USDA Natural Resources
Conservation Service

Ecological site R047XY010ID
High Mountain Loam 25-35 PZ ACSAG2/PHMA5/BRCA5

Last updated: 2/11/2025
Accessed: 05/21/2025

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 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 minerology 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 mixed alluvium and colluvium over bedrock derived from igneous rock or loess. Surface soils are channery-ashy-silt loam, gravelly silt loam to silt 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 moderately deep to deep, well-drained, and have moderately slow to moderate permeability. Available water-holding capacity ranges from 3.5 to 8.3 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly udic and the soil temperature regime is cryic. Precipitation ranges from 25 to 35 inches annually.

Associated sites

F047XA508UT	**High Mountain Loam (quaking aspen)**

Similar sites

R047XY009ID	**Mountain Loam 18-22 PZ ACGRG/ARTRV/PSSP6**

Table 1. Dominant plant species

Tree	(1) *Acer grandidentatum var. grandidentatum*
Shrub	Not specified

Herbaceous	Not specified

Physiographic features

This site is found on mountain slopes at elevations between 5,300 and 7,500 feet. It commonly occurs on North and East facing aspects and on slopes ranging from 15 to 60 percent. Occasionally this site is found on gentler slopes. Runoff is medium and flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope
Runoff class	Medium
Flooding frequency	None
Ponding frequency	None
Elevation	5,300–7,500 ft
Slope	15–60%
Aspect	N, NE, E

Climatic features

The climate of this site is characterized by cold snowy winters and cool dry summers. The average annual precipitation ranges from 22 to 35 inches. Distribution is 55 to 60 percent during the plant dormant period (October to March). This is the most dependable supply for plant growth. Lower precipitation and high evapotranspiration rates during July, August and September cause a reduction in growth of all plant species and dormancy in many of the grasses and forbs.

Table 3. Representative climatic features

Frost-free period (actual range)	
Freeze-free period (actual range)	
Precipitation total (actual range)	22-35 in
Frost-free period (average)	50 days
Freeze-free period (average)	90 days
Precipitation total (average)	29 in

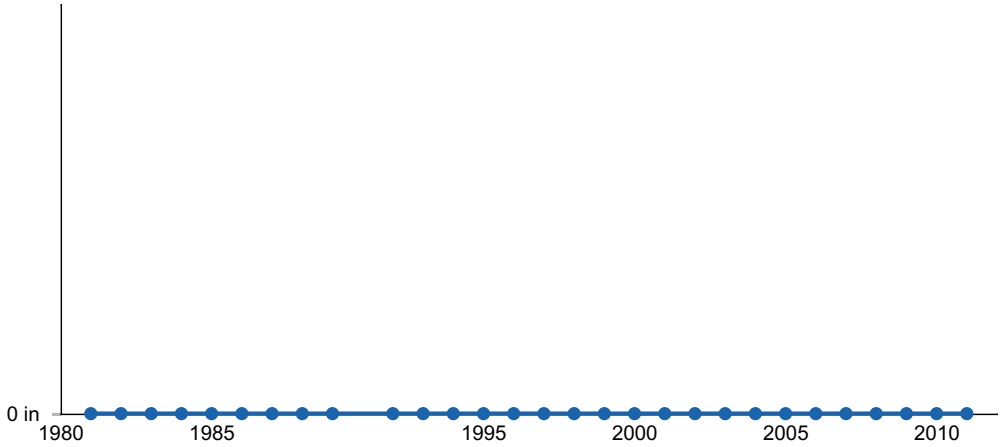


Figure 1. Annual precipitation pattern

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 mixed alluvium and colluvium over bedrock derived from igneous rock or loess. Surface soils are channery-ashy-silt loam, gravelly silt loam to silt 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 moderately deep to deep, well-drained, and have moderately slow to moderate permeability. Available water-holding capacity ranges from 3.5 to 8.3 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly udic and the soil temperature regime is cryic. Precipitation ranges from 25 to 35 inches annually.

Table 4. Representative soil features

Parent material	(1) Alluvium–igneous rock (2) Colluvium–igneous rock
Surface texture	(1) Channery silt loam (2) Gravelly silt loam (3) Silt loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate to moderately slow

Depth to restrictive layer	20–60 in
Soil depth	20–60 in
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	3.5–8.3 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)	6.6–7.8
Subsurface fragment volume <=3" (Depth not specified)	0–28%
Subsurface fragment volume >3" (Depth not specified)	0–8%

Ecological dynamics

Ecological Dynamics of the Site:
It is impossible to determine in any quantitative detail the Historic Climax Plant Community (HCPC) for this ecological site because of the lack of direct historical documentation preceding all human influence. In some areas, the earliest reports of dominant plants include the cadastral survey conducted by the General Land Office, which began in the late 19th century for this area. However, up to the 1870s the Shoshone Indians, prevalent in northern Utah and neighboring states, grazed horses and set fires to alter the vegetation for their needs. 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 and horses as the proportion of browse increased.

Below is a State and Transition Model diagram that illustrates 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, fuel wood harvest, etc. Reference State 1 illustrates the common plant communities that probably existed just prior to European settlement.

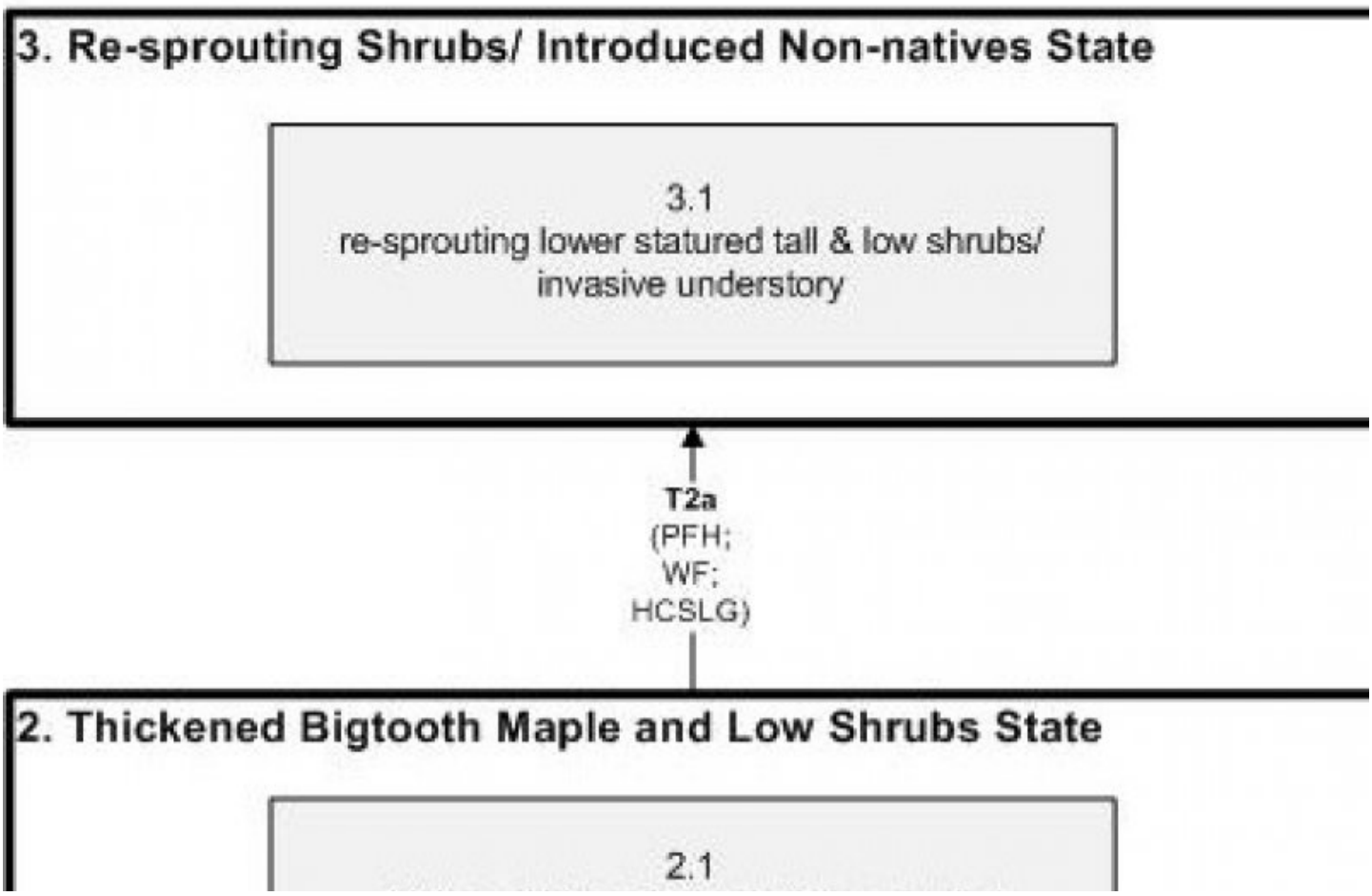
The major successional pathways within states, (“community pathways”) are indicated by

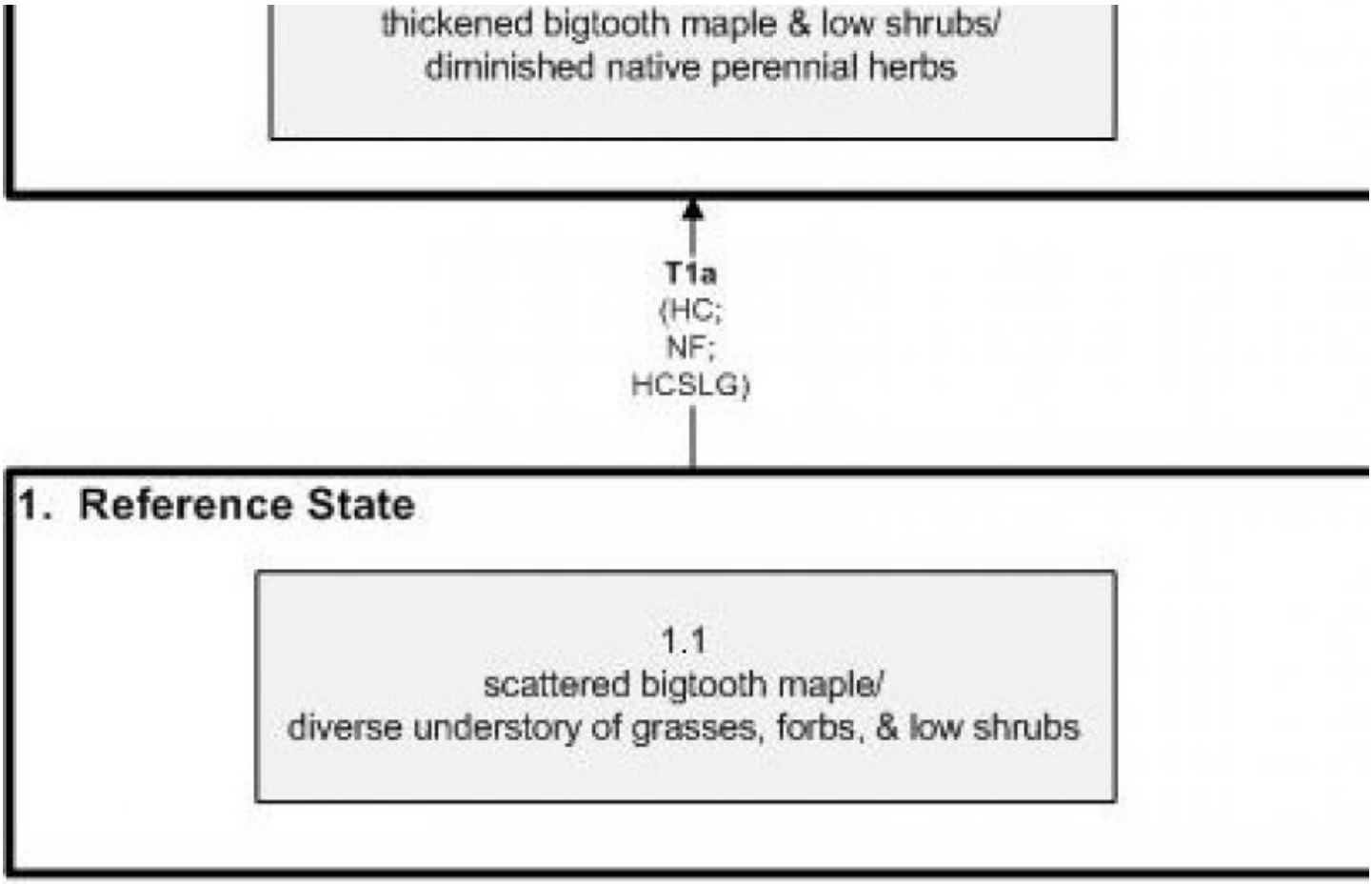
arrows between phases. “Transitions” are indicated by arrows between states. The drivers of these changes are indicated in codes decipherable by referring to the legend at the bottom of the page and by reading the detailed narratives that follow the diagram. The transition between Reference State 1 and 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.

Plant Community Narratives:
The plant communities shown in this State and Transition Model may not represent every possibility, but are probably the most prevalent and recurring plant communities. As more monitoring data are collected, some phases or states may be revised, removed, and 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 and Pasture Handbook, Desired Plant Communities (DPC’s) will be determined by the decision-makers and will meet minimum quality criteria established by the NRCS. The main purpose for including descriptions of a plant community is to capture the current knowledge at the time of this revision.

State and transition model





HC	Historic Change
HCSLG	Heavy Continuous Season Long Grazing
NF	No Fire
PFH	Post & Firewood Harvest
WF	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 rangeland relict areas where they exist. Shorter trees and shrub forms of bigtooth maple (*Acer grandidentatum*), quaking aspen (*Populus tremuloides*), and Rocky Mountain juniper (*Juniperus scopulorum*) would have made up the upper canopy. Other shrubs would have included mallow ninebark (*Physocarpus malvaceus*) and mountain snowberry (*Symphoricarpos oreophilus*). Understory shrubs would have been composed primarily of creeping barberry (*Mahonia repens*), Oregon boxleaf (*Paxistima myrsinites*), Woods' rose (*Rosa woodsii*). Grasses would have included blue wildrye (*Elymus glaucus*), mountain

brome (*Bromus marginatus*), and slender wheatgrass (*Elymus trachycaulus*). Forbs would have included tall ragwort (*Senecio serra*), western coneflower (*Rudbeckia occidentalis*), silvery lupine (*Lupinus argenteus*), and nettleleaf giant hyssop (*Agastache urticifolia*) among others. The average fire return interval would have ranged from approximately 50 to 60 years, which would have been the driving factor behind changes in relative abundance and size of trees and associated understory richness. Shorter trees and shrubs with an understory rich in forbs and grasses (1.1) would have been found following recent wildfire events (1.2a). As the length of time elapsed since the fire lengthened (1.1a), trees would have increased both in height and density, while the understory would have lessened (1.2). A more complete list of species by lifeform for the Reference State is available in accompanying tables in the “Plant Community Composition by Weight and Percentage” section of this ESD document.

Community 1.1
shorter trees & shrubs/ richer understory

This plant community would have been characterized by shorter trees and shrubs with a relatively rich understory of smaller shrubs, forbs, and grasses. Bigtooth maple would have been the dominant woody species. The understory would have consisted of a mixture of species including mallow ninebark, mountain snowberry, creeping barberry, Oregon boxleaf, woods' rose, blue wildrye, mountain brome, tall ragwort, silvery lupine, along with several other herbaceous species.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Forb	1400	1500	1600
Tree	720	800	850
Grass/Grasslike	280	300	525
Shrub/Vine	140	200	275
Total	**2540**	**2800**	**3250**

Table 6. Ground cover

Tree foliar cover	69-71%
Shrub/vine/liana foliar cover	19-21%
Grass/grasslike foliar cover	9-11%
Forb foliar cover	4-6%
Non-vascular plants	0%
Biological crusts	0%
Litter	0%

Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	0%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	–	4-6%
>1 <= 2	–	–	9-11%	–
>2 <= 4.5	–	19-21%	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	69-71%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
taller trees & some shrubs/ reduced understory

This phase would have been characterized by increased amounts and height of trees and shrubs, namely bigtooth maple, aspen, and Rocky Mountain juniper, with a corresponding decrease in understory richness.

Pathway 1.1a
Community 1.1 to 1.2

As the length of time elapsed since last fire increased (i.e. approaching 50 to 60 years), the trees and shrubs would have grown in both height and density, thus shading out some of the understory.

Pathway 1.2a
Community 1.2 to 1.1

Wildfire would temporarily reduce the tree and shrub component allowing the native perennial grasses and forbs to dominate.

State 2
Overgrown/ Depauperate Understory/ Introduced State

State 2 is very similar to State 1 in form and function, with the exception of the presence of non-native plants and animals, possible extinctions of some native species, and a different climate. State 2 is a description of the ecological site shortly following Euro-American settlement and should be considered the current potential. Heavy season-long livestock grazing was prevalent on these sites starting in the 1860s up through the 1950s, which had its most noticeable impact on diminishing the understory.

Community 2.1
taller, denser trees & shrubs/ reduced understory

This plant community is characterized by a taller, denser stand of trees, primarily bigtooth maple and Rocky Mountain juniper, but with a markedly reduced understory. A small component of non-native species may also be present such as cheatgrass (*Bromus tectorum*), smooth brome (*Bromus inermis*), or Kentucky bluegrass (*Poa pratensis*).

State 3
Lessened Tree Canopy/ Improved Understory State

Tree and brush removal by chemical, fire, or fuel wood cutting, helped to thin the tree canopy and provide for the re-establishment of the understory shrubs, forbs, and grasses.

Community 3.1
thinned tree canopy/ understory re-establishment

This plant community is characterized by a thinned canopy of bigtooth maple, aspen, and junipers, and re-established understory species such as mallow ninebark, mountain snowberry, creeping barberry, Oregon boxleaf, Woods' rose, blue wildrye, mountain brome, tall ragwort, silvery lupine, along with several other herbaceous species.

Transition T1a
State 1 to 2

The simultaneous introduction of exotic species, both plants and animals, possible extinctions of native flora and fauna, climate change, and the advent of intense season-long livestock grazing has caused State 1 to transition to State 2. Reversal of such historic changes (i.e. a return pathway) back to State 1 is not practical.

Transition T2a
State 2 to 3

This transition occurred where there was selective harvest of stems for fuel wood and tapping the maple for sugar. Unburned slash with abundant leaf fall makes this vegetation

susceptible to wildfire. The root sprouting of maple and other dominants makes it resilient. Excessive livestock grazing has been the major agent of positive feedback to accelerated soil erosion and vegetational change. Reduction of livestock numbers and season of use result in a rapid recovery of the perennial dominance. Brush management, whether by chemical means (e.g. 2,4-D, tebuthiron) or prescribed fire, will cause State 2 to transition to State 3. Cutting the trees for use as fuel wood was prevalent in some areas, which opened up the canopy allowing the understory components to re-establish abundantly if not excessively grazed.

Restoration pathway R3a
State 3 to 2

Heavy, continuous, season-long grazing will deplete the understory, decrease the chance of wildfire, and allow tree species to regain in dominance.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
0	**Dominant Trees**			560–700	
	bigtooth maple	ACGR3	*Acer grandidentatum*	560–700	–
	quaking aspen	POTR5	*Populus tremuloides*	140–280	–
4	**Sub-Dominant Trees**			35–84	
	Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	28–84	–
	quaking aspen	POTR5	*Populus tremuloides*	28–84	–
Shrub/Vine					
0	**Dominant Shrubs**			140–280	
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	140–280	–
	mallow ninebark	PHMA5	*Physocarpus malvaceus*	140–280	–
3	**Sub-Dominant Shrubs**			35–84	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	140–280	–
	Saskatoon serviceberry	AMALS	*Amelanchier alnifolia var. semiintegrifolia*	28–84	–
	creeping barberry	MARE11	*Mahonia repens*	28–84	–
	Oregon boxleaf	PAMY	*Paxistima myrsinites*	28–84	–
	chokecherry	PRVI	*Prunus virginiana*	28–84	

	chokecherry	PRVI	*Prunus virginiana*	28–84	–
	Woods' rose	ROWO	*Rosa woodsii*	28–84	–
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	28–84	–
Grass/Grasslike					
0	**Dominant Grasses**			250–450	
	California brome	BRCA5	*Bromus carinatus*	84–140	–
	blue wildrye	ELGL	*Elymus glaucus*	84–140	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	84–140	–
1	**Sub-Dominant Grasses**			35–90	
	Geyer's sedge	CAGE2	*Carex geyeri*	28–84	–
	basin wildrye	LECI4	*Leymus cinereus*	28–84	–
	oniongrass	MEBU	*Melica bulbosa*	28–84	–
	muttongrass	POFE	*Poa fendleriana*	28–84	–
	Grass, annual	2GA	*Grass, annual*	14–28	–
	Grass, perennial	2GP	*Grass, perennial*	14–28	–
Forb					
2	**Sub-Dominant Forbs**			1400–1600	
	Forb, annual	2FA	*Forb, annual*	28–84	–
	Forb, perennial	2FP	*Forb, perennial*	28–84	–
	common yarrow	ACMI2	*Achillea millefolium*	28–84	–
	nettleleaf giant hyssop	AGUR	*Agastache urticifolia*	28–84	–
	elkweed	FRSP	*Frasera speciosa*	28–84	–
	northern bedstraw	GABO2	*Galium boreale*	28–84	–
	common cowparsnip	HEMA80	*Heracleum maximum*	28–84	–
	Nevada pea	LALA3	*Lathyrus lanszwertii*	28–84	–
	tailcup lupine	LUCAC3	*Lupinus caudatus ssp. caudatus*	28–84	–
	feathery false lily of the valley	MARAR	*Maianthemum racemosum ssp. racemosum*	28–84	–
	tall fringed bluebells	MECI3	*Mertensia ciliata*	28–84	–
	western sweetroot	OSOC	*Osmorhiza occidentalis*	28–84	–
	western coneflower	RUOC2	*Rudbeckia occidentalis*	28–84	–
	tall ragwort	SESE2	*Senecio serra*	28–84	–

	western valerian	VAOC2	*Valeriana occidentalis*	28–84	–

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

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

Dean Stacy

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	05/21/2025
Approved by	Sarah Quistberg
Approval date	

Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

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2. **Presence of water flow patterns:**

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3. **Number and height of erosional pedestals or terracettes:**

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

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5. **Number of gullies and erosion associated with gullies:**

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6. **Extent of wind scoured, blowouts and/or depositional areas:**

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

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

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

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

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:**