USDA Natural Resources
Conservation Service

Ecological site R035XY307UT
Upland Sand (Mountain Big Sagebrush)

Accessed: 05/11/2025

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.

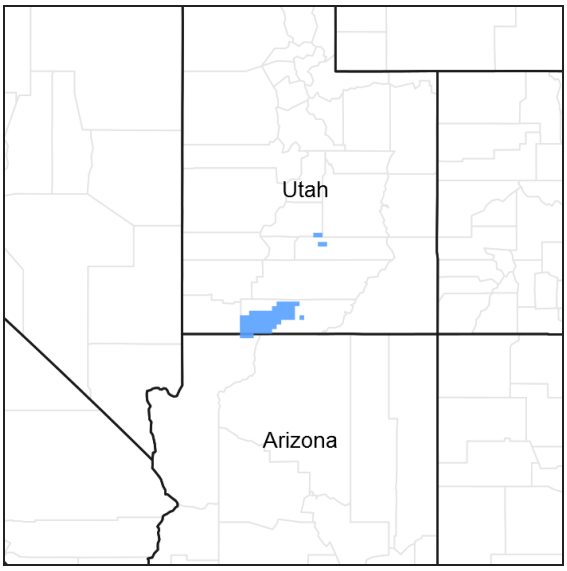

Figure 1. Mapped extent

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 climate zone of the Colorado and Green River Plateaus region (MLRA 35), at elevations between 5,200 to 7,900 feet. It is found mostly on sand sheets and climbing dunes that occur on structural benches or valley floors. Average annual precipitation ranges from 11 to 16 inches, with about 40% coming as convective thunderstorms from July through October. The soils are deep sands with very few rock fragments. The soil moisture regime is aridic ustic and the soil temperature regime is mesic. Mountain big sagebrush, blue grama, and needle-and-thread dominate the plant community. Utah juniper and pinyon, as well and non-native invasive grasses and forbs, are likely to invade this when the ecological condition deteriorates. However, these invasions have not yet been documented on this site.

Similar sites

R035XY324UT	**Upland Sand (Utah Juniper-Pinyon)** This site has drier soil conditions and supports Utah juniper and two-needle pinyon in the reference state.

Table 1. Dominant plant species

Tree	Not specified

Shrub	(1) *Artemisia tridentata ssp. vaseyana*
Herbaceous	(1) *Bouteloua gracilis* (2) *Hesperostipa comata*

Physiographic features

This site is found mostly on sand sheets and climbing dunes that occur on structural benches or valley floors. It can also be found on dunes, alluvial flats and drainageways. Slopes usually range from 2-15% but can bu up to 50% on dunes and other steep landforms. Elevations range from 5200 to 7900 ft.

Table 2. Representative physiographic features

Landforms	(1) Sand sheet (2) Structural bench (3) Valley floor
Flooding frequency	None
Ponding frequency	None
Elevation	5,200–7,900 ft
Slope	2–50%

Climatic features

The climate of this site is characterized by warm summers and cold winters. Annual precipitation averages 11 to 16 inches, with as much as 40% coming in the form of convective thuderstorms from July through October. June is typically the driest month during the growing season. Large fluctuations in daily temperature are common, and precipitation varies greatly from month to month and from year to year.

This section was developed using modeled climate data (PRISM) for soil map units correlated to this site.

Table 3. Representative climatic features

Frost-free period (average)	100 days
Freeze-free period (average)	120 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

The soils of this site are deep sands with very few rock fragments on the soil surface and throughout the profile. They formed in eolian deposits, alluvium and/or slope alluvium derived from sandstone. They are somewhat excessively drained with rapid permeability. Available water holding capacity ranges from 1.9 to 3.3 inches of water in the upper 40 inches of soil. The soil moisture regime is aridic ustic and the soil temperature regime is mesic.

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

UT623 - Emery Area - Maybell soil;
UT629 - Loa Marysvale Area - Royosa soil;
UT642 - Kane County Area - Pinepoint soil;
UT685 - Capitol Reef National Park - Pinepoint;
UT686 - Escalante Grand Staircase - Pinepoint;

Table 4. Representative soil features

Parent material	(1) Eolian sands–sandstone
Surface texture	(1) Fine sand (2) Loamy sand
Family particle size	(1) Sandy
Drainage class	Somewhat excessively drained to excessively drained
Permeability class	Rapid to very rapid
Soil depth	20 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	1.9–3.3 in
Calcium carbonate equivalent (0-40in)	0–2%
Electrical conductivity (0-40in)	2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	6.6–7.3
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

As ecological condition deteriorates due to overgrazing, Indian ricegrass, bottlebrush squirreltail decrease while sandhill muhly, milkvetch, broom snakeweed, increase. Fire does not appear to be an important factor in this ecosystem. However, when the potential natural plant community is burned some shrubs will temporarily decrease while grasses and fire tolerant shrubs may increase. Prolonged heavy wildlife browsing, aroga moth, or snow mold may also reduce woody species.

Utah juniper and pinyon, as well and non-native invasive grasses and forbs, are likely to invade this when the ecological condition deteriorates. However, these invasions have not yet been documented on this site.

The suitability for range seeding is poor. The major limiting factors are the severe hazard of erosion by wind and low available water capacity.

The modal location of this site occurs in Nephi’s Pasture which is in a cold pocket or bowl below the white cliffs. The area has very little slope and when the slope is increased over 15%, the plant community starts changing gradually due to the drier soil conditions into the ecological site – Upland Sand (Utah Juniper – Pinyon).

State and transition model

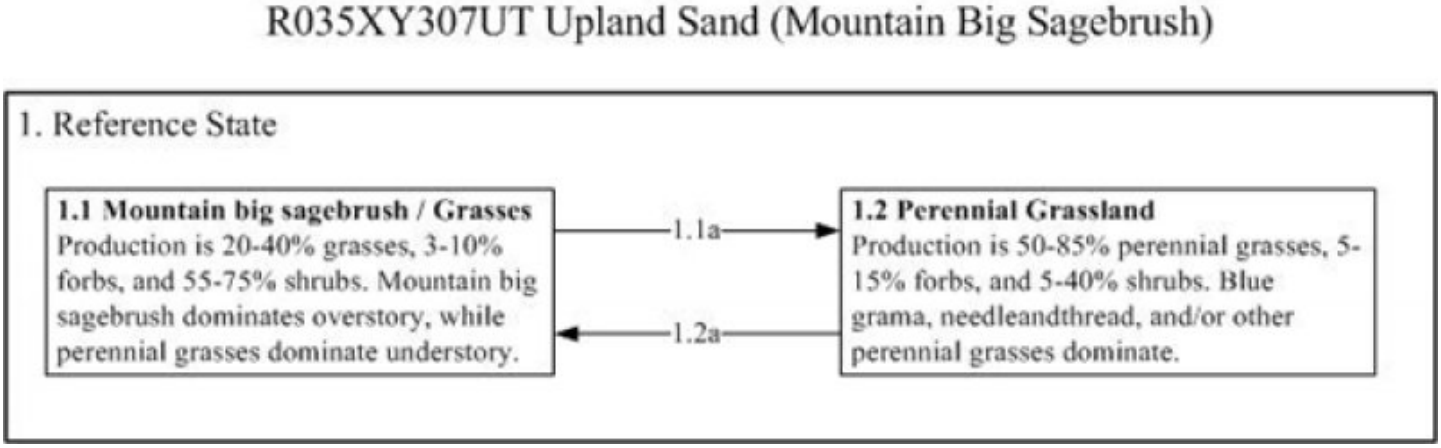

Figure 4. State-and-Transition Model

State 1
Reference State

The reference state represents the plant communities and ecological dynamics of the upland sand (mountain big sagebrush) site. This state includes the biotic communities that become established on the ecological site if all successional sequences are completed under the natural disturbance regime. The reference state is generally dominated by perennial grasses and mountain and/or Bonneville big sagebrush. The reference state is self sustaining and resistant to change due to high resistance to natural disturbances and high resilience following natural disturbances. When natural disturbances occur, the rate of recovery is variable due to disturbance intensity. Once invasive plants establish, return to the reference state may not be possible.

Community 1.1
Mountain big sagebrush / Perennial grass

The general view of this site is mountain big sagebrush with perennial grasses. The composition by annual air-dry weight is approximately 20-40% perennial grasses, 3-10% forbs, and 55-75% shrubs. In average years, plants begin growth around March 10 and end growth around October 10.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	275	375	475
Shrub/Vine	75	200	300
Forb	25	75	100
Total	**375**	**650**	**875**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	2-15%
Grass/grasslike foliar cover	20-30%
Forb foliar cover	3-8%
Non-vascular plants	0%
Biological crusts	0-5%
Litter	10-20%
Surface fragments >0.25" and <=3"	0-3%
Surface fragments >3"	0%

Bedrock	0%
Water	0%
Bare ground	25-50%

Table 7. Canopy structure (% cover)

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

Community 1.2
Perennial grassland

Figure 6. Phase 1.2

The general view of this site is perennial grasses with diverse forbs and sparse shrubs. Composition by annual air-dry weight is approximately 50-85% perennial grasses, 5-15% forbs, and 5-40% shrubs. Blue grama, needleandthread, sandhill muhly, and Indian ricegrass usually dominate. In average years, plants begin growth around March 10 and end growth around October 10.

Table 8. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	250	425	550
Grass/Grasslike	125	200	275
Forb	20	35	50
Total	**395**	**660**	**875**

Table 9. Ground cover

Tree foliar cover	0%

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

Table 10. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	0-5%	0-5%	0-5%
>0.5 <= 1	–	0-5%	5-15%	0-5%
>1 <= 2	–	0-10%	10-25%	0-5%
>2 <= 4.5	–	5-10%	2-10%	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

Pathway 1.1a
Community 1.1 to 1.2

Sagebrush decreases and perennial grasses and forbs increase. This may be due to prolonged wildlife browsing, aroga moth, snow mold, prolonged drought, and/or wildfire.

Pathway 1.2a
Community 1.2 to 1.1

This pathway results from the establishment and natural increase of Wyoming big sagebrush into the plant community 10-30 years following a fire or other sagebrush-reducing disturbance.

Additional community tables

Table 11. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
0	**Dominant Grasses**			200–400	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	175–450	10–25
	blue grama	BOGR2	*Bouteloua gracilis*	50–200	3–14
	needle and thread	HECO26	*Hesperostipa comata*	25–200	2–14

	sandhill muhly	MUPU2	*Muhlenbergia pungens*	25–75	2–5
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	25–75	2–5
	Gambel oak	QUGA	*Quercus gambelii*	15–75	1–5
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	20–75	2–5
1	**Sub-Domminant Grasses**			25–150	
	Grass, perennial	2GP	*Grass, perennial*	25–100	2–7
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–35	0–2
	Grass, annual	2GA	*Grass, annual*	5–35	0–2
	squirreltail	ELEL5	*Elymus elymoides*	0–20	0–2
	western wheatgrass	PASM	*Pascopyrum smithii*	0–20	0–2
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–15	0–1
Forb					
2	**Forbs**			20–50	
	Forb, annual	2FA	*Forb, annual*	5–30	0–2
	Forb, perennial	2FP	*Forb, perennial*	5–30	0–2
	cryptantha	CRYPT	*Cryptantha*	0–20	0–2
	buckwheat	ERIOG	*Eriogonum*	0–20	0–2
	spotted fritillary	FRAT	*Fritillaria atropurpurea*	0–20	0–2
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–20	0–2
	beardtongue	PENST	*Penstemon*	0–20	0–2
	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–20	0–2
	Pacific aster	SYCH4	*Symphyotrichum chilense*	0–20	0–2
	woolly plantain	PLPA2	*Plantago patagonica*	0–10	0–1
	evening primrose	OENOT	*Oenothera*	0–10	0–1
Shrub/Vine					
3	**Shrubs**			75–300	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	0–200	0–14
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	25–75	2–5
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	0–50	0–4
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–50	0–4
	Gambel oak	QUGA	*Quercus gambelii*	0–50	0–4
	mormon tea	EPVI	*Ephedra viridis*	0–35	0–2
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–30	0–2
	prairie sagewort	ARFR4	*Artemisia frigida*	0–30	0–2
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–20	0–2
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–20	0–2
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–20	0–2
	brittle pricklypear	OPFR	*Opuntia fragilis*	0–20	0–2
	plains pricklypear	OPPO	*Opuntia polyacantha*	5–20	0–2
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	5–20	0–2
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–15	0–1

Table 12. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Shrub/Vine					
0	**Dominant Shrubs**			200–450	
	mountain big sagebrush	ARTRV	*Artemisia tridentata ssp. vaseyana*	175–450	10–25
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	25–75	2–5
	Gambel oak	QUGA	*Quercus gambelii*	15–75	1–5
3	**Sub-Dominant Shrubs**			25–100	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	25–75	2–5
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–50	0–4
	mormon tea	EPVI	*Ephedra viridis*	0–35	0–2
	prairie sagewort	ARFR4	*Artemisia frigida*	0–30	0–2
	fourwing saltbush	ATCA2	*Atriplex canescens*	0–30	0–2
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	5–20	0–2
	sand sagebrush	ARFI2	*Artemisia filifolia*	0–20	0–2
	brittle pricklypear	OPFR	*Opuntia fragilis*	0–20	0–2
	plains pricklypear	OPPO	*Opuntia polyacantha*	5–20	0–2
	spineless horsebrush	TECA2	*Tetradymia canescens*	0–20	0–2
	narrowleaf yucca	YUAN2	*Yucca angustissima*	0–20	0–2
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–15	0–1
Grass/Grasslike					
0	**Dominant Grasses**			100–250	
	blue grama	BOGR2	*Bouteloua gracilis*	50–125	3–8
	needle and thread	HECO26	*Hesperostipa comata*	25–75	2–5
	sandhill muhly	MUPU2	*Muhlenbergia pungens*	25–75	2–5
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	20–75	2–5
1	**Sub-Domminant Grasses**			25–100	
	Grass, perennial	2GP	*Grass, perennial*	25–75	2–5
	sand dropseed	SPCR	*Sporobolus cryptandrus*	0–35	0–2
	Grass, annual	2GA	*Grass, annual*	5–35	0–2
	squirreltail	ELEL5	*Elymus elymoides*	0–20	0–2
	western wheatgrass	PASM	*Pascopyrum smithii*	0–20	0–2
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–15	0–1
Forb					
2	**Forbs**			20–50	
	Forb, annual	2FA	*Forb, annual*	5–30	0–2
	Forb, perennial	2FP	*Forb, perennial*	5–30	0–2
	cryptantha	CRYPT	*Cryptantha*	0–20	0–2
	buckwheat	ERIOG	*Eriogonum*	0–20	0–2
	spotted fritillary	FRAT	*Fritillaria atropurpurea*	0–20	0–2
	fineleaf hymenopappus	HYFI	*Hymenopappus filifolius*	0–20	0–2
	beardtongue	PENST	*Penstemon*	0–20	0–2

	gooseberryleaf globemallow	SPGR2	*Sphaeralcea grossulariifolia*	0–20	0–2
	Pacific aster	SYCH4	*Symphyotrichum chilense*	0–20	0–2
	woolly plantain	PLPA2	*Plantago patagonica*	0–10	0–1
	evening primrose	OENOT	*Oenothera*	0–10	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. Reseeding and/or restoration are possible, but the major limiting factor is the lack of precipitation at critical times. This site may occur in mule deer, desert bighorn sheep, pronghorn antelope, and elk 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, rabbitbrush, sand sagebrush, mormontea, gamble’s oak, and antelope bitterbrush, which provide good browse for cattle, sheep, goats, elk, mule deer, and desert bighorn sheep. The dominant shrub, mountain big sagebrush, is more palatable than the other two sub species of big sagebrush (Wyoming and basin) and thus is utilized more readily by livestock and wildlife, especially in the winter. The presence of grasses including blue grama, sandhill muhly, and Indian ricegrass provide good grazing habitat for all classes of livestock and wildlife. 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--

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

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

USDA, Forest Service. 2007. Fire effects information: plant species life form. Available at http://www.fs.fed.us/database/feis/plants/index.html. Accessed 7 August 2007.

Hydrological functions

The soil is in hydrologic group A in mapunits 5120, 5126 & 5181. The soil is in hydrologic group B in mapunit 5180.

Recreational uses

Recreational activities include aesthetic values, hiking, and hunting.

Wood products

None

Other information

--Poisonous/Toxic Plant Communities--

Toxic plants associated with this site include sand sagebrush, oak brush, and broom snakeweed. 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. Oakbrush 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. 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.

Potentially toxic plants associated with this site include some buckwheat species and mountain big sagebrush. Some buckwheat species 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. Mountain big sagebrush contains sesquiterpene lactones and monoterpenes which have been suspected of being toxic to sheep. An experimental dosage of ¾ lbs of big sagebrush fed to sheep for three days was found to be lethal.

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. Pinyon pine and Utah juniper are natural invaders if stands are found adjacent to this site. Trees left uncontrolled can form dense stands and eventually dominate the site.

--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.

Fire is an important aspect of mountain big sagebrush dominated ecological sites. Fire intervals are historically 15-20 years. Shrub vegetation is able to reestablish from seed dispersal from the adjacent non burned sagebrush stands; however the process is relatively slow. Fire also decreases the extent of Utah juniper/pinyon pine invasions, which allows the historic plant community to maintain integrity. When the plant community is burned shrubs will

decrease, while perennial and annual grasses increase. The perennial shrubs associated with this site are able to recover at a faster rate than the invading trees. When the site is degraded by the presence of invasive annuals, the fire return interval is shortened due to increased flashy fuels. The shortened fire return interval is often sufficient to suppress the native plant community.

--References--

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

USDA, Forest Service. 2007. Fire effects information: plant species life form. Available at http://www.fs.fed.us/database/feis/plants/index.html. Accessed 7 August 2007.

Other references

Johnson, Kathleen A. 2000. Artemisia tridentata subsp. vaseyana. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, September 12].

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

USDA, Forest Service. 2007. Fire effects information: plant species life form. Available at http://www.fs.fed.us/database/feis/plants/index.html. Accessed 7 August 2007.

Contributors

Susanne Mayne

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	11/20/2012
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 (<6 feet). An increase in rill formation may be seen after recent large thunderstorms. Such rill development should usually be limited to slopes exceeding 5% and adjacent to sites where runoff accumulation occurs (i.e. exposed bedrock, small watersheds, steep sites,etc.). Rills heal rapidly due to the coarse soil textures and frost heaving action over a couple of

winters.

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2. **Presence of water flow patterns:** Any water flow patterns present should be shorter than 5 feet and widely spaced (>20 feet), increasing with increased slopes. Very little deposition should be present.

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3. **Number and height of erosional pedestals or terracettes:** Rare. Any pedestals that occur are usually associated with natural wind erosion, and should not have exposed roots. Shrubs normally have coppice mounding up to 4 inches caused by deposition of wind borne sediments, do not misinterpret these as pedestals. Terracettes should be very rare, occurring in waterflow patterns obstructed by woody litter.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 35-50% bare ground. 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. 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 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:** Very minor soil movement by wind is normal. Wind caused blowouts, usually on hilltops or elevated areas (ridges), are generally stable or have healed over. Coppice mounding around Mormontea and other shrubs is common. 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 very little redistribution caused by water and wind movement.

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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 3 to 4 in the interspaces using the soil stability kit test. The average should be a 4.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface is typically about 6 inches. Structure typically weak fine subangular blocky. Color typically pale brown (10YR 6/3) when dry, or brown (10YR 4/3) when wet. The A horizon would be expected to be more strongly developed under plant canopies. It is important if you are sampling to observe the A horizon under plant canopies as well as the interspaces. Refer to soil survey for more detailed information about your specific site.

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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 and any well developed biological soil crusts will break raindrop impact and splash erosion. Spatial distribution of vascular plants and interspaces between well developed biological soil crusts (where present) provide detention storage and surface roughness that slows runoff allowing time for infiltration. Interspaces between plants and any well developed biological soil crusts (where present) 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. Naturally occurring soil horizons may be harder than the surface because of an accumulation of clay or calcium carbonate and should not be considered as 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: perennial grasses (Sandhill Muhly, Blue Grama) > non sprouting shrubs (Big sagebrush)

    Sub-dominant: sprouting shrubs (Gambel's oak, Rubber rabbitbrush, Bitterbrush) > 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 and Russian wildrye etc.). Forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

    Additional: Temporal variability factors include insects, drought, and infrequent fire. Spatial variability factors include soil texture, slope, etc.
    Following a recent disturbance such as fire or drought 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 reflect a community phase within the reference state.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** During years with average to above average precipitation, there should be very little recent mortality or decadence apparent in either the shrubs or grasses. Some mortality of bunchgrass and other shrubs may occur during very severe (long term) droughts.

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14. **Average percent litter cover (%) and depth (in):** Litter cover (including under plants) nearly all of which should be fine litter. Depth should be 1 leaf thickness in the interspaces and up to 1/2” under canopies. Litter cover may increase to 20% on some years due to increased grass plant production.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 650 #/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: Cheatgrass, Broom snakeweed & introduced annual forbs (Filarie, Russian thistle).

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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.
