USDA Natural Resources Conservation Service

Ecological site R035XY101UT
Desert Alkali Sandy Loam (Alkali Sacaton)

Accessed: 05/21/2025

General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

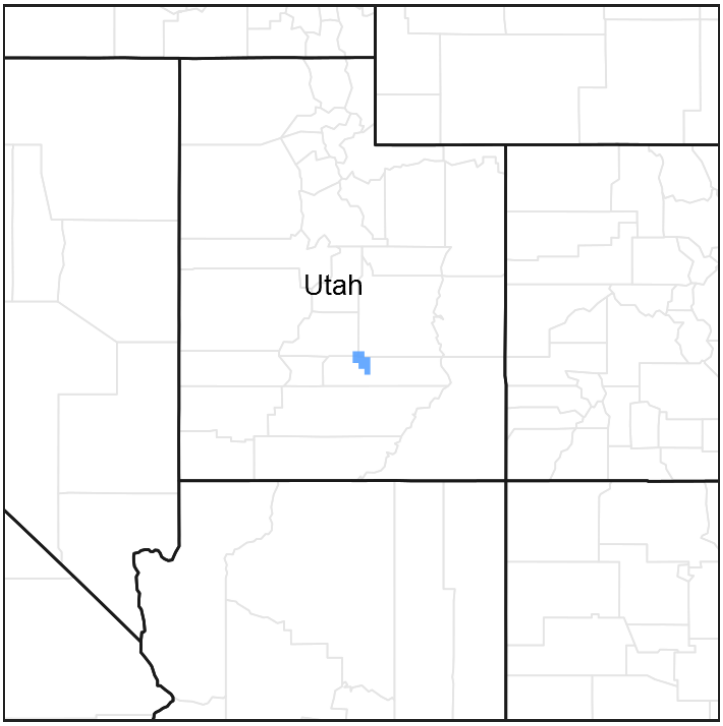

Figure 1. Mapped extent

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

MLRA notes

Major Land Resource Area (MLRA): 035X–Colorado Plateau

Site Concept: The Desert Alkali Sandy Loam ecological site occurs in alluvial valley bottoms on alluvial fans and stream terraces at elevations between 5000 and 6300 feet. It is found in the desert zone of the Colorado and Green River Plateaus region (MLRA 35).

Soils are deep sandy loams with varying degrees of salinity and typically few rock fragments. Annual precipitation ranges from 7 to 9 inches. The soil moisture regime is aridic and the soil moisture regime is mesic. The historic plant community is characterized by alkali sacaton and Indian ricegrass. In areas where soil movement by water is excessive, greasewood and/or rubber rabbitbrush increase and can co-dominate with alkali sacaton. Russian thistle and halogeton can establish on the site, but do not dominate. Fire is expected to be rare on this site, and does not significantly alter the plant community due to fire tolerance by all major species.

Associated sites

R035XY003UT	**Alkali Bottom (Greasewood)** This site occurs on similar landforms and soils, but where a water table exists in the upper 60 inches of soil for part of the year. It is dominated by greasewood, but can have alkali sacaton as an understory component.
R035XY136UT	**Desert Stony Loam (Shadscale-Bud Sagebrush)** This site occurs on the upslope edges of the alkali sacaton site where soils are stony (skeletal). It is often a transition between the deep sandy loams of the valley and the surrounding hills and uplands. This site is dominated by shadscale.
R035XY230UT	**Semidesert Shallow Sandy Loam (Shadscale)** This site occurs on the upslope edges of the alkali sacaton site where soils are shallow. It is often a transition between the deep sandy loams of the valley and the surrounding hills and uplands. This site is dominated by shadscale.

Similar sites

R035XY003UT	**Alkali Bottom (Greasewood)** This site resembles community phases 1.2 and 2.2 of the alkali sacaton site, however, it has a water table within 60 inches of the soil surface for part of the year. Therefore greasewood persists on this site regardless of excessive soil movement by water.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Sporobolus airoides* (2) *Achnatherum hymenoides*

Physiographic features

This site is typically found in alluvial valley bottoms on alluvial fans and stream terraces at elevations between 5000 and 6300 feet. Flooding is very rare and extremely brief and most commonly occurs in July and August. Slopes range from 1 to 8% and runoff is low.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Stream terrace (3) Pediment
Flooding duration	Extremely brief (0.1 to 4 hours)
Flooding frequency	None to very rare
Ponding frequency	None
Elevation	1,524–1,920 m
Slope	1–8%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site is dry with hot summers and cool winters. Average annual precipitation ranges from 7 to 9 inches. About half of the precipitation occurs as convective thunderstorms from July to October, while June is typically the driest month during the growing season. Plant growth typically begins around March 1st and ends around Octover 30th. Large fluctuations in daily temperatures are common, and precipitation can vary greatly from month to month and from year to year.

Modeled climate data (PRISM) was used to develop this section due to the remote location of this site (distance from established climate stations).

Table 3. Representative climatic features

Frost-free period (average)	180 days
Freeze-free period (average)	220 days
Precipitation total (average)	229 mm

Influencing water features

Ephemeral washes usually cross this site. Rubber rabbitbrush and/or greasewood are productive and often dominate near washes, but riparian obligate species are uncommon. When riparian obligate species are present, the wash is associated with an intermitent stream ecological site. Site R035XY030UT--Colorado Plateau Riparian Complex Discontinuous (Valley Type VIII - B5C Stream Type)--has been documented to cross this alkali sacaton site in the South Desert of Capitol Reef National Park (Polk Creek).

Soil features

The soils of this site are very deep sandy loams. They may be slightly to strongly saline, bordering on sodic. They formed in alluvial valley bottoms derived from sandstone, shale and/or eolian deposites. Rock fragments are not common on the soil surface or in the profile, but can comprise up to 20% of the soil volume. These soils are well drained with moderate to rapid permeability. Water holding capacity ranges from 2.4 inches (in coarser soils) to 6.4 inches (in finer soils) of water in the upper 40 inches of soil. The soil moisture regime is aridic and the soil temperature regime is mesic.

This site has been correlated to soils in the following soil surveys:

UT685 - Capitol Reef National Park - Fruitland, Peachspring, Monue, Begay, Mido, and Sheppard;

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone (2) Eolian sands–sandstone and shale
Surface texture	(1) Fine sandy loam (2) Loamy sand (3) Channery fine sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to rapid
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0–15%
Available water capacity (0-101.6cm)	6.1–16.26 cm
Calcium carbonate equivalent (0-101.6cm)	1–10%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0–20%

Ecological dynamics

This site developed under Colorado Plateau ecological conditions and the natural influences of herbivory and climate. Alkali sacaton dominates all documented plant communities. In areas where soil movement by water is excessive, greasewood and/or rubber rabbitbrush increase and can co-dominate with alkali sacaton. Indian ricegrass can also become abundant given sufficient cool season moisture.

There is little evidence to indicate a frequent fire return interval, given the sparse vegetation in surrounding uplands and fairly discontinuous fuels. Canopy gaps average about 60% with an average gap size of about 3.5 feet. Until further research indicates that fire played a significient role in the ecosystem processes of this site, this ecological site description will not include fire as a disturbance in the reference state.

Modern disturbances such as livestock grazing and recreationmay reduce the resistance of the site to invasive species. Disturbances that create germination sites, through soil surface disturbance, or provide a seed source for non-native invasive species can facilitate their establishment. Russian thistle and halogeton, are known to invade this site.

Improper livestock grazing, including season long grazing and\or heavy stocking rates, may accelerate a departure from the reference plant community by creating germination sites for Russian thistle or other non-native invasive species. However, Russian thistle is known to establish in the Colorado Plateau in the absence of disturbance. Non-native invasive species are not documented to dominate on this site. As ecological condition deteriorates, perennial grasses are expected to decrease, while greasewood, rubber rabbitbrush, and Russian thistle are expected to increase.

Management practices that maintain or improve rangeland vegetation include prescribed grazing and the proper location of water developments. Severe drought may adversely affect the production of the herbaceous perennial vegetation.

Suitability for rangeland seeding is very poor. It is not practical to revegetate large areas of this ecological site because of the low annual precipitation.

As vegetation communities respond to changes in management or natural influences that move them to a different ecological state, a return to previous states may not be possible without major energy inputs. The amount of energy needed to affect vegetative shifts depends on present biotic and abiotic features and the desired results.

The following State and Transition diagram shows some of the most commonly occurring plant communities found on this ecological site. These plant communities may not represent every possibility, but they are the most prevalent and repeatable. As more data is collected, some of these plant communities may be revised or removed, and new ones may be added. This model was developed using range data collected over the last 40 years in MLRA D35 in southeastern Utah. Both ocular and measured data was collected

and utilized.

State and transition model

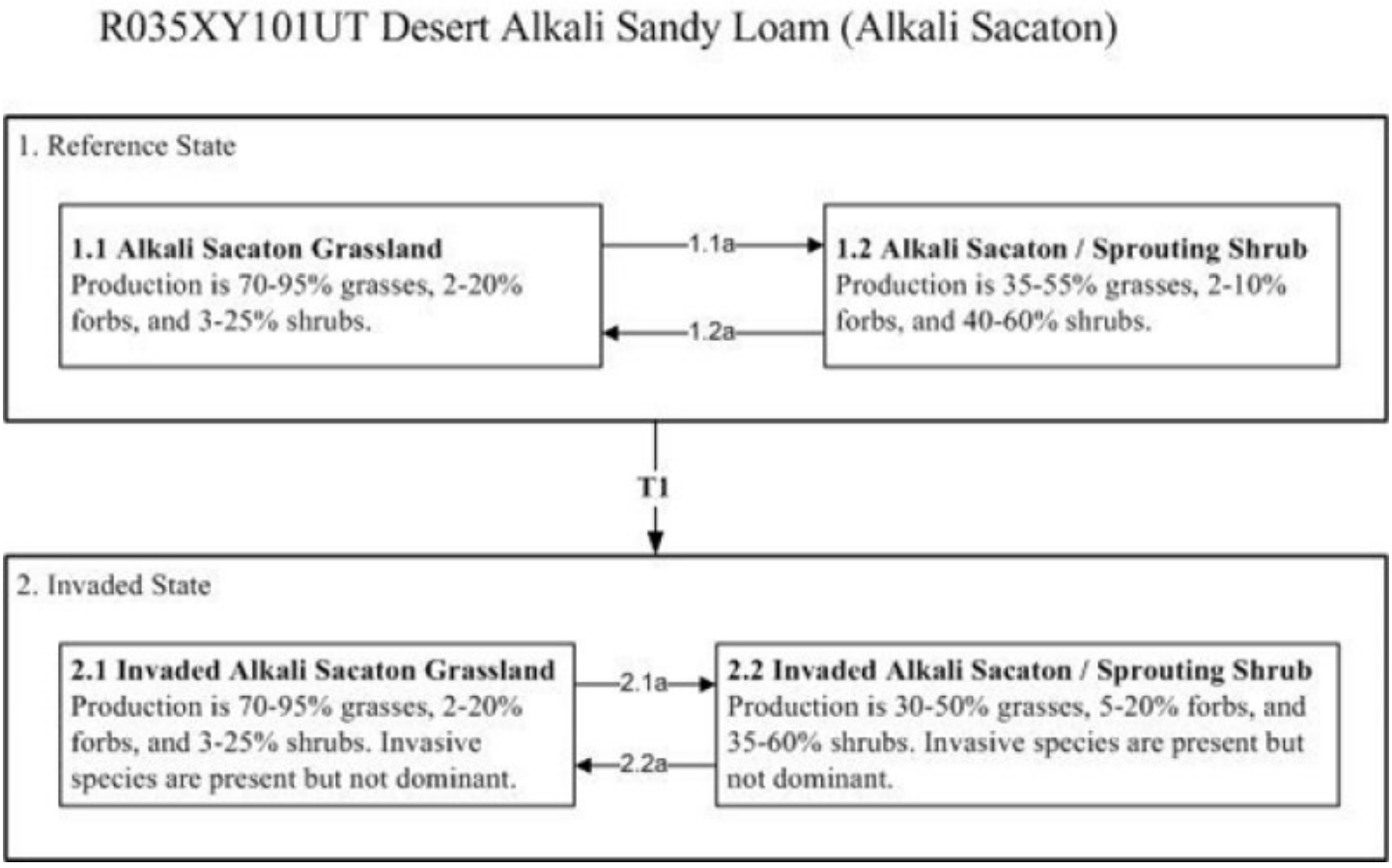

Figure 4. State-and-Transition Model

State 1
Reference State

The reference state is dominated by alkali sacaton. Indian ricegrass and other perennial grasses can also be abundant in the plant community. Excessive soil movement by water can result in an increase in rubber rabbitbrush and/or greasewood, while extended periods of stable soil trend toward alkali sacaton without shrub co-dominance. The reference plant community rarely burned, and would not have changed significantly in community composition following fire due to the fire tolerance of all major species in the community. The reference state is susceptible to Russian thistle and halogeton establishment, which results in a transition to an invaded state that is not likely to return to reference due to the persistence of Russian thistle and halogeton in the plant community.

Community 1.1
Alkali Sacaton Grassland

R035XY101UT—Desert Alkali Sandy Loam (Alkali Sacaton) community 1.1—Alkali Sacaton Grassland. Cover is

Figure 5. Phase 1.1

This plant community is dominated by alkali sacaton plants, which are regularly spaced in ring patterns across the landform. Indian ricegrass and other perennial grasses may also be abundant. Composition by air-dry weight is 70-95% grasses, 2-20% forbs, and 3-25% shrubs. Shrubs are likely to be more abundant along washes or in hilly areas.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	224	392	560
Shrub/Vine	22	67	112
Forb	11	45	78
Total	**257**	**504**	**750**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-6%
Grass/grasslike foliar cover	18-28%
Forb foliar cover	0-6%
Non-vascular plants	0%
Biological crusts	0-10%
Litter	2-12%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0-15%
Bedrock	0%

Water	0%
Bare ground	40-65%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-2%	0-2%	0-2%
>0.15 <= 0.3	–	0-2%	0-6%	0-4%
>0.3 <= 0.6	–	0-4%	4-20%	0-4%
>0.6 <= 1.4	–	0-4%	4-10%	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 1.2
Alkali Sacaton / Sprouting Shrub

R035XY101UT—Desert Alkali Sandy Loam (Alkali Sacaton) community 1.2—Alkali Sacaton / Sprouting Shrub.

Figure 7. Phase 1.2

This plant community is dominated by alkali sacaton plants, which are regularly spaced in ring patterns across the landform. Indian ricegrass and other perennial grasses may also be abundant. Composition by air-dry weight is 35-55% grasses, 2-20% forbs, and 40-60% shrubs. Shrubs are likely to be more abundant along washes or in hilly areas.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	112	196	280
Shrub/Vine	112	196	280
Forb	11	45	78
Total	**235**	**437**	**638**

Table 9. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	8-20%
Grass/grasslike foliar cover	12-22%
Forb foliar cover	2-8%
Non-vascular plants	0%
Biological crusts	0-10%
Litter	2-10%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0-15%
Bedrock	0%
Water	0%
Bare ground	35-60%

Table 10. Canopy structure (% cover)

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

Pathway 1.1a
Community 1.1 to 1.2

Alkali Sacaton Grassland

Alkali Sacaton / Sprouting Shrub

This pathway occurs when excessive soil movement by water removes or buries perennial grasses and provides the moisture and soil contact necessary for greasewood and/or rubber rabbitbrush establishment. Not all areas of this ecological sie are susceptible to the level of soil movement required for this pathway to occur. It is most likely to occur near washes, on low stream terraces, or on steeper areas where water concentrates such as hills, pediments, or at the base of toeslopes.

Pathway 1.2a
Community 1.2 to 1.1

Alkali Sacaton / Sprouting Shrub

Alkali Sacaton Grassland

This pathway occurs when soils have stabilized and not experienced excessive soil movement by water for many years. This pathway may take decades as alkali sacaton and other perennial grasses eventually exclude shrubs from co-dominating the plant community.

State 2
Invaded State

The invaded state is similar to the reference state in plant community structure and function, however the presencs of invasive species decreases the resistance and resillience of the site to further degradataion. Due to lack of highly disturbed areas, the community responses to major disturbances are not documented, and are not currently included in the state and transition model. This state is generally dominated by alkali sacaton. The primary disturbance mechanism is excessive soil movement by water.

Community 2.1
Invaded Alkali Sacaton Grassland

E. 4254832 N. Photo by Jake Owens, September 26, 2010.

Figure 9. Phase 2.1

This plant community is dominated by alkali sacaton plants, which are regularly spaced in ring patterns across the landform. Indian ricegrass and other perennial grasses may also be abundant. Composition by air-dry weight is 70-95% grasses, 2-20% forbs, and 3-25% shrubs. Shrubs are likely to be more abundant along washes or in hilly areas. Russian thistle or other non-native invasive species are present but not dominant.

Table 11. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	224	392	560
Shrub/Vine	22	67	112
Forb	11	45	78
Total	**257**	**504**	**750**

Table 12. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-6%
Grass/grasslike foliar cover	18-28%
Forb foliar cover	0-6%
Non-vascular plants	0%
Biological crusts	0-10%
Litter	2-12%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0-15%

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

Table 13. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-2%	0-2%	0-2%
>0.15 <= 0.3	–	0-2%	0-6%	0-4%
>0.3 <= 0.6	–	0-4%	4-20%	0-4%
>0.6 <= 1.4	–	0-4%	4-10%	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 2.2
Invaded Alkali Sacaton / Sprouting Shrub

R035XY101UT—Desert Alkali Sandy Loam (Alkali Sacaton) community 2.2—Invaded Alkali Sacaton /

Figure 11. Phase 2.2

This plant community is dominated by alkali sacaton plants, which are regularly spaced in ring patterns across the landform. Indian ricegrass and other perennial grasses may also be abundant. Composition by air-dry weight is 30-50% grasses, 5-20% forbs, and 35-60% shrubs. Shrubs are likely to be more abundant along washes or in hilly areas. Non-native invasive species are present but not dominant.

Table 14. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	112	196	280
Shrub/Vine	112	196	280
Forb	11	45	78
Total	**235**	**437**	**638**

Table 15. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	8-20%
Grass/grasslike foliar cover	12-22%
Forb foliar cover	2-8%
Non-vascular plants	0%
Biological crusts	0-10%
Litter	2-10%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0-15%
Bedrock	0%
Water	0%
Bare ground	35-60%

Table 16. Canopy structure (% cover)

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

Pathway 2.1a
Community 2.1 to 2.2

Invaded Alkali Sacaton Grassland

Invaded Alkali Sacaton / Sprouting Shrub

This pathway occurs when excessive soil movement by water removes or buries perennial grasses and provides the moisture and soil contact necessary for greasewood and/or rubber rabbitbrush establishment. Not all areas of this ecological sie are susceptible to the level of soil movement required for this pathway to occur. It is most likely to occur near washes, on low stream terraces, or on steeper areas where water concentrates such as hills, pediments, or at the base of toeslopes.

Pathway 2.2a
Community 2.2 to 2.1

Invaded Alkali Sacaton / Sprouting Shrub

Invaded Alkali Sacaton Grassland

This pathway occurs when soils have stabilized and not experienced excessive soil movement by water for many years. This pathway may take decades as alkali sacaton and other perennial grasses eventually exclude shrubs from co-dominating the plant community.

Transition T1
State 1 to 2

This transition occurs with the establishment of non-native invasive species. Disturbances that promote this transition include season long continuous grazing of perennial grasses, prolonged drought, recreation or other surface disturbances. However, invasive species such as Russian thistle can invade intact perennial plant communities with little to no disturbance. Once invasive plants are found in the plant community, a return to the reference state is not likely.

Additional community tables

Table 17. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			224–504	
	alkali sacaton	SPAI	*Sporobolus airoides*	84–448	5–25
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	28–140	2–8
	greasewood	SAVE4	*Sarcobatus vermiculatus*	45–101	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	22–76	–
	James' galleta	PLJA	*Pleuraphis jamesii*	11–56	1–4
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	13–26	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	13–26	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	13–26	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	13–26	–
1	**Sub-Dominant Grasses**			28–112	
	Grass, perennial	2GP	*Grass, perennial*	0–56	0–4
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–56	0–4
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–56	0–4
	blue grama	BOGR2	*Bouteloua gracilis*	0–45	0–3
	Grass, annual	2GA	*Grass, annual*	0–22	0–2
	purple threeawn	ARPU9	*Aristida purpurea*	0–17	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–17	0–1
Forb					
2	**Forbs**			11–78	
	Forb, perennial	2FP	*Forb, perennial*	0–34	0–2
	nodding buckwheat	ERCE2	*Eriogonum cernuum*	0–34	0–2
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–34	0–2
	sand buckwheat	ERLEP	*Eriogonum leptocladon var. papiliunculi*	0–34	0–2
	flatspine bur	AMAC2	*Ambrosia acanthicarpa*	0–28	0–2

	ragweed				
	rushy milkvetch	ASLO3	*Astragalus lonchocarpus*	0–22	0–1
	Forb, annual	2FA	*Forb, annual*	0–22	0–1
	buckwheat	ERIOG	*Eriogonum*	0–17	0–1
	western aster	SYAS3	*Symphyotrichum ascendens*	0–17	0–1
	rusty lupine	LUPU	*Lupinus pusillus*	0–11	0–1
	western blanketflower	GASP	*Gaillardia spathulata*	0–11	0–1
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–11	0–1
	roughseed cryptantha	CRFL6	*Cryptantha flavoculata*	0–6	0–1
	common sunflower	HEAN3	*Helianthus annuus*	0–6	0–1
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–6	0–1
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–6	0–1
	woolly plantain	PLPA2	*Plantago patagonica*	0–6	0–1
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–6	0–1
	small-leaf globemallow	SPPA2	*Sphaeralcea parvifolia*	0–6	0–1
Shrub/Vine					
3	**Shrubs**			22–112	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	6–45	0–3
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–45	0–3
	greasewood	SAVE4	*Sarcobatus vermiculatus*	6–34	0–2
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	13–26	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–22	0–2
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–22	0–2
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–17	0–5
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	0–2
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–11	0–1

	valley saltbush	ATCU	*Atriplex cuneata*	0–11	0–1
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–6	0–1
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–6	0–1
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–6	0–1

Table 18. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			112–224	
	alkali sacaton	SPAI	*Sporobolus airoides*	34–168	2–10
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	28–140	2–8
	greasewood	SAVE4	*Sarcobatus vermiculatus*	45–101	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	22–76	–
	blue grama	BOGR2	*Bouteloua gracilis*	11–45	1–3
	James' galleta	PLJA	*Pleuraphis jamesii*	6–39	1–3
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	13–26	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	13–26	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	13–26	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	13–26	–
1	**Sub-Dominant Grasses**			28–84	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–56	0–4
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–56	0–4
	Grass, perennial	2GP	*Grass, perennial*	0–56	0–4
	Grass, annual	2GA	*Grass, annual*	0–22	0–2
	purple threeawn	ARPU9	*Aristida purpurea*	0–17	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–17	0–1
Forb					
2	**Forbs**			11–78	
	Forb, perennial	2FP	*Forb, perennial*	0–34	0–2
	nodding buckwheat	ERCE2	*Eriogonum cernuum*	0–34	0–2

	buckwheat				
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–34	0–2
	sand buckwheat	ERLEP	*Eriogonum leptocladon var. papiliunculi*	0–34	0–2
	flatspine bur ragweed	AMAC2	*Ambrosia acanthicarpa*	0–28	0–2
	rushy milkvetch	ASLO3	*Astragalus lonchocarpus*	0–22	0–1
	Forb, annual	2FA	*Forb, annual*	0–22	0–1
	buckwheat	ERIOG	*Eriogonum*	0–17	0–1
	western aster	SYAS3	*Symphyotrichum ascendens*	0–17	0–1
	rusty lupine	LUPU	*Lupinus pusillus*	0–11	0–1
	western blanketflower	GASP	*Gaillardia spathulata*	0–11	0–1
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–11	0–1
	roughseed cryptantha	CRFL6	*Cryptantha flavoculata*	0–6	0–1
	common sunflower	HEAN3	*Helianthus annuus*	0–6	0–1
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–6	0–1
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–6	0–1
	woolly plantain	PLPA2	*Plantago patagonica*	0–6	0–1
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–6	0–1
	small-leaf globemallow	SPPA2	*Sphaeralcea parvifolia*	0–6	0–1
Shrub/Vine					
3	**Shrubs**			112–280	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	28–112	2–7
	greasewood	SAVE4	*Sarcobatus vermiculatus*	45–112	3–7
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–45	0–3
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	13–26	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–22	0–2
	yellow	CHVI8	*Chrysothamnus viscidiflorus*	0–22	0–2

	rabbitbrush				
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–17	0–5
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	0–2
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–11	0–1
	valley saltbush	ATCU	*Atriplex cuneata*	0–11	0–1
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–6	0–1
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–6	0–1
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–6	0–1

Table 19. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			224–504	
	alkali sacaton	SPAI	*Sporobolus airoides*	84–448	5–25
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	28–140	2–8
	greasewood	SAVE4	*Sarcobatus vermiculatus*	45–101	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	22–76	–
	James' galleta	PLJA	*Pleuraphis jamesii*	11–56	1–4
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	13–26	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	13–26	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	13–26	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	13–26	–
1	**Sub-Dominant Grasses**			28–112	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–56	0–4
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–56	0–4
	Grass, perennial	2GP	*Grass, perennial*	0–56	0–4
	blue grama	BOGR2	*Bouteloua gracilis*	0–45	0–3
	Grass, annual	2GA	*Grass, annual*	0–22	0–2
	purple threeawn	ARPU9	*Aristida purpurea*	0–17	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–17	0–1

Forb					
2	**Forbs**			11–78	
	prickly Russian thistle	SATR12	*Salsola tragus*	1–50	0–3
	Forb, perennial	2FP	*Forb, perennial*	0–34	0–2
	nodding buckwheat	ERCE2	*Eriogonum cernuum*	0–34	0–2
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–34	0–2
	sand buckwheat	ERLEP	*Eriogonum leptocladon var. papiliunculi*	0–34	0–2
	flatspine bur ragweed	AMAC2	*Ambrosia acanthicarpa*	0–28	0–2
	rushy milkvetch	ASLO3	*Astragalus lonchocarpus*	0–22	0–1
	Forb, annual	2FA	*Forb, annual*	0–22	0–1
	buckwheat	ERIOG	*Eriogonum*	0–17	0–1
	western aster	SYAS3	*Symphyotrichum ascendens*	0–17	0–1
	rusty lupine	LUPU	*Lupinus pusillus*	0–11	0–1
	western blanketflower	GASP	*Gaillardia spathulata*	0–11	0–1
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–11	0–1
	roughseed cryptantha	CRFL6	*Cryptantha flavoculata*	0–6	0–1
	common sunflower	HEAN3	*Helianthus annuus*	0–6	0–1
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–6	0–1
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–6	0–1
	woolly plantain	PLPA2	*Plantago patagonica*	0–6	0–1
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–6	0–1
	small-leaf globemallow	SPPA2	*Sphaeralcea parvifolia*	0–6	0–1
Shrub/Vine					
3	**Shrubs**			22–112	
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–45	0–3

	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	6–45	0–3
	greasewood	SAVE4	*Sarcobatus vermiculatus*	6–34	0–2
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	13–26	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–22	0–2
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–22	0–2
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–17	0–5
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	0–2
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–11	0–1
	valley saltbush	ATCU	*Atriplex cuneata*	0–11	0–1
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–6	0–1
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–6	0–1
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–6	0–1

Table 20. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			112–224	
	alkali sacaton	SPAI	*Sporobolus airoides*	34–168	2–10
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	28–140	2–8
	greasewood	SAVE4	*Sarcobatus vermiculatus*	45–101	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	22–76	–
	blue grama	BOGR2	*Bouteloua gracilis*	11–45	1–3
	James' galleta	PLJA	*Pleuraphis jamesii*	6–39	1–3
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	13–26	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	13–26	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	13–26	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	13–26	–
1	**Sub-Dominant Grasses**			28–84	

	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–56	0–4
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–56	0–4
	Grass, perennial	2GP	*Grass, perennial*	0–56	0–4
	Grass, annual	2GA	*Grass, annual*	0–22	0–2
	purple threeawn	ARPU9	*Aristida purpurea*	0–17	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–17	0–1
Forb					
2	**Forbs**			11–78	
	prickly Russian thistle	SATR12	*Salsola tragus*	0–73	0–5
	Forb, perennial	2FP	*Forb, perennial*	0–34	0–2
	nodding buckwheat	ERCE2	*Eriogonum cernuum*	0–34	0–2
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–34	0–2
	sand buckwheat	ERLEP	*Eriogonum leptocladon var. papiliunculi*	0–34	0–2
	flatspine bur ragweed	AMAC2	*Ambrosia acanthicarpa*	0–28	0–2
	rushy milkvetch	ASLO3	*Astragalus lonchocarpus*	0–22	0–1
	Forb, annual	2FA	*Forb, annual*	0–22	0–1
	western aster	SYAS3	*Symphyotrichum ascendens*	0–17	0–1
	buckwheat	ERIOG	*Eriogonum*	0–17	0–1
	saltlover	HAGL	*Halogeton glomeratus*	0–17	0–1
	rusty lupine	LUPU	*Lupinus pusillus*	0–11	0–1
	western blanketflower	GASP	*Gaillardia spathulata*	0–11	0–1
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–11	0–1
	roughseed cryptantha	CRFL6	*Cryptantha flavoculata*	0–6	0–1
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–6	0–1
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–6	0–1
	woolly plantain	PLPA2	*Plantago patagonica*	0–6	0–1
	common sunflower	HEAN3	*Helianthus annuus*	0–6	0–1

	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–6	0–1
	small-leaf globemallow	SPPA2	*Sphaeralcea parvifolia*	0–6	0–1
Shrub/Vine					
3	**Shrubs**			112–280	
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	34–112	2–7
	greasewood	SAVE4	*Sarcobatus vermiculatus*	45–112	3–7
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–45	0–3
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	13–26	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–22	0–2
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–22	0–2
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–17	0–5
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	0–2
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–11	0–1
	valley saltbush	ATCU	*Atriplex cuneata*	0–11	0–1
	Torrey's jointfir	EPTO	*Ephedra torreyana*	0–6	0–1
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–6	0–1
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–6	0–1

Animal community

--Livestock and Wildlife Grazing--
This site provides good/fair grazing conditions for livestock and wildlife during fall, winter, and spring due to accessibility and available nutritious forage. This site often lacks natural perennial water sources, which can influence the suitability for livestock and wildlife grazing. Care should be taken to maintain the native perennial grasses and shrubs due to the poor suitability for re-seeding or restoring this site. Reseeding and/or restoration are difficult due to the extreme temperatures, variability in time and amount of precipitation, and sodic soils. This site may occur in mule deer, desert bighorn sheep, and elk habitat; however in many places the populations will be small and have little grazing impact on the site.

The plant community is primarily grasses, including alkali sacaton, Indian ricegrass, galleta, and blue grama. These grasses provide good grazing conditions for all classes of

livestock and wildlife. Dominant shrubs, including shadscale, greasewood, winterfat, and fourwing saltbush, provide good winter browse for cattle, sheep, goats, bighorn sheep, mule deer, and elk. 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.

--References--
1. Relative Forage Preference of Plants for Grazing Use by Season: Plants commonly found in Major Land Resource Area D35 --The Colorado Plateau. 2007
2. Stubbendieck, J., S. L. Hatch, and C. H. Butterfield. 1997. North American range plants. Lincoln, NE: University of Nebraska Press. 501p.
3. USDA, Forest Service. 2007. Fire effects information: plant species life form. Available at http://www.fs.fed.us/database/feis/plants/index.html. Accessed 7 August 2007.

Wildlife-
This ecological site provides food and very limited cover for wildlife. Wildlife using this site includes coyote, bobcat, jackrabbit, snake, hawk, mule deer, coyote, and desert bighorn.

Recreational uses

Recreational uses are hiking, hunting, and horseback riding. This site often has scenic vistas associated with it.

Wood products

None

Other information

--Poisonous/Toxic Plant Communities--
Toxic plants associated with this site include broom and threadleaf snakeweed, greasewood, and lupine. Snakeweeds contains steroids, terpenoids, saponins, and flavones that can cause abortions or reproductive failure in sheep and cattle, however cattle are most susceptible. These toxins are most abundant during active growth and leafing stage. Cattle and sheep will typically only graze broom snakeweed when other forage is unavailable and generally in winter when toxicity levels are at their lowest. Greasewood contains sodium oxalate, which is toxic to cattle and sheep that have not accustomed to eating oxalate-containing plants. Oxalates accumulate in the greasewood leaves and are toxic only when consumed as 1.5 to 5.0 percent of the animal’s body weight over a short period of time. Oxalate poisoning causes kidney failure; clinical signs include muscle tremors, tetany, weakness, and depression. Lupine toxicity depends primarily on species—many lupines are nontoxic. The toxic compounds, quinolizidine and

piperlizidine alkaloids, are found in all part of the plants, during all phases. Lupine poisoning is associated with 2 syndromes: 1) crooked calf disease and 2) neurological disease. Crooked calf disease is characterized by calves being born with skeletal deformities and caused by cows consuming toxic levels of lupines between 40 and 70 days gestation. The neurological diseases is marked by include muscle tremors, labored breathing, coma, and death and is caused by animals grazing lupines at anytime. Potentially toxic plants associated with this site include four-wing saltbush, some buckwheat species, and basin big sagebrush. Four-wing saltbush and some buckwheat species 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. Basin big sagebrush contains sesquiterpene lactones and monoterpenes which have been suspected of being toxic to sheep. An experimental dosage of ¾ lbs of big sagebrush fed to sheep for three days was found to be lethal.

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

--Invasive Plant Communities--
Generally as ecological conditions deteriorate and perennial vegetation decreases due to disturbance (fire, over grazing, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses will invade the site. Of particular concern in semi-arid environments are the non-native annual invaders including cheatgrass, Russian thistle, kochia, halogeton, and annual mustards. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible. Due to the steep slopes associate with this site, the chance for disturbance is rare and thus possibility for invasion decreases. However, cheatgrass and Russian thistle are expected to invade when given the opportunity.

--Fire Ecology--

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

The occurrence of fire in alkali sacaton ecological sites is rare and fire intervals are most likely influenced by adjacent plant communities. Factors contributing to fire frequency in these areas include water table, flooding frequency, and annual forb/grass invasion. Alkali sacaton is tolerant of fire but, top killing is frequent, and the plants can be killed by severe fires. Recovery time of alkali sacaton following fire has been reported as 2-4 years and summer fires have the most effect on this plant.

--References--
1. Knight, A. P. and R. G. Walter. 2001. A guide to plant poisoning of animals in North America. Jackson, WY: Teton NewMedia. 367p.
2. USDA, Forest Service. 2007. Fire effects information: plant species life form. Available at http://www.fs.fed.us/database/feis/plants/index.html. Accessed 7 August 2007.

Other references

Johnson, Kathleen A. 2000. Sporobolus airoides. In: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, August 30].

Contributors

Jamin Johanson

Rangeland health reference sheet

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

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Contact for lead author	shane.green@ut.usda.gov
Date	09/11/2008
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills increase immediately following large storm events but should not persist more than one or two winters due to frost-heave recovery and coarse soil textures. There should be very few on slopes < 6%. On slopes >6%, rills may be 5-10 feet in length. Rills are most likely to form below adjacent exposed bedrock or water flow patterns where sufficient water accumulates to cause erosion.

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2. **Presence of water flow patterns:** There should be few and short (3-6') water flow patterns on low slopes (< 6%), increasing in frequency and length (up to 5-10') with slope. Waterflow patterns may increase on steeper slopes following large storm events, dissipating where the slope flattens. Interspaces between vegetation and/or well developed biological soil crusts appear to be depression water storage areas but actually serve as somewhat stable water flow patterns during precipitation events.

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3. **Number and height of erosional pedestals or terracettes:** Plants that occur on the edge of water flow patterns and rills on steeper slopes (>6%) may be slightly pedestalled, but there should be no exposed roots.
   Terracettes are few, occurring behind litter obstructions in water flow patterns. Well developed biological crusts may appear pedestalled, but are actually a characteristic of the crust formation.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 40 – 65%. (Soil surface is typically covered by 0 to 5 percent surface fragments). Ground cover is based on the first raindrop impact, and bare ground is the inverse of ground cover. Ground cover + bare ground = 100%. Any well developed biological crusts present should not be recorded as bare ground. Poorly developed biological soil crusts that are interpreted as functioning as bare ground (therefore

they would be susceptible to raindrop splash erosion) should be recorded as bare ground.

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5. **Number of gullies and erosion associated with gullies:** No active gullies. Some stable gullies may be present in landscape settings where increased runoff may accumulate (such as areas below exposed bedrock). Such gully development is expected to be limited to slopes exceeding 15% and adjacent to sites where runoff accumulation occurs. Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation and biological soil crusts.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** There should be very little evidence of active wind scoured, blowout or depositional areas.

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7. **Amount of litter movement (describe size and distance expected to travel):** There may be movement of fine litter on low slopes (< 6%) of up 2-4'. On steeper slopes, fine litter may be redistributed in waterflow patterns following large storm events, depositing where the slope flattens or behind obstructions. Woody litter (if present) should not move from beneath the plant.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have an soil stability rating of 4 or 5 under plant canopies and a rating of 4 in the interspaces using the soil stability test kit. The average rating should be a 4. Surface texture ranges from silt loam to loamy fine sand. Vegetation cover, litter accumulation, surface rock and biological soil crusts reduce erosion.

---

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface horizon is typically 3 to 7 inches deep. Structure is typically moderate thin platy to moderate medium platy. Color is typically brown to (7.5YR5/4) to yellowish red (5YR5/6). Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Vascular plants and/or any well developed biological soil crusts 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. Interspaces between plants and any well developed biological soil crusts may serve as water flow patterns during episodic runoff events, with natural erosion expected in severe storms. When perennial grasses decrease, reducing ground cover and increasing bare ground, runoff is expected to increase and any associated infiltration reduced.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. The presence of moderate thin platy to moderate medium platy structure on this site should not be confused with compaction layers.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Warm season perennial grasses (Alkali sacaton, Galleta, Blue grama) > sprouting shrubs (greasewood, rabbitbrush)

    Sub-dominant: Non-sprouting shrubs (shadscale, winterfat fourwing saltbush) > Cool season perennial bunchgrasses (Indian ricegrass) > perennial and annual native forbs > Biological soil crusts

    Other: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state (e.g. Crested wheatgrass, 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: Following a recent disturbance such as fire, drought or insects that remove the woody vegetation, forbs and perennial grasses (herbaceous species) may become more dominate in the community. These conditions reflect a community phase within the reference state.

---

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

expected to show mortality or decadence): During years with average to above-average precipitation, there should be very little recent mortality or decadence apparent in either the shrubs or grasses. During severe (multi-year) drought up to 20% of the plants may die. Some mortality of bunchgrass and other shrubs may also occur during severe droughts, particularly on the coarser soils associated with this site. There may be partial mortality of individual bunchgrasses and other shrubs during less severe drought.

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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. Litter cover may increase up to 10% immediately following leaf drop. Litter redistribution following natural extreme runoff events can reduce litter cover by concentrating it in low-lying areas. Litter cover may increase to 7-12% following seasons with above average production due to a high production of annuals.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 400-450 #/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:** Cheatgrass, Russian thistle and other introduced annual forbs.

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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.
