Ecological site R047XA620UT
Subalpine Meadow
(alpine timothy)

Last updated: 6/04/2025
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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

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.

Classification relationships

Modal Soil: Cluff Family GR-L 2-8% — clayey-skeletal, montmorillonitic Mollic Cryoboralfs

Ecological site concept

The soils of this site formed mostly in till derived from sandstone and conglomerate. Surface soils are gravelly 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, well-drained, and have a moderate to moderately slow permeability. pH is slightly acidic to neutral.. Available water-holding capacity ranges from 3.8 to 5.0 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly xeric and the soil temperature regime is cryic. Precipitation ranges from 35 to 48 inches annually.

Associated sites

R047XA624UT	Subalpine Semiwet Meadow (tufted hairgrass)

Similar sites

R047XA624UT	Subalpine Semiwet Meadow (tufted hairgrass)

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Phleum alpinum* (2) *Deschampsia caespitosa*

Physiographic features

This site occurs on till plains of past-glaciated mountains at elevations between 9,800 and 11,000 feet. Slopes are gentle at 2 to 8 percent and runoff is medium. Flooding and ponding do not occur on these meadows and they do not have a seasonally high water table.

Table 2. Representative physiographic features

Landforms	(1) Till plain
Runoff class	Medium
Flooding duration	Extremely brief (0.1 to 4 hours) to brief (2 to 7 days)
Flooding frequency	Very rare to rare
Ponding frequency	None
Elevation	2,990 – 3,350 m
Slope	0 – 10 %
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by cool, moist summers and cold, snowy winters. Approximately 70 percent of the precipitation occurs as snow from October through May. On the average, June through August are the driest months and September through May are the

wettest months.

Table 3 Representative climatic features

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	890-1,220 mm
Frost-free period (average)	40 days
Freeze-free period (average)	
Precipitation total (average)	

Influencing water features

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

Wetland description

N/A

Soil features

The soils of this site formed mostly in till derived from sandstone and conglomerate. Surface soils are gravelly 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, well-drained, and have a moderate to moderately slow permeability. pH is slightly acidic to neutral. Available water-holding capacity ranges from 3.8 to 5.0 inches of water in the upper 60 inches of soil. The soil moisture regime is mostly xeric and the soil temperature regime is cryic.

This site is correlated to the Crandall soil component of soil map unit 111 in the Summit Area soil survey (UT613).

Table 4. Representative soil features

Parent material	(1) Till – sandstone (2) Till – conglomerate
Surface texture	(1) Gravelly loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderate

Depth to restrictive layer	100 – 150 cm
Soil depth	100 – 150 cm
Surface fragment cover <=3"	20 %
Surface fragment cover >3"	10 %
Available water capacity (0-101.6cm)	9.65 – 12.7 cm
Calcium carbonate equivalent (0-101.6cm)	Not specified
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	Not specified
Soil reaction (1:1 water) (0-101.6cm)	6.1 – 7.3
Subsurface fragment volume <=3" (Depth not specified)	20 %
Subsurface fragment volume >3" (Depth not specified)	20 %

Ecological dynamics

As this site deteriorates due to grazing pressure, alpine timothy decreases while sedges increase. When the potential natural plant community is burned, forbs decrease and grasses increase.

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 (Galatowitsch 1990). 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 (Parson 1996). In the 1860s, Europeans brought cattle and horses to the area, grazing large numbers of them on unfenced parcels year-long (Parson 1996). 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, 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.

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 and Pasture Handbook (USDA-NRCS 2003), 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 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. The pre-settlement climax plant community (1.1) would have been a grassland (meadow) dominated by a rich mixture of native grasses and grass-likes such as meadow sedge (Carex praticola), tufted hairgrass (Deschampsia cespitosa), alpine timothy (Phleum alpinum), slender wheatgrass (Elymus trachycaulus), mountain brome (Bromus marginatus), and muttongrass (Poa fendleriana). Minor amounts (less than 15 percent) of forage production was due to native perennial forbs. Mesic shrubs such as silver sagebrush (Artemisia cana ssp. viscidula) and Woods’ rose (Rosa woodsii) were only minor components in the Reference State. 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 document.

Community Phase 1.1: meadow sedge & tufted hairgrass
The Reference State would have been dominated by assorted grasses and grass-likes with a very minor component of mesic shrubs. Grasses and grass-likes would have included meadow sedge, tufted hairgrass, alpine timothy, slender wheatgrass, mountain brome, and muttongrass.

Transition T1a: from State 1 to State 2 (Reference State to Meadow Sedge and Tufted Hairgrass/ Introduced Non-natives State)
The simultaneous introduction of exotic species, both plants and animals, possible extinctions of native flora and fauna, and climate change 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.

State 2: Meadow Sedge and Tufted Hairgrass/ Introduced Non-natives State
State 2 is identical to State 1 in form and function, with the exception of the presence of non-native plants and animals, possible extinctions of native species, and a different climate. State 2 is a description of the ecological site shortly following Euro-American settlement. This state can be regarded as the current potential. Grasses and grass-likes would have included meadow sedge, tufted hairgrass, alpine timothy, slender wheatgrass, mountain brome, and muttongrass. These meadows were key in the agricultural development of the lowlands. A very high percentage of these sites were homesteaded and altered by having livestock pasturage, haying, leveling, and irrigation. Native species more tolerant of disturbance (e.g. curlycup gumweed (Grindelia squarrosa), foxtail barley (Hordeum jubatum), Rocky Mountain iris (Iris missouriensis), bull thistle (Cirsium vulgare), sedges (Carex spp.), and alpine timothy increased relative to the less grazing tolerant and palatable grasses and grass-likes such as meadow sedge and tufted hairgrass. Additionally, exotics such as common dandelion (Taraxacum officinale), alpine timothy, Kentucky bluegrass (Poa pratensis), and meadow fescue (Schedonorus pratensis) increased. In general, species richness declined and species became more concentrated in fewer dominants. The single most important impact was whether irrigation took place to supplement the hydrologic input. In the cold temperatures of Rich County, where crop maturation has been a problem (Parson 1996), haying and pasturing have been the more sustainable pattern. Early flooding at the time of peak snowmelt in the watersheds above (May-June) has been the usual pattern.

When a single hay crop is taken in August and the subsequent crop aftermath is grazed by livestock in the fall (T2a), the resulting vegetation becomes dominated by creeping bentgrass (Agrostis stolonifera) and alpine timothy (State 3). If the land use pattern is a single spring flood irrigation followed by heavy growing season livestock grazing (T2b), this results in a sward more dominated by sedges (State 4). If these areas become fenced and heavily grazed season long (T2c), the more palatable herbs are lost, and mesic shrubs such

as silver sagebrush and white sagebrush (Artemisia ludoviciana), and the less palatable grass-likes, especially rushes (Juncus spp.), and forbs such as common dandelion and curlycup gumweed come to prevail (State 5). With subsequent intensified management (e.g. mowing, hay making, fertilization) State 5 can be turned into either State 3 (T5a) or State 4 (T5b). State 4, with deferred grazing during the growing season (T4a), can turn into State 3. Since there are now many exotics present and irrigation systems are unlikely to be dismantled (to restore the original hydrologic regime), a return to the Reference State is not thought possible. Although it would be possible to plow and reseed State 5 with improved exotic forage grasses without subsequent irrigation (T5c), this alternative (State 6) would probably stand up to economic scrutiny or social acceptability for public land.

Community Phase 2.1: meadow sedge and tufted hairgrass
This plant community is dominated by assorted grasses and grass-likes with a very minor component of mesic shrubs. Grasses and grass-likes include meadow sedge, tufted hairgrass, alpine timothy, slender wheatgrass, mountain brome, and muttongrass.

Transition T2a: from State 2 to State 3 (Meadow Sedge and Tufted Hairgrass/ Introduced Non-natives State to Creeping Bentgrass/ Timothy State)
The Meadow Sedge and Tufted Hairgrass/ Introduced Non-natives State will transition to the Creeping Bentgrass/ Timothy State with haying followed by prescribed grazing of cattle during fall months. The approach to this transition is indicated by changes in species composition (i.e. increases in creeping bentgrass and alpine timothy, and decreases in meadow sedge and tufted hairgrass). The trigger causing this transition is fall livestock grazing.

Transition T2b: from State 2 to State 4 (Meadow Sedge and Tufted Hairgrass/ Introduced Non-natives State to Sedge State)
The Meadow Sedge & Tufted Hairgrass/ Introduced Non-natives State will transition to the Sedge State where single spring flood irrigation is followed by heavy growing season livestock grazing. The approach to this transition is indicated by changes in species composition (i.e. an increase in sedges, and a decrease in tufted hairgrass. The trigger causing this transition is single spring flood irrigation followed by heavy growing season livestock grazing.

Transition T2c: from State 2 to State 5 (Meadow Sedge and Tufted Hairgrass/ Introduced Non-natives State to Silver Sagebrush State)
The Meadow Sedge & Tufted Hairgrass/ Introduced Non-natives State will transition to the Silver Sagebrush State when fencing is minimal and the area is heavily grazed season long. The approach to this transition is indicated by changes in species composition (i.e. an increase in unpalatable species such as silver sagebrush, rushes, curlycup gumweed, and common dandelion). The trigger causing this transition is heavy continuous growing season-long grazing.

State 3: Creeping Bentgrass/ Timothy State
The native grasses creeping bentgrass and alpine timothy are the dominants of this plant community. This plant community is encouraged by fall livestock grazing.

Community Phase 3.1: creeping bentgrass/alpine timothy
Creeping bentgrass and alpine timothy are the dominant species in this plant community.

State 4: Sedge State
Sedges, particularly meadow sedge, will dominate this plant community. This plant community is encouraged by spring flooding (either naturally or by irrigation) followed by heavy growing season livestock grazing. Heavy growing season grazing following flooding encourages the stability of this State. Changes in season of use and/or levels of use will reduce the stability of this State (i.e. will encourage transition to another State).

Community Phase 4.1: sedge-dominated
A single spring flood irrigation followed by heavy growing season livestock grazing results in a sward more dominated by sedges.

Transition T4a: from State 4 to State 3 (Sedge State to Creeping Bentgrass/ Timothy State)
The Sedge State will transition to the Creeping Bentgrass/ Timothy State when growing season grazing is deferred. This takes place due to differences in the palatability of the species dominating each State. The approach to this transition is indicated by changes in species composition (i.e. an increase in creeping bentgrass and alpine timothy, and a decrease in sedges). The trigger causing this transition is the change in grazing regime.

State 5: Silver Sagebrush State
Mesic shrubs such as silver sagebrush and white sagebrush, and the less palatable grass-likes, especially rushes, and forbs such as common dandelion and curlycup gumweed will dominate this plant community. These plant communities are produced when these areas are fenced and heavily grazed season long. This stability of this State is maintained by continued season long utilization of the relatively palatable species, leaving the less palatable species. A reduction of growing season utilization or a switch to non-growing season use will reduce the stability of this State (i.e. will encourage transition to another State).

Community Phase 5.1: silver sagebrush/ rush/ gumweed and dandelion
This Phase is dominated by less palatable species such as silver sagebrush, rushes, common dandelion and curlycup gumweed.

Transition T5a: from State 5 to State 3 (Silver Sagebrush State to Creeping Bentgrass/ Timothy State)
The Silver Sagebrush State transition to the Creeping Bentgrass/ Timothy State will be triggered when sites are inundated by flood or sprinkler irrigation followed by fall livestock utilization. The approach to this transition is indicated by a change in relative abundance of different species (i.e. an increase in creeping bentgrass and alpine timothy and a decrease in unpalatable herbs and silver sagebrush).

Transition T5b: from State 5 to State 4 (Silver Sagebrush State to Sedge State)
The Silver Sagebrush State transition to the Sedge State will be triggered when sites are inundated by flood or sprinkler irrigation followed by growing season long livestock utilization. The approach to this transition is indicated by a change in relative abundance of different species (i.e. an increase in sedges and a decrease in unpalatable herbs and silver sagebrush).

Transition T5c: from State 5 to State 4 (Silver Sagebrush State to Exotic Grasses Monoculture State)
The Silver Sagebrush State will transition to the Exotic Grass Monoculture State when the site is plowed and reseeded with improved exotic forage grasses such as meadow foxtail (Alopecurus pratensis), tall oatgrass (Arrhenatherum elatius), colonial bentgrass (Agrostis capillaris), bluejoint (Calamagrostis canadensis), or slimstem reedgrass (Calamagrostis stricta) without subsequent irrigation.

State 6: Exotic Grass Monoculture State
Monocultures of exotic grasses such as meadow foxtail, tall oatgrass, colonial bentgrass, bluejoint, or slimstem reedgrass are found at sites where plowing and re-seeding has taken place to improve forage for livestock.

Community Phase 6.1: exotic grass monoculture
This plant community is a monoculture of an exotic grass such as foxtail, tall oatgrass, colonial bentgrass, bluejoint, or slimstem reedgrass.

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			915-1435	
1	**Sub-Dominant Grasses**			108-179	
	Grass, annual	2GA	*Grass, annual*	54-90	–
	Grass, perennial	2GP	*Grass, perennial*	54-90	–
Forb					
2	**Sub-Dominant Forbs**			717-1076	
	Forb, annual	2FA	*Forb, annual*	269-359	–
	Forb, perennial	2FP	*Forb, perennial*	269-359	–
	sulphur-flower buckwheat	ERUMU2	*Eriogonum umbellatum var. umbellatum*	90-179	–

Animal community

This site provides grazing for cattle and sheep during the summer and fall. Food and Cover Wildlife using this site include moose, elk, mule deer, snowshoe hare, badger, grouse, and owl.

Hydrological functions

The soil series in in hydrologic group c. The hydrologic curve number is 74 when the vegetation is in good condition.

Recreational uses

Hiking and hunting

Wood products

None

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

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]

Contributors

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Approval

Kendra Moseley, 6/04/2025

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.

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Date	10/15/2012
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills: None. A very slight amount of rill development may be observed following large storm events or spring runoff periods, but they should heal within the following growing season. Slight rill development may also be observed where the site is adjacent to ecological sites that produce large amounts of runoff (i.e. steeper sites, slickrock, etc.).**

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2. **Presence of water flow patterns:** None to rare. Any flow patterns present should be sinuous and wind around perennial plant bases. They should be short (5 to 10 feet), < one foot wide, and spaced from 20 to 30 feet apart. They should be stable with only minor evidence of deposition. Flooding and ponding do not occur on these high elevation meadows and they do not have a seasonally high water table.

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3. **Number and height of erosional pedestals or terracettes:** None to rare. A few plants may show very minor pedestalling where they are adjacent to any water flow patterns present, but there will be no exposed roots. Terracettes are not present.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 10 to 20% bare ground. Any bare ground openings present should be < 1 foot in size and should not be connected.

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5. **Number of gullies and erosion associated with gullies:** None to Very Slight. Some slight gully development may be evident following significant weather events or where they convey runoff from higher elevation sites and/or rocky or naturally eroding areas.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** No evidence of wind generated soil movement. Wind scoured (blowouts) and depositional areas are not present.

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7. **Amount of litter movement (describe size and distance expected to travel):** The majority of litter accumulates in place at the base of plant canopies. Slight movement of the finest material (< 1/4 inch) may move 1 to 2 feet downslope when transported by water. Little accumulation is observed behind obstructions.

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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):** This site should have a soil stability rating of 5 to 6 under plant canopies and a rating of 4 to 5 in any interspaces present. The average should be 5. Surface textures typically vary from sandy loams to loams.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Crandall) Soil surface is typically 0 to 5 inches deep. Surface texture is a gravelly loam, and structure is weak fine granular. The A-horizon color is brown, (7.5YR 4/3). Soils have an Mollic epipedon that extends 10 to 16 inches into the soil profile. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Perennial vegetation breaks raindrop impact and reduces splash erosion. Dense distribution of plants slows runoff by obstructing surface flows, allowing time for increased infiltration.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. This site will normally have textural changes within its' profile. These should not be mistaken for compaction layers.

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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: Perennial Grasses (alpine timothy, tufted hairgrass, bentgrasses) > Perennial Forbs (Sulphurflower wild buckwheat).

    Sub-dominant: Sprouting Shrubs (silver sage, woods rose > Rhizomatous Grasses and grasslikes (arctic rush, alpine bluegrass)

    Other: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state. Biological soil crust is variable in its' expression where present on this site and is measured as a component of ground cover. Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

    Additional: Disturbance regimes include insects and infrequent . Temporal variability can be caused by fires, droughts, insects, etc. Spatial variability can be caused by runoff, soil pH, and topography.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** **During years with average to above average precipitation, there should be no mortality or decadence in either perennial grasses or grasslikes. During severe (multi-year) droughts that affect groundwater levels, up to 10% of the perennial plants may die. There may be partial mortality of individual grasses and grasslikes during less severe droughts.**

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14. **Average percent litter cover (%) and depth (in):** **Litter cover ranges from 40 to 60%. Depth should be 1 inch thickness in any interspaces 2 inches under perennial plant canopies.**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** **Annual production in air-dry herbage should be approximately 1500 to 1600 pounds per acre on an average year. Production could vary from 1100 to 2000 pounds per acre during drought or above-average years.**

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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:** **Black medic, Canada thistle, curlycup gumweed, whitetop and other non-native forbs and grasses.**

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17. **Perennial plant reproductive capability:** **All perennial plants should have the ability to reproduce sexually or asexually in most years, except in drought years.**
