Ecological site R035XY222UT
Semidesert Shallow Loam (Utah Juniper- James Galleta)

Accessed: 04/26/2024

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.

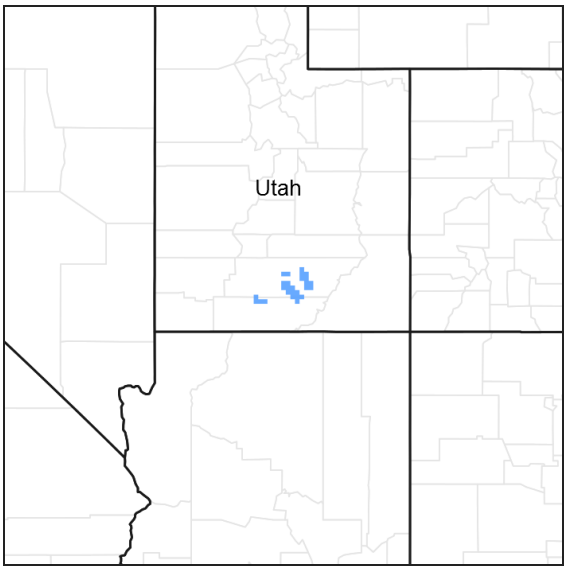


Figure 1. Mapped extent

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 stucturally 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.

Associated sites

R035XY221UT	**Semidesert Shallow Loam (Utah Juniper-Pinyon)**
R035XY234UT	**Semidesert Shallow Shale (Utah Juniper-Pinyon)**
R035XY237UT	**Semidesert Shallow Gypsum (Mormontea)**

Table 1. Dominant plant species

Tree	(1) *Juniperus osteosperma*
Shrub	Not specified

Herbaceous	(1) *Pleuraphis jamesii* (2) *Bouteloua gracilis*

Physiographic features

This site is located on hillslopes on structural benches, mesas, hillsides, and ridges. Runoff is highly variable and ranges from slow to rapid. Slopes generally rnage from 5% to 25% but can range to 50%. Elevations typically range from 5000 to 6900 feet.

Table 2. Representative physiographic features

Landforms	(1) Mesa (2) Structural bench (3) Ridge
Flooding frequency	None
Ponding frequency	None
Elevation	5,000–6,900 ft
Slope	5–25%
Aspect	S

Climatic features

Precipitation ranges from 9 to 12 inches. Approximately 70-75% occurs as rain from March through October. On the average, February, May, and June are the driest months and July through October are the wettest months. Precipitation is extremely variable from month to month and from year to year. Much of the summer precipitation occurs as convection thunderstorms. Mean average annual temperature ranges from 45 to 52 degrees fahrenheit.

Table 3. Representative climatic features

Frost-free period (average)	160 days
Freeze-free period (average)	140 days
Precipitation total (average)	12 in

Influencing water features

There are no influencing water features.

Soil features

This site occurs on very shallow to shallow soils. The dry surface layer color is typically reddish brown or brown and the surface soil textures range from channery loams to very stony fine sandy loams. These soils are moderatly well developed, well drained, and have moderate water holding capacities. Soil temperature regime is mesic and moisture regime is ustic aridic. Erosion potential of soils on reference state sites typically depends on surface rock fragments. Sites with greater than 50% rock fragments have lower wind and water erosion potentials than sites with less than 50% surface rock fragments. Biological crust cover is characterized as crustless with the possible occurrence of light cyanobacteria and/or isolated lichen and moss pinnacles. This site has been used in the following soils surveys and has been correlated to the following components:

UT685 - Capitol Reef - Mellenthin;
UT686—Escalante Grand Staircase National Monument— Nonip,Mellenthin.

Typical Soil Profile: (Mellenthin).
A—0-4 inches; very stony fine sandy loam; very strongly calcareous; moderately alkaline.
Bk1—4-11 inches; very stony loam; very strongly calcareous; moderately alkaline.

Bk2-11-15 inches; very stony loam; very strongly calcareous; moderately alkaline.
R—15 inches; sandstone.

Table 4. Representative soil features

Parent material	(1) Residuum–sandstone and shale (2) Colluvium–limestone
Surface texture	(1) Very channery loam (2) Extremely channery clay loam (3) Extremely gravelly sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate to moderately rapid
Soil depth	4–20 in
Surface fragment cover <=3"	0–70%
Surface fragment cover >3"	0–50%
Available water capacity (0-40in)	0.4–1.4 in
Calcium carbonate equivalent (0-40in)	15–30%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	7.9–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–50%
Subsurface fragment volume >3" (Depth not specified)	0–49%

Ecological dynamics

This site developed under Colorado Plateau ecological conditions and the natural influences of native herbivory, occasional fire and climate. Species composition is generally composed of an open canopy of Utah juniper, a few scattered two-needle pinyon may also be present. Shrub composition is sparse with broom snakeweed, fourwing saltbush and Torrey's jointfir found most often. Perennial cool and warm season grasses dominate the herbaceous layer with James galleta, blue grama and Indian ricegrass most common.

This site is very resistant to disturbance. Fire is an integral part of the natural cycle of the plant community. Periodic fire decreases the abundance of Utah juniper and increases perennial grasses. Improper livestock grazing, (i.e., heavy grazing in late winter and early spring) decreases cool season grasses allowing warm season grasses to dominance. Further disturbance can allow for the invasion of undesirable introduced species (i.e., cheatgrass and storksbill geranium) and for broom snakeweed to increase.

Drought and insect damage appear to be a driving factors in many pinyon/juniper communities. Betancourt et al. (1993), noted that pinyon and juniper woodlands in the southwest appear to be more susceptible to large die-offs during droughts, than at other locations. If a severe drought persists, two-needle pinyon, which is more susceptible to drought and insect damage than Utah juniper, appears to die out first, while the Utah juniper may survive. This event could allow for an increase in shrubs and herbaceous species during periods when wetter years return. During periods with an absence of fire, Utah juniper will increase in dominance, reducing understory herbaceous species.

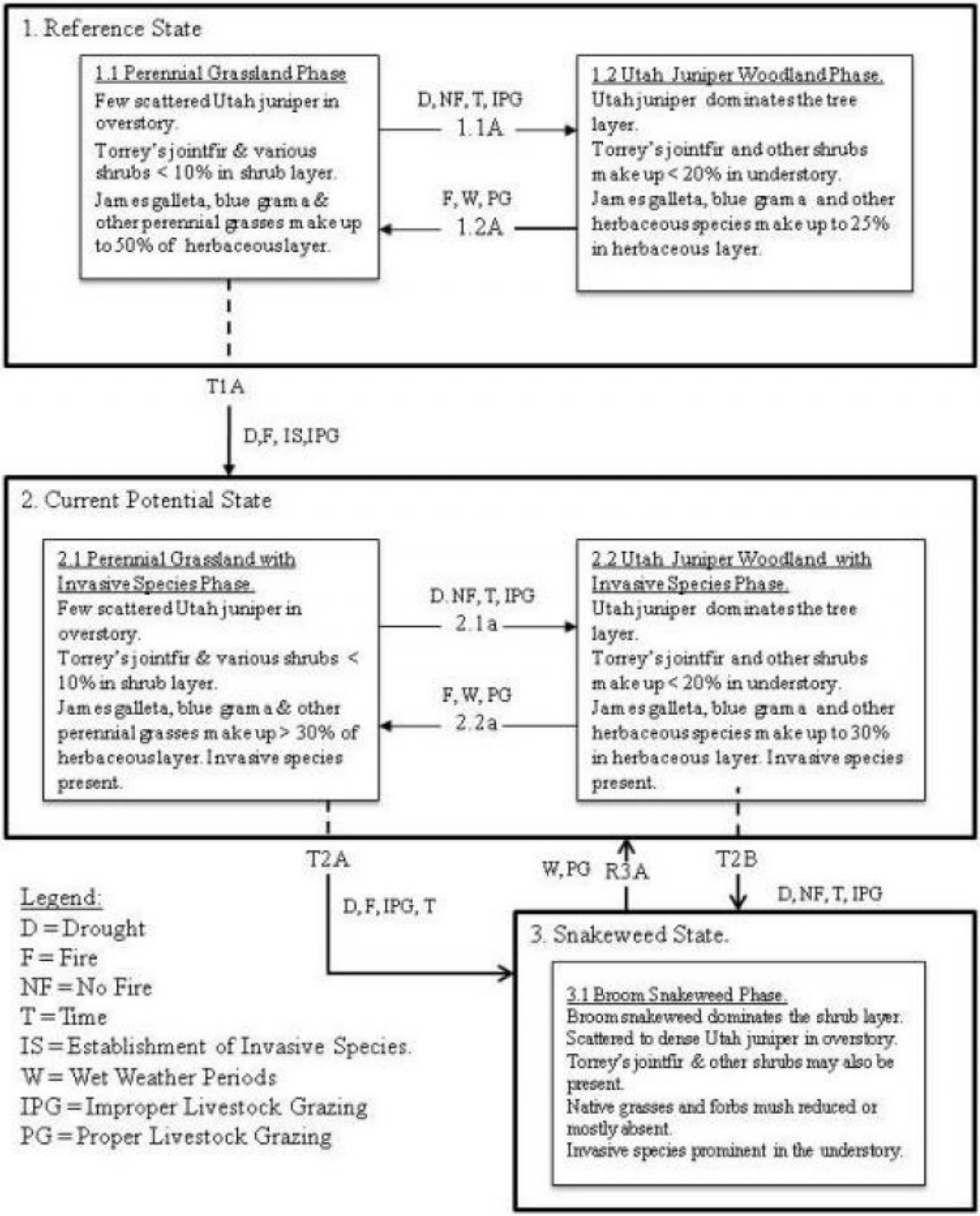
As vegetative communities respond to changes caused by natural occurrences, that cause them to cross ecological

thresholds, a return to previous states may not be possible without major energy inputs. The amount of energy input needed to affect desired vegetative shifts depends on the present sites biotic and abiotic features and the desired results.

The following State and Transition diagram depicts the most common plant communities found on this ecological site. It does not necessarily depict all the plant communities that can occur. Even though these plant communities may not represent every possibility, but they do show the most prevalent and repeatable. As more data are collected, some of these plant communities will be revised or removed, and new ones may be added. The main purpose for including any description of a plant community here is to capture the current knowledge and experience at the time of this revision.

State and transition model

State and Transition Model
State: Utah
Site Type: Rangeland
MLRA: D-35- Colorado Plateau
R035XY222UT – Semidesert Shallow Loam (James galleta/Utah juniper)



Legend:
D = Drought
F = Fire
NF = No Fire
T = Time
IS = Establishment of Invasive Species.
W = Wet Weather Periods
IPG = Improper Livestock Grazing
PG = Proper Livestock Grazing

State 1
Reference State

This Reference State was determined by the study of rangeland relic areas and areas protected from excessive disturbance and influences such as improper livestock grazing and high impact recreation. Literature reviews, historical accounts and observations of trends in plant community dynamics under a variety of sites has also been considered. Community phases, community pathways, other states, transitions, and thresholds, have been determined through similar studies and experience. The reference state represents the plant communities and ecological dynamics of the semidesert shallow loam, James galleta, Utah juniper site. This state includes the biotic communities that become established on this ecological site if all successional sequences are completed under the natural disturbance regime. The reference state is generally dominated by James galleta with an overstory canopy of Utah juniper, however depending on disturbance history, other native grasses, forbs, or other shrubs may dominate the site. Utah juniper will naturally increase on this site, in the absence of disturbance, due to its ability to out compete associated understory species. Primary disturbance mechanisms include infrequent fire, climate fluctuations, and native herbivore grazing. The timing of these natural disturbances dictates the ecological dynamics that can occur. 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 do occur, the rate of recovery is quite variable depending on disturbance intensity. The reference state will naturally fluctuate between community phases 1.1 and 1.2. Once these sites are invaded by non-native species, a return to these community phases may not be possible. Reference State: Plant communities influenced by infrequent fire, native herbivore grazing, and climate fluctuations. Indicators: A community dominated by James galleta and Utah juniper where other native perennial grasses and forbs may also be present. Feedbacks: Natural fluctuations in climate that allow for a self sustaining native grass community. Improper livestock grazing, more frequent fire, or other disturbance that may allow for the establishment of non-native species. At-risk Community Phase: All communities are at risk when native plants are stressed and nutrients become available for invasive plants to establish. Trigger: The establishment of non-native invasive plant species.

Community 1.1
Perennial Grassland Phase.

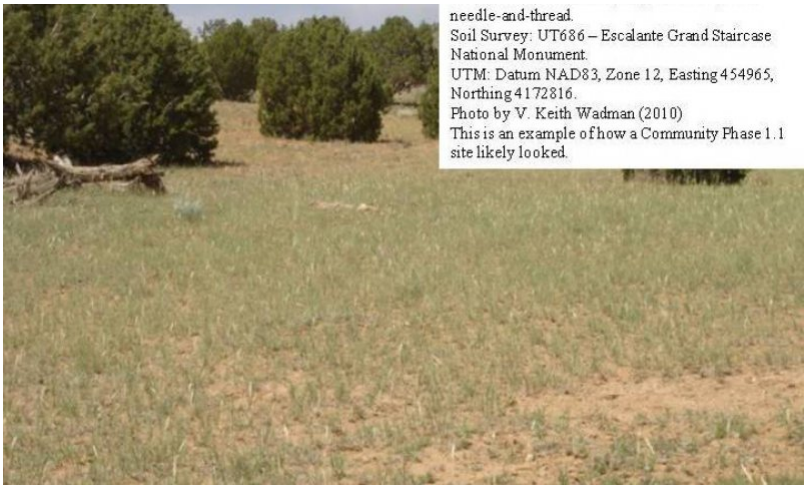


Figure 4. Utah juniper, James galleta Grassland.

This site is characterized by an overstory canopy of scattered Utah Juniper with an understory dominated by perennial warm and cool season grass species, with James galleta and blue grama most common. A few two-needle pinyon may also be present on some sites. Shrubs are widely scattered with fourwing saltbush, winterfat and broom snakeweed found most often. Warm season grasses often dominate the herbaceous layer where spring grazing is practiced, and because of the site abundance of summer precipitation. The composition by annual air-dry weight is approximately 45% perennial grasses, 10% forbs, 10% shrubs, and 35% trees. Plants growth begins around March 1 and ends around October 15. The following tables provide an example of the typical vegetative floristics of a community phase 1.1 plant community.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	135	200	290
Tree	90	135	195
Shrub/Vine	45	70	100
Forb	30	45	65
Total	**300**	**450**	**650**

Table 6. Ground cover

Tree foliar cover	10-15%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	15-20%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0-2%
Litter	5-10%
Surface fragments >0.25" and <=3"	10-85%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	25-45%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	20-20%	5-6%
>1 <= 2	–	5-7%	–	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	7-9%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
Utah Juniper Woodland Phase

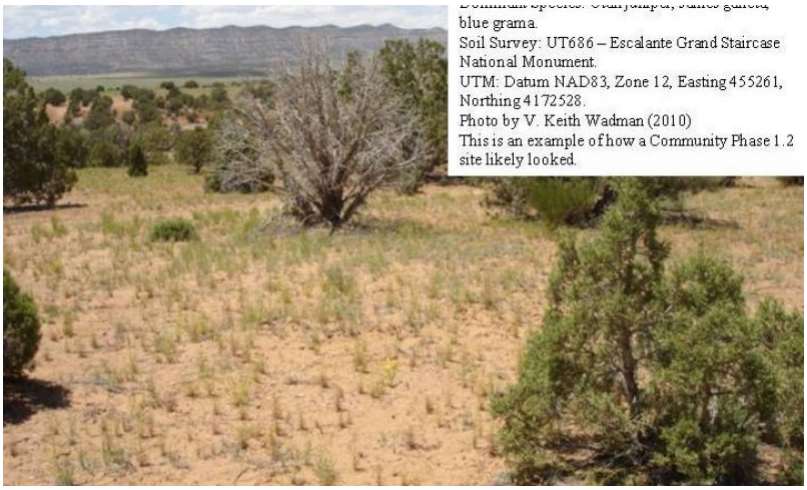


Figure 6. Utah juniper woodland with James galleta.

This community phase is characterized by a dense overstory canopy of Utah Juniper. Perennial warm and cool season grasses are present but make up less than 20% of the sites production. A few two-needle pinyon may be present and native shrubs, often dominated by broom snakeweed are commonly found. Warm season grasses occur more frequently than cool season species due to precipitation regime. The composition by annual air-dry weight is approximately 20% perennial grasses, 10% forbs, 20% shrubs, and 50% trees. Plants growth begins around March 1 and ends around October 15. The following tables provide an example of the typical vegetative floristics of a community phase 1.2 plant community.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	100	160	240
Tree	120	150	200
Shrub/Vine	50	70	100
Forb	30	45	65
Total	**300**	**425**	**605**

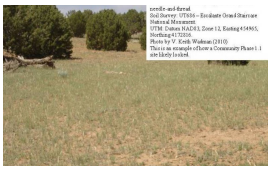
Table 9. Ground cover

Tree foliar cover	20-30%
Shrub/vine/liana foliar cover	10-15%
Grass/grasslike foliar cover	10-15%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0-2%
Litter	5-10%
Surface fragments >0.25" and <=3"	10-85%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	30-50%

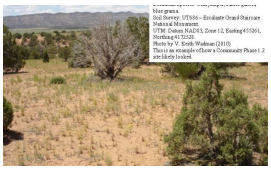
Table 10. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	20-20%	4-6%
>1 <= 2	–	5-7%	–	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	7-9%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 1.1A
Community 1.1 to 1.2



Perennial Grassland Phase.



Utah Juniper Woodland Phase

This community pathway occurs when any combination of extended drought, long periods without fire, and improper livestock grazing cause the perennial herbaceous community to become significantly reduced and Utah juniper and perennial shrubs to increase.

Pathway 1.2A
Community 1.2 to 1.1

Utah Juniper Woodland Phase

Perennial Grassland Phase.

This pathway occurs when any combination of fire, wet weather cycles and good livestock management cause the perennial grasses to increase and Utah juniper and broom snakeweed to decrease.

State 2
Current Potential State

The current potential state is similar to the reference state except that non-native, invasive species are now present in all community phases. This state is generally dominated by James galleta with an overystory canopy of Utah juniper, however, depending on disturbance history, other native grasses, forbs, and/or other shrubs may dominate the site. Utah juniper will, in the absence of natural disturbances, increase on this site due to its ability over time to out compete associated understory species. Primary disturbance mechanisms include infrequent fire, weather fluctuations, 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 will occur. The current potential state is still self sustaining; but is losing resistant to change due to a lower resistance to disturbances and a lower resilience following disturbances. When disturbances do occur, the rate of recovery is highly variable depending on severity. The current potential state will naturally fluctuate between community phases 2.1 and 2.2. Current Potential State: Plant communities influenced by infrequent fire, native herbivore grazing, climate fluctuations, domestic livestock grazing, and other surface disturbances. Indicators: A community dominated by James galleta and Utah juniper where native other perennial grasses and forbs may also be present. Non-native, invasive grasses and forbs are now present. Feedbacks: Natural fluctuations in weather

that allow for a self sustaining perennial grassland community. Improper livestock grazing which results in a decrease of the perennial grass canopy. Stand replacing fires, or other surface disturbances, which remove Utah juniper. Frequent fire or other disturbance that may allow for the dominance of annual grasses, such as cheatgrass or an increase in broom snakeweed. At-risk Community Phase: All communities are at risk as increased disturbance frequency allows for the dominance of annual grasses, such a cheatgrass or an incease in broom snakeweed. Trigger: Reoccurring fire that results in a dominance of cheatgrass or broom snakeweed.

Community 2.1
Perennial Grassland Phase with Invasive Species.

Figure 8. Utah juniper with James galleta & annual weeds.

This site is characterized by an overstory canopy of scattered Utah Juniper with an understory dominated by perennial warm and cool season grass species, with James galleta and blue grama being most common. Non-native annual species such as cheatgrass, Russian thistle, and ragweed species are also present. A few two-needle pinyon may also be present on some sites. Shrubs are widely scattered with fourwing saltbush, winterfat and broom snakeweed found most often. Warm season grasses often dominate the herbaceous layer where spring grazing is practiced, and because of the site abundance of summer precipitation. The composition by annual air-dry weight is approximately 45% annual and perennial grasses, 10% forbs, 10% shrubs, and 35% trees. Plants growth begins around March 1 and ends around October 15. The following tables provide an example of the typical vegetative floristics of a community phase 2.1 plant community.

Table 11. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	150	200	280
Tree	100	135	220
Shrub/Vine	45	75	125
Forb	30	45	65
Total	**325**	**455**	**690**

Table 12. Ground cover

Tree foliar cover	10-15%
Shrub/vine/liana foliar cover	10-20%
Grass/grasslike foliar cover	20-25%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0-2%
Litter	5-10%

Surface fragments >0.25" and <=3"	10-85%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	35-55%

Table 13. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	20-20%	4-6%
>1 <= 2	–	5-7%	–	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	7-9%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 2.2
Utah Juniper Woodland Phase with Invasive Species.

Figure 10. Utah juniper with James galleta.

This community phase is characterized by a dense overstory canopy of Utah Juniper. Perennial warm and cool season grasses are present but make up less than 20% of the sites production. Non-native annual species such as cheatgrass, Russian thistle, and ragweed species are also present. A few two-needle pinyon may be present and native shrubs, often dominated by broom snakeweed are commonly found. Warm season grasses occur more frequently than cool season species due to precipitation regime. The composition by annual air-dry weight is approximately 30% perennial grasses, 10% forbs, 10% shrubs, and 50% trees. Plants growth begins around March 1 and ends around October 15. The following tables provide an example of the typical vegetative floristics of a community phase 2.2 plant community.

Table 14. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	100	160	240
Tree	120	150	200
Shrub/Vine	50	70	100
Forb	30	45	65
Total	**300**	**425**	**605**

Table 15. Ground cover

Tree foliar cover	20-30%
Shrub/vine/liana foliar cover	15-20%
Grass/grasslike foliar cover	15-20%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0-2%
Litter	5-10%
Surface fragments >0.25" and <=3"	10-85%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	30-50%

Table 16. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	20-20%	4-6%
>1 <= 2	–	5-7%	–	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	7-9%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 2.1A
Community 2.1 to 2.2

Perennial Grassland Phase with Invasive Species.

Utah Juniper Woodland Phase with Invasive Species.

This community pathway occurs when any combination of extended drought, long periods without fire, and improper livestock grazing cause the perennial herbaceous community to become significantly reduced and Utah juniper and

perennial shrubs to increase. Annual invasive species such as cheatgrass, Russian thistle, and ragweed species may increase during this time.

Pathway 2.2A
Community 2.2 to 2.1

Utah Juniper Woodland Phase with Invasive Species.

Perennial Grassland Phase with Invasive Species.

This pathway occurs when any combination of fire, wet weather cycles and good livestock management cause the perennial grasses to increase and Utah juniper and broom snakeweed to decrease. Invasive species, although still present, are reduced as a percentage of the herbaceous layer.

State 3
Broom Snakeweed State

This state is characterized by a dominance of broom snakeweed. Native perennial grasses and shrubs may also be present. Native shrubs include Torrey's jointfir, and native grasses include James galleta, blue grama and Indian ricegrass may be present on small amounts. Invasive species such as cheatgrass, tansy mustard, and Russian thistle are typically present in all community phases. Other grasses, forbs, or shrubs may also be present and cover is variable. Utah juniper is often present but it's canopy cover is highly variable. Broom Snakeweed State: Community phases maintained by improper livestock grazing, time with out disturbances, and fluctuating precipitation trends. Indicators: A community dominated by broom snakeweed and other invasive species, where native perennial grass and shrubs may also be present. Feedbacks: A fire or other disturbance that decreases the broom snakeweed cover and allows for the proliferation of cheatgrass. Conditions that allow for continued dominance of broom snakeweed. At Risk Community Phase: All phases are at risk for the dominance of cheatgrass. Trigger: A fire or other disturbance that removes the broom snakeweed and allows for the dominance of cheatgrass.

Community 3.1
Broom snakeweed phase.

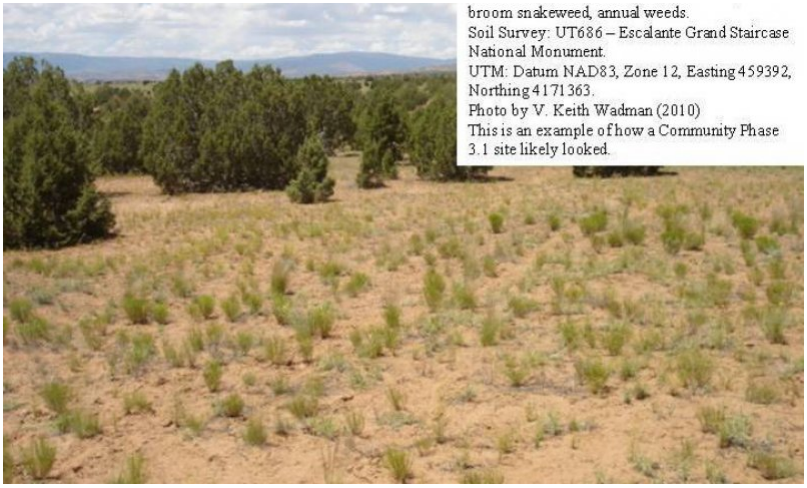


Figure 12. Utah juniper woodland with broom snkaeweed.

Figure 13. Utah juniper with dead snake weed.

This community phase is characterized by a dominance of broom snakeweed, with some occurrence of native perennial grasses, shrubs, and invasive species. Native species typically include Torrey's jointfir, James galleta, blue grama and Indian ricegrass. Invasive species typically include tansy mustard, cheatgrass, and Russian thistle. Utah juniper is known to increase in this community phase. Other grasses, forbs, and shrubs may also be present and cover is variable. Bare ground is minimal (25-30%), surface rock fragments are variable (5-50%), and biological crusts (5-25%) are characterized by light cyanobacteria and/or isolated moss and lichen pinnacles with little continuity. The following tables provide an example of the typical vegetative floristics of a community phase 3.1 plant community.

Table 17. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	135	200	275
Tree	90	135	195
Shrub/Vine	80	120	150
Forb	30	45	65
Total	**335**	**500**	**685**

Table 18. Ground cover

Tree foliar cover	5-10%
Shrub/vine/liana foliar cover	15-20%
Grass/grasslike foliar cover	20-25%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0%
Litter	5-10%
Surface fragments >0.25" and <=3"	10-85%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	30-60%

Table 19. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	–	–	–
>0.5 <= 1	–	–	20-20%	4-6%
>1 <= 2	–	5-7%	–	–
>2 <= 4.5	–	–	–	–
>4.5 <= 13	7-9%	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Transition T1A
State 1 to 2

This transitional pathway occurs when any combination of extended drought, fire, and improper livestock grazing cause the perennial herbaceous community to become significantly reduced and non-native species such as cheatgrass, russian thistle and ragweed species to become established. Broom snakeween may also increase during this time. Once invasive species occupy the site, a threshold has been crossed.

Transition T2A
State 2 to 3

This transitional pathway occurs when any combination of extended drought, fire, and improper livestock grazing, over long periods of time, cause the perennial herbaceous community to become significantly reduced and non-native species such as cheatgrass, russian thistle and ragweed species to increase. Broom snakeweed also increases during this time and dominates to shrub layer. Once invasive species and broom snakeweed are dominant,a threshold has been crossed.

Transition T2B
State 2 to 3

This transitional pathway occurs when any combination of extended drought, no fire, and improper livestock grazing, over long periods of time, cause the perennial herbaceous community to become significantly reduced and non-native species such as cheatgrass, russian thistle and ragweed species to increase. Broom snakeweed also increases during this time and dominates to shrub layer. Utah juniper dominates the overstory. Once invasive species and broom snakeweed dominate, a threshold has been crossed.

Restoration pathway R3A
State 3 to 2

This pathway occurs when excellent grazing management and average to wet weather cycles, combined with the episodic nature of broom snakeweed, allow the site to return to the current community state.

Additional community tables

Table 20. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
0	**Dominant Trees**			100–175	
	Utah juniper	JUOS	*Juniperus osteosperma*	100–175	–
4	**Sub-Dominant Trees**			4–25	
	twoneedle pinyon	PIED	*Pinus edulis*	4–25	–
Shrub/Vine					
0	**Dominant Shrubs**			35–125	
	fourwing saltbush	ATCA2	*Atriplex canescens*	12–50	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	12–50	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	12–25	–
3	**Sub-Dominant Shrubs**			30–125	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	10–50	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	4–15	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	4–15	–
	mormon tea	EPVI	*Ephedra viridis*	4–15	–
	Mexican cliffrose	PUME	*Purshia mexicana*	4–15	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	4–15	–
Grass/Grasslike					
0	**Dominant Grasses**			120–300	
	James' galleta	PLJA	*Pleuraphis jamesii*	80–120	–
	blue grama	BOGR2	*Bouteloua gracilis*	40–100	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	12–50	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	12–25	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	12–25	–
1	**Sub-Dominant Grasses**			30–115	
	Grass, annual	2GA	*Grass, annual*	12–50	–
	Grass, perennial	2GP	*Grass, perennial*	12–50	–
	purple threeawn	ARPU9	*Aristida purpurea*	4–15	–
Forb					
0	**Dominant Forbs**			25–50	
	woolly plantain	PLPA2	*Plantago patagonica*	12–25	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	12–25	–
2	**Sub-Dominant Forbs**			40–110	
	Forb, annual	2FA	*Forb, annual*	12–25	–
	Forb, perennial	2FP	*Forb, perennial*	12–25	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	4–15	–
	buckwheat	ERIOG	*Eriogonum*	4–15	–
	granite prickly phlox	LIPU11	*Linanthus pungens*	4–15	–
	rock goldenrod	PEPU7	*Petradoria pumila*	4–15	–
	greenstem paperflower	PSSP	*Psilostrophe sparsiflora*	4–15	–

Table 21. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
0	**Dominant Trees**			125–200	
	Utah juniper	JUOS	*Juniperus osteosperma*	125–200	–
4	**Sub-Dominant Trees**			4–25	
	twoneedle pinyon	PIED	*Pinus edulis*	4–25	–
Shrub/Vine					
0	**Dominant Shrubs**			40–130	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	25–75	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	12–50	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	12–25	–
3	**Sub-Dominant Shrubs**			30–125	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	12–50	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	4–15	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	4–15	–
	mormon tea	EPVI	*Ephedra viridis*	4–15	–
	Mexican cliffrose	PUME	*Purshia mexicana*	4–15	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	4–15	–
Grass/Grasslike					
0	**Dominant Grasses**			75–150	
	blue grama	BOGR2	*Bouteloua gracilis*	20–50	–
	James' galleta	PLJA	*Pleuraphis jamesii*	20–50	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	11–25	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	10–25	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–25	–
1	**Sub-Dominant Grasses**			30–115	
	Grass, annual	2GA	*Grass, annual*	12–50	–
	Grass, perennial	2GP	*Grass, perennial*	12–50	–
	purple threeawn	ARPU9	*Aristida purpurea*	5–15	–
Forb					
0	**Dominant Forbs**			24–50	
	woolly plantain	PLPA2	*Plantago patagonica*	12–25	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	12–25	–
2	**Sub-Dominant Forbs**			40–110	
	Forb, annual	2FA	*Forb, annual*	12–25	–
	Forb, perennial	2FP	*Forb, perennial*	12–25	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	4–15	–
	buckwheat	ERIOG	*Eriogonum*	4–15	–
	granite prickly phlox	LIPU11	*Linanthus pungens*	4–15	–
	rock goldenrod	PEPU7	*Petradoria pumila*	4–15	–
	greenstem paperflower	PSSP	*Psilostrophe sparsiflora*	4–15	–

Table 22. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
0	**Dominant Trees**			100–175	
	Utah juniper	JUOS	*Juniperus osteosperma*	100–175	–
4	**Sub-Dominant Trees**			4–25	
	twoneedle pinyon	PIED	*Pinus edulis*	4–25	–
Shrub/Vine					
0	**Dominant Shrubs**			40–125	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	30–60	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	12–50	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	12–25	–
3	**Sub-Dominant Shrubs**			30–125	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	12–50	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	4–15	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	4–15	–
	mormon tea	EPVI	*Ephedra viridis*	4–15	–
	Mexican cliffrose	PUME	*Purshia mexicana*	4–15	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	4–15	–
Grass/Grasslike					
0	**Dominant Grasses**			125–250	
	cheatgrass	BRTE	*Bromus tectorum*	40–100	–
	blue grama	BOGR2	*Bouteloua gracilis*	20–80	–
	James' galleta	PLJA	*Pleuraphis jamesii*	20–80	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–40	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–25	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	10–25	–
1	**Sub-Dominant Grasses**			30–115	
	Grass, annual	2GA	*Grass, annual*	12–50	–
	Grass, perennial	2GP	*Grass, perennial*	12–50	–
	purple threeawn	ARPU9	*Aristida purpurea*	10–25	–
Forb					
0	**Dominant Forbs**			25–50	
	woolly plantain	PLPA2	*Plantago patagonica*	15–30	–
	Russian thistle	SAKA	*Salsola kali*	15–30	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	15–30	–
2	**Sub-Dominant Forbs**			40–110	
	Forb, annual	2FA	*Forb, annual*	12–25	–
	Forb, perennial	2FP	*Forb, perennial*	12–25	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	4–15	–
	buckwheat	ERIOG	*Eriogonum*	4–15	–
	rock goldenrod	PEPU7	*Petradoria pumila*	4–15	–

	greenstem paperflower	PSSP	*Psilostrophe sparsiflora*	4–15	–

Table 23. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
0	**Dominant Trees**			100–250	
	Utah juniper	JUOS	*Juniperus osteosperma*	100–250	–
4	**Sub-Dominant Trees**			4–25	
	twoneedle pinyon	PIED	*Pinus edulis*	4–25	–
Shrub/Vine					
0	**Dominant Shrubs**			40–125	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	30–60	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	12–50	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	12–25	–
3	**Sub-Dominant Shrubs**			32–125	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	12–50	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	4–15	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	4–15	–
	mormon tea	EPVI	*Ephedra viridis*	4–15	–
	Mexican cliffrose	PUME	*Purshia mexicana*	4–15	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	4–15	–
Grass/Grasslike					
0	**Dominant Grasses**			116–300	
	cheatgrass	BRTE	*Bromus tectorum*	40–100	–
	blue grama	BOGR2	*Bouteloua gracilis*	20–80	–
	James' galleta	PLJA	*Pleuraphis jamesii*	20–80	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	10–40	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	10–25	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–25	–
1	**Sub-Dominant Grasses**			30–115	
	Grass, annual	2GA	*Grass, annual*	12–50	–
	Grass, perennial	2GP	*Grass, perennial*	12–50	–
	purple threeawn	ARPU9	*Aristida purpurea*	10–20	–
Forb					
0	**Dominant Forbs**			25–50	
	Russian thistle	SAKA	*Salsola kali*	15–30	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	12–25	–
	woolly plantain	PLPA2	*Plantago patagonica*	12–25	–
2	**Sub-Dominant Forbs**			40–110	
	Forb, annual	2FA	*Forb, annual*	12–25	–
	Forb, perennial	2FP	*Forb, perennial*	12–25	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	4–15	–

	buckwheat	ERIOG	*Eriogonum*	4–15	–
	rock goldenrod	PEPU7	*Petradoria pumila*	4–15	–
	greenstem paperflower	PSSP	*Psilostrophe sparsiflora*	4–15	–
	granite prickly phlox	LIPU11	*Linanthus pungens*	4–14	–

Table 24. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
0	**Dominant Trees**			100–175	
	Utah juniper	JUOS	*Juniperus osteosperma*	100–175	–
4	**Sub-Dominant Trees**			4–25	
	twoneedle pinyon	PIED	*Pinus edulis*	4–25	–
Shrub/Vine					
0	**Dominant Shrubs**			35–125	
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	80–120	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	10–30	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	10–15	–
3	**Sub-Dominant Shrubs**			30–125	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	10–50	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	4–15	–
	Torrey's jointfir	EPTO	*Ephedra torreyana*	4–15	–
	mormon tea	EPVI	*Ephedra viridis*	4–15	–
	Mexican cliffrose	PUME	*Purshia mexicana*	4–15	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	4–15	–
Grass/Grasslike					
0	**Dominant Grasses**			100–200	
	cheatgrass	BRTE	*Bromus tectorum*	40–80	–
	James' galleta	PLJA	*Pleuraphis jamesii*	20–40	–
	blue grama	BOGR2	*Bouteloua gracilis*	20–40	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	10–30	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–25	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	12–25	–
1	**Sub-Dominant Grasses**			30–115	
	Grass, annual	2GA	*Grass, annual*	12–50	–
	Grass, perennial	2GP	*Grass, perennial*	12–50	–
	purple threeawn	ARPU9	*Aristida purpurea*	5–15	–
Forb					
0	**Dominant Forbs**			25–50	
	Russian thistle	SAKA	*Salsola kali*	20–50	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	12–25	–
	woolly plantain	PLPA2	*Plantago patagonica*	12–25	–
2	**Sub-Dominant Forbs**			40–110	

	Forb, annual	2FA	*Forb, annual*	12–25	–
	Forb, perennial	2FP	*Forb, perennial*	12–25	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	4–15	–
	buckwheat	ERIOG	*Eriogonum*	4–15	–
	granite prickly phlox	LIPU11	*Linanthus pungens*	4–15	–
	rock goldenrod	PEPU7	*Petradoria pumila*	4–15	–
	greenstem paperflower	PSSP	*Psilostrophe sparsiflora*	4–15	–

Animal community

--Wildlife Interpretation--
Small herds of mule deer, pronghorn antelope, and elk can be seen grazing/browsing on these sites, especially when near water sources and in the winter. The hot climate and lack of water favors small mammals, which have an easier time finding shelter, food, and water. Many species of rats, mice, squirrels, bats, and chipmunks can be observed, along with coyotes and foxes. Utah juniper provides good habitat for several bird species including juniper titmice, scrub jays, pinyon jays, and black throated gray warblers, and sparrows. Lizards are the most visible and can be observed during the day. Species may include the northern whiptail, desert spiny, and the colorful western collard lizard. (NPS.gov, 2008).

--Grazing Interpretations--
This site provides good spring, fall, and winter grazing conditions for livestock due to its accessibility and available nutritious forage. Yet, this site may lack natural perennial water sources, which can influence the suitability for livestock grazing. The plant community is primarily composed of an overstory canopy of Utah juniper with an understory of perennial grasses with James galleta, blue grama, and sand dropseed occurring most often. Shrubs, including fourwing saltbush, Cutler jointfir, and winterfat can provide good winter browse for cattle, sheep, and goats. Cutler jointfir is typically only browsed by livestock in the fall and winter due to poor nutritional value in the spring and summer. 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 must be made.

Hydrological functions

The soils associated with this ecological site are generally in Hydrologic Soil Group D due to the shallow depth (NRCS National Engineering Handbook). These soils are saturated quickly due to high infiltration rates and shallow depth; once soils are saturated, run off potential is high. Hydrological 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 its affect 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 fair opportunities for hiking and hunting. Trees can provide some screening values for camping and picnicking. In good condition there are several forbs and shrubs that bloom in the spring. Shallow soils limit this site’s ability to be used for vacation homes, other residences, or deep ponds.

Wood products

Utah juniper and Two-needle pinyon may provide firewood and possibly fence post where growth is sufficient and regulations allow such use.

Other information

--Poisonous and Toxic Plant Communities--
Toxic plants associated with this site include woolly locoweed, broom snakeweed, and Russian thistle.

Woolly locoweed is toxic to all classes of livestock and wildlife. Locoweed is palatable and has similar nutrient value to alfalfa, which may cause animals to consume it even when other forage is available. Locoweed contains swainsonine (indolizdine alkaloid) and is poisonous at all stages of growth. Poisoning will become evident after 2-3 weeks of continuous grazing and is associated with 4 major symptoms: 1) neurological damage, 2) emaciation, 3) reproductive failure and abortion, and 4) congestive heart failure linked with “high mountain disease”.

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 generally will only graze broom snakeweed when other forage is unavailable, typically in winter when toxicity levels are at their lowest (Knight and Walter, 2001).

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, during periods with cool/cloudy days, and when growing on soils high in nitrogen and low in sulfur and phosphorus. 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.

Other potentially toxic plants associated with this site include four-wing saltbush and some buckwheat species, which 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, soughing 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.

--Invasive Plant Communities--
Generally, as ecological conditions deteriorate and perennial vegetation decreases due to disturbance (fire, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses may invade the site. Of particular concern in semi-arid environments are 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.

On well developed Utah juniper and two-needle pinyon communities, soils are often completely occupied by lateral roots which can inhibit a herbaceous understory as well as annual invasive species. Once these sites are disturbed and pinyon-juniper communities begin to decline invasion is possible.

--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 communities in the Colorado Plateau may have evolved without a significient influence of fire. However, a year of exceptionally heavy winter rains can generate enough fuels by producing heavy stands of annual forbs and grasses to carry fire. The two-needle pinyon and Utah juniper communities in the Colorado Plateau growing on shallow soils quite are unique. These trees can support stand-replacing fires, though historically, fires were likely a mixture of surface and crown fires with intensities and frequencies dependent on site productivity. Most research agrees that historic fire return intervals are at a minimum 100 years, indicating that fire may have not played an important role in community dynamics. Fires are more common when trees are stressed or dead due to drought and/or beetle infestations. Pinyon-juniper stands reestablish either by seeds dispersed from adjacent unburned patches or by unburned seeds found at the burn site. Continuous (every 20-40 years) burning of these ecological

sites can result in shrub dominated communities, due to the relatively fast recovery of shrubs when compared to trees. If invasive annual grasses are allowed to establish fires may become more frequent, inhibiting the site's ability to recover.

Inventory data references

Grand Staircase: Nonip – southeast of Escalante, along the Hole-in-the-Rock Road, on Sunset, Tenmile, and Seep Flats; and south of Cannonville. (Modal – Latitude: 37° 41' 44.41" N Longitude: 111° 30' 1.94" W) Mellenthin – east of Boulder, along the Burr Trail Road, in the Circle Cliffs Area below Wagon Box Mesa (Modal not in this site.)

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Contributors

Susanne Mayne, Tom Simper

V. Keith Wadman, Jacob Owens

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)	Robert Stager (BLM), F.E. Busby (USU), Dana Truman (NRCS), Paul Curtis (BLM), Shane A. Green (NRCS)
Contact for lead author	shane.green@ut.usda.gov
Date	09/12/2008
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** A. On more gentle slopes (< 15 %): None to Rare. Rills are most likely to form below adjacent exposed bedrock or from converging water flow patterns where sufficient water accumulates to cause erosion. B. On steep slopes (> 15 %): Rills are rarely present. Where they occur, rills are short (up to 10 feet long).

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2. **Presence of water flow patterns:** Very few sinuous flow patterns wind around perennial plants and surface rock. Evidence of flow patterns is expected to increase somewhat with slopes greater than 15%. Water flow patterns are long (15-20 feet), narrow (<1 foot wide), and spaced widely (10-20 yards) on gentle slopes (<15%) and more closely (<10 yards) on steeper slopes (>15%).

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3. **Number and height of erosional pedestals or terracettes:** Small pedestals may form at the base of plants that occur on the edge of water flow patterns, but should not show any exposed roots. Terracettes are fairly common, forming behind debris dams of small to medium sized litter (up to 2 inches in diameter) in water flow patterns. These debris dams may accumulate smaller litter (leaves, grass and forb stems) and sediment.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 20 – 30 %. (Soil surface is typically covered 45-85 percent surface fragments). Most bare ground is associated with water flow patterns, rills, and gullies. 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. Ground cover is based on first raindrop impact, and bare ground is the opposite of ground cover. Ground cover + bare ground = 100%.

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5. **Number of gullies and erosion associated with gullies:** None to rare on gentle slopes (< 15%). On steep slopes and areas below adjacent exposed bedrock, gullies may occur. Length often extends from exposed bedrock until gully reaches a stream or an area where water and sediment accumulate. Gullies may show slightly more indication of erosion as slope increases, or as the site occurs adjacent to steep sites/watershed with concentrated flow patterns.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None to very few. Trees break the wind and reduce the potential for wind erosion. The stones on the soil surface armor and reduces the potential for wind erosion.

7. **Amount of litter movement (describe size and distance expected to travel):** Most litter accumulates at the base of plants. Woody litter is usually not moved unless present in water flow patterns, rills, or gullies.

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 4 or 5 under the plant canopies, and a rating of 2 to 4 in the interspaces. The average should be a 4. 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 horizon is typically 1 inch deep. Structure is typically weak medium platy. Color is typically light yellowish brownish (10YR6/4). Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Spatial distribution of well developed biological soil crusts (where present) intercept raindrops reducing splash erosion and provide areas of surface detention to store water allowing additional 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 (beyond the reference state) reduces understory vegetation causing an associated increase in runoff.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None, although bedrock is found from 4 to 20 inches of soil surface. In addition, there may be layers of calcium carbonate or other naturally occurring hard layers found in the soil subsurface. These should not be considered to be 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: trees (Juniper) > warm season perennial grasses (Galleta, Blue grama, Sand dropseed) = cool season perennial grasses (Indian ricegrass, Needle and thread)

    Sub-dominant: non sprouting shrubs (Fourwing saltbush, winterfat) > forbs (Plantain, Globemallow) > 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, Smooth brome, Intermediate wheatgrass, Siberian wheatgrass and/or forage kochia etc.) Biological soil crust is variable in it's 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 insects and other pathogens (mistletoe), drought, extreme precipitation events, etc. Factors contributing to spatial variability include slope, amount of rock fragments, aspect, etc. Following a recent disturbance such as fire, drought or insects that may remove the woody vegetation, forbs and perennial grasses (herbaceous species) may become more dominate in the community. These conditions may reflect a functional community phase within the reference state.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** 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 up to 20% of the junipers may die, either from drought or pathogens such as mistletoe. 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. Because woody stems may persist for many years, juniper (especially older trees) will normally have dead stems within the plant canopy.

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14. **Average percent litter cover (%) and depth (in):** Litter cover (including under plants) nearly all of which should be fine litter. Depth should be 1 leaf thickness in the interspaces and up to ¼" under canopies, and up to ¾" under tree canopies. Litter cover may increase to 30% on some years due to increased production of plants.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 400-500 #/acre on an average year

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Few invasives capable of dominating this site. Cheatgrass, Broom snakeweed, and Mustard may invade the community.

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