

Ecological site R047XA310UT Upland Loam (basin wildrye)

Last updated: 2/05/2025
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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): 047X–Wasatch and Uinta Mountains

MLRA 47 occurs in Utah (86 percent), Wyoming (8 percent), Colorado (4 percent), and Idaho (2 percent). It encompasses approximately 23,825 square miles (61,740 square kilometers). The northern half of this area is in the Middle Rocky Mountains Province of the Rocky Mountain System. Parts of the western edge of this MLRA are in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. The MLRA includes the Wasatch Mountains, which trend north and south. The steeply sloping, precipitous Wasatch Mountains have narrow crests and deep valleys. Active faulting and erosion are a dominant force in controlling the geomorphology of the area.

The mountains in this area are primarily fault blocks that have been tilted up. Alluvial fans at the base of the mountains are recharge zones for the basin fill aquifers. An ancient shoreline of historic Bonneville Lake is evident on the footslopes along the western edge of the area. Rocks exposed in the mountains are mostly Mesozoic and Paleozoic sediments.

The average precipitation is from 12 to 16 inches in the valleys and can range up to 73 inches in the mountains. Peak precipitation occurs in the winter months. The average annual temperature is 30 to 50 degrees Fahrenheit (-1 to 15 C). The freeze-free period averages 140 days and ranges from 60 to 220 days, generally decreasing in length with elevation.

The dominant soil orders in this MLRA are Entisols, Inceptisols, and Mollisols. The lower elevations are dominated by a frigid temperature regime, while the higher elevations experience cryic temperature regimes. The soil moisture regime is typically xeric. The mineralogy is generally mixed and the soils are very shallow to very deep, generally well drained, and loamy or loamy-skeletal.

LRU notes

This LRU includes the Wasatch Mountains which tend to run north and south. These steeply sloping, precipitous mountains have narrow crests and deep valleys. They are primarily fault blocks that have been tilted up. The alluvial fans located at the base of these mountains are important recharge zones for valley aquifers.

Ecological site concept

The soils of this site formed mostly in alluvium from andesite, dacite, basalt, or tuff. Surface soils are very dark grayish brown and fine sandy loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but make up less than 35 percent of the soil volume. These soils are deep to very deep, moderately well-drained, and have moderate permeability. The pH is neutral. Available water-holding capacity ranges from 3 to 5.2 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly xeric and the soil temperature regime is frigid. Precipitation ranges from 16 to 22 inches annually.

Associated sites

R047XA320UT	Upland Shallow Loam (Wyoming big sagebrush)
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Similar sites

R047XA308UT	Upland Loam (basin big sagebrush)
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia tridentata ssp. tridentata</i>
Herbaceous	(1) <i>Leymus cinereus</i>

Physiographic features

This site occurs on stream terraces and fan remnants at elevations between 5,200 and 8,000 feet. Slopes are gentle and range from 2 to 10 percent. Runoff is low to medium and flooding and ponding are not typical of this site.

Table 2. Representative physiographic features

Landforms	(1) Stream terrace
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	5,200–8,000 ft
Slope	2–10%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site is characterized by warm, dry summers and cold snowy winters. Average annual precipitation ranges from 14 to 18 inches, with 55 to 65 percent coming during the plant dormant season (October to March). This winter moisture, along with spring rains in April and May, serves as the primary source of water for plant growth. Summer storms are typically lighter and less frequent than the cool season precipitation events on this site.

Table 3. Representative climatic features

Frost-free period (characteristic range)	48-60 days
Freeze-free period (characteristic range)	103-104 days
Precipitation total (characteristic range)	17 in
Frost-free period (actual range)	45-63 days
Freeze-free period (actual range)	102-105 days
Precipitation total (actual range)	17 in
Frost-free period (average)	54 days
Freeze-free period (average)	104 days
Precipitation total (average)	17 in

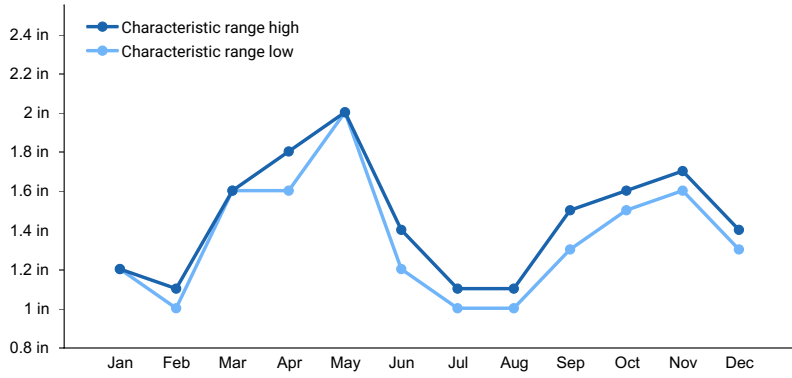


Figure 1. Monthly precipitation range

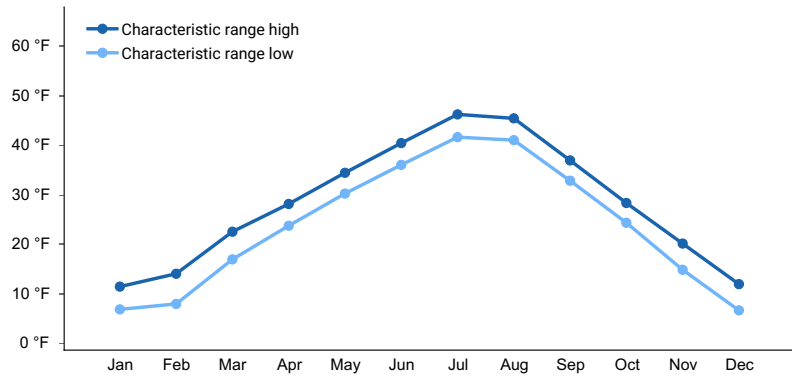


Figure 2. Monthly minimum temperature range

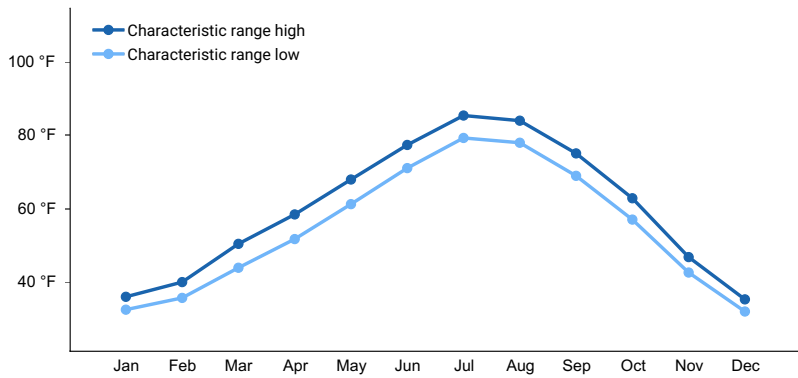


Figure 3. Monthly maximum temperature range

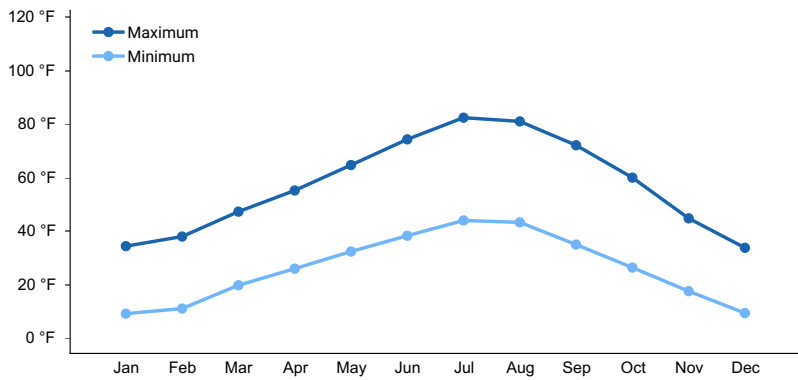


Figure 4. Monthly average minimum and maximum temperature

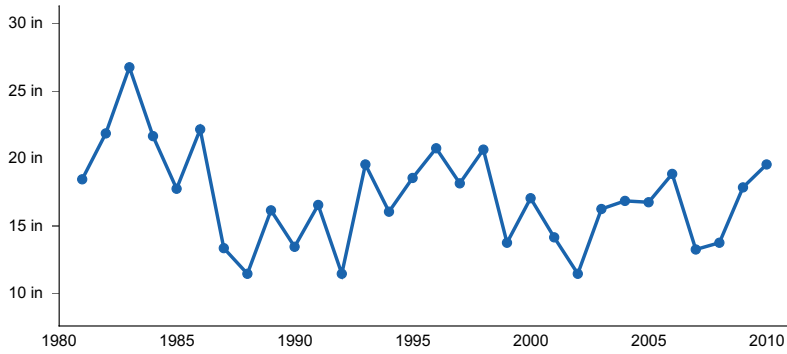


Figure 5. Annual precipitation pattern

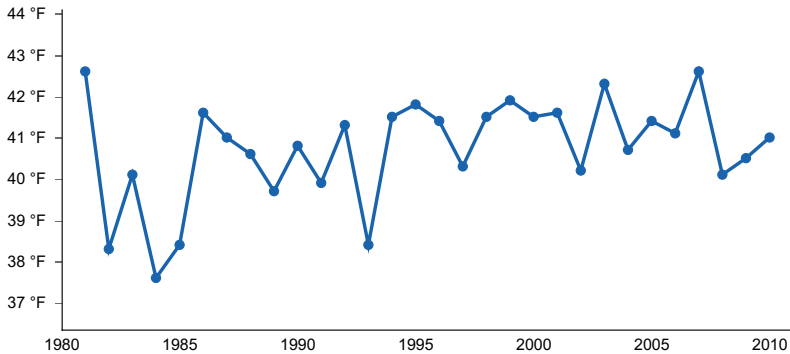


Figure 6. Annual average temperature pattern

Climate stations used

- (1) COALVILLE 13 E [USC00421590], Coalville, UT
- (2) COALVILLE [USW00024120], Coalville, UT

Influencing water features

This site is not influenced by water from a wetland or stream.

Wetland description

N/A

Soil features

The soils of this site are deep, well-drained loams that formed in alluvium from sandstone, quartzite and shale parent rock. Permeability is moderate and available water-holding capacity ranges from 5.5 to 6.7 inches of water in the upper 40 inches of soil. Rock fragments are typically not found on the soil surface, but the profile can contain up to 25 percent gravel by volume. The soil moisture regime is xeric and the soil temperature regime is frigid.

This site is correlated to the Echocreek (126, 127) soil component of the Summit County Area Soil Survey (UT613).

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale (2) Alluvium–quartzite
Surface texture	(1) Loam
Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate

Available water capacity (0-40in)	5.5–6.7 in
Calcium carbonate equivalent (0-40in)	0–15%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.6–8.4
Subsurface fragment volume <=3" (0-40in)	0%
Subsurface fragment volume >3" (0-40in)	0%

Ecological dynamics

Historic vegetation on this site was dominated by tall (7 ft) cool-season grasses, which are adapted to occasional high water tables. Other significant vegetation includes a variety of forbs and shrubs.

The dominant aspect of this site was grasses. The composition and production will vary naturally due to location (north to south of the MLRA), fluctuating precipitation, and fire return interval.

Due to the abundant forage, thermal cover, and often close proximity to water sources, this site has a high probability of receiving grazing pressures from domestic and wildlife grazers as well as having received historical grazing pressure.

Great basin wildrye is sensitive to spring grazing and clipping and frequent herbage removal during the growing season (Perry and Chapman 1976). Thus, under repetitive harvesting, Great basin wildrye can be “grazed out” of the system. As ecological condition deteriorates due to improper grazing, cool-season grasses Great basin wildrye and Nevada bluegrass decrease in frequency and production. The ungrazed plants or grazing tolerant plants such as Basin big sagebrush, rabbitbrush and other will increase in frequency and production. This increase combined with the declining perennial grasses can lead to a site dominated by sagebrush and rabbitbrush with little to no understory. The area without an understory of perennial grasses and forbs has little value as a functioning ecosystem.

As a result of the grass dominated system, this site had lots of root mass and vegetation production which creates and maintains an organic layer and a mollic epipedon. If the perennial grasses are removed from the system, it is typical to see a decrease in organic matter and accelerated erosion.

Great Basin wildrye is also susceptible to black grass bugs. Black grass bugs populations will invade a site, and can destroy most of the living grasses.

The fire regime for this site is similar to the surrounding sagebrush lands. The intensity of a fire determines the vegetation succession and structure. Low intensity or ground fires typically result in the removal of litter and decadent grasses while maintaining the nominal shrub cover, while higher intensity fires will remove the shrub species. After normal to high intensity fires, basin big sagebrush decreases while rubber rabbitbrush increases. If the fire regime is suppressed, this site may be invaded by junipers.

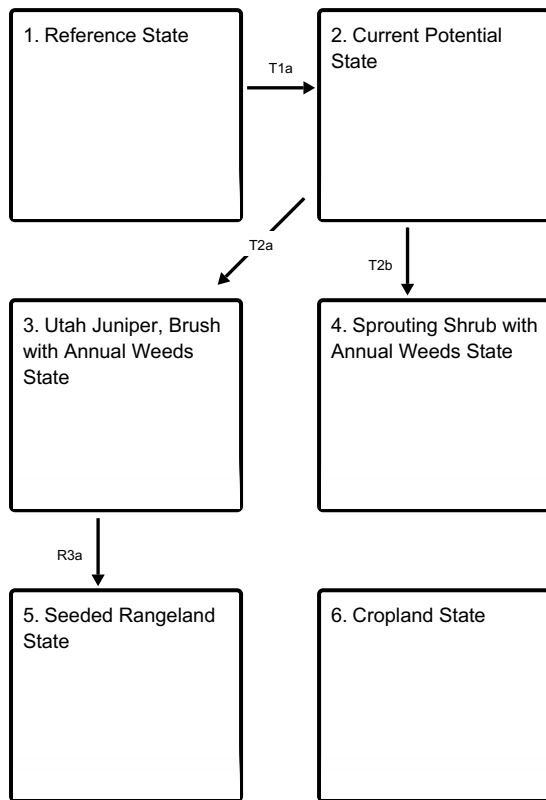
Because of the position on the landscape, this site is typically one of the first to be invaded. Junipers will start to creep down into the sagebrush communities by using this site as a corridor. The fire transition stages are relatively short-lived and tend to be mosaic in nature.

If thistles, houndstongue or other strongly invasive species, invade the site concurrent to the area being stressed by disturbances or drought, they are likely to invade and dominate this site.

When more information is available, this section will include a discussion of seral stages; fire influence and effects; effects of prolonged wet or dry periods; resistance to change; the influence of such things as grazing, rodent concentrations, insects, diseases, introduced species, and soil erosion or deposition; other stable vegetative states associated with this site as a result of extreme disturbance.

State and transition model

Ecosystem states



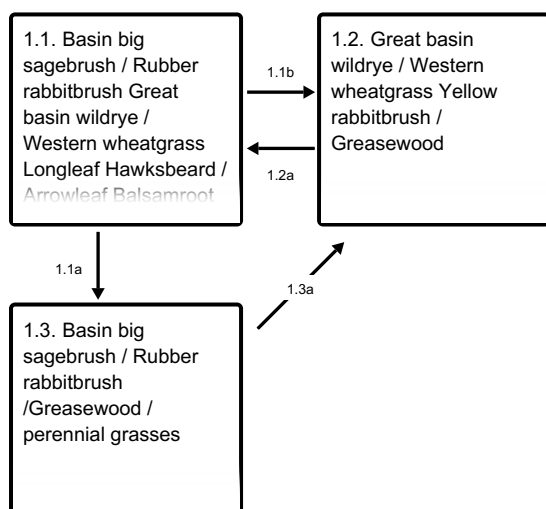
T1a - Improper grazing and drought remove fine fuels from the site lessening the potential for fire to occur.

T2a - Long-term improper grazing and prolonged drought

T2b - Disturbance: Sustained, long-term improper grazing, and prolonged drought

R3a - Disturbance: mechanical or chemical treatment of unwanted brush species; with seeding of introduced, native or combination rangeland species.

State 1 submodel, plant communities



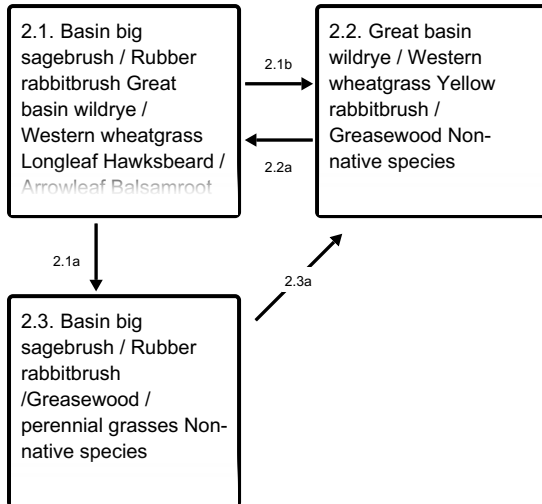
1.1b - Recent fire occurrence (1 to 30 years)

1.1a - Extended period of time without a major disturbance

1.2a - 40 to 50 years or more without a fire occurrence

1.3a - Recent fire occurrence (1 to 30 years).

State 2 submodel, plant communities



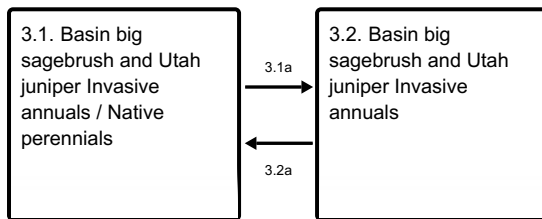
2.1b - Recent fire occurrence (1 to 30 years)

2.1a - Extended period of time without a major disturbance

2.2a - 40 to 50 years or more without a fire occurrence (normal fire frequency)

2.3a - Recent fire occurrence (1 to 30 years)

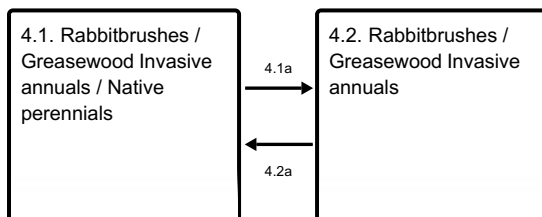
State 3 submodel, plant communities



3.1a - Long-term improper grazing and drought

3.2a - properly grazed over an extended period of time

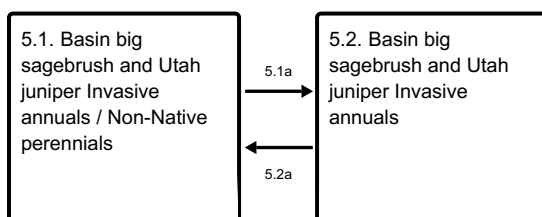
State 4 submodel, plant communities



4.1a - Long-term, improper grazing and drought

4.2a - properly grazed for an extended period of time

State 5 submodel, plant communities



5.1a - Long-term improper grazing and drought

5.2a - properly grazed over an extended period of time

State 1

Reference State

Community 1.1

Basin big sagebrush / Rubber rabbitbrush Great basin wildrye / Western wheatgrass Longleaf Hawksbeard / Arrowleaf Balsamroot

This community is dominated by Great basin wildrye. Basin big sagebrush is the major shrub. Other significant herbaceous species in the plant community include western wheatgrass, Nevada bluegrass, longleaf hawksbeard and arrowleaf balsamroot. Rubber rabbitbrush and black greasewood are other important shrubs. Percent composition by air-dry weight is 70 percent grass, 10 percent forbs, and 20 percent shrubs. Natural fire frequency is estimated to be 40 to 50 years.

Community 1.2

Great basin wildrye / Western wheatgrass Yellow rabbitbrush / Greasewood

Basin big sagebrush decreases in the community; rubber rabbitbrush also decreases, but to a lesser degree. Yellow rabbitbrush, black greasewood and, at times, horsebrush species resprout and increase in the community; much of the excess fine fuel accumulation is removed. Basin wildrye and other cool-season bunchgrasses recover following fire and flourish, western wheatgrass increases. Fire tolerant shrubs may persist as dominants in the shrub community for 30 years or longer.

Community 1.3

Basin big sagebrush / Rubber rabbitbrush /Greasewood / perennial grasses

Basin big sagebrush, rubber rabbitbrush and black greasewood increase in percent composition. Shrubs show signs of decadence due to age. Great basin wildrye and other cool-season bunchgrasses begin losing vigor due to increased shrub competition and increase in old vegetation. Percent composition by air-dry weight is 40 percent grass, 10 percent forbs, and 50 percent shrubs.

Pathway 1.1b

Community 1.1 to 1.2

Disturbance: Recent fire occurrence (1 to 30 years).

Pathway 1.1a

Community 1.1 to 1.3

Extended period of time without a major disturbance such as fire; insect infestation (i.e. black grass bugs); or prolonged drought. Fire frequency extends well beyond the 40 to 50 year average for the site.

Pathway 1.2a

Community 1.2 to 1.1

40 to 50 years or more without a fire occurrence (normal fire frequency).

Pathway 1.3a

Community 1.3 to 1.2

Disturbance: Recent fire occurrence (1 to 30 years).

State 2

Current Potential State

Plant communities in this state can include native, acclimatized, naturalized and invasive non-native species. This state is irreversibly changed from the Reference State because these non-native species will now remain a permanent part of the community.

Community 2.1

Basin big sagebrush / Rubber rabbitbrush Great basin wildrye / Western wheatgrass Longleaf Hawksbeard / Arrowleaf Balsamroot Non-native species

This community is dominated by Great basin wildrye. Basin big sagebrush is the major shrub. Other significant herbaceous species in the plant community include western wheatgrass, Nevada bluegrass, longleaf hawksbeard and arrowleaf balsamroot. Rubber rabbitbrush and black greasewood are other important shrubs. This community is dominated by native species, but may include acclimatized, naturalized and invasive non-native species. Percent composition by air-dry weight is 70 percent grass, 10 percent forbs, and 20 percent shrubs.

Community 2.2

Great basin wildrye / Western wheatgrass Yellow rabbitbrush / Greasewood Non-native species

Basin big sagebrush decreases in the community; rubber rabbitbrush also decreases, but to a lesser degree. Yellow rabbitbrush, black greasewood and, at times, horsebrush species resprout and increase in the community; much of the excess fine fuel accumulation is removed. Basin wildrye and other cool-season bunchgrasses recover following fire and flourish, western wheatgrass increases. Fire tolerant shrubs may persist as dominants in the shrub community for 30 years or longer. This community is dominated by native species, but may include acclimatized, naturalized and invasive non-native species.

Community 2.3

Basin big sagebrush / Rubber rabbitbrush /Greasewood / perennial grasses Non-native species

Pathway 2.1b

Community 2.1 to 2.2

Recent fire occurrence (1 to 30 years).

Pathway 2.1a

Community 2.1 to 2.3

Extended period of time without a major disturbance such as fire; insect infestation (i.e. black grass bugs); or prolonged drought. Fire frequency extends well beyond the 40 to 50 year average for the site.

Pathway 2.2a

Community 2.2 to 2.1

40 to 50 years or more without a fire occurrence (normal fire frequency).

Pathway 2.3a

Community 2.3 to 2.2

Recent fire occurrence (1 to 30 years).

State 3

Utah Juniper, Brush with Annual Weeds State

Community 3.1

Basin big sagebrush and Utah juniper Invasive annuals / Native perennials

Where Utah juniper has invaded, basin big sagebrush, rubber rabbitbrush and black greasewood may decrease, otherwise they dominate the community; yellow rabbitbrush often increases. Remaining perennial herbaceous vegetation is mostly found only in protected locations under shrubs. Invasive, non-native grasses and weeds, including cheatgrass, annual mustards, redstem storksbill, etc. dominate the understory.

Community 3.2

Basin big sagebrush and Utah juniper Invasive annuals

Where Utah juniper has invaded, basin big sagebrush, rubber rabbitbrush, and black greasewood decrease, otherwise they may dominate the community; yellow rabbitbrush often increases. Remaining perennial herbaceous vegetation is rare and is found only in protected locations under shrubs. Invasive, non-native grasses and weeds, including cheat grass, annual mustards, redstem storksbill, etc., dominate the understory.

Pathway 3.1a

Community 3.1 to 3.2

Disturbance: Long-term improper grazing (including, season long, overstocking, wrong season, etc.) and drought reduce perennial grasses. Fine fuels are reduced lessening the potential for fire to occur. Fire frequency is greater than 100 years.

Pathway 3.2a

Community 3.2 to 3.1

Site is properly grazed over an extended period of time. Native perennial vegetation slowly recovers; annual weeds dominate the understory. Fire frequency remains well beyond normal for the site. Fire frequency is greater than 100 years.

State 4

Sprouting Shrub with Annual Weeds State

Community 4.1

Rabbitbrushes / Greasewood Invasive annuals / Native perennials

Yellow rabbitbrush, black greasewood and smooth horsebrush resprout and dominate the shrub layer. Rubber rabbitbrush can be plentiful if conditions are right. Fire tolerant shrubs may persist as dominants with fire periods of 10 to 30 years. Broom snakeweed may be an episodic dominant species when conditions are favorable. Native bunchgrasses are significantly reduced; invasive annuals including cheatgrass, annual mustards, redstem storksbill, etc. dominate the understory.

Community 4.2

Rabbitbrushes / Greasewood Invasive annuals

Yellow rabbitbrush, black greasewood and smooth horsebrush dominate the overstory community. Rubber rabbitbrush can be plentiful if conditions are right. Fire tolerant shrubs may persist as dominants in this community with fire periods of 10 to 30 years. Broom snakeweed may be an episodic dominant species when conditions are favorable. Only remnant native bunchgrasses remain; invasive annuals including cheatgrass, annual mustards, redstem storksbill, etc. dominate the understory.

Pathway 4.1a

Community 4.1 to 4.2

Disturbance: Long-term, improper grazing (including, season long, overstocking, wrong season, etc.) and drought reduce perennial grasses. Highly combustible fine fuels from invasive annuals dominate the community resulting in a shortened fire frequency. Fire frequency is typically 10 to 30 years.

Pathway 4.2a

Community 4.2 to 4.1

Site is properly grazed for an extended period of time. Perennial vegetation very slowly recovers. Fire frequency is typically 10 to 30 years.

State 5

Seeded Rangeland State

Community 5.1

Basin big sagebrush and Utah juniper Invasive annuals / Non-Native perennials

Rangeland seeding that may be composed of introduced, native or combination grass and forb species. Unwanted trees and shrubs are reduced but may occupy a portion of the site because of natural regeneration. Invasive annual grasses and weedy forb species, primarily cheatgrass and various annual mustards, may be present in the seeding. Seeding, when healthy, is resistant to fire.

Community 5.2

Basin big sagebrush and Utah juniper Invasive annuals

This state is present after either a failed seeding or an improperly grazed one. Site may be herbaceous or may be returning to trees and shrubs.

Pathway 5.1a

Community 5.1 to 5.2

Disturbance: Long-term improper grazing (including, season long, overstocking, wrong season, etc.) and drought reduce perennial grasses. Fine fuels are reduced lessening the potential for fire to occur. Fire frequency is greater than 100 years.

Pathway 5.2a

Community 5.2 to 5.1

Site is properly grazed over an extended period of time. Native perennial vegetation slowly recovers; annual weeds dominate the understory. Fire frequency remains well beyond normal for the site. Fire frequency is greater than 100 years.

State 6

Cropland State

This state occurs when the Upland Loam ecological site is altered and permanently replaced with agricultural crops such as Alfalfa and Grain. This State is identified here to recognize that a very large portion of this ecological site has been converted to a cropland land use.

Transition T1a

State 1 to 2

Improper grazing (i.e. season long, overstocking, wrong season, etc.) and drought remove fine fuels from the site lessening the potential for fire to occur. This allows both sprouting and non-sprouting shrubs such as basin big sagebrush, rubber rabbitbrush and black greasewood to increase in the community. Shrubs may become decadent due to age. Great basin wildrye and other native bunchgrasses lose vigor and decrease in the community due to shrub competition and grazing pressure; Western wheatgrass may increase. Utah juniper seedlings and saplings may begin to invade the community if a seed source is available. The threshold is crossed when there is an introduction of non native species, primarily cheatgrass and various annual mustards, that become established on the site. Prior to crossing the threshold, if this site is properly grazed over an extended period of time native perennial vegetation may recover. Fire frequency can return to within the normal range for the site. These events could set the site back into the normal range of variability.

Transition T2a

State 2 to 3

Long-term improper grazing (including, season-long, overstocking, wrong season, etc.); and prolonged drought; lengthened fire return interval resulting in a dense non-sprouting tree and shrub overstory, reduction of native perennial understory vegetation and increasing invading annuals. Utah junipers may increase to occupy a significant portion of the overstory, if a seed source is present. Basin big sagebrush dominates the shrub layer and may be decadent due to age. Rubber rabbitbrush and greasewood may also be present. Great basin wildrye and other native bunchgrasses are significantly reduced due to increased shrub competition and heavy grazing pressure; western wheatgrass may increase. The threshold is crossed when invasive annuals including cheatgrass, annual mustards, redstem storksbill, etc. dominate the understory. The occurrence of fire extends well beyond the normal period for the site.

Transition T2b

State 2 to 4

Disturbance: Sustained, long-term improper grazing (including, season long, overstocking, wrong season, etc.) and prolonged drought; shortened fire frequency allows site to be dominated by sprouting shrubs including yellow rabbitbrush, black greasewood and smooth horsebrush; a significant reduction of perennial bunchgrass species is common. There is an invasion of annual grasses and weedy forb species primarily cheatgrass and various annual mustards.

Restoration pathway R3a

State 3 to 5

Disturbance: Mechanical chaining of Utah juniper where present, or mechanical or chemical treatment of unwanted brush species; with seeding of introduced, native or combination rangeland species.

Additional community tables

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel were also used.

Other references

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Contributors

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Approval

Kendra Moseley, 2/05/2025

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	02/26/2025
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:**

17. **Perennial plant reproductive capability:**
