USDA Natural Resources Conservation Service

Ecological site F047XC520UT
High Mountain Stony Loam (mixed conifer)

Last updated: 2/05/2025
Accessed: 05/10/2025

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 MLRA includes the Uinta Mountains, which trend east and west. 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. Rocks exposed in the Uinta mountains are Precambrian. The Uinta Mountains are one of the few ranges in the United States that are oriented west to east.
The average precipitation can range up to 73 inches (1854 mm) in the mountains. The Uinta mountains 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 Entisols, Inceptisols, and Mollisols.

LRU notes

This LRU is the Uinta Mountains portion of MLRA 47 that run east and west which includes the Uinta Wilderness and The Flaming Gorge National Recreation Area and towns such as Evanston, Wyoming, Hanna and Tabiona, Utah. Structurally these mountains consist of a broadly folded anticline that has an erosion resistance quartzite core. The Duchesne River and many other tributaries to the Green River run through this range, as well as the headwaters of the Bear River. The lower elevations are dominated by a frigid temperature regime, while the higher elevations experience cryic temperature regimes. The soil moisture regime is typically ustic. The minerology is generally mixed and the soils are very shallow to very deep, generally well drained, and loamy, sandy or sandy-skeletal.

Ecological site concept

This site is typically found in conjunction with Aspen sites.
The site is found on mountain slopes. It contains an association of Englemann's spruce, Sub-alpine fir, White fir, Douglas-fir and Lodgepole pine. It has a notable amount of Sub-alpine fir that grows in a low growth form resembling Common Juniper. Quite often the Douglas fir has been high graded out of these sites. It has an understory of forbs, shrubs and grasses in that order of importance. This site was first found on the top of Tabby Mountain.

The soils of this site formed mostly in colluvium over residuum and slope alluvium derived from conglomerate, metamorphic and sedimentary rocks. Surface soils are very dark and gravelly sandy-loam, cobbly-loam, or stony-sandy loam in texture. Rock fragments may be present on the soil surface and throughout the profile, and make up

more than 60 percent of the soil volume. These soils are shallow to moderately deep, well-drained, and have moderate to moderately rapid permeability and high runoff class. The pH is moderately acidic to slightly alkaline. Available water-holding capacity ranges from 1.7 to 4.6 inches of water in the upper 60 inches of soil. The soil moisture regime is udic and the soil temperature regime is cryic. Precipitation ranges from 28 to 36 inches annually.

Associated sites

F047XC531UT	**High Mountain Stony Loam (quaking aspen)** These sites often occur adjacent to each other.

Similar sites

F047XC512UT	**High Mountain Stony Loam (Douglas-fir)** Sites are similar, however this site has less conifer diversity.

Table 1. Dominant plant species

Tree	(1) *Picea engelmannii* (2) *Abies lasiocarpa*
Shrub	Not specified
Herbaceous	Not specified

Physiographic features

This ecological site typically occurs on mountain slopes. Slopes normally range from 20 to 70 percent but may occasionally be steeper. Slope steepness, aspect and elevation will influence the vegetative floristics of this site. Sites are typically located between 7,600 to 10,300 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	7,600–10,300 ft
Slope	20–70%
Aspect	Aspect is not a significant factor

Table 3. Representative physiographic features (actual ranges)

Runoff class	Not specified
Flooding frequency	Not specified
Ponding frequency	Not specified
Elevation	7,450–10,330 ft
Slope	2–70%

Climatic features

The climate of this site characterized by cold, snowy winters and cool summers. The average annual precipitation ranges from 28 to 36 inches. March thru May and August, are typically the wettest months with June and July 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 4. Representative climatic features

Frost-free period (characteristic range)	50-70 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	28-36 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 colluvium over residuum and slope alluvium derived from metamorphic and sedimentary rocks. Surface soils are very dark and gravelly sandy-loam, cobbly-loam, or stony-sandy loam in texture. Rock fragments are present on the soil surface and throughout the profile, and make up more than 60 percent of the soil volume. These soils are shallow to moderately deep, well-drained, and have moderate to moderately rapid permeability and high runoff class. pH is moderately acidic to slightly alkaline. Available water-holding capacity ranges from 1.7 to 4.6 inches of water in the upper 60 inches of soil. The soil moisture regime is udic and the soil temperature regime is cryic.

Table 5. Representative soil features

Parent material	(1) Colluvium–metamorphic and sedimentary rock (2) Slope alluvium–metamorphic and sedimentary rock (3) Residuum–metamorphic and sedimentary rock
Surface texture	(1) Stony sandy loam (2) Cobbly loam (3) Gravelly sandy loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Available water capacity (0-60in)	1.7–4.6 in
Calcium carbonate equivalent (0-60in)	0%
Electrical conductivity (0-60in)	0–1 mmhos/cm
Sodium adsorption ratio (0-60in)	0
Soil reaction (1:1 water) (0-60in)	5.6–7.5
Subsurface fragment volume <=3" (0-60in)	13–59%
Subsurface fragment volume >3" (0-60in)	21–27%

Ecological dynamics

It is impossible to determine in any quantitative detail the historic plant community for this ecological site because of

the lack of direct historical documentation preceding all human influence. In the 1860s, Europeans brought cattle and horses to the area, grazing large numbers of them on unfenced parcels year-long. Itinerant and local sheep flocks followed, largely replacing cattle as the browse component increased.

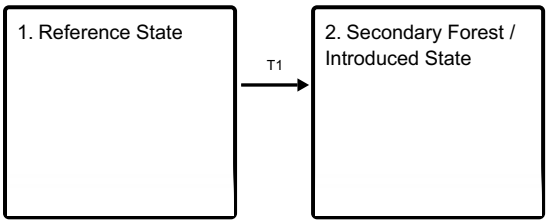
Below is a State and Transition Model diagram to illustrate the “phases” (common plant communities), and “states” (aggregations of those plant communities) that can occur on the site. Differences between phases and states depend primarily upon observations of a range of disturbance histories in areas 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, and kinds and times of timber harvest, 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 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.

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.

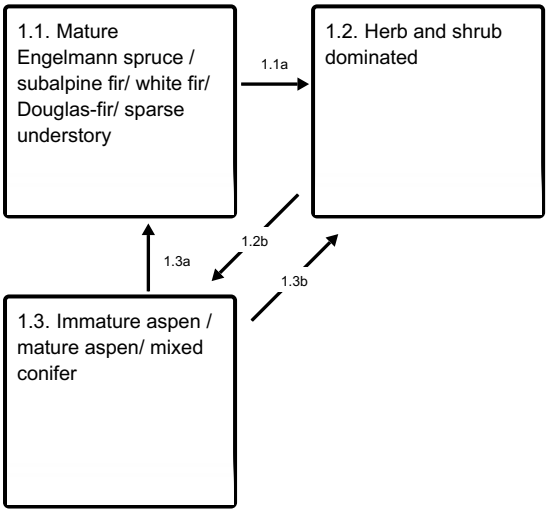
State and transition model

Ecosystem states



T1 - introduction of exotic species

State 1 submodel, plant communities



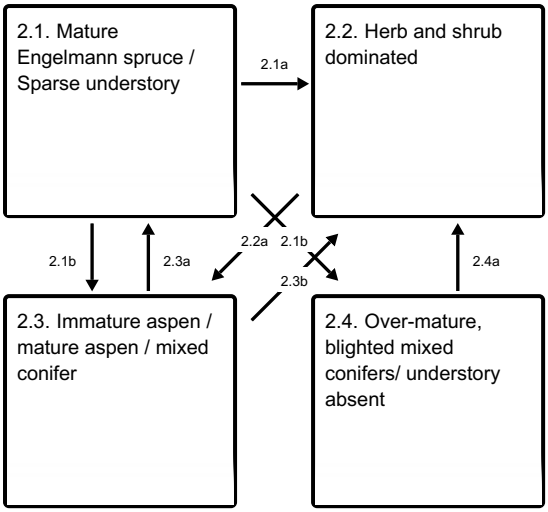
1.1a - Wildfire

1.2b - About 60 years after fire

1.3a - After about 100 years following the last fire

1.3b - Wildfire

State 2 submodel, plant communities



2.1a - stand-replacing wildfire or intensive logging

2.1b - removal of only the mature Douglas fir and Engelmann spruce

2.1b - fire exclusion

2.2a - About 60 years after fire

2.3a - After about 100 years following the last fire

2.3b - stand-replacing wildfire or intensive logging

2.4a - stand-replacing wildfire

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 relict areas where they exist. At the time of European colonization, what would have been observed on these sites would have primarily depended on the time since the last wildfire occurred. If fire had not occurred for about 100 years, a stand of mixed conifers including Engelmann Spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), Douglas-fir (*Pseudotsuga menziesii*), and white fir (*Abies concolor*), and lodgepole pine (*Pinus contorta*) would have been the dominant species occupying the site (1.1). The understory would have been relatively sparse under mature trees due to tree competition, overstory shading, and duff accumulation. Wildfire or insect outbreaks on particular tree species would have replaced these stands with a rich diversity of herb-dominated vegetation. In the absence of any major disturbance, the vegetation would have progressed into more of a shrub-herb co-dominance, followed by the increasing presence of aspen (*Populus tremuloides*) first as seedlings and saplings, and later as mature aspen with mixed conifer seedlings. Ultimately the conifers would have outcompeted aspen, returning the climax vegetation. Wildfire would have been the primary disturbance factor prior to colonization, although periodic outbreaks of insects destroying particular tree species could reset the successional clock. Early successional stages were shorter in duration.

Community 1.1
Mature Engelmann spruce / subalpine fir/ white fir/ Douglas-fir/ sparse understory

This plant community would have been characterized by a stand of mature mixed conifers including Engelmann spruce, subalpine fir, Douglas-fir, white fir, and lodgepole pine with a sparse understory of Geyer's sedge (*Carex geyeri*), slender wheatgrass (*Elymus trachycaulus*), and heartleaf arnica (*Arnica cordifolia*).

Community 1.2
Herb and shrub dominated

This plant community would have developed within the first 5 years following fire. Geyer's sedge, slender wheatgrass, and heartleaf arnica would have been the dominant species, along with many other short-lived herbaceous shade-intolerant species. After about 5 years, shrubs would begin to establish in the site. Between 5

and 60 years after fire, shrubs and herbs would co-dominate the site. The increasing shrub component would have included mountain snowberry (*Symphoricarpos oreophilus*), creeping barberry (*Mahonia repens*), mallow ninebark (*Physocarpus malvaceus*), and gooseberry currant (*Ribes montigenum*), among others.

Community 1.3
Immature aspen / mature aspen/ mixed conifer

This plant community would have been dominated by a stand of immature aspen, a seral species, while the conifer species would have begun to establish themselves under other nurse plants. A stand of immature aspen would have existed approximately 60 to 80 years following the last fire. Aspen would have continued to mature while the various conifers would have become well established in the understory. A stand of mature aspen intermixed with mixed conifers and various understory shrubs would have been encountered approximately 80 to 100 years post fire.

Pathway 1.1a
Community 1.1 to 1.2

Wildfire would have removed the trees, allowing shade-intolerant herbs to flourish briefly.

Pathway 1.2b
Community 1.2 to 1.3

About 60 years after fire, aspen would have become established in the site.

Pathway 1.3a
Community 1.3 to 1.1

After about 100 years following the last fire, the conifers would become mature, shading out aspen and the shade-intolerant shrub and herb species in the understory.

Pathway 1.3b
Community 1.3 to 1.2

Wildfire would have removed the trees, allowing shade-intolerant herbs to flourish briefly.

State 2
Secondary Forest / Introduced State

State 2 is similar to State 1 in form and function, with the exception of the presence of non-native plants and animals, possible extinctions of native species, a different climate, and a secondary stand of trees. State 2 is a description of the ecological site following Euro-American settlement. This state can be regarded as the current potential. With the least amount of disturbance or manipulation of the fire regime, a mature stand of subalpine fir, white fir, and Douglas fir with a sparse understory component is expected at this site (2.1). As with the Reference State, time since last wildfire remains the key factor in determining what vegetation will be encountered on these sites. Wildfire, particularly crown fires, or complete harvesting of the forest will replace these stands with a rich diversity of herb-dominated vegetation. In the absence of any major disturbance, the vegetation will progress into more of a shrub-herb co-dominance, followed by the increasing presence of aspen, first as seedlings and saplings, and later as mature aspen with immature conifers. Ultimately the conifers will outcompete aspen, returning to a semblance of climax vegetation. In some areas where wildfire has been prevented, the conifers may become over-mature and consequently are more susceptible to infestation by insects and pathogens. The resiliency of this State can be maintained by moderating human uses of the forest for timber and grazing.

Community 2.1
Mature Engelmann spruce / Sparse understory

This plant community is characterized by a stand of mature subalpine fir, white fir, and Douglas-fir. A sparse understory of Geyer’s sedge, slender wheatgrass, and heartleaf arnica may be present.

Community 2.2
Herb and shrub dominated

This plant community will develop within the first 5 years following the last fire or complete tree removal. Geyer's sedge, slender wheatgrass, and heartleaf arnica will be the dominant understory species. A small component of introduced species may be present. The combination of heavy season long livestock grazing would accelerate woody plant (shrub) establishment and diminish the herbaceous understory. A plant community co-dominated by shrubs and herbs will develop approximately 5 to 60 years following fire or complete tree removal.

Community 2.3
Immature aspen / mature aspen / mixed conifer

Aspen will establish in the site 60 to 80 years after the last fire or complete tree removal. The combination of heavy season long livestock grazing and fire exclusion would accelerate woody plant establishment and diminish the understory. A stand of mature aspen with an intermixed with subalpine fir, white fir, and Douglas-fir will develop approximately 80 to 100 years following fire or complete tree removal. The removal of mature aspen will leave a stand of immature aspen, possibly with a few Engelmann spruce, subalpine fir, white fir, lodgepole pine, and Douglas-fir in the understory, accelerating the pathway towards the mature conifer plant community.

Community 2.4
Over-mature, blighted mixed conifers/ understory absent

This plant community is the result of fire exclusion for well over 100 years. The Engelmann spruce and Douglas fir is over-mature and weakened, making it susceptible to infestation by insects or other pathogens.

Pathway 2.1a
Community 2.1 to 2.2

A stand-replacing wildfire or intensive logging will set the vegetation back to an early seral herb-dominated phase. Logging opens up the forest canopy, allowing shade-intolerant understory herbs and shrubs to flourish for 20 to 30 years.

Pathway 2.1b
Community 2.1 to 2.3

The removal of only the mature Douglas fir and Engelmann spruce will leave only the less desirable true fir species in the overstory.

Pathway 2.1b
Community 2.1 to 2.4

With fire exclusion, or well over 100 years since last fire, the conifer stand will ultimately deteriorate (become over-mature) and become increasingly susceptible to wildfire and infestation by insects or other pathogens.

Pathway 2.2a
Community 2.2 to 2.3

About 60 years after fire, aspen will have become established in the site. The combination of heavy season long livestock grazing would accelerate woody plant establishment and diminish the herbaceous understory.

Pathway 2.3a
Community 2.3 to 2.1

After about 100 years following the last fire, the conifers will become mature, shading out aspen and the shade-intolerant shrub and herb species in the understory. The combination of heavy season long livestock grazing and fire exclusion would accelerate woody plant establishment and diminish the understory.

Pathway 2.3b
Community 2.3 to 2.2

A stand-replacing wildfire or intensive logging will set the vegetation back to an early seral herb-dominated phase. Logging opens up the forest canopy allowing grasses, herbs, and shrubs to flourish for 20 to 30 years.

Pathway 2.4a
Community 2.4 to 2.2

A stand-replacing wildfire will set the vegetation back to an early seral herb-dominated phase.

Transition T1
State 1 to 2

The simultaneous introduction of exotic species, both plants and animals, and possible extinctions of native flora and fauna, along with climate change, has caused State 1 to transition to State 2. Europeans further altered this vegetation largely through logging, livestock grazing, trapping of beaver, and changing the fire regime. Continued impacts could prevent the recovery toward potential conifer dominance (State 2, various phases). The reversal of these changes (i.e. a return pathway) back to State 1 is not impractical.

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	05/10/2025
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:**