USDA Natural Resources Conservation Service

Ecological site R035XY324UT
Upland Sand (Utah Juniper-Pinyon)

Accessed: 04/24/2024

General information

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

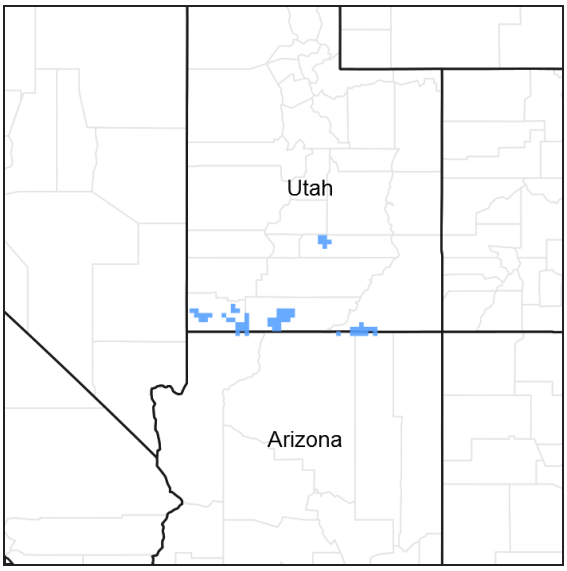

Figure 1. Mapped extent

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

MLRA notes

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

Site concept: This site occurs in the upland zone of the Colorado and Green River Plateaus Region (MLRA 35) in Southern Utah. It is found sand sheets and stabilized dunes atop mesas, structural benches, plateaus, and buttes at elevations between 5500 and 7500 feet. Average annual precipitation is 10 to 16 inches. Soils are fine sands derived from eolian deposits over sandstone residuum. The soil moisture regime is aridic ustic and the soil temperature regime is mesic. The plant community is characterized by a diverse mixture of grasses, forbs, shrubs and trees. Two-needle pinyon and Utah juniper dominate the tree canopy, with mountain big sagebrush, Gambel oak, manzanita, Mormon tea, prickly pear, and various other shrub species common. Sandhill muhly is the most common grass, especially in relatively sandy soils, with blue grama dominant in less sandy areas. Cheatgrass is the most common invader of this site, though it does not dominate.

Associated sites

R035XY011UT	**Loamy Bottom (Basin Big Sagebrush)**
R035XY307UT	**Upland Sand (Mountain Big Sagebrush)**
R035XY314UT	**Upland Shallow Sand (Pinyon-Utah Juniper)**
R035XY315UT	**Upland Shallow Loam (Pinyon-Utah Juniper) AWC <3**

Similar sites

R035XY307UT	**Upland Sand (Mountain Big Sagebrush)** This site occurs on similar soils, but is dominated by perennial grasses and mountain big sagebrush. Pinyon and juniper are known to encroach on this site, which makes these two sites very difficult to distinguish.

Table 1. Dominant plant species

Tree	(1) *Juniperus osteosperma* (2) *Pinus edulis*
Shrub	(1) *Artemisia tridentata var. vaseyana* (2) *Quercus gambelii*
Herbaceous	(1) *Muhlenbergia pungens* (2) *Bouteloua gracilis*

Physiographic features

This site usually occurs on sand sheets and stabilized dunes atop mesas, structural benches, plateaus, and buttes. Slopes are typically between 0-15% and elevations typically range from 5500 to 7500 feet.

Table 2. Representative physiographic features

Landforms	(1) Sand sheet (2) Dune (3) Mesa
Flooding frequency	None
Ponding frequency	None
Elevation	5,500–7,500 ft
Slope	0–15%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site is characterized by warm summers and cold winters. Average annual precipitation ranges from 10-16 inches. June is typically the driest month, as well as April and May. About 35% of the precipitation occurs as cool-season moisture from January to March, while 40% of the moisture occurs as convective thunderstorms from July through October. Large fluctuations in daily temperature are common, and precipitation varies greatly from month to month and from year to year.

Modeled climate data (PRISM) was used to develop this section.

Table 3. Representative climatic features

Frost-free period (average)	140 days
Freeze-free period (average)	180 days
Precipitation total (average)	16 in

Influencing water features

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

Soil features

These soils are typically deep fine sands derived primarily from eolian deposits over sandstone residuum. Very few rock fragments occur on the soil surface and throughout the soil profile. The soil moisture regime is aridic ustic and the soil temperature regime is mesic. These soils are well-drained to excessively-drained, with moderately rapid to very rapid permeability. They can be calcareous or non-calcareous, depending on the parent material. Water holding capacity ranges from 2.4 to 3.6 inches of water in the upper 40 inches of soil.

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

UT629-Loa Marysvale Area - Royosa;
UT641-Washington County Area - Mespun;
UT643-San Juan County - Shedado;
UT685-Capitol Reef National Park - Mido family, Pinepoint;
UT686-Escalante Grand Staircase National Monument - Pinepoint, Tenneycanyon;

Table 4. Representative soil features

Parent material	(1) Eolian sands–sandstone
Surface texture	(1) Fine sand (2) Loamy fine sand (3) Loamy very fine sand
Family particle size	(1) Sandy
Drainage class	Well drained to excessively drained
Permeability class	Moderately rapid to very rapid
Soil depth	20–60 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	2.4–3.6 in
Calcium carbonate equivalent (0-40in)	0–25%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–5
Soil reaction (1:1 water) (0-40in)	7.3–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0–5%

Ecological dynamics

This site's plant species composition is generally dominated by Utah juniper and two-needle pinyon. 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 pinions due to insects and drought have not been recorded for this ecological site. However, given the tendency for pinions to be susceptible to insect and drought kill, managers should be aware of the possibility.

There is no evidence to indicate that this site historically maintained a short burn frequency. Until further research indicates that fire played a role in the ecosystem processes of this site, the state and transition model will not

include fire as a disturbance mechanism in the reference state. However, due to modern disturbances such as brush treatments, invasive species, and OHV use, the resilience of the plant communities may be at risk. Disturbances that reduce the presence of perennial grasses result in an opportunity for invasive annuals to enter into the system and may produce a fuel load for fire to become an ecological driver.

The suitability for range seeding is poor. The major limiting factor is sandy soils, lack of dependable precipitation and low available water capacity.

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

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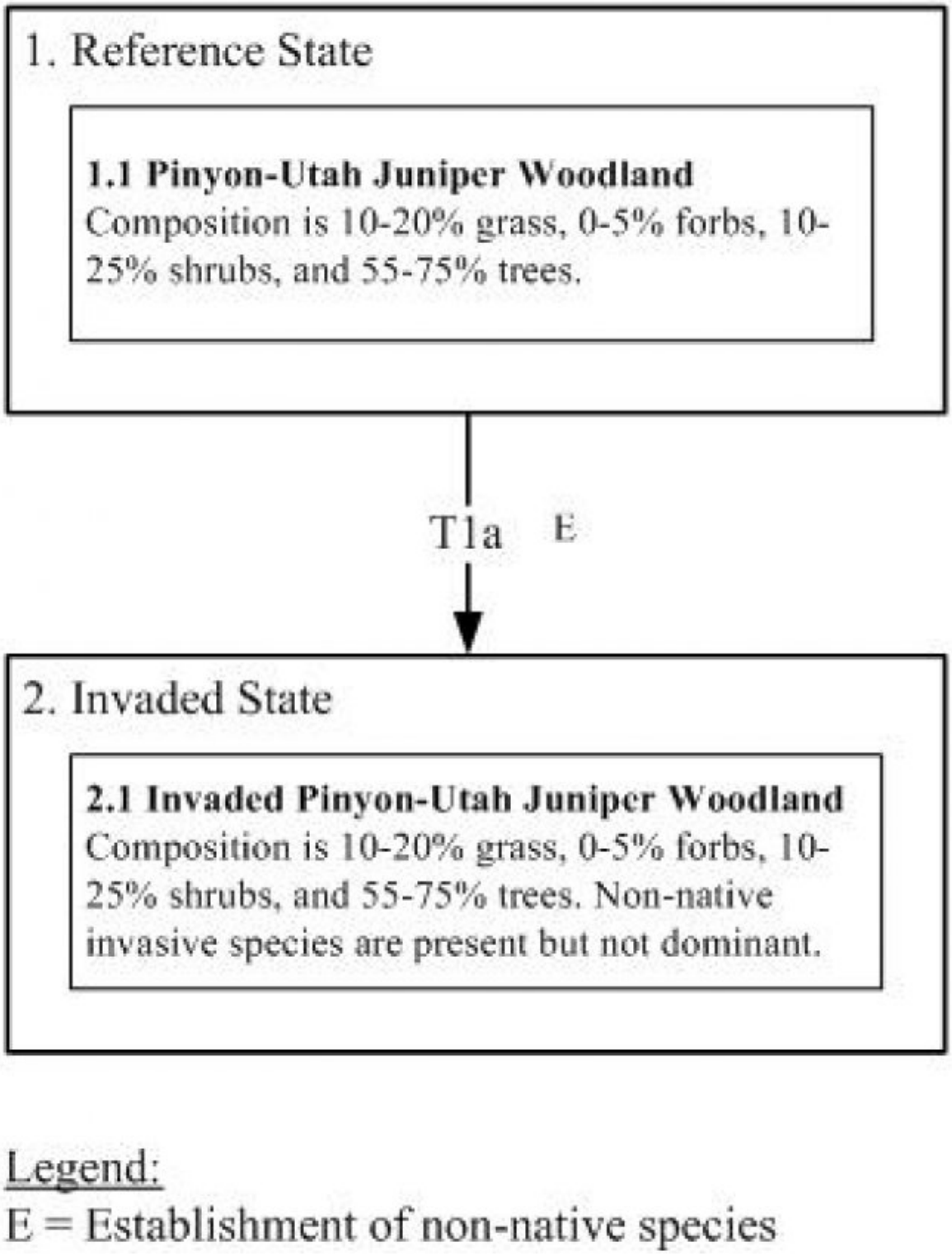

Figure 4. State and Transition Model

State 1
Reference State

The reference state is characterized by a diverse mixture of grasses, forbs, shrubs and trees. Two-needle pinyon and Utah juniper dominate the tree canopy, with mountain big sagebrush, Gambel oak, manzanita, Mormon tea, prickly pear, and various other shrub species common. Sandhill muhly is the most common grass, especially in relatively sandy soils, with blue grama dominant in less sandy areas. Grasses are diverse and often include Indian

ricegrass, needleandthread, mesa dropseed, bluegrass, muttongrass, sand dropseed, and squirreltail.

Community 1.1
Pinyon-Utah Juniper Woodland

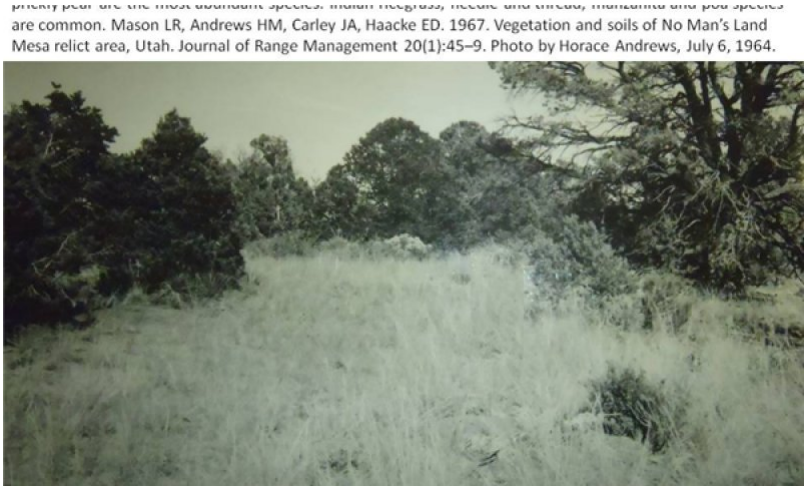

Figure 5. Phase 1.1

Composition by air-dry weight is 10-20% grasses, 0-10% forbs, 10-25% shrubs, and 55-75% trees.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Tree	425	510	600
Shrub/Vine	65	150	250
Grass/Grasslike	55	115	175
Forb	5	25	55
Total	**550**	**800**	**1080**

State 2
Invaded State

This state is functionally and structurally similar to state 1, however it allows for the presence of non-native species. As a result of the establishment of non-native species, the resillience of this state is less than the reference state.

Community 2.1
Pinyon-Utah Juniper Woodland

Composition by air-dry weight is 10-20% grasses, 0-10% forbs, 10-25% shrubs, and 55-75% trees. Non-native invasive species, particularly cheatgrass, are present on the site, but not dominant.

Table 6. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Tree	425	510	600
Shrub/Vine	65	150	250
Grass/Grasslike	55	115	175
Forb	5	25	55
Total	**550**	**800**	**1080**

Transition T1a
State 1 to 2

This transition occurs with the establishment of non-native invasive species, such as cheatgrass. Although disturbances such as roads, recreation, and grazing may facilitate the establishment of non-native species, they may establish on this site in the absence of major soil disturbances.

Additional community tables

Table 7. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
0	**Trees**			425–600	
	Utah juniper	JUOS	*Juniperus osteosperma*	100–450	5–25
	twoneedle pinyon	PIED	*Pinus edulis*	100–450	5–25
Shrub/Vine					
0	**Dominant Shrubs**			50–225	
	Gambel oak	QUGA	*Quercus gambelii*	0–150	0–13
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	5–125	0–10
	mormon tea	EPVI	*Ephedra viridis*	5–115	0–10
	greenleaf manzanita	ARPA6	*Arctostaphylos patula*	0–60	0–5
	plains pricklypear	OPPO	*Opuntia polyacantha*	5–50	0–4
	antelope bitterbrush	PUTR2	*Purshia tridentata*	5–35	0–3
3	**Sub-Dominant Shrubs**			0–50	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–30	0–3
	Utah serviceberry	AMUT	*Amelanchier utahensis*	0–15	0–1
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–15	0–1
	soaptree yucca	YUEL	*Yucca elata*	0–10	0–1
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–10	0–1
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–10	0–1
	buckwheat	ERIOG	*Eriogonum*	0–10	0–1
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–10	0–1
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–10	0–1
Grass/Grasslike					
0	**Dominant Grasses**			55–125	
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–125	0–10
	blue grama	BOGR2	*Bouteloua gracilis*	5–100	0–10
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–40	0–3
1	**Sub-Dominant Grasses**			0–75	
	Grass, perennial	2GP	*Grass, perennial*	0–40	0–3
	muttongrass	POFE	*Poa fendleriana*	0–25	0–2
	Grass, annual	2GA	*Grass, annual*	0–25	0–2
	Sandberg bluegrass	POSE	*Poa secunda*	0–25	0–1
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–20	0–2

	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–15	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	0–1
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	0–1
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–5	0–1
	western wheatgrass	PASM	*Pascopyrum smithii*	0–5	0–1
	purple threeawn	ARPU9	*Aristida purpurea*	0–5	0–1
	squirreltail	ELEL5	*Elymus elymoides*	0–5	0–1
Forb					
2	**Forbs**			5–55	
	cryptantha	CRYPT	*Cryptantha*	0–40	0–3
	Forb, perennial	2FP	*Forb, perennial*	0–30	0–2
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–30	0–2
	Forb, annual	2FA	*Forb, annual*	0–25	0–2
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–10	0–1
	freckled milkvetch	ASLE8	*Astragalus lentiginosus*	0–10	0–1
	aster	ASTER	*Aster*	0–5	0–1
	mustard	BRASS2	*Brassica*	0–5	0–1
	sego lily	CANU3	*Calochortus nuttallii*	0–5	0–1
	Douglas' dustymaiden	CHDO	*Chaenactis douglasii*	0–5	0–1
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–5	0–1
	rabbit ear rockcress	ARPE	*Arabis pendulina*	0–5	0–1
	browse milkvetch	ASCI2	*Astragalus cibarius*	0–5	0–1
	tarragon	ARDR4	*Artemisia dracunculus*	0–5	0–1
	annual buckwheat	ERAN4	*Eriogonum annuum*	0–5	0–1
	Bigelow's rubberweed	HYBI2	*Hymenoxys bigelovii*	0–5	0–1
	blue flax	LIPE2	*Linum perenne*	0–5	0–1
	evening primrose	OENOT	*Oenothera*	0–5	0–1
	beardtongue	PENST	*Penstemon*	0–5	0–1
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	0–5	0–1
	phlox	PHLOX	*Phlox*	0–5	0–1
	woolly plantain	PLPA2	*Plantago patagonica*	0–5	0–1
	Douglas' knotweed	PODO4	*Polygonum douglasii*	0–5	0–1
	tall ragwort	SESE2	*Senecio serra*	0–5	0–1
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–5	0–1
	American vetch	VIAM	*Vicia americana*	0–5	0–1

Table 8. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Tree					
0	**Trees**			425–600	
	Utah juniper	JUOS	*Juniperus osteosperma*	100–450	5–25
	twoneedle pinyon	PIED	*Pinus edulis*	100–450	5–25
Shrub/Vine					

0	**Dominant Shrubs**			50–225	
	Gambel oak	QUGA	*Quercus gambelii*	0–150	0–13
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	5–125	0–10
	mormon tea	EPVI	*Ephedra viridis*	5–115	0–10
	greenleaf manzanita	ARPA6	*Arctostaphylos patula*	0–60	0–5
	plains pricklypear	OPPO	*Opuntia polyacantha*	5–50	0–4
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3	**Sub-Dominant Shrubs**			0–50	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–30	0–3
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	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–10	0–1
	buckwheat	ERIOG	*Eriogonum*	0–10	0–1
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	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–10	0–1
Grass/Grasslike					
0	**Dominant Grasses**			55–125	
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	0–125	0–10
	blue grama	BOGR2	*Bouteloua gracilis*	5–100	0–10
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	2–40	0–3
1	**Sub-Dominant Grasses**			0–75	
	Grass, perennial	2GP	*Grass, perennial*	0–40	0–3
	cheatgrass	BRTE	*Bromus tectorum*	0–25	0–2
	Grass, annual	2GA	*Grass, annual*	0–25	0–2
	muttongrass	POFE	*Poa fendleriana*	0–25	0–2
	Sandberg bluegrass	POSE	*Poa secunda*	0–25	0–1
	needle and thread	HECOC8	*Hesperostipa comata ssp. comata*	0–20	0–2
	mesa dropseed	SPFL2	*Sporobolus flexuosus*	0–15	0–1
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–10	0–1
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–5	0–1
	western wheatgrass	PASM	*Pascopyrum smithii*	0–5	0–1
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–5	0–1
	squirreltail	ELEL5	*Elymus elymoides*	0–5	0–1
	purple threeawn	ARPU9	*Aristida purpurea*	0–5	0–1
Forb					
2	**Forbs**			5–55	
	cryptantha	CRYPT	*Cryptantha*	0–40	0–3
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	Forb, annual	2FA	*Forb, annual*	0–25	0–2

	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–10	0–1
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	aster	ASTER	*Aster*	0–5	0–1
	mustard	BRASS2	*Brassica*	0–5	0–1
	sego lily	CANU3	*Calochortus nuttallii*	0–5	0–1
	lambsquarters	CHAL7	*Chenopodium album*	0–5	0–1
	Douglas' dustymaiden	CHDO	*Chaenactis douglasii*	0–5	0–1
	Wright's bird's beak	COWR2	*Cordylanthus wrightii*	0–5	0–1
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	phlox	PHLOX	*Phlox*	0–5	0–1
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	Douglas' knotweed	PODO4	*Polygonum douglasii*	0–5	0–1
	tall ragwort	SESE2	*Senecio serra*	0–5	0–1
	prairie spiderwort	TROC	*Tradescantia occidentalis*	0–5	0–1
	American vetch	VIAM	*Vicia americana*	0–5	0–1
	rabbit ear rockcress	ARPE	*Arabis pendulina*	0–5	0–1
	browse milkvetch	ASCI2	*Astragalus cibarius*	0–5	0–1
	tarragon	ARDR4	*Artemisia dracunculus*	0–5	0–1

Animal community

--Livestock and Wildlife Grazing--

This site provides fair/good grazing conditions for livestock and wildlife 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 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. The suitability for reseeding and/or restoration is poor due to the lack of precipitation at critical times and shallow soil characteristics. This site may occur in mule deer and desert bighorn 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 mountain big sagebrush, green jointfir, broom snakeweed, and antelope bitterbrush, which provide browse for cattle, sheep, goats, mule deer, and bighorn sheep. The presence of grasses, including Indian ricegrass, blue grama and needleandthread, provide desirable 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 utilize these trees as forage. Forb composition and annual production depends primarily on precipitation amounts and thus is challenging to use in livestock grazing management decisions. However, forb composition should be monitored for species diversity, as well as poisonous or injurious plant communities which may be detrimental to livestock if grazed. Before making specific grazing management recommendations, an onsite evaluation must be made.

Recreational uses

Recreational activities include aesthetic values, hiking, and hunting.

Wood products

The site index for this site is 50. Wood is used for fenceposts and firewood.

Other information

--Poisonous/Toxic Plant Communities--

Toxic plant communities associated with this site include broom snakeweed, sand sagebrush, and freckled milkvetch. 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. Sand sagebrush is toxic to horses, but not to other livestock and wildlife ruminants. This plant contains sesquiterpene lactones and monoterpenes, where toxic concentrations are greatest in the late fall and winter. Horses develop neurological signs and exhibit abnormal behavior, such as ataxia and the tendency to fall down, after eating sand sagebrush for several days. Freckled milkvetch is toxic to all classes of livestock and may be toxic to 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. Milkvetch 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”.

Potentially toxic plants associated with this site include mountain and Wyoming big sagebrush, which contain 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.

Russian thistle is an invasive toxic plant, causing nitrate and to a lesser extent oxalate poisoning, which affects all classes of livestock. The buildup of nitrates in these plants is highly dependent upon environmental factors, such as after a rain storm during a drought, cool/cloudy days, and soils high in nitrogen and low in sulfur and phosphorus, all which cause increased nitrate accumulation. Nitrate collects in the stems and can persist throughout the growing season. Clinical signs of nitrate poisoning include drowsiness, weakness, muscular tremors, increased heart and respiratory rates, staggering gait, and death. Conversely, oxalate poisoning causes kidney failure; clinical signs include muscle tremors, tetany, weakness, and depression. Poisoning generally occurs when livestock consume and are not accustomed to grazing oxalate-containing plants. Animals with prior exposure to oxalates have increased numbers of oxalate-degrading rumen microflora and thus are able to degrade the toxin before clinical poisoning can occur.

--Invasive Plant Communities--

Generally as ecological conditions deteriorate and perennial vegetation decreases due to disturbance (fire, over grazing, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses will invade the site. Of particular concern in semi-arid environments are the non-native annual invaders including cheatgrass, Russian thistle, kochia, halogeton, and annual mustards. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible.

--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 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.

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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	01/31/2007
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None to very few. Any rills present should be somewhat short in length (less than 6 feet long) and follow the surface micro-features. An increase in rill formation may be seen after disturbance events such as

recent fire or thunderstorms in adjacent landscape settings where increased runoff may accumulate (such as areas below exposed bedrock). Such rill development should usually be limited to slopes exceeding 6%. Rills heal rapidly due to the coarse soil textures.

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2. **Presence of water flow patterns:** Flow patterns wind around perennial plant bases and show little to slight evidence of erosion. They are short and stable and there is minor evidence of deposition. On gently sloping (< 4 % slopes) locations within the site, water flow patterns are infrequent and usually less than 3 feet. Longer water flow patterns may be found on steeper slopes.

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3. **Number and height of erosional pedestals or terracettes:** Herbaceous plants may show little pedestaling. Pedestals may be up to 4 inches for shrubs. Terracettes should be absent or few. Pedestals that occur are usually associated with natural wind erosion.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 30 – 40% bare ground. 0-5% surface fragments. Ground cover is based on the first raindrop impact, and bare ground is the opposite of ground cover. Any well developed biological crusts present should not be recorded 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.

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5. **Number of gullies and erosion associated with gullies:** None to few. Some gullies may be present in landscape settings where increased runoff may accumulate (such as areas below exposed bedrock). Such gully development is expected to be limited to steeper slopes and adjacent to sites where runoff accumulation occurs. Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Some wind generated soil movement is normal. This site has the appearance of dunes that have been healed over. Wind caused blowouts and deposition are mostly stable or have healed over. Coppice mounding around perennial vegetation is common, especially the Mormontea. Increased wind generated soil movement can occur during severe wind events.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water movement. Very minor litter removal may occur in flow patterns and rills with deposition occurring at points of obstruction. The majority of litter accumulates at the base of plants. Some grass leaves and small twigs (grass stems) may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move.

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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, and a rating of 2 to 4 in the interspaces. The average should be a 3 or 4. Surface texture is fine sand to loamy very fine sand. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil

surface horizon is typically 6 to 7 inches deep. Structure is typically single grain and weak fine subangular blocky to weak medium granular. Color is typically pale brown (10YR6\3) to yellowish red (5YR5/6). 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:** Vascular plants will break raindrop impact and splash erosion. Spatial distribution of vascular plants provide detention storage and surface roughness that slows runoff allowing time for infiltration. Interspaces between plants may serve as water flow patterns during episodic runoff events, with natural erosion expected in severe storms. When perennial grasses decrease, reducing ground cover and increasing bare ground, runoff is expected to increase and any associated infiltration reduced.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** none

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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: Trees (Juniper > Pinion) > Non sprouting shrubs > Cool season perennial grasses > Sprouting shrubs = Warm season perennial grasses

    Sub-dominant: forbs > native annual grass

    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 it's expression where present on this site and is measured as a component of ground cover.

    Additional: Disturbance regime includes parasites, drought, insects, and infrequent fire. Following a recent disturbance such as fire, drought, or insects that removes the woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community. If a disturbance has not occurred for an extended period of time, woody species may continue to increase crowding out the perennial herbaceous understory species. In either case, these conditions could reflect a functional community phase within the reference state.
    Dominants: Utah juniper, Pinion, Mountain big sagebrush, Mormontea, Broom snakeweed ; Sub-dominants: Indian ricegrass, Sandhill muhly, Squirreltail, Bitterbrush. 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 to above average growing conditions with age class expression likely subdued during below average years, or on sites with high (usually greater tan 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):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 400-500 lbs/ac

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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:** Snakeweed and introduced annual grasses and forbs are expected to increase or invade this site.

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