USDA Natural Resources
Conservation Service

Ecological site R035XY011UT
Loamy Bottom (Basin Big Sagebrush)

Accessed: 05/03/2024

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.

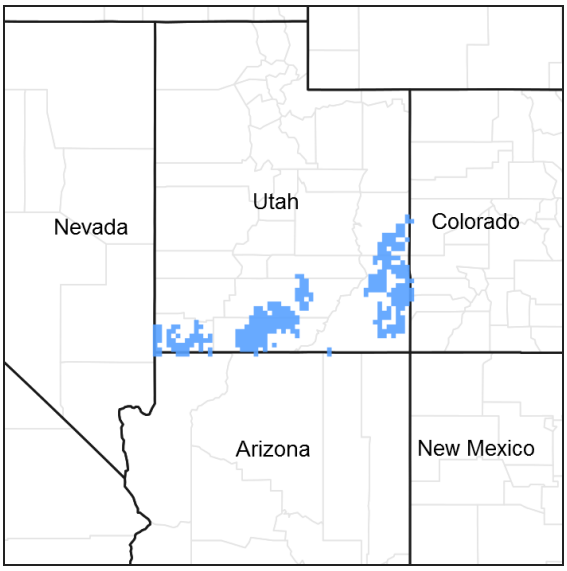


Figure 1. Mapped extent

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

Site concept: The loamy bottom (basin big sagebrush) ecological site is a run-in site found on terraces near streams or washes. It is mostly in the semidesert climate zone (4,000-7,000 feet) of the Colorado and Green River Plateaus region (MLRA 35). The site occurs at the bottom of the watershed in areas that receive extra water and sediment from surrounding uplands. The soils are deep with very few rock fragments. Surface textures are usually sandy loams, but range from loams to loamy sands. These soils are most often classified as fluvents, with mesic soil moisture regimes and ustic aridic soil temperature regimes (can be aridic ustic in some areas). The reference plant community is dominated by basin big sagebrush, gooseberryleaf globemallow, Indian ricegrass, and needle-and-thread. Cheatgrass and Russian thistle are common invaders of the understory, and tamarisk is capable of dominating this site when it occurs on low stream terraces.

Associated sites

R035XY003UT	**Alkali Bottom (Greasewood)** The alkali bottom site is often found in the same landscape position as the loamy bottom site, but in areas with higher salinity and typically finer soil textures. In some areas, these two site intermingle as soils properties transition from saline to non-saline.

R035XY215UT	**Semidesert Sandy Loam (4-Wing Saltbush)** This site is often found on stream terraces that are higher than those occupied by the loamy bottom site. On highly sloping floodplains and terraces, this site actually transitions into the loamy bottom site as it approaches the stream channel.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. tridentata*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Hesperostipa comata*

Physiographic features

This site is usually associated with a stream or a wash. It commonly occurs on flood plains, stream terraces, alluvial flats, and drainageways at elevations between 4,000 and 7,000 ft. Slopes are gentle and runoff potential is low. This site may have a seasonally high water table in the spring within 3 to 6 feet of the soil surface.

Table 2. Representative physiographic features

Landforms	(1) Alluvial flat (2) Flood plain (3) Stream terrace
Flooding duration	Extremely brief (0.1 to 4 hours) to brief (2 to 7 days)
Flooding frequency	None to rare
Ponding duration	Brief (2 to 7 days)
Ponding frequency	None to rare
Elevation	1,219–2,134 m
Slope	0–8%
Aspect	Aspect is not a significant factor

Climatic features

Total annual precipitation for this site is typically 9 to 13 inches. The plant growing season is from mid March to mid October, and approximately 75% of the precipitaion occurs during the growing season. This site receives additional moisture during the growing season in the form of runoff or subsurface flow. January, February and June are typically the driest months; and April, August and October are the wettest months.

Table 3. Representative climatic features

Frost-free period (average)	162 days
Freeze-free period (average)	187 days
Precipitation total (average)	330 mm

Influencing water features

This site may be associated with riparian ecological sites, but does not support riparian-obligate vegetation.

Soil features

The soils for this site are deep and well drained with very few rock fragments on the soil surface. The surface horizon (A horizon) is usually less than 4 inches thick. Surface textures are usually fine sandy loams, but can range from loams to fine sands. These soils formed from alluvium derived primarily from sandstone, shale, limestone

and/or igneous parent materials. Subsoils are often stratified and are non-skeletal. Water holding capacity ranges from 2.5 to 6 inches of water in the upper 40 inches of soil. The soil temperature regime is mesic and the soil moisture regime is aridic or ustic aridic. Most often these soils are classified as fluvents.

Soils Associated with Site R035AY011UT
Organized by Soil Survey Area and Soil Components (Map units in parentheses):

Canyonlands Area (UT633)-Barnum (3); Jocity (43); Ustic Torrifluvents (97);

San Juan County, Central-(UT638) Gilco (12, 13, 14); Redbank family (42, 43); Suwanee (66);

San Juan County, Navajo (UT643)-Redbank (RED);

Capitol Reef National Park (UT685) -Begay, Mido family, Radnik;

Escalante Grand Staircase (UT686)-Baldfield family (5090); Escavda (5141); Flatnose (5120, 5210); Radnick, moist (5112, 5140, 5141, 5142, 5143, 5172, 5174);

Arches National Park (UT687)-Mido (110);

Canyonlands National Park (UT688)-Mido (22);

Typical Soil Profile:
C1--0-4 inches; fine sandy loam; slightly alkaline
C2--4-60 inches; stratified sandy loam; slightly alkaline

Table 4. Representative soil features

Parent material	(1) Alluvium–volcanic sandstone
Surface texture	(1) Fine sandy loam (2) Loam (3) Fine sand
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	152 cm
Surface fragment cover <=3"	0–3%
Surface fragment cover >3"	0–2%
Available water capacity (0-101.6cm)	6.35–15.24 cm
Calcium carbonate equivalent (0-101.6cm)	0–25%
Electrical conductivity (0-101.6cm)	0–4 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)	0–15%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

This site was historically dominated by basin big sagebrush and a diverse perennial understory, including Indian ricegrass, gooseberryleaf globemallow, and needle-and-thread. The historic fire return interval is presumed to be about 50-100 years (Fryer and Luensmann 2012). Native grasses would have dominated for several years following fire, with sprouting shrubs increasing in the community. Sagebrush will most commonly re-establish and in the community within 10 years after the fire and increase steadily for 10-20 years until it dominates the overstory. In addition to fire, drought or aroga moths may cause sagebrush to decrease in the community.
Today this site often burns less frequently due to fire suppression efforts and reduce fine fuel loads resulting from improper livestock grazing. In addition, improper livestock grazing can cause native grasses and forbs to lose vigor or disappear from the community completely. Cheatgrass and Russian thistle commonly establish on this site, and Tamarisk can become dominant on low stream terraces. When the ecological processes are altered due to improper grazing, prolonged drought, altered fire regime, invasive species dominance, or other disturbances, alternative states can occur that differ from the historic reference state in both plant community structure and ecological function. In areas where irrigation is possible, this site has been used for cropland.
As stream channels are cut down, stream terraces occupied by the loamy bottom (basin big sagebrush) may cross an abiotic threshold into a semidesert sandy loam (Fourwing saltbush) site. This occurs when the site no longer recieves sufficient run-in moisture (via subsurface flow and/or runoff) to support a basin big sagebrush plant community. Fourwing saltbush dominance, stream downcutting, and a loss of skunkbrush sumac and other water-loving species indicate that a transition to a drier ecological site is occuring.

State and transition model

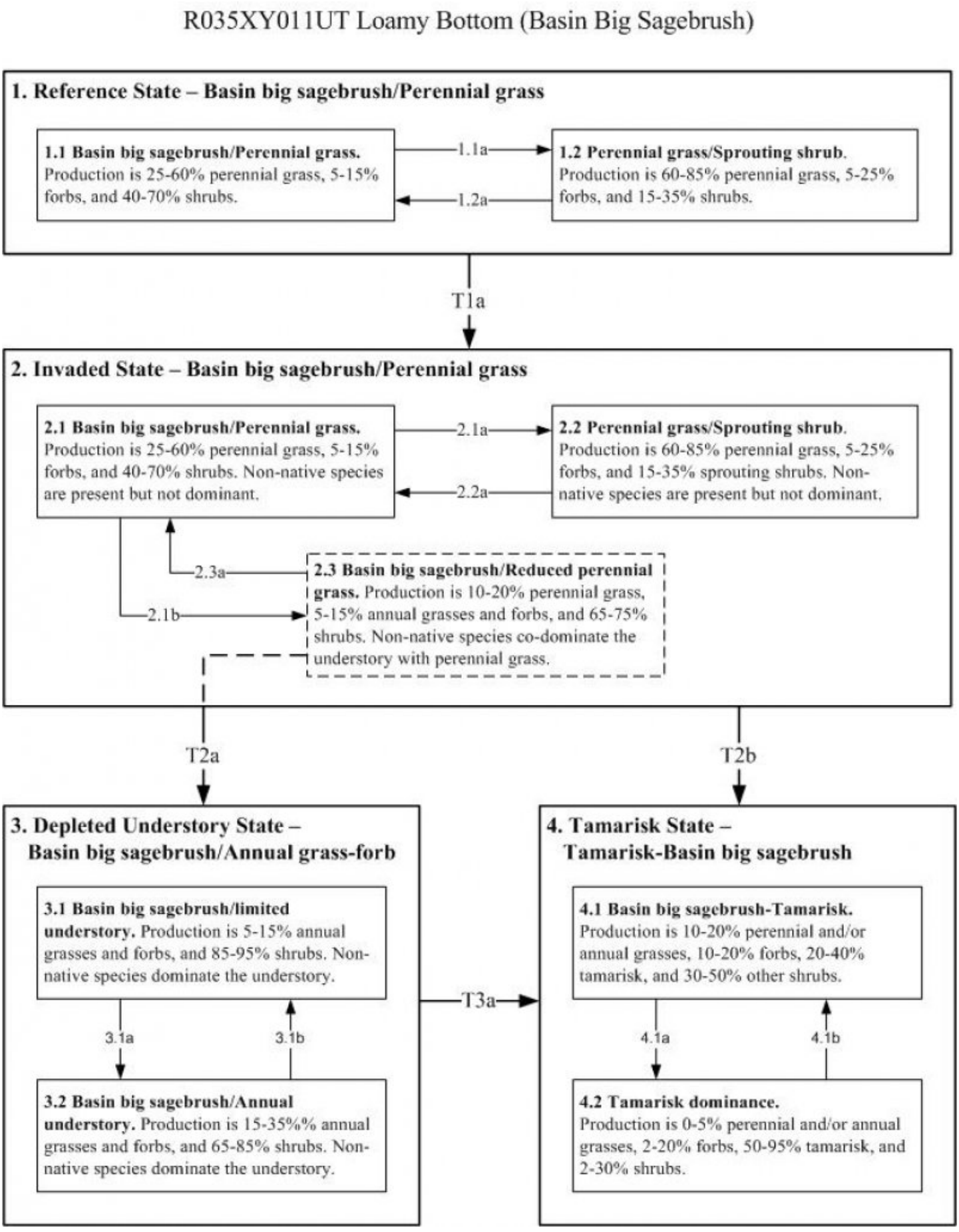


Figure 4. State-and-Transition Model

State 1
Reference State

The reference state contains plant communities presumed to occur prior to the introduction of non-native plants,

livestock grazing, and other modern disturbances. Basin big sagebrush dominance depends on time since fire, aroga moth, or extended drought.

Community 1.1
Basin big sagebrush/Perennial grass

R035XY011UT—Loamy Bottom (Basin big sagebrush) community 1.1—Basin big sagebrush/Perennial grass.

Figure 5. phase 1.1

R035XY011UT—Loamy Bottom (Basin big sagebrush) community 1.1—Basin big sagebrush/Perennial grass.

Figure 6.

R035XY011UT—Loamy Bottom (Basin big sagebrush) community 1.1—Basin big sagebrush/Perennial grass.

Figure 7.

Phase 1.1 is dominated by basin big sagebrush and perennial grasses. Percent composition by air-dry weight is 25-60% perennial grasses, 5-15% forbs, and 40-70% shrubs. In the reference state, this is the most common community phase.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	280	392	560
Grass/Grasslike	224	336	448
Forb	28	56	112
Total	**532**	**784**	**1120**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-25%
Grass/grasslike foliar cover	15-25%
Forb foliar cover	3-6%
Non-vascular plants	0%
Biological crusts	0-10%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-3%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	30-45%

Table 7. Canopy structure (% cover)

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

Community 1.2
Perennial grass/Sprouting shrub

Phase 1.2 is dominated by perennial grasses. Percent composition by air-dry weight is 60-85% perennial grasses, 5-25% forbs, and 15-35% shrubs. Sprouting shrubs make up most of the shrub component. This phase is usually the result of stand-replacing fire that eliminates basin big sagebrush for the space of several years. Sagebrush may begin to re-establish in the community within 10 years following fire, and will steadily increase in the community until it becomes co-dominant with the perennial grass.

Pathway 1.1a
Community 1.1 to 1.2

Stand-replacing fire is the most common cause of this community pathway. The fire return interval is highly variable

but usually occurs every 50-100 years (Fryer and Luensmann 2012). Sagebrush decreases and perennial grasses, forbs, and sprouting shrubs dominate the site. Aroga moth, low-intensity fires, and prolonged drought may also result in a substantial decrease in sagbrush, but do not necessarily eliminate it from the community.

Pathway 1.2a
Community 1.2 to 1.1

This pathway results from the establishment and natural increase of basin big sagebrush into the plant community 10-30 years following a fire.

State 2
Invaded State--Basin big sagebrush/Perennial grass

The invaded state is similar to the reference state in composition and ecological function, but allows for non-native species to be present. It also includes an at-risk plant community with reduced perennial grass production. When perennial grasses are losing vigor and the ability to propagate themselves, this state is at risk of transitioning to the depleted understory state, which is incapable of recoving perennial grasses without significant management inputs.

Community 2.1
Basin big sagebrush/Perennial grass

Figure 9. phase 2.1

Phase 2.1 is similar to the reference plant community in composition and ecological function, but it allows for the presence of non-native/invasive species. It is dominated by basin big sagebrush and perennial grasses. Percent composition by air-dry weight is 25-60% perennial grasses, 5-15% forbs, and 40-70% shrubs.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	280	392	560
Grass/Grasslike	224	336	448
Forb	28	56	112
Total	**532**	**784**	**1120**

Table 9. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-25%
Grass/grasslike foliar cover	15-25%
Forb foliar cover	3-6%

Non-vascular plants	0%
Biological crusts	0-10%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-3%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	30-45%

Table 10. Canopy structure (% cover)

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

Community 2.2
Perennial grass/Sprouting shrub

Phase 2.2 is dominated by perennial grasses. It is similar to phase 1.2 in composition and ecological function, but allows for non-native/invasive species to be present. Percent composition by air-dry weight is 60-85% perennial grasses, 5-25% forbs, and 15-35% shrubs. Sprouting shrubs make up most of the shrub component. This phase is usually the result of stand-replacing fire that eliminates basin big sagebrush for the space of several years. Sagebrush may begin to re-establish in the community within 10 years following fire, and will steadily increase in the community until it becomes co-dominant with the perennial grass.

Community 2.3
Basin big sagebrush/Reduced perennial grass

Figure 11. phase 2.3

Phase 2.3 is at-risk of crossing a threshold into the depleted understory state (state 3). Excessive grazing of perennial grasses during growth has favored non-native invasive species, primarily cheatgrass and/or Russian thistle, to co-dominate the understory. Prescribed grazing is required to improve the reproductive capability of perennial grasses and avoid the transition to state 3.

Table 11. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	280	392	560
Grass/Grasslike	84	168	252
Forb	28	56	112
Total	**392**	**616**	**924**

Pathway 2.1a
Community 2.1 to 2.2

Stand-replacing fire is the most common cause of this community pathway. The fire return interval is highly variable but usually occurs every 50-100 years (Fryer and Luensmann 2012). Sagebrush decreases and perennial grasses, forbs, and sprouting shrubs dominate the site. Aroga moth, low-intensity fires, and prolonged drought may also result in a substantial decrease in sagbrush, but do not necessarily eliminate it from the community.

Pathway 2.1b
Community 2.1 to 2.3

Basin big sagebrush/Perennial grass

Basin big sagebrush/Reduced perennial grass

This pathway occurs when perennial grasses are reduced in the understory due to excessive grazing during the growing period. Perennial grasses are losing their ability to propagate themselves, and non-native species may co-dominate the understory.

Pathway 2.2a
Community 2.2 to 2.1

This pathway results from the establishment and natural increase of basin big sagebrush into the plant community 10-30 years following a fire.

Pathway 2.3a
Community 2.3 to 2.1

Basin big sagebrush/Reduced perennial grass

Basin big sagebrush/Perennial grass

Prescribed grazing that provides rest during the growth period for perennial grasses can improve their vigor and reproductive capacity.

Conservation practices

Prescribed Grazing

State 3
Depleted Understory State--Basin big sagebrush/Annual grass-forb

The depleted understory state occurs when perennial grasses have been lost from the understory. Perennial forbs may also be reduced. This state is not as capable of carrying a stand replacing fire that removes big sagebrush due to a reduction in fine fules. As a result, sagebrush continues to increase and the understory continues to be reduced. Thinning of sagebrush by livestock trampling or other disturbance results in an increase in annual species in the understory.

Community 3.1
Basin big sagebrush/Limited understory

Bottom (basin big sagebrush) community 3.1—Basin big sagebrush/ Limited understory. Cover is 1% grass, 9% forb, 45% shrub, 10 % bare ground, 15% crust, and 20 % litter. NAD83 0610519 E. 4204679 N. Photo by Dana Truman May 14, 2007.

Figure 13. phase 3.1

Perennial grasses have been lost from the understory. Basin big sagebrush continues to increase beyond the natural fire return interval due to lack of fuel to carry a fire. Moss and biological soil crusts cover much of the soil surface.

Table 12. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	448	616	785
Forb	11	39	78
Grass/Grasslike	–	17	34
Total	**459**	**672**	**897**

Community 3.2
Basin big sagebrush/Annual understory

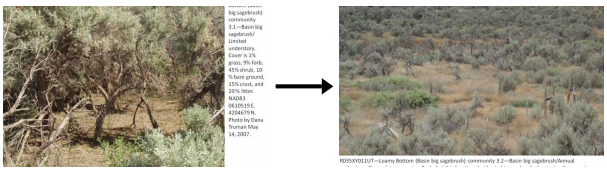
Figure 15. phase 3.2

This phase is dominated by basin big sagebrush in the overstory and annual grasses and/or forbs in the understory.

Table 13. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	336	448	616
Forb	28	56	196
Grass/Grasslike	56	112	168
Total	**420**	**616**	**980**

Pathway 3.1a
Community 3.1 to 3.2



Basin big sagebrush/Limited understory

Basin big sagebrush/Annual understory

Livestock trampling, mechanical treatment, or other disturbances reduces sagebrush cover and makes germination sites available for invasive annual species, particularly cheatgrass and Russian thistle.

Pathway 3.2a
Community 3.2 to 3.1

Basin big sagebrush/Annual understory

Basin big sagebrush/Limited understory

This pathway occurs when basin big sagebrush is not reduced by trampling, mechanical treatment, fire, or other disturbances for many years. Sagebrush increases and anuuals in the understory decrease.

State 4
Tamarisk State--Tamarisk-Basin big sagebrush

This state has only been documented on low stream terraces. The stream provides a corridor for tamarisk invasion, which spreads throughout the loamy bottom on low stream terraces, eventually dominating the site.

Community 4.1
Tamarisk-Basin big sagebrush

Figure 17. phase4.1

This community is co-dominated by basin big sagebrush and tamarisk. Production is 10-20% perennial and/or annual grasses, 10-20% forbs, 20-40% tamarisk, and 30-50% other shrubs.

Table 14. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	448	616	785
Forb	28	84	140
Grass/Grasslike	28	84	140
Total	**504**	**784**	**1065**

Community 4.2
Tamarisk dominance

Figure 19. phase 4.2

This community occurs when tamarisk becomes the lone dominant species.

Table 15. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	448	673	1121
Forb	22	45	90
Grass/Grasslike	–	22	45
Total	**470**	**740**	**1256**

Pathway 4.1a
Community 4.1 to 4.2

Tamarisk-Basin big sagebrush **Tamarisk dominance**

This pathway occurs as tamarisk contiues to increase in the community by outcompeting basin big sagebrush as the dominant shrub.

Pathway 4.2a
Community 4.2 to 4.1

Tamarisk dominance **Tamarisk-Basin big sagebrush**

This community pathway may occur with tamarisk control efforts, either mechanical or biological. The saltcedar leaf beetle (Diorhabda elongata)can cause enough stress to kill tamarisk in 5-7 years (Richman, Biological Control Field Guide for Utah).

Transition T1a
State 1 to 2

Establishment and persistence of non-native species results in a transition from the reference state to the invaded state.

Transition T2a
State 2 to 3

This transition occurs when perennial grasses are reduced by improper grazing to the point that they can no longer self-propagate. Few remnant plants may still persist under shrubs, but re-establishment and dominance by perennial grasses will not occur following a fire, or with the removal of livestock grazing.

Transition T2b
State 2 to 4

This transition only occurs when the site is on low stream terraces. The stream provides a corridor for tamarisk invasion, which spreads to low terraces dominated by basin big sagebrush.

Transition T3a
State 3 to 4

This transition only occurs when the site is on low stream terraces. The stream provides a corridor for tamarisk

invasion, which spreads to low terraces dominated by basin big sagebrush.

Additional community tables

Table 16. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			252–504	
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	224–448	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	17–56	–
3	**Sub-dominant shrubs**			28–112	
	skunkbush sumac	RHTRT	*Rhus trilobata var. trilobata*	0–67	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–67	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	11–56	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–34	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–34	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–28	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–17	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	–
Grass/Grasslike					
0	**Dominant Grasses**			112–336	
	needle and thread	HECO26	*Hesperostipa comata*	45–247	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	45–135	–
1	**Sub-dominant Grasses**			56–168	
	blue grama	BOGR2	*Bouteloua gracilis*	0–62	–
	Grass, perennial	2GP	*Grass, perennial*	17–56	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–34	–
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–34	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–28	–
	squirreltail	ELEL5	*Elymus elymoides*	0–17	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–17	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–17	–
	Grass, annual	2GA	*Grass, annual*	0–11	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–6	–
Forb					
2	**Forbs**			28–112	
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	6–56	–
	Forb, perennial	2FP	*Forb, perennial*	11–34	–
	silvery lupine	LUAR3	*Lupinus argenteus*	0–22	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–22	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–22	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–17	–
	Utah milkvetch	ASUT	*Astragalus utahensis*	0–17	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var.*	0–11	–

			chilense		
	Forb, annual	2FA	*Forb, annual*	2–11	–
	yellow spiderflower	CLLUL	*Cleome lutea var. lutea*	0–6	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–6	–
	rosy ipomopsis	IPRO	*Ipomopsis roseata*	0–6	–
	beardtongue	PENST	*Penstemon*	0–6	–

Table 17. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			252–504	
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	224–448	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	17–56	–
3	**Sub-dominant shrubs**			28–112	
	skunkbush sumac	RHTRT	*Rhus trilobata var. trilobata*	0–67	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–67	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	11–56	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–34	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–34	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–28	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–17	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	–
Grass/Grasslike					
0	**Dominant Grasses**			112–336	
	needle and thread	HECO26	*Hesperostipa comata*	45–247	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	45–135	–
1	**Sub-dominant Grasses**			56–168	
	blue grama	BOGR2	*Bouteloua gracilis*	0–62	–
	Grass, perennial	2GP	*Grass, perennial*	17–56	–
	cheatgrass	BRTE	*Bromus tectorum*	6–45	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–34	–
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–34	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–28	–
	squirreltail	ELEL5	*Elymus elymoides*	0–17	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–17	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–17	–
	Grass, annual	2GA	*Grass, annual*	0–11	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–6	–
Forb					
2	**Forbs**			28–112	
	prickly Russian thistle	SATR12	*Salsola tragus*	0–56	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	6–56	–
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–39	–

	stickseed	LAPPU	*Lappula*	0–39	–
	Forb, perennial	2FP	*Forb, perennial*	11–34	–
	silvery lupine	LUAR3	*Lupinus argenteus*	0–22	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–22	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–22	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–17	–
	Utah milkvetch	ASUT	*Astragalus utahensis*	0–17	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	0–11	–
	Forb, annual	2FA	*Forb, annual*	2–11	–
	rosy ipomopsis	IPRO	*Ipomopsis roseata*	0–6	–
	yellow spiderflower	CLLUL	*Cleome lutea var. lutea*	0–6	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–6	–
	beardtongue	PENST	*Penstemon*	0–6	–

Table 18. Community 2.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			224–448	
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	224–448	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	17–56	–
3	**Sub-dominant shrubs**			28–112	
	skunkbush sumac	RHTRT	*Rhus trilobata var. trilobata*	0–67	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–67	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	11–56	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–34	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–34	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–28	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	–
Grass/Grasslike					
0	**Dominant Grasses**			84–224	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	22–90	–
	needle and thread	HECO26	*Hesperostipa comata*	6–90	–
	cheatgrass	BRTE	*Bromus tectorum*	6–67	–
1	**Sub-dominant Grasses**			28–84	
	blue grama	BOGR2	*Bouteloua gracilis*	0–50	–
	Grass, perennial	2GP	*Grass, perennial*	0–34	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–17	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–17	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–17	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–17	–
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–17	–
	squirreltail	ELEL5	*Elymus elymoides*	0–11	–
	Grass, annual	2GA	*Grass, annual*	0–11	

	Grass, annual	2GA	*Grass, annual*	0–11	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–6	–
Forb					
2	**Forbs**			28–112	
	prickly Russian thistle	SATR12	*Salsola tragus*	6–101	–
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–39	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	2–28	–
	lemon scurfpea	PSLA3	*Psoralidium lanceolatum*	0–17	–
	yellow bush lupine	LUAR	*Lupinus arboreus*	0–17	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–11	–
	Forb, annual	2FA	*Forb, annual*	2–11	–
	Utah milkvetch	ASUT	*Astragalus utahensis*	0–11	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–11	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	0–11	–
	yellow spiderflower	CLLUL	*Cleome lutea var. lutea*	0–6	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–6	–
	beardtongue	PENST	*Penstemon*	0–6	–
	rosy ipomopsis	IPRO	*Ipomopsis roseata*	0–6	–

Table 19. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			448–785	
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	392–785	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	28–112	–
3	**Sub-dominant shrubs**			56–168	
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–112	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–112	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	11–67	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–34	–
	skunkbush sumac	RHTRT	*Rhus trilobata var. trilobata*	0–17	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–6	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	–
Grass/Grasslike					
1	**Grasses**			0–34	
	Grass, annual	2GA	*Grass, annual*	0–34	–
	Grass, perennial	2GP	*Grass, perennial*	0–17	–
Forb					
2	**Forbs**			11–67	
	prickly Russian thistle	SATR12	*Salsola tragus*	0–67	–
	tumblemustard	THELY3	*Thelypodiopsis*	0–45	–
	Forb, annual	2FA	*Forb, annual*	0–34	–
	Forb, perennial	2FP	*Forb, perennial*	0–22	–
	madwort	ALYSS	*Alyssum*	0–11	–
	goosefoot	CHENO	*Chenopodium*	0–11	–
	tansymustard	DESCU	*Descurainia*	0–11	–
	stickseed	LAPPU	*Lappula*	0–11	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–6	–
	redstem stork's bill	ERCI6	*Erodium cicutarium*	0–6	–
	yellow spiderflower	CLLU2	*Cleome lutea*	0–6	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–6	–

Table 20. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			280–504	
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	252–448	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	28–112	–
3	**Sub-dominant shrubs**			28–112	
	skunkbush sumac	RHTRT	*Rhus trilobata var. trilobata*	0–67	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–67	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–34	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–34	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–11	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–11	–
Grass/Grasslike					
0	**Dominant Grasses**			28–140	
	cheatgrass	BRTE	*Bromus tectorum*	28–140	–
1	**Sub-dominant grasses**			6–45	
	Grass, perennial	2GP	*Grass, perennial*	0–34	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–34	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–28	–
	Grass, annual	2GA	*Grass, annual*	0–22	–
Forb					
0	**Dominant Forbs**			28–140	
	prickly Russian thistle	SATR12	*Salsola tragus*	28–140	–
	tumblemustard	THELY3	*Thelypodiopsis*	0–140	–
2	**Sub-dominant forbs**			17–50	
	Forb, annual	2FA	*Forb, annual*	0–22	–
	Forb, perennial	2FP	*Forb, perennial*	0–22	–
	stickseed	LAPPU	*Lappula*	0–17	–
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–17	–
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–11	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–6	–

Table 21. Community 4.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant shrubs**			392–673	
	five-stamen tamarisk	TACH2	*Tamarix chinensis*	168–392	–
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	112–224	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	28–84	–
3	**Sub-dominant Shrubs**			28–84	
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–45	–
	skunkbush sumac	RHTRT	*Rhus trilobata var. trilobata*	0–45	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–45	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–22	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–11	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	–
Grass/Grasslike					
0	**Dominant grasses**			28–140	
	needle and thread	HECO26	*Hesperostipa comata*	0–135	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–135	–
	cheatgrass	BRTE	*Bromus tectorum*	6–112	–
2	**Sub-dominant grasses**			6–56	
	Grass, perennial	2GP	*Grass, perennial*	6–56	–
	Grass, annual	2GA	*Grass, annual*	0–11	–
Forb					
1	**Forbs**			28–140	
	prickly Russian thistle	SATR12	*Salsola tragus*	0–112	–
	canaigre dock	RUHY	*Rumex hymenosepalus*	0–45	–
	Forb, annual	2FA	*Forb, annual*	0–34	–
	Forb, perennial	2FP	*Forb, perennial*	0–34	–
	lambsquarters	CHAL7	*Chenopodium album*	0–11	–
	stickseed	LAPPU	*Lappula*	0–11	–

Table 22. Community 4.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			448–1121	
	five-stamen tamarisk	TACH2	*Tamarix chinensis*	448–1121	–
3	**Sub-dominant shrubs**			6–112	
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	6–112	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–22	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–22	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–22	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–11	–
Grass/Grasslike					
1	**Grasses**			0–45	
	cheatgrass	BRTE	*Bromus tectorum*	0–28	–
	Grass, perennial	2GP	*Grass, perennial*	0–22	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–11	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–11	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–11	–
	Grass, annual	2GA	*Grass, annual*	0–11	–
Forb					
2	**Forbs**			28–84	
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–45	–
	Forb, annual	2FA	*Forb, annual*	0–34	–
	Forb, perennial	2FP	*Forb, perennial*	0–34	–
	tansymustard	DESCU	*Descurainia*	0–34	–
	stickseed	LAPPU	*Lappula*	0–11	–
	canaigre dock	RUHY	*Rumex hymenosepalus*	0–11	–
	lambsquarters	CHAL7	*Chenopodium album*	0–11	–
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–6	–

Animal community

This site is suited to proper grazing by cattle and sheep during spring, summer, and fall, but requires sufficient rest during the growing season to maintain perennial grass. This site provides food and cover for diverse wildlife species.

Wood products

None

Other references

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Utah Climate Summaries. 2008. Available: http://www.wrcc.dri.edu/summary/climsmut.html. Accessed on February 25, 2008.

Grand Staircase: Radnik, moist – E of Boulder, along the Burr Trail, in the Circle Cliffs area; NE of Big Water in the Rogers Canyon Drainage on Fiftymile Mountain and drainages on Window Sash Bench; N of Big Water in drainages around Long Flat; W of Big Water along Highway 89 in the Kitchen Corral Wash drainage; SE of Escalante in the headwaters of the Alvey Wash and Wahweap Creek drainages; E of Kanab along Fivemile Valley, north of Hwy. 89 in the Paria River drainage, near the Paria Town Site; SE of Cannonville in Butler Valley; S of Cannonville near Sheep Creek; and in drainages NE of Tropic, along Henderson Creek and North Creek. (Modal – Latitude: 37° 33' 45.52" N Longitude: 111° 19' 9.83" W) Escavada – SE of Escalante in the headwaters of the Alvey Wash and Wahweap Creek drainages; W of Big Water along Highway 89 in the Kitchen Corral Wash drainage; NE of Big Water in drainages on Window Sash Bench; N of Big Water in drainages around Long Flat, and in drainages NE of Tropic, along Henderson Creek and North Creek. (Modal – Latitude: 37° 25' 22.80" N Longitude: 111° 43' 58.80" W) Flatnose – below the White Cliffs in the areas of Johnson Canyon and Nephi Pasture; along the Skutumpah Road from Skutumpah Terrace to Sheep
Creek Flat; and NE of Henrieville along Hwy. 12 along Henrieville Creek. (Modal – Latitude: 37° 9' 9.01" N Longitude: 112° 16' 3.30" W)
Capitol Reef: Begay Family – South Draw: 1,500 ft. W & 1,000 ft. N of the SE corner of Sec. 12, T. 30S. R. 7E. (Unsurveyed area, location description is estimated.)

East Coyote Wash, central part of San Juan County

Contributors

George Cook
Jamin Johanson
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Rangeland health reference sheet

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

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

Indicators

1. **Number and extent of rills:** Very minor rill development in sparsely vegetated areas. Rills present should be widely spaced, and not connected. Rill development will increase following large storm events, but rills heal within a few years through frost heaving. Rill development may increase where the site is adjacent to other sites that produce large amounts of runoff (i.e. steeper sites, slickrock, etc.)

2. **Presence of water flow patterns:** Few throughout the site. Flow patterns are usually sinuous and wind around perennial plant bases. They may be long (10 to 20 feet), and less than one foot wide, and spaced form 5 to 15 feet apart. They are stable with only minor evidence of deposition. Evidence of flow will increase somewhat on slopes greater than 3 percent. This site is periodically inundated with runoff water due to its physiographic location. During very high flow events in adjacent channels (lotic, wash, etc.), this site may act as a filter and trap sediment, sometimes up to a foot or more.

3. **Number and height of erosional pedestals or terracettes:** Plants may show very minor pedestalling where they are adjacent to water flow patterns, but there should never be any exposed roots. Terracettes should be very few and stable, occurring behind pieces of woody litter blocking water flow patterns.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 30-45%. Ground cover is based on the first raindrop impact, and bare ground is the opposite of ground cover. Ground cover + bare ground = 100%.

5. **Number of gullies and erosion associated with gullies:** Very few. They would usually be expected in the lowest part of the site where water flows concentrate and/or in locations where there are concentrated flows into the site from an adjacent area. Gullies may show minor signs of active erosion but the sides and bottoms would be mostly stabilized with perennial vegetation. Gullies may show more indication of erosion on slopes greater than 3 percent, or as influenced by adjacent areas (watersheds) that may be providing concentrated flow patterns.

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

7. **Amount of litter movement (describe size and distance expected to travel):** Due to the natural periodic concentration of runoff in this site, some fine litter movement is common. Often litter from adjacent sites/watershed contribute to litter noted on this ecological site. Litter removal may occur in flow patterns with deposition occurring at points of obstruction, especially following large storm events. Litter movement is expected to increase with slopes over 3 percent.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have an erosion rating of 5 or 6 under plant canopies and a rating of 4 to 5 in the interspaces using the soil stability kit test. The average should be a 5. Surface texture is sandy loam to silt loam to clay loam. Vegetation cover, litter, 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 0-4 inches deep. Structure is weak granular. Colors are reddish brown. 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: Vascular plants are expected to break raindrop impact and splash erosion. Spatial distribution of vascular plants slows runoff by obstructing surface flows to help create sinuous flow patterns that dissipate energy and allow time for infiltration. With the physiographic location of the site being in stream terraces, alluvial flats, drainage ways, and flood plains this site is one of the terminal accumulation sites for runoff water. As such, infiltration is naturally facilitated. Natural erosion would be expected in severe thunder storms or heavy spring runoff. 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. Due to this sites lower placement (bottoms, fans etc.), it accumulates fine particles such as sands, silts and clays. The associated soil structure is weak medium subangular blocky parting to weak fine to medium granular to weak thin to medium platy in the soil subsurface. These should not be considered to be 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: Perennial bunchgrasses (Indian ricegrass, Needle and thread) > Non-sprouting shrubs (Basin big sagebrush, Fourwing saltbush)

    Sub-dominant: sprouting shrubs (rabbitbrush, greasewood) > forbs (globemallow, asters, primrose)

    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, etc.)
    Biological soil crust is variable in its expression where present on this site and is measured as a component of ground cover.
    Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

    Additional: Assumed disturbance regime includes fire, insect, and floods that kill the non-sprouting shrubs.
    Temporal variability is caused by fires, droughts, insects, etc. and spatial variability is caused by adjacency to other sites that produce runoff, soil pH levels, and topography.
    Following a recent disturbance such as fire, drought, flood or insects that remove the woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community. If a disturbance has not occurred for an extended period of time, woody species may continue to increase crowding out the perennial herbaceous understory species. In either case, these conditions reflect a 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 either the shrubs or grasses. Some mortality of bunchgrass and other shrubs may occur during very severe (long term) droughts.

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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 1-2 leaf thickness in the interspaces and up to 1/2” under canopies. Litter cover may increase to 20-30% on some years due to increased plant production.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 600-1000 #/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:** Tamarisk, cheatgrass, tumble mustard, and Russian thistle.

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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.
