Ecological site R047XA611UT
Subalpine Clay Loam (mixed grasses/forbs)

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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. The southern half is in the High Plateaus of the Utah Section of the Colorado Plateaus Province of the Intermontane Plateaus. 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, and the Uinta Mountains, which trend east and west. 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 Uinta Mountains have a broad, gently arching, elongated shape. Structurally, they consist of a broadly folded anticline that has an erosion-resistant quartzite core. The Wasatch and Uinta Mountains have an elevation of 4,900 to about 13,500 feet (1,495 to 4,115 meters).

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, but Precambrian rocks are exposed in the Uinta Mountains. The Uinta Mountains are one of the few ranges in the United States that are oriented west to east. The southern Wasatch Mountains consist of Tertiary volcanic rocks occurring as extrusive lava and intrusive crystalline rocks.

The average precipitation is from 8 to 16 inches (203 to 406 mm) in the valleys and can range up to 73 inches (1854 mm) in the mountains. In the northern and western portions of the MLRA, peak precipitation occurs in the winter months. The southern and eastern portions have a greater incidence of high-intensity summer thunderstorms; hence, a significant amount of precipitation occurs during the summer 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 Aridisols, Entisols, Inceptisols, and Mollisols. The lower elevations are dominated by a frigid temperature regime, while the higher elevations experience cryic temperature regimes. Mesic temperature regimes come in on the lower elevations and south facing slopes in the southern portion of this MLRA. The soil moisture regime is typically xeric in the northern part of the MLRA, but grades to ustic in the extreme eastern and southern parts. The mineralogy is generally mixed and the soils are very shallow to very deep, generally well drained, and loamy or loamy-skeletal.

LRU notes

Major Land Resource Unit 47A is located in the northern half of the Middle Rocky Mountains Province of the Rocky Mountain System. This MLRA 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 slope alluvium, colluvium and till from mixed sources. Surface soils are gravelly to very gravelly loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but make generally make up less than 35 percent of the soil volume. These soils are deep to very deep, well-drained, and have moderate permeability. pH is moderately acidic to neutral. Available water-holding capacity ranges from 4.1 to 5.6 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly xeric to udic and the soil temperature regime is cryic. Precipitation ranges from 30 to 45 inches annually.

Associated sites

R047XA630UT	**Subalpine Stony Loam (snowfield sagebrush)** These sites can occur adjacent to each other.

Similar sites

R047XA557UT	**High Mountain Gravelly Loam (tall forb)** These sites have similar floral characteristics in having the herbaceous component as the dominant aspect.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Bromus carinatus* (2) *Geranium viscosissimum*

Physiographic features

This ecological site typically occurs on mountain slopes with slopes normally range from 10 to 40 percent but may occasionally be steeper. Slope steepness, aspect and elevation will influence the vegetative floristics of this site. Sites are typically located between 7,200 to 10,600 feet in elevation. Runoff is high.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Runoff class	High
Flooding frequency	None
Ponding frequency	None
Elevation	7,200–10,600 ft
Slope	10–40%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site characterized by cold, snowy winters and cool summers. The average annual precipitation ranges from 30 to 45 inches. October thru April, are typically the wettest months with June thru August 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 less reliable sources of moisture to support vegetative growth on this site.

Table 3. Representative climatic features

Frost-free period (characteristic range)	30-70 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	30-45 in

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 formed mostly in slope alluvium, colluvium and till from mixed sources. Surface soils are gravelly to very gravelly loam in texture. Rock fragments may be present on the soil surface and throughout the profile, but make generally make up less than 35 percent of the soil volume. These soils are deep to very deep, well-drained, and have moderate permeability. pH is moderately acidic to neutral. Available water-holding capacity ranges from 4.1 to 5.6 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly xeric to udic and the soil temperature regime is cryic. Precipitation ranges from 30-45 inches annually.

Table 4. Representative soil features

Parent material	(1) Slope alluvium–calcareous conglomerate (2) Till–sandstone (3) Colluvium–quartzite
Surface texture	(1) Gravelly, very gravelly loam
Family particle size	(1) Coarse-loamy (2) Fine
Drainage class	Well drained
Permeability class	Moderate
Depth to restrictive layer	60 in
Soil depth	60 in
Surface fragment cover <=3"	35%
Surface fragment cover >3"	5%
Available water capacity (0-40in)	4.1–5.6 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.9–7.3
Subsurface fragment volume <=3" (Depth not specified)	32%
Subsurface fragment volume >3" (Depth not specified)	5%

Ecological dynamics

As vegetation communities respond to changes in management or natural occurrences, thresholds can be crossed, which usually means that a reversal of direction is probably not possible without major energy input. The amount of energy input needed to effect vegetative shifts depends on what the present vegetation is and the desired results. The following diagram does not necessarily depict all the transition and states that this site may exhibit, but it does show some of the most common plant communities that can occur on the site and the transition pathways (arrows) among the communities. Bold lines surrounding each plant community or communities represent ecological thresholds. The ecological processes are discussed in detail, including photos, in the Plant Community Narrative section.

State 1: Reference State
This state includes the plant communities that were best adapted to the unique combination of factors associated with this ecological site prior to European settlement. It was in a natural dynamic equilibrium with the historic biotic, abiotic, climatic factors on its ecological site in North America at the time of European immigration and settlement. This dominant aspect of the plant community is tall forbs and mountain brome. The community is made up of 25 percent grass 65 percent forbs and 10 percent shrubs on a dry weight base.
This site is impacted by rodents (i.e.) potgut squirrels and pocket gophers. Another major influencing factor in this site is fire because of its association with quaking aspen and the needed fire frequency of 80 to 100 years for the aspen communities to maintain themselves.

All of these scenarios are very interrelated and dependent on weather patterns and events as well as fire frequency and intensity and also the amount and intensity of large and small herbivore use. Any set of events that are strong enough to force the plant community out of this pattern can push it over a threshold and push it into another state.

Community Phase 1.1: Tall forb, Cool season perennial grasses, Deciduous shrubs
This is the community that is described in the initial plant list. The fact that you will not find any species of sagebrush on the site and more tall forbs than grasses during the summer months are key identifying characteristics for this site. This community is represented with a typical plant community of 25 percent grasses, 70 percent forbs and 5 percent shrubs. One of the dominant forbs visually and in production is tall bluebell. The dominant grass is mountain brome and the dominant shrub visually is mountain snowberry. This community will have around 10 to 15 percent bare ground and surface rock fragments. This site will remain in phase 1.1 so long as the site continues to have the normal 80 to 100 year fires that are associated with the surrounding quaking aspen sites and there are no prolonged disturbances.

Community Phase 1.2: Cool season perennial bunch grasses, Tall forbs, Deciduous shrubs
Cool season perennial grasses, tall forbs, and some deciduous shrubs make up this phase in the reference state. This phase shows the results of overuse by large herbivores and small ungulates when the tall forbs have been damaged and grasses are allowed to gain a stronger place in the community. This community is represented with a plant community of 40% grasses, 35% tall forbs, 15 percent mid-height forbs and 10 percent deciduous shrubs. This community will have around 15 to 20 percent bare ground and surface rock fragments.

Community Phase 1.3: Tall and mid-height forbs, Deciduous shrubs, Cool season perennial bunch grasses
Site has been overused by grazing to the point that the mid-height forbs and deciduous shrubs have the advantage on the site. This community is represented with a plant community of 20 percent grasses, 35% tall forbs, 20 percent mid-height forbs and 25% deciduous shrubs. This community will have around 15 to 25 percent bare ground and surface rock fragments.

Community Pathways:
1.1a = This is caused by overuse by ungulates (i.e.) deer and/or elk. Most likely it would be elk as deer usually do not collect in that big of herds.
1.2a = Reduced use by ungulates.
1.2b = This is caused by the continued overuse by ungulates (i.e.) Deer and/or Elk.
1.3a = This is the result of fire. After the fire the area receives enough rest time for the tall forbs to recover.
1.3b = This is the results of fire. The deference between 1.3a and 1.3b is that the area is utilized by ungulates to soon and the grasses get more opportunity to express themselves.

Transition T1a

Introduction of non-native species into the ecosystem.

State 2: Current Potential State
This state includes the biotic communities that would become established on the ecological site if all successional sequences were completed without human interference under the present environmental conditions. Natural disturbances are inherent in its development. The Current Potential State (CPS) state will include acclimatized, naturalized or invasive nonnative species. There is no known way to effectively remove these plants from the site once they have become established. The level of occurrence of these plants in the CPS is such that careful management can prevent their domination of the site. There is no restoration pathway back to the Reference State. Plant communities within the CPS state may be managed and used for various purposes without significant alteration in plant community composition or production. It includes all of the plant communities that exist in the reference state with the inclusion of species that are non-native.

All of these scenarios are very interrelated and dependent on weather patterns and events as well as fire frequency and intensity and also the amount and intensity of large and small herbivore use. Any set of events that are strong enough to force the plant community out of this pattern can push it over a threshold and push it into another state.

Community Phase 2.1: Tall forbs, Cool season perennial bunch grasses, Deciduous shrubs, Introduced tall forbs
Tall forbs, perennial cool season grasses and deciduous shrubs with mountain snowberry being the most common. The fact that you will not find any species of sagebrush on the site and more tall forbs than grasses during the summer months are key identifying characteristics for this site. This community is represented with a plant community of 25 percent grasses, 70 percent forbs and 5 percent shrubs. One of the dominant forbs visually and in production is tall bluebell. The dominant grass is mountain brome and the dominant shrub visually is mountain snowberry along with any introduced and invasive plant species. This community will have 10 to 15 percent bare ground and surface rock fragments.

Community Phase 2.2: Cool season perennial bunch grasses, Tall forbs, Deciduous shrubs, Introduced tall forbs
Cool season perennial grasses, tall forbs, and some deciduous shrubs make up this phase. This phase shows the results of overuse by large herbivores and small ungulates when the tall forbs have been damaged and grasses are allowed to gain a stronger place in the community. This community is represented with a plant community of 40 percent grasses, 35 percent tall forbs, 15 percent mid-height forbs and 10 percent deciduous shrubs along with any introduced and/or invasive plant species. This community will have 15 to 20 percent bare ground and surface rock fragments.

Community Phase 2.3: Tall and mid-height forbs, Deciduous shrubs, Cool season perennial bunch grass, Introduced tall fobs
Site has been overused by grazing to the point that the mid-height forbs and deciduous shrubs have the advantage on the site. This community is represented with a mean plant community of 20 percent grasses, 35 percent tall forbs, 20 percent mid-height forbs and 25 percent deciduous shrubs along with any introduced and/or invasive plant species. This community will have 15 to 25 percent bare ground and surface rock fragments.

Community Pathways:
2.1a = This is caused by overuse by ungulates (i.e.) deer, elk, cattle and sheep. Most likely it would be elk, cattle and/or sheep as deer usually do not collect in that big of herds.
2.2a = This is caused by overuse by ungulates (i.e.) deer, elk, cattle and sheep. Most likely it would be elk, cattle and/or sheep as deer usually do not collect in that big of herds.
2.2b = This is caused by the continued overuse by ungulates (i.e.) deer and elk.
2.3a = This is the results of fire. After the fire the area receives enough rest time for the Tall Forbs to recover.
2.3b = This is the results of fire. The difference between 2.3a and 2.3b is that the area is utilized by ungulates to soon and the grasses get a little greater opportunity to express themselves.

Transition T2a
Lack of fire disturbance and the overuse of the site by large ungulates. Prolonged drought, overgrazing, extreme lengthening of the fire interval frequency. Also prolonged drought along with prolonged overgrazing.

State 3: Grass State
This state is the condition of the site when grazing and other factors damage the forb plant community. It will have a visual and production dominance of grasses, followed by deciduous shrubs and then by those native tall and mid-

height forbs and introduced forbs. The community will be 40 percent grasses, 35 percent deciduous shrubs, and 25 percent forbs. At this time forbs like Western coneflower move to the forefront in the forb community. It appears that this community can exist for an extended period of time until environmental conditions set the stage to move back to the more stable state found in the ”Current Potential State”.

Community Phase 3.1: Cool-season perennial bunchgrass, Deciduous shrubs, Tall and mid-stature native and introduced forbs
This is the state that this site will move to when it is overgrazed.

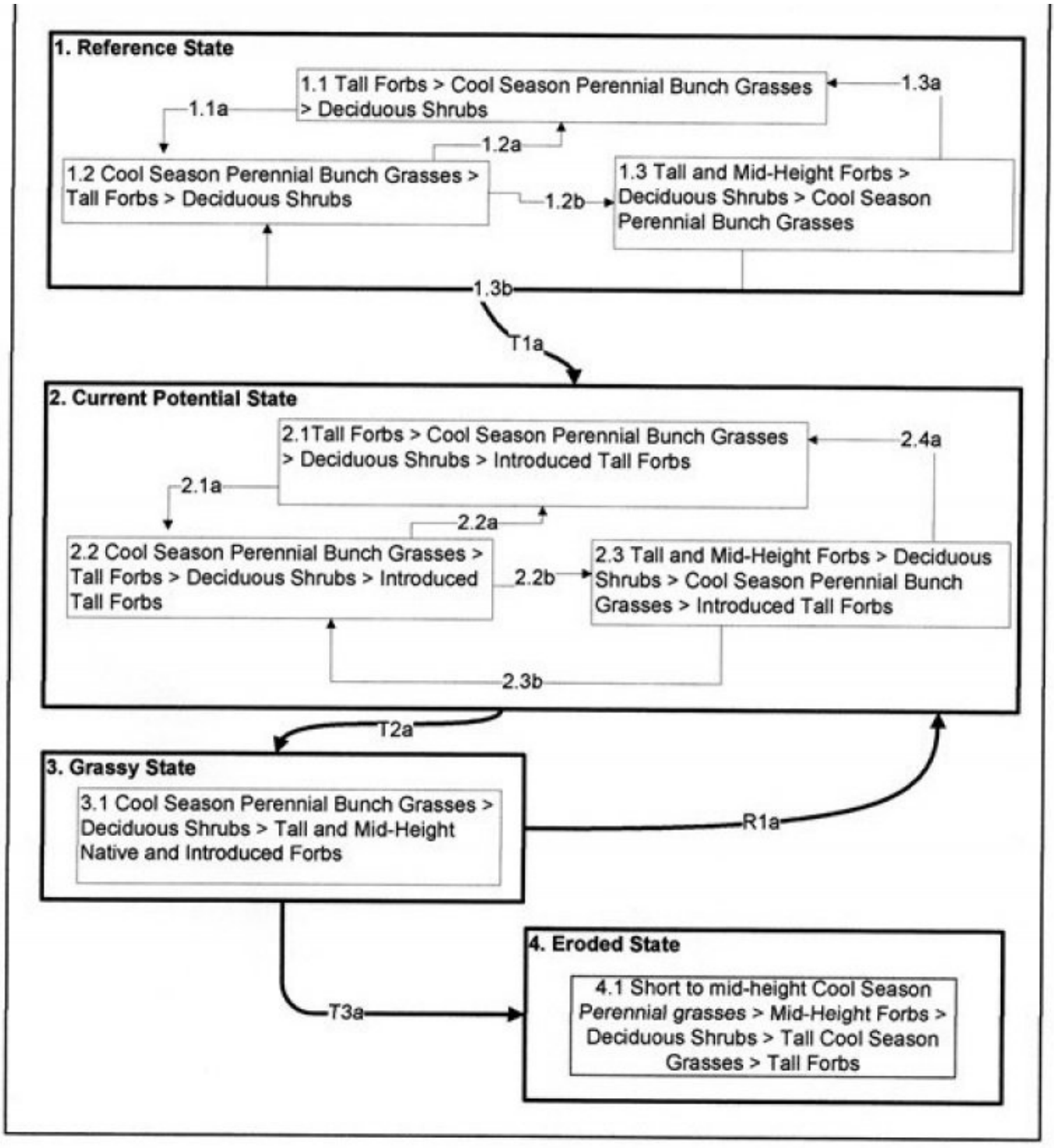
Transition T3a
Prolonged overgrazing; coupled with drought extreme lengthening of the fire interval due to the overgrazing reducing or eliminating the community’s ability to carry fire leading to extreme accelerated erosion.

Restoration Pathway R1a
Time with proper management that favors the native plants as they increase on site and/or move back into the site.

State 4: Eroded State
This is the state that exists when the site has deteriorated to the point where so much of the top soil has eroded away the site can no longer produce the plant community and support the production that it had in the “Reference or Current Potential States” It will often be represented with 15 percent mid-stature grasses, 25 percent short grasses, 35 percent deciduous shrubs, 15 percent mid-stature forbs and 10% tall forbs with the forbs being the grazing tolerant ones. At this state there will be twice as much bare ground and rock fragment visible as in the more productive states.

Community Phase 4.1: Short- and mid-stature forbs and Cool-season grasses, Deciduous shrub, Tall cool-season grass,
Short to mid-stature cool-season perennial grasses mid-height to short forbs deciduous shrubs perennial invasive plants annual invasive plants tall cool season perennial grasses tall forbs. This state exists when the site has deteriorated to the point that a good share of the top soil has eroded away and the top horizons have been lost. Return to a previous state is not possible within management time frames. Often the site will have a gravelly surface that will resemble the windblown desert soil surface known as desert pavement. In this state the site is only about one-third to one-half as productive as in the Reference State.

State and transition model


1. Reference State
1.1 Tall Forbs > Cool Season Perennial Bunch Grasses > Deciduous Shrubs
1.1a
1.3a
1.2a
1.2 Cool Season Perennial Bunch Grasses > Tall Forbs > Deciduous Shrubs
1.2b
1.3 Tall and Mid-Height Forbs > Deciduous Shrubs > Cool Season Perennial Bunch Grasses
1.3b
T1a
2. Current Potential State
2.1Tall Forbs > Cool Season Perennial Bunch Grasses > Deciduous Shrubs > Introduced Tall Forbs
2.4a
2.1a
2.2a
2.2 Cool Season Perennial Bunch Grasses > Tall Forbs > Deciduous Shrubs > Introduced Tall Forbs
2.2b
2.3 Tall and Mid-Height Forbs > Deciduous Shrubs > Cool Season Perennial Bunch Grasses > Introduced Tall Forbs
2.3b
T2a
3. Grassy State
3.1 Cool Season Perennial Bunch Grasses > Deciduous Shrubs > Tall and Mid-Height Native and Introduced Forbs
R1a
T3a
4. Eroded State
4.1 Short to mid-height Cool Season *Perennial grasses* > Mid-Height Forbs > Deciduous Shrubs > Tall Cool Season Grasses > Tall Forbs

Legend

1.1a = Overuse by ungulates.

1.2a = Reduced use by ungulates.

1.2b = Continued overuse by ungulates.

1.3a = Fire with natural succession.

1.3b = Fire with immediate use by ungulates.

2.1a = Overuse by ungulates. Domestic livestock now present.

2.2a = Result of prescribed grazing/management.

2.2b = Continued overuse by ungulates.

2.3a = Fire with natural succession.

2.3b = Fire with immediate use by ungulates.

T1a – Introduction of non native species.

T2a – Lack of fire and/or overgrazing.

T3a – Prolonged lack of fire and/or overgrazing.

R1a – Time and management.

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

Alexander, R. R. 1985. Major habitat types, community types, and plant communities in the Rocky Mountains. USDA- Forest Service Rocky Mountain Forest and Range Experiment Station. General technical report RM-123. 105p.

Alexander 1988. Forest vegetation on National Forests in the Rocky Mountain and Intermountain Regions: Habitat types and community types. USDA- Forest Service Rocky Mountain Forest and Range Experiment Station. General technical report RM-162. 47p.

Galatowitsch, S.M. 1990. Using the original land survey notes to reconstruct pre-settlement landscapes in the American West. Great Basin Naturalist: 50(2): 181-191. Keywords: [Western U.S., conservation, history, human impact]

Parson, R. E. 1996. A History of Rich County. Utah State Historical Society, County Commission, Rich County, Utah. Keywords: [Rich County, Utah, Historic land use, European settlements]

USDA-NRCS. 2003. National Range and Pasture Handbook. in USDA, editor, USDA-Natural Resources Conservation Service-Grazing Lands Technology Institute. Keywords: [Western US, Federal guidelines, Range pasture management]

Western Regional Climate Center, Western U.S. Climate Historical Summaries. Available at: http://www.wrcc.dri.edu/summary/Climsmut.html. Accessed 15 June 2009.

Web Soil Survey, Official Soil Series Descriptions. Available at: http://soils.usda.gov/technical/classification/osd/index.html. Accessed 15 June 2009.

Contributors

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Approval

Kendra Moseley, 2/06/2025

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	05/11/2025
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):**

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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:**
