USDA Natural Resources
Conservation Service

Ecological site R035XY317UT
Upland Steep Stony Loam (Utah Juniper-Pinyon)

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.

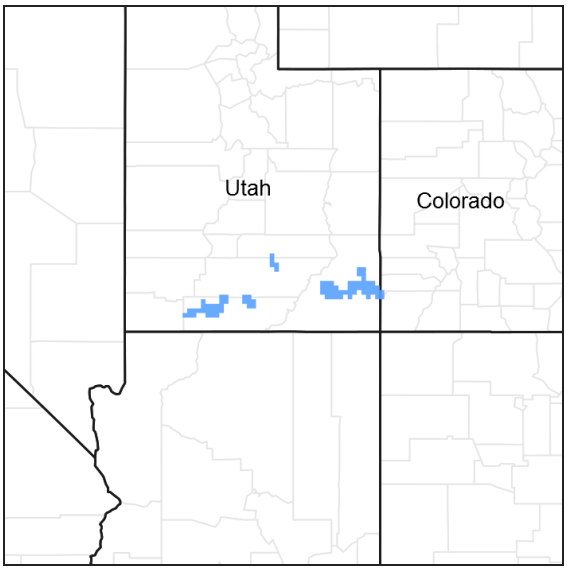

Figure 1. Mapped extent

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: This site occurs in the upland zone of the Colorado and Green River Plateaus Region (MLRA 35) in Southern Utah. It is found at elevations between 5500 and 8000 feet on 20-50% slopes, particularly on mountainsides, hillsides and canyon sideslopes. Average annual precipitation is 12 to 16 inches, with much of the summer precipitation occuring as convective thunderstorms from July through October. The soils are typically deep and loamy with rock fragments making up greater than 50% of the soil volume throughout the profile. They formed in colluvium and alluvium derived from sandstone. The soil moisture regime is aridic ustic and the soil temperature regime is mesic. Two-needle pinyon is the dominant plant, and Utah juniper is also abundant. Birchleaf mountainmahogany and other similar shrubs make up a significant portion of the understory. This site rarely burned under natural conditions. Non-native species have not yet been documented on this site.

Classification relationships

Modal Soil: Strych — loamy-skeletal, mixed, mesic Ustollic Calciorthids

Associated sites

R035XY018UT	**Talus Slope (Blackbrush-Shadscale)**

R035XY302UT	**Upland Dissected Slope (Twoneedle Pinyon-Utah Juniper)**
R035XY328UT	**Upland Very Steep Stony Loam (Pinyon-Utah Juniper)**

Similar sites

R035XY325UT	**Upland Very Steep Shallow Loam (Pinyon-Utah Juniper)** This site occurs on soils less than 20 inches deep, and on slopes steeper than 50%. It has similar soil textures and plant community composition.

Table 1. Dominant plant species

Tree	(1) *Pinus edulis* (2) *Juniperus osteosperma*
Shrub	(1) *Cercocarpus montanus*
Herbaceous	Not specified

Physiographic features

This site occurs on hillslopes, mountain slopes, and canyon sideslopes at elevations between 5500 and 8000 feet. Slopes typically range from 20-50%.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Structural bench (3) Canyon
Flooding frequency	None
Ponding frequency	None
Elevation	1,585–2,286 m
Slope	20–50%

Climatic features

The climate of this site is characterized by warm summers and cold winters. Average annual precipitation ranges from 12-16 inches. June is typically the driest month during the growing season. Much of the moisture occurs as convective thunderstorms from July through October. Large fluctuations in daily temperature are common, and precipitation varies greatly from month to month and from year to year.

Table 3. Representative climatic features

Frost-free period (average)	149 days
Freeze-free period (average)	173 days
Precipitation total (average)	406 mm

Influencing water features

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

Soil features

The soils are typically deep and loamy with rock fragments making up greater than 50% of the soil volume throughout the profile. Rock fragments are often less abundant on the soil surface. These soils formed in colluvium and alluvium derived from sandstone and shale. Textures of the fine fraction range from loams to loamy sands, and

rock fragment sizes range from gravels to boulders. These soils are well drained with moderately rapid permeability. Available water-holding capacity ranges from 1.9 to 3.0 inches of water in the upper 40 inches of soil. The soil moisture regime is aridic ustic and the soil temperature regime is mesic.

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

UT629 - Loa Marysvale - Bamac, Tonalea;
UT638 - San Juan County - Strych;
UT642 - Kane County - Quezcan family;
UT685 - Capitol Reef - Plumasano, Suzmayne;
UT686 - Escalante Grand Staircase - Yante, Aridic Ustorthents;

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale
Surface texture	(1) Extremely bouldery fine sandy loam (2) Very bouldery loam (3) Gravelly loamy sand
Drainage class	Well drained
Permeability class	Moderately rapid
Soil depth	102 cm
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	10–25%
Available water capacity (0-101.6cm)	4.83–7.62 cm
Calcium carbonate equivalent (0-101.6cm)	5–15%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	20–25%
Subsurface fragment volume >3" (Depth not specified)	25–50%

Ecological dynamics

This site developed under Colorado Plateau climatic conditions and included natural influences of herbivory, and climate; however due to the remote location, broken topography, steep slopes (20-50%), and lack of perennial water sources this area rarely served as habitat for large herds of native herbivores. This site’s plant species composition is generally dominated by twoneedle pinyon and Utah juniper, with birchleaf mountain mahogany or similar shrubs abundant in the understory.

There is no evidence to indicate that this site historically maintained a short burn frequency. Until further research indicates that fire played a role in the ecosystem processes of this site, the state and transition model will not include fire as a disturbance mechanism in the reference state. However, due to modern disturbances such as brush treatments, invasive species, and OHV use, the resilience of the plant communities may be at risk. Disturbances that reduce the presence of perennial grasses result in an opportunity for invasive annuals to enter into the system. However, to this point invasive species have not been documented on this site.

Drought and insects appear to be the main driving factors in many of the Pinyon/Juniper communities of Utah.

Betancourt et al. (1993), noted that Pinyon and Juniper woodlands in the southwest appear to be more susceptible to large die offs during droughts, than in other locations. As severe droughts persist, the Pinyon trees, being more susceptible to drought and insects, seem to die out, while the Utah juniper trees survive. Large die offs of pinyons due to insects and drought have not been recorded for this ecological site. However, given the tendency for pinions to be susceptible to insect and drought kill, managers should be aware of the possibility.

As vegetation communities respond to changes in management or natural occurrences, thresholds can be crossed, which usually means that a return to the previous state may not be possible without major energy inputs. The amount of energy input needed to affect vegetative shifts depends on the present biotic and abiotic features and the desired results. The following diagram does not necessarily depict all the transition and states that this site may exhibit, but it does show some of the most common plant communities that can occur on the site and the transition pathways among the 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 will be revised or removed, and new ones may be added. None of these plant communities should necessarily be thought of as the "desired plant community. The main purpose for including any description of a plant community here is to capture the current knowledge and experience at the time of this revision.

State and transition model

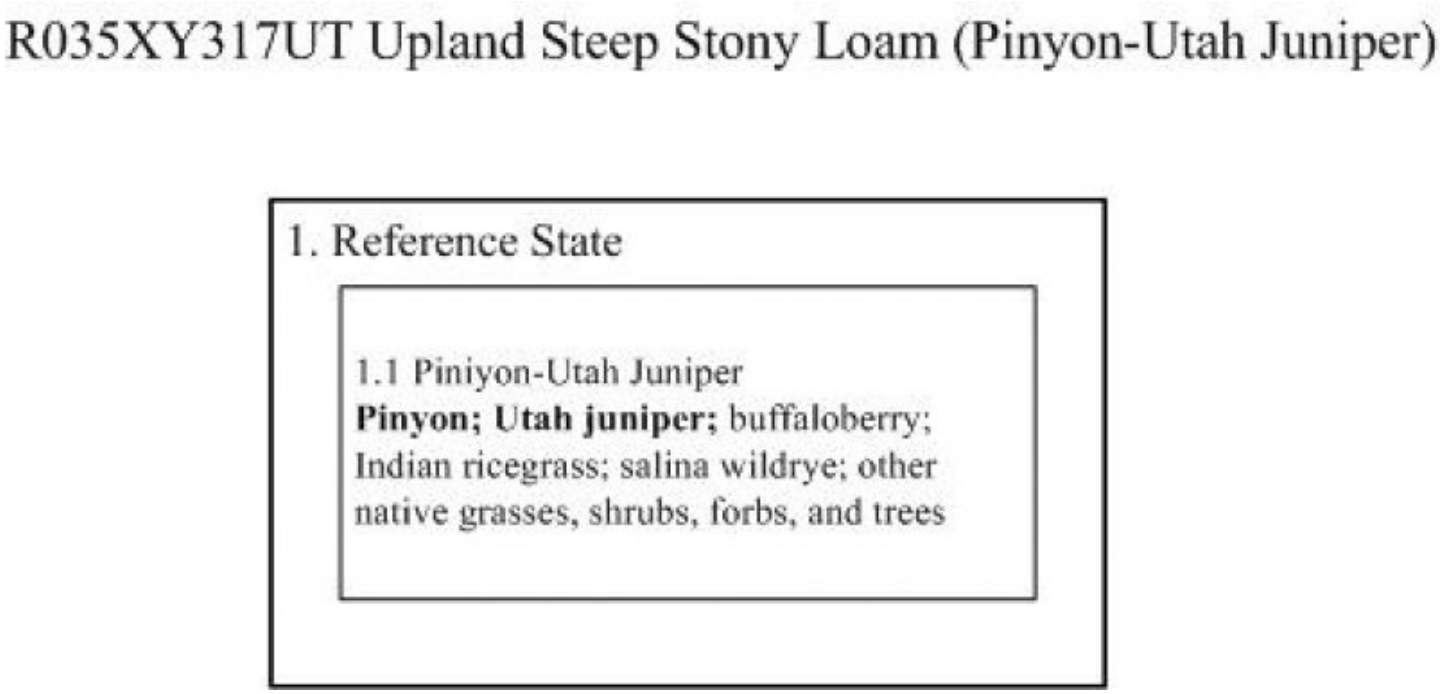

Figure 4. State-and-Transition Model

State 1
Reference State

This state represents the natural range of variability that historically dominated the dynamics of this ecological site. This state includes the biotic communities that would be expressed on the ecological site if all successional sequences were completed without modern disturbances under the present environmental conditions; natural disturbances are inherent in its development. This state is dominated by two-needle pinyon and Utah juniper with a diverse understory of shrubs, perennial grasses and forbs. The primary disturbance mechanisms for this site in the reference condition include drought and insects. Reference State: Two-needle pinyon and Utah juniper woodland Indicators: A community dominated by twoneedle pinyon and Utah juniper, where shrubs, and native perennial grasses and forb production is variable. Feedbacks: Disturbances that may allow for the establishment of invasive species.

Community 1.1
Reference State

R035XY317UT—Upland Steep Stony Loam (Pinyon-Juniper). Community Phase 1.1—Reference State. Cover

Figure 5. Phase 1.1

This plant community phase is characterized by an overstory canopy of two-needle pinyon and Utah juniper, with a shrub and perennial grass understory. Shrubs commonly seen include birchleaf and littleleaf mountainmahogany, buffaloberry and Mormon tea. Grasses that typically inhabit this site include Indian ricegrass and Salina wildrye. Forb composition is variable. Other grasses and shrubs are present; however, species composition varies from one site to the next.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	112	168	224
Shrub/Vine	56	112	168
Grass/Grasslike	28	84	140
Forb	6	17	28
Total	**202**	**381**	**560**

Table 6. Ground cover

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

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-2%	0-2%	0-5%
>0.15 <= 0.3	–	0-5%	2-5%	0-5%
>0.3 <= 0.6	–	2-5%	2-5%	0-5%
>0.6 <= 1.4	0-2%	5-15%	0-2%	–
>1.4 <= 4	10-20%	0-2%	–	–
>4 <= 12	0-5%	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0	**Trees**			112–224	
	twoneedle pinyon	PIED	*Pinus edulis*	84–168	5–10
	Utah juniper	JUOS	*Juniperus osteosperma*	56–112	4–8
Shrub/Vine					
0	**Dominant Shrubs**			39–112	
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	28–84	2–5
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	17–50	1–3
	Utah serviceberry	AMUT	*Amelanchier utahensis*	0–50	0–3
	mormon tea	EPVI	*Ephedra viridis*	6–34	1–2
3	**Sub-Dominant Shrubs**			17–56	
	Gambel oak	QUGA	*Quercus gambelii*	0–45	0–3
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–39	0–3
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–22	0–2
	littleleaf mountain mahogany	CEIN7	*Cercocarpus intricatus*	0–22	0–2
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–22	0–2
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	0–17	0–1
	skunkbush sumac	RHTRT	*Rhus trilobata var. trilobata*	0–11	0–10
	antelope bitterbrush	PUTR2	*Purshia tridentata*	0–11	0–1
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–11	0–1
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–11	0–1
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–11	0–1
Grass/Grasslike					
1	**Grass**			28–140	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	11–56	1–4
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	6–56	1–3

	James' galleta	PLJA	*Pleuraphis jamesii*	6–45	1–3
	blue grama	BOGR2	*Bouteloua gracilis*	6–45	1–3
	Grass, perennial	2GP	*Grass, perennial*	0–34	0–2
	Grass, annual	2GA	*Grass, annual*	0–22	0–2
	Sandberg bluegrass	POSE	*Poa secunda*	0–17	0–1
	Geyer's sedge	CAGE2	*Carex geyeri*	0–17	0–1
	needle and thread	HECO26	*Hesperostipa comata*	0–17	0–1
Forb					
2	**Forbs**			6–28	
	Forb, perennial	2FP	*Forb, perennial*	0–28	0–2
	Forb, annual	2FA	*Forb, annual*	0–22	0–2
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–11	0–1
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–11	0–1
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–6	0–1
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–6	0–1
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–6	0–1
	rayless tansyaster	MAGR2	*Machaeranthera grindelioides*	0–6	0–1
	lobeleaf groundsel	PAMU11	*Packera multilobata*	0–6	0–1
	Utah penstemon	PEUT	*Penstemon utahensis*	0–6	0–1
	stemless mock goldenweed	STAC	*Stenotus acaulis*	0–6	0–1

Animal community

--Livestock and Wildlife Grazing--

Due to the steep slopes associated with this site, livestock grazing is not a factor. This site provides good grazing conditions for wildlife due to availability of nutritious forage. This site often lacks natural perennial water sources, which can influence the suitability for wildlife grazing. Mule deer, desert bighorn sheep, and elk may utilize this site, though in many places the populations will be small and have little grazing impact.

The plant community is primarily grasses, including Salina wildrye, Indian ricegrass, and galleta, which provides desirable grazing conditions for all classes of wildlife. Shrubs include roundleaf buffaloberry, and mormontea, which provide browse for elk, mule deer, and bighorn sheep. Utah juniper and pinyon pine provide good cover for wildlife and may be utilized as forage for mule deer. Forb composition and annual production depends primarily on precipitation amounts and thus is challenging to use in grazing management decisions. Before making specific grazing management recommendations, an onsite evaluation must be made.

--References--

Relative Forage Preference of Plants for Grazing Use by Season: Plants commonly found in Major Land Resource Area D35 --The Colorado Plateau. 2007

Stubbendieck, J., S. L. Hatch, and C. H. Butterfield. 1997. North American range plants. Lincoln, NE: University of Nebraska Press. 501p.

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.

Hydrological functions

The soil is in hydrologic group b. The runoff curve numbers are 61 to 79 depending on the overall watershed condition.

Recreational uses

This site has a few plant species blooming throughout spring, summer, and fall.

Wood products

Posts and firewood

Other information

--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. On well developed Utah juniper and pinyon pine communities soils are complete occupied by lateral roots, which inhibit an herbaceous understory as well as annual invasions. However once these sites are disturbed and pinyon-juniper communities begin to decline invasion is possible.

--Fire Ecology--

The ability for an ecological site to carry fire depends primarily on the present fuel load and plant moisture content—sites with small fuel loads will burn more slowly and less intensely than sites with large fuel loads. Many 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 pinyon and Utah juniper communities in the Colorado Plateau on shallow soils are unique. These sites have a natural occurring fire regime, but this is not understood very well due to the difficulty in reconstructing fire histories in these ecosystems. The difficulty results from a lack of living fire-scarred trees in this area. These trees can support stand-replacing fires, though historically, fires were likely a mixture of surface and crown fires with intensities and frequencies dependent on site productivity. Most research agrees that historic fire return intervals are at a minimum 100 years, indicating that fire may have not played an important role in community dynamics. Fires are more common when trees are stressed or dead due to drought and/or beetle infestations. Pinyon-juniper stands reestablish either by seeds dispersed from adjacent unburned patches or by unburned seeds found at the burn site. Continuous (every 20-40 years) burning of these ecological sites can result in shrub dominated communities, due to the relatively fast recovery of shrubs when compared to trees. If invasive annual grasses are allowed to establish fires may become more frequent, inhibiting the site’s ability to recover.

--References--

Knight, A. P. and R. G. Walter. 2001. A guide to plant poisoning of animals in North America. Jackson, WY: Teton NewMedia. 367p.

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

Knight, A. P. and R. G. Walter. 2001. A guide to plant poisoning of animals in North America. Jackson, WY: Teton NewMedia. 367p.

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.

Contributors

George Cook

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	01/30/2007
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Common. Occur throughout the site. Rills may extend down entire slope.

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2. **Presence of water flow patterns:** Frequent and occur throughout area. Flow patterns wind between the surface rocks.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals form at the base of plants that occur on the edge of rills and gullies. Gullies may remove soil from the base of trees exposing roots that resemble pedestals. Interspaces between well developed biological soil crusts resemble pedestals and may be up to 2 inches high. Terracettes are present. Debris dams of small to medium sized litter (up to 2 inches in diameter) may form in water flow patterns, rills, and gullies. These debris dams may accumulate smaller litter (leaves, grass and forb stems).

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 10 – 20 %. Most bare ground is associated with water flow patterns, rills, and gullies. Soil is covered by 25-50% rock fragments. Areas with well developed biological soil crusts should not be counted 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. Ground cover is based on first raindrop impact, and bare ground is the opposite of ground cover.

5. **Number of gullies and erosion associated with gullies:** Gullies may be present. Length often extends from exposed bedrock until gully reaches a stream or an area where water and sediment accumulate, but they may be wide and shallow and armored with very large rocks. Gullies may remove soil from base of trees exposing roots.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None to very few. Trees break the wind and reduce the potential for wind erosion.

7. **Amount of litter movement (describe size and distance expected to travel):** Fine litter is moved with even moderate precipitation events and spring runoff, accumulating down slope behind plants and rock features in the site. Woody stems may be washed from site. Gullies may remove accumulated litter from under trees.

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 or 5 under the plant canopies, and a rating of 2 to 4 in the interspaces. The average should be a 3 or 4. Surface texture is stony fine sandy loam. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is typically 1 inch deep. Structure is typically weak thin platy. Color is typically yellowish brown (10YR5/4). There is little if any difference under canopy or in interspaces and a recognizable A horizon is expected to be present throughout. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Spatial distribution of plants and/or well developed biological soil crusts (where present) intercept raindrops reducing splash erosion and provide areas of surface detention to store water allowing additional time for infiltration. Crowns of trees and accumulating litter at base of trees appear to create a micro-topography that may enhance development of water flow patterns below the drip line of the canopy. Significant increases in Pinyon-juniper canopy (beyond the reference state) reduces understory vegetation causing an associated increase in runoff.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. There may be layers of calcium carbonate or other naturally occurring hard layers found in the soil subsurface. These should not be considered to be compaction layers.

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

    Dominant: Perennial bunchgrasses > Trees (Juniper>Pinion) > Non-sprouting shrubs

    Sub-dominant: sprouting shrubs > Forbs

    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, etc.) Biological soil crust is variable in it's expression where present on this site and is measured as a component of ground cover.

Additional: Disturbance regime includes parasites, insects, drought, and very infrequent fire. Following a recent disturbance such as fire, drought, or insects that removes 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 may reflect a functional community phase within the reference state.
Dominants— Salina Wildrye, Utah Juniper, Pinyon Pine, Utah serviceberry. Sub Dominants— Indian ricegrass, Galleta, forbs. Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Community is made up of young, mid, and old aged juniper and pinyon trees. Several standing dead trees may be present on the site and approximately 20 % of the trees can show evidence of decadence. All age classes of perennial grasses should be present under average growing condition with a decrease in age class expression under below average conditions, or on sites with high (usually greater than 65%) similarity index (late seral to historic climax). In drought tree mortality may increase with the first sign being a yellowish to reddish leaf color.

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 500-550

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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 and introduced annual forbs are likely to invade this site.

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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.
