USDA Natural Resources Conservation Service

Ecological site R035XY237UT
Semidesert Shallow Gypsum (Mormontea)

Accessed: 05/19/2024

General information

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

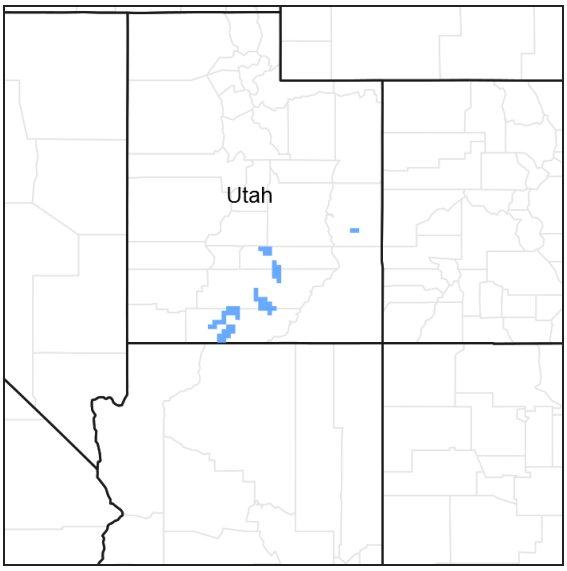


Figure 1. Mapped extent

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

MLRA notes

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

This site occurs on shallow, gypsum-rich soils in the semidesert zone of MLRA D35 (Colorado and Green River Plateaus). It recieves 8.5 to 13 inches of annual precipitation, most notably as convective thunderstorms from July through October. It most commonly occurs on knolls, hills and structural benches at elevations ranging from 5000-6600 feet. The reference plant community is sparsley vegetated and dominated by Torrey's jointfir, Mormon tea, shadscale, James' galleta, and Indian ricegrass. The reference plant community is highly resistant to change due to its inability to carry fire, along with a harsh soil environment that resists invasion and dominance by other species. However, Russian thistle can establish on the site.

Similar sites

R035XY126UT	**Desert Shallow Gypsum (Torrey's Jointfir)** This site only recieves 6-9 inches of annual precipitation, which results in lower total production.
R035XY142UT	**Desert Very Shallow Gypsum (Torrey's Jointfir)** This site has very shallow soils and only recieves 6-9 inches of annual precipitation. Production is lower as a result.

R035XY106UT	**Desert Gypsum Loam (Torrey's Jointfir)** This site only recieves 6-9 inches of annual precipitation, but it has deep soils and is typically lower in gypsum. As a result, grass production is slightly higher in this site, though total production is comparable.
R035XY264UT	**Semidesert Gypsum (Torrey's Jointfir)** This site has deep soils, similar climate, and less gypsum. As a result, production is about double, despite similarities in composition.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Ephedra torreyana* (2) *Ephedra viridis*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Pleuraphis jamesii*

Physiographic features

This site occurs on knolls, structural benches, and hillslopes at elevations ranging from 5000-6600 ft. Slopes typically range from 2-20%, but can be as high as 60% in highly dissected areas.

Table 2. Representative physiographic features

Landforms	(1) Knoll (2) Structural bench (3) Hill
Flooding frequency	None
Ponding frequency	None
Elevation	1,524–2,012 m
Slope	2–20%

Climatic features

The climate is characterized by hot summers and cool winters. Large fluctuations in daily temperatures are common. On average, May and June are the driest months and July through October are the wettest months during the growing season. Precipitation is extremely variable from month to month and from year to year but averages between 8.5-13 inches. Much of the summer precipitation occurs as convection thunderstorms.

Table 3. Representative climatic features

Frost-free period (average)	148 days
Freeze-free period (average)	172 days
Precipitation total (average)	330 mm

Influencing water features

Due to its landscape position, this site is not typically influenced by streams or wetlands. Ephemeral washes may cross this site, but these washes olny carry water during intense storms. As a result, production may increase and composition may differ near washes, but they do not support riparian-obligate vegetation.

Soil features

The soils of this site have high amounts of gypsum and range from very shallow to moderately deep. Soil textures range from silt loams to fine sandy loams and are well drained. Rock fragements are not common on the soil surface or in the profile. Water holding capacity ranges from 1.6 to 2.7 inches of water in the upper 40 inches of soil,

but may be higher on moderately deep soils. Soil Moisture regime is ustic aridic and soil temperature regime is mesic.

This site has been used in the following soil surveys and has been correlated to the following components:

UT685 - Capitol Reef National Park - Retsabal, Tanbark, Lemrac;
UT686 – Canyonlands National Park – Retsabal; Lemrac
UT687 – Aches National Park – Retsabal

Table 4. Representative soil features

Parent material	(1) Residuum–rock gypsum (2) Eolian deposits–sandstone and shale
Surface texture	(1) Silt loam (2) Very fine sandy loam (3) Loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	10–102 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	4.06–6.86 cm
Calcium carbonate equivalent (0-101.6cm)	4–30%
Electrical conductivity (0-101.6cm)	0–10 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–16%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site developed under the Colorado Plateau ecological conditions and the natural influences of herbivory and climate. During periods of drought, perennial warm and cool season grasses decrease, while periods of normal and above average precipitation result in an increase in perennial warm and cool season grasses. Shrub cover is generally lower under dry climatic conditions, and annual production decreases during drought. There is little natural herbivory attributed to large herbivores on the site due to the lack of cover available to wildlife species.

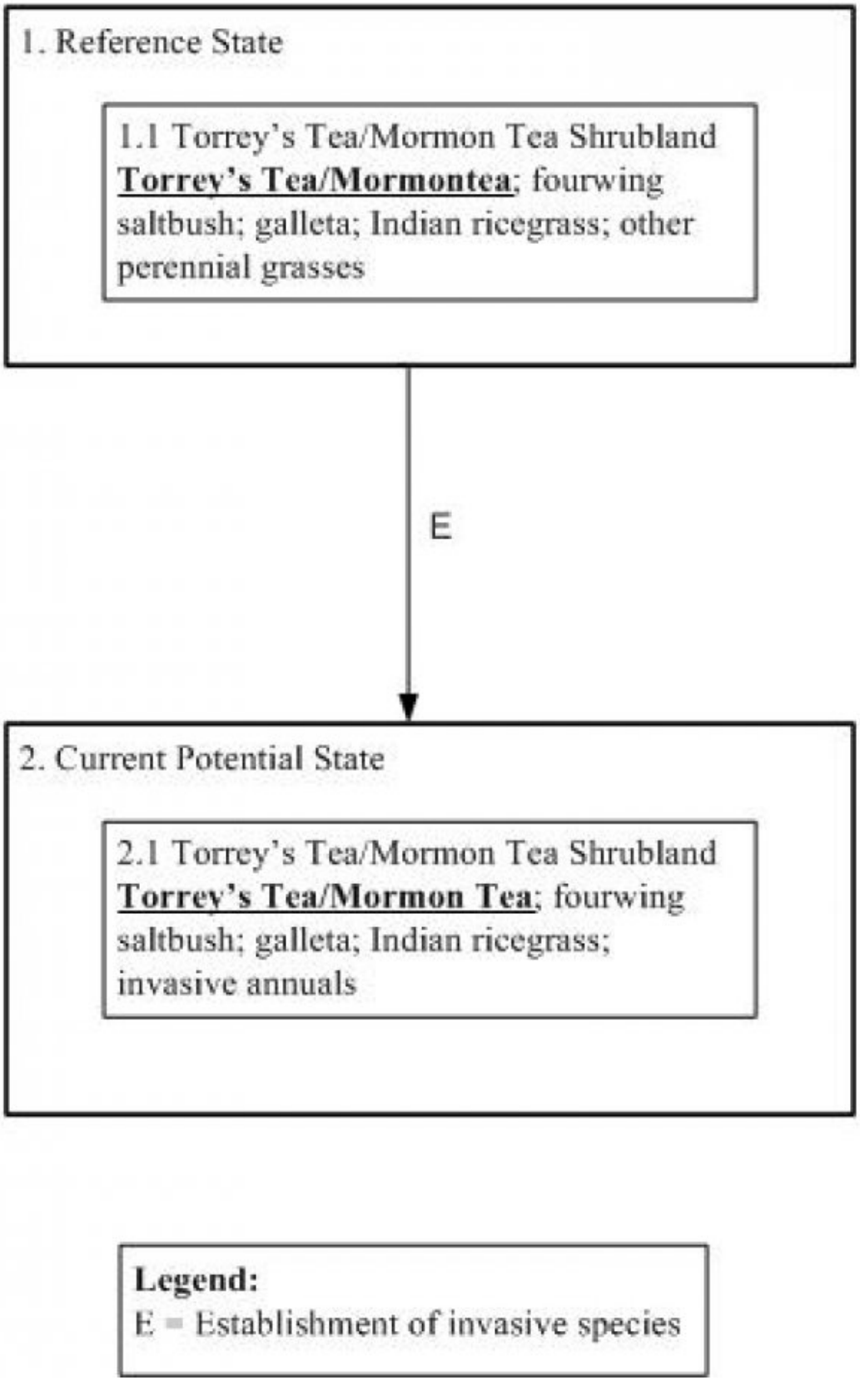
This ecological site has been grazed by domestic livestock since they were first introduced into the area (~1860). The introduction of domestic livestock and the use of fencing and reliable water sources have influenced the disturbance regime historically associated with this ecological site. This ecological site served as wintering pastures for sheep and cattle producers. Improperly managed livestock grazing (continuous season long grazing, heavy stocking rates, etc.) may cause this site to depart from the reference plant community. Indian ricegrass, needleandthread will decrease while galleta, invasive forbs, annual grasses, rabbitbrush and broom snakeweed will increase. Timing of grazing also affects the ecological dynamics—spring grazing results in a decline of cool season grasses, while heavy summer/early fall grazing results in a decline of warm season grasses.

Along Hole-in-the-Rock road area, south of Escalante, this site has Torrey’s mormontea as the main shrub in the understory and green mormontea as a trace component, as you progress west towards Kanab, green mormontea becomes the dominant shrub in the understory with a trace of Torrey’s mormontea. Torrey’s mormontea is the main shrub in the understory in Canyonlands, Capitol Reef, and Arches National Parks.

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

State and transition model

R035XY237UT Semidesert Shallow Gypsum (Torrey's jointfir-Mormon Tea)



State 1
Reference State

Reference State (State 1) The reference state was determined by study of rangeland relic areas, areas protected from excessive disturbance and outside influences, such as grazing and recreation. Literature reviews, trends in plant community dynamics, and historical accounts are also considered. The reference state represents the historic plant communities and ecological dynamics of the semidesert shallow gypsum, Mormon tea site. This state includes the biotic communities that become established on the ecological site if all successional sequences are completed under current climatic conditions; natural disturbances are inherent in its development. This state is dominated by Torrey’s jointfir and warm season perennial grasses. The reference state is self sustaining and resistant to change due to high resistance to natural disturbances and high resilience following natural disturbances. Reference State: Community phases resistant to natural disturbances. Indicators: A site dominated by Torrey’s jointfir where galleta, Indian ricegrass and sand dropseed may or may not be present. Feedbacks: Natural fluctuations in climate that allow for a self sustaining Torrey’s jointfir and native grass community. Any disturbance that may allow for the establishment of invasive species. At-risk Community Phase: All communities are at risk when perennial plants are stressed and nutrients are available for invasive plants to establish. Trigger: Introduction of invasive plants to fill available niches.

Community 1.1
Reference State

Figure 4. Phase 1.1

Figure 5. Higher than average production area

This plant community phase is dominated by ephedra (Torrey's tea and mormon tea), shadscale, fourwing saltbush, and perennial grasses. Grasses may include but are not limited to galleta and Indian ricegrass. Galleta is typically the dominant perennial grass species in this plant community phase.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	56	112	168
Grass/Grasslike	11	28	45
Forb	6	17	28
Tree	–	–	22
Total	**73**	**157**	**263**

Table 6. Ground cover

Tree foliar cover	0-2%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	0-5%
Forb foliar cover	0-5%
Non-vascular plants	0%
Biological crusts	20-60%
Litter	2-6%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0-5%
Water	0%
Bare ground	15-50%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	0-2%	0-3%
>0.15 <= 0.3	–	0-5%	0-5%	0-5%
>0.3 <= 0.6	–	5-15%	0-5%	0-2%
>0.6 <= 1.4	–	0-5%	–	–
>1.4 <= 4	0-2%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

State 2
Current Potential State

The current potential state is similar to the reference state however, invasive plants are present. Galleta is typically the dominant perennial grass species in this plant community phase.

Community 2.1
Current Potential State

Figure 7. 2.1

Figure 8. Higher than average production area

This plant community is similar to the reference state however, invasive plants are present. This plant community phase is dominated by Torrey's jointfir/mormon tea, shadscale, fourwing saltbush, and perennial grasses. Grasses may include but are not limited to galleta and Indian ricegrass. Galleta is typically the dominant perennial grass species in this plant community phase.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	56	112	168
Grass/Grasslike	11	28	45
Forb	6	17	28
Tree	–	–	22
Total	**73**	**157**	**263**

Table 9. Ground cover

Tree foliar cover	0-2%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	0-5%
Forb foliar cover	0-5%
Non-vascular plants	0%
Biological crusts	20-60%
Litter	2-6%

Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0-5%
Water	0%
Bare ground	15-50%

Table 10. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	0-3%	0-3%
>0.15 <= 0.3	–	0-5%	0-5%	0-5%
>0.3 <= 0.6	–	5-15%	0-5%	0-2%
>0.6 <= 1.4	–	0-5%	–	–
>1.4 <= 4	0-2%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Transition T1a
State 1 to 2

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

Additional community tables

Table 11. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			34–84	
	Torrey's jointfir	EPTO	*Ephedra torreyana*	17–56	1–6
	mormon tea	EPVI	*Ephedra viridis*	0–56	0–6
3	**Sub-Dominant Shrubs**			11–56	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	10–45	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–39	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–22	–
	blackbrush	CORA	*Coleogyne ramosissima*	0–18	–
	Utah serviceberry	AMUT	*Amelanchier utahensis*	0–13	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–11	–
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–9	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	0–8	–
	Mexican cliffrose	PUME	*Purshia mexicana*	0–7	–

	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–6	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–6	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–6	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–4	–
	frosted mint	POIN3	*Poliomintha incana*	0–3	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–3	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–2	–
Grass/Grasslike					
0	**Dominant Grasses**			11–45	
	James' galleta	PLJA	*Pleuraphis jamesii*	11–45	1–4
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–34	0–3
1	**Sub-Dominant Grasses**			0–28	
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–28	0–1
	Grass, annual	2GA	*Grass, annual*	0–11	0–1
	Grass, perennial	2GP	*Grass, perennial*	0–11	0–1
	purple threeawn	ARPU9	*Aristida purpurea*	0–6	0–1
	squirreltail	ELEL5	*Elymus elymoides*	0–6	0–1
Forb					
2	**Forbs**			6–28	
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	4–13	0–1
	desert princesplume	STPI	*Stanleya pinnata*	1–11	0–2
	Forb, annual	2FA	*Forb, annual*	0–11	0–1
	Forb, perennial	2FP	*Forb, perennial*	0–11	0–1
	buckwheat	ERIOG	*Eriogonum*	0–9	0–1
	curlycup gumweed	GRSQ	*Grindelia squarrosa*	0–6	0–1
	mountain pepperweed	LEMO2	*Lepidium montanum*	0–6	0–1
	flatspine bur ragweed	AMAC2	*Ambrosia acanthicarpa*	0–6	0–1
	triangle bur ragweed	AMDE4	*Ambrosia deltoidea*	0–6	0–1
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–6	0–1
	roughseed cryptantha	CRFL6	*Cryptantha flavoculata*	0–6	0–1
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–6	0–1
	woolly plantain	PLPA2	*Plantago patagonica*	0–3	0–1
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	0–2	0–1
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–2	0–1
Tree					
4	**Trees**			0–22	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–22	0–1
	twoneedle pinyon	PIED	*Pinus edulis*	0–22	0–1

Table 12. Community 2.1 plant community composition

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

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			34–84	
	Torrey's jointfir	EPTO	*Ephedra torreyana*	22–56	–
	mormon tea	EPVI	*Ephedra viridis*	0–56	–
3	**Sub-dominant Shrubs**			11–56	
	blackbrush	CORA	*Coleogyne ramosissima*	0–39	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–39	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–22	–
	Utah serviceberry	AMUT	*Amelanchier utahensis*	0–13	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–11	–
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–9	–
	slender buckwheat	ERMI4	*Eriogonum microthecum*	0–8	–
	Mexican cliffrose	PUME	*Purshia mexicana*	0–7	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–6	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–6	–
	big sagebrush	ARTR2	*Artemisia tridentata*	0–6	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–4	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–3	–
	frosted mint	POIN3	*Poliomintha incana*	0–3	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			11–45	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–34	–
	James' galleta	PLJA	*Pleuraphis jamesii*	11–34	–
1	**Sub-dominant Grasses**			0–28	
	Grass, annual	2GA	*Grass, annual*	0–11	–
	Grass, perennial	2GP	*Grass, perennial*	0–11	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–6	–
	cheatgrass	BRTE	*Bromus tectorum*	0–6	–
	squirreltail	ELEL5	*Elymus elymoides*	0–6	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–6	–
Forb					
2	**Forbs**			6–28	
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	4–13	–
	Forb, annual	2FA	*Forb, annual*	0–11	–
	Forb, perennial	2FP	*Forb, perennial*	0–11	–
	desert princesplume	STPI	*Stanleya pinnata*	1–11	–
	buckwheat	ERIOG	*Eriogonum*	0–9	–
	prickly Russian thistle	SATR12	*Salsola tragus*	0–6	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–3	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–2	–
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	0–2	–
Tree					

4	**Tree**			0–22	
	Utah juniper	JUOS	*Juniperus osteosperma*	0–22	–
	twoneedle pinyon	PIED	*Pinus edulis*	0–22	–

Animal community

Wildlife Interpretation
Water scarcity and lack of cover limit the species richness and abundance of large mammals on this site; however small herds of mule deer and pronghorn antelope may graze/browse on these sites, especially when near water sources and in the winter. The hot climate and lack of water favors small mammals, which have an easier time finding shelter, food, and water to live. Many species of rats, mice, squirrels, bats, and chipmunks can be observed, along with coyotes and foxes. Lizards are the most visible and can be observed during the day. Species may include the northern whiptail, desert spiny, and the colorful western collard lizard. (NPS.gov, 2008)

--Livestock and Wildlife Grazing--

This site provides fair/poor grazing conditions for livestock and wildlife due to sparse vegetative cover. This site also 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 shallow soils. This site may occur in mule deer 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 shrubs, with majority canopy cover being made up by Torrey jointfir and green mormontea. These shrubs are important winter browse for cattle, sheep, mule deer, and domestic goats due to its ability to extend above snow cover. Sub-dominant shrubs include cliffrose and broom snakeweed, which provide winter browse for cattle, sheep, goats, mule deer, and elk. Grasses include Indian ricegrass, galleta, and bottlebrush squirreltail. These grasses provide good spring and fall grazing conditions for horses, cattle, sheep and elk. The presence of Utah juniper provides good cover for livestock and wildlife; mule deer, and goats may utilize this tree as forage. Forb composition and annual production depends primarily on precipitation amounts and thus is challenging to use in livestock grazing management decisions. However, forb composition should be monitored for species diversity, as well as poisonous or injurious plant communities which may be detrimental to livestock if grazed. Before making specific grazing management recommendations, an onsite evaluation must be made.

Hydrological functions

The hydrologic group for Retsabal is D. The hydrologic group for Lemrac in mapunit 5010 is B and mapunit 5170 is C. Hydrologic groups are used in equations that estimate runoff from rainfall. These estimates are needed for solving hydrologic problems that arise in planning watershed-protection and flood-prevention projects and for designing structures for the use, control and disposal of water. Heavy grazing can alter the hydrology by decreasing plant cover and increasing bare ground. Fire can also affect hydrology, but it is variable. Fire intensity, fuel type, soil, climate, and topography can each have different influences. Fires can increase areas of bare ground and hydrophobic layers that reduce infiltration and increase runoff. (National Range and Pasture Handbook, 2003)

Recreational uses

Recreational uses are hiking, hunting, and aesthetics.

Wood products

Wood products are firewood and fenceposts when junipers are present.

Other information

--Poisonous/Toxic Plant Communities--

Toxic plants associated with this site include broom snakeweed and prince’s plume. Broom snakeweed contains

steroids, terpenoids, saponins, and flavones that can cause abortions or reproductive failure in sheep and cattle, however cattle are most susceptible. These toxins are most abundant during active growth and leafing stage. Cattle and sheep will generally only graze broom snakeweed when other forage is unavailable, typically in winter when toxicity levels are at their lowest. Prince's plume accumulates selenium; however is relatively unpalatable to livestock and thus is rarely consumed. The presence of prince's plume is an indicator of selenium rich soils, which may cause other more palatable forages to accumulate selenium and become detrimental to livestock.

Due to the possible increased soil selenium content that may be associated with this site other plants which may be toxic include four-wing saltbush and some buckwheat species. These plants accumulate selenium, but only when growing on selenium enriched soils. When consumed selenium enriched plants 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.

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 Torrey jointfir's and green mormontea's slow growth rate it does not compete well with invading plants after a disturbance and thus restoration efforts could be hindered.

--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.

Fires on Torrey jointfir and green mormontea ecological sites are relatively uncommon due to sparse vegetation and insufficient fuels. Its fire regime depends on the adjacent plant communities and has been to have a wide range of return intervals. This plant generally sprouts from the roots or woody rood crown after a fire, but also has the capability of reestablishing through seed. While it establishes quickly after fire, its slow growth rate inhibits vigorous competition with invading annuals, which could change the fire regime due to an increase in fine fuels.

Inventory data references

This model was developed using range data collected over the last 30 years in MLRA D35 in southeastern Utah. Both ocular and measured data was collected and utilized.

Type locality

Location 1: Grand County, UT	
UTM zone	N
UTM northing	4290804
UTM easting	619842
General legal description	Arches National Park

Other references

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Contributors

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Rangeland health reference sheet

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

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Date	10/23/2008

Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Foliar Cover

Indicators

1. **Number and extent of rills:** A. On more gentle slopes (< 10 %): Very few typically occur on the site. B. On steeper slopes (> 10 %): Rills are common and occur throughout the site. Rills commonly extend down entire slope. Rills are not active, but they seem to be persistent.

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2. **Presence of water flow patterns:** Frequent and occur throughout the area. They are expected to be slightly sinuous (wind around well formed crust and perennial plant bases), > 15 feet long, <1 foot wide, and not widely spaced (6-12 feet) and connected into drainage networks. Evidence of flow will increase with slope.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals form at the base of some plants that occur on the edge of rills and water flow patterns. On steeper slopes (>10%), gullies may remove soil from the base of shrubs exposing roots that resemble pedestals. Terracettes are not present.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 30-40%. Soil surface usually has no surface rock, but a few soils may have up to 5 percent mainly gravels gypsiferous materials. Ground cover is based on first raindrop impact, and bare ground is the opposite of ground cover. Ground cover + bare ground = 100%. 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:** Common. This site appears as a gullied landscape. On slopes and areas below adjacent exposed bedrock, gullies may be more numerous. Length often extends the entire slope until it reaches an area where water and sediment accumulate. Gullies typically appear active, but the shoulders are muted (truncated) and have perennial vegetation establishing on them. Gully bottoms are typically active and flow during most rainfall events.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None. While there may be some evidence of wind generated soil movement, wind caused blowouts would not be expected. Rare depositional areas may exist.

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7. **Amount of litter movement (describe size and distance expected to travel):** On gentle slopes (< 10 %) most litter accumulates at base of plants moved by wind or water. Some down slope redistribution caused by water. Some litter removal may occur in flow patterns or rills with deposition occurring at points of obstruction, especially following major storm events. Litter movement will increase with slopes > 10%.

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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 a soil stability rating of 4 to 5 under plant canopies and biological soil crusts and a rating of 3 in the interspaces using the soil stability kit test. The average should be a 4. Surface texture is fine sandy loam to

channery loam. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface horizon is .5 to 1 inches deep. Structure is strong to moderate thin platy. Color is brown (7.5YR5/4-6). It is important if you are sampling to observe the A horizon under plant canopies as well as the interspaces. 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:** Distribution of vascular plants are expected to intercept raindrops reducing splash erosion but not eliminating it. Plants are usually distributed in sufficient density to slow runoff allowing time for some infiltration. With the geomorphic location of the site being on gently sloping fans, benches, alluvial fans, upland valley plains and hillsides infiltration is somewhat reduced by slope and less plant cover. Natural erosion would be expected in severe thunder storms or heavy spring runoff. When perennial grasses and shrubs 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 associated structure is weak to moderate thin platy in the shallow A horizon with weak medium and fine subangular blocky structure and veins and streaks of gypsum in the B and C horizons. 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: non-sprouting shrubs (Cliffrose, Broom snakeweed, Desert holly, Crispleaf buckwheat) >= Sprouting shrubs (Torrey mormontea) > Biological soil crusts = perennial bunch grasses (Indian ricegrass, Galleta) > Trees (Utah juniper > Pinyon)

    Sub-dominant: perennial and native annual forbs (Brenda’s yellow cryptantha)

    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. Siberian Wheatgrass, Forage kochia etc.). Forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

    Additional: Temporal variability is caused by droughts, insects and other pathogens, large precipitation events, etc. and spatial variability is caused by adjacency to other sites that produce runoff, and topography.

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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 above average precipitation, there should be very little recent plant mortality and decadence in either the shrubs or grasses. During severe (multi year) drought, up to 20% of the Torrey mormontea stems will die. Some mortality of perennial grass and other shrubs may also occur during severe droughts. There may be partial mortality of individual grasses and 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 1/16” under canopies.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 300-400 #/acre on an average year

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

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