USDA Natural Resources Conservation Service

Ecological site R048AY309UT
Upland Loam (Birchleaf Mountain Mahogany)

Last updated: 3/05/2024
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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): 048A–Southern Rocky Mountains

MLRA 48A makes up about 45,920 square miles (119,000 square kilometers) and is the southern part of the Rocky Mountains. The Southern Rocky Mountains lies east of the Colorado Plateau, south of the Wyoming Basin, west of the Great Plains, and north of the Rio Grande Rift. It is in western and central Colorado, southeastern Wyoming, eastern Utah, and northern New Mexico. The headwaters of major rivers such as the Colorado, Yampa, Arkansas, Rio Grande, North Platte and South Plate rivers are located here. This MLRA has numerous national forests, including the Medicine Bow National Forest in Wyoming; the Routt, Arapaho, Roosevelt, Pike, San Isabel, White River, Gunnison, Grand Mesa, Uncompahgre, Rio Grande, and San Juan National Forests in Colorado; the Carson National Forest and part of the Santa Fe National Forest in New Mexico. Rocky Mountain National Park also is in this MLRA.

MLRA 48A is the southern Rocky Mountains physiographic region. The Southern Rocky Mountains consist primarily of two belts of strongly sloping to precipitous mountain ranges trending north to south. Several basins, or parks, are between the belts. Some high mesas and plateaus are included. It is characterized by mountain ranges that were uplifted during the Laramide Orogeny and then had periods of glaciation. The ranges include the Sangre de Cristo Mountains, the Laramie Mountains, and the Front Range in the east and the San Juan Mountains and the Sawatch and Park Ranges in the west. The ranges are dissected by many narrow stream valleys having steep gradients. In some areas the upper mountain slopes and broad crests are covered by snowfields and glaciers. Elevation typically ranges from 6,500 to 14,400 feet (1,980 to 4,390 meters) in this area. The part of this MLRA in central Colorado includes the highest point in the Rockies, Mount Elbert, which reaches an elevation of 14,433 feet (4,400 meters). More than 50 peaks in the part of the MLRA in Colorado are at an elevation of more than 14,000 feet (4,270 meters). Many small glacial lakes are in the high mountains.

The mountains in this area were formed mainly by crustal uplifts during the late Cretaceous and early Tertiary periods. This large MLRA can be subdivided into at least 4 large general divisions. First is the Rockies on the east side of this area are called the “Front Range,” which is a fault block that has been tilted up on edge and uplifted and is largely igneous and metamorphic geology. It was tilted up on the east edge, so there is a steep front on the east and the west side is more gently sloping and in the south east there are rocks exposed in the mountains are mostly Precambrian igneous and metamorphic rocks. Second is the tertiary rocks, primarily basalt and andesitic lava flows, tuffs, breccias, and conglomerates, are throughout this area (San Juan Mountains Area). The third division is Northwest part of the MLRA is dominantly sedimentary rock from the cretaceous/tertiary and Permian/ Pennsylvanian periods. The fourth subset is the long and narrow Sangre de Cristos mountains uplifted in the Cenozoic are between the Rio Grande rift and the great plains. Many of the highest mountain ranges were reshaped by glaciation during the Pleistocene. Alluvial fans at the base of the mountains are recharge zones for local basin and valley fill aquifers. They also are important sources of sand and gravel.

The average annual precipitation ranges predominantly from 12 to 63 inches. Summer rainfall commonly occurs as high-intensity, convective thunderstorms. About half of the annual precipitation occurs as snow in winter; this proportion increases with elevation. In the mountains, deep snowpacks accumulate throughout the winter and

generally persist into spring or early summer, depending on elevation. Some permanent snowfields and small glaciers are on the highest mountain peaks. In the valleys at the lower elevations, snowfall is lighter and snowpacks can be intermittent. The average annual temperature is 26 to 54 degrees F (-3 to 12 degrees C). The freeze-free period averages 135 days and ranges from 45 to 230 days, decreasing in length with elevation. The climate of this area is strongly dependent upon elevation; precipitation is greater, and temperatures are cooler at the higher elevations. The plant communities vary with elevation, aspect and change in latitudes due to changing in precipitation kind and timing and temperature.

The dominant soil orders in this MLRA are Mollisols, Alfisols, Inceptisols, and Entisols. The soils in the area dominantly have a frigid or cryic soil temperature regime and an ustic or udic soil moisture regime. Mineralogy is typically mixed, smectitic, or paramicaceous. In areas with granite, gneiss, and schist bedrock, Glossocryalfs (Seitz, Granile, and Leadville series) and Haplocryolls (Rogert series) formed in colluvium on mountain slopes. Dystrocryepts (Leighcan and Mummy series) formed on mountain slopes and summits at the higher elevations. In areas of andesite and rhyolite bedrock, Dystrocryepts (Endlich and Whitecross series) formed in colluvium on mountain slopes. In areas of sedimentary bedrock, Haplustolls (Towave series) formed on mountain slopes at low elevations and with low precipitation. Haplocryolls (Lamphier and Razorba series), Argicryolls (Cochetopa series), and Haplocryalfs (Needleton series) formed in colluvium on mountain slopes at high elevations.

Ecological site concept

The soils of this site formed mostly in slope alluvium derived from sandstone and shale over residuum weathered from sandstone and shale. Surface soils are sandy loam to channery fine sandy loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but generally make up less than 35 percent of the soil volume. These soils are shallow, well-drained, and have moderately slow to moderate permeability. Available water-holding capacity ranges from 1 to 2 inches of water in the upper 20 inches of soil. The soil moisture regime is mostly aridic bordering on ustic and the soil temperature regime is frigid. Precipitation ranges from 12-16 inches annually.

Associated sites

R048AY320UT	**Upland Shallow Loam (Black sagebrush)** Often occurs adjacent to this site.

Similar sites

R048AY306UT	**Upland Loam (Wyoming Big Sagebrush)** Although the proportions of deciduous shrubs are different between these sites, species are often similar.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Cercocarpus montanus* (2) *Amelanchier utahensis*
Herbaceous	(1) *Pseudoroegneria spicata* (2) *Achnatherum nelsonii*

Physiographic features

This site occurs at elevations between 5,300 and 9,000 feet. It is found on structural benches and hills with slopes ranging from 6 to 40 percent. Flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Structural bench (2) Hill
Runoff class	Medium

Flooding frequency	None
Ponding frequency	None
Elevation	5,300–9,000 ft
Slope	6–40%
Aspect	Aspect is not a significant factor

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 soil moisture regime is mostly ustic and the soil temperature regime is frigid.

Table 3. Representative climatic features

Frost-free period (characteristic range)	90-110 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	12-16 in

Influencing water features

Due to its landscape position, this site is not influenced by streams or wetlands.

Soil features

The soils of this site formed mostly in slope alluvium derived from sandstone and shale over residuum weathered from sandstone and shale. Surface soils are sandy loam to channery fine sandy loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but generally make up less than 35 percent of the soil volume. These soils are shallow, well-drained, and have moderately slow to moderate permeability. Available water-holding capacity ranges from 1 to 2 inches of water in the upper 20 inches of soil. The soil moisture regime is mostly aridic bordering on ustic and the soil temperature regime is frigid. Precipitation ranges from 12-16 inches annually.

Table 4. Representative soil features

Parent material	(1) Slope alluvium–sandstone and shale (2) Residuum–sandstone and shale
Surface texture	(1) Sandy loam (2) Channery fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	8–20 in
Soil depth	8–20 in
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–2%
Available water capacity (Depth not specified)	1–2 in

Calcium carbonate equivalent (Depth not specified)	Not specified
Electrical conductivity (Depth not specified)	Not specified
Sodium adsorption ratio (Depth not specified)	Not specified
Soil reaction (1:1 water) (Depth not specified)	Not specified
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0–8%

Ecological dynamics

It is impossible to determine in any quantitative detail the historic climax plant community (HCPC) for this ecological site because of the lack of direct historical documentation preceding all human influence. In some areas, the earliest reports of dominant plants include the cadastral survey conducted by the General Land Office, which began in the late 19th century for this area (Galatowitsch 1990). However, up to the 1870s the Shoshone Indians, prevalent in northern Utah and neighboring states, grazed horses and set fires to alter the vegetation for their needs (Parson 1996). In the 1860s, Europeans brought cattle and horses to the area, grazing large numbers of them on unfenced parcels year-long (Parson 1996). Itinerant and local sheep flocks followed, largely replacing cattle as the browse component increased.

Below is a State and Transition Model diagram to illustrate the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas where this ESD is represented. These situations include grazing gradients to water sources, fence-line contrasts, patches with differing dates of fire, herbicide treatment, tillage, etc. Reference State 1 illustrates the common plant communities that probably existed just prior to European settlement.

The major successional pathways within states, (“community pathways”) are indicated by arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the detailed narratives that follow the diagram. The transition between Reference State 1 and State 2 is considered irreversible because of the naturalization of exotic species of both flora and fauna, possible extinction of native species, and climate change. There may have also been accelerated soil erosion.

The plant communities shown in this State and Transition Model may not represent every possibility, but are probably the most prevalent and recurring plant communities. As more monitoring data are collected, some phases or states may be revised, removed, and/or new ones may be added. None of these plant communities should necessarily be thought of as “Desired Plant Communities.” According to the USDA NRCS National Range & Pasture Handbook (USDA-NRCS 2003), Desired Plant Communities (DPC’s) will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including descriptions of a plant community is to capture the current knowledge at the time of this revision.

State 1: Reference State:
The Reference State is a description of this ecological site just prior to Euro-American settlement but long after the arrival of Native Americans. The description of the Reference State was determined by NRCS Soil Survey Type Site Location information and familiarity with rangeland relict areas where they exist. The least modified plant community would have been a tall shrub-dominated community with occasional Rocky Mountain juniper (*Juniperus scopulorum*), and a rich and productive understory of graminoids and forbs (1.1). Dominant shrubs would have included alderleaf mountain mahogany (*Cercocarpus montanus*), Utah serviceberry (*Amelanchier utahensis*), along with the associated shrubs mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana), mountain snowberry (*Symphoricarpos oreophilus*), and antelope bitterbrush (*Purshia tridentata*). Primary grasses would have included bluebunch wheatgrass (*Pseudoroegneria spicata*), mountain brome (*Bromus marginatus*), and Columbia

needlegrass (*Achnatherum nelsonii*). Dominant forbs would have included arrowleaf balsamroot (*Balsamorhiza sagittata*), tailcup lupine (*Lupinus caudatus* ssp. caudatus), and longleaf phlox (*Phlox longifolia*) among others. Wildfires would have maintained a balance between woody and non-woody vegetation, as many of the primary shrub species are root-sprouters and respond quickly following fire.

Community Phase 1.1: alderleaf mountain mahogany, Utah serviceberry & other tall shrubs/ scattered Rocky Mountain juniper/ rich & productive herbaceous understory
This plant community would have been characterized by tall shrub-dominated vegetation, primarily alderleaf mountain mahogany and Utah serviceberry, with scattered Rocky Mountain juniper, and a rich and productive native perennial herbaceous understory. Other associated shrubs would have included mountain big sagebrush, mountain snowberry, and antelope bitterbrush. Understory grasses would have included bluebunch wheatgrass, sheep fescue, and Columbia needlegrass. Dominant forbs would have included arrowleaf balsamroot, tailcup lupine, and longleaf phlox among others.

Transition T1a: from State 1 to State 2 (Reference State to Alderleaf Mountain Mahogany/ Utah Serviceberry/ Introduced Non-natives State)
The simultaneous introduction of exotic species, both plants and animals, possible extinctions of native flora and fauna, and climate change has caused State 1 to transition to State 2. Reversal of such historic changes (i.e. a return pathway) back to State 1 is not practical.

State 2: Alderleaf Mountain Mahogany/ Utah Serviceberry/ Introduced Non-natives State:
State 2 is a description of the ecological site shortly following Euro-American settlement, which has been influenced by the introduction of several non-native plants and animals, possible extinctions of native species, and a different climate. The plant community will be very similar to State 1 with the exception that some introduced species are likely to be present. This state can be regarded as the current potential. The site is dominated by a mixture of tall shrubs including alderleaf mountain mahogany, Utah serviceberry, mountain big sagebrush, mountain snowberry, antelope bitterbrush and scattered Rocky Mountain juniper. A rich and productive native perennial herbaceous understory will also be present (2.1). Because of the steepness of these sites, the vegetation was not heavily used by cattle and horses. However, herding of sheep was quite prevalent during the first half of the 20th Century. This vegetation was and still remains a favorite of big game. Because these classes of animals focus on browse, the understory is more intact than less steep nearby sites. Wildfires are important in rejuvenating the woody component, as the majority of the shrubs on these sites respond and recover rapidly following fire. Because soils on this site are rocky, they are considered “self armoring,” thus making the site resistant to the effects of erosion. Another factor contributing to the resiliency of this state is that the most desirable species are long-lived and are root-sprouters. Resiliency, however, will be reduced by excessive utilization which results in insufficient regeneration of the desirable species. Without regeneration of desirable species, some populations over-mature making them susceptible to catastrophic, sudden losses, and as a result unpalatable invaders can take over the site.

Community Phase 2.1: alderleaf mountain mahogany, Utah serviceberry & other tall shrubs/ scattered Rocky Mountain juniper/ rich & productive herbaceous understory
This plant community is characterized by a mixture of tall shrubs including alderleaf mountain mahogany, Utah serviceberry, mountain big sagebrush, mountain snowberry, antelope bitterbrush and scattered Rocky Mountain juniper. The understory is composed of grasses including bluebunch wheatgrass, sheep fescue, and Columbia needlegrass. Dominant forbs would include arrowleaf balsamroot, tailcup lupine, and longleaf phlox among others.

Transition T2a: from State 2 to State 3 (Alderleaf Mountain Mahogany/ Utah Serviceberry Introduced Non-natives State to Taller Shrubs/ Rocky Mountain Juniper State)
Heavy utilization primarily by sheep and occasionally by cattle and horses during the first half of the 20th century, combined with fire suppression, reduced much of the understory and allowed the shrubs to take over the site. Big game then hedged and high-lined the remaining shrubs. The survivors are all taller with the canopies having a marked browse line.

State 3: Taller Shrubs/ Rocky Mountain Juniper State:
Lengthening of the fire cycle directly through fire control and indirectly through heavy livestock grazing reduces the fine fuels, ultimately tipping the balance toward woody plants and increasing the proportion of non-sprouters such as Rocky Mountain juniper and mountain big sagebrush (3.1). Because soils on this site are rocky they are considered “self armoring,” thus making the site resistant to the effects of erosion. The state will maintain stability

with cool season fires, whereas hot summer fires are likely to reduce state stability.

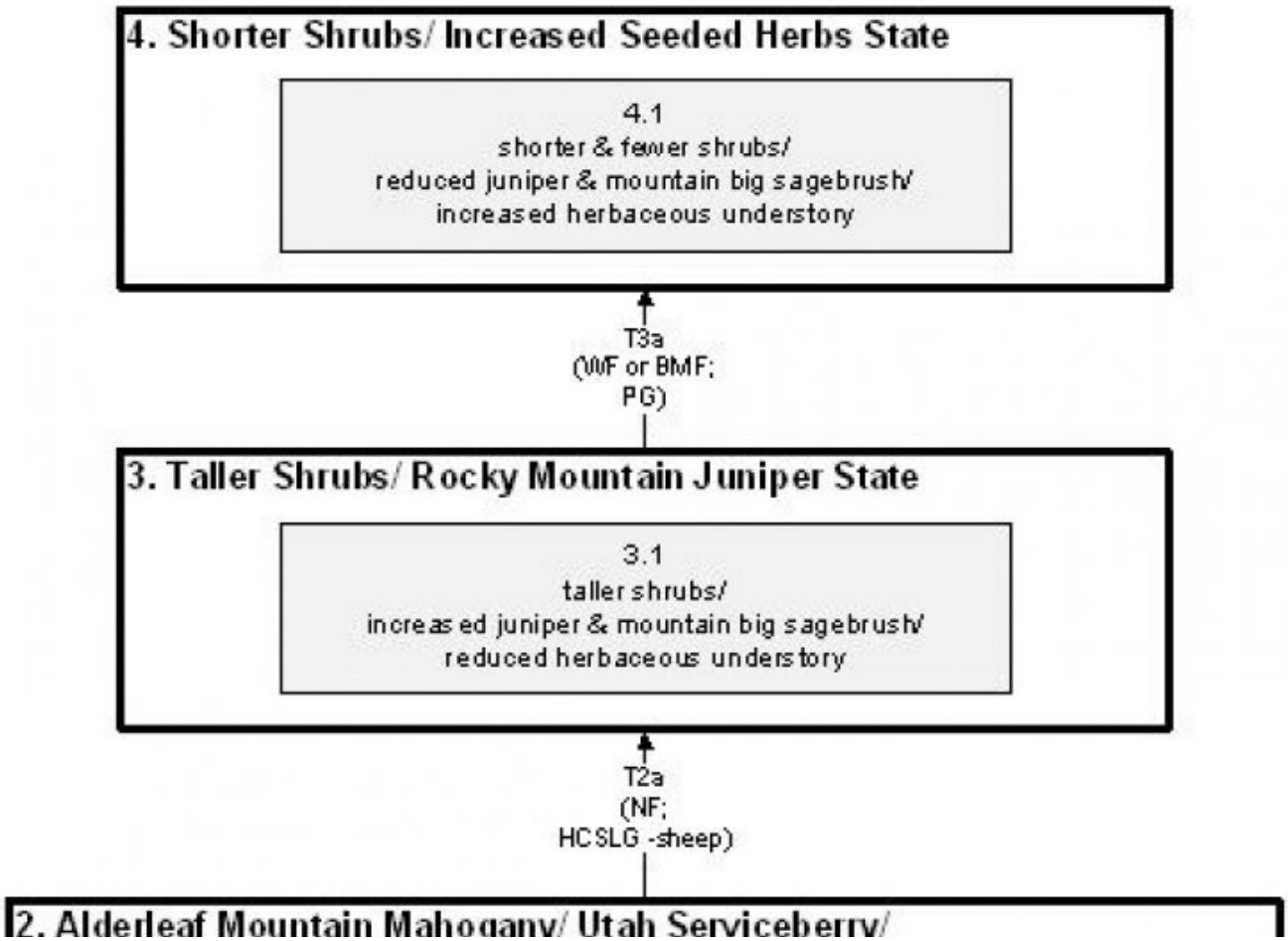
Community Phase 3.1: taller shrubs/ increased juniper & mountain big sagebrush/ reduced herbaceous understory
This plant community is characterized by taller, denser shrubs, including the non-sprouting species such as Rocky Mountain juniper and mountain big sagebrush. The herbaceous understory is diminished due to heavy livestock grazing during the growing season of grasses.

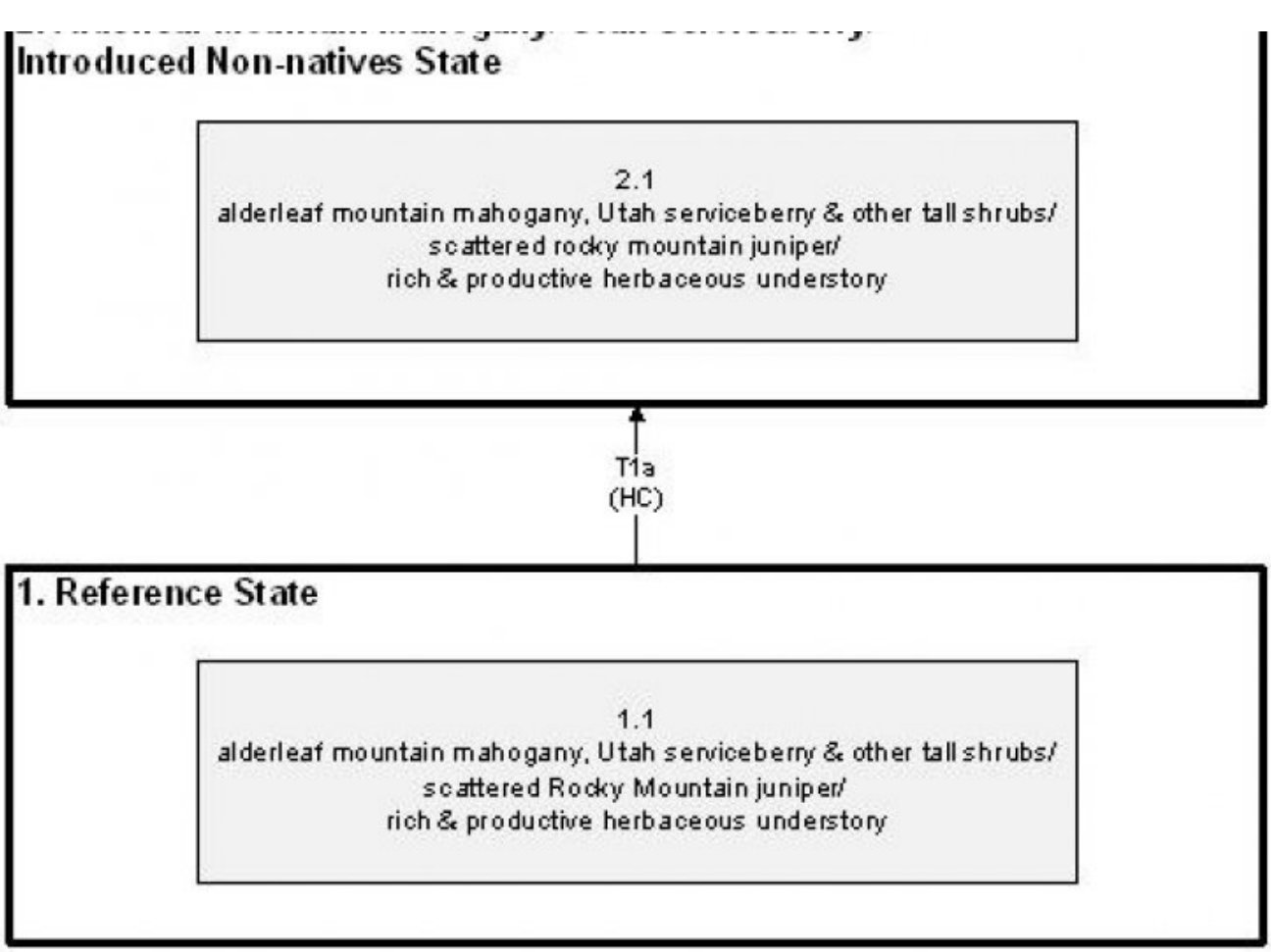
Transition T3a: from State 3 to State 4 (Taller Shrubs/ Rocky Mountain Juniper State to Shorter Shrubs/ Increased Seeded Herbs State)
Prescribed burning or wildfire accompanied by aerial seeding, followed by grazing deferment, offers the only logical way to proactively promote a more diverse state with a better balance between woody and non-woody plants. Shrubs will be shorter, with non-sprouting species temporarily be reduced. Fire may potentially produce an increase in invasive herbs. If increased grazing is allowed too soon after fire, introduced species are given an additional advantage. A key indicator of the approach to this transition is the build up of fuels, and fire is the trigger for the transition. Because of steep slopes on this site, a restoration pathway is impracticable.

State 4: Shorter Shrubs/ Increased Seeded Herbs State:
State 4 is dominated by shorter, mostly re-sprouting shrubs, and an herbaceous understory composed of both native and introduced perennials. Native shrubs include mountain big sagebrush and yellow rabbitbrush (*Chrysothamnus viscidiflorus*). Wildfire or prescribed burning followed by a period of grazing deferment will provide a balance between woody and non-woody plants. If increased grazing is allowed too soon after fire, introduced species may dominate the understory (4.1). This state will lose stability with the increase in exotics and the loss of native herbs and grasses.

Community Phase 4.1: shorter & fewer shrubs/ reduced juniper & mountain big sagebrush/ increased herbaceous understory
This plant community is dominated by re-sprouting shrubs, such as yellow rabbitbrush, with an understory of grazing-tolerant native herbs and invaded herbs, such as arrowleaf balsamroot.

State and transition model





BMF	Brush Management (fire)
HC	Historic Change
HCSLG	Heavy Continuous Season Long Grazing
NF	No Fire
PG	Prescribed grazing
WF	Wildfire

Inventory data references

When available, monitoring data (of various types) were employed to validate more subjective inferences made in this diagram. See the complete files in the office of the State Range Conservationist for more details.

Other references

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Contributors

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Approval

Kirt Walstad, 3/05/2024

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	04/20/2024
Approved by	Kirt Walstad
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:**

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

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

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

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

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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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:

    Sub-dominant:

    Other:

    Additional:

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

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

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

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

for the ecological site:

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17. **Perennial plant reproductive capability:**
