

# Ecological site R028AY238UT

## Semidesert Shallow Loam (Utah Juniper-Bluebunch Wheatgrass)

Accessed: 05/01/2024

### 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.

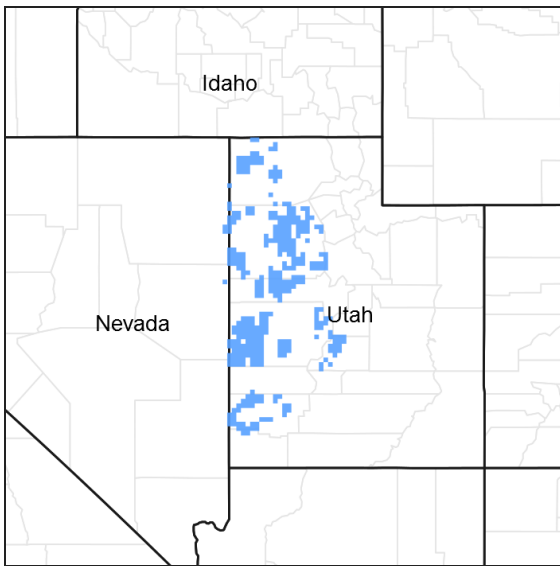


Figure 1. Mapped extent

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.

### Ecological site concept

The Semidesert Shallow Loam (Utah Juniper / Bluebunch Wheatgrass) ecological site is found on mountainsides and hillsides in the northern Great Salt Lake Area (MLRA D28A) at elevations between 4800 and 7000 feet. It occurs in the semidesert climate zone and receives about 8-10 inches of annual precipitation. Plant growth relies on spring moisture in April and May, which is usually followed by hot, dry summers when most plants go dormant. The soils are shallow and loamy with low water holding capacity. These soils typically formed in colluvium and residuum derived from limestone and/or sandstone. The reference plant community is dominated by Utah juniper, bluebunch wheatgrass, and often black sagebrush. Fire is the most common natural disturbance on this site. Cheatgrass and storksbill are common invaders of the understory, and cheatgrass is capable of dominating this site and altering the fire regime.

### Associated sites

R028AY215UT	Semidesert Gravelly Loam (Wyoming Big Sagebrush) North
R028AY220UT	Semidesert Loam (Wyoming Big Sagebrush)

### Similar sites

R028AY232UT	Semidesert Shallow Hardpan (Utah Juniper)
-------------	---

**Table 1. Dominant plant species**

Tree	(1) <i>Juniperus osteosperma</i>
Shrub	(1) <i>Artemisia nova</i>
Herbaceous	(1) <i>Pseudoroegneria spicata</i>

## Physiographic features

This site is commonly found on mountainsides and hillsides, and may extend across ridges and fan pediments in some areas. It occurs on all aspects, and at elevations between 4800 and 7000 feet.

**Table 2. Representative physiographic features**

Landforms	(1) Mountain slope (2) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	1,463–2,134 m
Slope	10–70%
Aspect	Aspect is not a significant factor

## Climatic features

This site has a semiarid climate that is characterized by spring moisture, hot summers and cold winters. Precipitation is usually 8 to 10 inches, with April and May as the wettest months and July as the driest month during the growing season. Moisture becomes limiting to plant growth in June and throughout the remainder of the growing season. Plant growth begins about mid-March and continues until mid-June when plants mature or go dormant due to soil moisture depletion and high temperatures. Some of the grasses and forbs green up during the early fall due to increased precipitation and cooler temperatures.

**Table 3. Representative climatic features**

Frost-free period (average)	183 days
Freeze-free period (average)	210 days
Precipitation total (average)	254 mm

## Influencing water features

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

## Soil features

The soils of this site formed mostly in colluvium and residuum derived from limestone and sandstone. Soils are shallow to bedrock with loamy surface textures. Rock fragments may be abundant or completely absent on the soil surface and throughout the profile. High amounts of carbonates are common in these soils but are not present in all locations for this site. The soil moisture regime is xeric and the soil temperature regime is mesic. Total water holding capacity ranges from 1.1 to 1.9 inches of water. These soils are well to somewhat excessively drained with moderately slow to moderately rapid permeability.

**Table 4. Representative soil features**

Parent material	(1) Colluvium–limestone (2) Slope alluvium–limestone and sandstone
-----------------	---

Surface texture	(1) Very cobbly loam (2) Very stony sandy loam (3) Gravelly
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately slow to moderately rapid
Soil depth	25–51 cm
Surface fragment cover ≤3"	0–20%
Surface fragment cover >3"	0–30%
Available water capacity (0-101.6cm)	2.79–4.83 cm
Calcium carbonate equivalent (0-101.6cm)	0–40%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–10
Soil reaction (1:1 water) (0-101.6cm)	7.4–9
Subsurface fragment volume ≤3" (Depth not specified)	0–35%
Subsurface fragment volume >3" (Depth not specified)	0–20%

## Ecological dynamics

### State and transition model

R028AY238UT Semidesert Shallow Loam (Utah Juniper / Bluebunch Wheatgrass)

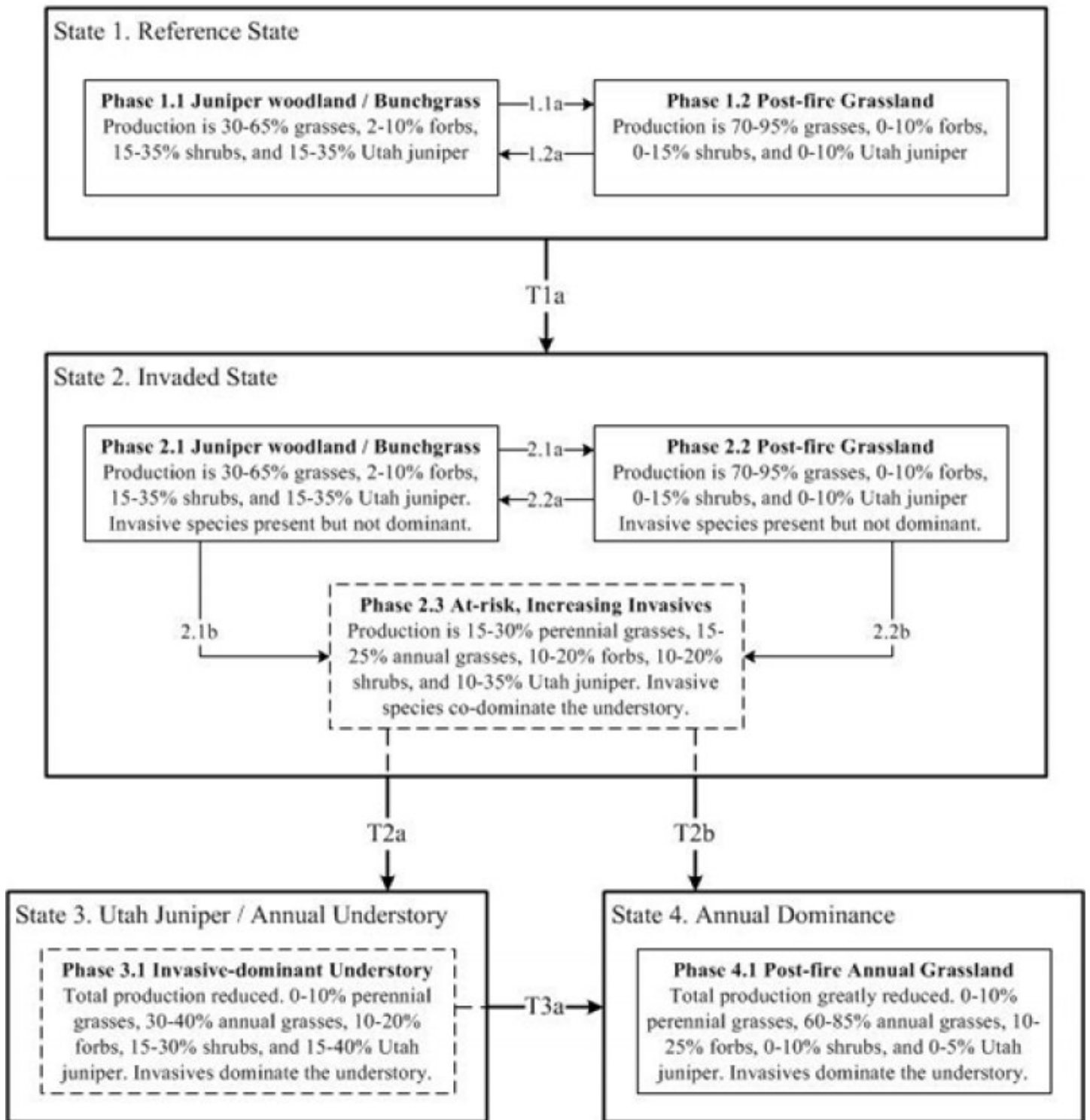


Figure 4. State-and-Transition Model

**State 1  
Reference State**

The reference state is characterized by mature stands of Utah juniper with an understory of bluebunch wheatgrass and black sagebrush. Fire, the most common natural disturbance on this site, removes juniper and most shrubs, while promoting bluebunch wheatgrass growth for several decades following fire. Non-sprouting shrubs and juniper increases slowly in the plant community after fire. Juniper regains overstory dominance after about 70 years (Barney and Frischknecht 1974).

**Community 1.1  
Juniper woodland / Bunchgrass**



R028AY238UT—Semidesert Shallow Loam (Utah Juniper / Bluebunch Wheatgrass) community 1.1 Juniper

Figure 5. Phase 1.1



R028AY238UT—Semidesert Shallow Loam (Utah Juniper / Bluebunch Wheatgrass) community 1.1 Juniper

Figure 6. Phase 1.1 Landscape

The juniper woodland / bunchgrass community is characterized by scattered mature Utah junipers with an understory of bluebunch wheatgrass, black sagebrush, and other perennial grasses, shrubs, and forbs. Percent composition by air-dry weight is 30-65% grasses, 2-10% forbs, 15-35% shrubs and 15-35% trees. The overstory is composed of Utah juniper as the dominant woodland species with a few singleleaf or two-needle pinyon occurring on moister sites. The understory shrub layer is most commonly black sagebrush and shadscale, with yellow rabbitbrush, horsebrush, and various other shrubs occurring in different locations. Bluebunch wheatgrass is the primary component of the understory, with lesser amounts of Nevada bluegrass and Indian ricegrass commonly present. Scattered perennial forbs are diverse and species vary by location.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	224	336	448
Shrub/Vine	140	196	252
Tree	112	168	224
Forb	28	56	84
<b>Total</b>	<b>504</b>	<b>756</b>	<b>1008</b>

Table 6. Ground cover

Tree foliar cover	5-15%
Shrub/vine/liana foliar cover	10-15%
Grass/grasslike foliar cover	5-15%
Forb foliar cover	0-5%

Non-vascular plants	0%
Biological crusts	0%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-30%
Bedrock	0-5%
Water	0%
Bare ground	15-30%

Table 7. Canopy structure (% cover)

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

Figure 8. Plant community growth curve (percent production by month).  
UT2381, PNC. Excellent Condition.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	15	40	30	5	5	0	0	0	0

Figure 9. Plant community growth curve (percent production by month).  
UT2382, Good Condition NO. 1. Bluegrass, Black Sagebrush.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	20	50	20	5	5	0	0	0	0

## Community 1.2 Post-fire Grassland



R028AY238UT—Semidesert Shallow Loam (Utah Juniper / Bluebunch Wheatgrass) community 1.2 Post-fire

Figure 10. Phase 1.2



R028AY238UT—Semidesert Shallow Loam (Utah Juniper / Bluebunch Wheatgrass) communities 1.1 and 1.2.

**Figure 11. Phase 1.2 landscape**

The post-fire grassland community consists of bluebunch wheatgrass and other perennial grasses, forbs, and sometimes sprouting shrubs. Percent composition by air-dry weight is 70-95% grasses, 0-10% forbs, 0-15% shrubs and 0-10% trees. Some mature juniper trees may survive surface fires, but most are usually killed by fire, along with non-sprouting shrubs and forbs. Bluebunch wheatgrass responds most vigorously to the burn and dominates the site for 10-30 years before shrubs begin to increase. Utah juniper may increase slowly in this community phase, but normally does not regain dominance of the overstory until about 70 years following fire (Barney and Frischknecht 1974).

**Table 8. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	420	504	588
Shrub/Vine	—	56	112
Tree	—	28	73
Forb	—	28	67
<b>Total</b>	<b>420</b>	<b>616</b>	<b>840</b>

**Table 9. Ground cover**

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	0-5%
Grass/grasslike foliar cover	20-35%
Forb foliar cover	0-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-30%
Bedrock	0-5%
Water	0%
Bare ground	15-30%

**Table 10. Canopy structure (% cover)**

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	0%	0%	0-5%	0-5%
>0.15 <= 0.3	0%	0-5%	0-5%	0-5%
>0.3 <= 0.6	0%	0-5%	15-30%	0-5%
>0.6 <= 1.4	0-5%	—	0-5%	—
>1.4 <= 4	0-5%	—	—	—
>4 <= 12	—	—	—	—
>12 <= 24	—	—	—	—
>24 <= 37	—	—	—	—
>37	—	—	—	—

### Pathway 1.1a Community 1.1 to 1.2



Juniper woodland /  
Bunchgrass



Post-fire Grassland

This pathway occurs when a crown or surface fire kills most or all of the trees and shrubs on the site. Perennial grasses respond to fire with vigorous growth and drive the ecological processes in phase 1.2 for several decades after the fire event.

### Pathway 1.2a Community 1.2 to 1.1



Post-fire Grassland



Juniper woodland /  
Bunchgrass

This pathway occurs gradually as Utah juniper trees mature and regain dominance after about 70 years without fire. This timeframe may be affected by the pre-fire plant community and seedbank, or by fire intensity and subsequent events (such as soil erosion from unusually heavy rainfall).

#### Conservation practices

Firebreak
Fuel Break

## State 2 Invaded State

The invaded state functions similarly to the reference state, but allows for the presence of non-native species.

### Community 2.1 Juniper woodland / Bunchgrass





R028AY238UT—Semidesert Shallow Loam (Utah Juniper / Bluebunch Wheatgrass) community 2.1 Invaded

**Figure 13. Phase 2.1**

The juniper woodland / bunchgrass community is characterized by scattered mature Utah junipers with an understory of bluebunch wheatgrass, black sagebrush, and other perennial grasses, shrubs, and forbs. Invasive species, including cheatgrass, storksbill, halogeton, Russian thistle and others, are present but not dominant. Percent composition by air-dry weight is 30-65% grasses, 2-10% forbs, 15-35% shrubs and 15-35% trees. The overstory is composed of Utah juniper as the dominant woodland species with a few singleleaf or two-needle pinyon occurring on moister sites. The understory shrub layer is most commonly black sagebrush and shadscale, with yellow rabbitbrush, horsebrush, and various other shrubs occurring in some locations. Bluebunch wheatgrass is the primary component of the understory, with lesser amounts of Nevada bluegrass and Indian ricegrass commonly present. Scattered perennial forbs are diverse and species vary by location.

**Table 11. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	224	336	448
Shrub/Vine	140	196	252
Tree	112	168	224
Forb	28	56	84
<b>Total</b>	<b>504</b>	<b>756</b>	<b>1008</b>

**Table 12. Ground cover**

Tree foliar cover	5-15%
Shrub/vine/liana foliar cover	10-15%
Grass/grasslike foliar cover	5-15%
Forb foliar cover	0-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-30%
Bedrock	0-5%
Water	0%
Bare ground	15-30%

**Table 13. Canopy structure (% cover)**

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

Figure 15. Plant community growth curve (percent production by month).  
UT2381, PNC. Excellent Condition.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	15	40	30	5	5	0	0	0	0

Figure 16. Plant community growth curve (percent production by month).  
UT2382, Good Condition NO. 1. Bluegrass, Black Sagebrush.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	20	50	20	5	5	0	0	0	0

## Community 2.2 Post-fire Grassland



R028AY238UT—Semidesert Shallow Loam (Utah Juniper / Bluebunch Wheatgrass) community 2.2 Invaded

Figure 17. Phase 2.2

The post-fire grassland community consists of bluebunch wheatgrass and other perennial grasses, forbs, and sometimes sprouting shrubs. Percent composition by air-dry weight is 70-95% grasses, 0-10% forbs, 0-15% shrubs and 0-10% trees. Invasive species are present but not dominant. Some mature juniper trees may survive surface fires, but most are usually killed by fire, along with non-sprouting shrubs and forbs. Bluebunch wheatgrass responds most vigorously to the burn and dominates the site for 10-30 years before shrubs begin to increase. Utah juniper may increase slowly in this community phase, but normally does not regain dominance of the overstory until about 70 years following fire (Barney and Frischknecht 1974).

Table 14. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	420	504	588
Shrub/Vine	–	56	112
Tree	–	28	73
Forb	–	28	67
<b>Total</b>	<b>420</b>	<b>616</b>	<b>840</b>

Table 15. Ground cover

Tree foliar cover	0-5%
Shrub/vine/liana foliar cover	0-5%
Grass/grasslike foliar cover	20-35%
Forb foliar cover	0-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-30%
Bedrock	0-5%
Water	0%
Bare ground	15-30%

Table 16. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	0%	0%	0-5%	0-5%
>0.15 <= 0.3	0%	0-5%	0-5%	0-5%
>0.3 <= 0.6	0%	0-5%	15-30%	0-5%
>0.6 <= 1.4	0-5%	–	0-5%	–
>1.4 <= 4	0-5%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

### Community 2.3 At-risk, Increasing Invasives

becoming the upper fire community. Production is about 400 kg/ha. Invasives and creosote are dominant with juniper and black sagebrush. Sandberg's bluegrass, Russian thistle, and storksbill and are also present. NAD83 Zone 12N 0348820 E. 4522767 N. Photo by Jamin Johanson, August 1, 2013.



**Figure 19. Phase 2.3 At-Risk**

This community phase is characterized by the co-dominance of invasive annual species with perennial grasses in the understory. It is at-risk of transitioning to states 3 and 4, which are dominated by invasive annuals. When perennial grass vigor is reduced, resources become available for invasive annual species. The presence of invasive species in the plant community provides a seed source, and invasive species increase to the point that the plant community becomes at-risk of losing the perennial grasses. Reduced perennial grass vigor is often the result of improper grazing and/or disturbance (such as fire, mechanical treatment, etc).

**Table 17. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	224	336	448
Shrub/Vine	140	196	252
Tree	112	168	224
Forb	28	56	84
<b>Total</b>	<b>504</b>	<b>756</b>	<b>1008</b>

**Table 18. Ground cover**

Tree foliar cover	5-15%
Shrub/vine/liana foliar cover	10-15%
Grass/grasslike foliar cover	5-15%
Forb foliar cover	0-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-30%
Bedrock	0-5%
Water	0%
Bare ground	15-30%

**Table 19. Canopy structure (% cover)**

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

### Pathway 2.1a Community 2.1 to 2.2



Juniper woodland /  
Bunchgrass

Post-fire Grassland

This pathway occurs when a crown or surface fire kills most or all of the trees and shrubs on the site. Perennial grasses respond to fire with vigorous growth and drive the ecological processes in phase 1.2 for several decades after the fire event. Mechanical or chemical removal of shrubs and trees are not documented for this site. However, they are not expected to result in vigorous growth of perennial grasses as compared to fire. Mechanical and chemical removal of woody species leaves many nutrients tied up in woody debris, and may cause a different response in the plant community than fire. An increase in invasive species often occurs with disturbance in the invaded state due to the presence of invasive species seed in the seedbank that take advantage of resources made available by disturbance.

#### Conservation practices

Brush Management
Prescribed Burning
Grazing Land Mechanical Treatment

### Pathway 2.1b Community 2.1 to 2.3



Juniper woodland /  
Bunchgrass

At-risk, Increasing Invasives

This pathway occurs when invasive annual species increase due to the reduction in vigor of perennial grasses. Improper grazing and/or disturbance (fire, mechanical treatments, etc.) drive this community pathway.

### Pathway 2.2a Community 2.2 to 2.1



Post-fire Grassland



Juniper woodland /  
Bunchgrass

This pathway occurs gradually as Utah juniper trees mature and regain dominance after about 70 years without fire. This timeframe may be affected by the pre-fire plant community and seedbank, or by fire intensity and subsequent events (such as soil erosion from unusually heavy rainfall).

**Conservation practices**

Firebreak
Fuel Break

**Pathway 2.2b  
Community 2.2 to 2.3**



Post-fire Grassland



At-risk, Increasing Invasives

This pathway occurs when invasive annual species increase due to the reduction in vigor of perennial grasses. Shrubs and Utah juniper also increase. Improper grazing and/or disturbance (excluding fire) drive this community pathway.

**State 3  
Utah Juniper / Annual Understory**

This state retains juniper dominance in the overstory, but is dominated by invasive annual species in the understory. Production is greatly reduced and limited to a few weeks in April and early May. This state is not resistant or resilient against further degradation to state 4, in which the juniper overstory is lost.

**Community 3.1  
Invasive-dominant Understory**

This community phase is characterized by the dominance of invasive annual species in the understory and Utah juniper in the overstory. It is at-risk of transitioning to state 4, which is dominated by invasive annuals without a juniper overstory. Composition by air-dry weight is 0-10% perennial grasses, 30-40% annual grasses, 10-20% forbs, 15-30% shrubs, and 15-40% Utah juniper.

Table 20. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	112	224	336
Tree	112	168	224
Shrub/Vine	84	140	196
Forb	56	84	112
<b>Total</b>	<b>364</b>	<b>616</b>	<b>868</b>

Table 21. Ground cover

Tree foliar cover	5-15%
-------------------	-------

Shrub/vine/liana foliar cover	2-10%
Grass/grasslike foliar cover	5-25%
Forb foliar cover	2-20%
Non-vascular plants	0%
Biological crusts	0%
Litter	15-30%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-30%
Bedrock	0-5%
Water	0%
Bare ground	10-20%

**Table 22. Canopy structure (% cover)**

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

## **State 4 Annual Dominance**

This state is dominated by invasive annuals, primarily cheatgrass, which increases the fire frequency to every several years (as opposed to decades or centuries). The fire frequency precludes woody species from regaining dominance on the site, and the resource pulses favor annual species. There is currently no transition or restoration pathway out of this state.

### **Community 4.1 Invasive-dominant Understory**



R028AY238UT—Semidesert Shallow Loam (Utah Juniper / Bluebunch Wheatgrass) community 4.1 Post-fire

**Figure 22. Phase 4.1**

This community phase is characterized by the dominance of invasive annual species in the understory and the general lack of native woody and herbaceous species. Total production is greatly reduced due to the loss of all functional/structural groups besides annual grasses and forbs. Composition by air-dry weight is 0-10% perennial grasses, 60-85% annual grasses, 10-25% forbs, 0-10% shrubs, and 0-5% Utah juniper.

**Table 23. Annual production by plant type**

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	112	280	504
Shrub/Vine	6	56	112
Forb	56	84	112
Tree	—	22	45
<b>Total</b>	<b>174</b>	<b>442</b>	<b>773</b>

**Table 24. Ground cover**

Tree foliar cover	0-2%
Shrub/vine/liana foliar cover	0-5%
Grass/grasslike foliar cover	20-35%
Forb foliar cover	2-25%
Non-vascular plants	0%
Biological crusts	0%
Litter	15-30%
Surface fragments >0.25" and <=3"	0-20%
Surface fragments >3"	0-30%
Bedrock	0-5%
Water	0%
Bare ground	10-30%

**Table 25. Canopy structure (% cover)**



Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	0%	0%	5-15%	5-20%
>0.15 <= 0.3	0%	0-5%	15-30%	5-20%
>0.3 <= 0.6	0%	0-5%	0-5%	0-5%
>0.6 <= 1.4	0%	–	–	–
>1.4 <= 4	0-2%	–	–	–
>4 <= 12	0-2%	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

### Transition T1a State 1 to 2

This transition occurs when invasive species establish on the site. Establishment of invasive species provides a seed source that decreases the resiliency of the site following natural or human disturbance.

### Transition T2a State 2 to 3

This transition occurs when invasive annual species, such as cheatgrass and storksbill, become dominant in the understory, while Utah juniper remains dominant in the overstory. Some perennial grasses may be present but not dominant. Improper grazing that further reduces the vigor of perennial grasses during the growing season can drive this transition.

### Transition T2b State 2 to 4

This transition occurs when fire or other disturbance removes the woody species and frees up resources for invasive annuals, such as cheatgrass and storksbill. Invasive annuals now dominate the site and drive the ecological processes in their own favor, and to the exclusion of native species. Perennial grasses may be present but not dominant. The fire return interval is expected to be reduced to every few years, instead of several decades or centuries.

### Transition T3a State 3 to 4

This transition occurs when fire or other disturbance removes woody species and frees up resources for invasive annual species to thrive. Juniper and other woody species are not able to regain dominance in the community due to increased fire frequency following this transition.

## Additional community tables

Table 26. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Tree</b>					
0	<b>Trees</b>			112–224	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	112–224	5–15
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0–22	0–1
	singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	0–22	0–1

Shrub/Vine					
0	<b>Shrubs</b>			140–252	
	black sagebrush	ARNO4	<i>Artemisia nova</i>	56–140	5–15
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	6–56	0–3
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	6–56	0–3
	shortspine horsebrush	TESP2	<i>Tetradymia spinosa</i>	0–56	0–3
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0–34	0–2
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0–34	0–2
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0–34	0–2
	spineless horsebrush	TECA2	<i>Tetradymia canescens</i>	0–34	0–2
Grass/Grasslike					
0	<b>Primary Grasses</b>			202–448	
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	179–404	8–15
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	11–56	1–3
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	11–56	1–3
1	<b>Secondary Grasses</b>			0–39	
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0–22	0–2
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0–22	0–2
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0–22	0–2
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0–22	0–2
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0–22	0–2
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0–22	0–2
	basin wildrye	LECI4	<i>Leymus cinereus</i>	0–11	0–1
Forb					
2	<b>Forbs</b>			28–84	
	desert princesplume	STPI	<i>Stanleya pinnata</i>	0–39	0–3
	aster	ASTER	<i>Aster</i>	0–22	0–2
	Hooker's balsamroot	BAHO	<i>Balsamorhiza hookeri</i>	0–22	0–2
	cryptantha	CRYPT	<i>Cryptantha</i>	0–22	0–2
	fleabane	ERIGE2	<i>Erigeron</i>	0–22	0–2
	cushion buckwheat	EROV	<i>Eriogonum ovalifolium</i>	0–22	0–2
	ballhead ipomopsis	IPCOC3	<i>Ipomopsis congesta ssp. congesta</i>	0–22	0–2
	Chambers' twinpod	PHCH2	<i>Physaria chambersii</i>	0–22	0–2
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0–22	0–2
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	0–22	0–2
	browse milkvetch	ASCI2	<i>Astragalus cibarius</i>	0–17	0–2

Table 27. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0	<b>Trees</b>			0–73	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	0–73	0–4

	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0-11	0-1
	singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	0-11	0-1
<b>Shrub/Vine</b>					
0	<b>Shrubs</b>			0-112	
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0-56	0-4
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	0-56	0-3
	black sagebrush	ARNO4	<i>Artemisia nova</i>	0-56	0-3
	shortspine horsebrush	TESP2	<i>Tetradymia spinosa</i>	0-56	0-3
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	0-34	0-2
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0-34	0-2
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0-34	0-2
	spineless horsebrush	TECA2	<i>Tetradymia canescens</i>	0-34	0-2
<b>Grass/Grasslike</b>					
0	<b>Primary Grasses</b>			420-588	
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	336-560	15-20
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	11-84	1-5
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	11-84	1-5
1	<b>Secondary Grasses</b>			0-84	
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0-45	0-2
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0-45	0-2
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0-45	0-2
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0-34	0-2
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0-34	0-2
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0-34	0-2
	basin wildrye	LECI4	<i>Leymus cinereus</i>	0-11	0-1
<b>Forb</b>					
2	<b>Forbs</b>			0-67	
	desert princesplume	STPI	<i>Stanleya pinnata</i>	0-39	0-3
	aster	ASTER	<i>Aster</i>	0-22	0-2
	Hooker's balsamroot	BAHO	<i>Balsamorhiza hookeri</i>	0-22	0-2
	cryptantha	CRYPT	<i>Cryptantha</i>	0-22	0-2
	fleabane	ERIGE2	<i>Erigeron</i>	0-22	0-2
	cushion buckwheat	EROV	<i>Eriogonum ovalifolium</i>	0-22	0-2
	ballhead ipomopsis	IPCOC3	<i>Ipomopsis congesta ssp. congesta</i>	0-22	0-2
	Chambers' twinpod	PHCH2	<i>Physaria chambersii</i>	0-22	0-2
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0-22	0-2
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	0-22	0-2
	browse milkvetch	ASCI2	<i>Astragalus cibarius</i>	0-17	0-2

Table 28. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Tree</b>					

0	<b>Trees</b>			112-224	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	112-224	5-15
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0-22	0-1
	singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	0-22	0-1
<b>Shrub/Vine</b>					
0	<b>Shrubs</b>			140-252	
	black sagebrush	ARNO4	<i>Artemisia nova</i>	56-140	5-15
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	6-56	0-3
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	6-56	0-3
	shortspine horsebrush	TESP2	<i>Tetradymia spinosa</i>	0-56	0-3
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0-34	0-2
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0-34	0-2
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0-34	0-2
	spineless horsebrush	TECA2	<i>Tetradymia canescens</i>	0-34	0-2
<b>Grass/Grasslike</b>					
0	<b>Primary Grasses</b>			202-448	
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	179-404	8-15
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	11-56	1-3
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	11-56	1-3
	cheatgrass	BRTE	<i>Bromus tectorum</i>	1-28	0-2
1	<b>Secondary Grasses</b>			0-39	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0-22	0-2
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0-22	0-2
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0-22	0-2
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0-22	0-2
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0-22	0-2
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0-22	0-2
	basin wildrye	LECI4	<i>Leymus cinereus</i>	0-11	0-1
<b>Forb</b>					
2	<b>Forbs</b>			28-84	
	desert princesplume	STPI	<i>Stanleya pinnata</i>	0-39	0-3
	Russian thistle	SAKA	<i>Salsola kali</i>	0-28	0-2
	tall tumbled mustard	SIAL2	<i>Sisymbrium altissimum</i>	0-28	0-2
	redstem stork's bill	ERIC16	<i>Erodium cicutarium</i>	0-28	0-2
	saltlover	HAGL	<i>Halogeton glomeratus</i>	0-28	0-2
	ballhead ipomopsis	IPCOC3	<i>Ipomopsis congesta ssp. congesta</i>	0-22	0-2
	Chambers' twinpod	PHCH2	<i>Physaria chambersii</i>	0-22	0-2
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0-22	0-2
	fleabane	ERIGE2	<i>Erigeron</i>	0-22	0-2
	cushion buckwheat	EROV	<i>Eriogonum ovalifolium</i>	0-22	0-2
	aster	ASTER	<i>Aster</i>	0-22	0-2
	Hooker's balsamroot	BAHO	<i>Balsamorhiza hookeri</i>	0-22	0-2
	cryptantha	CRYPT	<i>Cryptantha</i>	0-22	0-2

	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossularifolia</i>	0-22	0-2
	browse milkvetch	ASCI2	<i>Astragalus cibarius</i>	0-17	0-2

Table 29. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Tree</b>					
0	<b>Trees</b>			0-73	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	0-73	0-4
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0-11	0-1
	singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	0-11	0-1
<b>Shrub/Vine</b>					
0	<b>Shrubs</b>			0-112	
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0-56	0-4
	shortspine horsebrush	TESP2	<i>Tetradymia spinosa</i>	0-56	0-3
	black sagebrush	ARNO4	<i>Artemisia nova</i>	0-56	0-3
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	0-56	0-3
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0-34	0-2
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	0-34	0-2
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0-34	0-2
	spineless horsebrush	TECA2	<i>Tetradymia canescens</i>	0-34	0-2
<b>Grass/Grasslike</b>					
0	<b>Primary Grasses</b>			420-588	
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	336-560	15-20
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	11-84	1-5
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	11-84	1-5
	cheatgrass	BRTE	<i>Bromus tectorum</i>	1-56	0-3
1	<b>Secondary Grasses</b>			0-84	
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0-45	0-2
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0-45	0-2
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0-45	0-2
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0-34	0-2
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0-34	0-2
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0-34	0-2
	basin wildrye	LECI4	<i>Leymus cinereus</i>	0-11	0-1
<b>Forb</b>					
2	<b>Forbs</b>			0-67	
	redstem stork's bill	ERIC6	<i>Erodium cicutarium</i>	0-56	0-4
	desert princesplume	STPI	<i>Stanleya pinnata</i>	0-39	0-3
	Russian thistle	SAKA	<i>Salsola kali</i>	0-28	0-2
	tall tumbled mustard	SIAL2	<i>Sisymbrium altissimum</i>	0-28	0-2
	saltlover	HAGL	<i>Halogeton glomeratus</i>	0-28	0-2
	ballhead ipomopsis	IPCOC3	<i>Ipomopsis congesta</i> ssp. <i>congesta</i>	0-22	0-2
	Chenopodium...	PLUC10	<i>Physalis...</i>	0-20	0-2

	Chambers twinpod	PHCH2	<i>Phytolacca chambersii</i>	0-22	0-2
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0-22	0-2
	fleabane	ERIGE2	<i>Erigeron</i>	0-22	0-2
	cushion buckwheat	EROV	<i>Eriogonum ovalifolium</i>	0-22	0-2
	aster	ASTER	<i>Aster</i>	0-22	0-2
	Hooker's balsamroot	BAHO	<i>Balsamorhiza hookeri</i>	0-22	0-2
	cryptantha	CRYPT	<i>Cryptantha</i>	0-22	0-2
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	0-22	0-2
	browse milkvetch	ASCI2	<i>Astragalus cibarius</i>	0-17	0-2

Table 30. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Tree</b>					
0	<b>Trees</b>			112-224	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	112-224	5-15
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0-22	0-1
	singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	0-22	0-1
<b>Shrub/Vine</b>					
0	<b>Shrubs</b>			140-252	
	black sagebrush	ARNO4	<i>Artemisia nova</i>	56-140	5-15
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	6-56	0-3
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	6-56	0-3
	shortspine horsebrush	TESP2	<i>Tetradymia spinosa</i>	0-56	0-3
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0-34	0-2
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0-34	0-2
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0-34	0-2
	spineless horsebrush	TECA2	<i>Tetradymia canescens</i>	0-34	0-2
<b>Grass/Grasslike</b>					
0	<b>Primary Grasses</b>			202-448	
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	90-202	4-8
	cheatgrass	BRTE	<i>Bromus tectorum</i>	90-202	0-2
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	11-56	1-3
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	11-56	1-3
1	<b>Secondary Grasses</b>			0-39	
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0-22	0-2
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0-22	0-2
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0-22	0-2
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0-22	0-2
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0-22	0-2
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0-22	0-2
	basin wildrye	LECI4	<i>Leymus cinereus</i>	0-11	0-1
<b>Forb</b>					
2	<b>Forbs</b>			28-84	

	desert princesplume	STPI	<i>Stanleya pinnata</i>	0-39	0-3
	Russian thistle	SAKA	<i>Salsola kali</i>	0-28	0-2
	tall tumbled mustard	SIAL2	<i>Sisymbrium altissimum</i>	0-28	0-2
	redstem stork's bill	ERCI6	<i>Erodium cicutarium</i>	0-28	0-2
	saltlover	HAGL	<i>Halogeton glomeratus</i>	0-28	0-2
	ballhead ipomopsis	IPCOC3	<i>Ipomopsis congesta</i> ssp. <i>congesta</i>	0-22	0-2
	Chambers' twinpod	PHCH2	<i>Physaria chambersii</i>	0-22	0-2
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0-22	0-2
	fleabane	ERIGE2	<i>Erigeron</i>	0-22	0-2
	cushion buckwheat	EROV	<i>Eriogonum ovalifolium</i>	0-22	0-2
	aster	ASTER	<i>Aster</i>	0-22	0-2
	Hooker's balsamroot	BAHO	<i>Balsamorhiza hookeri</i>	0-22	0-2
	cryptantha	CRYPT	<i>Cryptantha</i>	0-22	0-2
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	0-22	0-2
	browse milkvetch	ASCI2	<i>Astragalus cibarius</i>	0-17	0-2

Table 31. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Tree</b>					
0	<b>Trees</b>			112-224	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	112-224	5-15
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0-22	0-1
	singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	0-22	0-1
<b>Shrub/Vine</b>					
0	<b>Shrubs</b>			84-196	
	black sagebrush	ARNO4	<i>Artemisia nova</i>	56-140	5-15
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	6-56	0-3
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	6-56	0-3
	shortspine horsebrush	TESP2	<i>Tetradymia spinosa</i>	0-56	0-3
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0-34	0-2
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0-34	0-2
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0-34	0-2
	spineless horsebrush	TECA2	<i>Tetradymia canescens</i>	0-34	0-2
<b>Grass/Grasslike</b>					
0	<b>Primary Grasses</b>			112-336	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	101-325	5-25
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	11-56	1-3
1	<b>Secondary Grasses</b>			0-28	
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	0-28	0-2
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0-22	0-2
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0-22	0-2
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0-22	0-2

	squirreltail	ELEL5	<i>Elymus elymoides</i>	0-11	0-1
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0-11	0-1
	basin wildrye	LECI4	<i>Leymus cinereus</i>	0-11	0-1
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	0-11	0-1
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0-1	0-1
<b>Forb</b>					
2	<b>Forbs</b>			56-112	
	redstem stork's bill	ERIC6	<i>Erodium cicutarium</i>	0-112	0-8
	Russian thistle	SAKA	<i>Salsola kali</i>	0-84	0-6
	tall tumbled mustard	SIAL2	<i>Sisymbrium altissimum</i>	0-56	0-4
	saltlover	HAGL	<i>Halogeton glomeratus</i>	0-56	0-4
	desert princesplume	STPI	<i>Stanleya pinnata</i>	0-39	0-3
	gooseberryleaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	0-22	0-2
	ballhead ipomopsis	IPCOC3	<i>Ipomopsis congesta ssp. congesta</i>	0-22	0-2
	Chambers' twinpod	PHCH2	<i>Physaria chambersii</i>	0-22	0-2
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0-22	0-2
	fleabane	ERIGE2	<i>Erigeron</i>	0-22	0-2
	cushion buckwheat	EROV	<i>Eriogonum ovalifolium</i>	0-22	0-2
	aster	ASTER	<i>Aster</i>	0-22	0-2
	Hooker's balsamroot	BAHO	<i>Balsamorhiza hookeri</i>	0-22	0-2
	cryptantha	CRYPT	<i>Cryptantha</i>	0-22	0-2
	browse milkvetch	ASCI2	<i>Astragalus cibaricus</i>	0-17	0-2

Table 32. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
<b>Tree</b>					
0	<b>Trees</b>			0-45	
	Utah juniper	JUOS	<i>Juniperus osteosperma</i>	0-45	0-2
	twoneedle pinyon	PIED	<i>Pinus edulis</i>	0-11	0-1
	singleleaf pinyon	PIMO	<i>Pinus monophylla</i>	0-11	0-1
<b>Shrub/Vine</b>					
0	<b>Shrubs</b>			6-112	
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	0-112	0-8
	rubber rabbitbrush	ERNA10	<i>Ericameria nauseosa</i>	0-112	0-8
	broom snakeweed	GUSA2	<i>Gutierrezia sarothrae</i>	0-112	0-8
	shortspine horsebrush	TESP2	<i>Tetradymia spinosa</i>	0-84	0-5
	plains pricklypear	OPPO	<i>Opuntia polyacantha</i>	0-56	0-4
	spineless horsebrush	TECA2	<i>Tetradymia canescens</i>	0-56	0-4
	black sagebrush	ARNO4	<i>Artemisia nova</i>	0-11	0-1
	shadscale saltbush	ATCO	<i>Atriplex confertifolia</i>	0-11	0-1
<b>Grass/Grasslike</b>					
0	<b>Primary Grasses</b>			112-448	



	cheatgrass	BRTE	<i>Bromus tectorum</i>	112-448	10-30
1	<b>Secondary Grasses</b>			0-56	
	Sandberg bluegrass	POSE	<i>Poa secunda</i>	0-45	0-3
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	0-28	0-2
	purple threeawn	ARPU9	<i>Aristida purpurea</i>	0-22	0-2
	blue grama	BOGR2	<i>Bouteloua gracilis</i>	0-22	0-2
	James' galleta	PLJA	<i>Pleuraphis jamesii</i>	0-22	0-2
	squirreltail	ELEL5	<i>Elymus elymoides</i>	0-11	0-1
	needle and thread	HECO26	<i>Hesperostipa comata</i>	0-11	0-1
	basin wildrye	LECI4	<i>Leymus cinereus</i>	0-11	0-1
	Indian ricegrass	ACHY	<i>Achnatherum hymenoides</i>	0-11	0-1
	western wheatgrass	PASM	<i>Pascopyrum smithii</i>	0-1	0-1
<b>Forb</b>					
2	<b>Forbs</b>			56-112	
	redstem stork's bill	ERCI6	<i>Erodium cicutarium</i>	0-112	0-8
	Russian thistle	SAKA	<i>Salsola kali</i>	0-84	0-6
	tall tumbled mustard	SIAL2	<i>Sisymbrium altissimum</i>	0-84	0-6
	saltlover	HAGL	<i>Halogeton glomeratus</i>	0-56	0-4
	gooseberry leaf globemallow	SPGR2	<i>Sphaeralcea grossulariifolia</i>	0-22	0-2
	desert princesplume	STPI	<i>Stanleya pinnata</i>	0-11	0-1
	fleabane	ERIGE2	<i>Erigeron</i>	0-11	0-1
	cushion buckwheat	EROV	<i>Eriogonum ovalifolium</i>	0-11	0-1
	ballhead ipomopsis	IPCOC3	<i>Ipomopsis congesta ssp. congesta</i>	0-11	0-1
	Chambers' twinpod	PHCH2	<i>Physaria chambersii</i>	0-11	0-1
	spiny phlox	PHHO	<i>Phlox hoodii</i>	0-11	0-1
	browse milkvetch	ASCI2	<i>Astragalus cibarius</i>	0-11	0-1
	aster	ASTER	<i>Aster</i>	0-11	0-1
	Hooker's balsamroot	BAHO	<i>Balsamorhiza hookeri</i>	0-11	0-1
	cryptantha	CRYPT	<i>Cryptantha</i>	0-11	0-1

## Animal community

Approximately 40 percent of the plants furnish some forage for livestock. Limited numbers of plant species occur, but they have enough variety to provide balanced nutrition for cattle, horses, and sheep. Grazing can be during all seasons, but best efficiency is in the fall or winter. Spring grazing is a common practice.

Wildlife using this site include antelope, blacktailed jackrabbit, coyote, morning dove, golden eagles (fall and spring), a few songbirds, and a few species of small mammals.

This is a short list of the more common species found. Many other species are present as well and migratory birds are present at times.

## Hydrological functions

The soil series is in hydrologic group D. The hydrologic curve number is 80 when the vegetation is in good condition.

## Recreational uses

Values are fair for camping, hiking, and picnicking.

## Wood products

This site yields approximately three cords of juniper per acre for firewood.

## Other information

Threatened and endangered species include plants and animals.

## Type locality

Location 1: Box Elder County, UT	
General legal description	Warm Springs Hill 15 Miles west of Park Valley

## Other references

Barney, Milo A.; Frischknecht, Neil C. 1974. Vegetation changes following fire in the pinyon-juniper type of west-central Utah. *Journal of Range Management*. 27(2): 91-96. [397]

## Contributors

GR DJS

GR, David J. Somerville

## Rangeland health reference sheet

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

Author(s)/participant(s)	Jack Alexander, Range Specialist, Synergy Resource Solutions, Inc. Julia Kluck, Soil Scientist, Synergy Resource Solutions, Inc. Shane Green, State Range Specialist, Utah NRCS
Contact for lead author	Shane Green, Shane.Green@ut.usda.gov
Date	02/09/2010
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

## Indicators

1. **Number and extent of rills:** Some rills present. Rill development may increase following large storm events, but should begin to heal during the following growing season. Frost heaving will accelerate recovery. Rill development may increase when run inflow enters site from other sites that produce large amounts of runoff (i.e. steeper sites, slickrock, rock outcrop).

- 
2. **Presence of water flow patterns:** Water flow patterns will be short (2-5') and meandering; interrupted by plants and

exposed rocks. Some evidence of erosion or deposition associated with flow patterns. Where slopes exceed 5%, water flow patterns may be longer (5–10').

---

3. **Number and height of erosional pedestals or terracettes:** Plants may have small pedestals (1-3") where they are adjacent to water flow patterns, but without exposed roots. Terracettes should be few and stable. Terracettes should be small (1-3") and show little sign of active erosion. Some plants may appear to have a pedestal but rather than be formed by erosion, the only place litter accumulates and soil collects is at plant bases forming the appearance of a pedestal.

Well-developed biological crusts may appear pedestalled, but are actually a characteristic of the crust formation. Some plants may appear to have a pedestal but rather than be formed by erosion, the only place litter accumulates and soil collects is at plant bases forming the appearance of a pedestal.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 20-40% bare ground (soil with no protection from raindrop impact). Herbaceous communities are most likely to have lower values. As species composition by shrubs increases, bare ground is likely to increase. Poorly developed biological soil crust that is susceptible to raindrop splash erosion should be recorded as bare ground. Very few if any bare spaces of greater than 1 square foot.
- 

5. **Number of gullies and erosion associated with gullies:** No gullies present.
- 

6. **Extent of wind scoured, blowouts and/or depositional areas:** Very minor evidence of active wind-generated soil movement. Wind scoured (blowouts) and depositional areas are rarely present. If present they have muted features and are mostly stabilized with vegetation and/or biological crust. Gravel or desert pavement protects the site from wind scour.
- 

7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water and wind movement. Very minor 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 leaves, stems, and small twigs may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move. On steep slopes (>30%), litter will move downhill to next obstruction.
- 

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 an erosion rating of 5 or 6 under plant canopies and a rating of 4 to 5 in the interspaces with an average rating of 5 using the soil stability kit test.
- 

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** This description is based on the modal soil (Amtoft Family CBV-L, soil survey area: 611, Tooele), the only soil correlated with this site.

Soil surface horizon is typically 8 inches deep. Structure is typically weak medium subangular blocky. Color is typically pale brown (10YR 6/3), brown (10YR 4/3) moist. An ochric horizon extends to a depth of 8 inches. 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.

---

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Vascular plants and any well-developed biological soil crusts (where present) will break raindrop impact and 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. Crowns of trees and accumulating litter at base of trees appear to create a micro-topography that may enhance development of water flow patterns below the drip line of the canopy. Significant increases in pinyon-juniper canopy reduces understory vegetation and increases runoff.
- 

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Lithic contact (the boundary with hard bedrock) may occur at about 17 inches. Naturally occurring soil horizons may be harder than the surface because of an accumulation of calcium carbonate and should not be considered as compaction layers.
- 

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: Utah juniper > bluebunch wheatgrass, black sagebrush

Sub-dominant: Indian ricegrass, shadscale saltbush

Other: other shrubs, other grasses, forbs

Additional: In the northern portion of the MLRA cool-season perennial grasses (Indian ricegrass, needle and thread) dominate. In the southernmost portion of the MLRA warm-season perennial grasses (galleta, sand dropseed) dominate. The two groups share dominance in the middle portion of the MLRA.

---

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 either the shrubs or grasses. Some bunchgrass and shrub mortality may occur during severe droughts, particularly on the shallower and coarser soils associated with this site.
- 

14. **Average percent litter cover (%) and depth ( in):** Litter cover includes litter under plants. Most litter will be fine litter. Depth should be 1-2 leaf thickness in the interspaces and up to 1/2" under canopies. Litter cover may increase to 20-30% following years with favorable growing conditions. Excess litter may accumulate in absence of disturbance. Vegetative production may be reduced if litter cover exceeds 40%.
- 

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 650#/acre.  
Even the most stable communities exhibit a range of production values. Production will vary between communities and across the MRLA. Refer to the community descriptions in the ESD. Production will differ across the MLRA due to the naturally occurring variability in weather, soils, and aspect. The biological processes on this site are complex; therefore,

representative values are presented in a land management context.

---

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, halogeton, green rabbitbrush, annual forbs, broom snakeweed, Utah juniper, purple threeawn, medusahead rye.
- 

17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually, except in drought years. Density of plants indicates that plants reproduce at level sufficient to fill available resource. Within capability of site there are no restrictions on seed or vegetative reproductive capacity.
-