USDA Natural Resources Conservation Service

Ecological site R036XC302UT
Upland Dissected Slope (pinyon-Utah juniper)

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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.

Classification relationships

Semiarid Benchlands and Canyonlands Ecoregion (Woods, et. al, 2001)
Intermountain Semidesert and Desert Province, 341 (Bailey, 1995)

Associated sites

R036XY306UT	**Upland Loam (big sagebrush)**
R036XY307UT	**Upland Loam (pinyon-Utah juniper)**

Similar sites

R035XY302UT	**Upland Dissected Slope (Twoneedle Pinyon-Utah Juniper)** This site is similar to the dissected slope site in MLRA 36, however it is located in MLRA 35.

Table 1. Dominant plant species

Tree	(1) *Pinus edulis* (2) *Juniperus osteosperma*
Shrub	(1) *Shepherdia rotundifolia*
Herbaceous	Not specified

Physiographic features

This site most commonly occurs on mesa edges and structural benches, but may also

occur on cuestas, plateaus, hills, and ridges. Run-off is variable, and is greatly influenced by micro-topography. This site has low to medium runoff on slopes less than 12 percent and very rapid runoff on slopes greater than 12 percent. Typically slopes range from 2-40%; however sites can occur on slopes with up to 55% slope.

Table 2. Representative physiographic features

Landforms	(1) Mesa (2) Structural bench (3) Cuesta
Flooding frequency	None
Ponding frequency	None
Elevation	5,500–7,500 ft
Slope	10–40%
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by warm summers, cool winters. The climate is modified by local topographic conditions, such as aspect. Mean annual high temperatures range from 62-65 degrees Fahrenheit and mean annual low temperatures range from 35-40 degrees Fahrenheit. Much of the rainfall occurs as convective storms in late summer and early fall; about 20-30% percent of the total precipitation fall in July and August. Snow packs are generally light and not persistent, about 15 to 20 percent of the total precipitation falls as snow. May and June are typically the driest months, with average annual precipitation ranging from 12-14 inches.

Table 3. Representative climatic features

Frost-free period (average)	175 days
Freeze-free period (average)	178 days
Precipitation total (average)	14 in

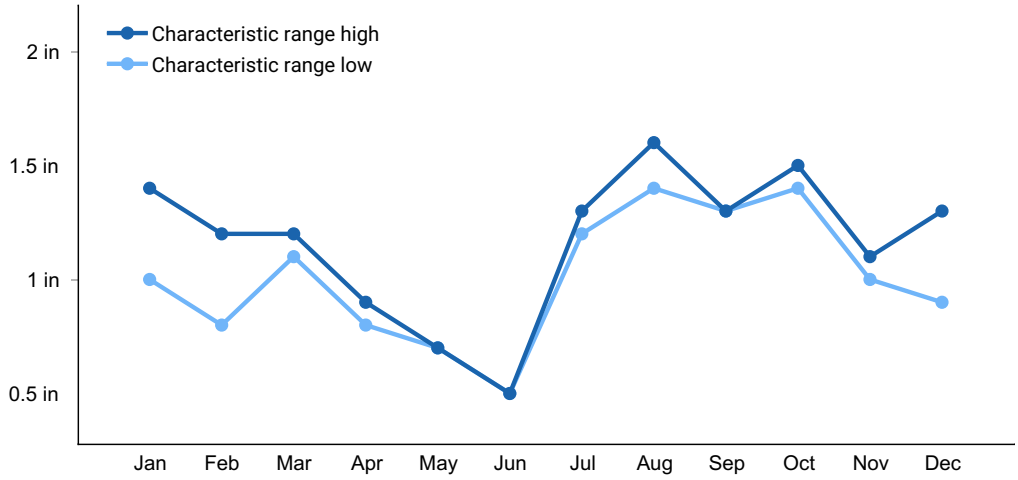


Figure 1. Monthly precipitation range

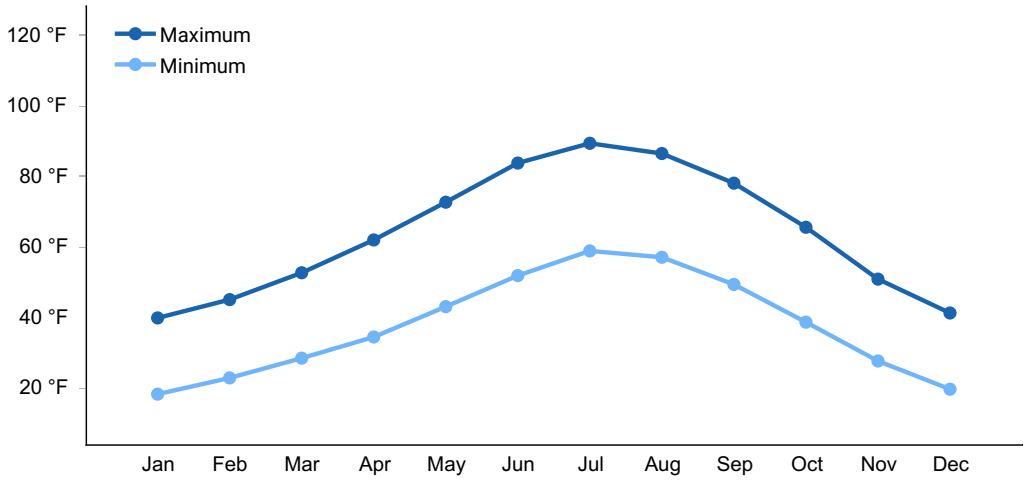


Figure 2. Monthly average minimum and maximum temperature

Influencing water features

There are no influencing water features.

Soil features

This site is characterized by dissected slopes. The soils are deep to very deep and well drained. Typically the surface layer is a dark yellowish brown sandy loam and the subsurface is a brown to light reddish brown sandy loam to sandy clay loam. These soils are well developed with moderately high water holding capacities. Surface fragments range from 0 to 5% and are described as gravels. Average annual soil loss in potential is approximately 0.5 to 2.0 tons/acre. This site has been used in the following soil surveys and has been correlated to the following components:

UT638—Natural Bridges National Monument, UT – Plumasano and Plumasano Family

Typical Soil Profile:
A—0-2 inches; dark yellowish brown; sandy loam; week fine granular; slightly alkaline (pH

7.6)
Bw—2-11 inches; brown; sandy loam; weak medium subangular blocky; slightly alkaline (pH 7.6)
Bk1—11-27 inches; light brown; sandy loam; massive; slightly alkaline (pH 7.6)
Bk2—27-43 inches; strong brown; fine sandy loam; massive; slightly alkaline (pH 7.4)
Bk3—43-53 inches; light reddish brown; fine sandy loam; massive; slightly alkaline (pH 7.8)
Bk4—53-65 inches; light brown; sandy clay loam; massive; slightly alkaline (pH 7.6)

The combined thickness of the Bk horizons in 36 to 60 inches. This soil may at times have a C horizon.

Table 4. Representative soil features

Surface texture	(1) Fine sandy loam (2) Sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderate to moderately rapid
Soil depth	40–60 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	6–7 in
Calcium carbonate equivalent (0-40in)	10–15%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	6–8
Soil reaction (1:1 water) (0-40in)	7.5–8
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site developed under Colorado Plateau climatic conditions and included natural influences of herbivory, rarely fire, and climate; however due to the remote location,

broken topography, and lack of perennial water sources this area rarely served as habitat for herds of native herbivores or large frequent historic fires. This ecological site occurs on the deep to very deep, well developed soils found dissected slopes on mesa edges, and structural benches in Major Land Resource Area (MLRA) 36—Southwestern Plateaus, Mesas, and Foothills. The precipitation and climate of MLRA 36 are conducive to producing Pinyon/juniper, sagebrush, and grassland complexes.

Pinyon and Juniper communities throughout the West have received a lot of attention because many areas have experienced increases in the spatial extent and density of trees (Miller and Wigand, 1994). In MLRA 36, the woodland expansion began during the late 1800s (Tausch et al., 1981). The causes of woodland expansion are being studied, and are often attributed to an increase in the fire return interval, introduction of livestock grazing, shifts in climate, and increases in atmospheric CO2 (Miller and Rose, 1999). The natural disturbance regime on soils historically dominated by Pinyon and Utah juniper in the Colorado Plateau area is unique and little is understood (Miller and Tausch, 2001; Floyd et al., 2004). Historic fire return intervals are long, possibly indicating that fire did not play a frequent role in community dynamics.

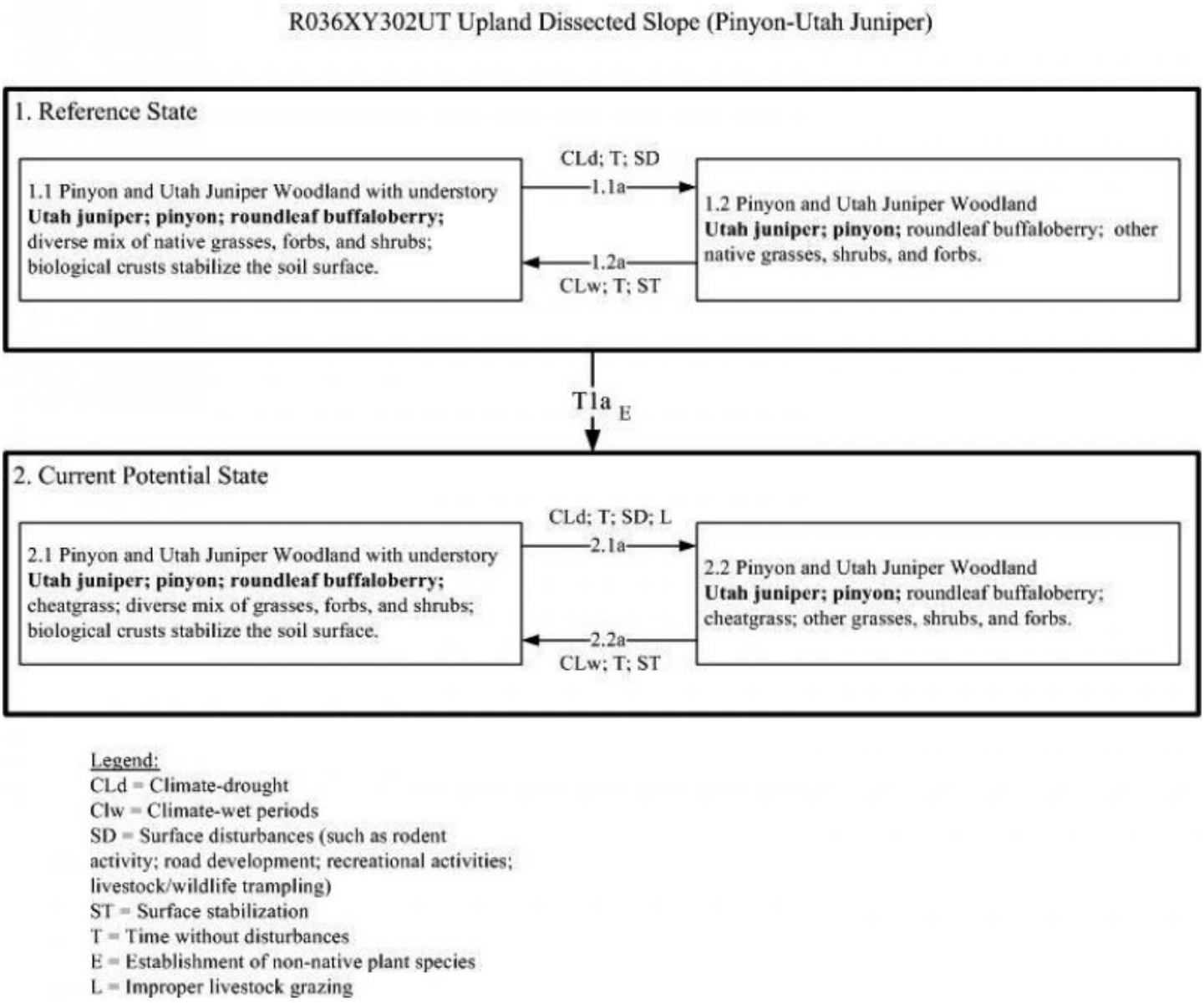
Drought and natural surface disturbances appear to be the main driving factors in this ecological site. Bentancourt (1993), noted that Pinyon and juniper woodlands in the southwest appear to be more susceptible to large die offs during droughts, than in other locations. As severe droughts persist, the Pinyon trees, being more susceptible to drought and insects, seem to die out, while the Utah juniper trees survive. This action could open the canopy for a few years and with sufficient moisture, grasses and forbs would be expected to respond favorably.

The communities of mature Pinyon and juniper are stable, but fragile. Disturbances such as improper grazing (continuous season long grazing, heavy stocking rates, etc.), recreation activities, etc., can remove herbaceous vegetation and compact the soils. The unpredictability of the annual growing conditions and surface instability make these communities susceptible to the loss of understory and the resulting accelerated erosion. This ecological site has been grazed by domestic livestock since they were introduced into the area, though grazing has been light due to the lack of water and difficult terrain. The introduction of domestic livestock and the use of fencing and reliable water sources have influenced the disturbance regime of this site. As of this date, invasive annual grasslands that are so common in the Great Basin after a severe disturbance are not as prevalent on this ecological site in MLRA 36, potentially due to the remote location, the climate, and/or the soils.

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



Legend:
CLd = Climate-drought
Clw = Climate-wet periods
SD = Surface disturbances (such as rodent activity; road development; recreational activities; livestock/wildlife trampling)
ST = Surface stabilization
T = Time without disturbances
E = Establishment of non-native plant species
L = Improper livestock grazing

State 1
Reference

The Reference State has been determined by study of rangeland relic areas, areas protected from excessive disturbance, and areas under influences such as grazing and recreational uses. Through literature review, historical accounts and observations of trends in plant community dynamics under a variety of uses have been considered. Community

phases, community pathways, states, transitions, thresholds, and restoration pathways have been determined through similar studies and experience. 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 have been expressed on the ecological site if all successional sequences were completed without interferences by man under the present environmental conditions; natural disturbances are inherent in its development. It was in a natural dynamic equilibrium with the historic biotic, abiotic, climatic factors at the time of European immigration and settlement. The dominant aspect of this site is Pinyon and Utah juniper with an understory of roundleaf buffaloberry and associated grasses. Fluctuations in species compositions and relative production may change from year to year dependant upon abnormal precipitation or other climatic factors. The primary disturbance mechanisms for this site in reference condition include drought, and natural surface disturbances. Reference state: Community phases maintained by climate fluctuations, natural surface disturbances, and time. Indicators: A well developed understory co-existing with a canopy of older Pinyon and Utah juniper. Feedbacks: Infrequent, but regular droughts to reduce tree cover and allow for a productive herbaceous understory. The loss of native herbaceous understory species that results in opportunities for erosion. At-risk Community Phase: All communities are at risk when native plants in the understory are stressed, and nutrients become available for non-natives to establish. Trigger: Decrease of native plants in the understory and the introduction of non-native plants to fill the available niches.

Community 1.1
Pinyon and Utah Juniper Woodland with Understory

This plant community phase is characterized by and Pinyon and Utah juniper woodland, where roundleaf buffaloberry and other native shrubs, grasses, and forbs are present in the understory. In this phase diverse communities of biological crusts stabilize the dissected slopes and soil surface. Grasses present typically include Indian ricegrass and Bottlebrush squirreltail. Forbs typically present include Lobeleaf groundsel, Winged buckwheat, and Cryptantha species. Other grasses, shrubs, and forbs may or may not be present, and cover and production are variable. Bare ground (2-8% foliar cover) is fairly uncommon in this community phase, while biological crusts (40-60% foliar cover) are very common and diverse.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	75	140	200
Tree	90	120	200
Forb	35	75	100
Grass/Grasslike	25	75	100
Total	**225**	**410**	**600**

Table 6. Ground cover

Tree foliar cover	10-25%
Shrub/vine/liana foliar cover	10-25%
Grass/grasslike foliar cover	10-20%
Forb foliar cover	5-15%
Non-vascular plants	0%
Biological crusts	40-60%
Litter	3-10%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	2-8%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	0-5%
>0.5 <= 1	–	5-10%	5-10%	5-10%
>1 <= 2	–	10-15%	0-5%	5-10%
>2 <= 4.5	0-5%	5-10%	0-2%	0-5%
>4.5 <= 13	10-15%	–	–	–
>13 <= 40	10-15%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 1.2
Pinyon and Utah Juniper Woodland

This community phase is characterized by a Pinyon and Utah juniper woodland with very little understory. Roundleaf buffaloberry is generally present; however other grasses, shrubs, and forbs are variable in their expression. Biological crust cover (25-45%) has dramatically decreased, while bare ground has increased (25- 50%). The occurrence of Pinyon and Utah juniper may remain similar to community phase 1.1 or cover may have increased slightly. Erosion potential by both wind and water has greatly increased.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Tree	90	120	200
Shrub/Vine	25	50	100
Forb	0	35	75
Grass/Grasslike	0	35	75
Total	**115**	**240**	**450**

Table 9. Ground cover

Tree foliar cover	15-25%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	0-10%
Forb foliar cover	0-15%
Non-vascular plants	0%
Biological crusts	25-45%
Litter	3-10%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	25-50%

Table 10. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	0-5%
>0.5 <= 1	–	5-10%	0-5%	0-10%
>1 <= 2	–	10-15%	0-5%	0-5%
>2 <= 4.5	0-5%	5-10%	0-2%	0-5%
>4.5 <= 13	10-15%	–	–	–
>13 <= 40	10-15%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 1.1A
Community 1.1 to 1.2

This pathway occurs and climate conditions (drought) or surface disturbances causes a decrease in the understory shrub, grass, forb, and biological crust cover and an increase in erosion. Surface disturbances may include increased rodent activity, increased trampling by wildlife, and increased wind and water erosion.

Pathway 1.2A
Community 1.2 to 1.1

This pathway occurs as climate conditions (wet periods) and soil stabilization occurs. This typically is caused by an increase in the shrub, grass, and forb understory as well as an increase in the diversity and cover of biological soil crusts.

State 2
Current Potential

This state is very similar to the reference state, except that non-native grasses and/or forbs are now present in all phases. The current potential state may include naturalized or invasive non-native species. The primary disturbance mechanisms include all those found in the reference state as well as human induced disturbances, including improper domestic livestock grazing and recreation activities, including off highway vehicle (OHV) overuse. Plant communities within the current potential state are more likely managed and used for various purposes by man, without significant alteration in plant community composition or production. In time, continued surface disturbances, will likely stress the native plant species and allow for non-native species to increase. This shift in species composition could affect nutrient cycling, hydrology, and soil stability. At this time there is no known way to effectively remove the non-native plants from this site, once they have

become established. Therefore this site is often irreversibly altered from the reference state. Current Potential state: Community phases influenced by climate, surface disturbances, and domestic livestock grazing. Indicators: A well developed understory co-existing with a canopy of older Pinyon and Utah juniper. Feedbacks: Infrequent, but regular droughts to reduce tree cover and allow for a productive herbaceous understory. The loss of native herbaceous understory species that results in opportunities for erosion.

Community 2.1
Pinyon and Utah Juniper Woodland with Understory

This plant community phase is characterized by and Pinyon and Utah juniper woodland, where roundleaf buffaloberry and other shrubs, grasses, and forbs are present in the understory. In this phase diverse communities of biological crusts stabilize the dissected slopes and soil surface. Grasses present typically include Indian ricegrass, cheatgrass, and bottlebrush squirreltail. Forbs typically present include lobeleaf groundsel, winged buckwheat, and Cryptantha species. Other grasses, shrubs, and forbs may or may not be present, and cover and production are variable. Bare ground (2-8% foliar cover) is fairly uncommon in this community phase, while biological crusts (40-60% foliar cover) are very common and diverse.

Table 11. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	75	140	200
Tree	90	120	200
Forb	35	75	100
Grass/Grasslike	25	75	100
Total	**225**	**410**	**600**

Table 12. Ground cover

Tree foliar cover	10-25%
Shrub/vine/liana foliar cover	10-25%
Grass/grasslike foliar cover	10-20%
Forb foliar cover	5-15%
Non-vascular plants	0%
Biological crusts	40-60%
Litter	3-10%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0%

Bedrock	0%
Water	0%
Bare ground	2-8%

Table 13. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	0-5%
>0.5 <= 1	–	5-10%	5-10%	5-10%
>1 <= 2	–	10-15%	0-5%	5-10%
>2 <= 4.5	0-5%	5-10%	0-2%	0-5%
>4.5 <= 13	10-15%	–	–	–
>13 <= 40	10-15%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Community 2.2
Pinyon and Utah Juniper Woodland

This community phase is characterized by a Pinyon and Utah juniper woodland with very little understory. Roundleaf buffaloberry is generally present; however other grasses, shrubs, and forbs are variable in their expression. Biological crust cover (25-45%) has dramatically decreased, while bare ground has increased (25- 50%). The occurrence of Pinyon and Utah juniper may remain similar to community phase 2.1 or cover may have increased slightly. Erosion potential by both wind and water has greatly increased.

Table 14. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Tree	90	120	200
Shrub/Vine	25	50	100
Forb	0	35	75
Grass/Grasslike	0	35	75
Total	**115**	**240**	**450**

Table 15. Ground cover

Tree foliar cover	15-25%
Shrub/vine/liana foliar cover	5-15%
Grass/grasslike foliar cover	0-10%
Forb foliar cover	0-15%
Non-vascular plants	0%
Biological crusts	25-45%
Litter	3-10%
Surface fragments >0.25" and <=3"	0-5%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	25-50%

Table 16. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	0-5%
>0.5 <= 1	–	5-10%	0-5%	0-10%
>1 <= 2	–	10-15%	0-5%	0-5%
>2 <= 4.5	0-5%	5-10%	0-2%	0-5%
>4.5 <= 13	10-15%	–	–	–
>13 <= 40	10-15%	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 2.1A
Community 2.1 to 2.2

This pathway occurs as climate conditions (drought) or surface disturbances causes a decrease in the understory shrub, grass, forb, and biological crust cover and an increase in erosion. Surface disturbances may include increased rodent activity, increased trampling by wildlife/livestock, recreation activities (OHV use), road development, and increased wind and water erosion.

Pathway 2.2A

Community 2.2 to 2.1

This pathway occurs as climate conditions (wet periods) and soil stabilization occurs. This typically is caused by an increase in the shrub, grass, and forb understory as well as an increase in the diversity and cover of biological soil crusts.

Transition T1A
State 1 to 2

This transition from the native perennial bunchgrass and shrub understory in the reference state to a state that has been invaded by naturalized species such as crested wheatgrass (blown in), cheatgrass, and annual wheatgrass. This transition occurs as natural and/or management actions favor an increase in non-native grasses and forbs, especially annuals. Possible events include the mere presence of invasive species, improper livestock grazing, seeding introduced species nearby, extended droughts, and surface disturbances combined with an available seed source of non-native species.

Additional community tables

Table 17. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			35–70	
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	30–60	–
	mormon tea	EPVI	*Ephedra viridis*	5–10	–
3	**Sub-Dominant Shrubs**			0–75	
	Utah serviceberry	AMUTU	*Amelanchier utahensis var. utahensis*	0–15	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–15	–
	desert snowberry	SYLO	*Symphoricarpos longiflorus*	0–15	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–10	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	0–10	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–10	–
Grass/Grasslike					
0	**Dominant Grasses**			25–50	
	squirreltail	ELEL5	*Elymus elymoides*	15–30	–
	Indian ricegrass	ACHY	*Achnatherum*	10–20	–

	indian ricegrass	ACHY	*Achnatherum hymenoides*	10–20	
1	**Sub-Dominant Grasses**			0–40	
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–10	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	0–10	–
Forb					
0	**Dominant Forbs**			30–45	
	cryptantha	CRYPT	*Cryptantha*	10–15	–
	winged buckwheat	ERAL4	*Eriogonum alatum*	10–15	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	10–15	–
2	**Sub-Dominant Forbs**			0–20	
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	0–10	–
	rock goldenrod	PEPUP	*Petradoria pumila ssp. pumila*	0–10	–
	Utah penstemon	PEUT	*Penstemon utahensis*	0–10	–
	spiny phlox	PHHO	*Phlox hoodii*	0–10	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–10	–
Tree					
4	**Trees**			90–120	
	Utah juniper	JUOS	*Juniperus osteosperma*	50–60	–
	twoneedle pinyon	PIED	*Pinus edulis*	45–60	–

Table 18. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
1	**Dominant Shrubs**			25–50	
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	25–50	–
2	**Sub-Dominant Shrubs**			0–50	
	desert snowberry	SYLO	*Symphoricarpos*	0–10	–

			longiflorus		
	Utah serviceberry	AMUTU	*Amelanchier utahensis var. utahensis*	0–10	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–10	–
	mormon tea	EPVI	*Ephedra viridis*	0–10	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–5	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	0–5	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–5	–
Grass/Grasslike					
3	**Grasses**			0–50	
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–10	–
	squirreltail	ELEL5	*Elymus elymoides*	0–10	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–10	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	0–10	–
Forb					
4	**Forbs**			10–50	
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	cryptantha	CRYPT	*Cryptantha*	0–10	–
	winged buckwheat	ERAL4	*Eriogonum alatum*	0–10	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	0–10	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	0–10	–
	rock goldenrod	PEPUP	*Petradoria pumila ssp. pumila*	0–10	–
	Utah penstemon	PEUT	*Penstemon utahensis*	0–10	–
	spiny phlox	PHHO	*Phlox hoodii*	0–10	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–10	–
Tree					
5	**Shrubs**			90–120	
	Utah juniper	JUOS	*Juniperus osteosperma*	50–60	–

	twoneedle pinyon	PIED	*Pinus edulis*	45–60	–

Table 19. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
1	**Dominant Shrubs**			35–70	
2	**Sub-Dominant Shrubs**			0–75	
	Utah serviceberry	AMUTU	*Amelanchier utahensis var. utahensis*	0–15	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–15	–
	desert snowberry	SYLO	*Symphoricarpos longiflorus*	0–15	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–10	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–10	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	0–10	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–10	–
Grass/Grasslike					
3	**Dominant Grasses**			25–50	
	squirreltail	ELEL5	*Elymus elymoides*	15–30	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	10–20	–
	cheatgrass	BRTE	*Bromus tectorum*	5–10	–
4	**Sub-Dominant Grasses**			0–40	
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–10	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–10	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	0–10	–
Forb					
5	**Dominant Forbs**			10–50	
	cryptantha	CRYPT	*Cryptantha*	10–15	–
	winged buckwheat	ERAL4	*Eriogonum alatum*	10–15	–

	lobeleaf groundsel	PAMU11	*Packera multilobata*	10–15	–
6	**Sub-Dominant Forbs**			0–20	
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	tansymustard	DESCU	*Descurainia*	0–10	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	0–10	–
	rock goldenrod	PEPUP	*Petradoria pumila ssp. pumila*	0–10	–
	Utah penstemon	PEUT	*Penstemon utahensis*	0–10	–
	spiny phlox	PHHO	*Phlox hoodii*	0–10	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–10	–
Tree					
7	**Trees**			90–120	
	Utah juniper	JUOS	*Juniperus osteosperma*	50–60	–
	twoneedle pinyon	PIED	*Pinus edulis*	45–60	–

Table 20. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
1	**Dominant Shrubs**			25–50	
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	25–50	–
2	**Sub-Dominant Shrubs**			0–50	
	Utah serviceberry	AMUTU	*Amelanchier utahensis var. utahensis*	0–10	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–10	–
	mormon tea	EPVI	*Ephedra viridis*	0–10	–
	desert snowberry	SYLO	*Symphoricarpos longiflorus*	0–10	–
	sulphur-flower buckwheat	ERUM	*Eriogonum umbellatum*	0–5	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–5	–
	antelope bitterbrush	PUTR2	*Purshia tridentata*	0–5	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–5	–

Grass/Grasslike					
3	**Grasses**			0–50	
	Grass, annual	2GA	*Grass, annual*	0–10	–
	Grass, perennial	2GP	*Grass, perennial*	0–10	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–10	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–10	–
	cheatgrass	BRTE	*Bromus tectorum*	0–10	–
	squirreltail	ELEL5	*Elymus elymoides*	0–10	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–10	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	0–10	–
Forb					
4	**Forbs**			10–50	
	Forb, annual	2FA	*Forb, annual*	0–10	–
	Forb, perennial	2FP	*Forb, perennial*	0–10	–
	cryptantha	CRYPT	*Cryptantha*	0–10	–
	tansymustard	DESCU	*Descurainia*	0–10	–
	winged buckwheat	ERAL4	*Eriogonum alatum*	0–10	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	0–10	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	0–10	–
	rock goldenrod	PEPUP	*Petradoria pumila ssp. pumila*	0–10	–
	Utah penstemon	PEUT	*Penstemon utahensis*	0–10	–
	spiny phlox	PHHO	*Phlox hoodii*	0–10	–
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–10	–
Tree					
5	**Shrubs**			90–120	
	Utah juniper	JUOS	*Juniperus osteosperma*	50–60	–
	twoneedle pinyon	PIED	*Pinus edulis*	45–60	–

Animal community

--Threatened and Endangered Species--

This section will be populated as more information becomes available.

--Wildlife Interpretations--
The scarcity of water up on the mesas limits the species richness and the abundance of large mammals. This site provides thermal cover and limited forage opportunities for mule deer and elk. Birds, bats, lizards, snakes and rodents are more common. Birds from several families are common, from hawks to sparrows. Golden eagles and red-tailed hawks are common as well as the great horned-owl. Species typical of pinyon and juniper areas including black-chinned and rufous hummingbirds, and several fly catchers, wood peckers. Corvids will use this site for nesting and foraging. Several species of rodents forage and occupy this site including desert cottontail, black tailed jack rabbit, Colorado chipmunk, white–tailed antelope squirrel, Apache pocket mouse, and several species of Peromyscus. Coyotes and kit foxes will also forage in the area; however dens are likely to be located in other ecological sites due to shallow soils and/or presence rocks fragments and rock outcrop. Bats (Myotis, Pipisturellus, and others) can be observed in this ecological site, but are likely limited to areas near water or canyons.

--Grazing Interpretations--
This site provides fair grazing conditions for livestock during spring, summer, and fall when in good ecological condition due to accessibility and nutritious forage. However, this site often lacks natural perennial water sources, which can influence the suitability 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. The suitability for reseeding and/or restoration is poor due to the lack of precipitation at critical times and shallow soil characteristics.

The plant community is primarily shrubs, including roundleaf buffaloberry and mormontea which provide browse for cattle, sheep, and goats. Cattle will typically only use these shrubs in the late fall and winter when nutrient needs can not be met by palatable shrubs and dormant grasses alone. The presence of grasses, including Indian ricegrass, galleta, blue grama, and muttongrass, provide grazing habitat for all classes of livestock. Utah juniper and pinyon provide good cover for livestock. Forb composition and annual production depends primarily on precipitation amounts and thus is challenging to use in livestock grazing management decisions. However, forb composition should be monitored for species diversity, as well as poisonous or injurious plant communities which may be detrimental to livestock if grazed. Before making specific grazing management recommendations, an onsite evaluation must be made.

Hydrological functions

The soils associated with this ecological site are generally in Hydrologic Soil Group B. Here runoff potential is low and infiltration rates are moderate, depending on slope and ground cover/health (NRCS National Engineering Handbook). Hydrological groups are

used in equations that estimate runoff from rainfall. These estimates are needed for solving hydrologic problems that arise in planning watershed-protection and flood-prevention projects and for designing structures for the use, control and disposal of water. In areas similar to the reference state where ground cover is adequate infiltration is increased and runoff potential is decreased. In areas where ground cover is less than 50%, infiltration is reduced and runoff potential is increased. Heavy use by domestic livestock affects hydrology in two ways. Trampling increases bulk density and breaks down soil aggregates. This results in decreased infiltration rates and increased runoff. 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. Different plant communities affect hydrology in different ways. Weedy communities such as states 3 and 4 alter the hydrology by changing the surface soil texture. Soil surfaces will typically become siltier which reduces infiltration and increases runoff potential. (National Range and Pasture Handbook, 2003)

Recreational uses

Recreation activities include aesthetic value and opportunities for camping, hiking and hunting. The more open canopy, gentle slopes, and proximity of this site to the canyon walls, makes this site popular for hiking trails. The tall trees and opens understory creates camp sites that provide shade and protection from the wind. Trees provide screening values for camping and picnicking. In addition, during certain years, this site provides good opportunities for pinyon nut collection.

Wood products

This site is a good site for gathering fence posts or firewood.

Other information

--Poisonous/Toxic Plant Communities--
Toxic plants associated with this site include woolly locoweed and broom snakeweed. Woolly locoweed is toxic to all classes of livestock and wildlife. Locoweed is palatable and has similar nutrient value to alfalfa, which may cause animals to consume it even when other forage is available. Locoweed contains swainsonine (indolizdine alkaloid) and is poisonous at all stages of growth. Poisoning will become evident after 2-3 weeks of continuous grazing and is associated with 4 major symptoms: 1) neurological damage, 2) emaciation, 3) reproductive failure and abortion, and 4) congestive heart failure linked with “high mountain disease”. Broom snakeweed contains steroids, terpenoids, saponins, and flavones that can cause abortions or reproductive failure in sheep and cattle, however cattle are most susceptible. These toxins are most abundant during active growth and leafing stage. Cattle and sheep will typically only graze broom snakeweed when other forage is unavailable and generally in winter when toxicity levels are at their lowest.

(Knight and Walter, 2001)

Potentially toxic plants associated with this site include big sagebrush, which contains sesquiterpene lactones and monoterpenes which have been suspected of being toxic to sheep. An experimental dosage of ¾ lbs of big sagebrush fed to sheep for three days was found to be lethal. (Knight and Walter, 2001)

Russian thistle is an invasive toxic plant, causing nitrate and to a lesser extent oxalate poisoning, which affects all classes of livestock. The buildup of nitrates in these plants is highly dependent upon environmental factors, such as after a rain storm during a drought, 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. (Knight and Walter, 2001)

--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.

Inventory data references

The data collected in 2005-2007 were in conjunction with the soil survey update for Natural Bridges National Monument. The vegetation data was collected in associated with a soil pit and geo-referenced. All the data is stored as hard copy files and in electronic format in the NRCS Utah State Office

Type locality

Location 1: San Juan County, UT	
UTM zone	N
UTM northing	4161511

UTM easting	588390
General legal description	Located in Natural Bridges National Monument; Kane Gulch USGS Quad.

Other references

--References--

Anderson, M. D. 2002. Pinus edulis. In: Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. Accessed on September 9, 2008.

Bentancourt, J. L., E. A. Pierson, K. A. Rvlander, J. A. Fairchild-Parks, and J. S. Dean. 1993. Influence of history and climate on New Mexico pinyon-juniper woodlands. General technical report RM. US9443188.

Floyd, M.L.; Hanna, D.D.; Romme, W.H. 2004. Historical and recent fire regimes in pinon-juniper woodlands on Mesa Verde, Colorado, USA. Forest Ecology and Management 198 (2004) 269-289

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

Miller, R. F. and J. A. Rose. 1999. Fire history and western juniper encroachment in sagebrush steppe. Journal of Range Management. 52:550-559.

Miller, R. F.; R..J. Tausch..2001. The role of fire in juniper and pinyon woodlands: a descriptive analysis. In: Galley, K.E.M.; Wilson. T.P., eds. Proceedings of the invasive species workshop: the role of fire in the control and spread on invasive species. Fire conference 2000. Miscellaneous Publication Number 11. Tallahassee, Fl: Tall Timbers Research Station: 15-30.

Miller, R. F. and P. E. Wigand. 1994. Holocene changes in semiarid pinyon-juniper woodlands. Bioscience. 44:465-474

National Engineering Handbook. US Department of Agriculture, Natural Resources Conservation Service. Available: http://www.info.usda.gov/CED/Default.cfm#National%20Engineering%20Handbook. Accessed February 25, 2008.

NRCS Grazing Lands Technology Institute. 2003. National Range and Pasture Handbook. Fort Worth, TX, USA: US Department of Agriculture, Natural Resources Conservation Service, 190-VI-NRPH.

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

Tausch, R.J.; West, N.E.; Nabi, A.A. 1981. Tree age and dominance patterns in Great Basin pinyon-juniper woodlands. Journal of Rangeland Management. 34: 259-264

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

Zlatnik, E. 1999. Juniperus osteosperma. In: Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). http://www.fs.fed.us/database/feis/. Accessed September 9, 2008

**Utah Division of Wildlife Resources. 2007. Utah's federally (US F&WS) listed threatened, endangered, and candidate species. Available: http://dwrcdc.nr.utah.gov/ucdc/ViewReports/te_list.pdf. Accessed on February 25, 2008.

Contributors

DKT/AG

Approval

Kirt Walstad, 1/14/2025

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)	Dana Truman (NRCS), Ashley Garrelts (NRCS), Shane A. Green (NRCS)
Contact for lead author	shane.green@ut.usda.gov
Date	11/17/2008

Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Foliar Cover

Indicators

1. **Number and extent of rills:** Rills frequently occur throughout the site and typically extend down entire slopes

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2. **Presence of water flow patterns:** The presence of water flow patterns is very common and typically they occur throughout site, following the microtopography. Interspaces between well developed biological soil crusts appear to be water depression storage areas but can serve as water flow patterns across areas covered with biological soil crust during episodic precipitation events. Flow patterns will be more visible as slope increases.

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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. Larger rills and gullies may remove soil from the base of trees exposing roots that resemble pedestals. Well developed biological soil crusts appear pedestaled and may be up to 2 inches high. Terracettes are present, forming behind 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 small 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):** Bare ground in the reference state varies between the two community phases, when site is in good condition and in community phase 1.1 bare ground is fairly uncommon (2-8 % cover). Most bare ground is associated with water flow patterns, and rills. In community phase 1.2 bare ground is more common (25-50% cover) due to decreased cover by biological soil crusts, and decreased cover in understory plant canopies. 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. Ground cover + bare ground = 100%.

5. **Number of gullies and erosion associated with gullies:** Few gullies actually exist on this site, in the reference condition and are associated with steeper slopes and microtopography when present. Gully length is short and they will remove soil from the base of trees exposing roots.

6. **Extent of wind scoured, blowouts and/or depositional areas:** The occurrence of wind scoured, blowout, and/or depositional areas are none to very few. Trees and shrubs impede the wind, and biological crusts reduce the potential for wind erosion; however when the site is in community phase 1.2 the opportunities for wind erosion are greatly increased.

7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water movement and wind. Fine litter (<1/4 inch in diameter) may be moved up to 2-3ft and usually occurs in water flow patterns rills, and gullies, with deposition occurring at obstruction. Sites with well developed crust cover may exhibit litter trapped by the crust pinnacles. The majority of litter accumulates at the base of plants or in soil depressions adjacent to the plant. Woody stems (those greater than ¼ inch in diameter) only move when located in rills, and gullies. On steeper slopes (> 20 %), woody stems may be washed from site, while large rills 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 3 to 4 in the interspaces. The average should be a 4. The surface texture is loamy. Vegetation cover, litter, and biological soil crusts reduce erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is 1-2 inches deep, structure is weak fine granular, and the surface color is typically a dark yellowish brown (10YR4/4). The A horizon would be expected to be more strongly developed under plant canopies. 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.

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 reduce 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.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** There is no compaction layer in the reference state. There may be layers of calcium carbonate accumulation 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: 10-25% Cover by Trees (e.g. Pinyon and Utah Juniper)
    10-15% Cover by Evergreen Shrubs (e.g. Roundleaf Buffaloberry and Green Mormontea)
    40-60% Cover by Biological Soil Crusts (e.g. Lichen, Moss, Cyanobacteria)

    Sub-dominant: 10-20% Cover by Perennial Grasses (e.g. Indian Ricegrass and Bottlebrush Squirreltail)
    5-10% Cover by other Shrubs (e.g. Utah Serviceberry and Long Flower Snowberry)

    Other: Other forbs, shrubs, and grasses. Developed biological crusts are common, but are highly variable and do not necessarily drive the ecological dynamics for this ecological site.

    Additional:

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 and roundleaf buffaloberry. Several standing dead trees may be present on the site and approximately 20% of the trees and shrubs can show evidence of decadence. All age classes of perennial grasses should be present under average growing

condition. 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):** Litter cover (including under plants) ranges from 12-20%. Most litter, however, accumulates below and to the side of live plants, and thus percent litter will be just slightly above percent canopy cover. Typically litter under shrubs is 1 leaf thickness;, but is expected to increase during drought, when shrubs experience leaf drop. Litter under trees may be up to 1 inch deep.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 250-400 lbs/acre in 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:** Known invasive species include cheatgrass (Bromus tectorum), broom snakeweed (Gutierrezia sarothrae), tansy mustard (Descurainia pinnata), annual stickseed (Lappula sp.), annual Cryptantha (Cryptantha sp.), and Russian thistle (Salsola tragus).

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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce in all years, except in extreme drought years.

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18. **Supporting Data:** NRCS (Dana Truman) 2005-2006 ESD data from Natural Bridges National Monument

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