USDA Natural Resources
Conservation Service

Ecological site R047XC430UT
Mountain Loam (mountain big sagebrush)

Last updated: 2/11/2025
Accessed: 05/20/2025

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.

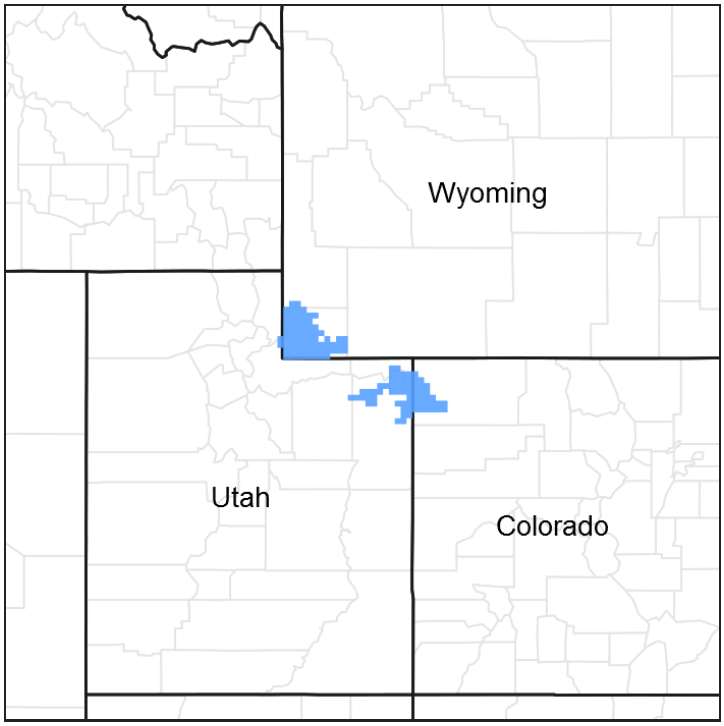


Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

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

E47C 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.

Ecological site concept

The soils on this site were formed on eolian deposits over slope alluvium derived from sedimentary parent material including sandstone, limestone, shale and quartzite. These soils formed on hills, are deep and well-drained and usually have a loamy surface texture. There are few coarse fragments in the root zone profile. The profile has less than 35 percent rock fragments. The available water capacity is between 5.2 and 7.8 inches in the upper 40 inches of soil. The pH ranges from 6.6 to 7.8 with some locations having a pH of 8.4. The soil temperature regime is frigid and the soil moisture regime is ustic.

Associated sites

R047XC460UT	**Mountain Stony Loam (shrub)**
R047XC462UT	**Mountain Stony Loam (mountain big sagebrush)**
R047XC475UT	**Mountain Windswept Ridge (black sagebrush)**
R047XC008UT	**Wet Fresh Meadow (sedge)**
R047XC404UT	**Mountain Clay (silver sagebrush)**
R047XC456UT	**Mountain Stony Loam (antelope bitterbrush)**
R047XC474UT	**Mountain Very Steep Stony Loam (shrub)**

Similar sites

R047XC462UT	**Mountain Stony Loam (mountain big sagebrush)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. vaseyana*
Herbaceous	(1) *Pascopyrum smithii*

Physiographic features

This site occurs on hills between elevations of 6800 and 7600 feet with some locations occurring up to 8500 feet. Slope ranges from 3 to 25 percent with medium runoff. Flooding and ponding do not occur on this site.

Table 2. Representative physiographic features

Landforms	(1) Hill
Flooding frequency	None

Ponding frequency	None
Elevation	2,073–2,316 m
Slope	3–25%
Aspect	Aspect is not a significant factor

Climatic features

The climate characterized by cool, moist summers and cold, snowy winters. Approximately 60 percent of the moisture comes as rain from may through october. On the average, January through April are the driest months and May through October are the wettest months. The soil moisture regime is ustic and soil temperatures are in the frigid regime.

Table 3. Representative climatic features

Frost-free period (characteristic range)	60-90 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	406-559 mm

Influencing water features

Due to its landscape position, this site is not influenced by streams or wetlands. However, it may be located upslope from these water features.

Wetland description

N/A

Soil features

The soils on this site were formed on eolian deposits over slope alluvium derived from sedimentary parent material including sandstone, limestone, shale and quartzite. These soils formed on hills, are deep and well-drained and usually have a loamy surface texture. There are few coarse fragments in the root zone profile. The profile has less than 35 percent rock fragments. The available water capacity is between 5.2 and 7.8 inches in the upper 40 inches of soil. The pH ranges from 6.6 to 7.8 with some locations having a pH of 8.4. The soil temperature regime is frigid and the soil moisture regime is ustic.

Soils associated with this site:
Soil Survey Area: Soil components (map units)

Uintah Area (UT047): Cortyzack (56, 57, 58, 59); Diagulch (56)

Modal Soil:
Cortyzack Fine-loamy, mixed, superactive, frigid Calcidic Argiustolls
Diagulch Fine-loamy, mixed, superactive, frigid Typic Haplustolls

Table 4. Representative soil features

Surface texture	(1) Loam
Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	152–203 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	13.21–19.81 cm
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)	2–6%
Subsurface fragment volume >3" (Depth not specified)	0–1%

Ecological dynamics

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. 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, 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, and/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 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 least modified plant community would have been co-dominated by mountain big sagebrush (*Artemisia tridentata* ssp. vaseyana) and a mixture of herbaceous species (1.1). The primary disturbance factor prior to European colonization would have been wildfire (1.1a), which would have removed the sagebrush and allowed the herbs to dominate for a time (1.2) As the time elapsed since the last wildfire grew longer (1.2a), mountain big sagebrush would have increased, and the herbaceous component would have decreased correspondingly. 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 Phase 1.1: mountain big sagebrush-steppe/ rich and productive herbaceous component

This plant community would have been characterized by the presence of mountain big sagebrush with a rich and productive herbaceous layer.

Community Pathway 1.1a:
Wildfire would remove sagebrush, allowing the herbs to dominate for a time.

Community Phase 1.2: herb dominated
This phase would have been dominated by herbaceous species and having few, if any, mountain big sagebrush present.

Community Pathway 1.2a:
Over time, sagebrush would increase, and the herbaceous understory would decrease slightly.

Transition T1a: (State 1 to State 2)
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: Mountain Big Sagebrush-Steppe/ 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. This State varies in the amount of mountain big sagebrush present based upon the time elapsed since the last wildfire. The least modified plant community is a mountain big sagebrush-steppe, characterized by the co-dominance shrubs and herbaceous species. Mountain big sagebrush is the dominant shrub, but other minor shrubs may be present. There is a rich and diverse mixture of herbs as well. Dominant grasses include western wheatgrass, Sandberg bluegrass, and Columbia needlegrass, and forbs include sticky purple geranium, phloxes, and lupines, among others (2.1). A small component of non-natives will also be present. Wildfire (2.1a) will remove sagebrush and allow the community to become dominated by herbaceous species for a time (2.2). As the length of time elapsed since the last wildfire grows longer (2.2a), sagebrush will re-establish, and the herbs will decrease slightly. This State is maintained by periodic wildfire and by a healthy, productive, and diverse plant community that can provide native seed sources and promotes soil stability, water infiltration, and soil moisture retention. The resiliency of this State will be maintained by reducing or altering seasons of use and number of livestock. Conversely, this State's resiliency will be negatively impacted by continuous season-long livestock use.

Community Phase 2.1: Mountain big sagebrush-steppe/ rich and productive herbaceous component
This plant community is characterized by co-dominance of mountain big sagebrush and a

rich and productive understory of herbs.

Community Pathway 2.1a:
Wildfire will remove sagebrush, allowing the herbs to dominate for a time.

Community Phase 2.2: herb dominated
This phase is dominated by herbaceous species and having few, if any, mountain big sagebrush present.

Community Pathway 2.2a:
Over time, sagebrush will increase, and the herbaceous understory will decrease slightly.

Transition T2a: from State 2 to State 3 (Mountain Big Sagebrush-Steppe/ Introduced Non-natives State to Mountain Big Sagebrush Super-dominance State)
Lack of fire and continued heavy livestock grazing during the growing season of grasses will cause State 2 to transition into the Mountain Big sagebrush Super-dominance State (State 3). The approach to this transition is indicated by a loss of the perennial grass understory, an increase in the shrub component relative to the grasses, and evidence of soil loss. The trigger causing this transition is heavy growing season grazing.

State 3: Mountain Big Sagebrush Super-dominance State
This State is characterized by a super-dominance of mountain big sagebrush with a markedly diminished grass component which occurs in the absence of fire and with continued heavy impacts from livestock grazing. The stability of this State is maintained by the lack of a healthy, productive and diverse herb component capable of providing native seed source, soil stabilization, and soil moisture retention, and by an abundant seed source for mountain big sagebrush. The resiliency of this State will be maintained by decreased grazing during the growing season of grasses. Conversely, the resiliency of this State will be negatively impacted by continued heavy growing season livestock use.

Community Phase 3.1: abundant Mountain big sagebrush / diminished perennial herbs
This plant community is characterized by a dramatic increase in mountain big sagebrush with substantial reduction in the perennial herbaceous component as compared to State 2.

Transition T3a: from State 3 to State 4 (Mountain Big Sagebrush Super-dominance State to Yellow Rabbitbrush State)
Wildfire or brush management, either by mechanical means or prescribed fire, will temporarily remove the mountain big sagebrush. However, an increase in yellow rabbitbrush (*Chrysothamnus viscidiflorus*) is expected in most circumstances. The herbaceous component will also increase after fire or brush beating. The approach to this transition is indicated by an increase in rabbitbrush seedlings. The transition is triggered by wildfire or mechanical removal of sagebrush accompanied by heavy grazing.

Transition T3b: from State 3 to State 5 (Mountain Big Sagebrush Super-dominance State to Native Perennial Grass State)

Brush management using 2, 4-D or 2, 4-5T will remove both the shrub and forb components, leaving the grasses. This transition is triggered by herbicide application.

Transition T3c: from State 3 to State 6 (Mountain Big Sagebrush Super-dominance State to Introduced Grassland State)
This transition occurs when a decision is made to increase forage production by tilling and re-seeding with intermediate wheatgrass (*Thinopyrum intermedium*), smooth brome (*Bromus inermis*), or orchardgrass (*Dactylis glomerata*) –all introduced (non-native) species.

Restoration Pathway: R3a
Prescribed grazing during the non-growing season of the grasses and forbs will allow the native perennial herbaceous species to re-establish, returning the community to a mountain big sagebrush-steppe (State 2).

State 4: Yellow Rabbitbrush State
This State is characterized by having an abundance of yellow rabbitbrush and forb species and a reduced amount of mountain big sagebrush. This State occurs when the sagebrush is removed by fire or mechanical means from an area where it was previously super-dominant. This State is maintained by lack of sagebrush seedling establishment. It could also be maintained by periodic sagebrush removal by fire.

Community Phase 4.1: yellow rabbitbrush & forbs abundant/ mountain big sagebrush reduced
This Phase is characterized by having an abundance of yellow rabbitbrush and forb species and having a reduced amount of mountain big sagebrush.

Transition T4a: from State 4 to State 3 (Yellow Rabbitbrush State to Mountain Big Sagebrush Super-dominance State)
Heavy continuous season long grazing will impact the herbaceous component, allowing the shrubs to return to dominance.

State 5: Native Perennial Bunchgrass State
This State is dominated by native perennial bunchgrasses such as western wheatgrass, Sandberg bluegrass, and Columbia needlegrass. Shrubs and have been reduced and forbs eliminated by 2,4-D™ or 2,4-5T™ application. This State is maintained by the lack of shrub and forb seed source, and the abundance of native perennial grass seed source.

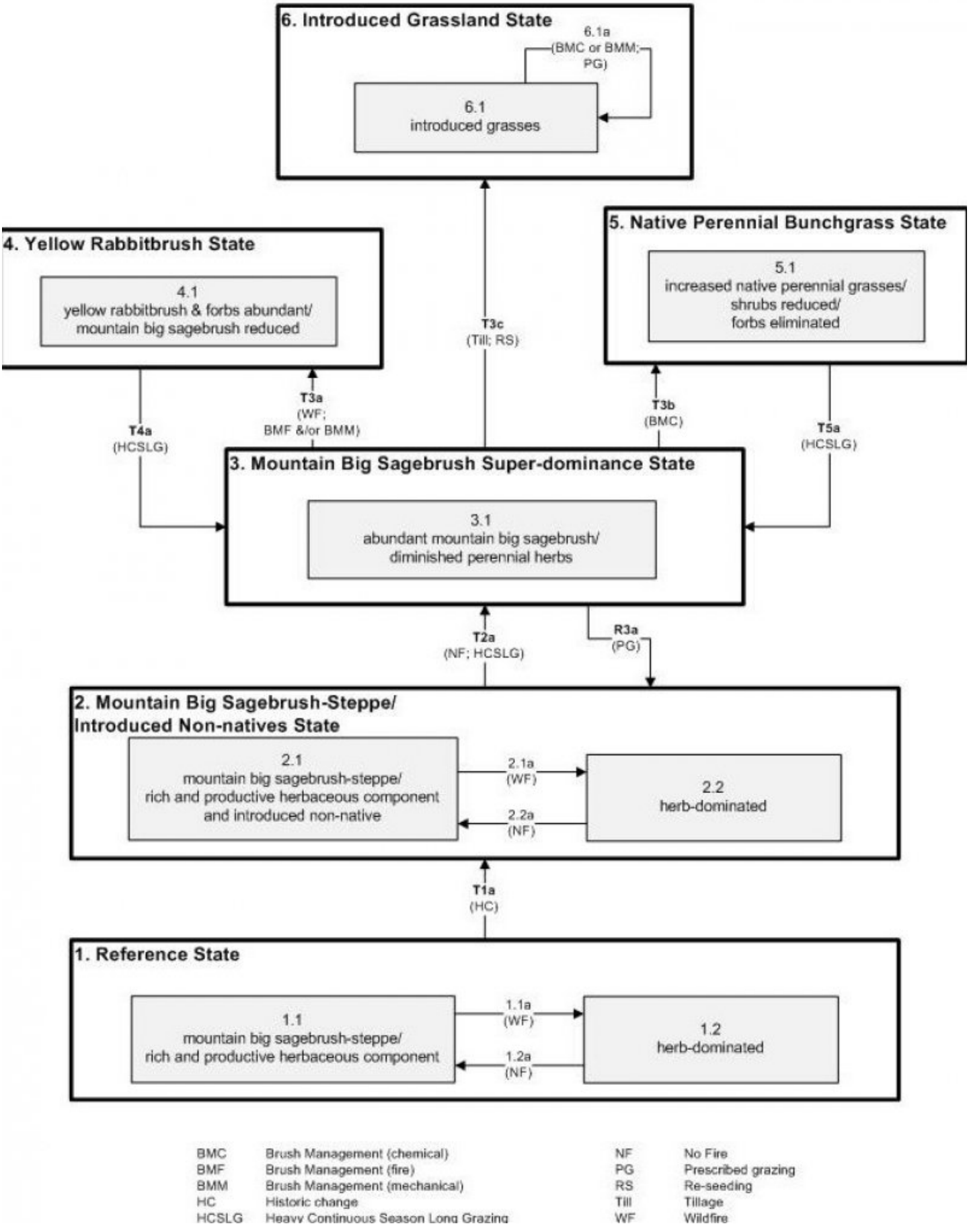
Community Phase 5.1: increased native perennial grasses/ shrubs reduced/ forbs eliminated
This Phase is characterized by the dominance of perennial native bunchgrasses such as western wheatgrass, Sandberg bluegrass, and Columbia needlegrass. Shrubs and have been reduced and forbs eliminated.

Transition T5a: from State 5 to State 3 (Native Perennial Bunchgrass State to Mountain

Big Sagebrush Super-dominance State)
Heavy continuous season long grazing will impact the native graminoids, allowing the shrubs to return to dominance. The approach to this transition is indicated by an increase in sagebrush seedlings. This transition is triggered by heavy growing season livestock grazing.

State 6: Introduced Grassland State
This state is characterized by the dominance of seeded grasses such as intermediate wheatgrass, smooth brome, or orchardgrass. This state occurs when a decision is made to increase forage production by tilling and re-seeding introduced grasses. Periodic brush management is required to maintain the grass-dominance of this state. This resiliency of this State can be maintained by sustainable levels of livestock grazing as determined by monitoring. Conversely, continued heavy use will negatively impact the resiliency of this state.

State and transition model



State 1
Reference State

As this site deteriorates due to grazing pressure Columbia needlegrass, bluegrass, bitterbrush, and palatable forbs decrease while mountain big sagebrush, lupine, rabbitbrush, western wheatgrass and Letterman needlegrass increase. Fire will kill mountain big sagebrush, Columbia needlegrass and sometimes bitterbrush, however, western wheatgrass, rabbitbrush and lupine will increase.

Community 1.1
Reference Plant Community

The dominant aspect of the plant community is mountain big sagebrush and grass. The composition by air-dry weight of the potential plant community is 55 percent perennial grasses, 20 percent forbs, and 25 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	586	894	1203
Shrub/Vine	266	406	546
Forb	213	325	437
Total	**1065**	**1625**	**2186**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	14-16%
Grass/grasslike foliar cover	39-41%
Forb foliar cover	14-16%
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 (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	–
>0.15 <= 0.3	–	–	–	14-16%
>0.3 <= 0.6	–	–	39-41%	–
>0.6 <= 1.4	–	14-16%	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			219–336	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	168–252	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	50–84	–
3	**Sub-Dominant Shrubs**			56–224	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	50–84	–
	longflower rabbitbrush	CHDE2	*Chrysothamnus depressus*	17–34	–
	yellow rabbitbrush	CHVIL4	*Chrysothamnus viscidiflorus ssp. lanceolatus*	17–34	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	17–34	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	17–34	–
	wild crab apple	PERA4	*Peraphyllum ramosissimum*	17–34	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	17–34	–
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	17–34	–
	spineless horsebrush	TECA2	*Tetradymia canescens*	17–34	–

	horsebrush				
Grass/Grasslike					
0	**Dominant Grasses**			504–729	
	western wheatgrass	PASM	*Pascopyrum smithii*	252–336	–
	Sandberg bluegrass	POSE	*Poa secunda*	84–168	–
	Columbia needlegrass	ACNE9	*Achnatherum nelsonii*	84–168	–
	needle and thread	HECO26	*Hesperostipa comata*	84–168	–
1	**Sub-Dominant Grasses**			168–448	
	Grass, annual	2GA	*Grass, annual*	84–168	–
	Grass, perennial	2GP	*Grass, perennial*	84–168	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	50–84	–
	Letterman's needlegrass	ACLE9	*Achnatherum lettermanii*	50–84	–
	mountain brome	BRMA4	*Bromus marginatus*	50–84	–
	Geyer's sedge	CAGE2	*Carex geyeri*	50–84	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	50–84	–
Forb					
0	**Dominant Forbs**			101–168	
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	50–84	–
	tapertip hawksbeard	CRAC2	*Crepis acuminata*	50–84	–
2	**Sub-Dominant Forbs**			112–336	
	Forb, annual	2FA	*Forb, annual*	84–168	–
	Forb, perennial	2FP	*Forb, perennial*	84–168	–
	common yarrow	ACMI2	*Achillea millefolium*	17–50	–
	textile onion	ALTE	*Allium textile*	17–50	–
	littleleaf pussytoes	ANMI3	*Antennaria microphylla*	17–50	–
	Eastwood's sandwort	AREAE	*Arenaria eastwoodiae var. eastwoodiae*	17–50	–
	Wyoming Indian paintbrush	CALI4	*Castilleja linariifolia*	17–50	–
	purple fleabane	ERPU3	*Erigeron purpuratus*	17–50	–

	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	17–50	–
	sticky purple geranium	GEVI2	*Geranium viscosissimum*	17–50	–
	tailcup lupine	LUCAC3	*Lupinus caudatus ssp. caudatus*	17–50	–
	hoary tansyaster	MACA2	*Machaeranthera canescens*	17–50	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	17–50	–
	spiny phlox	PHHO	*Phlox hoodii*	17–50	–
	longleaf phlox	PHLO2	*Phlox longifolia*	17–50	–
	slender cinquefoil	POGR9	*Potentilla gracilis*	17–50	–
	low beardtongue	PEHU	*Penstemon humilis*	17–50	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	17–50	–
	American vetch	VIAM	*Vicia americana*	17–50	–

Animal community

This site provides grazing for cattle and sheep in the spring, summer and fall.

This site provides food and cover for many species of wildlife. Wildlife using this site include sage grouse, rabbit, coyote, mule deer, and elk.

Hydrological functions

The soil series are in hydrologic group B. The hydrologic curve number is 61 when the vegetation is in good condition.

Recreational uses

This site offers colors and aesthetic appeal during the growing season.

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

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Contributors

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Approval

Sarah Quistberg, 2/11/2025

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

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Date	10/24/2012
Approved by	Sarah Quistberg
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None to Rare. Some minor rill development may occur on steeper slopes (> 20%) or on areas located below exposed bedrock or other water shedding areas where increased runoff may occur. Where these rills are present, they should be fairly short (3-6 feet), < 1 inch deep and somewhat widely spaced (4-8 feet). Minor rill development may be observed on all slopes following major thunderstorm or spring runoff events but should heal during the next growing season.

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2. **Presence of water flow patterns:** Rare. Some very minor evidence of water flow patterns may be found winding around perennial plant bases. They show little evidence of current erosion. They are expected to be short (3-6 feet), stable, sinuous and normally not connected. There may be very minor evidence of deposition. Evidence of water flow may increase somewhat in slopes > 20%.

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3. **Number and height of erosional pedestals or terracettes:** Perennial vegetation shows little evidence of erosional pedestalling (1 to 2% of individual plants). Plant roots are covered and most litter remains in place around plant crowns. Terracettes should be absent or, if present, stable. A slight increase in both pedestal and terracette development may occur with increasing slope.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground ranges from 20% - 30%. Soil surface may be covered by 15 to 35% coarse fragments. Bare ground openings should not be greater than 1 foot in diameter and should normally not be connected.

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5. **Number of gullies and erosion associated with gullies:** None to Rare at site level. Scattered landscape level gully channels, however, are a normal component of desert environments. Where landscape gullies are present, they should be stable, partially vegetated on their sides and bottoms, with no evidence of head-cutting. Some slight increase in disturbance may be evident following significant weather events or when gullies convey considerable runoff from higher elevation rocky or naturally eroding areas.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None. No evidence of wind generated soil movement is present. Wind caused blowouts and deposition are not present.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water movement. Minor litter removal may occur in flow channels with deposition occurring within 1 to 2 feet at points of obstruction. The majority of litter accumulates at the base of plants. Some grass leaves and small twigs (grass stems) may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move. However, some litter movement is expected (up to 6 feet) with increases in slopes >20% and/or increased runoff resulting from heavy thunderstorms.

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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 or 6 under the plant canopies, and a rating of 4 to 5 in the interspaces. The average rating should be a 5. Soil surface textures are typically loams, very fine sandy loams and silt loams.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Diagulch) Soil surface 0-4 inches. Texture is a loam; color is very dark brown (7.5YR 2/2); and structure is weak medium prismatic parting to moderate fine and very fine granular. Mollic epipedon ranges to 9 inches. 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 produces sufficient cover and spatial arrangement to intercept most raindrops and reduce raindrop splash erosion. Litter on soil surface and cryptogamic crusting, where present, also protects soil from splash erosion and encourages a higher rate of infiltration. Plant spatial distribution

should slow runoff, allowing additional time for infiltration. Bare spaces are expected to be small and irregular in shape and are usually not connected. Vegetative structure is usually adequate to capture snow and ensure that snowmelt occurs in a controlled manner, allowing maximum time for infiltration, and reducing runoff and erosion in all but the most extreme storm events. When perennial grasses and shrubs decrease due to natural events including drought, insect damage, etc., which reduce ground cover and increase bare ground, runoff is expected to increase and associated infiltration reduced.

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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. Some soils have an argillic horizon that could be mistaken for a compaction pan.

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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: Rhizomatous grasses (western wheatgrass) >> Perennial bunchgrasses (Columbia needlegrass, Nevada bluegrass), => Non-sprouting shrub (mountain big sagebrush, >> Sprouting shrub (bitterbrush).

    Sub-dominant: Perennial bunchgrasses & grasslikes (Leterman needlegrass, Geyer sedge) > > Sprouting shrubs (green rabbitbrush, mountain snowberry) > Perennial forbs (arrowleaf balsamroot).

    Other: A wide variety of other perennial grasses and both perennial and annual forbs can be expected to occur in the plant community.

    Additional: Natural disturbance regimes include fire, drought, and insects. Assumed fire cycle of 30 to 40+ years. Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference. Following a disturbance such as fire, drought, rodents or insects that remove woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community for a period of time. If a disturbance has not occurred for an extended period of time, woody species may continue to increase. These conditions would reflect different functional community phases within the reference state.

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13. **Amount of plant mortality and decadence (include which functional groups are**

expected to show mortality or decadence): All age classes of perennial grasses should be present under average to above average growing conditions with age class expression likely subdued during periods of extended drought. Slight decadence in the principle shrubs could occur near the end of the fire cycle or during periods of extended drought, or insect infestations. In general, a mix of age classes should be expected with some dead and decadent plants present.

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14. **Average percent litter cover (%) and depth (in):** Litter cover will be heavier under plants. Most litter will be herbaceous and depths of 1 to 3 inches would be considered normal. Perennial vegetation should be well distributed on the site.

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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 1400 - 1500 #/acre on an average year but could range from 900 - 2000 #/acre during periods of prolonged drought or above average precipitation.

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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:** Cheatgrass, Allysum, Russian thistle, mustard species, Utah juniper.

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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce in all years, except in extreme drought years. Green rabbitbrush sprouts vigorously following fire. There are no restrictions on either seed or vegetative reproduction. Some seedling recruitment of major species is present during average and above average growing years.
