USDA Natural Resources Conservation Service

Ecological site R035XY240UT
Semidesert Steep Shallow Loam (Utah Juniper-Two-Needle Pinyon)

Accessed: 04/29/2024

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.

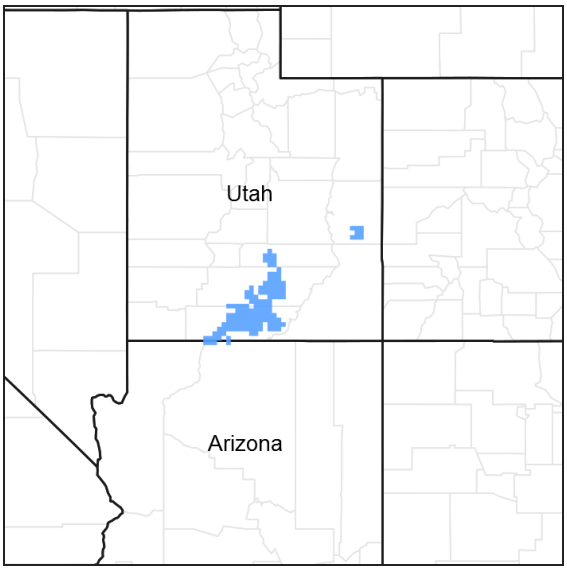


Figure 1. Mapped extent

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 ecological site occurs in the northern portion of MLRA 35, Colorado Plateau Province. It is found principally in the Canyon Lands and High Plateaus of Utah sections within that MLRA. This area has been stucturally uplifted over time while rivers flowing across it were cutting down into its bedrock. Areas of shale, sandstone, limestone, dolomite, and volcanic rock outcrop are found throughout the region.

Associated sites

R035XY206UT	**Semidesert Gravelly Loam (Utah Juniper-Pinyon)**
R035XY209UT	**Semidesert Loam (Wyoming Big Sagebrush)**
R035XY221UT	**Semidesert Shallow Loam (Utah Juniper-Pinyon)**
R035XY234UT	**Semidesert Shallow Shale (Utah Juniper-Pinyon)**
R035XY239UT	**Semidesert Shallow Clay (Shadscale-Utah Juniper)**
R035XY246UT	**Semidesert Stony Loam (Utah Juniper-Pinyon)**

Similar sites

R035XY263UT	**Semidesert Very Steep Stony Loam (Two-Needle Pinyon, Utah Juniper)**

Table 1. Dominant plant species

Tree	(1) *Juniperus osteosperma* (2) *Pinus edulis*
Shrub	(1) *Coleogyne ramosissima* (2) *Artemisia bigelovii*
Herbaceous	(1) *Achnatherum hymenoides* (2) *Leymus salinus*

Physiographic features

This site occurs on escarpments and hillslopes associated with structural benches, ledges on escarpments, dissected structural benches, side slope canyons, canyon walls, and scarp slopes on cuestas. Run off is very high. Slopes typically range from 15-80%, and elevations are generally 4800-6900ft.

Table 2. Representative physiographic features

Landforms	(1) Escarpment (2) Structural bench (3) Ledge
Flooding frequency	None
Ponding frequency	None
Elevation	1,524–2,103 m
Slope	15–80%
Aspect	Aspect is not a significant factor

Climatic features

The climate is characterized by hot summers and cool to warm winters. Large fluctuations in daily temperatures are common. Mean annual high temperatures range from 60-70 degrees Fahrenheit and mean annual low temperatures range from 32-40 degrees Fahrenheit. Approximately 70-75% occurs as rain from March through October. On the average, February, May, and June are the driest months and July through October are the wettest months. Precipitation is extremely variable from month to month and from year to year but averages between 9-12 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)	305 mm

Influencing water features

There are no influencing water features associated with this site.

Soil features

The soils are very shallow (rarely moderately deep) and are well drained. Typically, the dry surface color ranges from dark brown to yellowish red. The soil temperature and moisture regimes are mesic and ustic aridic respectively. Surface textures are generally sandy loams but can range to very fine silty loams, loams, and fine sandy loams. Subsurface textures are generally loamy sands, cobbly loams, channery loams, or gravelly sandy loams. Soils are nonsaline to slightly saline.

Chilton Family and Gaddes Family are moderately deep soils that are included in this site. Chilton Family soil has an available water capacity of 1 to 3 inches and Gaddes has an available water capacity of 4.2 inches. Remorris in map unit 5032 has an available water capacity of 2.6 inches and a very high runoff due to the heaver textures (i.e. silty clay loam) found in this mapunit. Gaddes Family, Simel – steep, and Remorris (map unit 5032) have a moderately slow (0.2 to 0.6 in/hr) permeability due to the heaver textured horizons (i.e. silty clay loam, and clay loam). Atchee Family – steep has rapid (6.0 to 20.0 in /hr) permeability due to the slopes being greater than 50% and high percentage of rock fragments on the soil surface.

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

UT685 – Capital Reef National Park – Reef, Daklos, Simel, Skyvillage family, Lazear, Remorris, Gaddes, Kenzo;
UT686 – Escalante Grand Staircase National Monument – Daklos; Kenzo; Atchee; Remorres; Simel; Lazear
UT687 – Arches National Park – Chedeskie Family

Typical Profile:
A – 0-3 inches; loam to cobbly sandy loam; slightly to moderately alkaline
C – 3-11 inches; channery/gravelly loam to cobbly sandy loam; slightly to moderately alkaline
R – 11 inches; sandstone bedrock

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone (2) Residuum–shale (3) Colluvium–limestone and shale
Surface texture	(1) Very gravelly sandy loam (2) Very stony loam (3) Cobbly loamy sand
Family particle size	(1) Loamy
Drainage class	Well drained to somewhat excessively drained
Permeability class	Moderately rapid to rapid
Soil depth	10–51 cm
Surface fragment cover <=3"	10–30%
Surface fragment cover >3"	0–35%
Available water capacity (0-101.6cm)	1.78–6.86 cm
Calcium carbonate equivalent (0-101.6cm)	1–20%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–5
Soil reaction (1:1 water) (0-101.6cm)	7.9–8.4
Subsurface fragment volume <=3" (Depth not specified)	6–39%
Subsurface fragment volume >3" (Depth not specified)	0–35%

Ecological dynamics

This site developed under Colorado Plateau ecological conditions, and the natural influences of herbivory and climate. Species composition is generally dominated by a sparse layer of Utah juniper and two-needle pinyon. Bigelow sagebrush, mormon tea and blackbrush are common shrub species. Perennial herbaceous species

occurrence is highly variable with Indian ricegrass, Salina wildrye and desert needlegrass found most often. There is no evidence to indicate that this site historically maintained a short burn cycle. Until further research indicates that fire played a significant role in the ecosystem processes of this site, its State and Transition model will not include fire as a disturbance in the reference state.

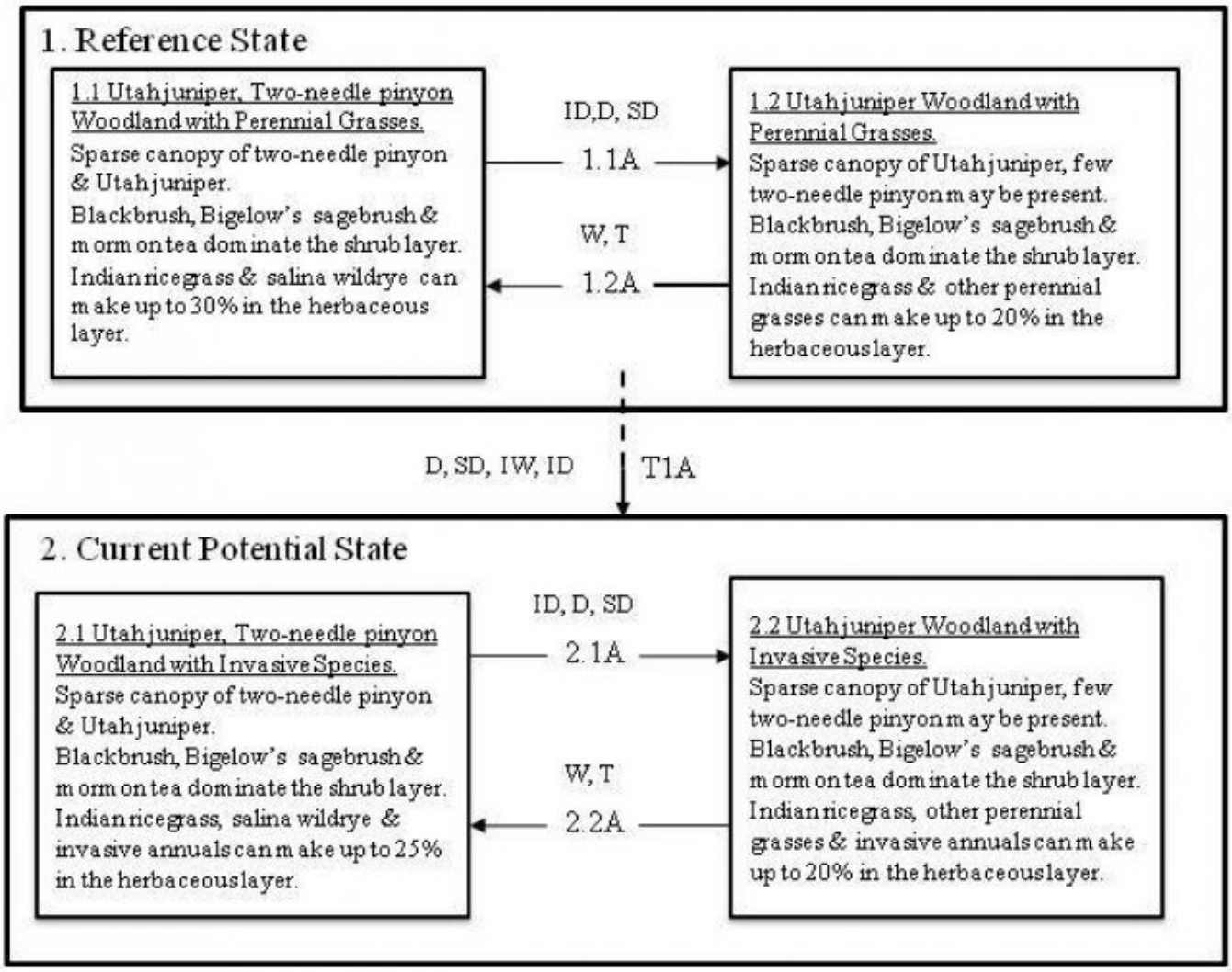
Drought and insect damage appear to be the main driving factors in many pinyon/juniper communities. Betancourt et al. (1993), noted that pinyon and juniper woodlands in the southwest appear to be more susceptible to large die-offs during droughts, than at other locations. If a severe drought persists, two-needle pinyon being more susceptible to drought and insect damage than Utah juniper, appear to die out first, while the Utah juniper may survive. This event could allow for an increase in shrubs and herbaceous species during periods when wetter years return.

As vegetative communities respond to changes caused by natural occurrences that cause them to cross ecological thresholds, a return to previous states may not be possible without major energy inputs. The amount of energy input needed to affect desired vegetative shifts depends on the present biotic and abiotic features and the desired results.

The following State and Transition diagram depicts the most common plant communities found on this ecological site. It does not necessarily depict all the plant communities that can occur. Even though these plant communities may not represent every possibility, but they do show the most prevalent and repeatable. As more data are collected, some of these plant communities will be revised or removed, and new ones may be added. 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

State and Transition Model
State: Utah
Site Type: Rangeland
MLRA: D-35- Colorado Plateau
R035XY240UT – Semidesert Steep Shallow Loam (Utah juniper, Two-needle pinyon).



Legend:
D = Drought.
W = Wet weather periods.
T = Time
ID = Insect Damage.
SD = Surface Disturbance.
IW = Invasive Weed Source.

State 1
Reference State

This Reference State was determined by the study of rangeland relic areas and areas protected from excessive disturbance and influences such as grazing and recreation. Literature review, historical accounts and observations of trends in plant community dynamics under a variety of sites has also been considered. Community phases, community pathways, other states, transitions, and thresholds, 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. This state is dominated by a sparse canopy of two-needle pinyon and Utah juniper with a well developed understory of native shrubs, perennial grasses and perennial and annual forbs. The primary disturbance mechanisms for this site in the reference condition include drought and insects. Reference state: Community phases maintained by drought and insect pathogen cycles. Indicators: A well developed shrub and grass understory co-existing with a canopy of Utah juniper and Two-needle pinyon. Feedbacks: Infrequent, but regular droughts that reduce tree cover. At-risk Community Phase: All communities are at risk when plants in the understory are stressed, and nutrients become available for invasives to establish. Trigger: The introduction of invasive plants into the understory.

Community 1.1
Utah juniper, Two-needle pinyon Woodland with Perennial Grasses

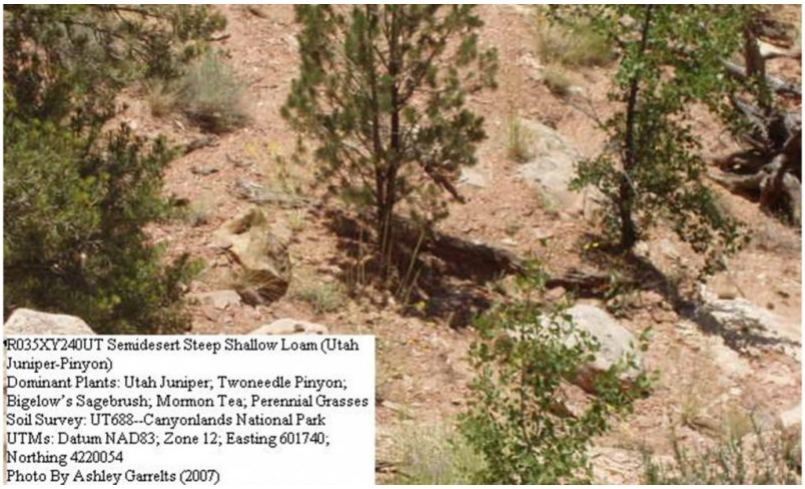


Figure 4. Pinyon/juniper woodland with perennial grasses.

This plant community phase is characterized by a sparse canopy of Utah juniper and two-needle pinyon, with a well developed shrub layer and perennial grass understory. Shrubs commonly seen include blackbrush, Bigelow's sagebrush and mormon tea. Typical grasses include Indian ricegrass and Salina wildrye. Forb composition varies greatly depending on seed source, soil, and growing conditions. Other grasses and shrubs are also present; however, species composition varies from one site to the next. Surface rock fragments ranging from gravels to boulders make up the majority of cover on this site and may be has high as 65%. The following tables provide an example of the typical vegetative floristics of a Community Phase 1.1 site.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	84	135	174
Tree	45	56	84
Grass/Grasslike	28	67	84
Forb	22	28	34
Total	**179**	**286**	**376**

Table 6. Ground cover

Tree foliar cover	5-20%
Shrub/vine/liana foliar cover	5-20%
Grass/grasslike foliar cover	0-30%
Forb foliar cover	3-5%
Non-vascular plants	0%
Biological crusts	0-12%
Litter	3-15%

Surface fragments >0.25" and <=3"	10-30%
Surface fragments >3"	0-35%
Bedrock	4-20%
Water	0%
Bare ground	3-24%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	0%	0-5%	2-8%	0-5%
>0.15 <= 0.3	–	0-5%	2-10%	0-2%
>0.3 <= 0.6	0-5%	10-20%	2-5%	0-5%
>0.6 <= 1.4	0-10%	0-5%	–	–
>1.4 <= 4	5-20%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 1.2
Utah juniper Woodland with Perennial Grasses

Figure 6. Utah juniper woodland with perennial grasses.

This community phase is characterized by a sparse canopy of Utah juniper. Other commonly occurring plants include blackbrush, Bigelow’s sagebrush mormon tea. Indian ricegrass, and a variety of other perennial grasses and forbs occupy the understory. Two-needle pinyon may be present in small amounts. The sites species composition varies greatly from one location to another depending on seed source, soil, and growing conditions. Surface rock fragments include from channers, gravels to boulders and run as high as 65% cover. The following tables provide an example of the typical vegetative floristics of a Community Phase 1.2 site.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	56	168	202
Grass/Grasslike	45	56	62
Tree	34	45	50
Forb	11	28	34
Total	**146**	**297**	**348**

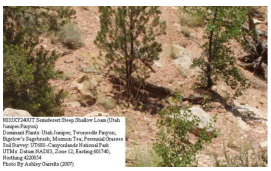
Table 9. Ground cover

Tree foliar cover	5-20%
Shrub/vine/liana foliar cover	5-20%
Grass/grasslike foliar cover	0-30%
Forb foliar cover	3-5%
Non-vascular plants	0%
Biological crusts	0-12%
Litter	3-15%
Surface fragments >0.25" and <=3"	10-30%
Surface fragments >3"	0-35%
Bedrock	4-20%
Water	0%
Bare ground	3-24%

Table 10. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	2-8%	0-5%
>0.15 <= 0.3	–	0-5%	2-10%	0-5%
>0.3 <= 0.6	0-5%	10-20%	2-5%	0-5%
>0.6 <= 1.4	0-10%	0-5%	–	–
>1.4 <= 4	5-20%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Pathway 1.1A
Community 1.1 to 1.2



Utah juniper, Two-needle pinyon Woodland with Perennial Grasses

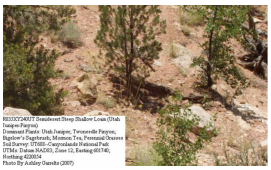
Utah juniper Woodland with Perennial Grasses

This pathway occurs as drought and/or insect herbivory removes two-needle pinyon from the site. Drought can also

impact shrub and herbaceous production which may be reduced until more normal weather patterns return. A reduction in the overstory canopy may also allow for more nutrients to be captured by perennial grasses and shrubs.

Pathway 1.2A
Community 1.2 to 1.1

Utah juniper Woodland with Perennial Grasses



Utah juniper, Two-needle pinyon Woodland with Perennial Grasses

This pathway occurs as normal to above average precipitation patterns coupled with time allow for the reestablishment of two-needle pinyon and other less drought tolerant shrubs and grasses.

State 2
Current Potential State

This state is very similar to the reference state, except that invasive grasses and/or forbs are present in all phases. The primary disturbance mechanisms for this state include natural and human caused disturbances; however, due to steep slopes there are very little man induced disturbances. Drought and insects may influence the community shifts. Trailing of livestock to water and some minor recreational activities (i.e. hiking) are the most common and have very little impact on the site other than introduction of invasive grasses and forbs. The shift in species composition could affect nutrient cycling, hydrology and soil stability. At this time there is no known way to effectively remove invasive plants from the site once they have become established. Therefore, this site is often irreversibly altered from the reference state Current Potential State: Community phases maintained by drought and insect herbivory cycles. Indicators: A shrub and grass understory co-existing with a canopy of Utah juniper. Feedbacks: Infrequent, but regular droughts to reduce tree cover. Establishment of invasive plant species such as cheatgrass.

Community 2.1
Utah Juniper, Two-needle Pinyon Woodland with Invasive Species

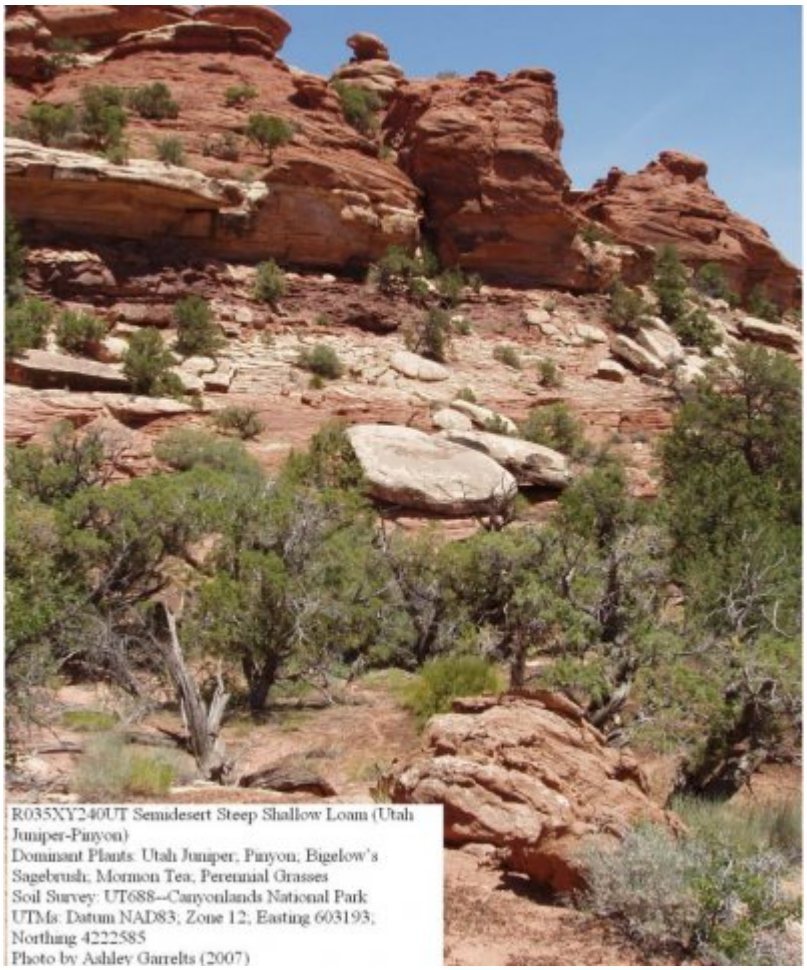


Figure 8. Pinyon/juniper woodland with invasive species.

This plant community phase is characterized by a sparse canopy of Utah juniper and two-needle pinyon with a mixed shrub and perennial grass understory. Shrubs commonly seen include blackbrush, Bigelow's sagebrush and mormon tea. Grasses that typically inhabit this site include cheatgrass, Indian ricegrass, and Salina wildrye. Forb composition varies greatly depending on seed source, soil, and growing conditions. Other grasses and shrubs are present; however, species composition varies from one site to the next. Surface rock fragments ranging from gravels to boulders make up the majority of cover for this site and may be has high as 65%. The following tables provide an example of the typical vegetative floristics of a Community Phase 2.1 site.

Table 11. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	84	135	174
Tree	43	56	85
Grass/Grasslike	17	34	50
Forb	22	28	34
Total	**166**	**253**	**343**

Table 12. Ground cover

Tree foliar cover	5-20%
Shrub/vine/liana foliar cover	5-20%
Grass/grasslike foliar cover	0-30%
Forb foliar cover	3-5%
Non-vascular plants	0%
Biological crusts	0-12%

Litter	3-15%
Surface fragments >0.25" and <=3"	10-30%
Surface fragments >3"	0-35%
Bedrock	4-20%
Water	0%
Bare ground	3-24%

Table 13. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	2-8%	0-5%
>0.15 <= 0.3	–	0-5%	2-10%	0-5%
>0.3 <= 0.6	0-5%	10-20%	2-5%	0-5%
>0.6 <= 1.4	0-10%	0-5%	–	–
>1.4 <= 4	5-20%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Community 2.2
Utah Juniper Woodland with Invasive Species

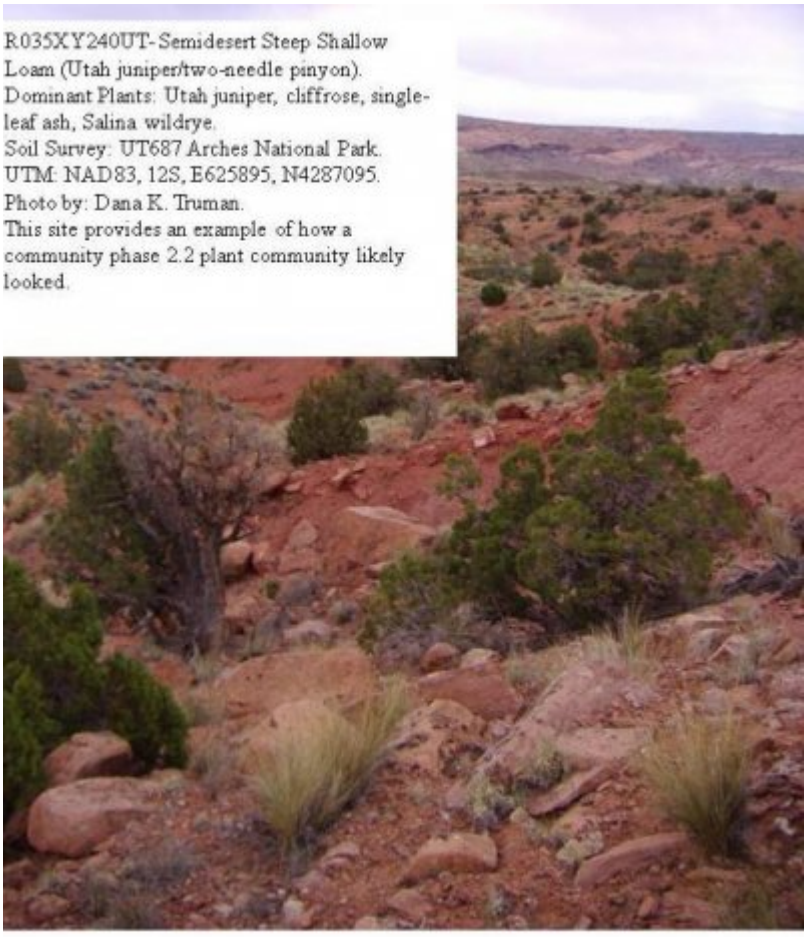


Figure 10. Utah juniper with invasive weeds.

This plant community phase is characterized by a sparse canopy of Utah juniper. Other commonly occurring plants include blackbrush, Bigelow's sagebrush, mormon tea, cheatgrass, Indian ricegrass, and various forbs, including invasive species. Pinyon may be present in small amounts. Forb composition varies greatly depending on seed source, soil, and growing conditions. Other grasses, shrubs, and trees are present,however, species composition varies from one site to the next. Surface rock fragments ranging from gravels to boulders make up the majority of cover for this site and may be has high as 65%. The following tables provide an example of the typical vegetative floristics of a Community Phase 2.2 site.

Table 14. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Shrub/Vine	56	112	202
Grass/Grasslike	45	56	62
Tree	34	56	50
Forb	11	28	34
Total	**146**	**252**	**348**

Table 15. Ground cover

Tree foliar cover	5-20%
Shrub/vine/liana foliar cover	5-20%
Grass/grasslike foliar cover	0-30%
Forb foliar cover	3-5%
Non-vascular plants	0%
Biological crusts	0-12%
Litter	3-15%
Surface fragments >0.25" and <=3"	10-30%
Surface fragments >3"	0-35%
Bedrock	4-20%
Water	0%
Bare ground	3-24%

Table 16. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	2-8%	0-5%
>0.15 <= 0.3	–	0-5%	2-10%	0-5%
>0.3 <= 0.6	0-5%	10-20%	2-5%	0-5%
>0.6 <= 1.4	0-10%	0-5%	–	–
>1.4 <= 4	5-20%	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Pathway 2.1A
Community 2.1 to 2.2

Utah Juniper, Two-needle Pinyon Woodland with Invasive Species

Utah Juniper Woodland with Invasive Species

This pathway occurs as drought and/or insect herbivory removes two-needle pinyon from the site. Drought can also impact shrub and herbaceous production which may be reduced until more normal weather patterns return. A reduction in the overstory canopy may also allow for more nutrients to be captured by perennial grasses and shrubs. Invasive species may also increase during periods favorable for annual growth.

Pathway 2.2A
Community 2.2 to 2.1

Utah Juniper Woodland with Invasive Species

Utah Juniper, Two-needle Pinyon Woodland with Invasive Species

This pathway occurs as normal to above average precipitation patterns coupled with time, allow for the reestablishment and persistence of two-needle pinyon and other less drought tolerant shrubs and grasses. Invasive annual species may also increase during this time.

Transition T1A
State 1 to 2

Transition from Reference State (State 1) to Current Potential State (State 2). This transition from the perennial grass and forb understory found in the reference state to a state that has contains invasive plants. This transition occurs as natural and/or management actions favor an increase in invasive grasses and forbs, especially annuals. Possible events include the mere presence of invasive species seed sources and extended droughts.

Additional community tables

Table 17. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0	**Dominant Trees**			45–84	
	Utah juniper	JUOS	*Juniperus osteosperma*	28–45	–
	twoneedle pinyon	PIED	*Pinus edulis*	11–39	–
Shrub/Vine					
0	**Dominant Shrubs**			17–28	
	blackbrush	CORA	*Coleogyne ramosissima*	6–28	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–22	–
	mormon tea	EPVI	*Ephedra viridis*	0–11	–
3	**Sub-Dominant Shrubs**			56–146	
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–34	–
	Havard oak	QUHA3	*Quercus havardii*	0–28	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–22	–
	Utah serviceberry	AMUT	*Amelanchier utahensis*	0–22	–

	Utah serviceberry	AMU1	*Amelanchier utahensis*	0–22	
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	6–22	–
	littleleaf mountain mahogany	CEIN7	*Cercocarpus intricatus*	0–17	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–17	–
	spiny hopsage	GRSP	*Grayia spinosa*	0–17	–
	sumac	RHUS	*Rhus*	0–17	–
	rock goldenrod	PEPU7	*Petradoria pumila*	0–11	–
	littleleaf mock orange	PHMI4	*Philadelphus microphyllus*	0–11	–
	Mexican cliffrose	PUME	*Purshia mexicana*	0–11	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–11	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	2–11	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–11	–
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–11	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–11	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–11	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–11	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	2–11	–
	black sagebrush	ARNO4	*Artemisia nova*	0–6	–
	brickellbush	BRICK	*Brickellia*	0–6	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–6	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–6	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–2	–
Grass/Grasslike					
0	**Dominant Grasses**			17–34	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	6–34	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	6–34	–
	James' galleta	PLJA	*Pleuraphis jamesii*	6–11	–
1	**Sub-Dominant Grasses**			0–22	
	Grass, annual	2GA	*Grass, annual*	0–22	–
	Grass, perennial	2GP	*Grass, perennial*	0–22	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–11	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–11	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–11	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–6	–
	Mormon needlegrass	ACAR14	*Achnatherum aridum*	0–6	–
	bluegrass	POA	*Poa*	0–2	–
Forb					
2	**Sub-Dominant Forbs**			45–114	
	desert princesplume	STPI	*Stanleya pinnata*	0–17	–
	Forb, annual	2FA	*Forb, annual*	0–11	–
	Forb, perennial	2FP	*Forb, perennial*	0–11	–

	white sagebrush	ARLU	*Artemisia ludoviciana*	0–11	–
	aster	ASTER	*Aster*	0–6	–
	milkvetch	ASTRA	*Astragalus*	0–6	–
	buckwheat	ERIOG	*Eriogonum*	0–6	–
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–3	–
	mountain pepperweed	LEMO2	*Lepidium montanum*	0–3	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	0–3	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–3	–
	thrift mock goldenweed	STARA	*Stenotus armerioides var. armerioides*	0–1	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–
	beardtongue	PENST	*Penstemon*	0–1	–
	Utah penstemon	PEUT	*Penstemon utahensis*	0–1	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–1	–

Table 18. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant**			11–56	
	blackbrush	CORA	*Coleogyne ramosissima*	0–56	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–24	–
	mormon tea	EPVI	*Ephedra viridis*	0–13	–
3	**Sub-dominant Shrubs**			45–146	
	sumac	RHUS	*Rhus*	0–59	–
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–34	–
	Havard oak	QUHA3	*Quercus havardii*	0–27	–
	Utah serviceberry	AMUT	*Amelanchier utahensis*	0–22	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–22	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	6–20	–
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–20	–
	spiny hopsage	GRSP	*Grayia spinosa*	0–17	–
	littleleaf mountain mahogany	CEIN7	*Cercocarpus intricatus*	0–17	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–17	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–11	–
	rock goldenrod	PEPU7	*Petradoria pumila*	0–10	–
	littleleaf mock orange	PHMI4	*Philadelphus microphyllus*	0–10	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–10	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–10	–
	Mexican cliffrose	PUME	*Purshia mexicana*	0–9	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–7	–
	black sagebrush	ARNO4	*Artemisia nova*	0–6	–
	brickellbush	BRICK	*Brickellia*	0–3	–

	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			34–45	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–45	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	0–45	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–20	–
1	**Sub-dominant Grass**			11–17	
	Grass, annual	2GA	*Grass, annual*	0–22	–
	Grass, perennial	2GP	*Grass, perennial*	0–22	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–10	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–7	–
	bluegrass	POA	*Poa*	0–2	–
Forb					
2	**Forbs**			11–34	
	desert princesplume	STPI	*Stanleya pinnata*	0–15	–
	Forb, annual	2FA	*Forb, annual*	0–11	–
	Forb, perennial	2FP	*Forb, perennial*	0–11	–
	aster	ASTER	*Aster*	0–6	–
	buckwheat	ERIOG	*Eriogonum*	0–4	–
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–3	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–3	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	0–3	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–3	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–2	–
	thrift mock goldenweed	STAR10	*Stenotus armerioides*	0–1	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–
	beardtongue	PENST	*Penstemon*	0–1	–
	Utah penstemon	PEUT	*Penstemon utahensis*	0–1	–

Table 19. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0	**Trees**			0–22	
	Utah juniper	JUOS	*Juniperus osteosperma*	28–45	–
	twoneedle pinyon	PIED	*Pinus edulis*	7–40	–
Shrub/Vine					
0	**Dominant Shrubs**			17–28	
	blackbrush	CORA	*Coleogyne ramosissima*	0–27	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–26	–
	mormon tea	EPVI	*Ephedra viridis*	0–13	–
3	**Sub-dominant Shrubs**			56–146	
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–34	–

	Havard oak	QUHA3	*Quercus havardii*	0–27	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	6–20	–
	mountain magnolia	MAFR	*Magnolia fraseri*	0–20	–
	Utah serviceberry	AMUT	*Amelanchier utahensis*	0–20	–
	littleleaf mountain mahogany	CEIN7	*Cercocarpus intricatus*	0–17	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–17	–
	spiny hopsage	GRSP	*Grayia spinosa*	0–17	–
	sumac	RHUS	*Rhus*	0–17	–
	crispleaf buckwheat	ERCO14	*Eriogonum corymbosum*	0–13	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–11	–
	rock goldenrod	PEPU7	*Petradoria pumila*	0–10	–
	littleleaf mock orange	PHMI4	*Philadelphus microphyllus*	0–10	–
	narrowleaf yucca	YUAN2	*Yucca angustissima*	3–10	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–10	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–9	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–9	–
	Mexican cliffrose	PUME	*Purshia mexicana*	0–9	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–7	–
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–6	–
	black sagebrush	ARNO4	*Artemisia nova*	0–6	–
	brickellbush	BRICK	*Brickellia*	0–3	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			22–45	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–45	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	0–34	–
	cheatgrass	BRTE	*Bromus tectorum*	0–20	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–6	–
1	**Sub-dominant Grass**			0–22	
	Grass, annual	2GA	*Grass, annual*	0–22	–
	Grass, perennial	2GP	*Grass, perennial*	0–22	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–11	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–9	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–9	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–7	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–7	–
	bluegrass	POA	*Poa*	0–2	–
Forb					
2	**Forbs**			22–34	
	desert princesplume	STPI	*Stanleya pinnata*	0–15	–
	Forb, annual	2FA	*Forb, annual*	0–11	–
	Forb, perennial	2FP	*Forb, perennial*	0–11	–

	white sagebrush	ARLU	*Artemisia ludoviciana*	0–10	–
	aster	ASTER	*Aster*	0–6	–
	milkvetch	ASTRA	*Astragalus*	0–6	–
	buckwheat	ERIOG	*Eriogonum*	0–4	–
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–3	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–3	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	0–3	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–3	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–2	–
	thrift mock goldenweed	STAR10	*Stenotus armerioides*	0–1	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–
	Utah penstemon	PEUT	*Penstemon utahensis*	0–1	–

Table 20. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0	**Dominant Tree**			34–50	
	Utah juniper	JUOS	*Juniperus osteosperma*	12–34	–
	twoneedle pinyon	PIED	*Pinus edulis*	0–6	–
Shrub/Vine					
0	**Dominant Shrubs**			11–56	
	blackbrush	CORA	*Coleogyne ramosissima*	0–56	–
	Bigelow sage	ARBI3	*Artemisia bigelovii*	0–24	–
	mormon tea	EPVI	*Ephedra viridis*	0–13	–
3	**Sub-dominant Shrubs**			45–146	
	sumac	RHUS	*Rhus*	0–59	–
	singleleaf ash	FRAN2	*Fraxinus anomala*	0–34	–
	Havard oak	QUHA3	*Quercus havardii*	0–27	–
	Utah serviceberry	AMUT	*Amelanchier utahensis*	0–22	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	0–22	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	6–20	–
	spiny hopsage	GRSP	*Grayia spinosa*	0–17	–
	littleleaf mountain mahogany	CEIN7	*Cercocarpus intricatus*	0–17	–
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–17	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–11	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–10	–
	rock goldenrod	PEPU7	*Petradoria pumila*	0–10	–
	littleleaf mock orange	PHMI4	*Philadelphus microphyllus*	0–10	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–10	–
	Mexican cliffrose	PUME	*Purshia mexicana*	0–9	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–7	–

	black sagebrush	ARNO4	*Artemisia nova*	0–6	–
	brickellbush	BRICK	*Brickellia*	0–3	–
	Whipple's fishhook cactus	SCWH	*Sclerocactus whipplei*	0–2	–
Grass/Grasslike					
0	**Dominant Grass**			34–45	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–56	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	0–45	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–20	–
	cheatgrass	BRTE	*Bromus tectorum*	0–20	–
1	**Sub-dominant**			11–17	
	Grass, annual	2GA	*Grass, annual*	0–22	–
	Grass, perennial	2GP	*Grass, perennial*	0–22	–
	desert needlegrass	ACSP12	*Achnatherum speciosum*	0–11	–
	purple threeawn	ARPU9	*Aristida purpurea*	0–10	–
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–9	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–9	–
	bluegrass	POA	*Poa*	0–2	–
Forb					
2	**Forbs**			11–34	
	desert princesplume	STPI	*Stanleya pinnata*	0–15	–
	Forb, annual	2FA	*Forb, annual*	0–11	–
	Forb, perennial	2FP	*Forb, perennial*	0–11	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–10	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–8	–
	aster	ASTER	*Aster*	0–6	–
	milkvetch	ASTRA	*Astragalus*	0–6	–
	buckwheat	ERIOG	*Eriogonum*	0–4	–
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–3	–
	Jones' pepperweed	LEMOJ	*Lepidium montanum var. jonesii*	0–3	–
	lobeleaf groundsel	PAMU11	*Packera multilobata*	0–3	–
	Newberry's twinpod	PHNE5	*Physaria newberryi*	0–3	–
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–2	–
	thrift mock goldenweed	STAR10	*Stenotus armerioides*	0–1	–
	longbeak streptanthella	STLO4	*Streptanthella longirostris*	0–1	–
	Townsend daisy	TOWNS	*Townsendia*	0–1	–
	beardtongue	PENST	*Penstemon*	0–1	–
	Utah penstemon	PEUT	*Penstemon utahensis*	0–1	–

Animal community

--Wildlife Interpretation--
The very steep slopes and scarcity of water on this site limits its species richness and the abundance of large mammals. It does provide thermal cover and limited forage opportunities for mule deer. Birds, bats, lizards, snakes and rodents are quite common. Several species of birds can be found using this site. Golden eagles and red-tailed

hawks are common as well as great horned-owls. Other species typical of pinyon juniper areas including black-chinned and rufous hummingbirds, several fly catchers, wood peckers, and corvids will use this site for nesting and foraging. Several species of rodents occupy this site including desert cottontail, black tailed jack rabbit, Colorado chipmunk, white–tailed Antelope squirrel, Apache pocket mouse, and several species of Peromyscus. 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 sites plant community primarily consists of a very sparse canopy of two-needle pinyon and Utah Juniper growing on very steep slopes. Common shrubs include Utah serviceberry, littleleaf mahogany, mormon tea and Bigelow's sagebrush. Grasses include Salina wildrye, Indian ricegrass and James galleta.

These steep slopes seriously limit the sites use for livestock grazing. Its lack natural perennial water sources also reduces its suitability. Mule deer, desert bighorn sheep, pronghorn antelope, and elk may utilize this site to some degree, although in many places, their populations will be small and have little grazing impact.

Hydrological functions

The soils associated with this ecological site are generally in Hydrologic Soil Group D.
Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. All soils with a depth to a water impermeable layer less than 50 centimeters [20 inches]. In this case the shallow soil over bedrock puts this ESD in group D. The runoff curve numbers are 80 to 89 depending on the overall watershed condition. 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. (NRCS National Engineering Handbook). 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, infiltration is reduced and runoff potential is increased.

Surface disturbance and compaction caused by ATV off-road vehicles tracks, and dirt roads can affect this sites hydrology. Any resulting compaction increases bulk density and breaks down soil aggregates. This results in decreased infiltration rates and increased runoff. The actual removal of the plants due to the tire tracks can alter the hydrology by decreasing plant cover and increasing bare ground. In the rare event that fire occurs on this site, it can also affect its hydrology, but these affects are highly 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)

Different plant communities affect hydrology in different ways.

Recreational uses

Recreation activities include aesthetic value, bird viewing, hunting and hiking.

Wood products

Potential wood products include firewood and fenceposts; however, harvesting such products may be difficult due to steep slopes and sparse stands.

Other information

--Poisonous and Toxic Plant Communities--
Toxic plants associated with this site include woolly locoweed, broom snakeweed, and wavy leaf (Havard) oak.

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 generally will only graze broom snakeweed when other forage is unavailable, typically in winter when toxicity levels are at their lowest (Knight and Walter, 2001).

Havard oak is thought to contain tannins that can be detrimental to cattle, sheep, and occasionally horses if grazed as more than 50% of the diet. Oak is highly toxic during the budding stage, leafing stage, and when acorns are available. Symptoms include lack of appetite, weakness, excessive thirst, edema, reluctance to follow the herd, and emaciation

--Invasive Plant Communities--
Generally, as ecological conditions deteriorate and perennial vegetation decreases due to disturbance (fire, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses may invade the site. Of particular concern in semi-arid environments are the 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 often completely occupied by lateral roots which can inhibit a herbaceous understory as well as annual invasive species. 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 semi-desert communities in the Colorado Plateau may have evolved without a significient influence of fire. However, a year of exceptionally heavy winter rains can generate enough fuels by producing heavy stands of annual forbs and grasses to carry fire. When fires do occur, the effect on the plant community may be extreme due to the sites harsh environment and slow rate of recovery.

There is no evidence that this site historically mainained a short burn frequency. Only a few species show fire scars and can be aged. This ecological site is comprised of scattered trees with bare interspaces to patchy occurrence of grasses and shrubs, which is unlikely to carry a fire unless under conditions of high winds, high temperature, and low humidity. Currently, burning is not a recommended brush management tool. If annual grasses or forbs dominate the area after disturbance, revegetating efforts could be hampered due to several factors including an increase in fire frequency.

Inventory data references

This site description is written based on data collected over the last 30 years. The data collected in 2005-2009 were in conjunction with the soil survey update for Arches and Canyonlands National Park. 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	4220054
UTM easting	601740
General legal description	Canyonlands National Park

Other references

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

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.

Author(s)/participant(s)	Jacob Owens (NRCS), V. Keith Wadman (NRCS Ret.)
Contact for lead author	shane.green@ut.usda.gov
Date	12/07/2009
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Few, due to the surface rock fragments on this site. The overall gravelly to channery surface is expected to be resistant to rill formation and accelerated erosion in general. Where rills occur, they may extend down entire slope.

2. **Presence of water flow patterns:** Due to the steep slopes, flow patterns are present and tend to be very sinuous and wind around rock fragments and perennial plant bases. They show some evidence of erosion with fines and litter depositing against the uphill side of gravel, rocks and plants. During episodic precipitation events e.g. thunderstorms, these sites are expected to shed large volumes of water to adjacent ecological sites.

3. **Number and height of erosional pedestals or terracettes:** Pedestals may form at the base of plants that occur on the edge of primary flow patterns and rills. Interspaces between any 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).

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 5–25%. Most bare ground is associated with water flow patterns, rills, and gullies. Soil is covered by up to 60 percent rock fragments. Any 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:** Few 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.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None to very few.

7. **Amount of litter movement (describe size and distance expected to travel):** Due to the steepness of slope being between 30 to 70 percent, down slope redistribution of any incident litter caused by water is expected. Deposition would likely occur at points of obstruction such as the uphill side of gravel, rocks and plants, especially following major storm events. Fine litter is moved with even moderate precipitation events and spring runoff. 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):** 80 to 90% of this site should have an erosion rating of 4 or 5. 10 to 20% may have a rating of 3 to 4. The average should be a 4. Surface texture is gravelly loam to very channery 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 2 to 4 inches deep. Structure is typically weak fine granular. Color is highly variable ranging from red (2.5YR 4/8) through yellowish brown (10YR 5/4). The A horizon would be expected to be more strongly developed under plant canopies. It is important 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 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.

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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. There may be layers of calcium carbonate, gravel, cobbles or other naturally occurring hard layers found in the soil subsurface. These should not be considered to be compaction layers.

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

    Dominant: Dominants— Utah juniper, two-needle pinion, Bigelow's sagebrush, mormon tea, and Indian ricegrass. Dominance by average annual production: Trees (Juniper > Pinion) > Sprouting shrubs > Cool season perennial grasses > Warm season perennial grasses. Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state.

    Sub-dominant: Sub Dominants— Broom snakeweed, Single-leaf ash, roundleaf buffalo berry, James galleta.

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

    Additional: 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 would reflect a functional community phase within the reference state. 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):** 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 general, a mix of age classes may be expected with some dead and decadent plants present.

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14. **Average percent litter cover (%) and depth (in):** Litter cover 2-5%. Variability may occur due to weather.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 150-320 #/acre on an average year.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if**

their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site: Possible invaders or increasers on this site are cheatgrass, sunflower, and halogeton, locoweed, broom snakeweed and juniper.

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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.
