USDA Natural Resources
Conservation Service

Ecological site F047XC542UT
High Mountain Stony Sandy Loam (lodgepole pine)

Last updated: 2/05/2025
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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 047X–Wasatch and Uinta Mountains

MLRA 47 occurs in Utah (86 percent), Wyoming (8 percent), Colorado (4 percent), and Idaho (2 percent). It encompasses approximately 23,825 square miles (61,740 square kilometers). The 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

The soils of this site formed mostly in colluvium and/or slope alluvium derived from metamorphic, sedimentary and conglomerate rock . Surface soils are very dark with a very cobbly loam or fine sandy loam or very gravelly loam texture. Rock fragments may be present on the soil surface and throughout the profile, but make up greater than 50 percent of the soil volume. These soils are deep to very deep, well-drained to excessive, and have moderately slow to moderate permeability. pH is slightly acidic to neutral. Available water-holding capacity ranges from 2 to 4 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 24 to 36 inches annually.

Associated sites

F047XC508UT	**High Mountain Loam (quaking aspen)**

Similar sites

F047XC508UT	**High Mountain Loam (quaking aspen)**

Table 1. Dominant plant species

Tree	(1) *Pinus contorta*
Shrub	(1) *Vaccinium scoparium*
Herbaceous	(1) *Calamagrostis rubescens*

Physiographic features

This ecological site typically occurs on mountain slopes. Slopes normally range from 5 to 55 percent but may occasionally be steeper. Slope steepness, aspect and elevation will influence the vegetative floristics of this site. Sites are typically located between 7,500 to 10,300 feet in elevation. Runoff is low to medium.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Runoff class	Low to medium
Flooding frequency	None
Ponding frequency	None
Elevation	2,286–3,139 m
Slope	5–55%
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	Not specified
Slope	2–70%

Climatic features

The climate of this site characterized by cold, snowy winters and cool summers. The average annual precipitation ranges from 24 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)	610-914 mm
Frost-free period (average)	60 days
Freeze-free period (average)	

Precipitation total (average)	762 mm

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 and slope alluvium derived from metamorphic, sedimentary and conglomerate rock . Surface soils are very dark with a very cobbly loam or fine sandy loam or very gravelly loam texture. Rock fragments may be present on the soil surface and throughout the profile, but make up greater than 50 percent of the soil volume. These soils are deep to very deep, well-drained to excessive, and have moderately slow to moderate permeability. The pH is slightly acidic to neutral. Available water-holding capacity ranges from 2 to 4 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 24 to 36 inches annually.

Table 5. Representative soil features

Parent material	(1) Colluvium–metamorphic and sedimentary rock (2) Slope alluvium–metamorphic and sedimentary rock (3) Residuum–conglomerate
Surface texture	(1) Very cobbly fine sandy loam (2) Very cobbly, very gravelly loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained to excessively drained
Permeability class	Moderately slow to moderately rapid
Depth to restrictive layer	152 cm
Soil depth	152 cm
Available water capacity (0-152.4cm)	5.08–10.16 cm
Calcium carbonate equivalent (0-152.4cm)	0%
Electrical conductivity (0-152.4cm)	0–1 mmhos/cm
Sodium adsorption ratio (0-152.4cm)	0
Soil reaction (1:1 water) (0-152.4cm)	6.1–7
Subsurface fragment volume <=3" (0-152.4cm)	25–50%
Subsurface fragment volume >3" (0-152.4cm)	32–60%

Table 6. Representative soil features (actual values)

Drainage class	Not specified
Permeability class	Not specified
Depth to restrictive layer	Not specified

Soil depth	Not specified
Available water capacity (0-152.4cm)	2.54–11.43 cm
Calcium carbonate equivalent (0-152.4cm)	Not specified
Electrical conductivity (0-152.4cm)	Not specified
Sodium adsorption ratio (0-152.4cm)	Not specified
Soil reaction (1:1 water) (0-152.4cm)	Not specified
Subsurface fragment volume <=3" (0-152.4cm)	23–72%
Subsurface fragment volume >3" (0-152.4cm)	32–71%

Ecological dynamics

Ecological Dynamics of the Site
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.

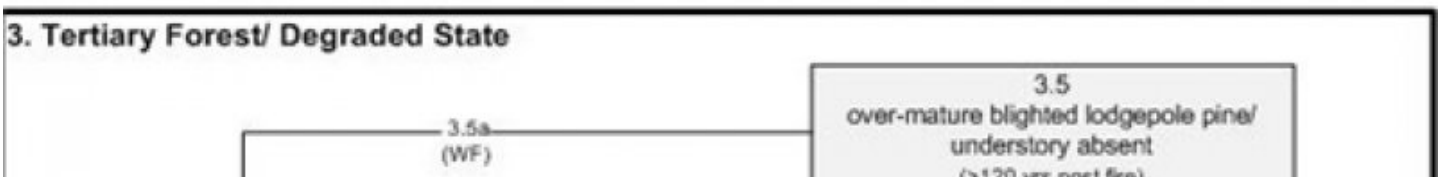
Below is a State and Transition Model diagram that illustrates the common plant communities and “states” (aggregations of those plant communities) that can occur on the site. Differences between communities and states depend primarily upon observations of a range of disturbance histories in areas where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

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.

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, 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 planning 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 and transition model



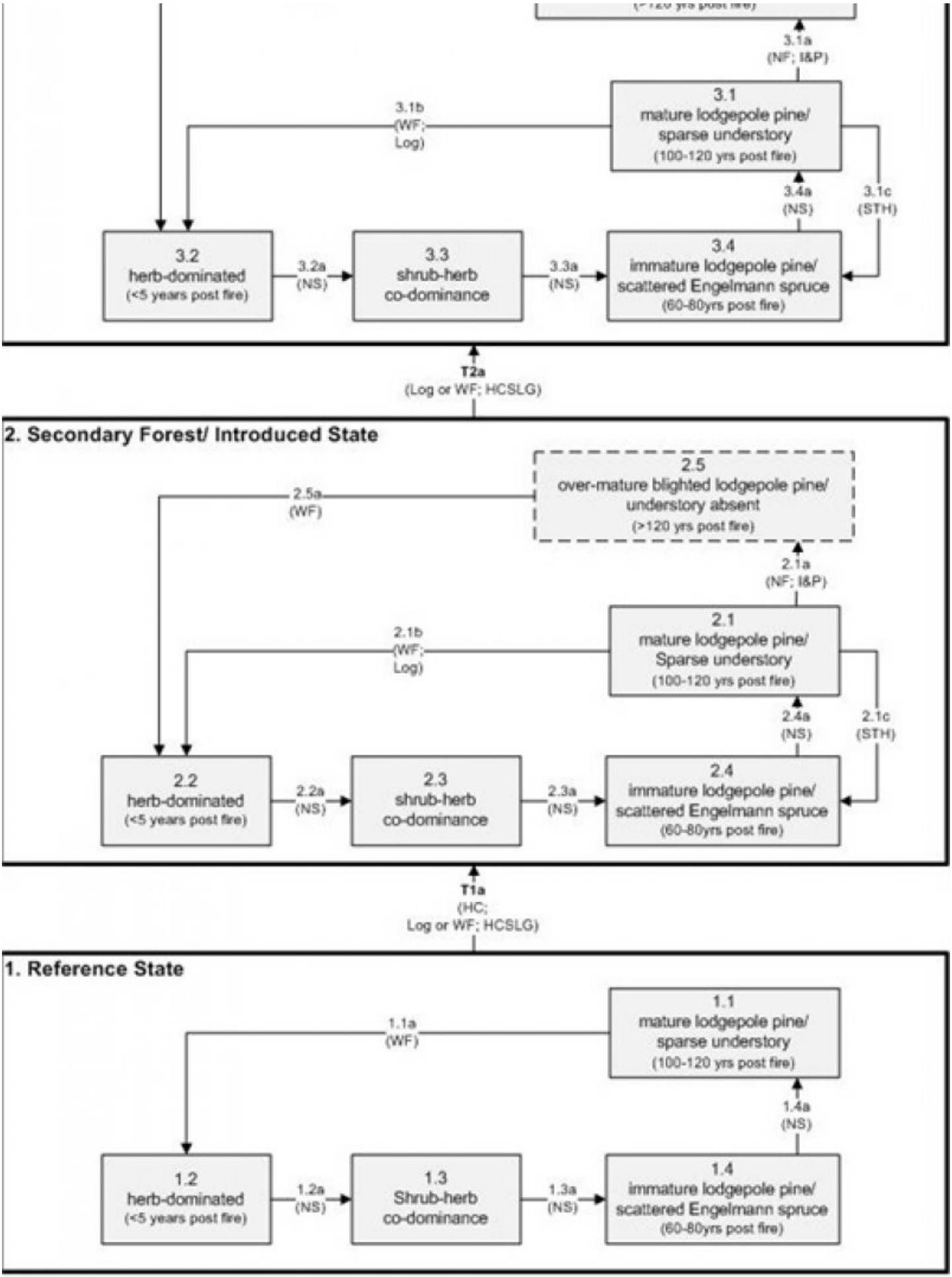

3.1a
(NF; I&P)
3.1
mature lodgepole pine/
sparse understory
(100-120 yrs post fire)
3.1b
(WF;
Log)
3.4a
(NS)
3.1c
(STH)
3.2
herb-dominated
(<5 years post fire)
3.2a
(NS)
3.3
shrub-herb
co-dominance
3.3a
(NS)
3.4
immature lodgepole pine/
scattered Engelmann spruce
(60-80yrs post fire)
T2a
(Log or WF; HCSLG)
2. Secondary Forest/ Introduced State
2.5
over-mature blighted lodgepole pine/
understory absent
(>120 yrs post fire)
2.5a
(WF)
2.1a
(NF; I&P)
2.1
mature lodgepole pine/
Sparse understory
(100-120 yrs post fire)
2.1b
(WF;
Log)
2.4a
(NS)
2.1c
(STH)
2.2
herb-dominated
(<5 years post fire)
2.2a
(NS)
2.3
shrub-herb
co-dominance
2.3a
(NS)
2.4
immature lodgepole pine/
scattered Engelmann spruce
(60-80yrs post fire)
T1a
(HC;
Log or WF; HCSLG)
1. Reference State
1.1
mature lodgepole pine/
sparse understory
(100-120 yrs post fire)
1.1a
(WF)
1.4a
(NS)
1.2
herb-dominated
(<5 years post fire)
1.2a
(NS)
1.3
Shrub-herb
co-dominance
1.3a
(NS)
1.4
immature lodgepole pine/
scattered Engelmann spruce
(60-80yrs post fire)
HC Historic Change
HCSLG Heavy Continuous Season Long Grazing
I&P Insects & Other Pathogens
Log Logging
NF No Fire
NS Natural Succession
STH Selective Timber Harvest
WF Wildfire

Figure 1. STM

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. At the time of European colonization, what would have been observed on these sites depended on the time since the last wildfire occurred. If the site had not seen fire for about 100 to 120 years, lodgepole pine (*Pinus contorta*) would have been the dominant species occupying the site with a sparse understory due to tree competition, overstory shading, and duff accumulation. Wildfire would have replaced these stands with a rich 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 establishment of lodgepole pine, and ultimately to fully mature lodgepole pine forest. Wildfire would have been the primary disturbance factor prior to Euro-American settlement. Early successional stages were shorter in duration. A more complete list of species by lifeform for the Reference State is available in the accompanying tables in the “Plant Community Composition by Weight and Percentage” section of this document.

Community 1.1
Mature lodgepole pine/ sparse understory

This plant community would have been characterized by a stand of mature lodgepole pine with a sparse understory of pinegrass (*Calamagrostis rubescens*), nodding bluegrass (*Poa reflexa*), and Letterman’s needlegrass (*Achnatherum lettermanii*).

Table 7. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	269	404	538
Shrub/Vine	157	235	314
Forb	22	34	45
Total	**448**	**673**	**897**

Community 1.2
herb-dominated / shrub-herb co-dominance

An herb-dominated plant community would have developed within the first 5 years following the last fire. Pinegrass, nodding bluegrass, Letterman’s needlegrass, and shade-intolerant forbs would have been the dominant grass species. After about 5 years, shrubs would begin to establish in the site. Time since last fire would have been approximately 5 to 60 years. An increasing shrub component would have included Woods’ Rose (*Rosa woodsii*), gooseberry currant (*Ribes montigenum*), grouse whortleberry (*Vaccinium scoparium*), and Oregon boxleaf (*Paxistima myrsinites*), among others.

Community 1.3
Immature lodgepole pine

This phase would have been characterized by a plant community of immature lodgepole pine. This plant community would occur approximately 60 to 80 years after the last fire.

Pathway 1.1a
Community 1.1 to 1.2

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

Pathway 1.2a
Community 1.2 to 1.3

About 60 years after fire, lodgepole pine would become established in the site.

Pathway 1.3a
Community 1.3 to 1.1

About 100 years after fire, lodgepole pine would have become mature and the understory would have become sparse.

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 shortly following Euro-American settlement (Alexander 1985, 1988). This state can be regarded as the current potential. With the least amount of disturbance or manipulation of fire regime, a mature stand of lodgepole pine with a sparse understory component is expected at this site. As with the Reference State, time since last wildfire remains the key factor in determining what vegetation would be encountered here. Wildfire, particularly crown fires, or complete harvesting of the forest will replace these stands with a rich 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 establishment of lodgepole pine, and ultimately to fully mature lodgepole pine forest. In some areas where wildfire has been prevented, lodgepole pine trees may be over-mature and consequently become more susceptible to infestation by insects and other pathogens.

Community 2.1
Mature lodgepole pine/ sparse understory

This plant community is characterized by a stand of mature lodgepole pine with a sparse understory of pinegrass, nodding bluegrass, Letterman’s needlegrass, and shade-tolerant forbs. This stand will develop approximately 100 to 120 years post fire.

Community 2.2
Herb-dominated / shrub-herb co-dominance

This plant community will develop within the first 5 years since the last fire. Dominant grasses are pinegrass, nodding bluegrass, Letterman’s needlegrass, along with shade-intolerant forbs such as subalpine fleabane (*Erigeron peregrinus*). A small component of introduced species may be present. This pathway is characterized by natural succession. A plant community co-dominated by shrubs and herbs will develop approximately 5 to 60 years post-fire. A small component of introduced species may be present.

Community 2.3
Immature lodgepole pine

This plant community will develop approximately 60 to 80 years since the last fire.

Community 2.4
Over-mature blighted lodgepole pine/ understory absent

This plant community is the result of fire exclusion for well over 120 years. The lodgepole pine is over-mature and weakened, making it susceptible to infestation by insects or other pathogens.

Pathway 2.1b
Community 2.1 to 2.2

A stand-replacing wildfire or intensive logging will return the vegetation to an early seral herb-dominated phase. Logging opens up the forest canopy allowing more understory for 20 to 30 years.

Pathway 2.1a
Community 2.1 to 2.4

With fire exclusion, and well over 100 years since last fire, a lodgepole pine stand will ultimately deteriorate and will become increasingly susceptible to infestation of insects or other pathogens.

Pathway 2.2a
Community 2.2 to 2.3

This pathway is characterized by natural succession.

Pathway 2.4a
Community 2.3 to 2.1

This pathway is characterized by natural succession.

Pathway 2.4a
Community 2.4 to 2.2

A stand-replacing wildfire or intensive logging will return the vegetation to an early seral herb-dominated phase. Logging opens up the forest canopy allowing more understory for 20 to 30 years.

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

Animal community

a. Livestock Grazing

This site is suited to cattle and sheep grazing during the summer and fall. Livestock will often concentrate on this site taking advantage of the shade and shelter offered by the tree overstory. Many areas are not used because of steep slopes or lack of adequate water. Attentive grazing management is required due to steep slopes and erosion hazards. Harvesting trees under a sound management program can open up the tree canopy to allow increased production of understory species desirable for grazing.

Wildlife species seeking food and cover in this forest site include moose, elk, mule deer, bear, porcupine, snowshoe hare, owl, and woodpecker.

Wood products

Silvicultural Practices

a. Harvest cut selectively or in small patches (size dependent upon site conditions) to enhance forage production.

1. Thinning and improvement cutting – removal of poorly formed, diseased, and low vigor trees.

2. Harvest cutting – selectively harvest surplus trees to achieve desired spacing. Save large, healthy, full-crowned trees. Do not select only “high grade” trees during thinning.

b. Prescription burning program may be used to maintain desired canopy cover and manage site reproduction.

c. Selective tree removal on suitable sites to enhance forage production and manage site reproduction.

d. Pest Control – use necessary and approved control for specific pests or diseases.

e. Fire hazard – fire is usually not a problem in mature grazed stands. Install firebreaks or fire lines as necessary.

Other information

Limitations and Considerations

a. Potential for sheet and rill erosion is moderate to severe depending on slope.

b. Moderate to severe equipment limitations on steeper slopes and on sites having extreme surface stoniness.

c. Proper spacing is the key to a well managed multiple use and multi-product forest.

Essential Requirements

a. Adequately protect from uncontrolled burning.

b. Protect soils from accelerated erosion.

c. Apply proper grazing management practices (see management guides)

Table 8. Representative site productivity

Common Name	Symbol	Site Index Low	Site Index High	CMAI Low	CMAI High	Age Of CMAI	Site Index Curve Code	Site Index Curve Basis	Citation
lodgepole pine	*PICO*	31	37	30	50	–	–	–	

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

“Silvics of North America” Agriculture Handbook 654, Volume 1, Conifers

Mauk, Ronald L., Henderson, Jan A. “Coniferous Forest Habitat Types of Northern Utah,” General Technical Report INT 170, July 1884PICO/VASC, Page 57

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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	05/14/2025
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):**

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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:**
