USDA Natural Resources
Conservation Service

Ecological site R047XB508UT
High Mountain Loam (aspen)

Last updated: 2/11/2025
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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. 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

E47B is the Wasatch Mountains South MLRA. It occurs in the Loa, Panguitch, New Harmony area. Most of Zion, Bryce Canyon National Parks and Cedar Breaks National Monument are in this area. This area is composed of mountain ranges that run north and south.

Ecological site concept

The soils of this site formed mostly in colluvium/residuum from sandstone, shale and igneous rock. Surface soils are stony loam, clay loam to 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 deep to very deep, well-drained, and have slow to moderate permeability. pH is slightly acidic to slightly alkaline. Available water-holding capacity ranges from 4.0 to 7.0 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly ustic and the soil temperature regime is cryic. Precipitation ranges from 22 to 35 inches annually.

Associated sites

R047XB516UT	**High Mountain Loam (mountain big sagebrush)** Sites can occur adjacent to each other.

Similar sites

F047XA532UT	**High Mountain Stony Loam (Douglas-fir)** These sites have similar floral characteristics however this site has more rock fragments in the soil profile.

Table 1. Dominant plant species

Tree	(1) *Populus tremuloides*
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This ecological site typically occurs on mountain slopes and mountain valleys. Slopes normally range from 4 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 8,000 to 10,500 feet in elevation. Runoff is high to very high.

Table 2. Representative physiographic features

Landforms	(1) Mountain valley (2) Mountain slope
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	8,000–10,500 ft
Slope	4–40%
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by cold, snowy winters and cool, moist summers. Approximately 50 percent of the moisture comes during the plant growth period from April 1 through September 30. On the average April, May, and June are the driest months and July, August, and September are the wettest months. Average annual precipitation is 22 to 35 inches.

Table 3. Representative climatic features

Frost-free period (characteristic range)	40-70 days
Freeze-free period (characteristic range)	

Precipitation total (characteristic range)	22-35 in

Influencing water features

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

Wetland description

N/A

Soil features

The soils of this site formed mostly in colluvium and residuum from sandstone, shale and igneous rock. Surface soils are stony loam, clay loam to 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 deep to very deep, well-drained, and have slow to moderate permeability. pH is slightly acidic to slightly alkaline. Available water-holding capacity ranges from 4.0 to 7.0 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly ustic and the soil temperature regime is cryic. Precipitation ranges from 22 to 35 inches annually.

Table 4. Representative soil features

Parent material	(1) Colluvium–sandstone and shale (2) Residuum–sandstone and shale (3) Colluvium–igneous rock (4) Residuum–igneous rock
Surface texture	(1) Loam (2) Clay loam (3) Stony loam
Family particle size	(1) Loamy (2) Clayey-skeletal
Drainage class	Well drained
Permeability class	Slow to moderate
Depth to restrictive layer	60–100 in
Soil depth	60–100 in
Surface fragment cover <=3"	0–20%
Surface fragment cover >3"	0–21%
Available water capacity (Depth not specified)	4–7 in
Calcium carbonate equivalent (Depth not specified)	0%
Electrical conductivity (Depth not specified)	0 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	6.1–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–30%
Subsurface fragment volume >3" (Depth not specified)	0–25%

Ecological dynamics

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 1 Reference State
This Reference State describes the biotic communities that may become established on this ecological site if all successional sequences are completed under natural disturbance conditions. Species composition is generally dominated by mature or seral aspen community types. Shrubs are of minor importance in this state.

Several seral communities are described in this reference state including those of open canopy, seedling, sapling, pole, immature forest, mature forest, and eventually to an old or overmature forest type if fire is excluded for very long periods of time.

The primary disturbance mechanisms in this state are overstory canopy density, weather fluctuations, and fire, or lack of fire. The reference state is self-sustaining and resistant to change beyond it's normal seral community types due to a good adaptation to natural disturbances and a high resilience following those disturbances. When natural disturbances such as fire do occur, the rate of recovery can be quite variable.

Feedbacks: Natural fluctuations in weather patterns that allow for a self-sustaining mix of a aspen, shrubs and native grass and grasslike 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 non-native plants to establish.

Trigger: The establishment of non-native plant species.

Community 1.1 Mature Aspen Community Phase.
This community phase is dominated by an overstory canopy of mature aspen that have reached or are near maximal heights for the site. Average age is 80 to 120 years. Trees have developed tall, straight, clear stems with short, high rounded crowns. Tree canopy cover ranges from 20 to 40 percent. Understory vegetation is strongly influenced by tree competition, overstory shading, duff accumulation, etc. A few seedlings and/or saplings of quaking aspen occur in the understory. Shade tolerant plants dominate the understory.

Community 1.2 Aspen Seedling/ Herbaceous Community Phase.
This community phase is dominated by aspen sprouts and seedlings, and by perennial grasses and forbs under nearly full sunlight. This stage is experienced after a major disturbance such as crown fire, insect damage or disease. Any skeleton forest (dead trees) remaining have little or no affect on the composition and production of the herbaceous vegetation. Various amounts of tree seedlings 1 to 25 years old are present up to the point where they are obviously a major component of the vegetal structure.

Air dry composition of this site is approximately 30 percent grasses, 15 percent forbs, 10 percent shrubs and and 55 aspen reproduction. Thick duff layers are present on some sites, completely covering the forest floor with needles and twigs.

Community 1.3 Immature Aspen Forest/ Herbaceous Community Phase.
This community phase is characterized by a growing canopy of pole sized and immature aspen. Trees are developing tall, straight, clear stems with narrow pointed crowns. Average age is 25 to 80 years. Tree canopy cover ranges from 10 to 20 percent. Understory vegetation is somewhat influenced by tree competition, overstory shading, duff accumulation, etc. Seedlings and saplings of quaking aspen are common in the understory. Shade tolerant plants dominate the understory.

Air dry composition of this site is approximately 20 percent grasses, 10 percent forbs, 10 percent shrubs and and 60 mature aspen. Thick duff layers are present on some sites, completely covering the forest floor with needles and twigs.

Community 1.4 Decadent Aspen Community Phase.
This community phase is dominated by an overstory canopy of very mature and decadent aspen that have reached maximal heights for the site. Average age is 120 plus years. Trees have developed tall, straight, clear stems with high, very rounded crowns. This phase typically develops in the absence of wildfire or other naturally occurring disturbances including disease and insect damage. Tree canopy cover is at a maximum for the site and is commonly greater than 50 percent. Very old trees often show signs of disease and/or insect damage. Understory vegetation is somewhat sparse due to tree competition, overstory shading, duff accumulation, etc.

Pathway 1.1B Community 1.1 to 1.2
This community pathway occurs when wildfire removes the aspen overstory. This event can be exacerbated by drought, insect damage or disease.

Pathway 1.1A Community 1.1 to 1.4
This community pathway occurs when fire is excluded from the plant community for long periods of time.

Pathway 1.2A Community 1.2 to 1.3
This community pathway occurs when fire is excluded from the plant community for long periods of time.

Pathway 1.3A Community 1.3 to 1.1
This community pathway occurs when fire is excluded from the plant community for long periods of time.

Pathway 1.3B Community 1.3 to 1.2
This community pathway occurs when wildfire removes the growing aspen overstory. This event can be exacerbated by drought, insect damage and/or disease.

Pathway 1.4A Community 1.4 to 1.1
This community pathway occurs when insect damage or disease kills old trees and allows the community to return to a community phase 1.1 type with snags present.

Pathway 1.4B Community 1.4 to 1.2
This community pathway occurs when wildfire removes the aspen overstory. This event can be exacerbated by drought, insect damage or disease.

State 2 Current Potential State
The current potential state is similar to the reference state, however minor amounts of non-native species may now be present in all community phases. This condition has not been well documented and so community phases in this state are based on possible community dynamics and not documented facts. This state describes the biotic communities that may become established on this ecological site if all successional sequences are completed under natural disturbance conditions. Species composition is generally dominated by mature or seral aspen community types. Shrubs are of minor importance in this state.
Several seral communities are described in this reference state including those of open canopy, seedling, sapling, pole, immature forest, mature forest, and eventually to an old or overmature forest type if fire is excluded for very long periods of time.

The primary disturbance mechanisms in this state are overstory disturbance, canopy density, weather fluctuations, and fire, or lack of fire. The current potential state is still self-sustaining and resistant to change beyond it's normal seral community types due to a good adaptation to natural disturbances and a high resilience following those disturbances. When disturbances such as fire do occur, the rate of recovery can be quite variable.

Current Potential State: Plant communities influenced by Aspen canopy density, long term weather fluctuations, and periodic fire.

Feedbacks: Natural fluctuations in weather patterns that allow for a self-sustaining mix of a aspen, shrubs and native grass and grasslike community. Insect herbivory, more frequent fires, or other disturbances that may allow for the increase of non-native species.

At-risk Community Phase: All communities are at risk when native plants are stressed and nutrients become

available for non-native plants to increase.

Trigger: The increase of non-native plant species.

Community 2.1 Mature Aspen, Non-Native Herbaceous Community Phase.
This community phase is dominated by an overstory canopy of mature aspen that have reached or are near maximal heights for the site. Trees have developed tall, straight, clear stems with short, high rounded crowns. Tree canopy cover ranges from 20 to 40 percent. Understory vegetation is strongly influenced by tree competition, overstory shading, duff accumulation, etc. A few seedlings and/or saplings of quaking aspen occur in the understory. Shade tolerant plants dominate understory species. Non-native species including smooth brome, orchardgrass, and Kentucky bluegrass may now be present in the community.

Air dry composition of this site is approximately 25 percent grasses, 10 percent forbs, 10 percent shrubs and aspen reproduction and 65 mature aspen. Thick duff layers are present on some sites, completely covering the forest floor with needles and twigs.

Community 2.2 Aspen Seedling/ Non-Native Herbaceous Community Phase.
This community phase is dominated by aspen sprouts and seedlings, and by perennial grasses and forbs under nearly full sunlight. This stage is experienced after a major disturbance such as crown fire, insect damage or disease. Any skeleton forest (dead trees) remaining have little or no affect on the composition and production of the herbaceous vegetation. Various amounts of tree seedlings 1 to 25 years old are present up to the point where they are obviously a major component of the vegetal structure. Non-native including smooth brome, orchardgrass, and Kentucky bluegrass may also occur on the site.
Air dry composition of this site is approximately 30 percent grasses, 15 percent forbs, 10 percent shrubs and and 55 aspen reproduction. Thick duff layers are present on some sites, completely covering the forest floor with needles and twigs.

Community 2.3 Immature Aspen Forest/Non-Native Herbaceous Community Phase.
This community phase is characterized by a growing canopy of pole sized and immature aspen. Trees are developing tall, straight, clear stems with narrow pointed crowns. Average age is 25 to 80 years. Tree canopy cover ranges from 10 to 20 percent. Understory vegetation is somewhat influenced by tree competition, overstory shading, duff accumulation, etc. Seedlings and/or saplings of quaking aspen are common in the understory. Shade tolerant plants dominate understory. Non-native species including smooth brome. orchardgrass and Kentucky bluegrass are present in the community
Air dry composition of this site is approximately 20 percent grasses, 10 percent forbs, 10 percent shrubs and and 60 mature aspen. Thick duff layers are present on some sites, completely covering the forest floor with needles and twigs.

Community 2.4 Decadent Aspen, Non-Native Herbaceous Community Phase.
This community phase is dominated by an overstory canopy of very mature and decadent aspen that have reached maximal heights for the site. Average age is 120 plus years. Trees have developed tall, straight, clear stems with high, very rounded crowns. This phase typically develops in the absence of wildfire or other naturally occurring disturbances including disease and insect damage. Tree canopy cover is at a maximum for the site and is commonly greater than 50 percent. Very old trees often show signs of disease and insect damage. Understory vegetation is somewhat sparse due to tree competition, overstory shading, duff accumulation, etc. Minor amounts of non-native species including smooth brome, orchardgrass and Kentucky bluegrass may be present on the community.
Air dry composition of this site is approximately 5 percent grasses, 5 percent forbs, 10 percent shrubs and 70 aspen. Bare ground is variable (5 to 30 percent) depending on litter and biological crust cover, which are also variable (10 to 40 percent) and surface rock fragments (0 to 50 percent). Thick duff layers are often present, completely covering the forest floor with needles and twigs.

Pathway 2.1B Community 2.1 to 2.2
This community pathway occurs when wildfire removes the growing aspen overstory. This event can be exacerbated by drought, insect damage and disease.

Pathway 2.1A Community 2.1 to 2.4
This community pathway occurs when fire is excluded from the plant community for long periods of time.

Pathway 2.2A Community 2.2 to 2.3
This community pathway occurs when fire is excluded from the plant community for long periods of time.

Pathway 2.3A Community 2.3 to 2.1
This community pathway occurs when fire is excluded from the plant community for long periods of time.

Pathway 2.3B Community 2.3 to 2.2
This community pathway occurs when wildfire removes the growing aspen overstory. This event can be exacerbated by drought, insect damage and disease.

Pathway 2.4B Community 2.4 to 2.1
This community pathway occurs when insect damage or disease kills old trees and allows the community to return to a community phase 2.1 type with snags present.

Pathway 2.4A Community 2.4 to 2.2
This community pathway occurs when wildfire removes the growing aspen overstory. This event can be exacerbated by drought, insect damage and disease.

State 3 Logged/Disturbed State
The logged or disturbed state is similar to the current potential state, however merchantable timber composed mostly of mature and old aspen have been removed. Various amounts of invasive species may also now be present in all community phases. This condition has not been well documented and so community phases in this state are based on possible community dynamics and not documented facts. Species composition is generally dominated by an immature canopy of aspen. Shrubs are of minor importance in the understory. A wide diversity of perennial forbs and grasses are also present. Non-native species including orchard grass, Kentucky bluegrass and smooth brome may also be present. These species could have been seeded as part of the site rehabilitation following the logging process.

Logging will release younger aspen trees and will give the site the look of an immature forest. Site will return to a mature, and finally an old or over-mature forest type if fire is excluded for very long periods of time.

The primary disturbance mechanisms are logging, road building or other man caused activities, weather fluctuations and fire or lack of fire. The logged state is still self sustaining but has a lower resistant to change due to a reduced resistance to disturbances. When disturbances do occur, the rate of recovery can be highly variable.

Logged/disturbed State: Plant communities influenced by man caused activities, wildlife browsing, insect herbivory, weather fluctuations, fire periods and surface disturbances.
Indicators: A community dominated by immature aspen with an understory of aspen reproduction, shrubs, grasses and forbs. The density of the overstory canopy determines the amount and composition of the other native perennial grasses, grass-likes and forbs that may be present.

Feedbacks: Natural fluctuations in weather patterns that allow for a self-sustaining mix of a aspen, shrubs and native grass and grasslike community. Insect herbivory, more frequent fires, or other disturbances that may allow for the increase of non-native species.
At-risk Community Phase: All communities are at risk when native plants are stressed and nutrients become available for non-native plants to increase.

Trigger: The increase of non-native plant species.

Community 3.1 Logged Aspen Forest Community Phase.
This community phase is typically found following logging or other man caused activity such as road building or pipeline construction. It is characterized by a partial canopy of aspen. Pole and immature sized trees are present and are beginning to once again dominate the community. Shrubs are a minor component in the understory as well as native perennial grasses and forbs. Non-native species including orchard grass, Kentucky bluegrass and smooth brome may potentially also be found on the site. Understory vegetation is somewhat influenced by tree competition, overstory shading, duff accumulation, etc. Seedlings and saplings of quaking aspen are common in the understory.

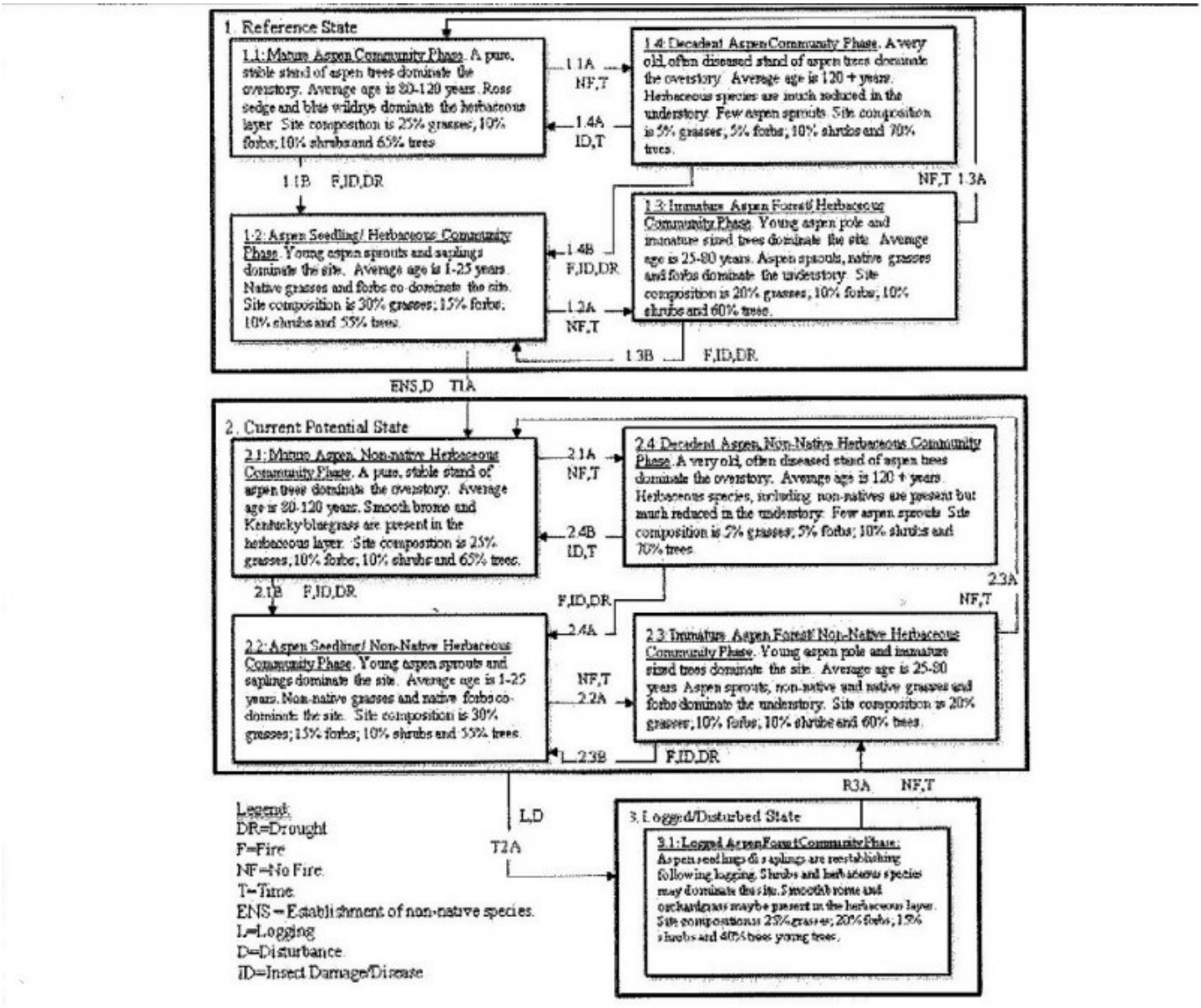
Air dry composition of this site is approximately 25 percent grasses, 20 percent forbs, 15 percent shrubs and and 40 mature aspen. Thick duff layers are present on some sites, completely covering the forest floor with needles and twigs.

Transition T1A State 1 to 2
This transitional pathway occurs when various disturbances such as road building, pipeline construction or fence-line clearing provides and opportunity for non-native species to become established. Seeding of these species could be a normal part of these activities. Once non-native species are established, a threshold has been crossed.

Transition T2A State 2 to 3
This transitional pathway occurs when timber logging and its associated activities, including road building and skid trail development, removes mature and over-mature aspen trees from the site and provides an opportunity for non-native species to increase. Seeding species such as orchardgrass and smooth brome would often be a normal part of these activities. Once the site is logged, a threshold has been crossed.

Restoration pathway R3A State 3 to 2
This restoration pathway occurs following logging activities when the site is allowed to recover naturally. Pole sized and immature aspen trees are increasing in dominance. Seeded, non-native herbaceous species where present, are well established.

State and transition model



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

Sarah Quistberg, 2/11/2025

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	Sarah Quistberg
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:**