USDA Natural Resources
Conservation Service

Ecological site R035XY321UT
Upland Stony Loam (Pinyon-Utah Juniper)

Accessed: 05/13/2025

General information

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

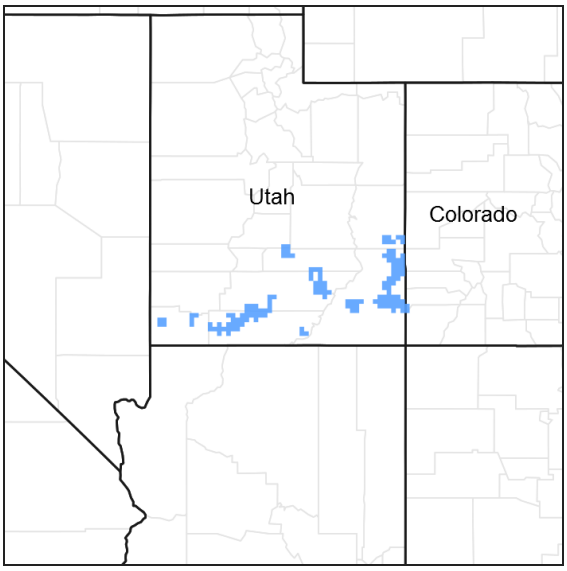


Figure 1. Mapped extent

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

MLRA notes

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

Site Concept: This site occurs in the upland zone of the Colorado and Green River Plateaus region (MLRA 35) in southern Utah. It is found on at elevations between 5500 and 7500 feet. Average annual precipitation ranges from 12 to 16 inches, with much of the summer precipitation coming as convective thunderstorms from July through October. Soils are deep loams or sandy loams, and usually have a cobbly or bouldery surface with over 50% rock fragments throughout the profile. Two-needle pinyon and Utah juniper dominate the overstory, with blue grama typically abundant in the understory. Perennial grasses can be lost as Utah juniper and two-needle pinyon increase. This may be accelerated by improper livestock grazing practices, and may lead to accelerated soil loss.

Classification relationships

Modal Soil: Clapper — loamy-skeletal, mixed, mesic Ustollic Calciorthids
Type Location: See Kane County, Utah, Soil Survey.

Similar sites

R035XY246UT	**Semidesert Stony Loam (Utah Juniper-Pinyon)** This site has similar soils, but recieves less annual precipitation (9-14 inches). Trees are less dominant on this site, allowing perennial grasses to make up 30-60% of the community composition by air-dry weight.
R047XB333UT	**Upland Stony Loam (pinyon/Utah juniper)**
R035XY317UT	**Upland Steep Stony Loam (Utah Juniper-Pinyon)** This site typically occurs on steeper slopes (although slope ranges do overlap somewhat on these two sites). This site has similar plant community composition, but lower total production.

Table 1. Dominant plant species

Tree	(1) *Pinus edulis* (2) *Juniperus osteosperma*
Shrub	Not specified
Herbaceous	(1) *Bouteloua gracilis*

Physiographic features

This site is found on many landforms with deep stony soils, including; mountain slopes, slump blocks, structural benches, remnant alluvial fans, remnant stream terraces, landslides, and benches. Elevations range from 5500 to 7500 feet and slopes are typically between 2 and 50%.

Table 2. Representative physiographic features

Landforms	(1) Slump block (2) Structural bench (3) Landslide
Flooding frequency	None
Ponding frequency	None
Elevation	1,676–2,286 m
Slope	2–50%

Climatic features

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

Table 3. Representative climatic features

Frost-free period (average)	175 days
Freeze-free period (average)	200 days
Precipitation total (average)	406 mm

Influencing water features

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

Soil features

The soils of this site are deep, with greater than 50% rock fragments (by volume) throughout the profile. Large rock fragments are common on the soil surface as well. These soils formed in alluvium or colluvium derived from diorite or sedimentary rock, including sandstone, siltstone, limestone and shale. Textures range from loams to sandy loams, and rock fragments range from gravels to boulders. These soils are well drained with moderate permeability.

The soil moisture regime is aridic ustic and the soil temperature regime is mesic. Available water-holding capacity ranges from 2.3 to 6.6 inches of water in the upper 40 inches of soil.

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

UT623 - Emery Area - Foy;
UT631 - Henry Mountains Area - Montosa family;
UT633 - Canyonlands Area - Strych, Ustollic Haplargids;
UT638 - San Juan County - Bodot;
UT639 - San Juan Area - Scorup;
UT641 - Washington County Area - Tacan;
UT646 - Dixie National Forest - Tacan;
UT685 - Capitol Reef National Park - Foy;
UT686 - Escalante Grand Staircase - Suzmayne, Quagmire, Upler;

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone, sandstone, and shale (2) Colluvium–diorite
Surface texture	(1) Cobbly very fine sandy loam (2) Very stony sandy clay loam (3) Very stony sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderate
Soil depth	51 cm
Surface fragment cover <=3"	8–12%
Surface fragment cover >3"	14–47%
Available water capacity (0-101.6cm)	5.84–16.76 cm
Calcium carbonate equivalent (0-101.6cm)	0–15%
Electrical conductivity (0-101.6cm)	0–2 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	5–27%
Subsurface fragment volume >3" (Depth not specified)	0–29%

Ecological dynamics

This site developed under Colorado Plateau climatic conditions and included natural influences of herbivory, and climate; however due to the remote location, broken topography, steep slopes (2-50%), and lack of perennial water sources this area rarely served as habitat for large herds of native herbivores. This site’s plant species composition is generally dominated by two-needle pinyon and Utah juniper, with some perennial grasses.

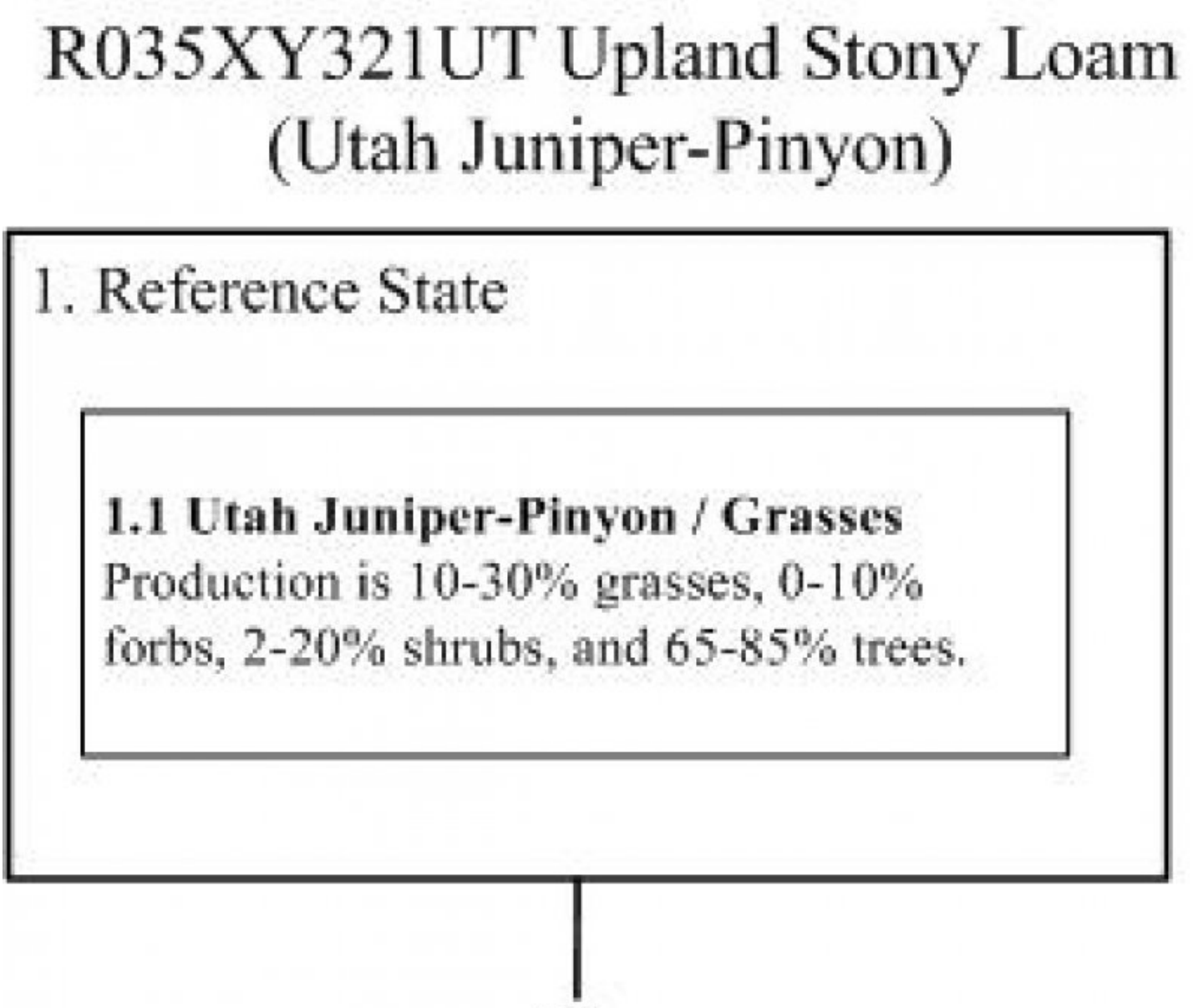
There is no evidence to indicate that this site historically maintained a short burn frequency. Until further research indicates that fire played a role in the ecosystem processes of this site, the state and transition model will not include fire as a disturbance mechanism in the reference state. However, due to modern disturbances such as

brush treatments, invasive species, and OHV use, the resilience of the plant communities may be reduced. Disturbances that reduce the presence of perennial grasses result in an opportunity for invasive annuals to enter into the system. However, to this point invasive species have not been documented on this site.

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

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

State and transition model



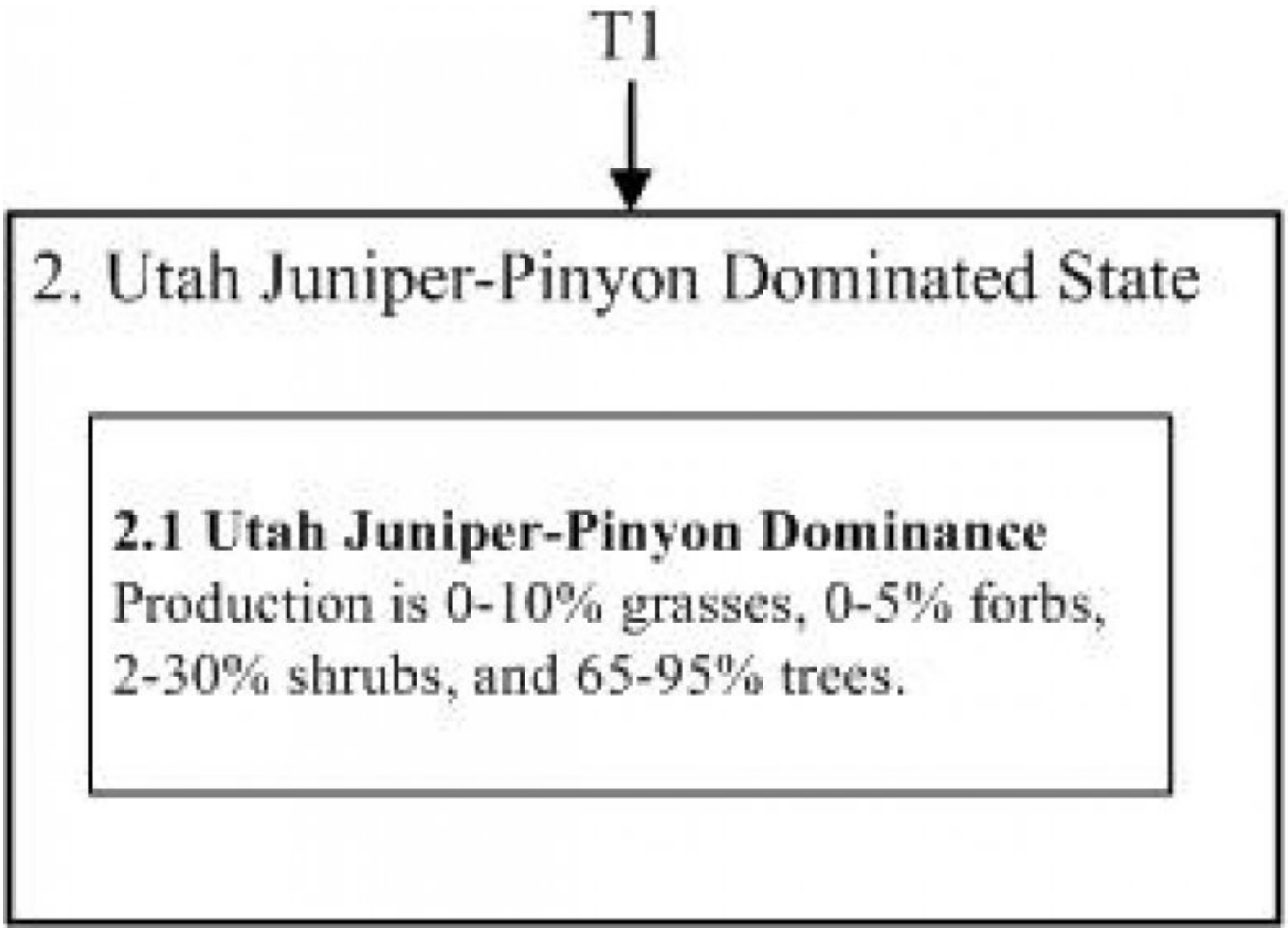


Figure 4. State-and-Transition Model

State 1
Reference State

The reference plant community is dominated by two-needle pinyon and Utah juniper, with some perennial grasses present in the understory. The reference state is resistant to soil erosion due to moderate grass cover and high rock fragments on the soil surface. Areas with fewer rock fragments and coarser soil textures may be less resillient following disturbance that removes perennial grasses, such as improper livestock grazing. Non-native invasive species have not been documented on this site, but cheatgrass is likely capable of establishing.

Community 1.1
Reference State

R035XY321UT—Upland Stony Loam (Pinyon-Juniper). Community Phase 1.1—Reference State. Cover is 8%

Figure 5. Phase 1.1

The reference plant community is dominated by two-needle pinyon and Utah juniper. Perennial grasses, especially blue grama, are present in the understory. Shrubs may also be abundant, but not in all area. Composition by air-dry weight is 10-30% grasses, 0-10% forbs, 2-20% shrubs, and 65-85% trees. This phase is resistant to soil erosion as well as invasion by non-native species.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	336	476	616
Grass/Grasslike	56	112	168
Shrub/Vine	22	67	112
Forb	–	22	45
Total	**414**	**677**	**941**

Table 6. Ground cover

Tree foliar cover	20-30%
Shrub/vine/liana foliar cover	0-5%
Grass/grasslike foliar cover	4-10%
Forb foliar cover	0-3%
Non-vascular plants	0%
Biological crusts	0%
Litter	15-25%
Surface fragments >0.25" and <=3"	5-15%
Surface fragments >3"	15-45%
Bedrock	0%
Water	0%
Bare ground	10-20%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-2%	0-2%	0-2%
>0.15 <= 0.3	–	0-2%	0-4%	0-2%
>0.3 <= 0.6	–	0-5%	0-3%	0-2%
>0.6 <= 1.4	0-5%	0-5%	–	–
>1.4 <= 4	15-30%	–	–	–
>4 <= 12	0-10%	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

State 2
Pinyon-Utah Juniper Dominated State

This state results when perennial grasses are lost from the system and trees increase and dominate. Soil erosion may become a hazard, and non-native invasive species, particularly cheatgrass, may be more likely to establish in this state. However, non-native species have not been documented on this ecological site.

Community 2.1
Pinyon-Utah Juniper Dominance

This phase is dominated by Utah juniper and two-needle pinyon. Perennial grasses and forbs are greatly reduced, while shrubs may increase, decrease, or remain stable. Soil erosion may result from the lack of herbaceous cover. Composition by air-dry weight is 0-10% grasses, 0-5% forbs, 2-30% shrubs, and 65-95% trees. This phase may be more susceptible to invasion by non-native invasive species, though none have been documented on this site.

Table 8. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Tree	476	588	701
Shrub/Vine	28	140	224
Forb	–	17	45
Grass/Grasslike	–	22	45
Total	**504**	**767**	**1015**

Table 9. Ground cover

Tree foliar cover	20-30%
Shrub/vine/liana foliar cover	0-8%
Grass/grasslike foliar cover	0-5%
Forb foliar cover	0-2%
Non-vascular plants	0%
Biological crusts	0%
Litter	15-25%
Surface fragments >0.25" and <=3"	5-15%
Surface fragments >3"	15-45%
Bedrock	0%
Water	0%
Bare ground	15-25%

Table 10. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-2%	0-2%	0-2%
>0.15 <= 0.3	–	0-2%	0-2%	0-2%
>0.3 <= 0.6	–	0-5%	0-2%	0-2%
>0.6 <= 1.4	0-5%	0-8%	–	–
>1.4 <= 4	15-30%	0-5%	–	–
>4 <= 12	0-10%	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Transition T1

State 1 to 2

This transition occurs when perennial grasses are reduced by improper livestock grazing (heavy stocking rates, continuous season-long grazing, etc.) followed by an increase in Utah juniper and pinyon (West et al. 1998). The resulting state is unable to regain perennial grasses without significant management inputs.

Additional community tables

Table 11. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0	**Trees**			336–616	
	twoneedle pinyon	PIED	*Pinus edulis*	196–392	10–18
	Utah juniper	JUOS	*Juniperus osteosperma*	140–280	8–15
Grass/Grasslike					
0	**Dominant Grasses**			34–112	
	blue grama	BOGR2	*Bouteloua gracilis*	22–101	2–7
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	11–78	1–5
1	**Sub-dominant Grasses**			22–84	
	Grass, annual	2GA	*Grass, annual*	0–34	0–2
	Grass, perennial	2GP	*Grass, perennial*	0–34	0–2
	needle and thread	HECO26	*Hesperostipa comata*	0–34	0–2
	James' galleta	PLJA	*Pleuraphis jamesii*	0–28	0–2
	Geyer's sedge	CAGE2	*Carex geyeri*	0–22	0–2
	muttongrass	POFE	*Poa fendleriana*	0–17	0–1
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	0–17	0–1
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–11	0–1
	squirreltail	ELEL5	*Elymus elymoides*	0–11	0–1
Forb					
2	**Forbs**			0–45	
	Forb, perennial	2FP	*Forb, perennial*	0–34	0–2
	Navajo tea	THSU	*Thelesperma subnudum*	0–22	0–2
	Forb, annual	2FA	*Forb, annual*	0–22	0–2
	dwarf lousewort	PECE	*Pedicularis centranthera*	0–17	0–1
	Utah penstemon	PEUT	*Penstemon utahensis*	0–17	0–1
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–11	0–1
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–11	0–1
	cushion buckwheat	EROV	*Eriogonum ovalifolium*	0–11	0–1
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–11	0–1
	Utah fleabane	ERUT	*Erigeron utahensis*	0–6	0–1
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–6	0–1
	manybranched ipomopsis	IPPO2	*Ipomopsis polycladon*	0–6	0–1
	rusty lupine	LUPU	*Lupinus pusillus*	0–6	0–1
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–6	0–1

	perennial rockcress	ARPE2	*Arabis perennans*	0–6	0–1
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–6	0–1
	Wyoming Indian paintbrush	CALI4	*Castilleja linariifolia*	0–6	0–1
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–6	0–1
	rock goldenrod	PEPU7	*Petradoria pumila*	0–6	0–1
	sharpleaf twinpod	PHAC4	*Physaria acutifolia*	0–6	0–1
	longleaf phlox	PHLO2	*Phlox longifolia*	0–6	0–1
Shrub/Vine					
3	**Shrubs**			22–112	
	Gambel oak	QUGA	*Quercus gambelii*	0–101	0–6
	Utah serviceberry	AMUT	*Amelanchier utahensis*	0–67	0–5
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–45	0–3
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–45	0–3
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	16–31	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–28	0–2
	greenleaf manzanita	ARPA6	*Arctostaphylos patula*	0–22	0–2
	brittle pricklypear	OPFR	*Opuntia fragilis*	0–22	0–2
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	0–22	0–2
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–17	0–1
	Spanish bayonet	YUHA	*Yucca harrimaniae*	0–17	0–1
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	0–1
	wild crab apple	PERA4	*Peraphyllum ramosissimum*	0–17	0–1
	kingcup cactus	ECTR	*Echinocereus triglochidiatus*	0–17	0–1
	mormon tea	EPVI	*Ephedra viridis*	0–17	0–1
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–11	0–1
	Mexican cliffrose	PUME	*Purshia mexicana*	0–11	0–1
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–11	0–1
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–11	0–1
	blue elderberry	SANIC5	*Sambucus nigra ssp. cerulea*	0–11	0–1

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Tree					
0	**Trees**			476–701	
	twoneedle pinyon	PIED	*Pinus edulis*	280–476	15–22
	Utah juniper	JUOS	*Juniperus osteosperma*	196–336	10–18
	blue grama	BOGR2	*Bouteloua gracilis*	22–101	2–7
	Utah serviceberry	AMUT	*Amelanchier utahensis*	26–93	–
	Gambel oak	QUGA	*Quercus gambelii*	26–93	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	11–78	1–5
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	26–62	–

	mahogany				
	antelope bitterbrush	PUTR2	*Purshia tridentata*	26–62	–
	mormon tea	EPVI	*Ephedra viridis*	16–31	–
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	16–31	–
Grass/Grasslike					
1	**Grasses**			0–45	
	blue grama	BOGR2	*Bouteloua gracilis*	0–34	0–2
	needle and thread	HECO26	*Hesperostipa comata*	0–34	0–2
	Grass, annual	2GA	*Grass, annual*	0–34	0–2
	Grass, perennial	2GP	*Grass, perennial*	0–34	0–2
	James' galleta	PLJA	*Pleuraphis jamesii*	0–28	0–2
	Geyer's sedge	CAGE2	*Carex geyeri*	0–22	0–2
	muttongrass	POFE	*Poa fendleriana*	0–17	0–1
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	0–17	0–1
	squirreltail	ELEL5	*Elymus elymoides*	0–11	0–1
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–11	0–1
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	0–11	0–1
Forb					
2	**Forbs**			0–45	
	Forb, perennial	2FP	*Forb, perennial*	0–34	0–2
	Navajo tea	THSU	*Thelesperma subnudum*	0–22	0–2
	Forb, annual	2FA	*Forb, annual*	0–22	0–2
	dwarf lousewort	PECE	*Pedicularis centranthera*	0–17	0–1
	Utah penstemon	PEUT	*Penstemon utahensis*	0–17	0–1
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–11	0–1
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–11	0–1
	cushion buckwheat	EROV	*Eriogonum ovalifolium*	0–11	0–1
	stemless four-nerve daisy	TEACA2	*Tetraneuris acaulis var. acaulis*	0–11	0–1
	Utah fleabane	ERUT	*Erigeron utahensis*	0–6	0–1
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–6	0–1
	manybranched ipomopsis	IPPO2	*Ipomopsis polycladon*	0–6	0–1
	rusty lupine	LUPU	*Lupinus pusillus*	0–6	0–1
	tufted evening primrose	OECA10	*Oenothera caespitosa*	0–6	0–1
	perennial rockcress	ARPE2	*Arabis perennans*	0–6	0–1
	woolly locoweed	ASMO7	*Astragalus mollissimus*	0–6	0–1
	Wyoming Indian paintbrush	CALI4	*Castilleja linariifolia*	0–6	0–1
	sanddune wallflower	ERCAC	*Erysimum capitatum var. capitatum*	0–6	0–1
	rock goldenrod	PEPU7	*Petradoria pumila*	0–6	0–1
	sharpleaf twinpod	PHAC4	*Physaria acutifolia*	0–6	0–1
	longleaf phlox	PHLO2	*Phlox longifolia*	0–6	0–1
Shrub/Vine					
3	**Shrubs**			28–224	

	Gambel oak	QUGA	*Quercus gambelii*	0–168	0–10
	Utah serviceberry	AMUT	*Amelanchier utahensis*	0–67	0–5
	alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	0–67	0–4
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–56	0–4
	greenleaf manzanita	ARPA6	*Arctostaphylos patula*	0–56	0–3
	roundleaf buffaloberry	SHRO	*Shepherdia rotundifolia*	0–50	0–3
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–45	0–3
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–28	0–2
	mountain snowberry	SYOR2	*Symphoricarpos oreophilus*	0–22	0–2
	brittle pricklypear	OPFR	*Opuntia fragilis*	0–22	0–2
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–17	0–1
	wild crab apple	PERA4	*Peraphyllum ramosissimum*	0–17	0–1
	Spanish bayonet	YUHA	*Yucca harrimaniae*	0–17	0–1
	kingcup cactus	ECTR	*Echinocereus triglochidiatus*	0–17	0–1
	mormon tea	EPVI	*Ephedra viridis*	0–17	0–1
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–11	0–1
	Fremont's mahonia	MAFR3	*Mahonia fremontii*	0–11	0–1
	Mexican cliffrose	PUME	*Purshia mexicana*	0–11	0–1
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–11	0–1
	blue elderberry	SANIC5	*Sambucus nigra ssp. cerulea*	0–11	0–1

Animal community

--Livestock and Wildlife Grazing--

This site provides fair/poor grazing conditions for livestock and wildlife during spring, summer, and fall when in good ecological condition due to sparse vegetative cover. This site often lacks natural perennial water sources, which can influence the suitability for livestock and wildlife grazing. Care should be taken to maintain the native perennial grasses and shrubs due to the poor suitability for re-seeding or restoring this site. Reseeding and/or restoration are difficult due to the extreme temperatures and variability in time and amount of precipitation. This site occurs in elk, mule deer, and big horn sheep habitat; however in many places the populations will be small and have little grazing impact on the site.

The plant community is primarily shrubs, including Utah serviceberry, gambel oak, alderleaf mountain mahogany, antelope bitterbrush, mountain big sagebrush, and green jointfir. These shrubs provide fair browse for cattle, sheep, goats, elk, mule deer, and bighorn sheep. Grasses include mutton bluegrass and Indian ricegrass, and provide fair grazing conditions for all classes of livestock and wildlife. Utah juniper and pinyon pine provide good cover for livestock and wildlife; mule deer and goats may also graze these trees. 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.

--References--

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Hydrological functions

The hydrologic group is b. The hydrologic curve number is 61 when the vegetation condition is good.

Recreational uses

Some recreation uses of this site are hiking and hunting.

Wood products

Pinyon pine production of firewood is 1.7 to 5.4 cords per acre. Utah juniper production of firewood is 1.3 to 4.1 cords per acre. Utah juniper production of posts is 4 per acre.

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. This plant 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 generally only graze broom snakeweed when other forage is unavailable, typically in winter when toxicity levels are at their lowest.

Potentially toxic plants associated with this site include some buckwheat species, which may accumulate selenium, but only when growing on selenium enriched soils. These plants, when consumed will cause alkali disease or chronic selenosis, which affects all classes of livestock (excluding goats). Typically animals consuming 5-50 ppm selenium will develop chronic selenosis and animals consuming greater than 50 ppm selenium will develop acute selenosis. Clinical signs include lameness, soughing of the hoof, hair loss, blindness, and aimless wondering. Horses tend to develop what is called a “bob” tail or “roached” main due to breakage of the long hairs.

--Invasive Plant Communities--

Generally as ecological conditions deteriorate and perennial vegetation decreases due to disturbance (fire, over grazing, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses will invade the site. Of particular concern in semi-arid environments are the non-native annual invaders including cheatgrass, Russian thistle, kochia, halogeton, and annual mustards. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible. On well developed Utah juniper and pinyon pine communities soils are complete occupied by lateral roots, which inhibit an herbaceous understory as well as annual invasions. However once these sites are disturbed and pinyon-juniper communities begin to decline invasion is possible.

--Fire Ecology--

The ability for an ecological site to carry fire depends primarily on the present fuel load and plant moisture content—

sites with small fuel loads will burn more slowly and less intensely than sites with large fuel loads. Many plant communities in the Colorado Plateau may have evolved without the influence of fire. However a year of exceptionally heavy winter rains can generate fuels by producing heavy stands of annual forbs and grasses. When fires do occur, the effect on the plant community may be extreme due to the harsh environment and slow rate of recovery.

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

--References--

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Contributors

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Rangeland health reference sheet

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

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

Indicators

1. **Number and extent of rills:** A. On more gentle slopes (< 10 %): Common and occur throughout site in exposed areas. Rills may be 6 to 10 feet in length. Sides of rills may be up to 3 inches high. B. On steep slopes (> 20 %): Common. Occur throughout the site. Rills may extend down entire slope.

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2. **Presence of water flow patterns:** Frequent and occur throughout area and wind between exposed rocks and plant bases. Interspaces between rocks and 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. Evidence of flow patterns will increases with slope.

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

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 5 – 10 %. Most bare ground is associated with water flow patterns, rills, and gullies. The soil surface is covered by up to 50% rock fragments . Areas with well developed biological soil crusts should not be counted as bare ground. Poorly developed biological soil crusts that are interpreted as functioning as bare ground (therefore they would be susceptible to raindrop splash erosion) should be recorded as bare ground. Ground cover is based on first raindrop impact, and bare ground is the opposite of ground cover. Ground cover + bare ground = 100%.

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5. **Number of gullies and erosion associated with gullies:** None to few. On steeper slopes and areas below and adjacent to sites with concentrated water flow (such as exposed bedrock), gullies may increase. Length is short and is usually interrupted by large rock fragments. Gullies are shallow and wide and armored with large stones. Gullies may remove soil from the base of trees exposing roots.

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

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter accumulates at base of

plants and exposed rocks. Woody stems from trees not moved unless present in water flow pattern, rill, or gully. On steeper slopes (> 20 %), woody stems may be washed from site. Large rills may remove accumulated litter from under trees.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have a soil stability rating of 4 or 5 under the plant canopies using the soil stability kit test, and a rating of 2 to 4 in the interspaces. The average should be a 3 or 4. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface varies from 1 to 3 inches. Structure is thin platy. Color varies from yellowish brown (10YR5/4) to brown (7.5YR6/6). There is little if any difference under canopy or in interspaces and a recognizable A horizon is expected to be present throughout. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Spatial distribution of well developed biological soil crusts (where present)or surface fragments 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. Perennial grasses obstruct water flow patterns creating sinuosity.

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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 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: Sprouting shrubs > Trees (Pinion > Juniper) > Non-sprouting shrubs

    Sub-dominant: perennial grasses > forbs

    Other: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state (e.g. Crested wheatgrass, Intermediate wheatgrass, etc.)
    Biological soil crust is variable in its expression where present on this site and is measured as a component of ground cover.

    Additional: Disturbance regime includes parasites, very infrequent fire, drought and insects. 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.
    Dominants— Pinion pine, diverse shrubs. Sub Dominants— Perennial grasses, forbs, Utah juniper. Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

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 several dominant shrubs. 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 with a decrease in age class expression under below average conditions. In drought tree mortality may increase with the first sign being a yellowish to reddish leaf color.

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

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 450-550 lbs/ac

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

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