USDA Natural Resources Conservation Service

Ecological site R028AY227UT
Semidesert Gravelly Sandy Loam (Black Sagebrush)

Accessed: 05/16/2024

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.

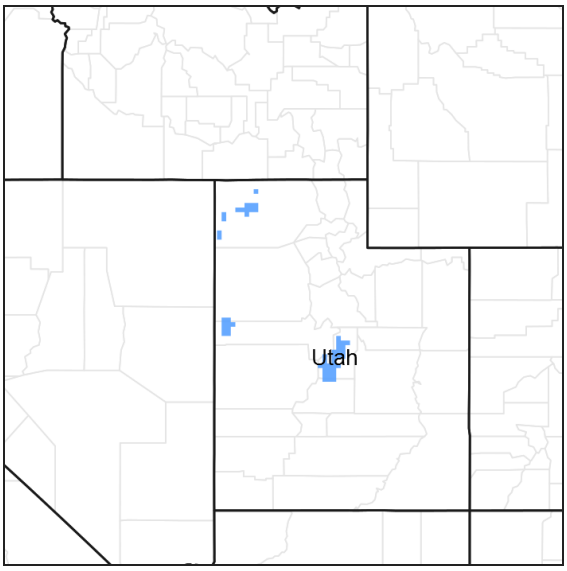

Figure 1. Mapped extent

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): 028A–Ancient Lake Bonneville

MLRA 28A occurs in Utah (82%), Nevada (16%), and Idaho (2%). It encompasses approximately 36,775 square miles (95,246 square kilometers). A large area west and southwest of Great Salt Lake is a salty playa. This area is the farthest eastern extent of the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. It is an area of nearly level basins between widely separated mountain ranges trending north to south. The basins are bordered by long, gently sloping alluvial fans. The mountains are uplifted fault blocks with steep side slopes. Most of the valleys are closed basins containing sinks or playa lakes. Elevation ranges from 3,950 to 6,560 feet (1,204 to 2000 meters) in the basins and from 6,560 to 11,150 feet (1996 to 3398 meters) in the mountains. Much of the MLRA has alluvial valley fill and playa lakebed deposits at the surface from pluvial Lake Bonneville, which dominated this MLRA 13,000 years ago. A level line of remnant lake terraces on some mountain slopes indicates the former extent of this glacial lake. The Great Salt Lake is what remains of the pluvial lake.

Mountains in the interior of this MLRA consist of tilted blocks of marine sediments from Cambrian to Mississippian age with scattered outcrops of Tertiary continental sediments and volcanic rocks. The average annual precipitation is 5 to 12 inches (13 to 30 cm) in the valleys and ranges up to 49 inches (124 cm) in the mountains. Most of the rainfall in the southern LRU occurs as high-intensity, convective thunderstorms during the growing season (April through September). The driest period is from midsummer to early autumn in the northern LRU. Precipitation in winter typically occurs as snow. The average annual temperature is 39 to 53 °F (4 to 12 °C). The freeze-free period averages 165 days and ranges from 110 to 215 days, decreasing in length with increasing elevation. The dominant

soil orders in this MLRA are Aridisols, Entisols, and Mollisols. Soils are dominantly in the mesic or frigid soil temperature regime, aridic or xeric soil moisture regime, and mixed mineralogy. They generally are well drained, loamy or loamy-skeletal, and very deep.

Land Resource Unit (LRU): Basin and Range North

Notes: The Basin and Range North LRU exhibits dry summer with stronger xeric patterns than the Basin and Range South LRU. Ranges in the north LRU are about 50 percent Paleozoic sedimentary/metasedimentary (limestone/quartzite dominant) and about 10 percent Tertiary volcanics. The basin floors are between 4,200 and 5,100 feet (1280 to 1554 meters) in elevation. Pinyon and juniper sites have a greater percentage of Utah juniper (Juniperus osteosperma) in the plant community than pinyon pine (Pinus edulis or monophylla). The Basin and Range North have few semidesert ecological sites with Utah juniper. Cool season grasses, such as bluebunch wheatgrass (Pseudoroegneria spicata), are dominant in the plant community, while warm season grasses are largely absent or a small component of the plant community.

Classification relationships

MLRA: 28A Great Salt Lake Area> LRU: Basin and Range North> Ecological Zone: Semidesert> Ecological Site> Semidesert Gravelly Sandy Loam (Black Sagebrush)

EPA Ecoregions: North American Desert> Cold Deserts> Central Basin and Range> Shadscale-Dominated Saline Basins> Sagebrush Basins and Slopes, Woodland-and Shrub-Covered Low Mountains

Ecological site concept

This site is found on alluvial fans on lake terraces. The soil is typically a deep well drained gravelly sandy loam. Black sagebrush is the dominant shrub and Indian ricegrass is the dominant understory species.

Associated sites

R028AY215UT	**Semidesert Gravelly Loam (Wyoming Big Sagebrush) North** Located adjacent to the site, typically in soil that does not have the carbonate cementation.
R028AY226UT	**Semidesert Sandy Loam (Wyoming Big Sagebrush)** Located adjacent to the site on soil that has fewer coarse fragments in the soil.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia nova*
Herbaceous	Not specified

Physiographic features

This site occurs on alluvial fans on lake terraces. It is found between 4500 and 6000 feet on slopes between 1 and 8 percent. There is no flooding or ponding on this site.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Lake terrace
Flooding frequency	None
Ponding frequency	None
Elevation	1,372–1,829 m
Slope	1–8%

Climatic features

The climate is semi-arid and characterized by cold snowy winters and warm dry summers. The average annual precipitation is 8 to 12 inches. Approximately 70 percent comes as rain from March through October. On the average, June through September are the driest months and March through May are the wettest months.

Table 3. Representative climatic features

Frost-free period (average)	103 days
Freeze-free period (average)	131 days
Precipitation total (average)	279 mm

Climate stations used

- (1) MORONI [USC00425837], Mount Pleasant, UT

Influencing water features

Soil features

The characteristic soils in this site are over 60 inches deep and well drained.

They formed in ancient beach deposits derived mainly from granite, sandstone, and ryolite parent materials. The surface horizon is gravelly sandy loam textures and 3 inches thick. About 15 percent of the soil surface is covered by rock fragments; the volume of rock fragments in the soil profile is 5 to 15 percent.

The soils have weak carbonate and silica cementation above a depth of 20 inches. The available water capacity is 2 to 6 inches. The permeability is moderate. Runoff is slow with a slight erosion hazard. The cementation is the limiting soil factor affecting plant growth on this site, allowing black sagebrush to dominate instead of a big sagebrush species.

Modal soil for this site is Okrist GR-SL, found on the east fan of the Pilot Mountains.

This site is correlated to the following soil component:
Box Elder County, Utah - Western Part (UT601): Okrist

Table 4. Representative soil features

Parent material	(1) Alluvium–limestone and sandstone (2) Beach sand–shale
Surface texture	(1) Gravelly sandy loam (2) Fine sandy loam
Drainage class	Well drained
Permeability class	Slow to moderately rapid
Soil depth	152 cm
Surface fragment cover <=3"	8–22%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	4.32–15.75 cm
Calcium carbonate equivalent (0-101.6cm)	0–40%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm

Sodium adsorption ratio (0-101.6cm)	1–5
Soil reaction (1:1 water) (0-101.6cm)	7.4–9
Subsurface fragment volume <=3" (Depth not specified)	8–12%
Subsurface fragment volume >3" (Depth not specified)	7%

Ecological dynamics

As ecological condition deteriorates due to overgrazing, Indian ricegrass (*Achnatherum hymenoides*), needleandthread (*Hesperostipa comata*), and globemallow (*Sphaeralcea coccinea*) decrease while rabbitbrush (*Chrysothamnus viscidiflorus*) and broom snakeweed (*Gutierrezia sarothrae*) increase.

When the potential natural plant community is burned, Indian ricegrass and black sagebrush (*Artemisia nova*) decrease while rabbitbrush and horsebrush (*Tetradymia nuttallii*) increase.

Cheatgrass (*Bromus tectorum*) and annual forbs are most likely to invade this site.

State and transition model

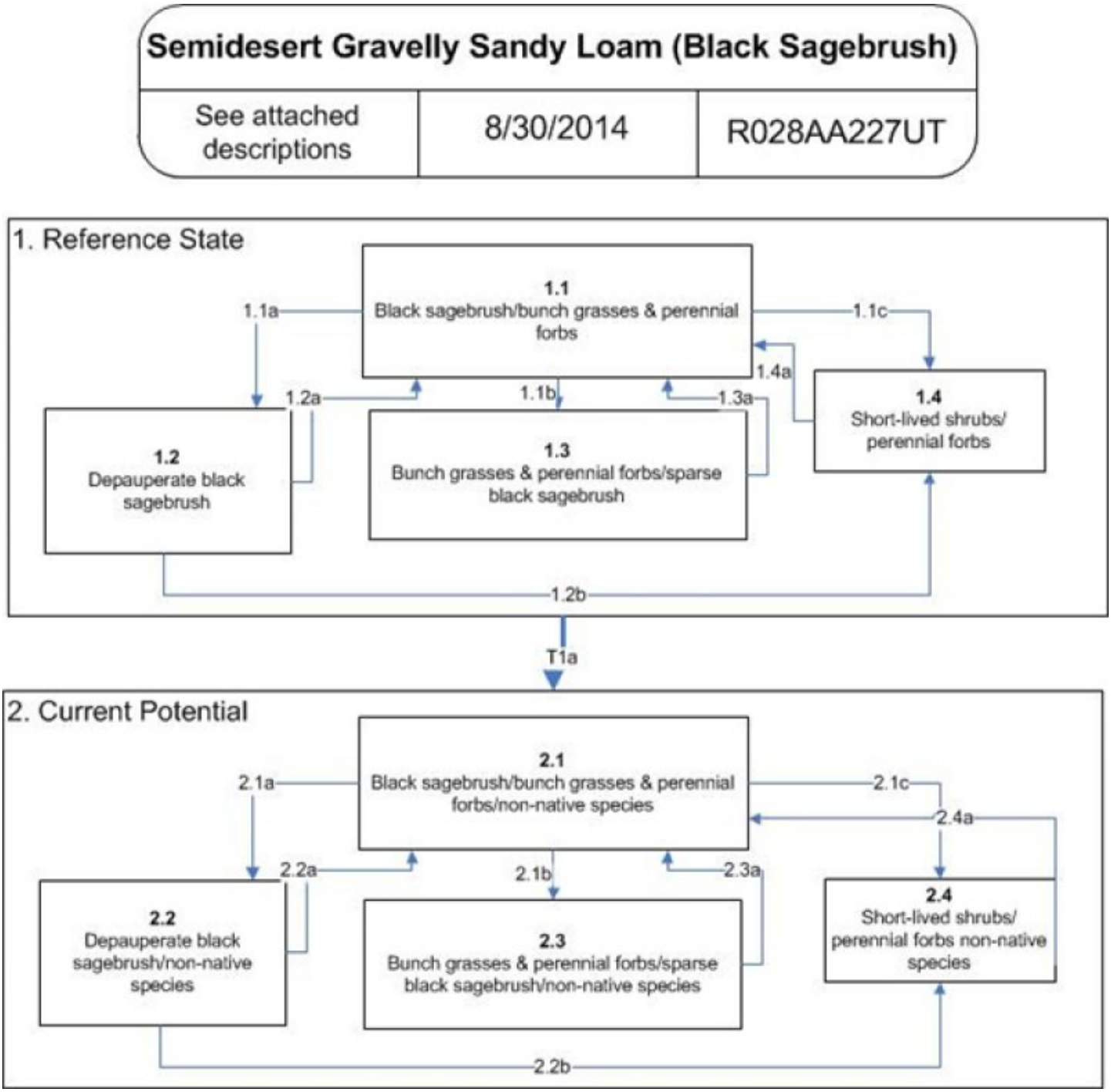

Figure 6. STM R028AA227UT

State 1
Reference State

The Reference State is a description of this ecological site just prior to Euro-American settlement but long after the arrival of Native Americans. The description of the Reference State was determined by NRCS Soil Survey Type Site Location information, and familiarity with rangeland with a low presence of non-native plants. The least modified plant community (1.1) within the Reference State would have been a black sagebrush-dominated (*Artemisia nova*) stand with scattered prickly pear (*Opuntia polyacantha*) and associated bunch grasses such as Indian ricegrass (*Achnatherum hymenoides*), needle and thread grass (*Hesperostipa comata*), Sandberg bluegrass (*Poa secunda*), muttongrass (*Poa fendleriana*), and bottlebrush squirreltail (*Elymus elymoides*). Forbs such as phlox (Phlox spp.), buckwheat (Eriogonum spp.) and locoweed (Astragalus spp.) would have been common. The generally gravelly soils would have accentuated the effects of drought and reduced the chances of fire altering this state. The reference plant community (1.1) would have been relatively stable with occasional use by wildlife. However, heavy utilization by bison, elk, and Native American horses on these sites (1.1a) would have depleted the grasses creating a near monoculture of black sagebrush (1.2). Heavy browsing by deer during the dormant season of black sagebrush (1.1b) would have created an herbaceous variant (1.3). Infestation of some insects and

pathogens on sagebrush (1.1c) could have led to a similar result where the herbaceous species became temporarily dominant (1.3). The combination of an unusually dry period and heavy utilization by all grazers (e.g. deer, bison, elk, and horses used by Native Americans) (1.1d) would have removed the palatable species from the plant community while allowing unpalatable, shorter-lived species such as yellow rabbitbrush (*Chrysothamnus viscidiflorus* ssp. viscidiflorus), locoweed, and phlox to predominate (1.4). The depauperate black sagebrush (*Artemisia nova*) community (1.2) could have also shifted to the unpalatable short-lived shrub community phase (1.4) in areas that have sustained heavy browsing by deer (1.2b). Relatively rocky sites such as these typically would not have declined in overall cover or productivity. However, the portion that was palatable may have changed appreciably. Similarly, these soils would have been more resistant to erosion than other stone-free soils. Each of the phases within State 1 could have returned to Community Phase 1.1 if climate conditions were within the normal range of variability and there was a release from heavy grazing and/or browsing pressure (1.2a, 1.3a, and 1.4a). A small amount of Wyoming big sagebrush and/or an informally recognized variety of big sagebrush (*A. tridentata*), called “bonnevillensis” (Shultz, 2009) would have also been present. A more complete list of species by lifeform for the Reference State, Community Phase 1.1 is available in the accompanying tables in the “Plant Community Composition by Weight and Percentage” section of this document.

Community 1.1
Black Sagebrush/bunch grasses & perennial forbs

The least modified plant community within the Reference State would have been a black sagebrush-dominated stand with scattered prickly pear and associated bunch grasses, such as, Indian ricegrass, needle and thread, Sandberg bluegrass, muttongrass, and bottlebrush squirreltail. Phlox, buckwheat, locoweed, and common yarrow would have been the commonly associated forbs. The dominant cover of the plant community is black sagebrush and Indian ricegrass. The composition by air-dry weight is approximately 45 percent perennial grasses, 15 percent forbs, and 40 percent shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	177	341	404
Shrub/Vine	157	303	359
Forb	59	113	135
Total	**393**	**757**	**898**

Table 6. Ground cover

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

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	–	–	–
>0.15 <= 0.3	–	–	–	–
>0.3 <= 0.6	–	15-25%	25-35%	5-15%
>0.6 <= 1.4	–	–	–	–
>1.4 <= 4	–	–	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 8. Plant community growth curve (percent production by month). UT2271, PNC. Excellent Condition.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	5	15	40	30	5	5	0	0	0	0

Community 1.2
Depauperate Black Sagebrush

This plant community would have developed under heavy continuous season-long grazing by bison, elk, and Native American horses. Heavy utilization of grasses would have created a near monoculture of black sagebrush.

Community 1.3
Bunch grasses & perennial forbs/sparse black sagebrush

There are several environmental conditions that would have produced this plant community. Heavy browsing by deer would have resulted in an herbaceous-dominated variant because of the utilization of black sagebrush during the dormant season. Under the occasional very wet period associated with an El Nino-Southern Oscillation event, temporary soil anoxia could have developed (West 2000), killing the sagebrush and allowing the forbs and grasses to dominate for a short time. A similar plant community would have also developed following an outbreak of insects and pathogens where sagebrush was the dominant host.

Community 1.4
Short -lived shrubs/perennial forbs

This plant community would have developed under the combined effect of unusual drought conditions and heavy grazing by all grazers including deer, bison, elk, and Native American horses. Focused utilization would have reduced the palatable species while allowing the noxious, unpalatable, and shorter-lived species such as yellow rabbitbrush, locoweed, and phlox to predominate.

Pathway 1.1a
Community 1.1 to 1.2

Heavy continuous season-long grazing by bison, elk, and Native American horses would have converted the Reference State to a depauperate black sagebrush community.

Pathway 1.1b
Community 1.1 to 1.3

Heavy browsing by deer would have converted the Reference State to a plant community dominated by bunchgrasses and perennial forbs.

Pathway 1.1c
Community 1.1 to 1.4

An extremely wet period such as an El Nino-Southern Oscillation event and subsequent anoxic soil conditions would have converted the Reference State to a plant community dominated by bunchgrasses and perennial forbs. The same result would occur following a sudden insect (or other pathogen) outbreak on sagebrush.

Pathway 1.2a
Community 1.2 to 1.1

The absence of grazing would have allowed the native bunchgrasses and perennial forbs to return to the system converting it back to the Community Phase 1.1.

Pathway 1.2b
Community 1.2 to 1.4

Heavy browsing by deer would have converted the depauperate black sagebrush community to an unpalatable short-lived shrub community phase.

Pathway 1.3a
Community 1.3 to 1.1

A return to normal climate conditions and the absence of heavy browsing would have allowed black sagebrush to re-establish and convert back to the Community Phase 1.1.

Pathway 1.4a
Community 1.4 to 1.1

A return to normal climate conditions followed by a prolonged reduction in grazing pressure would have allowed black sagebrush and native bunchgrasses to re-establish returning to the reference plant community (1.1).

State 2
Current Potential State

State 2 is similar to State 1 in form and function, with the exception of the presence of non-native plants and animals, possible extinctions of native species, and a different climate. State 2 is a description of the ecological site following Euro-American settlement, which can be regarded as the current potential. The least modified plant community (2.1) within State 2 is a black sagebrush-dominated stand with scattered prickly pear and associated bunch grasses such as bluebunch wheatgrass, Indian ricegrass, Sandberg bluegrass, muttongrass, and bottlebrush squirreltail. Forbs such as phlox, buckwheat, locoweed, and common yarrow are common. The generally shallow and stony soils accentuate the effect of drought and reduce the chances of fires altering this state. This plant community is relatively stable under mixed use by wildlife and livestock. However, heavy utilization by bison, elk, horses, and domestic cattle on these sites during the growing season (2.1a) would deplete the grasses creating a near monoculture of black sagebrush (2.2). Heavy browsing by deer and sheep (2.1b) would create an herbaceous variant (2.3) because of year-round utilization of black sagebrush. Occasionally very wet years during El Nino-Southern Oscillation periods can cause temporary soil anoxia (West 2000) (2.1c) killing the sagebrush and allowing the forbs and grasses to dominate for a short time (2.3). Some insects and pathogens on sagebrush (2.1c) can lead to a similar result where the herbaceous species become temporarily dominant (2.3). The interaction of an unusually dry period and heavy utilization of grasses by bison, elk, horses, and domestic cattle (2.1d) would remove the palatable species from the plant community while allowing unpalatable, shorter-lived species such as yellow rabbitbrush, locoweed, and phlox to predominate. While species composition does not change, species abundance does (2.4). The depauperate black sagebrush community (2.2) may also shift to the unpalatable short-lived shrub community phase (2.4) with heavy utilization of browse by deer and sheep (2.2b). Relatively rocky sites such as these typically do not decline in overall cover or productivity, however, the portion that is palatable may change appreciably. Similarly, these soils are more resistant to erosion than associated stone-free soils. Each of the phases within State 2 can return to Community Phase 2.1 when climate conditions are within the normal range of variability and grazing pressure is moderated (2.2a, 2.3a, 2.4a). A small amount of Wyoming big sagebrush and/or

an informally recognized variety of big sagebrush, called “bonnevillensis” (Shultz, 2009) may also be present.

Community 2.1
Black sagebrush/bunch grasses & perennial forbs/non-native species

The least modified plant community within the Black Sagebrush/ Introduced Non-natives State is a black sagebrush-dominated stand with scattered prickly pear and associated bunch grasses such as bluebunch wheatgrass, Indian ricegrass, Sandberg bluegrass, muttongrass, and bottlebrush squirreltail. Phlox, buckwheat, locoweed, and common yarrow are commonly associated forbs. This community phase also includes non-native annual species, such as cheatgrass.

Community 2.2
Depauperate black sagebrush/non-native species

This plant community is developed under heavy continuous season-long grazing by bison, elk, cattle, and horses. Heavy utilization of grasses creates a near monoculture of black sagebrush. Some areas currently in this phase, and under tighter management of livestock and wildlife may be recovering, but are still in a phase depauperate in herbaceous understory compared to Community Phase 2.1. Annual non-native species are present.

Community 2.3
Bunchgrasses & perennial forbs/ sparse black sagebrush/non-native species

There are several environmental conditions that would produce this plant community. Heavy year-round browsing by deer and sheep would result in an herbaceous-dominated variant because of the utilization of black sagebrush. Following the occasional very wet period associated with an El Nino-Southern Oscillation event, temporary soil anoxia could develop, (West 2000) killing the sagebrush and allowing the forbs and grasses to dominate for a short time. A similar plant community would also develop following an outbreak of insects and pathogens where sagebrush is the dominant host.

Community 2.4
Short -lived shrubs/perennial forbs/ non-native species

This plant community is developed under extreme drought conditions combined with heavy continuous season-long grazing. Such disturbances will reduce the palatable species and allow the unpalatable, shorter-lived species such as yellow rabbitbrush, locoweed, and phlox to predominate. Annual non-native species are present in the community.

Pathway 2.1a
Community 2.1 to 2.2

Heavy continuous season-long grazing by bison, elk, horses, and cattle would convert the Black sagebrush/ sparse bunchgrasses & perennial forbs phase to a depauperate black sagebrush community.

Pathway 2.1b
Community 2.1 to 2.3

Heavy browsing by deer and sheep would convert the Black sagebrush/ sparse bunchgrasses & perennial forbs phase to a plant community dominated by bunchgrasses and perennial forbs.

Pathway 2.1c
Community 2.1 to 2.4

An extremely wet period such as an El Nino-Southern Oscillation event and subsequent anoxic soil conditions would convert the Black sagebrush/ sparse bunchgrasses & perennial forbs phase to a plant community dominated by bunchgrasses and perennial forbs. The same result would be seen following a sudden insect (or other pathogen) outbreak on sagebrush.

Pathway 2.2a
Community 2.2 to 2.1

This plant community can move back towards the Black sagebrush/ sparse bunchgrasses & perennial forbs phase when grazing management, particularly of sheep, and use by deer, take place only during the non-growing season of the herbaceous component, along with broadcast re-seeding with native perennial forbs and grasses.

Pathway 2.2b
Community 2.2 to 2.4

Heavy browsing by deer and sheep would convert the depauperate black sagebrush phase to the unpalatable short-lived shrub and perennial forb community.

Pathway 2.3a
Community 2.3 to 2.1

This plant community can move back to the Black sagebrush/ sparse bunchgrasses & perennial forbs phase with a return to normal climate conditions and when grazing by both livestock and wildlife is concentrated during the spring to put pressure on the herbaceous component, allowing the native woody component to re-establish.

Pathway 2.4a
Community 2.4 to 2.1

A return to the Black sagebrush/ sparse bunchgrasses & perennial forbs phase is possible with a return to normal (or wetter) climate conditions and high intensity short duration grazing management to allow the native woody component to re-establish and decrease the competition by herbaceous species.

Transition T1A
State 1 to 2

The simultaneous introduction of exotic species, both plants and animals, and possible extinctions of native flora and fauna, along with climate change, will cause State 1 to transition to State 2. A return pathway back to State 1 would be impracticable because of these issues.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Primary Shrubs**			173–275	
	black sagebrush	ARNO4	*Artemisia nova*	78–118	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	24–39	–
	spiny hopsage	GRSP	*Grayia spinosa*	24–39	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	24–39	–
	Nuttall's horsebrush	TENU2	*Tetradymia nuttallii*	24–39	–
3	**Secondary Shrubs**			24–39	
	Nevada jointfir	EPNE	*Ephedra nevadensis*	8–24	–
	matted buckwheat	ERCA8	*Eriogonum caespitosum*	8–24	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	8–24	–
	Watson's prickly phlox	LIWA4	*Linanthus watsonii*	8–24	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	8–24	–
Grass/Grasslike					
0	**Primary Grasses**			230–471	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	118–235	–
	needle and thread	HECO26	*Hesperostipa comata*	78–118	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	24–39	–
1	**Secondary Grasses**			24–39	
	squirreltail	ELEL5	*Elymus elymoides*	8–24	–
	western wheatgrass	PASM	*Pascopyrum smithii*	8–24	–
	Sandberg bluegrass	POSE	*Poa secunda*	8–24	–
Forb					
0	**Primary Forbs**			16–39	
	longleaf phlox	PHLO2	*Phlox longifolia*	16–39	–
2	**Secondary Forbs**			39–78	
	littleleaf pussytoes	ANMI3	*Antennaria microphylla*	8–24	–
	Utah milkvetch	ASUT	*Astragalus utahensis*	8–24	–
	Searls' prairie clover	DASE3	*Dalea searlsiae*	8–24	–
	twolobe larkspur	DENU2	*Delphinium nuttallianum*	8–24	–
	cushion buckwheat	EROV	*Eriogonum ovalifolium*	8–24	–
	largeflower skeletonplant	LYGR	*Lygodesmia grandiflora*	8–24	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	8–24	–

Animal community

This site is suited for cattle and sheep grazing during winter and spring.

Wildlife using this site include rabbit, coyote, fox, badger, pronghorn antelope, mule deer, and dove.

This is a short list of the more common species found. Many other species are present as well and migratory birds are present at times.

Hydrological functions

The soils are in hydrologic group B with runoff curves ranging from 61 to 79 depending on hydrologic condition.

Recreational uses

Resources that have special aesthetic and landscape value are wildflowers. Some recreation uses of this site are hiking and horseback riding.

Wood products

None

Other information

Threatened and endangered species include plants and animals.

Type locality

Location 1: Box Elder County, UT	
General legal description	Box Elder County, Utah, East fan of Pilot Mountains.

Other references

Shultz, L.M. 2009. Monograph of Artemisia subgenus Tridentatae (Asteraceae-Anthemideae). Systematic Botany Monographs, pp.1-131.

West, N.E. 2000. Synecology and disturbance regimes of sagebrush steppe ecosystems. In Proceedings of the sagebrush steppe ecosystems symposium: 2000 (pp. 15-26). USDI Bureau of Land Management.

Contributors

David J. Somorville
DJS
Sarah Quistberg

Rangeland health reference sheet

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

Author(s)/participant(s)	Jack Alexander, Range Specialist, Synergy Resource Solutions, Inc. Julia Kluck, Soil Scientist, Synergy Resource Solutions, Inc. Shane Green, State Range Specialist, Utah NRCS
Contact for lead author	Shane Green, Shane.Green@ut.usda.gov
Date	02/08/2010
Approved by	Shane A. Green
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** No rills present. Very minor rill development may occur in sparsely vegetated areas. If rills are present, they should be widely spaced and not connected. Rill development may increase following large storm events, but should begin to heal during the following growing season. Frost heaving will accelerate recovery. Rill development may increase when run inflow enters site from adjacent sites that produce large amounts of runoff (i.e. steeper sites, slickrock, rock outcrop). Site is essentially level and rills do not form.

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2. **Presence of water flow patterns:** Water flow patterns will be short (2-5'), narrow (<1'), and meandering; interrupted by plants and exposed rocks. Slight to no evidence of erosion or deposition associated with flow patterns.

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3. **Number and height of erosional pedestals or terracettes:** Plants may have small pedestals (1-3") where they are adjacent to water flow patterns, but without exposed roots. Terracettes should be few and stable. Terracettes should be small (1-3") and show little sign of active erosion. Some plants may appear to have a pedestal but rather than be formed by erosion, the only place litter accumulates and soil collects is at plant bases forming the appearance of a pedestal.

   Well-developed biological crusts may appear pedestalled, but are actually a characteristic of the crust formation. Some plants may appear to have a pedestal but rather than be formed by erosion, the only place litter accumulates and soil collects is at plant bases forming the appearance of a pedestal.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 20-35% bare ground (soil with no protection from raindrop impact). Herbaceous communities are most likely to have lower values. As species composition by shrubs increases, bare ground is likely to increase. Poorly developed biological soil crust that is susceptible to raindrop splash erosion should be recorded as bare ground. Very few if any bare spaces of greater than 1 square foot.

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5. **Number of gullies and erosion associated with gullies:** No gullies present.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Very minor evidence of active wind-generated soil movement. Wind scoured (blowouts) and depositional areas are rarely present. If present they have muted features and are mostly stabilized with vegetation and/or biological crust. Gravel or desert pavement protects the site from wind scour.

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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 and wind 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 leaves, stems, and small twigs 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):** Soil surface is moderately stable (average soil stability score of 3.5 -5).

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** This description is based on a combination of the 3 correlated soils for this site. This results in variation of each of these

attributes. Due to the natural variability of soil attributes, it is critical to supplement this description with the soil-specific information from the published soil survey.

Soil surface horizon is typically 6 to 10 inches deep. Structure is typically weak thin or medium platy. Color is typically light brownish gray (10YR 6/2), dark grayish brown (10YR 3/2) (moist) or light brown (7.5 YR 6/3) brown (7.5YR 5/3) moist. An ochric horizon extends to a depth of 10 inches. An ochric horizon typically extends to a depth of 2 to 10 inches. The ochric horizon is a surface horizon lacking fine stratification and which is either light colored, or thin, or has an low organic carbon content, or is massive and (very) hard when dry. 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.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Bunchgrasses and shrubs equally important for increasing infiltration and reducing runoff. Litter plays a role in increasing infiltration and decreasing runoff. Plants provide microhabitat for seedlings, catch litter and soil, and slow raindrops and runoff. Vascular plants and/or well-developed biological soil crusts (where present) 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. Shrubs catch snow, slow wind evaporation, and provide microhabitat for seedling establishment.

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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 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: Indian ricegrass

    Sub-dominant: needle and thread, black sagebrush

    Other: other grasses > other shrubs > forbs

    Additional: In the northern portion of the MLRA cool-season perennial grasses (Indian ricegrass, needle and thread) dominate. In the southernmost portion of the MLRA warm-season perennial grasses (galleta, sand dropseed) dominate. The two groups share dominance in the middle portion of the MLRA.

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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. There may be partial mortality of individual bunchgrasses and shrubs during less severe drought. Long-lived species dominate site. Open spaces from disturbance are quickly filled by new plants through seedlings and reproductive reproduction (tillering).

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14. **Average percent litter cover (%) and depth (in):** Litter cover includes litter under plants. Most litter will be fine litter. Depth should be 1-2 leaf thickness in the interspaces and up to 1/2" under canopies. Litter cover may increase to 15-25% following years with favorable growing conditions. Excess litter may accumulate in absence of disturbance. Vegetative production may be reduced if litter cover exceeds 40%.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 675#/acre.
    Even the most stable communities exhibit a range of production values. Production will vary between communities and across the MRLA. Refer to the community descriptions in the ESD. Production will differ across the MLRA due to the naturally occurring variability in weather, soils, and aspect. The biological processes on this site are complex; therefore, representative values are presented in a land management context.

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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 and annual forbs

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17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually, except in drought years. Density of plants indicates that plants reproduce at level sufficient to fill available resource. Within capability of site there are no restrictions on seed or vegetative reproductive capacity.
