

## Ecological site R034BY212UT Semidesert Loam (Wyoming Big Sagebrush)

Last updated: 3/05/2022  
Accessed: 05/05/2024

### 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.

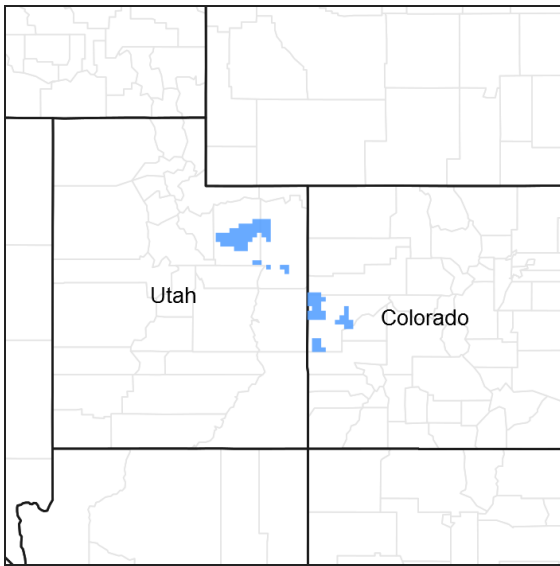


Figure 1. Mapped extent

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): 034B–Warm Central Desertic Basins and Plateaus

MLRA 34B occurs in is in Utah (70 percent) and Colorado (30 percent). It makes up about 12,850 square miles (33,290 square kilometers). A small part of the area is in the High Plateaus of Utah Section of the Colorado Plateaus Province of the Intermontane Plateaus. The northern part of the MLRA occurs in the Uinta Basin Section, which is bounded by the Uinta Mountains to the north, the Wasatch Range to the west, the Roan Plateau to the south, and the Rabbit Hills to the east. The southern part of the MLRA occurs in the northern third of the Canyon Lands Section. This section is bounded by the Roan Plateau to the north, the Wasatch Plateau to the west, the southern end of the San Rafael Swell to the south, and the western slope of the Rocky Mountains to the east. Elevation ranges from 4,100 feet (1,250 meters) near Green River, Utah, to 7,500 feet (2,285 meters) at the base of the Wasatch Range and the Roan Plateau.

Most of this area is covered by residual basin-floor materials and materials washed in from the surrounding mountains and plateaus. Shale and sandstone are the dominant rock types. The Tertiary-age Green River, Uinta, and Duchesne Formations dominate the northern part of the MLRA. The southern part is dominated by Cretaceous-age materials with lesser amounts of Jurassic and Triassic materials. The dominant Cretaceous formations are Mancos Shale, Dakota Sandstone, and the members of the Mesa Verde Group. The dominant Jurassic formations are the Morrison, Entrada, and Navajo. The dominant Triassic formations are the Chinle and Moenkopi. Quaternary alluvial, eolian, and glacial deposits occur in both parts of the MLRA.

The average annual precipitation in most of this area ranges from 6 to 10 inches (150 to 255 millimeters). A small part of this area receives as much as 24 inches of annual precipitation.

Much of the precipitation occurs as high-intensity, convective thunderstorms during the period July through September. May and June are usually the drier months. Precipitation is more evenly distributed throughout the year in the northern part of the MLRA than in the southern part, where there is a significant peak in late summer. The northern part of the MLRA receives more precipitation as snow during winter than the southern part. The average annual temperature ranges from 41 to 54 degrees F (5 to 12 degrees C). The freeze-free period averages 170 days and ranges from 110 to 235 days.

The dominant soil orders in this MLRA are Aridisols and Entisols. Mollisols occur at the higher elevations, particularly in the northern part of the MLRA. The dominant soil temperature regime is mesic, and the dominant soil moisture regime is aridic. The soils receiving less than 8 inches (205 millimeters) of precipitation annually have an aridic soil moisture regime. The soils receiving 8 to 12 inches (205 to 305 millimeters) have an aridic soil moisture regime that borders on ustic. The soils receiving 12 to 16 inches (305 to 405 millimeters) generally have an ustic soil moisture regime that borders on aridic. The dominant soil mineralogy is mixed and soils are formed in slope alluvium or residuum derived from shale or sandstone. Many of the soils are shallow or moderately deep to shale or sandstone bedrock. The soils at the lower elevations generally have significant amounts of calcium carbonate, salts, and gypsum.

### Ecological site concept

Characteristic soils in this site are deep and well-drained. They formed in alluvium and colluvium derived mainly from mixed sedimentary parent materials. The soils are generally fine-loamy with a surface texture of loam, fine sandy loam or silty clay loam. Permeability is moderate-slow to moderate and runoff is medium. The water supplying capacity is 3 to 7 inches. Average annual soil loss in potential is approximately 0.5 to 1.5 tons/acre. The soil surface may be covered with gravels or cobbles to the extent of 40 percent of area.

### Associated sites

R034BY216UT	<b>Semidesert Sandy Loam (Fourwing Saltbush)</b> Semidesert Sandy Loam (Fourwing saltbush)
R034BY233UT	<b>Semidesert Shallow Loam (Utah Juniper-Pinyon)</b> Semidesert Shallow Loam (Utah juniper-Pinyon)
R034BY247UT	<b>Semidesert Stony Loam (Utah Juniper-Pinyon)</b> Semidesert Stony Loam (Utah juniper-Pinyon)

### Similar sites

R034BY205UT	<b>Semidesert Gravelly Loam (Wyoming Big Sagebrush)</b> Semidesert gravelly loam (Wyoming big sagebrush)
R034BY206UT	<b>Semidesert Gravelly Sandy Loam (Wyoming Big Sagebrush)</b> Semidesert sandy gravelly loam (Wyoming big sagebrush)

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia tridentata ssp. wyomingensis</i>
Herbaceous	(1) <i>Achnatherum hymenoides</i>

### Physiographic features

This site occurs on alluvial fans, terraces, pediment foot slopes, toe slopes and occasionally in drainages. Slopes are mostly 1 to 25 percent, but may range up to 40 percent. Elevations range from 5,300 to 6,800 feet on all aspects.

**Table 2. Representative physiographic features**

Landforms	(1) Fan remnant (2) Alluvial fan (3) Hill
Runoff class	Medium to high
Flooding frequency	None
Ponding frequency	None
Elevation	1,615–2,073 m
Slope	1–25%
Ponding depth	Not specified
Water table depth	Not specified
Aspect	Aspect is not a significant factor

### Climatic features

Average annual precipitation is 8 to 12 inches. Approximately 60% occurs as rain from March through September. On the average, November through February are the driest months and July through October are the wettest months. The mean annual air temperature is 10 degrees Celsius and the soil temperatures are in the mesic regime. The average freeze-free period is 127 to 151 days. In average years, plants begin growth around March 30 and end growth around September 30.

**Table 3. Representative climatic features**

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	127-151 days
Precipitation total (characteristic range)	203-305 mm

### Climate stations used

- (1) ALTAMONT [USC00420074], Altamont, UT
- (2) VERNAL MUNICIPAL AP [USW00094030], Vernal, UT
- (3) NEOLA [USC00426123], Roosevelt, UT

### Influencing water features

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

### Soil features

Characteristic soils in this site are deep and well-drained. They formed in alluvium and slope alluvium derived mainly from mixed sedimentary parent materials. The soils are generally fine-loamy with a surface texture of loam, fine sandy loam or silty clay loam. Permeability is moderate-slow to moderate and runoff is medium. The water supplying capacity is 3 to 7 inches. Average annual soil loss in potential is approximately 0.5 to 1.5 tons/acre. The soil surface may be covered with gravels or cobbles to the extent of 40 percent of area.

Modal Soil: Abra L 3-8%, 1-3% — fine-loamy, mixed, mesic Ustollic Calciorthids

Soil Survey Area: 047:

Abra L 3-8%, 1-3% GR-SL 3-25%; Abra GR-SL 25-40% Eroded; Abra VFSL CL Cob Substr 1-3%; Baldfield SiC 1-3%; Hazmaz L 1-3%, 2-5% GR-L 3-8%; Honlu SL 1-8% CBV-SL 8-15%; Lapoint CL 2-4%; Curcreek VFSL Dry 3-8%; Paradox CL 3-8% L 3-8%; Paradox L 3-8%, 1-3%, 8-25% Eroded; Paradox SiC 1-3%; Sinkson L 2-5%, 5-8%; Mikim L 3-15% CB-CL 8-25%; Mikim L 25-40% Eroded 1-3%; Mikim GR-L 2-8%; Penistaja FSL 3-8%; Alldown L 2-5%, 5-8%; Bowbac SL 2-5%; Cerrillos CL 2-5%; Creered SiL Dry 2-4%; Glenberg Family 3-6%; Haverdad L 1-8%;

Hernandez Family 1-3%, 3-8%; Barx FSL 1-5% and Sazi FLS 3-8%

**Table 4. Representative soil features**

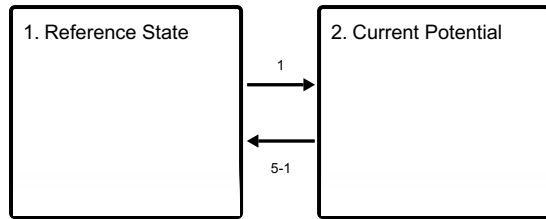
Parent material	(1) Alluvium–sandstone and shale (2) Alluvium–limestone and sandstone (3) Alluvium–quartzite
Surface texture	(1) Silty clay loam (2) Sandy loam (3) Loam
Family particle size	(1) Fine-loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	51–152 cm
Soil depth	51–152 cm
Surface fragment cover ≤3"	2–11%
Surface fragment cover >3"	0–5%
Available water capacity (Depth not specified)	7.62–17.78 cm
Calcium carbonate equivalent (Depth not specified)	1–10%
Electrical conductivity (Depth not specified)	2–6 mmhos/cm
Sodium adsorption ratio (Depth not specified)	0–5
Soil reaction (1:1 water) (Depth not specified)	7.4–8.4
Subsurface fragment volume ≤3" (Depth not specified)	0–20%
Subsurface fragment volume >3" (Depth not specified)	0–15%

### Ecological dynamics

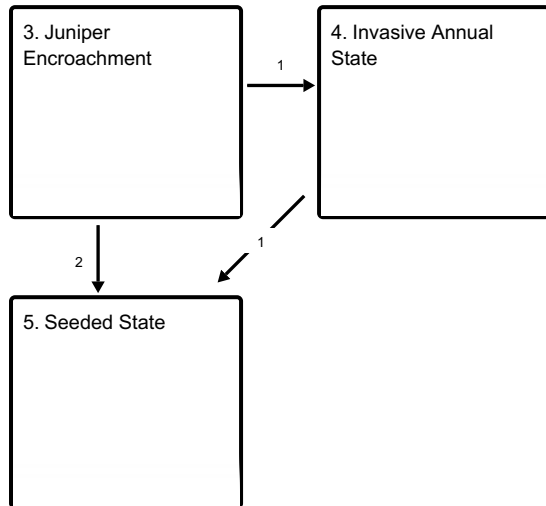
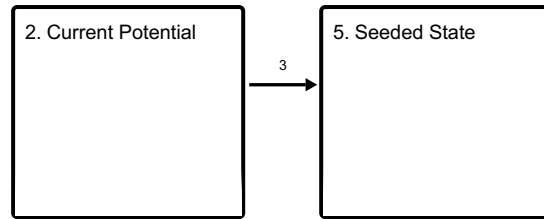
Wyoming sagebrush is typically the dominant shrub in this community phase. Where Utah juniper has invaded, Wyoming big sagebrush and other shrubs decline, otherwise they dominate the community. Winterfat is dead or dying. Remaining perennial herbaceous vegetation is mostly found only in protected locations under shrubs. Invasive, non-native grasses and weeds including cheatgrass, annual mustards, redstem storksbill, etc. dominate the understory.

### State and transition model

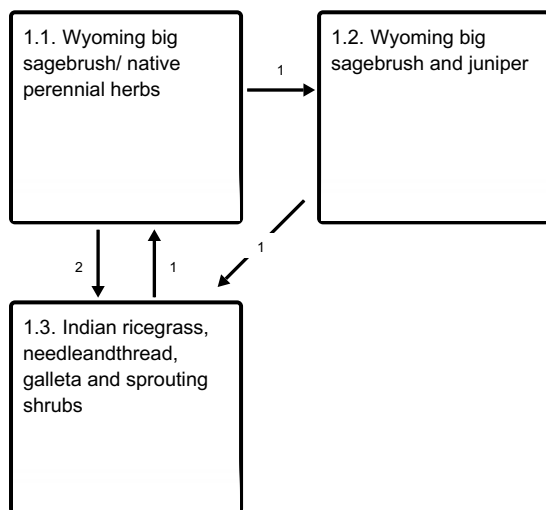
### Ecosystem states



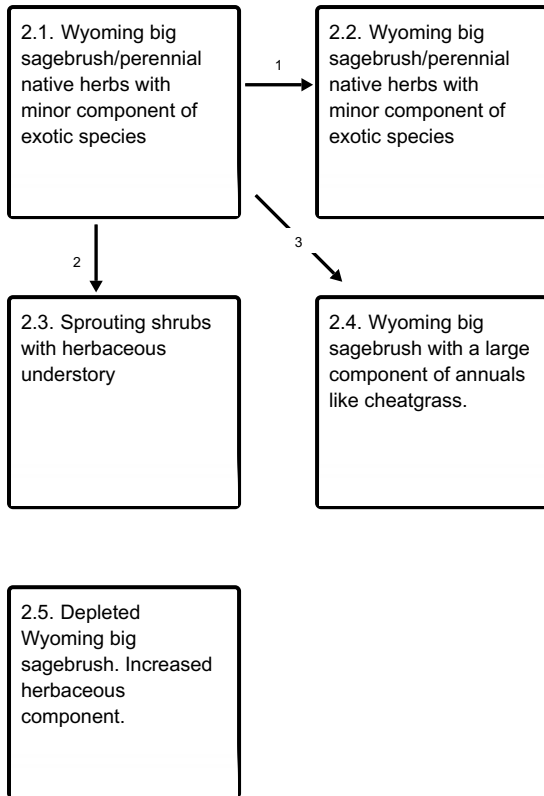
### States 2 and 5 (additional transitions)



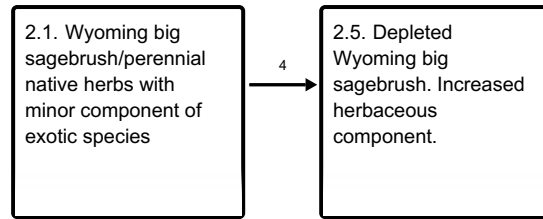
### State 1 submodel, plant communities



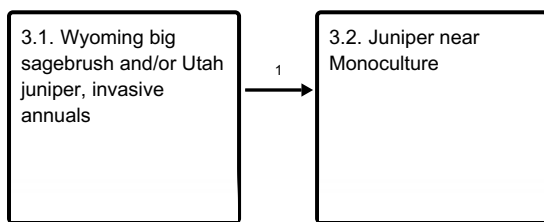
### State 2 submodel, plant communities



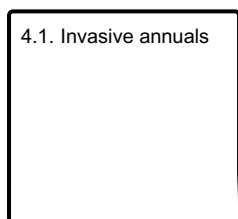
### Communities 1 and 5 (additional pathways)



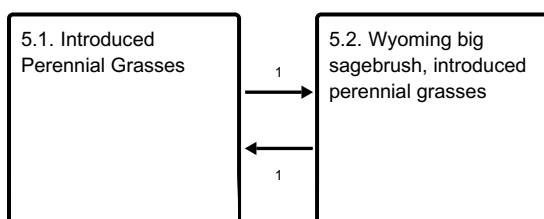
### State 3 submodel, plant communities



### State 4 submodel, plant communities



### State 5 submodel, plant communities



## 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 Reference State for this site would have been a shrub steppe characterized by Wyoming big sagebrush and associated native perennial forbs and grasses. A more complete list of species by lifeform for the Reference State is available in the accompanying tables in the "Plant Community Composition by Weight and Percentage" section of this document.

## Community 1.1

### Wyoming big sagebrush/ native perennial herbs

This community is dominated by Wyoming big sagebrush, Indian ricegrass and galleta. Shadscale and winterfat are also commonly present in the shrub layer. Indian ricegrass and galleta are the principle perennial grasses. Bottlebrush squirreltail is also commonly present. Abundant forbs including longleaf phlox and scarlet globemallow. Percent composition by air-dry weight is 35% grass, 10% forbs, and 55% shrubs. Natural fire frequency is estimated to be 10 to 70 years (USDA-FS, 2006).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	196	303	532
Grass/Grasslike	280	379	491
Forb	17	140	252
<b>Total</b>	<b>493</b>	<b>822</b>	<b>1275</b>

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	24-26%
Grass/grasslike foliar cover	29-31%
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 (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	–
>0.15 <= 0.3	–	–	–	4-6%
>0.3 <= 0.6	–	–	29-31%	–
>0.6 <= 1.4	–	24-26%	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

## Community 1.2

### Wyoming big sagebrush and juniper

This phase represents an extended period of time without a major disturbance such as fire; insect damage; or prolonged drought. Wyoming big sagebrush and shadscale increases significantly in percent composition. Winterfat and yellow rabbitbrush may increase also. Shrubs become decadent due to age. Perennial grasses and forbs lose vigor and juniper may have begun to encroach on the site. With the plant interspaces becoming larger from the reduction of rhizomatous grasses, soil erosion may accelerate because of the increased bare ground. Water flow patterns and pedestals become more abundant. Although the overall functionality of the site is still intact, it is at risk with further degradation.

### **Community 1.3**

#### **Indian ricegrass, needleandthread, galleta and sprouting shrubs**

Native perennial bunchgrasses dominate this community phase. Wyoming big sagebrush and shadscale decrease in the community. Winterfat has the ability to re-sprout and re-establish following a fire. Yellow rabbitbrush and horsebrush species may increase significantly following fire and much of the excess fine fuel accumulation is removed. Fire tolerant shrubs typically persist as dominants in the community for 30 years or longer. Indian ricegrass and other cool season bunchgrasses flourish. Galleta increases in herbaceous cover.

### **Pathway 1**

#### **Community 1.1 to 1.2**

Extended period of time without a major disturbance such as fire; insect damage; or prolonged drought. Fire frequency extends well beyond the 40 to 50 year average for the site.

### **Pathway 2**

#### **Community 1.1 to 1.3**

Recent fire occurrence, lightning or human caused (1 – 30 years). Site is properly grazed.

### **Pathway 1**

#### **Community 1.2 to 1.3**

This pathway occurs from the occurrence of a natural or human induced fire.

### **Pathway 1**

#### **Community 1.3 to 1.1**

This represents the time following a fire with good grazing management, with a normal fire return interval of 40-50 years.

## **State 2**

### **Current Potential**

This state includes plant communities dominated by a diverse mixture of perennial grasses, a mixture of Wyoming big sagebrush and perennial grasses, and a community dominated by Wyoming big sagebrush. These community phases occur depending on the time since a disturbance that kills Wyoming big sagebrush has occurred, such as fire, insects, or drought, and grazing that provides adequate duration, timing, and intensity that maintain plant vigor and health of the plant community. Plant communities in this state can include native, acclimatized, naturalized and invasive non-native species. This state is irreversibly changed from the reference state because these non-native species will now remain a permanent part of the community. This plant community has the composition, structure and cover present that facilitates the capture, storage, and safe release of precipitation, nutrients are being cycled through deep rooted perennial grasses, forbs, and evergreen shrubs, and cool season energy capture throughout the entire growing season (March to October) such that this plant community and site resiliency is maintained. With a lengthened fire return interval (greater than 60 years), an increase in sagebrush canopy occurs until sagebrush dominates resource use. This results in a decrease in vigor, cover and reproduction of perennial bunch grasses, and results in an increase in invasive annuals such as cheatgrass. This leads into transition T2b. With increased sagebrush cover, bare ground increases, resulting in a reduction in the capture, storage, and safe release of precipitation, a reduction in the amount of nutrient cycling and energy capture.



## Community 2.1

### Wyoming big sagebrush/perennial native herbs with minor component of exotic species



Figure 7. 2.1



Figure 8. 2.1

This community is dominated by Wyoming big sagebrush, Indian ricegrass and galleta. Shadscale and winterfat are also commonly present in the shrub layer. Indian ricegrass and galleta are the principle perennial grasses. Bottlebrush squirreltail is also commonly present. Abundant forbs including longleaf phlox and scarlet globemallow. Naturalized and invasive non-native species also exist. Percent composition by air-dry weight is 35% grass, 10% forbs, and 55% shrubs. Natural fire frequency is estimated to be 40 to 50 years.

Figure 9. Plant community growth curve (percent production by month).  
UT0002, Current Potential. Community Phase 2.1.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1	9	17	22	19	12	8	5	3	2	1

## Community 2.2

### Wyoming big sagebrush/perennial native herbs with minor component of exotic species



**Figure 10. 2.2**

Wyoming big sagebrush and shadscale increase significantly in percent composition. Winterfat and Yellow rabbitbrush may increase also. Shrubs become decadent due to age. Indian ricegrass, needleandthread and other cool season bunchgrasses begin to lose vigor because of improper grazing (including, season long overstocking, wrong season, etc.) and/or increased shrub competition and become dense with old vegetation. Galleta increases in herbaceous cover. This community is dominated by native species, but may include acclimatized, naturalized and invasive non-native species. Utah Juniper can encroach in this community phase and is small and low in cover. Percent composition by air-dry weight is 30% grass, 10% forbs, and 60% shrubs.

### **Community 2.3 Sprouting shrubs with herbaceous understory**



**Figure 11. 2.3**

Wyoming big sagebrush and Shadscale decrease in the community. Winterfat resprouts following the fire. Yellow rabbitbrush and horsebrush may increase significantly in the community following fire. Several native grasses dominate the understory. Fire tolerant shrubs typically persist as dominants in the community for 30 years or longer. This community is dominated by native species. Depending on the abundance of invasive annuals prior to the disturbance, will dictate their abundance post disturbance.

### **Community 2.4 Wyoming big sagebrush with a large component of annuals like cheatgrass.**



Figure 12. 2.4

At risk community. Sagebrush is increasing in dominance and capturing site resources, reducing opportunity for perennial bunchgrasses to thrive. Fire frequency extends beyond the 40 – 50 year average for the site. Utah juniper may also begin invading the site if a seed source is available. An increase in sagebrush canopy until sagebrush dominates available resources, resulting in a decrease in vigor, cover and reproduction of perennial bunch grasses and forbs resulting in an increase in invasive annuals such as cheatgrass.

## Community 2.5

**Depleted Wyoming big sagebrush. Increased herbaceous component.**



Figure 13. 2.5



Figure 14. 2.5

Depleted Wyoming big sagebrush. Herbaceous understory has increased significantly due to the reduced competition for resources. Scattered annual species are also present.

## Pathway 1 Community 2.1 to 2.2



Wyoming big sagebrush/perennial native herbs with minor component of exotic species



Wyoming big sagebrush/perennial native herbs with minor component of exotic species

Improper grazing (including season long, overstocking, wrong season, etc.) and/or drought remove annual and perennial fine fuels from the site lessening the potential for fire to occur. Fire frequency extends beyond the 40 – 50 year average for the site. Utah juniper will often invade the site if a seed source is available.

## Pathway 2 Community 2.1 to 2.3



Wyoming big sagebrush/perennial native herbs with minor component of exotic species



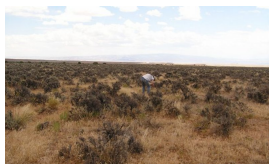
Sprouting shrubs with herbaceous understory

Fire removes non-sprouting shrubs from the community. Yellow rabbitbrush and/or horsebrush species become dominant. Recent fire occurrence (1 to 30 years).

## Pathway 3 Community 2.1 to 2.4



Wyoming big sagebrush/perennial native herbs with minor component of exotic species



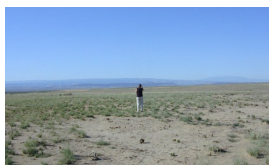
Wyoming big sagebrush with a large component of annuals like cheatgrass.

Improper grazing (including season long, overstocking, continual spring grazing, etc.) and/or drought remove perennial grass facilitating an increase in invasive annual species.

## Pathway 4 Community 2.1 to 2.5



Wyoming big sagebrush/perennial native herbs with minor component of exotic species



Depleted Wyoming big sagebrush. Increased herbaceous component.

Wyoming big sagebrush significantly depleted due to brush management practices and/or heavy browsing by sheep and/or deer.

### **State 3**

#### **Juniper Encroachment**

Native shrubs such as Wyoming big sagebrush or rabbitbrush dominate the site. The dominance depends on time since fire. Wyoming big sagebrush is non-sprouting and will be killed by fire. Rabbitbrush can sprout after a fire and can become the dominant shrub. This state typically has invasive grasses and/or forbs as the dominant understory species. There may be a few native species remaining, but they do not dominate. Utah junipers may increase to occupy a significant portion of the over story, if a seed source is present. Wyoming big sagebrush dominates the shrub layer and may be decadent due to age. Indian ricegrass and other native bunchgrasses are significantly reduced due to increased shrub competition and/or heavy grazing pressure. Galleta may increase. The threshold is crossed when invasive annuals including cheatgrass, annual mustards, redstem storksbill, etc. dominate the understory. The occurrence of fire extends well beyond the normal period for the site.

#### **Community 3.1**

##### **Wyoming big sagebrush and/or Utah juniper, invasive annuals**



Figure 15. 3.1

Wyoming sagebrush is typically the dominant shrub in this community phase. Where Utah juniper has invaded, Wyoming big sagebrush and other shrubs decline, otherwise they dominate the community. Winterfat is dead or dying. Remaining perennial herbaceous vegetation is mostly found only in protected locations under shrubs. Invasive, non-native grasses and weeds including cheatgrass, annual mustards, redstem storksbill, etc. dominate the understory.

#### **Community 3.2**

##### **Juniper near Monoculture**



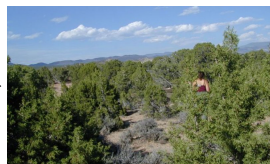
Figure 16. 3.2

The understory shrub and herbaceous has become very decadent or absent. A few scattered shrubs may still exist with the herbaceous component nearly nonexistent. Exposed soil results in increased runoff and erosion.

## Pathway 1 Community 3.1 to 3.2



Wyoming big sagebrush  
and/or Utah juniper, invasive  
annuals



Juniper near Monoculture

Sustained, long-term improper grazing (including season long, overstocking, wrong season, etc.); and/or prolonged drought. Lengthening of the fire return interval.

## State 4 Invasive Annual State

Invasive grasses and forbs dominate this state. This may occur under a shortend fire return cycle which excludes native shrubs by frequent burning or this may occur with repeated improper grazing, or a combination of the two. Indian ricegrass and other native bunchgrasses are significantly reduced due to increased shrub competition and/or heavy grazing pressure. Galleta may increase. Only remnant perennial species remain. Highly combustible fine fuels from invasive annuals to dominate the community. Reoccurring fire is common. Fire frequency is 5 – 30 years.

## Community 4.1 Invasive annuals



Figure 17. 4.1

Invasive annuals dominate this community phase. If shrubs are present, yellow rabbitbrush dominates the shrub layer. Remaining Winterfat is mostly dead. Horsebrush species can also be plentiful if conditions are right. Fire tolerant shrubs may persist as dominants with fire periods reoccurring at intervals of 5 - 30 years. Broom snakeweed may be a dominant episodic species when conditions are favorable. Only remnant perennial bunchgrasses remain, if any; invasive annuals including cheatgrass, annual mustards, redstem storksbill, etc. dominate the understory.

## State 5 Seeded State

This state is seeded to rangeland species that are composed of mostly introduced species. Unwanted trees and/or shrubs are reduced but they may occupy a portion of the site through natural regeneration. Invasive annual grasses and weedy forb species primarily, cheatgrass and various annual mustards, may be present in the seeding, but do not dominate.

## Community 5.1 Introduced Perennial Grasses



Figure 18. 5.1



Figure 19. 5.1

This community is seeded to rangeland species that is composed of mostly introduced species. Unwanted trees and/or shrubs are reduced but they may occupy a portion of the site through natural regeneration. Invasive annual grasses and weedy forb species primarily, cheatgrass and various annual mustards, may be present in the seeding, but do not dominate. Range seedings, when healthy, are usually resistant to fire.

## Community 5.2 Wyoming big sagebrush, introduced perennial grasses



Figure 20. 5.2

This community includes the dominance of introduced perennial understory. Native shrubs are re-establishing.

## Pathway 1 Community 5.1 to 5.2



Introduced Perennial Grasses



Wyoming big sagebrush,  
introduced perennial grasses

Over time Wyoming big sagebrush and other shrubs gradually move back into the site. The rate of this re-colonization may depend on external factors such as climate, management and grazing (both domestic and wildlife). Over time with the lack of disturbance such as brush management or fire, sagebrush reestablished itself on the site and dominates the herbaceous understory for resources.

## Pathway 1 Community 5.2 to 5.1



Wyoming big sagebrush,  
introduced perennial grasses



Introduced Perennial Grasses

Site receives good grazing management. Mechanical, chemical, biological or fire disturbances reduce the woody vegetation components of the community. Perennial herbaceous vegetation very slowly recovers.

## Transition 1 State 1 to 2

The threshold is crossed when there is an introduction of non-native species, primarily cheatgrass and various annual mustards, that become established in the community.

## Restoration pathway 5-1 State 2 to 1

Reduction of browsing animals and/or proper grazing following chemical brush management treatment.

## Transition 3 State 2 to 5

Disturbance such as a fire or brush management followed by a rangeland seeding.

## Transition 1 State 3 to 4

Long-term improper grazing (including season long, overstocking, wrong season, etc.) and/or prolonged drought, fire causes State to cross a threshold into State 4.

## Transition 2 State 3 to 5

Fire or brush management followed by a rangeland seeding of introduced, native or a combination rangeland species.



## Restoration pathway 1 State 4 to 5

Seeding of introduced, native or a combination rangeland species with prescribed grazing.

### Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Shrub/Vine</b>					
0	<b>Dominant Shrubs</b>			180–275	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	112–224	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	34–90	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	22–67	–
3	<b>Sub-Dominant Shrubs</b>			110–290	
	Shrub (>.5m)	2SHRUB	<i>Shrub (&gt;.5m)</i>	39–78	–
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	6–28	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	6–28	–
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	6–28	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	6–28	–
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	6–28	–
	spiny hopsage	GRSP	<i>Grayia spinosa</i>	6–28	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	6–28	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	6–28	–
	Nuttall's horsebrush	TENU2	<i>Tetradymia nuttallii</i>	6–28	–
<b>Grass/Grasslike</b>					
0	<b>Dominant Grasses</b>			196–353	
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	73–135	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	39–90	–
	needle and thread	HECO26	<i>Hesperostipa comata</i>	39–90	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	39–90	–
1	<b>Sub-Dominant Grasses</b>			94–220	
	Grass, perennial	2GP	<i>Grass, perennial</i>	22–45	–
	saline wildrye	LESAS	<i>Leymus salinus ssp. salinus</i>	6–34	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	6–34	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	6–28	–
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	6–28	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	6–28	–
<b>Forb</b>					
0	<b>Dominant Forbs</b>			8–39	
	scarlet globemallow	SPCO	<i>Sphaeralcea coccinea</i>	6–45	–
2	<b>Sub-Dominant Forbs</b>			67–224	
	Forb, perennial	2FP	<i>Forb, perennial</i>	34–67	–
	Forb, annual	2FA	<i>Forb, annual</i>	28–56	–

littleleaf pussytoes	ANMI3	<i>Antennaria microphylla</i>	0-11	-
woolly locoweed	ASMO7	<i>Astragalus mollissimus</i>	0-11	-
sego lily	CANU3	<i>Calochortus nuttallii</i>	0-11	-
twolobe larkspur	DENU2	<i>Delphinium nuttallianum</i>	0-11	-
western tansymustard	DEPI	<i>Descurainia pinnata</i>	0-11	-
cushion buckwheat	EROV	<i>Eriogonum ovalifolium</i>	0-11	-
basin fleabane	ERPU9	<i>Erigeron pulcherrimus</i>	0-11	-
manybranched ipomopsis	IPPO2	<i>Ipomopsis polycladon</i>	0-11	-
Barneby's pepperweed	LEBA	<i>Lepidium barnebyanum</i>	0-11	-
mountain pepperweed	LEMO2	<i>Lepidium montanum</i>	0-11	-
Gray's biscuitroot	LOGR	<i>Lomatium grayi</i>	0-11	-
whitestem blazingstar	MEAL6	<i>Mentzelia albicaulis</i>	0-11	-
Lapoint beardtongue	PEGO2	<i>Penstemon goodrichii</i>	0-11	-
longleaf phlox	PHLO2	<i>Phlox longifolia</i>	0-11	-
hedgemustard	SIOF	<i>Sisymbrium officinale</i>	0-11	-

### Animal community

This site provides proper grazing for sheep, cattle and horses all seasons of the year, but more particularly in the spring and fall.

This site provides food and cover for wildlife. Wildlife using this site include jackrabbit, snake, coyote, mule deer, and hawk.

### Hydrological functions

The soil is in hydrologic groups b and c. The runoff curve numbers are 61 through 86 depending on the condition of the watershed.

### Recreational uses

This site has moderate recreational opportunities and often has scenic vistas.

### Wood products

Utah juniper and pinyon invade this site and may produce firewood or posts.

### Inventory data references

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USDA-FS. 2006. *Fire Effects Information System (FEIS)*.

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## Contributors

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## Approval

Kirt Walstad, 3/05/2022

## 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	04/26/2012
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

- 1. Number and extent of rills:** None to very few rills present. Some very minor rill development may occur on steeper slopes 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:** Some very minor evidence of water flow patterns may be found around perennial plant bases. They show little evidence of current erosion. They are expected to be short (3-6 feet), stable, sinuous and not connected. There may be very minor evidence of deposition. Evidence of water flow may increase somewhat with slope.

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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 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):** 15-20% bare ground. Bare ground spaces should not be greater than 1 to 2 feet in diameter.

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5. **Number of gullies and erosion associated with gullies:** No gullies present on site. A very few gullies may be present in landscape settings where they transport runoff from areas of greater water flow such as exposed bedrock. These gullies will be limited to slopes exceeding 20% and adjacent to sites where this runoff accumulation occurs. Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation.
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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 >15% 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 and silt loams.
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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** (Abracon) Soil surface 0-4 inches. Texture is a loam; color is brown (7.5YR 5/4) and structure is weak thin platy. Ochric epipedon ranges to 4 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 (< 3 feet) 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 a calcic horizon at 7 to 24 inches 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: Non-sprouting shrubs (Wyoming big sagebrush, shadscale) > Perennial bunchgrasses (Indian ricegrass, bottlebrush squirreltail) > Forbs (Scarlet globemallow).

Sub-dominant: Sprouting shrubs (fourwing saltbush, winterfat) > Rhizomatous grasses (James galleta, blue grama) > Perennial forbs (woolly milkvetch).

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 state. 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 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 1/2 to 1 inch 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 650 - 700 #/acre on an average year but could range from 500 - 900 #/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, Russian thistle, Utah juniper, and non-native, invasive annual forbs.
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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.
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