

Ecological site R035XY209UT Semidesert Loam (Wyoming Big Sagebrush)

Accessed: 05/04/2024

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.

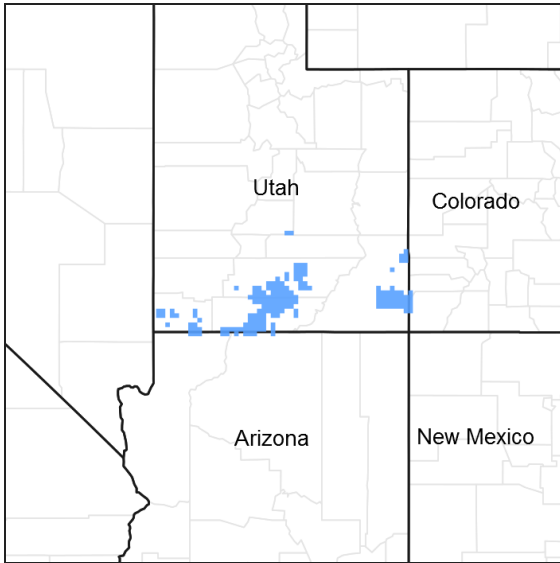


Figure 1. Mapped extent

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): 035X–Colorado Plateau

This ecological site occurs in the northern portion of MLRA 35, Colorado Plateau Province. It is found principally in the Canyon Lands and High Plateaus of Utah sections within that MLRA. This area has been structurally uplifted over time while rivers flowing across it were cutting down into its bedrock. Areas of shale, sandstone, limestone, dolomite, and volcanic rock outcrop are found throughout the region.

Classification relationships

Modal Soil: Barx FSL — fine-loamy, mixed, mesic Ustollic Haplargids

Associated sites

R035XY009UT	Alkali Flat (Greasewood)
R035XY011UT	Loamy Bottom (Basin Big Sagebrush)
R035XY109UT	Desert Loam (Shadscale)
R035XY215UT	Semidesert Sandy Loam (4-Wing Saltbush)

R035XY216UT	Semidesert Sandy Loam (Wyoming Big Sagebrush)
R035XY221UT	Semidesert Shallow Loam (Utah Juniper-Pinyon)
R035XY226UT	Semidesert Shallow Loam (Black Sagebrush/Indian Ricegrass)
R035XY234UT	Semidesert Shallow Shale (Utah Juniper-Pinyon)
R035XY237UT	Semidesert Shallow Gypsum (Mormontea)
R035XY238UT	Semidesert Shallow Hardpan (Utah Juniper-Pinyon)
R035XY240UT	Semidesert Steep Shallow Loam (Utah Juniper-Two-Needle Pinyon)
R035XY246UT	Semidesert Stony Loam (Utah Juniper-Pinyon)

Similar sites

R035XY216UT	Semidesert Sandy Loam (Wyoming Big Sagebrush)
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia tridentata ssp. wyomingensis</i> (2) <i>Krascheninnikovia lanata</i>
Herbaceous	(1) <i>Achnatherum hymenoides</i> (2) <i>Pleuraphis jamesii</i>

Physiographic features

This site occurs on alluvial flats, dissected alluvial fans, structural benches, and alluvial fans. Run off is medium to high. Slopes typically range from 1-15%, and elevations are generally 5000-6600 ft.

Table 2. Representative physiographic features

Landforms	(1) Alluvial flat (2) Alluvial fan (3) Structural bench
Flooding frequency	None
Ponding frequency	None
Elevation	1,524–2,012 m
Slope	1–15%
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by hot summers and cool to warm winters, which can be slightly modified by local topographic conditions, such as aspect. Large fluctuations in daily temperatures are common. The mean annual high temperature is 64 degrees Fahrenheit and the mean annual low temperature is 33 degrees Fahrenheit. July through October are the wettest months, and April, May, and June are the driest months. Precipitation is extremely variable from month to month and from year to year but averages between 9-14 inches a year. Much of the summer precipitation occurs as convection thunderstorms.

Mean Annual Precipitation: 9-14in

Frost Free Period: 125-145 days

Freeze Free Period (0°C days): 146-170 days

Table 3. Representative climatic features

Frost-free period (average)	141 days
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Freeze-free period (average)	170 days
Precipitation total (average)	356 mm

Influencing water features

There are no influencing water features in this site.

Soil features

The soils are moderately deep to very deep and well drained. Soils are derived from eolian sand depositions and sandstone slope alluvium. Typically the dry surface is reddish brown, brown, or reddish yellow. Surface texture is generally a very fine sandy loam, but can range from loams to fine sands. These soils are well developed and have a calcic horizon or an accumulation of calcium carbonate. Runoff potential is moderate to high due to the moderate to moderately slow permeability. Soils on reference state sites typically have moderate wind and water erosion potential, and the occurrence of water flow patterns, rills, gullies, and coppice mounding of shrubs is uncommon; however they can be found. Biological crust cover is characterized by a weak crust, with light cyanobacteria and/or isolated moss clumps, with no continuity or isolated pinnacles of lichen and moss with little continuity. This site has been used in the following soils surveys and has been correlated to the following components:

UT636 – Panguitch Area – Barx; Mikim

UT685 – Capitol Reef - Aquima, Mikim, Mivida, Abra, Sazi family, Strych, Barx;

UT686 – GSENM – Alvey; Atrac; Barx; Clapper; Horsemountain; Humbug; Mikim; Progresso; Sazi; Strych

Table 4. Representative soil features

Parent material	(1) Alluvium–calcareous sandstone
Surface texture	(1) Fine sandy loam (2) Loam (3) Very fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	53–406 cm
Surface fragment cover ≤3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	11.18–18.03 cm
Calcium carbonate equivalent (0-101.6cm)	1–30%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume ≤3" (Depth not specified)	0–8%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site is influenced by many of the natural disturbances typical of MLRA 35. Fire is among such disturbances. Following a burn, perennial grasses generally dominate the community. After a few years of average precipitation, Wyoming big sagebrush regains dominance of the site. In contrast, lack of fire results in juniper encroachment. Due to modern disturbances such as invasive species and OHV use, the resilience of the plant communities may be at risk. Disturbances that reduce the presence of the perennial plant community result in an opportunity for invasive annuals to enter into the system. Fire suppression has resulted in some areas transitioning to a juniper-pinyon dominated state.

Continuous season long grazing and or heavy stocking rates may result in the loss of desirable grass species. This type of grazing may cause this site to depart from the reference plant community. Improper grazing may increase the chance of invasion by snakeweed, cheatgrass, and invasive annual forbs, as well as lengthening the fire return interval due to the lack of fine fuel.

This site may be suitable for rangeland seedings in average or above-average precipitation years.

As vegetation communities respond to changes in management or natural influences, return to previous states may not be possible. The amount of energy needed to affect vegetative shifts depends on present biotic and abiotic features and the desired results. The following diagram does not necessarily depict all the transitions and states that are possible, but it does show some of the most commonly occurring plant communities. These plant communities may not represent every possibility, but they are the most prevalent and repeatable. As more data is collected, some of these plant communities may be revised or removed, and new ones may be added. This model was developed using range data collected over the last 30 years in MLRA D35 in southeastern Utah. Both ocular and measured data was collected and utilized.

State and transition model

R035XY209UT Semidesert Loam (Wyoming Big Sagebrush)

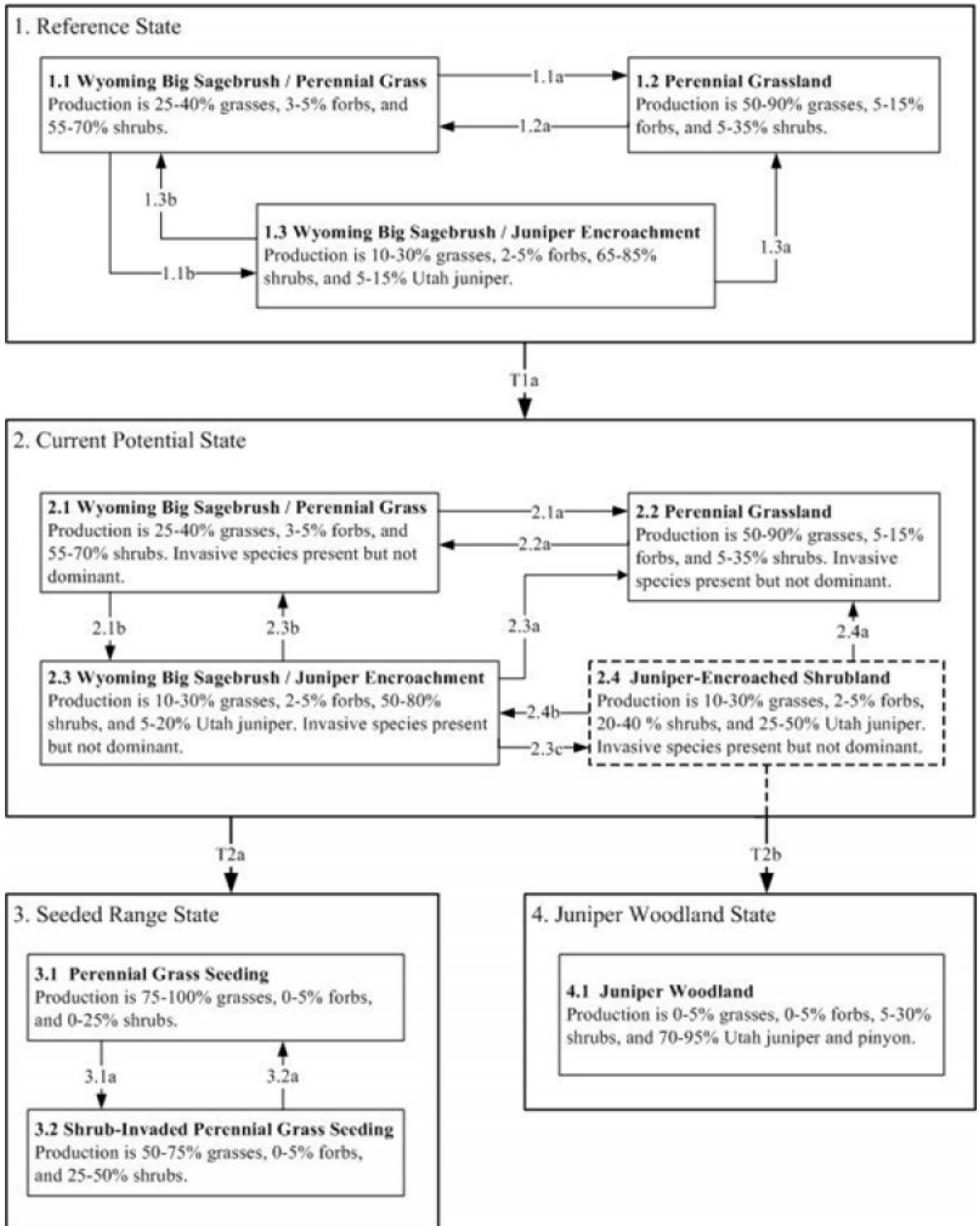


Figure 4. State-and-Transition Model

Reference State

The reference state represents the plant communities and ecological dynamics of the semidesert loam (Wyoming big sagebrush) site. This state includes the biotic communities that become established on the ecological site if all successional sequences are completed under the natural disturbance regime. The reference state is generally dominated by Wyoming big sagebrush and perennial grasses. The reference state is self sustaining and resistant to change due to high resistance to natural disturbances and high resilience following natural disturbances. When natural disturbances occur, the rate of recovery is variable due to disturbance intensity. Once invasive plants establish, return to the reference state may not be possible. Reference State: Wyoming big sagebrush state with fluctuations form a Wyoming big sagebrush shrubland to a grassland and a shrubland/grassland community. Indicators: A community dominated by Wyoming big sagebrush or perennial grasses. Feedbacks: Continuous season long grazing of perennial grasses, frequent fire, or other disturbance that may allow for the establishment of invasive species. At-risk Community Phase: This state is at risk when plants are stressed and nutrients become available for invasive plants to establish. Trigger: The establishment of invasive plant species.

Community 1.1

Wyoming Big Sagebrush / Perennial Grass



R035XY209UT—Semidesert Loam (Wyoming big sagebrush) community 1.1—Wyoming big sagebrush/Perennial grass. Cover is 12% grass, 2% forb, 28% shrub, 18% bare ground, 35% biotic crust, and 3% tree cover.

Figure 5. Phase 1.1

This community is characterized by a mixture of perennial shrubs and grasses. In this phase, Wyoming big sagebrush is co-dominant with perennial grasses. Commonly seen grasses include Indian ricegrass, James' galleta and sandberg bluegrass. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable. Bare ground is variable (3-19%) depending on the amount of biological crusts (35% to 45%).

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	191	247	291
Grass/Grasslike	34	78	112
Forb	11	28	45
Total	236	353	448

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	15-20%
Grass/grasslike foliar cover	20-40%
Forb foliar cover	1-10%
Non-vascular plants	0%
Biological crusts	10-55%

Litter	5-15%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	5-20%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	10-20%	0-5%
>0.15 <= 0.3	–	0-5%	5-20%	0-10%
>0.3 <= 0.6	–	0-5%	0-10%	0-10%
>0.6 <= 1.4	–	0-10%	–	–
>1.4 <= 4	–	0-5%	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 1.2 Perennial Grassland

This community is characterized by a perennial grassland, where some minimal amounts of shrubs are present. Commonly seen grasses include Indian ricegrass and sandberg bluegrass. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable. Bare ground is variable (6-20%) depending on the amount of biological crusts (10% to 55%).

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	230	336	415
Shrub/Vine	22	78	112
Forb	34	56	67
Tree	11	28	45
Total	297	498	639

Table 9. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-10%
Grass/grasslike foliar cover	20-40%
Forb foliar cover	1-10%
Non-vascular plants	0%
Biological crusts	10-55%
Litter	5-10%
Surface fragments >0.25" and <=3"	0-5%

Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	6-10%

Table 10. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	10-20%	0-5%
>0.15 <= 0.3	–	0-10%	5-20%	0-10%
>0.3 <= 0.6	–	0-5%	0-10%	0-10%
>0.6 <= 1.4	–	0-5%	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 1.3 Wyoming Big Sagebrush / Juniper Encroachment

Utah and Wyoming big sagebrush, mountain bluegrass, and James' galleta community. Upper montane Survey, Mikim family soil component. NAD83 0492445 E. 4206517 N. Photo by Jake Owens, May 20, 2010.



Figure 8. Phase 1.3

This community is characterized by a Wyoming big sagebrush shrub canopy, where some perennial grasses are be present. Commonly seen grasses include Indian ricegrass, James' galleta and sandberg bluegrass. As grass cover increases, shrub interspaces are filled. Utah juniper may establish in this community phase, but does not dominate. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable. Bare ground is (6-10%) depending on the amount of biological crusts (35% to 46%).

Table 11. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	280	347	404
Tree	34	56	90
Grass/Grasslike	11	34	56
Forb	11	28	45
Total	336	465	595

Table 12. Ground cover

Tree foliar cover	0-4%
Shrub/vine/liana foliar cover	20-25%
Grass/grasslike foliar cover	0-10%
Forb foliar cover	1-10%
Non-vascular plants	0%
Biological crusts	35-45%
Litter	5-15%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	5-15%

Table 13. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	0-5%	0-5%
>0.15 <= 0.3	–	5-15%	0-10%	0-5%
>0.3 <= 0.6	–	5-10%	0-5%	0-5%
>0.6 <= 1.4	0-4%	0-5%	–	–
>1.4 <= 4	0-4%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

**Pathway 1.1a
Community 1.1 to 1.2**

Fire can reduce the Wyoming big sagebrush dominance of this site and result in a grass dominated community.

**Pathway 1.1b
Community 1.1 to 1.3**



**Wyoming Big Sagebrush /
Perennial Grass**



**Wyoming Big Sagebrush /
Juniper Encroachment**

Time without disturbance and/or continuous season long grazing of perennial grasses results in a reduction of perennial grasses, and an increase in Wyoming big sagebrush. Utah juniper can become a minor component of the plant community, but it is eliminated from the community by fire before it can establish dominance.

**Pathway 1.2a
Community 1.2 to 1.1**

Time without disturbance and/or continuous season long grazing of perennial grasses results in a reduction of perennial grasses, and an increase in Wyoming big sagebrush.

Pathway 1.3a Community 1.3 to 1.1



Wyoming Big Sagebrush /
Juniper Encroachment



Wyoming Big Sagebrush /
Perennial Grass

Time without disturbance and/or continuous season long grazing of perennial grasses results in a reduction of perennial grasses, and an increase in Wyoming big sagebrush.

Pathway 1.3b Community 1.3 to 1.2

Less severe fire, insects, or drought can reduce the dominance of Wyoming big sagebrush. This transition has occurred when Wyoming big sagebrush production is reduced, but remains a dominant species.

State 2 Current Potential State

The current potential state is similar to the reference state, however invasive species are present in all community phases. This state is generally dominated by Wyoming big sagebrush, however depending on disturbance history, native grasses may dominate the site. Primary disturbance mechanisms include climate fluctuations, fire, native herbivore grazing, domestic livestock grazing and surface disturbances such as road and pipeline development and off road vehicle (OHV) use. Timing of these disturbances dictates the ecological dynamics that occur. The current potential state is stable, but is losing resistance to change due to lower resistance to disturbances and lower resilience following disturbances. When disturbances occur, the rate of recovery is variable depending on severity. Current Potential State: Wyoming big sagebrush state with fluctuations from a Wyoming big sagebrush shrubland to a grassland, shrubland/grassland, or a juniper encroached shrubland community. Invasive plants are present. Indicators: A community dominated by Wyoming big sagebrush where native perennial grasses and forbs may or may not be present. Invasive grasses and forbs are present.

Community 2.1 Wyoming Big Sagebrush / Perennial Grass

This community is characterized by a mixture of perennial shrubs and grasses. In this phase, Wyoming big sagebrush is co-dominant with perennial grasses. Commonly seen grasses include Indian ricegrass, James' galleta and sandberg bluegrass. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable. Invasive species are present. Bare ground is variable (3-19%) depending on the amount of biological crusts (35% to 45%).

Community 2.2 Perennial Grassland

This community is characterized by a perennial grassland, where some minimal amounts of shrubs are present. Commonly seen grasses include Indian ricegrass and sandberg bluegrass. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable. Invasive Species are present. Bare ground is variable (6-20%) depending on the amount of biological crusts (10% to 55%).

Community 2.3 Wyoming Big Sagebrush / Juniper Encroachment

This community is characterized by a Wyoming big sagebrush shrub canopy, where some perennial grasses are present. Commonly seen grasses include Indian ricegrass, James' galleta and sandberg bluegrass. As grass cover increases, shrub interspaces are filled. Utah juniper may establish in this community phase, but does not dominate. Other perennial grasses, shrubs, and forbs may or may not be present and cover is variable. Invasive species are present. Bare ground is (6-10%) depending on the amount of biological crusts (35% to 46%).

Community 2.4 Juniper-Encroached Shrubland (At-risk)

Wyoming big sagebrush, Utah juniper, Indian ricegrass, James' galleta, and sandberg bluegrass dominate.
Canyonland Soil Survey, Redbank soil. NAD83 0614378 E. 4203945 N. Photo by Ashley Garrelts, 7/24/2007.



Figure 13. Phase 2.4

This community phase is characterized by a Utah juniper/ Pinyon woodland with an understory of Wyoming big sagebrush and perennial grasses.

Table 14. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	101	168	280
Shrub/Vine	112	140	168
Grass/Grasslike	11	45	73
Forb	6	17	34
Total	230	370	555

Table 15. Soil surface cover

Tree basal cover	10-15%
Shrub/vine/liana basal cover	10-15%
Grass/grasslike basal cover	0-10%
Forb basal cover	1-10%
Non-vascular plants	0%
Biological crusts	30-45%
Litter	5-15%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	5-15%

Table 16. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	0-5%	0-5%
>0.15 <= 0.3	–	5-10%	0-5%	0-5%
>0.3 <= 0.6	–	5-10%	0-5%	–
>0.6 <= 1.4	–	5-15%	–	–
>1.4 <= 4	0-10%	0-5%	–	–
>4 <= 12	5-15%	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Pathway 2.1a
Community 2.1 to 2.2

Fire and/or brush removal can reduce the Wyoming big sagebrush dominance of this site and result in a grass dominated community.

Pathway 2.1b
Community 2.1 to 2.3

Time without disturbance (Fire) results in a pinyon-juniper encroached shrubland.

Pathway 2.2a
Community 2.2 to 2.1

Time without disturbance and/or continuous season long grazing of perennial grasses results in a reduction of perennial grasses, and an increase in Wyoming big sagebrush.

Pathway 2.3b
Community 2.3 to 2.1

Less severe fire, insects, drought, and/or brush removal can reduce the dominance of Wyoming big sagebrush and allow for broom snakeweed and perennial grasses to become co-dominant with Wyoming big sagebrush. This transition has occurred when Wyoming big sagebrush production is reduced, but Wyoming big sagebrush remains a dominant species.

Pathway 2.3a
Community 2.3 to 2.2

Fire and/or brush removal can reduce the Wyoming big sagebrush dominance of this site and result in a grass dominated community.

Pathway 2.3c
Community 2.3 to 2.4

Time without disturbance (Fire) results in a pinyon-juniper encroached shrubland.

Pathway 2.4a
Community 2.4 to 2.2

Fire or brush management practices reduces juniper cover and results in a perennial grassland.

Pathway 2.4b Community 2.4 to 2.3

Juniper management practices reduce juniper cover and result in a shrubland with some perennial grasses.

State 3 Seeded Range State

This state is the result of a successful rangeland seeding during years of average or above average precipitation during the growing season. Russian wildrye and crested wheatgrass are documented to establish on this site, and native species begin to re-establish naturally on the site 10-30 years after seeding. Failed seedings on this site have not been documented as of this report.

Community 3.1 Perennial Grass Seeding



Figure 15. Phase 3.1

This phase is dominated by Russian wildrye, crested wheatgrass, and/or other non-native perennial grass species.

Table 17. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	673	785	897
Shrub/Vine	–	11	22
Forb	–	11	22
Total	673	807	941

Table 18. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-5%
Grass/grasslike foliar cover	25-35%
Forb foliar cover	0-2%
Non-vascular plants	0%
Biological crusts	0%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-15%
Surface fragments >3"	0%

Bedrock	0%
Water	0%
Bare ground	40-65%

Table 19. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	0%	–
>0.15 <= 0.3	–	–	0-10%	–
>0.3 <= 0.6	–	0-5%	10-20%	–
>0.6 <= 1.4	–	0-5%	5-15%	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 3.2 Shrub-invaded Perennial Grass Seeding



R035XY209UT—Semidesert Loam (Wyoming big sagebrush) community 3.2—Shrub-Invaded Perennial Grass

Figure 17. Phase 3.2

This state occurs 10-30 years after a successful rangeland seeding when native shrubs and herbaceous species re-invade the site. In the absence of major disturbances, Wyoming big sagebrush is expected to eventually dominate the site.

Table 20. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	392	560	673
Shrub/Vine	112	168	224
Forb	–	11	22
Total	504	739	919

Table 21. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	5-15%

Grass/grasslike foliar cover	15-25%
Forb foliar cover	0-5%
Non-vascular plants	0%
Biological crusts	0-10%
Litter	15-25%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	35-45%

Table 22. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-2%	0-2%	0-2%
>0.15 <= 0.3	–	0-5%	2-5%	0-5%
>0.3 <= 0.6	–	0-10%	5-10%	0-5%
>0.6 <= 1.4	–	0-10%	10-20%	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Pathway 3.1a Community 3.1 to 3.2



Perennial Grass Seeding



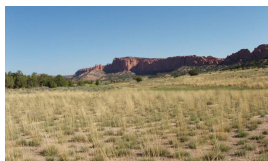
**Shrub-invaded Perennial
Grass Seeding**

This phase is a natural re-invasion of sagebrush and other native species into the seeding. It has been documented to occur between 10 and 30 years following a successful seeding.

Pathway 3.2a Community 3.2 to 3.1



**Shrub-invaded Perennial
Grass Seeding**



Perennial Grass Seeding

This phase occurs as brush management or wildfire that removes shrubs. It may also require seeding of perennial grasses.

State 4 Juniper Woodland

This state occurs when perennial grasses become too sparse to produce and bank sufficient seed to become dominant after fire or tree removal. Shrubs also decrease and may be unable to return following tree removal. It is unknown whether this state accelerates erosion, but soil fertility is expected to decline as this state persists, due to a lack of fine root turnover and other organic matter inputs associated with sagebrush grasslands.

Community 4.1 Juniper Woodland



R035XY209UT—Semidesert Loam (Wyoming big sagebrush) community 4.1—Juniper Woodland. Cover is

Figure 19. Phase 4.1

This phase is dominated by Utah juniper. Pinyon can also co-dominate.

Table 23. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	392	504	616
Shrub/Vine	28	84	140
Grass/Grasslike	—	11	22
Forb	—	6	11
Total	420	605	789

Table 24. Ground cover

Tree foliar cover	8-20%
Shrub/vine/liana foliar cover	5-10%
Grass/grasslike foliar cover	0-5%
Forb foliar cover	0-5%
Non-vascular plants	0%
Biological crusts	35-60%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	10-15%

Table 25. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	0-5%	0-5%
>0.15 <= 0.3	–	0-5%	0-5%	0-5%
>0.3 <= 0.6	–	0-5%	0-5%	–
>0.6 <= 1.4	0-5%	0-10%	–	–
>1.4 <= 4	8-18%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Transition T1a State 1 to 2

This transition is from the native perennial warm and cool season grass understory in the reference state to a state that contains invasive species. Events can include establishment of invasive plant species, intense continuous grazing of perennial grasses, prolonged drought, and/or surface disturbances, etc. However, invasive species such as cheatgrass have been known to invade intact perennial plant communities with little to no disturbance. Once invasive species are found in the plant community a threshold has been crossed.

Transition T2a State 2 to 3

This transition occurs when a successful range seeding (during average or above-average precipitation years during the growing season) results in the establishment, dominance, and persistence of non-native grasses.

Transition T2b State 2 to 4

This transition occurs when fire suppression extends well beyond the natural fire return interval (over 100 years), resulting in dominance by Utah juniper.

Additional community tables

Table 26. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	Dominant Shrubs			168–224	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	168–224	–
3	Sub-Dominant Shrubs			22–67	
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	11–56	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–45	–
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	0–11	–
	Nevada jointfir	EPNE	<i>Ephedra nevadensis</i>	0–11	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	0–11	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–11	–
	spineless horsetail	TECA2	<i>Tetradymia canescens</i>	0–11	–

	spineless horsebrush	TECAZ	<i>Tetradymia canescens</i>	0-11	-
	narrowleaf yucca	YUAN2	<i>Yucca angustissima</i>	0-6	-
	spiny hopsage	GRSP	<i>Grayia spinosa</i>	0-6	-
Grass/Grasslike					
0	Dominant Grass			34-112	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0-39	-
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	0-34	-
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	0-28	-
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0-17	-
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0-11	-
1	Sub Dominant Grass			0-22	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0-22	-
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0-17	-
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0-11	-
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0-11	-
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0-7	-
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	0-3	-
Forb					
2	Forbs			11-45	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	34-90	-
	hoary tansyaster	MACA2	<i>Machaeranthera canescens</i>	0-13	-
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	0-11	-
	Forb, annual	2FA	<i>Forb, annual</i>	0-11	-
	Forb, perennial	2FP	<i>Forb, perennial</i>	0-11	-
	field pussytoes	ANNE	<i>Antennaria neglecta</i>	0-11	-
	twolobe larkspur	DENU2	<i>Delphinium nuttallianum</i>	0-8	-
	mountain pepperweed	LEMO2	<i>Lepidium montanum</i>	0-8	-
	longleaf phlox	PHLO2	<i>Phlox longifolia</i>	0-8	-
	Cutler's spurred lupine	LUCAC	<i>Lupinus caudatus ssp. cutleri</i>	0-7	-
	pointed gumweed	GRFA	<i>Grindelia fastigiata</i>	0-7	-
	manybranched ipomopsis	IPPO2	<i>Ipomopsis polycladon</i>	0-7	-
	freckled milkvetch	ASLE8	<i>Astragalus lentiginosus</i>	0-7	-
	sego lily	CANU3	<i>Calochortus nuttallii</i>	0-7	-
	shaggy fleabane	ERPU2	<i>Erigeron pumilus</i>	0-6	-
	whitestem blazingstar	MEAL6	<i>Mentzelia albicaulis</i>	0-6	-
	bluestem beardtongue	PECY4	<i>Penstemon cyanocaulis</i>	0-3	-
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossularifolia</i>	0-1	-
	longbeak streptanthella	STLO4	<i>Streptanthella longirostris</i>	0-1	-
	tansymustard	DESCU	<i>Descurainia</i>	0-1	-

Table 27. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Mine					

Shrub/Vine

0	Dominant Shrubs			22–112	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata</i> ssp. <i>wyomingensis</i>	0–56	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	22–56	–
3	Sub Dominant Shrubs			11–34	
	Cutler's jointfir	EPCU	<i>Ephedra cutleri</i>	0–22	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–7	–
	Utah serviceberry	AMUTU	<i>Amelanchier utahensis</i> var. <i>utahensis</i>	0–4	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–4	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	0–3	–
	yellow rabbitbrush	CHV18	<i>Chrysothamnus viscidiflorus</i>	0–3	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–2	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–1	–
	narrowleaf yucca	YUAN2	<i>Yucca angustissima</i>	0–1	–
Grass/Grasslike					
0	Dominant Grass			196–381	
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	56–112	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	45–90	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	39–67	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	28–56	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	28–56	–
1	Sub Dominant Grasses			34–56	
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0–22	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0–17	–
	needle and thread	HECOC8	<i>Hesperostipa comata</i> ssp. <i>comata</i>	0–17	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–17	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0–11	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–11	–
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	0–11	–
Forb					
2	Forbs			34–67	
	hoary tansyaster	MACA2	<i>Machaeranthera canescens</i>	0–13	–
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	0–11	–
	Forb, annual	2FA	<i>Forb, annual</i>	0–11	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–11	–
	field pussytoes	ANNE	<i>Antennaria neglecta</i>	0–11	–
	twolobe larkspur	DENU2	<i>Delphinium nuttallianum</i>	0–8	–
	Jones' pepperweed	LEMOJ	<i>Lepidium montanum</i> var. <i>jonesii</i>	0–8	–
	longleaf phlox	PHLO2	<i>Phlox longifolia</i>	0–8	–
	Cutler's spurred lupine	LUCAC	<i>Lupinus caudatus</i> ssp. <i>cutleri</i>	0–7	–
	pointed gumweed	GRFA	<i>Grindelia fastigiata</i>	0–7	–
	manybranched ipomopsis	IPPO2	<i>Ipomopsis polycladon</i>	0–7	–

	freckled milkvetch	ASLE8	<i>Astragalus lentiginosus</i>	0–7	–
	sego lily	CANU3	<i>Calochortus nuttallii</i>	0–7	–
	shaggy fleabane	ERPU2	<i>Erigeron pumilus</i>	0–6	–
	whitestem blazingstar	MEAL6	<i>Mentzelia albicaulis</i>	0–6	–
	bluestem beardtongue	PECY4	<i>Penstemon cyanocaulis</i>	0–3	–
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossularifolia</i>	0–3	–
	longbeak streptanthella	STLO4	<i>Streptanthella longirostris</i>	0–1	–
	tansymustard	DESCU	<i>Descurainia</i>	0–1	–
Tree					
4	Tree			0–45	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	0–45	–

Table 28. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	Dominant Shrubs			224–404	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	224–404	–
3	Sub Dominant Shrubs			11–56	
	Cutler's jointfir	EPCU	<i>Ephedra cutleri</i>	0–34	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–17	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	0–11	–
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	0–11	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	0–7	–
	Utah serviceberry	AMUTU	<i>Amelanchier utahensis var. utahensis</i>	0–7	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–7	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–7	–
	spiny hopsage	GRSP	<i>Grayia spinosa</i>	0–6	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–2	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–1	–
	narrowleaf yucca	YUAN2	<i>Yucca angustissima</i>	0–1	–
Grass/Grasslike					
0	Dominant Grass			11–56	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–39	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	0–34	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	0–28	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–17	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0–11	–
1	Sub Dominant Grass			0–28	
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0–17	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0–11	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–11	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–11	–

	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0–11	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0–6	–
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	0–3	–
Forb					
2	Forbs			11–45	
	hoary tansyaster	MACA2	<i>Machaeranthera canescens</i>	0–13	–
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	0–11	–
	Forb, annual	2FA	<i>Forb, annual</i>	0–11	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–11	–
	field pussytoes	ANNE	<i>Antennaria neglecta</i>	0–11	–
	twolobe larkspur	DENU2	<i>Delphinium nuttallianum</i>	0–8	–
	Jones' pepperweed	LEMOJ	<i>Lepidium montanum var. jonesii</i>	0–8	–
	longleaf phlox	PHLO2	<i>Phlox longifolia</i>	0–8	–
	Cutler's spurred lupine	LUCAC	<i>Lupinus caudatus ssp. cutleri</i>	0–7	–
	pointed gumweed	GRFA	<i>Grindelia fastigiata</i>	0–7	–
	manybranched ipomopsis	IPPO2	<i>Ipomopsis polycladon</i>	0–7	–
	freckled milkvetch	ASLE8	<i>Astragalus lentiginosus</i>	0–7	–
	sego lily	CANU3	<i>Calochortus nuttallii</i>	0–7	–
	shaggy fleabane	ERPU2	<i>Erigeron pumilus</i>	0–6	–
	whitestem blazingstar	MEAL6	<i>Mentzelia albicaulis</i>	0–6	–
	bluestem beardtongue	PECY4	<i>Penstemon cyanocaulis</i>	0–3	–
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	0–3	–
	longbeak streptanthella	STLO4	<i>Streptanthella longirostris</i>	0–1	–
	tansymustard	DESCU	<i>Descurainia</i>	0–1	–
Tree					
4	Tree			34–90	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	34–84	–
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0–11	–

Table 29. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	Dominant Shrubs			168–224	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	0–56	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	22–56	–
3	Sub-Dominant Shrubs			22–67	
	Cutler's jointfir	EPCU	<i>Ephedra cutleri</i>	0–22	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–7	–
	Utah serviceberry	AMUTU	<i>Amelanchier utahensis var. utahensis</i>	0–4	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–4	–
	mormon tea	FPVI	<i>Ephedra viridis</i>	0–3	–

	yellow rabbitbrush	CHV18	<i>Chrysothamnus viscidiflorus</i>	0-3	-
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0-2	-
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0-1	-
	narrowleaf yucca	YUAN2	<i>Yucca angustissima</i>	0-1	-
Grass/Grasslike					
0	Dominant Grass			34-112	
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	56-112	-
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	45-90	-
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	39-67	-
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	28-56	-
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	28-56	-
	cheatgrass	BRTE	<i>Bromus tectorum</i>	1-34	-
1	Sub Dominant Grass			0-22	
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0-22	-
	Grass, annual	2GA	<i>Grass, annual</i>	0-17	-
	Grass, perennial	2GP	<i>Grass, perennial</i>	0-17	-
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0-17	-
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0-11	-
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0-11	-
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	0-11	-
	cheatgrass	BRTE	<i>Bromus tectorum</i>	0-11	-
Forb					
2	Forbs			11-45	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	11-45	-
	prickly Russian thistle	SATR12	<i>Salsola tragus</i>	0-22	-
	hoary tansyaster	MACA2	<i>Machaeranthera canescens</i>	0-13	-
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	0-11	-
	Forb, annual	2FA	<i>Forb, annual</i>	0-11	-
	Forb, perennial	2FP	<i>Forb, perennial</i>	0-11	-
	field pussytoes	ANNE	<i>Antennaria neglecta</i>	0-11	-
	redstem stork's bill	ERCI6	<i>Erodium cicutarium</i>	0-11	-
	twolobe larkspur	DENU2	<i>Delphinium nuttallianum</i>	0-8	-
	Jones' pepperweed	LEMOJ	<i>Lepidium montanum var. jonesii</i>	0-8	-
	longleaf phlox	PHLO2	<i>Phlox longifolia</i>	0-8	-
	Cutler's spurred lupine	LUCAC	<i>Lupinus caudatus ssp. cutleri</i>	0-7	-
	pointed gumweed	GRFA	<i>Grindelia fastigiata</i>	0-7	-
	manybranched ipomopsis	IPPO2	<i>Ipomopsis polycladon</i>	0-7	-
	freckled milkvetch	ASLE8	<i>Astragalus lentiginosus</i>	0-7	-
	sego lily	CANU3	<i>Calochortus nuttallii</i>	0-7	-
	shaggy fleabane	ERPU2	<i>Erigeron pumilus</i>	0-6	-
	bluestem beardtongue	PECY4	<i>Penstemon cyanocaulis</i>	0-3	-
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	0-3	-

	longbeak streptanthella	STLO4	<i>Streptanthella longirostris</i>	0–1	–
	tansymustard	DESCU	<i>Descurainia</i>	0–1	–

Table 30. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	Dominant Shrubs			22–112	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	112–168	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	56–73	–
3	Sub Dominant Shrubs			11–34	
	Cutler's jointfir	EPCU	<i>Ephedra cutleri</i>	0–34	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	0–7	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–7	–
	Utah serviceberry	AMUTU	<i>Amelanchier utahensis var. utahensis</i>	0–7	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–7	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	0–3	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–2	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–1	–
	narrowleaf yucca	YUAN2	<i>Yucca angustissima</i>	0–1	–
Grass/Grasslike					
0	Dominant Grass			196–381	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–39	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	1–34	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	0–34	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	0–28	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–17	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0–11	–
1	Sub Dominant Grasses			34–56	
	Grass, annual	2GA	<i>Grass, annual</i>	0–11	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–11	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	0–11	–
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0–7	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0–6	–
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	0–3	–
Forb					
2	Forbs			34–67	
	prickly Russian thistle	SATR12	<i>Salsola tragus</i>	0–22	–
	hoary tansyaster	MACA2	<i>Machaeranthera canescens</i>	0–13	–
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	0–11	–
	Forb, annual	2FA	<i>Forb, annual</i>	0–11	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–11	–
	field pussytoes	ANNE	<i>Antennaria neglecta</i>	0–11	–

	redstem stork's bill	ERIC6	<i>Erodium cicutarium</i>	0–11	–
	twolobe larkspur	DENU2	<i>Delphinium nuttallianum</i>	0–8	–
	Jones' pepperweed	LEMOJ	<i>Lepidium montanum var. jonesii</i>	0–8	–
	longleaf phlox	PHLO2	<i>Phlox longifolia</i>	0–8	–
	Cutler's spurred lupine	LUCAC	<i>Lupinus caudatus ssp. cutleri</i>	0–7	–
	pointed gumweed	GRFA	<i>Grindelia fastigiata</i>	0–7	–
	manybranched ipomopsis	IPPO2	<i>Ipomopsis polycladon</i>	0–7	–
	freckled milkvetch	ASLE8	<i>Astragalus lentiginosus</i>	0–7	–
	sego lily	CANU3	<i>Calochortus nuttallii</i>	0–7	–
	shaggy fleabane	ERPU2	<i>Erigeron pumilus</i>	0–6	–
	whitestem blazingstar	MEAL6	<i>Mentzelia albicaulis</i>	0–6	–
	bluestem beardtongue	PECY4	<i>Penstemon cyanocaulis</i>	0–3	–
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	0–3	–
	longbeak streptanthella	STLO4	<i>Streptanthella longirostris</i>	0–1	–
	tansymustard	DESCU	<i>Descurainia</i>	0–1	–
Tree					
4	Tree			0–45	

Table 31. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	Dominant Shrubs			224–404	
	Wyoming big sagebrush	ARTRW8	<i>Artemisia tridentata ssp. wyomingensis</i>	56–112	–
3	Sub Dominant Shrubs			11–56	
	Cutler's jointfir	EPCU	<i>Ephedra cutleri</i>	0–34	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	6–27	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–7	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	0–7	–
	Utah serviceberry	AMUTU	<i>Amelanchier utahensis var. utahensis</i>	0–7	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–7	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	0–3	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–2	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–1	–
	narrowleaf yucca	YUAN2	<i>Yucca angustissima</i>	0–1	–
Grass/Grasslike					
0	Dominant Grass			11–56	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–39	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	1–34	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	0–34	–
	needle and thread	HECOC8	<i>Hesperostipa comata ssp. comata</i>	0–28	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–11	–

	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0–6	–
1	Sub Dominant Grass			0–28	
	Grass, annual	2GA	<i>Grass, annual</i>	0–11	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–11	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	0–11	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0–11	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–11	–
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0–7	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0–6	–
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	0–3	–
Forb					
2	Forbs			11–45	
	prickly Russian thistle	SATR12	<i>Salsola tragus</i>	0–22	–
	hoary tansyaster	MACA2	<i>Machaeranthera canescens</i>	0–13	–
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	0–11	–
	Forb, annual	2FA	<i>Forb, annual</i>	0–11	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–11	–
	field pussytoes	ANNE	<i>Antennaria neglecta</i>	0–11	–
	redstem stork's bill	ERCI6	<i>Erodium cicutarium</i>	0–11	–
	twolobe larkspur	DENU2	<i>Delphinium nuttallianum</i>	0–8	–
	Jones' pepperweed	LEMOJ	<i>Lepidium montanum var. jonesii</i>	0–8	–
	longleaf phlox	PHLO2	<i>Phlox longifolia</i>	0–8	–
	Cutler's spurred lupine	LUCAC	<i>Lupinus caudatus ssp. cutleri</i>	0–7	–
	pointed gumweed	GRFA	<i>Grindelia fastigiata</i>	0–7	–
	manybranched ipomopsis	IPPO2	<i>Ipomopsis polycladon</i>	0–7	–
	freckled milkvetch	ASLE8	<i>Astragalus lentiginosus</i>	0–7	–
	sego lily	CANU3	<i>Calochortus nuttallii</i>	0–7	–
	shaggy fleabane	ERPU2	<i>Erigeron pumilus</i>	0–6	–
	whitestem blazingstar	MEAL6	<i>Mentzelia albicaulis</i>	0–6	–
	bluestem beardtongue	PECY4	<i>Penstemon cyanocaulis</i>	0–3	–
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossularifolia</i>	0–3	–
	longbeak streptanthella	STLO4	<i>Streptanthella longirostris</i>	0–1	–
	tansymustard	DESCU	<i>Descurainia</i>	0–1	–
Tree					
4	Tree			34–90	

Table 32. Community 2.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0	Trees			101–280	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	101–280	–
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0–112	–

Shrub/Vine					
0	Dominant Shrubs			56–112	
3	Sub-dominant Shrubs			22–56	
	Cutler's jointfir	EPCU	<i>Ephedra cutleri</i>	0–34	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	6–28	–
	winterfat	KRLA2	<i>Krascheninnikovia lanata</i>	0–6	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–6	–
	Spanish bayonet	YUHA	<i>Yucca harrimaniae</i>	0–6	–
	Utah serviceberry	AMUT	<i>Amelanchier utahensis</i>	0–6	–
	prairie sagewort	ARFR4	<i>Artemisia frigida</i>	0–6	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–6	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	0–6	–
	mormon tea	EPVI	<i>Ephedra viridis</i>	0–3	–
Grass/Grasslike					
0	Dominat Grasses			0–56	
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–39	–
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0–39	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	1–34	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	0–34	–
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0–11	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0–6	–
1	Sub-dominant Grasses			0–17	
	Grass, annual	2GA	<i>Grass, annual</i>	0–11	–
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–11	–
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0–11	–
	sand dropseed	SPCR	<i>Sporobolus cryptandrus</i>	0–11	–
	sixweeks fescue	VUOC	<i>Vulpia octoflora</i>	0–6	–
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0–6	–
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0–6	–
Forb					
2	Forbs			6–34	
	prickly Russian thistle	SATR12	<i>Salsola tragus</i>	0–22	–
	Wright's bird's beak	COWR2	<i>Cordylanthus wrightii</i>	0–11	–
	Forb, annual	2FA	<i>Forb, annual</i>	0–11	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–11	–
	redstem stork's bill	ERCI6	<i>Erodium cicutarium</i>	0–11	–
	shaggy fleabane	ERPU2	<i>Erigeron pumilus</i>	0–6	–
	pointed gumweed	GRFA	<i>Grindelia fastigiata</i>	0–6	–
	manybranched ipomopsis	IPPO2	<i>Ipomopsis polycladon</i>	0–6	–
	Jones' pepperweed	LEMOJ	<i>Lepidium montanum var. jonesii</i>	0–6	–
	Utah desertparsley	LOPA	<i>Lomatium parryi</i>	0–6	–
	Cutler's spurred lupine	LUCAC	<i>Lupinus caudatus ssp. cutleri</i>	0–6	–
	hoary tansyaster	MACA2	<i>Machaeranthera canescens</i>	0–6	–

	whitestem blazingstar	MEAL6	<i>Mentzelia albicaulis</i>	0–6	–
	bluestem beardtongue	PECY4	<i>Penstemon cyanocaulis</i>	0–6	–
	longleaf phlox	PHLO2	<i>Phlox longifolia</i>	0–6	–
	field pussytoes	ANNE	<i>Antennaria neglecta</i>	0–6	–
	freckled milkvetch	ASLE8	<i>Astragalus lentiginosus</i>	0–6	–
	sego lily	CANU3	<i>Calochortus nuttallii</i>	0–6	–
	twolobe larkspur	DENU2	<i>Delphinium nuttallianum</i>	0–6	–
	tansymustard	DESCU	<i>Descurainia</i>	0–6	–
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	0–6	–
	longbeak streptanthella	STLO4	<i>Streptanthella longirostris</i>	0–6	–

Table 33. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
0	Dominant Grasses			673–897	
	crested wheatgrass	AGCR	<i>Agropyron cristatum</i>	0–897	–
	Russian wildrye	PSJU3	<i>Psathyrostachys juncea</i>	0–897	–
3	Sub-dominant Grasses			0–22	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	0–11	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0–6	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	0–6	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–6	–
Shrub/Vine					
1	Shrubs			0–22	
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	0–22	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–22	–
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–11	–
Forb					
2	Forbs			0–22	
	prickly Russian thistle	SATR12	<i>Salsola tragus</i>	0–11	–
	Forb, annual	2FA	<i>Forb, annual</i>	0–11	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–11	–
	redstem stork's bill	ERCI6	<i>Erodium cicutarium</i>	0–11	–
	prairie sunflower	HEPE	<i>Helianthus petiolaris</i>	0–6	–
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	0–6	–

Table 34. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
0	Dominant Grasses			392–673	
	crested wheatgrass	AGCR	<i>Agropyron cristatum</i>	0–673	–
	Russian wildrye	PSJU3	<i>Psathyrostachys juncea</i>	0–673	–
3	Sub-dominant Grasses			0–56	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–34	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	0–34	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–34	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0–34	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	0–11	–
	Grass, annual	2GA	<i>Grass, annual</i>	0–11	–
Shrub/Vine					
1	Shrubs			112–224	
	fourwing saltbush	ATCA2	<i>Atriplex canescens</i>	0–45	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–45	–
	Shrub (>.5m)	2SHRUB	<i>Shrub (>.5m)</i>	0–45	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–6	–
Forb					
2	Forbs			0–22	
	prickly Russian thistle	SATR12	<i>Salsola tragus</i>	0–11	–
	Forb, annual	2FA	<i>Forb, annual</i>	0–11	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–11	–
	redstem stork's bill	ERCI6	<i>Erodium cicutarium</i>	0–11	–
	prairie sunflower	HEPE	<i>Helianthus petiolaris</i>	0–6	–
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	0–6	–

Table 35. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0	Trees			336–560	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	336–560	–
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0–336	–
Shrub/Vine					
1	Shrubs			28–140	
	mormon tea	EPVI	<i>Ephedra viridis</i>	0–28	–
	roundleaf buffaloberry	SHRO	<i>Shepherdia rotundifolia</i>	0–28	–
	Stansbury cliffrose	PUST	<i>Purshia stansburiana</i>	0–22	–
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–11	–
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–6	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	0–6	–
Grass/Grasslike					
2	Grasses			0–22	
	Grass, perennial	2GP	<i>Grass, perennial</i>	0–11	–
	cheatgrass	BRTE	<i>Bromus tectorum</i>	0–11	–
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0–6	–
	saline wildrye	LESAS	<i>Leymus salinus ssp. salinus</i>	0–6	–
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0–6	–
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	0–6	–
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–6	–
	Grass, annual	2GA	<i>Grass, annual</i>	0–6	–
Forb					
3	Forbs			0–11	
	Forb, annual	2FA	<i>Forb, annual</i>	0–11	–
	Forb, perennial	2FP	<i>Forb, perennial</i>	0–11	–
	Brenda's yellow cryptantha	CRFL5	<i>Cryptantha flava</i>	0–6	–
	stemless four-nerve daisy	TEACA2	<i>Tetraneuris acaulis var. acaulis</i>	0–6	–
	hoary Townsend daisy	TOIN	<i>Townsendia incana</i>	0–2	–
	purple springparsley	CYPU2	<i>Cymopterus purpureus</i>	0–2	–
	redstem stork's bill	ERCI6	<i>Erodium cicutarium</i>	0–2	–
	leptosiphon	LEPTO22	<i>Leptosiphon</i>	0–2	–
	prickly Russian thistle	SATR12	<i>Salsola tragus</i>	0–2	–
	heartleaf twistflower	STCO6	<i>Streptanthus cordatus</i>	0–2	–
	desert princesplume	STPI	<i>Stanleya pinnata</i>	0–2	–
	beautiful rockcress	ARPU2	<i>Arabis pulchra</i>	0–2	–
	Preuss' milkvetch	ASPR6	<i>Astragalus preussii</i>	0–2	–
	Wright's bird's beak	COWR2	<i>Cordylanthus wrightii</i>	0–2	–

Animal community

Ecological Site Interpretations

--General wildlife--This site provides both food and cover for wildlife. There is palatable browse for mule deer and pronghorn, and when present, grasses such as Indian ricegrass and sandberg bluegrass offer good grazing. When this site occurs near water, the species richness and the abundance of large mammals is increased. Birds, bats, lizards, snakes and rodents are more common when this site occurs far from water.

--Grazing Interpretations--

This site provides good year round grazing conditions for livestock and wildlife due to the high availability of nutritious forage. However, this site often lacks natural perennial water sources, which can influence the suitability for livestock and wildlife grazing. The suitability for re-seeding or restoring this site is fair due to the extreme variability in timing and amount of precipitation. This site may occur in desert bighorn sheep, mule deer and pronghorn antelope ranges, and are important wintering areas for these wildlife species. However, in many places the populations will be small and have little grazing impact on the site.

The plant community is primarily grasses, with majority of the cover coming from Indian ricegrass, sandberg bluegrass, and galleta. These grasses provide good grazing conditions for horses, cattle, sheep, elk, and bighorn sheep. The presence of shrubs, primarily Wyoming big sagebrush, fourwing saltbush, winterfat, and rabbitbrush provide year round browse for all classes of livestock and wildlife. Wyoming sagebrush and winterfat provides good wintering browse due to its high protein content; however sagebrush is used sparingly by livestock when other herbaceous forages are available. Forb composition and annual production depends primarily on precipitation amounts and thus is challenging to use in livestock grazing management decisions. However, forb composition should be monitored for species diversity, as well as poisonous or injurious plant communities which may be detrimental to livestock if grazed. Before making specific grazing management recommendations, an onsite evaluation should be made.

Hydrological functions

The majority of the soils are in hydrologic groups B and C (NRCS National Engineering Handbook). Hydrologic groups are used in equations that estimate runoff from rainfall. These estimates are needed for solving hydrologic problems that arise in planning watershed-protection and flood-prevention projects and for designing structures for the use, control and disposal of water. Heavy grazing can alter the hydrology by decreasing plant cover and increasing bare ground. Fire can also affect hydrology, but it is variable. Fire intensity, fuel type, soil, climate, and topography can each have different influences. Fires can increase areas of bare ground and hydrophobic layers that reduce infiltration and increase runoff. (National Range and Pasture Handbook, 2003)

Recreational uses

Recreation activities include aesthetic value and good opportunities for hiking, horseback riding, and off-road vehicle use.

Wood products

Juniper posts can be produced on locations with juniper encroachment.

Other information

--Poisonous and Toxic Plant Communities--

Toxic plants associated with this site include broom snakeweed. Broom snakeweed contains steroids, terpenoids, saponins, and flavones that can cause abortions or reproductive failure in sheep and cattle, however cattle are most susceptible. These toxins are most abundant during active growth and leafing stage. Cattle and sheep will typically only graze broom snakeweed when other forage is unavailable and generally in winter when toxicity levels are at their lowest.

Potentially toxic plants associated with this site include four-wing saltbush and Wyoming big sagebrush. Four-wing saltbush may accumulate selenium, but only when growing on selenium enriched soils. These plants, when consumed will cause alkali disease or chronic selenosis, which affects all classes of livestock (excluding goats). Typically animals consuming 5-50 ppm selenium will develop chronic selenosis and animals consuming greater

than 50 ppm selenium will develop acute selenosis. Clinical signs include lameness, souging of the hoof, hair loss, blindness, and aimless wondering. Horses tend to develop what is called a “bob” tail or “roached” main due to breakage of the long hairs. Wyoming big sagebrush contains sesquiterpene lactones and monoterpenes which have been suspected of being toxic to sheep. An experimental dosage of ¾ lbs of big sagebrush fed to sheep for three days was found to be lethal.

Russian thistle is an invasive toxic plant, causing nitrate and to a lesser extent oxalate poisoning, which affects all classes of livestock. The buildup of nitrates in these plants is highly dependent upon environmental factors, such as after a rain storm during a drought, cool/cloudy days, and soils high in nitrogen and low in sulfur and phosphorus, all which cause increased nitrate accumulation. Nitrate collects in the stems and can persist throughout the growing season. Clinical signs of nitrate poisoning include drowsiness, weakness, muscular tremors, increased heart and respiratory rates, staggering gait, and death. Conversely, oxalate poisoning causes kidney failure; clinical signs include muscle tremors, tetany, weakness, and depression. Poisoning generally occurs when livestock consume and are not accustomed to grazing oxalate-containing plants. Animals with prior exposure to oxalates have increased numbers of oxalate-degrading rumen microflora and thus are able to degrade the toxin before clinical poisoning can occur.

--Invasive Plant Communities--

Generally as ecological conditions deteriorate and perennial vegetation decreases due to disturbance (fire, over grazing, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses will invade the site. Of particular concern in semi-arid environments are the non-native annual invaders including cheatgrass, Russian thistle, kochia, halogeton, and annual mustards. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible. Pinyon pine and Utah juniper are natural invaders if stands are found adjacent to this site. Trees left uncontrolled can form dense stands and eventually dominate the site.

--Fire Ecology--

The ability for an ecological site to carry fire depends primarily on the present fuel load and plant moisture content—sites with small fuel loads will burn more slowly and less intensely than sites with large fuel loads. Many semi-desert plant communities in the Colorado Plateau may have evolved without the influence of fire. However a year of exceptionally heavy winter rains can generate fuels by producing heavy stands of annual forbs and grasses. When fires do occur, the effect on the plant community may be extreme due to the harsh environment and slow rate of recovery.

Fire is an important aspect of Wyoming big sagebrush dominated ecological sites. Fire intervals are historically 10-70 years and fires are typically patchy, forming mosaics. Shrub vegetation is able to reestablish from seed dispersal from the adjacent non burned sagebrush stands; however the process is relatively slow. Fire also decreases the extent of Utah juniper/pinyon pine invasions, which allows the historic plant community to maintain integrity. When the plant community is burned shrubs decrease, while perennial and annual grasses increase. The perennial shrubs associated with this site are able to recover at a faster rate than the invading trees. When the site is degraded by the presence of invasive annuals, the fire return interval is shortened due to increased flashy fuels. The shortened fire return interval is often sufficient to suppress the native plant community.

Inventory data references

The data collected in 2005-2009 were in conjunction with the soil survey update for Canyonlands National Park. The vegetation data was collected in association with a soil pit and geo-referenced. All the data is stored as hard copy files and in electronic format in the NRCS Utah State Office.

Other references

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Contributors

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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	09/11/2008
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

- 1. Number and extent of rills:** None to rare. Any rill formation may be seen after recent large storms on adjacent landscape settings where increased runoff may accumulate (such as areas below exposed bedrock). Such rill development should usually be limited to slopes exceeding 20%. Any rills present should be somewhat short in length (less than 6 feet long), and heal rapidly (within a couple of winters) through frost heaving.

- 2. Presence of water flow patterns:** Flow patterns wind around perennial plant bases and show no evidence of erosion.

They are short and stable and there is minor evidence of deposition. On gently sloping (< 15 % slopes) locations within the site, water flow patterns are infrequent and usually less than 3 feet. Longer water flow patterns may be found on steeper slopes (> 20 %). Water flow patterns are narrow (> 1 foot wide) and widely spaced (10-20 yards apart)

3. **Number and height of erosional pedestals or terracettes:** Plants should show no pedestalling. Small (>1 sq ft) terracettes should be very few. A few rare pedestals may occur on steeper slopes (> 20%) and are usually associated with water flow patterns, and should not have any exposed roots. Interspaces between well developed biological soil crusts may resemble pedestals but they are actually a characteristic of the crust formation.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 3-20% bare ground. Ground cover is based on the first raindrop impact, and bare ground is the opposite of ground cover. Well developed biological soil crusts should not be recorded as bare ground. Poorly developed biological soil crusts that are interpreted as functioning as bare ground (therefore they would be susceptible to raindrop splash erosion) should be recorded as bare ground.

5. **Number of gullies and erosion associated with gullies:** None to rare. Rare gullies may be present in landscape settings where increased runoff may accumulate (such as areas below exposed bedrock). Such gully development is expected to be limited to slopes exceeding 15% and adjacent to sites where runoff accumulation occurs (i.e. small watersheds, step sites, exposed bedrock, etc.). Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Very minor evidence of wind generated soil movement. Wind scoured (blowouts) and depositional areas are rarely present.

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 fine litter removal may occur in flow patterns and rills with deposition occurring at points of obstruction. The majority of litter accumulates at the base of plants. Some herbaceous litter may accumulate in soil depressions adjacent to plants. Woody litter is not likely to move.

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 vegetation canopies and a rating of 4 in the interspaces. The average should be a 5. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface thickness typically varies from 2 to 3 inches. Structure varies from fine granular to thin platy. Color is typically light brown (10YR6/2 to yellowish red 5YR5/6). Organic matter is > 2%. An ochric horizon typically extends to a depth of 2 to 10 inches. The ochric horizon is a surface horizon lacking fine stratification and which is either light colored, or thin, or has a low organic carbon content, or is massive and (very) hard when dry. The A horizon would be expected to be more strongly developed under plant canopies. It is important if you are sampling to observe the A horizon under plant canopies as well as the interspaces. Refer to soil survey for more detailed information about your specific site.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Vascular plants and well developed biological soil crusts will break raindrop impact and reduce splash erosion. Spatial distribution of vascular plants and interspaces between well developed biological soil crusts (where present) provide detention storage and surface roughness that slows runoff allowing time for infiltration. Interspaces between plants and well developed biological soil crusts (where present) may serve as water flow patterns during episodic runoff events, with natural erosion expected in severe storms. When perennial grasses decrease, reducing ground cover and increasing bare ground, runoff is expected to increase and any 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. A few soils have bedrock at about 30+ inches. Naturally occurring soil horizons may be harder than the surface because of an accumulation of clay or calcium carbonate and should not be considered as 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: non-sprouting shrubs (Wyoming big sagebrush) > cool season perennial grasses (Indian ricegrass, Squirreltail) > warm season perennial grasses (Galleta, Blue grama)

Sub-dominant: sprouting shrubs (rabbitbrush) > forbs > biological soil crusts

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 (e.g. Crested wheatgrass and Russian wildrye etc.) Biological soil crust is variable in its expression where present on this site and is measured as a component of ground cover. Forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

Additional: Factors contributing to temporal variability include drought, insects, and fire. Assumed fire cycle of 50-100+ years. Spatial variability factors include slope, aspect, etc. Following a recent disturbance such as fire or drought that removes the woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community. If a disturbance has not occurred for an extended period of time, woody species may continue to increase crowding out the perennial herbaceous understory species. In either case, these conditions could reflect a functional community phase within the reference state.

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 very little recent mortality or decadence apparent in trees, shrubs, or grasses. During severe (multi-year) drought some sagebrush may die. There may be partial mortality of individual bunchgrasses and other shrubs during drought. Some bunchgrass and shrub mortality may occur during severe droughts, particularly on the shallower and coarser soils associated with this site.
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14. **Average percent litter cover (%) and depth (in):** Litter cover Average litter cover (including under plants) Depth should be 1 leaf thickness in the interspaces, up to ¼" under shrub. Litter redistribution following natural extreme runoff events can reduce litter cover by concentrating it in low-lying areas. Litter cover may increase by 5 to 10% followings seasons with high production of annuals.
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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 210 - 430 #/acre on an average year

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: Green rabbitbrush, Cheatgrass, Purple Threeawn, Broom snakeweed & introduced annual forbs (Filarie, Russian thistle).

17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually in most years, except in drought years. Low green rabbitbrush sprouts vigorously following fire.
