – |
| **Tree** | | | | | |
| 6 | **Dominant Trees** | | | 90–179 | |
| | twoneedle pinyon | PIED | *Pinus edulis* | 84–168 | – |
| | Utah juniper | JUOS | *Juniperus osteosperma* | 28–56 | – |

**Table 16. Community 2.2 plant community composition**

| Group | Common Name | Symbol | Scientific Name | Annual Production (Kg/Hectare) | Foliar Cover (%) |
|---|---|---|---|---|---|
| **Grass/Grasslike** | | | | | |
| 1 | **Dominant Grasses** | | | 22–45 | |
| | Indian ricegrass | ACHY | *Achnatherum hymenoides* | 0–22 | – |
| | Geyer's sedge | CAGE2 | *Carex geyeri* | 0–22 | – |
| | saline wildrye | LESA4 | *Leymus salinus* | 0–22 | – |
| 2 | **Sub-Dominant Grasses** | | | 11–34 | |
| | cheatgrass | BRTE | *Bromus tectorum* | 11–22 | – |
| | squirreltail | ELEL5 | *Elymus elymoides* | 0–11 | – |
| | James' galleta | PLJA | *Pleuraphis jamesii* | 0–11 | – |
| | Sandberg bluegrass | POSE | *Poa secunda* | 0–11 | – |
| | bluebunch wheatgrass | PSSP6 | *Pseudoroegneria spicata* | 0–11 | – |

| | | | | | |
|---|---|---|---|---|---|
| | Letterman's needlegrass | ACLE9 | *Achnatherum lettermanii* | 0–11 | – |
| | blue grama | BOGR2 | *Bouteloua gracilis* | 0–11 | – |
| **Forb** | | | | | |
| 3 | **Forbs** | | | 34–56 | |
| | Russian thistle | SAKA | *Salsola kali* | 11–22 | – |
| | tall tumblemustard | SIAL2 | *Sisymbrium altissimum* | 6–11 | – |
| | stemless mock goldenweed | STAC | *Stenotus acaulis* | 6–11 | – |
| | longstalk clover | TRLO | *Trifolium longipes* | 6–11 | – |
| | American vetch | VIAM | *Vicia americana* | 6–11 | – |
| | desert madwort | ALDE | *Alyssum desertorum* | 6–11 | – |
| | low pussytoes | ANDI2 | *Antennaria dimorpha* | 6–11 | – |
| | clasping arnica | ARAM2 | *Arnica amplexicaulis* | 6–11 | – |
| | Holboell's rockcress | ARHO2 | *Arabis holboellii* | 6–11 | – |
| | woollypod milkvetch | ASPU9 | *Astragalus purshii* | 6–11 | – |
| | aridland goosefoot | CHDE | *Chenopodium desiccatum* | 6–11 | – |
| | narrowstem cryptantha | CRGR3 | *Cryptantha gracilis* | 6–11 | – |
| | roundspike cryptantha | CRHU2 | *Cryptantha humilis* | 6–11 | – |
| | herb sophia | DESO2 | *Descurainia sophia* | 6–11 | – |
| | sulphur-flower buckwheat | ERUM | *Eriogonum umbellatum* | 6–11 | – |
| | scarlet gilia | IPAG | *Ipomopsis aggregata* | 6–11 | – |
| | hoary tansyaster | MACA2 | *Machaeranthera canescens* | 6–11 | – |
| | rock goldenrod | PEPU7 | *Petradoria pumila* | 6–11 | – |
| | Whipple's penstemon | PEWH | *Penstemon whippleanus* | 6–11 | – |
| | spiny phlox | PHHO | *Phlox hoodii* | 6–11 | – |
| | longleaf phlox | PHLO2 | *Phlox longifolia* | 6–11 | – |
| | basindaisy | PLIN7 | *Platyschkuhria integrifolia* | 6–11 | – |
| | woolly plantain | PLPA2 | *Plantago patagonica* | 6–11 | – |
| **Shrub/Vine** | | | | | |
| 4 | **Dominant Shrubs** | | | 90–135 | |
| | alderleaf mountain mahogany | CEMO2 | *Cercocarpus montanus* | 34–67 | – |
| | black sagebrush | ARNO4 | *Artemisia nova* | 22–34 | – |
| 5 | **Sub-Dominant Shrubs** | | | 22–45 | |
| | yellow rabbitbrush | CHVI8 | *Chrysothamnus viscidiflorus* | 6–11 | – |
| | mormon tea | EPVI | *Ephedra viridis* | 6–11 | – |
| | rubber rabbitbrush | ERNA10 | *Ericameria nauseosa* | 6–11 | – |
| | bastardsage | ERWR | *Eriogonum wrightii* | 6–11 | – |
| | spiny hopsage | GRSP | *Grayia spinosa* | 6–11 | – |
| | broom snakeweed | GUSA2 | *Gutierrezia sarothrae* | 6–11 | – |
| | Mexican cliffrose | PUME | *Purshia mexicana* | 6–11 | – |
| | antelope bitterbrush | PUTR2 | *Purshia tridentata* | 6–11 | – |
| | blue elderberry | SANIC5 | *Sambucus nigra ssp. cerulea* | 6–11 | – |
| | narrowleaf yucca | YUAN2 | *Yucca angustissima* | 6–11 | – |

| | | | | | |
|---|---|---|---|---|---|
| **Tree** | | | | | |
| 6 | **Dominant Trees** | | | 224–420 | |
| | twoneedle pinyon | PIED | *Pinus edulis* | 196–308 | – |
| | Utah juniper | JUOS | *Juniperus osteosperma* | 84–112 | – |

## Animal community

--Wildlife Interpretation--
Small herds of mule deer, pronghorn antelope, and elk can be seen grazing/browsing on these sites, especially when near water sources and in the winter. The hot summers and lack of water favors small mammals, which have an easier time finding shelter, food, and water. Many species of rats, mice, squirrels, bats, and chipmunks can be observed, along with coyotes and foxes. Utah juniper provides good habitat for several bird species including juniper titmice, scrub jays, pinyon jays, and black throated gray warblers, and sparrows. Lizards are the most visible and can be observed during the day. (NPS.gov, 2008).

--Grazing Interpretations--
The open canopy community phases of this site can provide fair spring, fall, and winter grazing conditions for livestock because of its accessible but somewhat limited nutritious forage. This site may lack natural perennial water sources, however, which can influence its suitability for livestock grazing. The plant community is primarily composed of an overstory canopy of two-needle pinyon and Utah juniper with an understory of perennial grasses, with Indian ricegrass, Salina wildrye, and Geyer sedge occurring most often. Shrubs, including alderleaf mountain mahogany,black sage and bitterbrush can provide some winter browse for cattle, sheep, and goats. Forb composition and annual production depends primarily on precipitation amounts, and thus, is challenging to use in making livestock grazing management decisions. However, forb composition should be monitored for species diversity, as well as the occurence of poisonous or injurious plant communities which may be detrimental to livestock if grazed. Before making specific grazing management recommendations, a science based grazing management plan should be developed.

## Hydrological functions

The soils associated with this ecological site are generally in Hydrologic Soil Group D due to the shallow depth (NRCS National Engineering Handbook). These soils are saturated quickly due to high infiltration rates and shallow depth; once soils are saturated, run off potential is high. Hydrological groups are used in equations that estimate runoff from rainfall. These estimates are needed for solving hydrologic problems that arise in planning watershed-protection and flood-prevention projects and for designing structures for the use, control and disposal of water. Heavy grazing can alter the hydrology by decreasing plant cover and increasing bare ground. Fire can also affect hydrology, but its affect is variable. Fire intensity, fuel type, soil, climate, and topography can each have different influences. Fires can increase areas of bare ground and hydrophobic layers that reduce infiltration and increase runoff (National Range and Pasture Handbook, 2003).

## Recreational uses

Recreation activities include aesthetic value and fair opportunities for hiking and hunting. Trees can provide some screening values for camping and picnicking. In good condition there are several forbs and shrubs that bloom in the spring. Shallow soils limit this site’s ability to be used for vacation homes, other residences, or deep ponds.

## Wood products

Two-needle pinyon and Utah juniper can provide firewood and fence post where growth is sufficient and regulations allow for such use.

## Other information

--Poisonous and Toxic Plant Communities--
Toxic plants associated with this site include woolly locoweed, broom snakeweed, and Russian thistle.

Woolly locoweed is toxic to all classes of livestock and wildlife. Locoweed is palatable and has similar nutrient value to alfalfa, which may cause animals to consume it even when other forage is available. Locoweed contains swainsonine (indolizdine alkaloid) and is poisonous at all stages of growth. Poisoning will become evident after 2-3 weeks of continuous grazing and is associated with 4 major symptoms: 1) neurological damage, 2) emaciation, 3) reproductive failure and abortion, and 4) congestive heart failure linked with “high mountain disease”.

Broom snakeweed contains steroids, terpenoids, saponins, and flavones that can cause abortions or reproductive failure in sheep and cattle, however, cattle are most susceptible. These toxins are most abundant during active growth and leafing stage. Cattle and sheep generally will only graze broom snakeweed when other forage is unavailable, typically in winter when toxicity levels are at their lowest (Knight and Walter, 2001).

Russian thistle is an invasive toxic plant, causing nitrate and to a lesser extent oxalate poisoning, which affects all classes of livestock. The buildup of nitrates in these plants is highly dependent upon environmental factors such as after a rain storm, during a drought, during periods with cool/cloudy days, and when growing on soils high in nitrogen and low in sulfur and phosphorus. Nitrate collects in the stems and can persist throughout the growing season. Clinical signs of nitrate poisoning include drowsiness, weakness, muscular tremors, increased heart and respiratory rates, staggering gait, and death. Conversely, oxalate poisoning causes kidney failure; clinical signs include muscle tremors, tetany, weakness, and depression. Poisoning generally occurs when livestock consume and are not accustomed to grazing oxalate-containing plants. Animals with prior exposure to oxalates have increased numbers of oxalate-degrading rumen microflora, and thus, are able to degrade the toxin before clinical poisoning can occur.

--Invasive Plant Communities--
Generally, as ecological conditions deteriorate and perennial vegetation decreases due to disturbance (fire, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses may invade the site. Of particular concern in semi-arid environments are annual invaders including cheatgrass, Russian thistle, alyssum and annual mustards. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult, but suppression may be possible.

On well developed Utah juniper and two-needle pinyon communities, soils are often completely occupied by lateral roots which can inhibit the herbaceous understory as well as limit annual invasive species. Once these sites are disturbed and pinyon-juniper communities begin to decline, their increase or invasion is possible.

--Fire Ecology--
The ability for an ecological site to carry fire depends primarily on its' present fuel load and plant moisture content. Sites with small fuel loads will burn more slowly and less intensely than sites with large fuel loads. The two-needle pinyon and Utah juniper communities growing on shallow soils are quite unique. These trees can support stand-replacing fires, though historically, fires were likely a mixture of surface and crown fires with intensities and frequencies dependent on site productivity. Most research agrees that historic fire return intervals are at a minimum 100 years, indicating that fire may have not played an important role in short term community dynamics. Fires are more common when trees are stressed or dead due to drought and/or beetle infestations. Pinyon-juniper stands reestablish either by seeds dispersed from adjacent unburned patches or by unburned seeds found at the burn site. Continuous (every 20-40 years) burning of these ecological sites can result in shrub dominated communities, due to the relatively fast recovery of shrubs when compared to trees. If invasive annual grasses are allowed to establish, fires may become more frequent, inhibiting the site’s ability to recover.

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## Approval

Kirt Walstad, 3/05/2022

## 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.

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| Approved by | Kirt Walstad |
| Approval date | |

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| Composition (Indicators 10 and 12) based on | Annual Production |

## Indicators

1. **Number and extent of rills:** Very few rills present. Some very minor rill development may occur on steeper slopes or on areas located below exposed bedrock or other water shedding areas where increased runoff may occur. Any rills present should be <1 inch deep, fairly short (<8 feet long) and somewhat widely spaced (6-8 feet). Minor rill development may be observed following major thunderstorm or spring runoff events but should heal during the next growing season.

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2. **Presence of water flow patterns:** Very few sinuous flow patterns wind around perennial plants and surface rock. Evidence of flow patterns is expected to increase somewhat with slopes greater than 15%. Water flow patterns are long (15-20 feet), narrow (<1 foot wide), and spaced widely (10-20 yards) on gentle slopes (<15%) and more closely (<10 yards) on steeper slopes (>15%).

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3. **Number and height of erosional pedestals or terracettes:** Small pedestals may form at the base of plants that occur on the edge of water flow patterns, but should not show any exposed roots. Terracettes are fairly common, forming behind debris dams of small to medium sized litter (up to 2 inches in diameter) in water flow patterns. These debris dams may accumulate smaller litter (leaves, grass and forb stems) and sediment.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 30–60%. (Soil surface is typically covered 0-20% surface fragments). Most bare ground is associated with water flow patterns, rills, and gullies. Poorly developed biological soil crusts that are interpreted as functioning as bare ground (therefore they would be susceptible to raindrop splash erosion) should be recorded as bare ground. Ground cover is based on first raindrop impact, and bare ground is the opposite of ground cover. Ground cover + bare ground = 100%.

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5. **Number of gullies and erosion associated with gullies:** None to rare on gentle slopes (< 15%). On steeper slopes and areas below adjacent exposed bedrock, gullies may occur. Length often extends from exposed bedrock until gully reaches a stream or an area where water and sediment accumulate. Gullies may show slightly more indication of erosion as slope increases, or as the site occurs adjacent to steep sites/watershed with concentrated flow patterns.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None. Trees break the wind and reduce the potential for wind erosion. The channers on the soil surface help armor it and reduce the potential for wind erosion.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water movement. Minor litter removal may occur in flow channels with deposition occurring within 1 to 2 feet at points of obstruction. The majority of litter accumulates at the base of plants. Some grass leaves and small twigs (grass stems) may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move. However, some litter movement is expected (up to 6 feet) with increases in slopes >15% and/or increased runoff resulting from heavy thunderstorms.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have an erosion rating of 4 or 5 under the plant canopies, and a rating of 3 to 4 in the interspaces. The average should be a 4. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Thudie) Soil surface horizon is typically 3 to 10 inches deep. Structure is typically very fine subangular blocky. Color is typically dark yellowish brownish (10YR4/3). Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Spatial distribution of well developed biological soil crusts (where present) intercept raindrops reducing splash erosion and provide areas of surface detention to store water allowing additional time for infiltration. Crowns of trees and accumulating litter at base of trees appear to create a micro-topography that may enhance development of water flow patterns below the drip line of the canopy. Significant increases in Pinyon-juniper canopy (beyond the reference state) reduces understory vegetation causing an associated increase in runoff.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None, although bedrock is typically found from 6 to 20 inches of soil surface. In addition, there may be layers of calcium carbonate or other naturally occurring hard layers found in the soil subsurface. These should not be considered to be compaction layers.

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

    Dominant: Trees (two-needle pinyon/Utah juniper) > Non-sprouting shrubs (black sage)> cool season perennial grasses (Indian ricegrass, Salina wildrye).

    Sub-dominant: warm season perennial grasses (James galleta, blue grama) > forbs (woolypod locoweed, cusion phlox) > biological soil crusts.

    Other: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state (e.g. crested wheatgrass, intermediate wheatgrass, and siberian wheatgrass) Biological soil crust is variable in its expression where present on this site and is measured as a component of ground cover. Forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

    Additional: Factors contributing to temporal variability include insects and other pathogens (mistletoe), drought, extreme precipitation events, etc. Factors contributing to spatial variability include slope, amount of rock fragments, aspect, etc. Following a recent disturbance such as fire, drought or insects that may remove the woody vegetation, forbs and perennial grasses (herbaceous species) may become more dominate in the community. These conditions may reflect a functional community phase within the reference state.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** During years with average to above-average precipitation, there should be very little recent mortality or decadence apparent in trees, shrubs, or grasses. During severe (multi-year) drought up to 20% of the pinyons and junipers may die, either from drought, insect damage or pathogens such as mistletoe. There may be partial mortality of

individual bunchgrasses and other shrubs during drought. Some bunchgrass and shrub mortality may occur during severe droughts, particularly on the shallower and coarser soils associated with this site. Because woody stems may persist for many years, both pinyons and junipers (especially older trees) will normally have dead stems within the plant canopy.

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14. **Average percent litter cover (%) and depth ( in):** Litter cover (including under plants) nearly all of which should be fine litter. Depth should be 1 leaf thickness in the interspaces and up to ¼" under canopies, and up to ¾" under tree canopies. Litter cover may increase to 30% on some years due to increased production of plants.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Annual production in air-dry herbage should be approximately 500 - 600#/acre on an average year, but could range from 300 to 800#/acre during periods of prolonged drought or above average precipitation.

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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:** Few invasive species are capable of dominating this site. When invasion does occur, cheatgrass, and mustard species are the most likely species to invade.

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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce in all years, except in extreme drought years. There are no restrictions on either seed or vegetative reproduction. Some seedling recruitment of major species is present during average and above average growing years.

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