

Ecological site R047XA560UT High Mountain Gravelly Loam (mountain big sagebrush)

Last updated: 2/06/2025
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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.

MLRA notes

Major Land Resource Area (MLRA): 047X–Wasatch and Uinta Mountains

MLRA 47 occurs in Utah (86 percent), Wyoming (8 percent), Colorado (4 percent), and Idaho (2 percent). It encompasses approximately 23,825 square miles (61,740 square kilometers). The northern half of this area is in the Middle Rocky Mountains Province of the Rocky Mountain System. The southern half is in the High Plateaus of the Utah Section of the Colorado Plateaus Province of the Intermontane Plateaus. Parts of the western edge of this MLRA are in the Great Basin Section of the Basin and Range Province of the Intermontane Plateaus. The MLRA includes the Wasatch Mountains, which trend north and south, and the Uinta Mountains, which trend east and west. The steeply sloping, precipitous Wasatch Mountains have narrow crests and deep valleys. Active faulting and erosion are a dominant force in controlling the geomorphology of the area. The Uinta Mountains have a broad, gently arching, elongated shape. Structurally, they consist of a broadly folded anticline that has an erosion-resistant quartzite core. The Wasatch and Uinta Mountains have an elevation of 4,900 to about 13,500 feet (1,495 to 4,115 meters).

The mountains in this area are primarily fault blocks that have been tilted up. Alluvial fans at the base of the mountains are recharge zones for the basin fill aquifers. An ancient shoreline of historic Bonneville Lake is evident on the footslopes along the western edge of the area. Rocks exposed in the mountains are mostly Mesozoic and Paleozoic sediments, but Precambrian rocks are exposed in the Uinta Mountains. The Uinta Mountains are one of the few ranges in the United States that are oriented west to east. The southern Wasatch Mountains consist of Tertiary volcanic rocks occurring as extrusive lava and intrusive crystalline rocks.

The average precipitation is from 8 to 16 inches (203 to 406 mm) in the valleys and can range up to 73 inches (1854 mm) in the mountains. In the northern and western portions of the MLRA, peak precipitation occurs in the winter months. The southern and eastern portions have a greater incidence of high-intensity summer thunderstorms; hence, a significant amount of precipitation occurs during the summer months. The average annual temperature is 30 to 50 degrees Fahrenheit (-1 to 15 C). The freeze-free period averages 140 days and ranges from 60 to 220 days, generally decreasing in length with elevation.

The dominant soil orders in this MLRA are Aridisols, Entisols, Inceptisols, and Mollisols. The lower elevations are dominated by a frigid temperature regime, while the higher elevations experience cryic temperature regimes. Mesic temperature regimes come in on the lower elevations and south facing slopes in the southern portion of this MLRA. The soil moisture regime is typically xeric in the northern part of the MLRA, but grades to ustic in the extreme eastern and southern parts. The mineralogy is generally mixed and the soils are very shallow to very deep, generally well drained, and loamy or loamy-skeletal.

LRU notes

Major Land Resource Unit 47A is located in the northern half of the Middle Rocky Mountains Province of the Rocky Mountain System. This MLRA includes the Wasatch Mountains which tend to run north and south. These steeply sloping, precipitous mountains have narrow crests and deep valleys. They are primarily fault blocks that have been

tilted up. The alluvial fans located at the base of these mountains are important recharge zones for valley aquifers.

Ecological site concept

The soils of this site formed in colluvium, slope alluvium and till derived from various parent materials including limestone, sandstone, shale and conglomerate rock. They are moderately deep and well-drained, with moderately slow to moderate permeability. Surface textures are gravelly loam and the soil volume usually contains greater than 35 percent gravels or channers. Rock fragments are often present on the soil surface but not always. These soils are moderately acidic to neutral and available water-holding capacity ranges from 3.6 to 5.0 inches of water in the upper 60 inches of soil. The soil moisture regime is xeric and the soil temperature regime is cryic.

Associated sites

F047XA508UT	High Mountain Loam (quaking aspen)
R047XA516UT	High Mountain Loam (mountain big sagebrush)
F047XA512UT	High Mountain Loam (Douglas-fir)

Similar sites

R047XA516UT	High Mountain Loam (mountain big sagebrush)
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Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) <i>Artemisia tridentata ssp. vaseyana</i> (2) <i>Symphoricarpos oreophilus</i>
Herbaceous	(1) <i>Pseudoroegneria spicata</i> (2) <i>Carex geyeri</i>

Physiographic features

This ecological site typically occurs on mountain slopes and kame moraines. Slope steepness, aspect and elevation will influence the vegetative floristics of this site. Sites are typically located between 7,300 to over 10,800 feet in elevation but may occasionally be found as low as 5600 feet. Slopes normally range from 20 to 60 percent. Runoff ranges from high to very high.

Table 2. Representative physiographic features

Landforms	(1) Mountain slope (2) Moraine
Runoff class	High to very high
Flooding frequency	None
Ponding frequency	None
Elevation	7,300–10,800 ft
Slope	20–60%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site characterized by cold, snowy winters and cool summers. The average annual precipitation ranges from 22 to 35 inches. December thru April, are typically the wettest months with June thru August being the driest. The most reliable sources of moisture for plant growth are the snow that accumulates over the winter and spring rains. Summer thunderstorms are intermittent and sporadic in nature, and thus, are less reliable sources of moisture to support vegetative growth on this site. The typical mean annual air temperature ranges from 35 to 40

degrees. The soil moisture regime for this site is xeric or udic and the soil temperature regime is cryic.

Table 3. Representative climatic features

Frost-free period (characteristic range)	
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	22-35 in
Frost-free period (average)	90 days
Freeze-free period (average)	102 days
Precipitation total (average)	

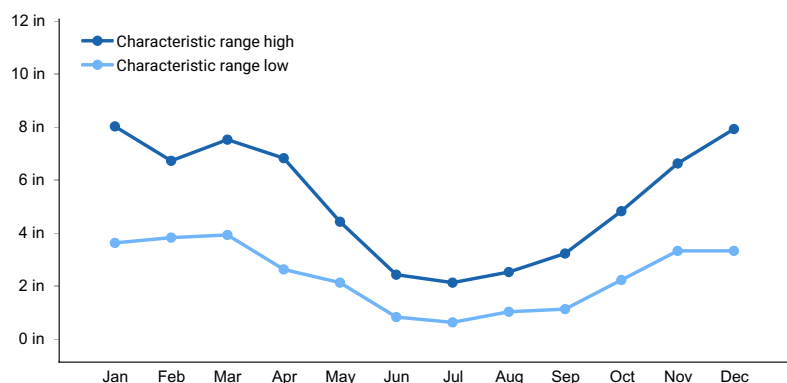


Figure 1. Monthly precipitation range

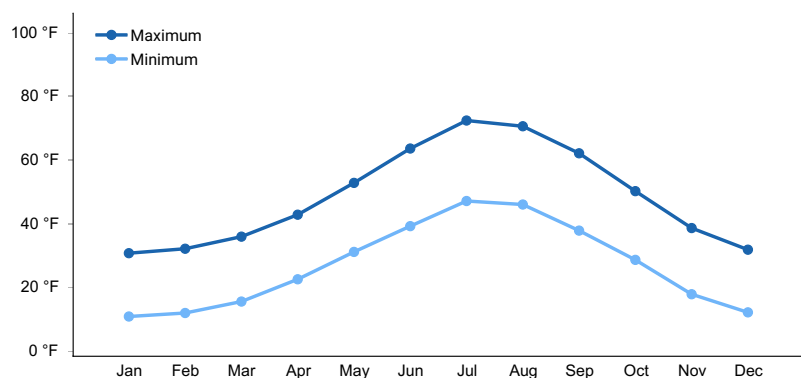


Figure 2. Monthly average minimum and maximum temperature

Influencing water features

This site has no influencing water features.

Wetland description

N/A

Soil features

The soils of this site formed in colluvium, slope alluvium and till derived from various parent materials including limestone, sandstone, shale and conglomerate rock. They are moderately deep and well-drained, with moderately slow to moderate permeability. Surface textures are gravelly loam and the soil volume usually contains greater than 35 percent gravels or channers. Rock fragments are often present on the soil surface but not always. These soils are moderately acidic to neutral and available water-holding capacity ranges from 3.6 to 5.0 inches of water in the upper 60 inches of soil. The soil moisture regime is xeric and the soil temperature regime is cryic.

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

UT013 – Duchesne Area - Allencreek; Elwood; Naphide; Squaretop.

UT650 – Uintah National Forest - Squaretop; Naphide; Elwood.

UT613- Summit Area - Crandall.

Typical Profile: (Crandall).

A1-0-5 inches: very dark brown gravelly loam; non-effervescent; neutral (pH 6.8).

A2-5-14 inches: dark brown gravelly loam; non-effervescent; neutral (pH 6.8).

Bt-14-45 inches: brown very cobbly clay loam; non-effervescent; neutral (pH 7.0).

Bt-45-55 inches: brown very cobbly loam; slightly effervescent; slightly alkaline (pH 7.8).

R-55 inches: conglomerate bedrock.

The surface is covered by 25 percent gravel; 15 percent cobble; and 1 percent stone.

Table 4. Representative soil features

Parent material	(1) Colluvium–shale (2) Alluvium–conglomerate (3) Till–sandstone
Surface texture	(1) Gravelly loam (2) Very gravelly loam
Family particle size	(1) Loamy-skeletal
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Depth to restrictive layer	40–60 in
Soil depth	40–60 in
Surface fragment cover <=3"	20–30%
Surface fragment cover >3"	5–10%
Available water capacity (0-40in)	3.6–5 in
Calcium carbonate equivalent (0-40in)	0%
Electrical conductivity (0-40in)	0 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	5.8–7.3
Subsurface fragment volume <=3" (0-40in)	20–25%
Subsurface fragment volume >3" (0-40in)	15–20%

Ecological dynamics

This site developed under the Middle Rocky Mountains Province of the Rocky Mountain System, which includes the Wasatch Mountains, ecological conditions and the natural influences of herbivory, fire and climate. This site occurs on moderately steep to steep slopes (20 to 60 percent) and can occur on all aspects. It is usually found on mountain slopes and kame moraines. Species composition is generally composed of a shrub layer dominated by Mountain big sagebrush and Mountain snowberry. The herbaceous layer is normally a mixture of perennial grasses and forbs with bluebunch wheatgrass, Geyer's sedge and Letterman's needlegrass being the most common grass species. Spike trisetum is often found on this site a higher elevations. A wide variety of perennial and annual forbs are also

normally present.

This sites cobbly and/or gravelly soils combined with its steep slopes may somewhat limit its availability for livestock grazing. Grazing is often limited to bands of sheep that quickly move through the site during the summer months. Cattle may also be seen grazing this site where slopes allow for such grazing and water is available.

Evidence indicates that this site historically maintained a fairly long burn cycle (100 years or more). Following a fire, non-sprouting shrub species are removed or much reduced and sprouting shrubs such as green rabbitbrush and herbaceous species may dominate the site for a period of years. Over time a mountain big sagebrush will once again dominate the community.

As vegetative communities respond to changes caused by natural or manmade events that cause them to cross ecological thresholds, a return to previous states may not be possible. The amount of effort needed to affect desired vegetative shifts depends on a sites present biotic and abiotic features and the desired results.

The following State and Transition diagram depicts the most common plant communities found on this ecological site. It does not necessarily depict all the plant communities that can occur, but does show the most prevalent and repeatable. As more data are collected, some of these plant communities may be revised or removed, and new ones added. These descriptions capture the current knowledge and experience at the time of this revision.

State and transition model

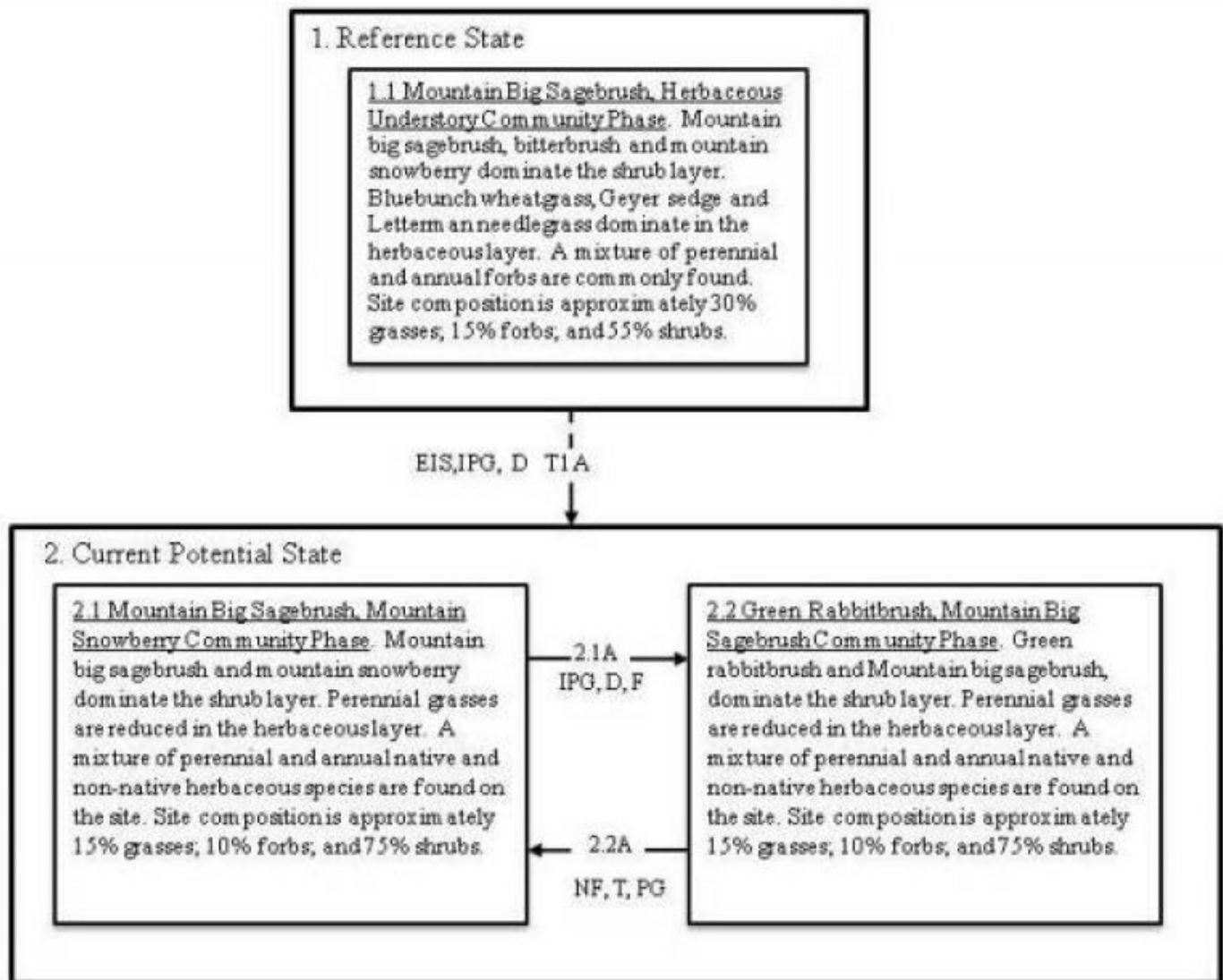
State and Transition Model

State: Utah

Site Type: Rangeland

MLRA: E47A-Middle Rocky Mountain Province, Wasatch Mountains Unit.

R047XA560UT – High Mountain Gravelly Loam (Mountain Big Sagebrush).



Legend

D=Drought

T=Time.

F=Fire.

NF=No Fire.

EIS = Establishment of invasive species.

PG=Proper Livestock Grazing.

IPG = Improper Livestock Grazing.

State 1 Reference State

This state describes the biotic communities that may become established on this ecological site if all successional

sequences are completed under natural disturbance conditions. Species composition is generally dominated by mountain big sagebrush and mountain snowberry. Other important shrubs include Utah serviceberry and bitterbrush. Perennial herbaceous species occurrence is directly related to canopy density with bluebunch wheatgrass, Letterman needlegrass and geyer sedge being the most common species. Sites located at higher elevations may contain species such as spike trisetum and a few aspen. The primary disturbance mechanisms are shrub canopy density, weather fluctuations, and fire or lack of fire. The reference state is self-sustaining and resistant to change due to a high resistance to natural disturbances and a high resilience following those disturbances. When natural disturbances occur, the rate of recovery can be quite variable. Reference State: Plant communities influenced by shrub canopy density, long term weather fluctuations, and periodic fire. Indicators: A community dominated by mountain big sagebrush and mountain snowberry. The density of the shrub canopy determines the amount and composition of the other native perennial grasses, grasslikes and forbs that may be present. Feedbacks: Natural fluctuations in weather patterns that allow for a self sustaining shrub and native grass and grasslike community. Insect herbivory, more frequent fires, or other disturbances that may allow for the establishment of invasive species. At-risk Community Phase: All communities are at risk when native plants are stressed and nutrients become available for invasive plants to establish. Trigger: The establishment of invasive plant species

Community 1.1 Mountain Big Sagebrush, Herbaceous Understory Community Phase.

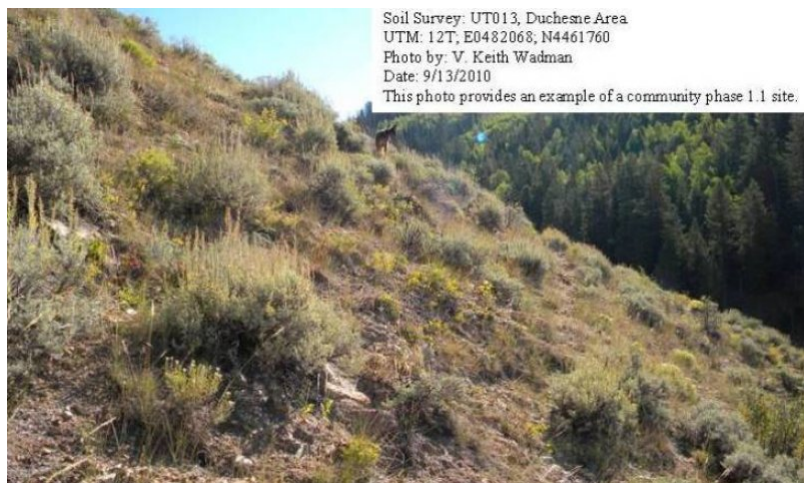


Figure 3. Community Phase 1.1

This community phase is characterized by an overstory canopy generally dominated by mountain big sagebrush, mountain snowberry and bitterbrush. A mixture of deciduous shrubs including chokecherry, alderleaf mountain mahogany and Utah serviceberry are also commonly present. Perennial herbaceous species occurrence is directly related to canopy density with bluebunch wheatgrass, Letterman's needlegrass and geyer's sedge found most often. Other perennial grasses, shrubs, and forbs are also often present. Air dry composition of this site is approximately 35 percent grasses, 15 percent forbs, and 60 percent shrubs. Bare ground is variable (5 to 40 percent) depending on litter and biological crust cover, which are also variable (10 to 40 percent) and surface rock fragments (0 to 40 percent). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example the typical vegetative floristics of a community phase 1.1 plant community.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	250	325	400
Grass/Grasslike	200	250	300
Forb	50	75	100
Total	500	650	800

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	25-30%
Grass/grasslike foliar cover	15-20%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	5-15%
Litter	5-30%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	15-40%

State 2

Current Potential State.

The current potential state is similar to the reference state, however minor amounts of invasive species may now present in all community phases. This state describes the biotic communities that may become established on this ecological site if all successional sequences are completed under natural disturbance conditions. The current potential state is generally dominated by mountain big sagebrush and mountain snowberry. Other important shrubs include Utah serviceberry and bitterbrush. Perennial herbaceous species occurrence is reduced with bluebunch wheatgrass, Letterman needlegrass and geyer sedge still being the most common species. Cheatgrass and non-native annual forbs could potentially be present in both community phases but this occurrence has not yet been well documented. Areas disturbed by road building an/or mining are most likely to allow this invasion to occur. The primary disturbance mechanisms are shrub canopy density, weather fluctuations and fire or lack of fire. The current potential state is still self-sustaining but has a lower resistant to change due to a reduced resistance to disturbances. When disturbances do occur, the rate of recovery can be highly variable. Current Potential State: Plant communities influenced by shrub canopy density, long term weather fluctuations, and periodic fire. Indicators: A community dominated by mountain big sagebrush and mountain snowberry. The density of the overstory canopy determines the amount and composition of the other native and non-native grasses, grasslikes and forbs that may be present. Feedbacks: Natural fluctuations in weather patterns that allow for a self sustaining shrub and native grass and grasslike community. Insect herbivory, more frequent fires, or other disturbances that may allow for the development of invasive species. At-risk Community Phase: All communities are at risk when native plants are stressed and nutrients become available for invasive plants to increase. Trigger: The increase of invasive plant species.

Community 2.1

Mountain Big Sagebrush, Mountain Snowberry Community Phase.

mountain snowberry, perennial bunchgrasses.
 Soil Survey: UT013, Duchesne Area
 UTM: 12T, E0481046; N4465305
 Photo by: V. Keith Wadman
 Date: 9/13/2010
 This photo provides an example of a
 community phase 2.1 site.

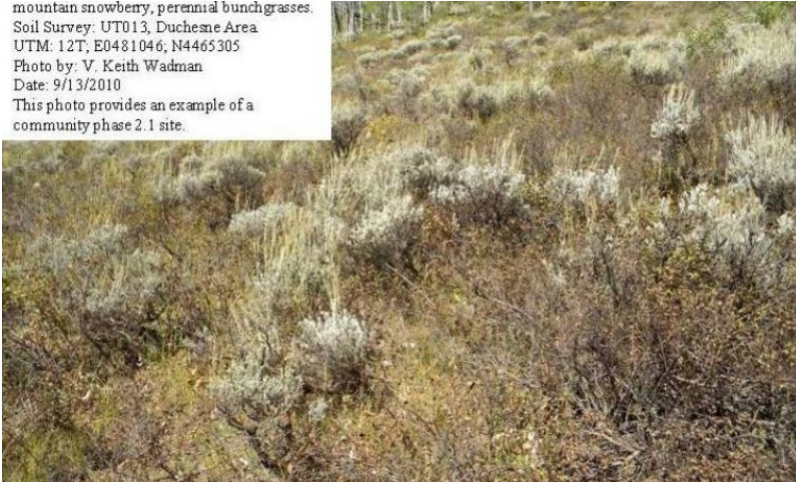


Figure 5. Community Phase 2.1

This community phase is characterized by an overstory canopy generally dominated by mountain big sagebrush, mountain snowberry and bitterbrush. A mixture of deciduous shrubs including chokecherry, alderleaf mountain mahogany and Utah serviceberry are also commonly present. Perennial herbaceous species are significantly reduced in the community with bluebunch wheatgrass, Letterman's needlegrass, geyer's sedge and occasionally cheatgrass found most often. Other native and non-native grasses and forbs are also typically present. Air dry composition of this site is approximately 15 percent grasses, 10 percent forbs, and 75 percent shrubs. Bare ground is variable (5 to 40 percent) depending on litter and biological crust cover, which are also variable (10 to 40 percent) and surface rock fragments (0 to 40 percent). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example the typical vegetative floristics of a community phase 2.1 plant community.

Table 7. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	350	425	500
Grass/Grasslike	100	150	200
Forb	50	75	100
Total	500	650	800

Table 8. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	35-40%
Grass/grasslike foliar cover	5-10%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	5-15%
Litter	5-30%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	20-50%

Community 2.2

Green Rabbitbrush, Mountain Big Sagebrush Community Phase.

big sagebrush, perennial bunchgrasses.
 Soil Survey: UT013, Duchesne Area.
 UTM: 12T, E0482068; N4461760
 Photo by: V. Keith Wadman.
 Date: 9/13/2010
 This photo provides an example of a community phase 2.2 site.



Figure 7. Community Phase 2.2

This community phase is characterized by an overstory canopy generally dominated by green rabbitbrush, mountain snowberry and mountain big sagebrush. A mixture of deciduous shrubs including chokecherry, alderleaf mountain mahogany and Utah serviceberry are also commonly present. Perennial herbaceous species occurrence reduced and is directly related to shrub canopy density with bluebunch wheatgrass, Letterman's needlegrass and geyer's sedge found most often. Other perennial grasses, shrubs, and forbs are also often present. Non-native annuals such as cheatgrass may also be present on the site. Air dry composition of this site is approximately 15 percent grasses, 10 percent forbs, and 75 percent shrubs. Bare ground is variable (5 to 40 percent) depending on litter and biological crust cover, which are also variable (10 to 40 percent) and surface rock fragments (0 to 40 percent). Biological crusts can vary from sites dominated by light cyanobacteria in the plant interspaces, with occasional moss and lichen pinnacles under shrub canopies, to those dominated by lichen and moss pinnacles as well as cyanobacteria in the site interspaces. The following tables provide an example the typical vegetative floristics of a community phase 1.1 plant community.

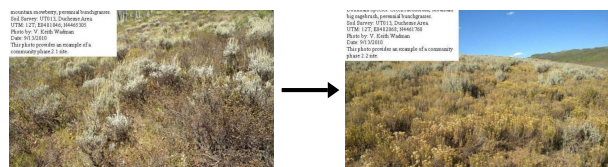
Table 9. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Shrub/Vine	350	425	500
Grass/Grasslike	100	150	200
Forb	50	75	100
Total	500	650	800

Table 10. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	35-40%
Grass/grasslike foliar cover	5-15%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	5-15%
Litter	5-30%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	15-40%

Pathway 2.1A Community 2.1 to 2.2



Mountain Big Sagebrush, Mountain Snowberry Community Phase.

Green Rabbitbrush, Mountain Big Sagebrush Community Phase.

This community pathway occurs when fire and any combination of drought and improper livestock grazing allows for sprouting shrubs such as green rabbitbrush to dominate the community. Native perennial grasses are somewhat reduced and any non-native species present may increase.

Pathway 2.2A Community 2.2 to 2.1



Green Rabbitbrush, Mountain Big Sagebrush Community Phase.

Mountain Big Sagebrush, Mountain Snowberry Community Phase.

This community pathway occurs when fire is eliminated from the site for long periods of time and the site is well managed. Sprouting shrubs such as green rabbitbrush are slowly reduced and non-sprouters such as mountain big sagebrush slowly increase till they dominate the shrub layer. Native perennial grasses also slowly increase and any non-native species present slowly decrease.

Transition T1A State 1 to 2

This transitional pathway occurs when drought and improper livestock grazing causes the perennial herbaceous community to become significantly reduced allowing non-native species such as cheatgrass, alyssum, Russian thistle and other invasive weeds the opportunity to become established. Green rabbitbrush may also increase during this time. Once invasive species occupy the site, a threshold has been crossed. Little evidence exists to verify that this transition is common. Invaded sites are likely present but are of small extent.

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					
1	Dominant Grasses			200–250	
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	75–150	–
	Letterman's needlegrass	ACLE9	<i>Achnatherum lettermanii</i>	25–75	–
	Geyer's sedge	CAGE2	<i>Carex geyeri</i>	25–75	–
2	Sub-Dominant Grasses			150–200	
	Columbia needlegrass	ACNE9	<i>Achnatherum nelsonii</i>	20–30	–
	nodding brome	BRAN	<i>Bromus anomalus</i>	20–30	–

	mountain brome	BRMA4	<i>Bromus marginatus</i>	20–30	–
	blue wildrye	ELGL	<i>Elymus glaucus</i>	20–30	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	20–30	–
	basin wildrye	LECI4	<i>Leymus cinereus</i>	20–30	–
	spike fescue	LEKI2	<i>Leucopoa kingii</i>	20–30	–
	oniongrass	MEBU	<i>Melica bulbosa</i>	20–30	–
	muttongrass	POFE	<i>Poa fendleriana</i>	20–30	–
	nodding bluegrass	PORE	<i>Poa reflexa</i>	20–30	–
	spike trisetum	TRSP2	<i>Trisetum spicatum</i>	20–30	–
Forb					
3	Forbs			70–90	
	common yarrow	ACMI2	<i>Achillea millefolium</i>	10–20	–
	nettleleaf giant hyssop	AGUR	<i>Agastache urticifolia</i>	10–20	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	10–20	–
	silverleaf milkvetch	ASAR4	<i>Astragalus argophyllus</i>	10–20	–
	tapertip hawksbeard	CRAC2	<i>Crepis acuminata</i>	10–20	–
	twolobe larkspur	DENU2	<i>Delphinium nuttallianum</i>	10–20	–
	tall mountain larkspur	DESC	<i>Delphinium scaposum</i>	10–20	–
	shortstem buckwheat	ERBR5	<i>Eriogonum brevicaula</i>	10–20	–
	Eaton's fleabane	EREA	<i>Erigeron eatonii</i>	10–20	–
	sticky purple geranium	GEVI2	<i>Geranium viscosissimum</i>	10–20	–
	spotted stickseed	HAPA	<i>Hackelia patens</i>	10–20	–
	common sneezeweed	HEAU	<i>Helenium autumnale</i>	10–20	–
	oneflower helianthella	HEUN	<i>Helianthella uniflora</i>	10–20	–
	Nevada pea	LALA3	<i>Lathyrus lanszwertii</i>	10–20	–
	western stoneseed	LIRU4	<i>Lithospermum ruderale</i>	10–20	–
	desertparsley	LOMAT	<i>Lomatium</i>	10–20	–
	prairie bluebells	MELAL2	<i>Mertensia lanceolata var. lanceolata</i>	10–20	–
	western sweetroot	OSOC	<i>Osmorhiza occidentalis</i>	10–20	–
	beardtongue	PENST	<i>Penstemon</i>	10–20	–
	towering Jacob's-ladder	POFO	<i>Polemonium foliosissimum</i>	10–20	–
	western coneflower	RUOC2	<i>Rudbeckia occidentalis</i>	10–20	–
	tall ragwort	SESE2	<i>Senecio serra</i>	10–20	–
	Fendler's meadow-rue	THFE	<i>Thalictrum fendleri</i>	10–20	–
	Parry's clover	TRPA5	<i>Trifolium parryi</i>	10–20	–
	mountain deathcamas	ZIEL2	<i>Zigadenus elegans</i>	10–20	–
Shrub/Vine					
4	Dominant Shrubs			200–300	

	mountain big sagebrush	ARTRV	<i>Artemisia tridentata ssp. vaseyana</i>	125–250	–
	mountain snowberry	SYOR2	<i>Symphoricarpos oreophilus</i>	50–125	–
5	Sub-Dominant Shrubs			300–600	
	Utah serviceberry	AMUT	<i>Amelanchier utahensis</i>	25–50	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	25–50	–
	yellow rabbitbrush	CHVIV4	<i>Chrysothamnus viscidiflorus ssp. viscidiflorus var. viscidiflorus</i>	25–50	–
	creeping barberry	MARE11	<i>Mahonia repens</i>	25–50	–
	chokecherry	PRVI	<i>Prunus virginiana</i>	25–50	–
	antelope bitterbrush	PUTR2	<i>Purshia tridentata</i>	25–50	–
	whitestem gooseberry	RIIN2	<i>Ribes inerme</i>	25–50	–
	blue elderberry	SANIC5	<i>Sambucus nigra ssp. cerulea</i>	25–50	–

Table 12. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Dominant Grasses			100–150	
	Letterman's needlegrass	ACLE9	<i>Achnatherum lettermanii</i>	25–50	–
	Geyer's sedge	CAGE2	<i>Carex geyeri</i>	25–50	–
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	25–50	–
2	Sub-Dominant Grasses			150–200	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	25–50	–
	blue wildrye	ELGL	<i>Elymus glaucus</i>	20–30	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	20–30	–
	basin wildrye	LECI4	<i>Leymus cinereus</i>	20–30	–
	spike fescue	LEKI2	<i>Leucopoa kingii</i>	20–30	–
	oniongrass	MEBU	<i>Melica bulbosa</i>	20–30	–
	muttongrass	POFE	<i>Poa fendleriana</i>	20–30	–
	nodding bluegrass	PORE	<i>Poa reflexa</i>	20–30	–
	spike trisetum	TRSP2	<i>Trisetum spicatum</i>	20–30	–
	Columbia needlegrass	ACNE9	<i>Achnatherum nelsonii</i>	20–30	–
	nodding brome	BRAN	<i>Bromus anomalus</i>	20–30	–
	mountain brome	BRMA4	<i>Bromus marginatus</i>	20–30	–
Forb					
3	Forbs			70–90	
	common yarrow	ACMI2	<i>Achillea millefolium</i>	10–20	–
	nettleleaf giant hyssop	AGUR	<i>Agastache urticifolia</i>	10–20	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	10–20	–

	silverleaf milkvetch	ASAK4	<i>Astragalus argophyllus</i>	10–20	–
	tapertip hawksbeard	CRAC2	<i>Crepis acuminata</i>	10–20	–
	two-lobed larkspur	DENU2	<i>Delphinium nuttallianum</i>	10–20	–
	tall mountain larkspur	DESC	<i>Delphinium scaposum</i>	10–20	–
	short-stem buckwheat	ERBR5	<i>Eriogonum brevicaulis</i>	10–20	–
	Eaton's fleabane	EREA	<i>Erigeron eatonii</i>	10–20	–
	sticky purple geranium	GEVI2	<i>Geranium viscosissimum</i>	10–20	–
	spotted stickseed	HAPA	<i>Hackelia patens</i>	10–20	–
	common sneezeweed	HEAU	<i>Helenium autumnale</i>	10–20	–
	one-flower helianthella	HEUN	<i>Helianthella uniflora</i>	10–20	–
	Nevada pea	LALA3	<i>Lathyrus lanszwertii</i>	10–20	–
	western stone seed	LIRU4	<i>Lithospermum ruderale</i>	10–20	–
	desert parsley	LOMAT	<i>Lomatium</i>	10–20	–
	prairie bluebells	MELAL2	<i>Mertensia lanceolata</i> var. <i>lanceolata</i>	10–20	–
	western sweetroot	OSOC	<i>Osmorhiza occidentalis</i>	10–20	–
	beardtongue	PENST	<i>Penstemon</i>	10–20	–
	towering Jacob's- ladder	POFO	<i>Polemonium foliosissimum</i>	10–20	–
	western coneflower	RUOC2	<i>Rudbeckia occidentalis</i>	10–20	–
	tall ragwort	SESE2	<i>Senecio serra</i>	10–20	–
	Fendler's meadow- rue	THFE	<i>Thalictrum fendleri</i>	10–20	–
	Parry's clover	TRPA5	<i>Trifolium parryi</i>	10–20	–
	mountain deathcamas	ZIEL2	<i>Zigadenus elegans</i>	10–20	–

Shrub/Vine

4	Dominant Shrubs			300–400	
	mountain big sagebrush	ARTRV	<i>Artemisia tridentata</i> ssp. <i>vaseyana</i>	225–350	–
	mountain snowberry	SYOR2	<i>Symphoricarpos oreophilus</i>	100–170	–
5	Sub-Dominant Shrubs			300–600	
	Utah serviceberry	AMUT	<i>Amelanchier utahensis</i>	25–50	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	25–50	–
	yellow rabbitbrush	CHVIV4	<i>Chrysothamnus viscidiflorus</i> ssp. <i>viscidiflorus</i> var. <i>viscidiflorus</i>	25–50	–
	creeping barberry	MARE11	<i>Mahonia repens</i>	25–50	–
	chokecherry	PRVI	<i>Prunus virginiana</i>	25–50	–
	antelope bitterbrush	PUTR2	<i>Purshia tridentata</i>	25–50	–
	whitestem gooseberry	RIIN2	<i>Ribes inerme</i>	25–50	–
	blue elderberry	SANIC5	<i>Sambucus nigra</i> ssp. <i>cerulea</i>	25–50	–

Table 13. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	Dominant Grasses			100–150	
	Letterman's needlegrass	ACLE9	<i>Achnatherum lettermanii</i>	25–50	–
	Geyer's sedge	CAGE2	<i>Carex geyeri</i>	25–50	–
	bluebunch wheatgrass	PSSP6	<i>Pseudoroegneria spicata</i>	25–50	–
2	Sub-Dominant Grasses			150–200	
	cheatgrass	BRTE	<i>Bromus tectorum</i>	25–50	–
	blue wildrye	ELGL	<i>Elymus glaucus</i>	20–30	–
	slender wheatgrass	ELTR7	<i>Elymus trachycaulus</i>	20–30	–
	basin wildrye	LECI4	<i>Leymus cinereus</i>	20–30	–
	spike fescue	LEKI2	<i>Leucopoa kingii</i>	20–30	–
	oniongrass	MEBU	<i>Melica bulbosa</i>	20–30	–
	muttongrass	POFE	<i>Poa fendleriana</i>	20–30	–
	nodding bluegrass	PORE	<i>Poa reflexa</i>	20–30	–
	spike trisetum	TRSP2	<i>Trisetum spicatum</i>	20–30	–
	Columbia needlegrass	ACNE9	<i>Achnatherum nelsonii</i>	20–30	–
	nodding brome	BRAN	<i>Bromus anomalus</i>	20–30	–
	mountain brome	BRMA4	<i>Bromus marginatus</i>	20–30	–
Forb					
3	Forbs			70–90	
	common yarrow	ACMI2	<i>Achillea millefolium</i>	10–20	–
	nettleleaf giant hyssop	AGUR	<i>Agastache urticifolia</i>	10–20	–
	white sagebrush	ARLU	<i>Artemisia ludoviciana</i>	10–20	–
	silverleaf milkvetch	ASAR4	<i>Astragalus argophyllus</i>	10–20	–
	tapertip hawksbeard	CRAC2	<i>Crepis acuminata</i>	10–20	–
	twolobe larkspur	DENU2	<i>Delphinium nuttallianum</i>	10–20	–
	tall mountain larkspur	DESC	<i>Delphinium scaposum</i>	10–20	–
	shortstem buckwheat	ERBR5	<i>Eriogonum brevicaulis</i>	10–20	–
	Eaton's fleabane	EREA	<i>Erigeron eatonii</i>	10–20	–
	sticky purple geranium	GEVI2	<i>Geranium viscosissimum</i>	10–20	–
	spotted stickseed	HAPA	<i>Hackelia patens</i>	10–20	–
	common sneezeweed	HEAU	<i>Helenium autumnale</i>	10–20	–
	oneflower helianthella	HEUN	<i>Helianthella uniflora</i>	10–20	–
	Nevada pea	LALA3	<i>Lathyrus lanszwertii</i>	10–20	–
	western stoneseed	LIRU4	<i>Lithospermum ruderales</i>	10–20	–
	desertparsley	LOMAT	<i>Lomatium</i>	10–20	–
	prairie bluebells	MELAL2	<i>Mertensia lanceolata</i> var. <i>lanceolata</i>	10–20	–
	western sweetroot	OSOC	<i>Osmorhiza occidentalis</i>	10–20	–
	beardtongue	PENST	<i>Penstemon</i>	10–20	–

	towering Jacob's-ladder	POFO	<i>Polemonium tolloisissimum</i>	10–20	–
	western coneflower	RUOC2	<i>Rudbeckia occidentalis</i>	10–20	–
	tall ragwort	SESE2	<i>Senecio serra</i>	10–20	–
	Fendler's meadow-rue	THFE	<i>Thalictrum fendleri</i>	10–20	–
	Parry's clover	TRPA5	<i>Trifolium parryi</i>	10–20	–
	mountain deathcamas	ZIEL2	<i>Zigadenus elegans</i>	10–20	–
Shrub/Vine					
4	Dominant Shrubs			200–300	
	mountain big sagebrush	ARTRV	<i>Artemisia tridentata ssp. vaseyana</i>	75–200	–
	yellow rabbitbrush	CHVI8	<i>Chrysothamnus viscidiflorus</i>	100–200	–
	mountain snowberry	SYOR2	<i>Symphoricarpos oreophilus</i>	50–125	–
5	Sub-Dominant Shrubs			300–600	
	Utah serviceberry	AMUT	<i>Amelanchier utahensis</i>	25–50	–
	silver sagebrush	ARCA13	<i>Artemisia cana</i>	25–50	–
	creeping barberry	MARE11	<i>Mahonia repens</i>	25–50	–
	chokecherry	PRVI	<i>Prunus virginiana</i>	25–50	–
	antelope bitterbrush	PUTR2	<i>Purshia tridentata</i>	25–50	–
	whitestem gooseberry	RIIN2	<i>Ribes inerme</i>	25–50	–
	blue elderberry	SANIC5	<i>Sambucus nigra ssp. cerulea</i>	25–50	–

Animal community

--Wildlife Interpretation--

The steep slopes and scarcity of water may limit this site species richness and the abundance of large mammals. It does provide some thermal cover and limited browsing opportunities for mule deer and elk. Several species of birds can be found using this site. Golden eagles and red-tailed hawks are common as well as great horned-owls. Other species typical of mixed forest and open areas including black-chinned and rufous hummingbirds, several fly catchers, woodpeckers, and corvids will use this site for foraging. Several species of rodents occupy this site including cottontail, black tailed jackrabbit, Colorado chipmunk, white-tailed Antelope squirrel, Apache pocket mouse, and several species of Peromyscus. Bats (Myotis, Pipisturellus, and others) can be observed in this ecological site, but are likely limited to areas near water or canyons.

--Grazing Interpretations--

This sites plant community primarily consists of a mixed shrubs and herbaceous grasses and forbs growing on steep slopes. Common shrubs include mountain big sagebrush and mountain snowberry. Grasses include Letterman's needlegrass and bluebunch wheatgrass.

This sites steep slopes and high elevations somewhat limit its use for livestock grazing. Its lack natural perennial water sources also reduces its suitability. Mule deer and Rocky Mountain Elk often utilize this site, and heavy browsing on palatable shrub species is common. Bands of sheep may utilize the site as they move through the higher mountains and will browse on the palatable shrubs and herbaceous vegetation.

Hydrological functions

The soils associated with this ecological site are generally in Hydrologic Soil Group B (NRCS National Engineering Handbook). Once these soils become saturated, however, because of their steep slopes, runoff potential is high. Hydrological groups are used in equations that estimate runoff from rainfall. These estimates are needed for solving hydrologic problems that arise in planning watershed-protection and flood-prevention projects and for designing structures for the use, control and disposal of water. Heavy grazing can alter the hydrology by decreasing plant cover and increasing bare ground. Fire can also affect hydrology, but its affect is variable. Fire intensity, fuel type, soil, climate, and topography can each have different influences. Fires can increase areas of bare ground and hydrophobic layers that reduce infiltration and increase runoff (National Range and Pasture Handbook, 2003).

Recreational uses

This steep site has good aesthetic appearance and natural beauty. It has a variety of grasses, forbs and shrubs which add diversity and color to the landscape. Hunting for upland game birds, deer and elk is good to excellent.

Wood products

None.

Other information

--Poisonous and Toxic Plant Communities--

Toxic plants possibly associated with this site include woolly locoweed, broom snakeweed, and Russian thistle.

Woolly locoweed is toxic to all classes of livestock and wildlife. Locoweed is palatable and has similar nutrient value to alfalfa, which may cause animals to consume it even when other forage is available. Locoweed contains swainsonine (indolizidine alkaloid) and is poisonous at all stages of growth. Poisoning will become evident after 2-3 weeks of continuous grazing and is associated with 4 major symptoms: 1) neurological damage, 2) emaciation, 3) reproductive failure and abortion, and 4) congestive heart failure linked with "high mountain disease".

Broom snakeweed contains steroids, terpenoids, saponins, and flavones that can cause abortions or reproductive failure in sheep and cattle, however, cattle are most susceptible. These toxins are most abundant during active growth and leafing stage. Cattle and sheep generally will only graze broom snakeweed when other forage is unavailable, typically in winter when toxicity levels are at their lowest (Knight and Walter, 2001).

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, during periods with cool/cloudy days, and when growing on soils high in nitrogen and low in sulfur and phosphorus. 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, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses may invade the site. Of particular concern in semi-arid environments are annual invaders including cheatgrass, Russian thistle, alyssum 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. Very few invaded site have been observed to date and so documentation is very limited.

--Fire Ecology--

The ability for an ecological site to carry fire depends primarily on its' 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. 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 short term community dynamics. Fires are more common when plants are stressed or dead due to drought. Fire tolerant shrubs will recover quickly following fire. Sagebrush will 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 herbaceous dominated communities, due to the relatively fast recovery of grasses and forbs when compared to shrubs. If invasive annual grasses are allowed to establish, fires may become more frequent, inhibiting the site's ability to recover.

Inventory data references

Information presented here has been derived from NRCS clipping data and other inventory data. Field observations from range trained personnel were also used.

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Ecoregions of Utah (color poster with map, descriptive text, summary tables, and photographs). Reston, Virginia, U.S. Geological Survey (map scale 1:1,175,000).

Contributors

V. Keith Wadman

Approval

Kendra Moseley, 2/06/2025

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)	Shane Green (NRCS); V. Keith Wadman, (NRCS Retired).
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Contact for lead author	shane.green@ut.usda.gov
Date	10/15/2011
Approved by	Kendra Moseley
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None to very few. Due to the surface coarse fragments on this site, traditional rill formation is reduced. The overall gravelly to channery surface is expected to be resistant to rill formation and accelerated erosion in general. Small rills may be observed directly following spring runoff events or after severe thunderstorms but they appear to be within the sites natural limits.

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

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

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 20 – 40%. Most bare ground is associated with water flow patterns, rills, and gullies. Soil is covered by up to 30 percent rock fragments. Any areas with well developed biological soil crusts should not be counted as bare ground. Poorly developed biological soil crusts that are interpreted as functioning as bare ground (therefore they would be susceptible to raindrop splash erosion) should be recorded as bare ground. Ground cover is based on first raindrop impact, and bare ground is the opposite of ground cover.

5. **Number of gullies and erosion associated with gullies:** Very few gullies present. Where present, their length may extend down slope until they reach a stream or other area where water and sediment accumulate. They should be wide and shallow and armored with large rocks.

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

7. **Amount of litter movement (describe size and distance expected to travel):** Due to the sites slopes being between 5 to 60 percent, some down slope redistribution of any incident litter caused by water is expected. Deposition would likely occur at points of obstruction such as on the uphill side of gravel, rocks and plants, especially following major storm events. Fine litter is moved with moderate to heavy precipitation events and spring runoff. Gullies may remove accumulated litter from under shrubs.

-
8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** 80 to 90% of this site should have an erosion rating of 4 or 5. 10 to 20% may have a rating of 3 to 4. The average should be a 4. Surface textures are typically gravelly or cobbly loams. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.
-
9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The Crandall series soil surface is 5 inches deep. Structure is weak fine granular. Color is dark brown (7.5YR 2.5/2). The A horizon would be expected to be more strongly developed under shrub canopies. It is important if you are sampling to observe the A horizon under canopies as well as the interspaces. Use the specific information for the soil you are assessing found in the published soil survey to supplement this description.
-
10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Spatial distribution of plants and/or well developed biological soil crusts (where present) intercept raindrops reducing splash erosion and provide areas of surface detention to store water allowing additional time for infiltration. Crowns of shrubs and accumulating litter at base of shrubs appear to create a micro-topography that may enhance development of water flow patterns below the drip line of the canopy. Significant increases in shrub canopy reduces understory vegetation causing an associated increase in runoff.
-
11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. There may be layers of calcium carbonate, gravel, cobbles or other naturally occurring hard layers found in the soil subsurface. These should not be considered to be compaction layers.
-
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: Dominance by average annual production: Non-sprouting shrubs (mountain big sagebrush, mountain snowberry) > Cool season perennial grasses (bluebunch wheatgrass, Letterman needlegrass).
- Sub-dominant: Sprouting shrubs (green rabbitbrush, alderleaf mountain mahogany) > Grasses/grasslikes (Geyer sedge, muttongrass).
- Other: Biological soil crust is variable in its expression where present on this site and is measured as a component of ground cover.
- Additional: Following a recent disturbance such as fire that removes woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community for a time. Sprouting shrubs would be the first to recover with non-sprouting shrubs lagging behind. If a disturbance such as fire has not occurred for an extended period of time, these woody species will continue to increase reducing the perennial herbaceous understory species. These conditions would reflect functional community phases within the reference state.
-
13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** In general, a mix of age classes may be expected with a few dead and decadent plants present.
-

14. **Average percent litter cover (%) and depth (in):** Litter cover 30-40%. Depth is highly variability due to slope and the stability of the soil surface.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 500-800 #/acre on an average year.

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:** Potential invaders on this site are cheatgrass, Russian thistle, alyssum and mustard species.

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