USDA Natural Resources Conservation Service

Ecological site R028AY332UT
Upland Alkali Loam (Wyoming Big Sagebrush)

Accessed: 05/06/2024

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.

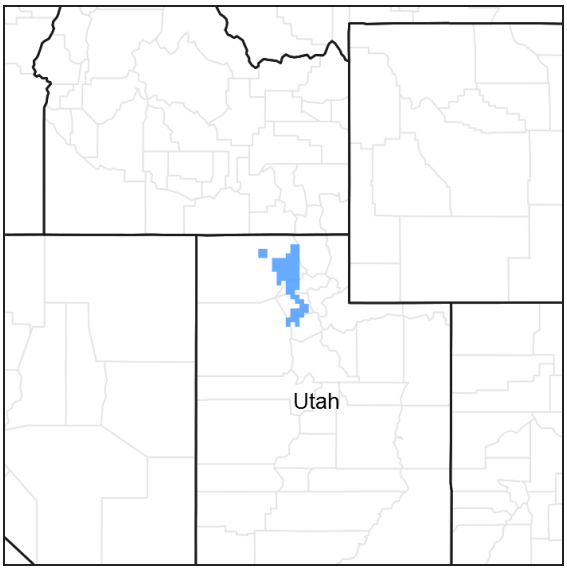


Figure 1. Mapped extent

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-D28A, Great Salt Lake Area, occurs in the eastern portion of the Basin and Range Province. This area is composed of nearly level basins located between widely separated mountain ranges that run mostly north and south. Basin edges are often bordered by gently sloping alluvial fans. The mountains are uplifted fault blocks with steep side slopes.

Associated sites

R028AY004UT	**Alkali Flat (Black Greasewood)**
R028AY024UT	**Wet Saline Meadow (Saltgrass)**
R028AY025UT	**Lakeshore Marsh**
R028AY131UT	**Desert Salty Silt (Pickleweed)**
R028AY330UT	**Upland Sand (Black Greasewood, Indian Ricegrass)**

Similar sites

R028AY004UT	**Alkali Flat (Black Greasewood)**

R028AY330UT	**Upland Sand (Black Greasewood, Indian Ricegrass)**

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata ssp. wyomingensis* (2) *Sarcobatus vermiculatus*
Herbaceous	(1) *Elymus elymoides* (2) *Achnatherum hymenoides*

Physiographic features

This site is typically located on mounds and knolls on lake plains. It also occupies the highest lake terrace elevations on these plains before they transition into bedrock controlled upland sites. Slopes range from 0 to 3 percent and runoff is medium.

Table 2. Representative physiographic features

Landforms	(1) Lake plain (2) Terrace (3) Knoll
Ponding frequency	None
Elevation	1,280–1,295 m
Slope	0–3%
Aspect	Aspect is not a significant factor

Climatic features

The climate of this site dry subhumid and is characterized by cold, snowy winters and warm, dry summers. The average annual precipitation ranges from 11 to 16 inches. April and May are typically the wettest months with July and August being the driest. The most reliable sources of moisture for plant growth are the snow that accumulates over the winter and spring rains that, in combination, wet the sites soil throughout the spring and early summer months. Summer thunderstorms are intermittent and sporadic in nature and thus are not reliable sources of moisture to support vegetative growth on this site. The mean annual air temperature is 49 degrees.

Table 3. Representative climatic features

Frost-free period (average)	161 days
Freeze-free period (average)	189 days
Precipitation total (average)	406 mm

Influencing water features

Soil features

Characteristic soils in this site are very deep and well drained. The soil moisture and temperature regimes are xeric aridic and mesic respectively. The dry surface color is typically a very pale brown. These soils formed in loess and lacustrine deposits derived mainly from sandstone or siltstone parent material. Soil textures are typically silt loams. They are slightly saline (0 to 4 mmhos/cm) and slightly to moderately alkaline. Available water capacity is 3.0 to 4.6 inches.

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

UT603 – Box Elder County, Eastern Part – Pogal.

Typical Profile (Pogal):
A – 0-4 inches; silt loam; strongly effervescent; moderately alkaline.
Bw – 4-13 inches; silt loam; strongly effervesent; strongly alkaline.
Bn – 13-22 inches; silt loam; strongly efferverscent; strongly alkaline.
Bkn1 – 22-35 inches; silt loam; strongly effervescent; strongly alkaline.
Bkn2 - 35-49 inches; silt loam; violently effervescent; very strongly alkaline.
Cn – 49-60 inches; silt loam; violently effervescent; very strongly alkaline.

Table 4. Representative soil features

Parent material	(1) Lacustrine deposits–limestone and sandstone
Surface texture	(1) Silt loam
Drainage class	Well drained
Permeability class	Moderate
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	7.62–11.68 cm
Calcium carbonate equivalent (0-101.6cm)	15–30%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	5–30
Soil reaction (1:1 water) (0-101.6cm)	7.9–8.4
Subsurface fragment volume <=3" (Depth not specified)	0%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

This site developed under the natural ecological conditions found in the Great Salt Lake Area portion of the Basin and Range Province, and includes the natural influences of native herbivore grazing and browsing, and climate. Vegetation is characterized by a shrub layer dominated by Wyoming big sagebrush with black greasewood commonly occurring. Bottlebrush squirreltail and Indian ricegrass are common herbaceous grasses. On average years, plant growth begins about April 1 and ends around October 30.

This site is usually found adjacent to, and just above the Alkali Flat (Greasewood) 028AY004UT site. Greasewood typically increases in the community where it approaches the Alkali Flat site.

During periods of drought, perennial warm and cool season grasses decrease, while periods of normal and above average precipitation result in their increase. Shrub cover is generally lower under dryer climatic conditions, and annual production decreases during drought.

This ecological site has been grazed by domestic livestock since they were first introduced into the area around 1850. This livestock introduction, including the use of fencing, and the development of reliable water sources, have influenced the disturbance regime historically associated with this ecological site. This site often served as wintering pastures for sheep and cattle producers.

Improperly managed livestock grazing (continuous season long grazing, heavy stocking rates, repeated early spring

grazing, etc.) can cause this site to depart from its reference plant community. Bottlebrush squirreltail and Indian ricegrass will often decrease while Wyoming big sagebrush, green rabbitbrush, and black greasewood increase. During periods of continous winter grazing by sheep, black greasewood will also decrease.

Timing of grazing also affects the sites ecological dynamics, for example, spring grazing can result in a decline of cool season grasses, while summer/early fall grazing can result in a decline of warm season grasses.

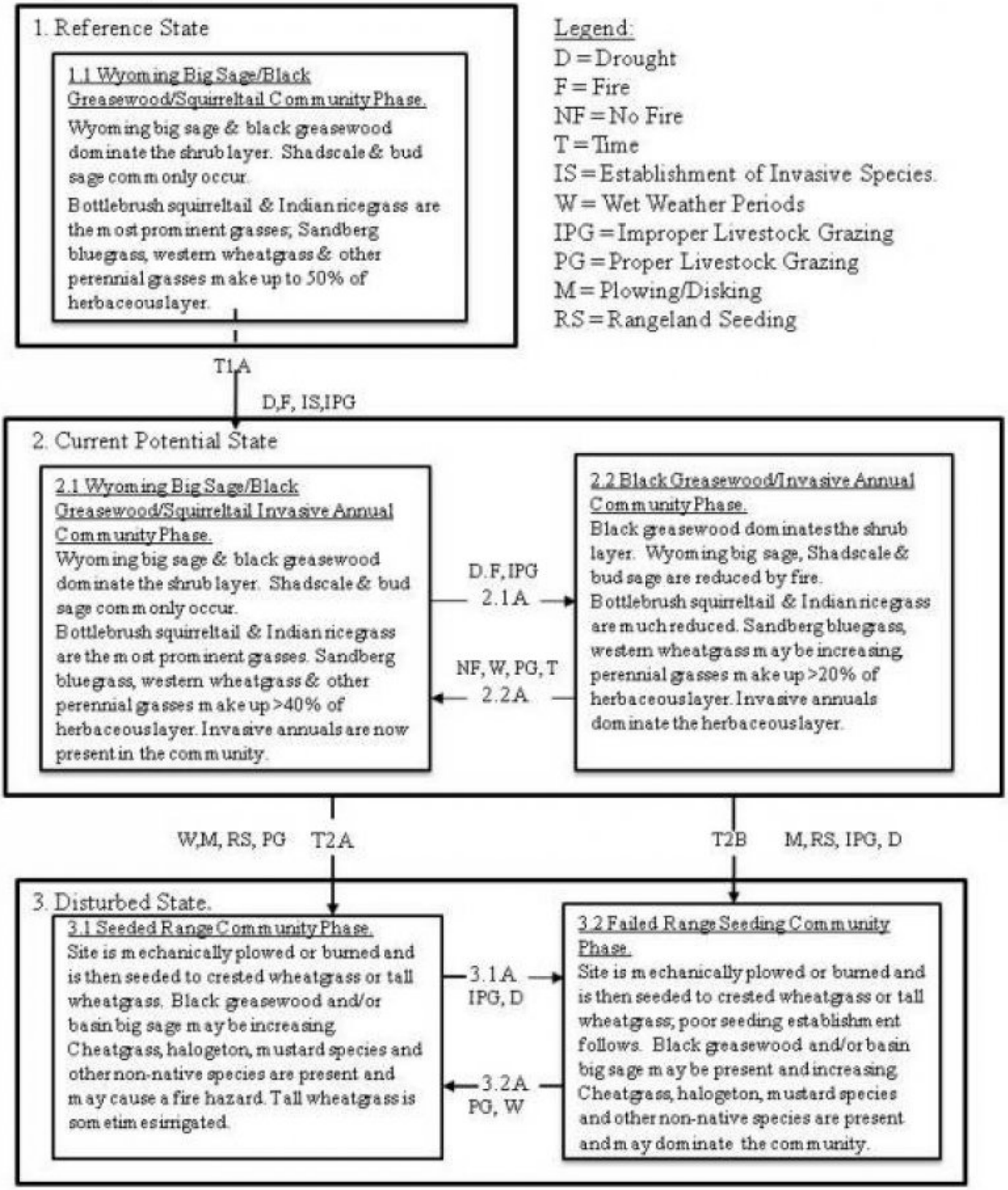
Fire will kill Wyoming big sagebrush allowing green rabbitbrush and black greasewood to increase. Broom snakeweed, halogeton, burr buttercup and Russian thistle are likely to invade as the site deteriorates.

As vegetative communities respond to changes in management or natural influences that move them from one state to another, a return to previous states may not be possible. The amount of energy needed to affect these vegetative shifts depends on present biotic and abiotic features and the desired results.

The following state and transition model diagram depicts some of the most commonly occurring plant communities found on this ecological site. These communities may not represent every possibility, but they are the most prevalent and repeatable. As more data are collected, some of these plant communities may be revised or removed, and new ones may be added. This model was developed using range data collected for publication of the Box Elder County, Eastern Part, Soil Survey and the recent Eastern Shores update. Both ocular and measured data was collected and utilized. Range data collected by the NRCS since 1983 was also used.

State and transition model

State and Transition Model
State: Utah
Site Type: Rangeland
MLRA: D-28A - Great Salt Lake Area
R028AY332UT – Upland Alkali Loam(Wyoming Big Sage, Black Greasewood, Bottlebrush Squirreltail).



State 1

Reference State

The reference state represents the plant communities and ecological dynamics of the Upland Alkali Loam (Wyoming big sage/black greasewood/bottlebrush squirreltail) site. This state includes the biotic communities that become established on this ecological site when all successional sequences are completed under the natural disturbance regime. The reference state generally has co-dominate shrubs composed of Wyoming big sagbrush and black greasewood. Bottlebrush squirreltail and Indian ricegrass dominate the hergaceous layer. 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 become established, return to the reference state may not be possible. Reference State: Wyoming big sage/black greasewood/bottlebrush squirreltail state with natural fluctuations that allow either shrub species to dominate at any given location depending on the natural disturbance history. Indicators: A healthy community dominated by Wyoming big sage, black greasewood and bottlebrush squirreltail. Feedbacks: Improper livestock grazing of perennial grasses and/or other disturbances that may allow for the establishment of invasive species. At-risk Community Phase: This state is 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
Wyoming Big Sage/Black Greasewood/Bottlebrush Squirreltail

This community is characterized by a Wyoming big sagebrush, black greasewood shrub canopy, small amounts of bud sagebrush and shadscale may also be present. The herbaceous layer is dominated by bottlebrush squirreltail and Indian ricegrass. Other commonly occurring grasses include Sandberg bluegrass and western wheatgrass. A mix of other perennial grasses, shrubs, and forbs are also present. The composition by air-dry weight is approximately 40 to 50 percent perennial grasses, 10 percent forbs, and 40 to 50 percent shrubs. Bare ground is variable (35-45%) depending on the amount of biological crust (0 to 15), and plant cover. 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	280	392	560
Shrub/Vine	336	448	560
Forb	67	90	112
Total	**683**	**930**	**1232**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-20%
Grass/grasslike foliar cover	10-20%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0-15%
Litter	15-20%
Surface fragments >0.25" and <=3"	0-1%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	30-40%

State 2

Current Potential State

The current potential state is similar to the reference state, however invasive grasses and/ or forbs are now present in all community phases. This state is still dominated by a shrub canopy of Wyoming big sagebrush and black greasewood, however depending on disturbance history, green and/or rubber rabbitbrush may be prominent on the site. Bottlebrush squirreltail and Indian ricegrass are still the primary perennial grass species however, Sandberg bluegrass, western wheatgrass, cheatgrass and other less palatable species now make up a larger portion of the herbaceous layer. Primary disturbance mechanisms include native herbivore grazing and domestic livestock grazing. Timing of these disturbances dictates the ecological dynamics that occur. The current potential state is still self sustaining; but is losing resistance to change due to lower resilience following disturbances. When disturbances occur, the rate of recovery is variable depending on severity. Current Potential State: Wyoming big sagebrush/Black greasewood/ bottlebrush squirreltail state with variations of green and/or rubber rabbitbrush shrubs present. Invasive plants are present. Indicators: A community dominated by a mixture of native perennial grassses, forbs and. Invasive grasses and/or forbs are also present. Feedbacks: Frequent disturbances that may allow the dominance of annual invasive species such as cheatgrass to dominate. At-risk Community Phase: As increased disturbance frequency allows for the dominance of annual grasses, such as cheatgrass, this community is at greater risk. Trigger: Reoccurring disturbances that result in a dominance of annual grasses in the herbaceous layer.

Community 2.1
Wyoming Big Sage/Black Greasewood/Bottlebrush Squirreltail Invasive Annuals

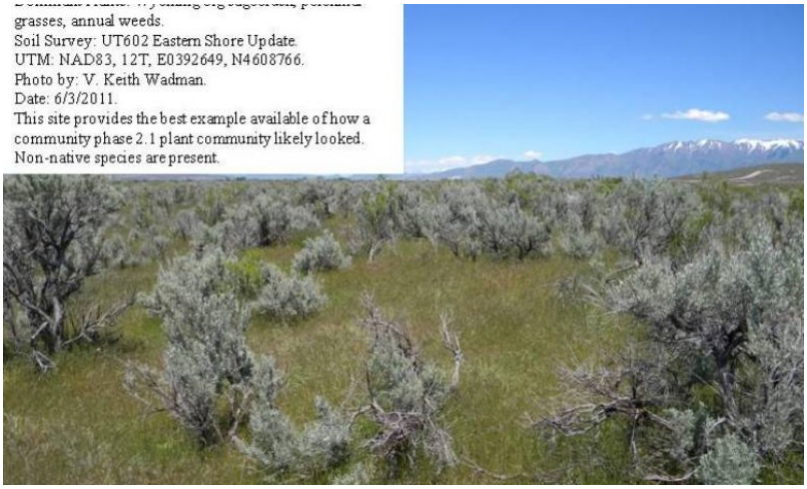


Figure 5. Community Phase 2.1

This community is characterized by a Wyoming big sagebrush, black greasewood shrub canopy, small amounts of bud sagebrush and shadscale may also be present. The herbaceous layer is dominated by bottlebrush squirreltail and Indian ricegrass. Other commonly occurring grasses include cheatgrass, Sandberg bluegrass and western wheatgrass. A mix of other non-native annual grasses and forbs are also present. The composition by air-dry weight is approximately 30 to 40 percent perennial grasses, 10 percent forbs, and 50 to 60 percent shrubs. Bare ground is variable (40-50%) depending on the amount of biological crust (0 to 15), and plant cover. 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 (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	280	392	560
Shrub/Vine	336	448	560
Forb	67	90	112
Total	**683**	**930**	**1232**

Table 8. Ground cover

Tree foliar cover	0%

Shrub/vine/liana foliar cover	10-25%
Grass/grasslike foliar cover	10-20%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0-10%
Litter	15-20%
Surface fragments >0.25" and <=3"	0-1%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	30-40%

Community 2.2
Black Greasewood/Invasive Annuals

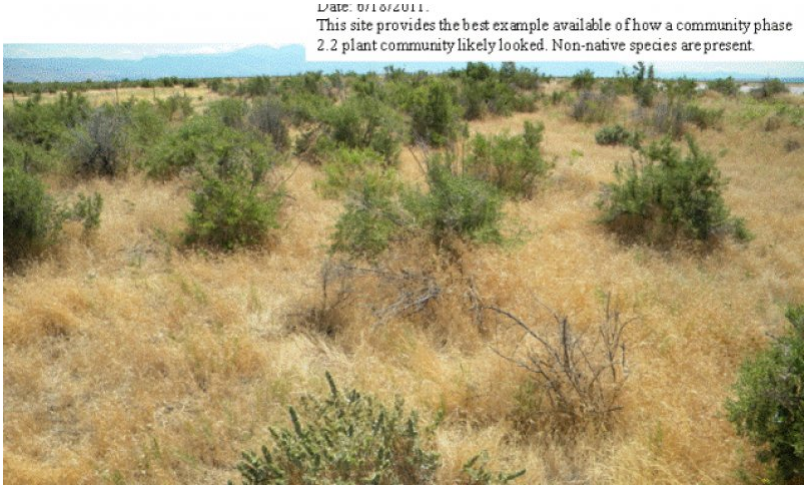


Figure 7. Community Phase 2.2

This community is characterized by a Wyoming big sagebrush and/or black greasewood shrub canopy, small amounts of bud sagebrush and shadscale may also be present. The herbaceous layer is dominated by cheatgrass and/or Japanese brome. Bottlebrush squirreltail and Indian ricegrass may still be present in small amounts. Other commonly occurring grasses include Sandberg bluegrass and western wheatgrass. A mix of other non-native annual grasses and forbs are also present. The composition by air-dry weight is approximately 10 to 20 percent perennial grasses, 20 percent forbs, and 60 to 70 percent shrubs. Bare ground is variable (40-50%) depending on the amount of biological crust (0 to 10), and plant cover. The following tables provide an example the typical vegetative floristics of a community phase 2.2 plant community.

Table 9. Annual production by plant type

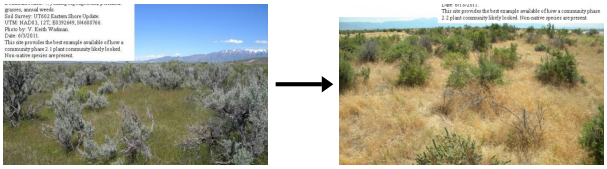
Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	280	392	560
Shrub/Vine	336	448	560
Forb	67	90	112
Total	**683**	**930**	**1232**

Table 10. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-25%

Grass/grasslike foliar cover	20-30%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0-10%
Litter	25-30%
Surface fragments >0.25" and <=3"	0-1%
Surface fragments >3"	0%
Bedrock	0%
Water	0%
Bare ground	20-30%

Pathway 2.1A
Community 2.1 to 2.2



Wyoming Big Sage/Black Greasewood/Bottlebrush Squirreltail Invasive Annuals

Black Greasewood/Invasive Annuals

This pathway occurs when events favor a decrease in palatable perennial grasses and grasslikes and an increase in shrubs such as black greasewood and/or Wyoming big sage. Non-native annuals including cheatgrass and Japanese brome may eventually dominate the community. Events may include any combination of extended drought, improper livestock grazing, and fire that increase annuals and decrease desirable perennials. Fire may also remove Wyoming big sage from the shrub layer.

Pathway 2.2A
Community 2.2 to 2.1

Black Greasewood/Invasive Annuals

Wyoming Big Sage/Black Greasewood/Bottlebrush Squirreltail Invasive Annuals

This pathway occurs when events favor an increase in palatable perennial grasses and grasslikes an a decrease in less palatable species. Non-native annuals, including cheatgrass and Japanese brome may become less dominate in the community as perennial grasses increase in vigor. Events may include extended periods with above average moisture, carefully managed livestock grazing, and the absence of fire, which, in combination, can decrease annuals and less palatable perennials, and increase more desirable perennial vegeration. Time without fire may also allow Wyoming big sage to icrease in the shrub layer.

State 3
Disturbed State

This state occurs when the site is plowed or disked and planted to various rangeland grasses. Tall wheatgrass, crested wheatgrass and Russian wildrye are the most commonly seeded species. These seedings may be very clean and healthy or may have various amounts of non-native annuals including, but are not limited to Russian thistle, cheatgrass, tansy mustard, broom snakeweed, alyssum, 5-horned smotherweed and annual Cryptantha. Invasive Forb State: Range seeding community phases influenced by livestock grazing practices and weather

cycles. Indicators: Perennial rangeland seeding with annual, invasive forbs and grasses present in various amounts. Feedbacks: Livestock grazing practices and weather cycles that maintain or degrade the range seeding and suppress or increase the non-native annuals present in the community. Trigger: An increase of cheatgrass and other annuals that may shorten the sites fire interval, decrease perennial seeding production and increase bare ground.

Community 3.1
Seeded Range Community Phase

Figure 9. Community Phase 3.1

This community phase has been mechanically plowed, disked or burned and then seeded to rangeland grasses including crested wheatgrass, tall wheatgrass and/or Russian wildrye. Black greasewood, rubber rabbitbrush and/or Wyoming big sage may be present in small amounts. Annuals including cheatgrass, halogeton, various mustard species and other non-native species are also present in small amounts and during above average moisture years, may become prominent enough in the stand to cause a fire hazard. Tall wheatgrass is sometimes irrigated. The following tables provide an example the typical vegetative floristics of a community phase 3.1 plant community.

Table 11. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	560	785	1009
Forb	56	112	168
Shrub/Vine	28	56	112
Total	**644**	**953**	**1289**

Table 12. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-10%
Grass/grasslike foliar cover	20-30%
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	50-60%

Community 3.2
Failed Range Seeding Community Phase.

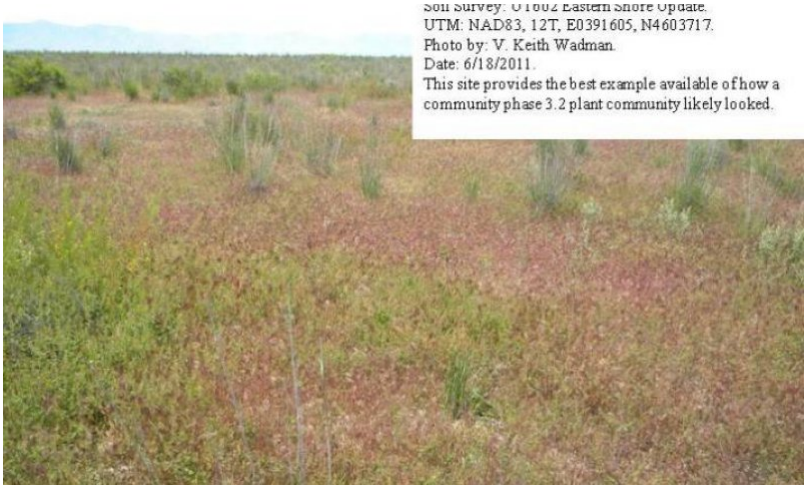


Figure 11. Community Phase 3.2

This community phase has been mechanically plowed, disked or burned and then seeded to renge seeding species including crested wheatgrass, tall wheatgrass, and/or Russian wildrye. Poor management and/or drought causes the seeding to fail. Black greasewood, rubber rabbitbrush and/or basin big sage may be present and increasing in the stand. Cheatgrass, halogeton, various mustard species and other non-native species are present and often dominate the community. The following tables provide an example the typical vegetative floristics of a community phase 3.2 plant community.

Table 13. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	336	560	785
Forb	112	224	336
Shrub/Vine	56	112	168
Total	**504**	**896**	**1289**

Table 14. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	20-45%
Grass/grasslike foliar cover	25-45%
Forb foliar cover	10-30%
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	40-60%

Pathway 3.1A
Community 3.1 to 3.2

Seeded Range Community Phase

Failed Range Seeding Community Phase.

This pathway occurs when events favor an decrease in seeded rangeland species and an increase in unwanted invasive annuals. Events may include extended drought and improper livestock grazing that it increases annuals and decreases desirable perennials.

Pathway 3.2A
Community 3.2 to 3.1

Failed Range Seeding Community Phase.

Seeded Range Community Phase

This pathway occurs when events favor an increase in seeded rangeland species and a reduction in unwanted invasive annuals. Events may include a series of above average moisture years and proper livestock grazing.

Transition T1A
State 1 to 2

This transition is from the native perennial warm and cool season grass and grasslike understory in the reference state to a state that contains non-native, invasive species. Events may include the establishment of invasive grasses and forbs, and an increase in black greasewood, basin big sagebrush and/or rubber rabbitbrush. Factors that drive such events include, improper livestock grazing of perennial grasses, prolonged drought, and the presence of a seed source for invasive species. Fire may also be a driver for this change in some instances. Invasive species such as cheatgrass however have been known to invade intact perennial plant communities with little to no disturbance. Once invasive species are found in the plant community a threshold has been crossed.

Transition T2A
State 2 to 3

This transition is from the current potential state to a well established seeded rangeland community phase. Site is plowed, disked and/or burned, and seeded to adapted rangeland species including tall wheatgrass, crested wheatgrass or Russian wilrye. Factors that drive such events include, proper livestock grazing of perennial grasses, sufficient moisture for seeding establishment, and adequate control of unwanted invasive species. Once site is converted, a threshold has been crossed.

Transition T2B
State 2 to 3

This transition is from the current potential state to a failed seeded rangeland community phase. Site is plowed, disked and/or burned, and seeded to adapted rangeland species including tall wheatgrass, crested wheatgrass or Russian wilrye. Factors that drive such events include, improper livestock grazing of perennial grasses, prolonged drought for seeding establishment, and poor control of unwanted invasive species. Once site is converted, a threshold has been crossed.

Additional community tables

Table 15. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Primary Shrubs**			247–392	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	135–179	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	135–168	–
3	**Secondary Shrubs**			56–112	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	34–67	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	34–67	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	22–34	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	11–22	–
	green molly	BAAM4	*Bassia americana*	11–22	–
	yellow rabbitbrush	CHVIS5	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. stenophyllus*	11–22	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	11–22	–
Grass/Grasslike					
0	**Primary Grasses**			247–336	
	squirreltail	ELEL5	*Elymus elymoides*	146–168	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	56–112	–
	Sandberg bluegrass	POSE	*Poa secunda*	45–78	–
1	**Secondary Grasses**			45–90	
	western wheatgrass	PASM	*Pascopyrum smithii*	17–34	–
	James' galleta	PLJA	*Pleuraphis jamesii*	11–22	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	11–22	–
	purple threeawn	ARPU9	*Aristida purpurea*	11–22	–
	saltgrass	DISP	*Distichlis spicata*	11–22	–
	basin wildrye	LECI4	*Leymus cinereus*	11–22	–
Forb					
2	**Forbs**			34–78	
	common yarrow	ACMI2	*Achillea millefolium*	11–22	–
	freckled milkvetch	ASLE8	*Astragalus lentiginosus*	11–22	–
	clasping pepperweed	LEPE2	*Lepidium perfoliatum*	11–22	–
	pale evening primrose	OEPA	*Oenothera pallida*	11–22	–
	old-man-in-the-Spring	SEVU	*Senecio vulgaris*	11–22	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	11–22	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	11–22	–
	yellow salsify	TRDU	*Tragopogon dubius*	11–22	–

Table 16. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Primary Shrubs**			247–392	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	135–179	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	146–168	–
3	**Secondary Shrubs**			56–112	
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	34–67	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	34–67	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	22–34	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	11–22	–
	green molly	BAAM4	*Bassia americana*	11–22	–
	yellow rabbitbrush	CHVIS5	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. stenophyllus*	11–22	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	11–22	–
Grass/Grasslike					
0	**Primary Grasses**			247–336	
	squirreltail	ELEL5	*Elymus elymoides*	146–168	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	56–112	–
	cheatgrass	BRTE	*Bromus tectorum*	45–90	–
	Sandberg bluegrass	POSE	*Poa secunda*	45–78	–
1	**Secondary Grasses**			45–90	
	western wheatgrass	PASM	*Pascopyrum smithii*	17–34	–
	James' galleta	PLJA	*Pleuraphis jamesii*	11–22	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	11–22	–
	purple threeawn	ARPU9	*Aristida purpurea*	11–22	–
	saltgrass	DISP	*Distichlis spicata*	11–22	–
	basin wildrye	LECI4	*Leymus cinereus*	11–22	–
Forb					
2	**Forbs**			56–112	
	common yarrow	ACMI2	*Achillea millefolium*	11–22	–
	freckled milkvetch	ASLE8	*Astragalus lentiginosus*	11–22	–
	lambsquarters	CHAL7	*Chenopodium album*	11–22	–
	herb sophia	DESO2	*Descurainia sophia*	11–22	–
	clasping pepperweed	LEPE2	*Lepidium perfoliatum*	11–22	–
	pale evening primrose	OEPA	*Oenothera pallida*	11–22	–
	Russian thistle	SAKA	*Salsola kali*	11–22	–
	old-man-in-the-Spring	SEVU	*Senecio vulgaris*	11–22	–

	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	11–22	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	11–22	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	11–22	–
	field pennycress	THAR5	*Thlaspi arvense*	11–22	–
	yellow salsify	TRDU	*Tragopogon dubius*	11–22	–

Table 17. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Shrub/Vine					
0	**Primary Shrubs**			247–392	
	greasewood	SAVE4	*Sarcobatus vermiculatus*	135–179	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	146–168	–
3	**Secondary Shrubs**			56–112	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	34–67	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	34–67	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	22–34	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	11–22	–
	green molly	BAAM4	*Bassia americana*	11–22	–
	yellow rabbitbrush	CHVIS5	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. stenophyllus*	11–22	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	11–22	–
Grass/Grasslike					
0	**Primary Grasses**			247–448	
	cheatgrass	BRTE	*Bromus tectorum*	112–224	–
	Sandberg bluegrass	POSE	*Poa secunda*	67–112	–
	squirreltail	ELEL5	*Elymus elymoides*	22–56	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	22–34	–
1	**Secondary Grasses**			45–90	
	western wheatgrass	PASM	*Pascopyrum smithii*	17–34	–
	James' galleta	PLJA	*Pleuraphis jamesii*	11–22	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	11–22	–
	purple threeawn	ARPU9	*Aristida purpurea*	11–22	–
	saltgrass	DISP	*Distichlis spicata*	11–22	–
	basin wildrye	LECI4	*Leymus cinereus*	11–22	–
Forb					
2	**Forbs**			56–168	
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	34–45	–
	field pennycress	THAR5	*Thlaspi arvense*	34–45	–
	lambsquarters	CHAL7	*Chenopodium album*	34–45	–
	field bindweed	COAR4	*Convolvulus arvensis*	34–45	–

	herb sophia	DESO2	*Descurainia sophia*	34–45	–
	prickly lettuce	LASE	*Lactuca serriola*	34–45	–
	desert madwort	ALDE	*Alyssum desertorum*	34–45	–
	annual ragweed	AMAR2	*Ambrosia artemisiifolia*	34–45	–
	Russian thistle	SAKA	*Salsola kali*	34–45	–
	old-man-in-the-Spring	SEVU	*Senecio vulgaris*	11–22	–
	freckled milkvetch	ASLE8	*Astragalus lentiginosus*	11–22	–
	clasping pepperweed	LEPE2	*Lepidium perfoliatum*	11–22	–
	pale evening primrose	OEPA	*Oenothera pallida*	11–22	–
	yellow salsify	TRDU	*Tragopogon dubius*	11–22	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	11–22	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	11–22	–
	common yarrow	ACMI2	*Achillea millefolium*	11–22	–

Table 18. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant Grasses**			673–1009	
	tall wheatgrass	THPO7	*Thinopyrum ponticum*	0–1345	–
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–1121	–
	Russian wildrye	PSJU3	*Psathyrostachys juncea*	0–897	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	8–22	–
	western wheatgrass	PASM	*Pascopyrum smithii*	8–22	–
	James' galleta	PLJA	*Pleuraphis jamesii*	8–22	–
2	**Sub-dominant Grasses**			224–336	
	cheatgrass	BRTE	*Bromus tectorum*	56–84	–
	saltgrass	DISP	*Distichlis spicata*	56–84	–
	freckled milkvetch	ASLE8	*Astragalus lentiginosus*	8–37	–
	clasping pepperweed	LEPE2	*Lepidium perfoliatum*	8–37	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	8–37	–
	Pacific aster	SYCHC	*Symphyotrichum chilense var. chilense*	8–37	–
Forb					
3	**Forbs**			112–336	
	desert madwort	ALDE	*Alyssum desertorum*	28–56	–
	annual ragweed	AMAR2	*Ambrosia artemisiifolia*	28–56	–
	lambsquarters	CHAL7	*Chenopodium album*	28–56	–
	field bindweed	COAR4	*Convolvulus arvensis*	28–56	–
	herb sophia	DESO2	*Descurainia sophia*	28–56	–
	prickly lettuce	LASE	*Lactuca serriola*	28–56	–
	Russian thistle	SAKA	*Salsola kali*	28–56	–
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	28–56	–
	field pennycress	THAR5	*Thlaspi arvense*	28–56	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	8–22	–
	green molly	BAAM4	*Bassia americana*	8–22	–
	yellow rabbitbrush	CHVIS5	*Chrysothamnus viscidiflorus ssp. viscidiflorus var. stenophyllus*	8–22	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	8–22	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	8–22	–
	bud sagebrush	PIDE4	*Picrothamnus desertorum*	8–22	–
Shrub/Vine					
4	**Shrubs**			56–168	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–112	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	28–112	–

Table 19. Community 3.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Dominant Grasses**			112–448	
	crested wheatgrass	AGCR	*Agropyron cristatum*	0–168	–
	tall wheatgrass	THPO7	*Thinopyrum ponticum*	0–168	–
	Russian wildrye	PSJU3	*Psathyrostachys juncea*	0–112	–
2	**Sub-Dominant Grasses**			560–785	
	cheatgrass	BRTE	*Bromus tectorum*	336–448	–
	saltgrass	DISP	*Distichlis spicata*	56–140	–
Forb					
3	**Forbs**			224–560	
	Russian thistle	SAKA	*Salsola kali*	112–168	–
	tall tumblemustard	SIAL2	*Sisymbrium altissimum*	56–84	–
	field pennycress	THAR5	*Thlaspi arvense*	56–84	–
	desert madwort	ALDE	*Alyssum desertorum*	56–84	–
	annual ragweed	AMAR2	*Ambrosia artemisiifolia*	56–84	–
	lambsquarters	CHAL7	*Chenopodium album*	56–84	–
	field bindweed	COAR4	*Convolvulus arvensis*	56–84	–
	herb sophia	DESO2	*Descurainia sophia*	56–84	–
	prickly lettuce	LASE	*Lactuca serriola*	56–84	–
Shrub/Vine					
4	**Shrubs**			56–168	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	0–112	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	28–112	–

Animal community

--Wildlife Interpretation--

This ecological site, in its reference state, produced large amounts of nutritious forage that was utilized by native herbivores including deer and antelope who lived here along their associated predators. Although much of this site is presently different from the reference state, it is still very important as wildlife habitat. Other wildlife commonly observed using this site include rabbit, coyote, badger, fox, and various waterfowl species.

In many locations, this ecological site and its associated wetland ecological sites provide critical habitat for migrating birds from both the Pacific and Central Flyways of North America. These areas contain abundant food for birds.

The following statistics were provided by the Bear River Migratory Bird Refuge where much of this ecological site is located:

1. Breeding colonies of white-faced ibis contain as many as 18,000 birds.

2. Up to 10,000 American avocets breed at the Refuge annually.

3. One of North America’s three largest American white pelican breeding colonies, containing in excess of 50,000 birds, is found on Gunnison Island in Great Salt Lake.

4. Northern Utah marshes host up to 60 percent of the continental breeding population of cinnamon teal.

5. The Great Salt Lake boasts the largest fall staging concentration of Wilson’s phalaropes in the world, at approximately 500,000 birds. Red-necked phalaropes number nearly 100,000.

6. The Great Salt Lake area hosts greater than 50 percent of the continental breeding population of snowy plovers.

7. The Great Salt Lake area hosts 26 percent of the global population of marbled godwits during migration.

8. Bear River Refuge may attract over 65,000 black-necked stilts in the fall, more than anywhere else in the country.

--Grazing Interpretations--
This site provides good spring, fall, and winter grazing conditions for domestic livestock due to its accessibility and its supply of nutritious forage. The plant community is primarily grasses, with the majority of canopy cover being attributed to bottlebrush squirreltail and Indian ricegrass. Improper livestock grazing can cause these species to decrease while annual forbs, black greasewood, Wyoming big sage and rabbitbrush increase.

When this site is stressed, cheatgrass, Russian thistle and halogeton are likely to invade.

Hydrological functions

The soils associated with this ecological site are generally in Hydrologic Soil Group B. On these sites runoff potential is low and infiltration rates are moderate, depending on slope and ground cover/health (NRCS National Engineering Handbook). 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. In areas similar to the reference state where ground cover is adequate infiltration is increased and runoff potential is decreased. In areas where ground cover is less than 50%, infiltration is reduced and runoff potential is increased. Heavy use by domestic livestock affects hydrology in two ways. Trampling increases bulk density and breaks down soil aggregates. This results in decreased infiltration rates and increased runoff. Heavy grazing can also alter the hydrology by decreasing plant cover and increasing bare ground. Fire can also affect hydrology, but it 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.

Recreational uses

Recreation activities include aesthetic value and good opportunities for hiking, horseback riding, hunting, and off-road vehicle use. Due to the high erosion potential after a surface disturbance, care should be taken when planning recreational activities. Camp sites are usually limited due to lack of sheltering trees or rock outcrop.

Wood products

None.

Other information

--Poisonous/Toxic Plant Species--
The toxic plant associated with this site include broom snakeweed and Russian thistle.

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

Russian thistle can cause 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. (Knight and Walter, 2001)

--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 cheatgrass, Russian thistle, kochia, halogeton, and annual mustards. The presence of these species depends 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 possible.

Cheatgrass and Russian thistle are common invaders to this site, especially in lower areas that concentrate nutrients and moisture. In some cases cheatgrass has been able to establish into an intact perennial grass and shrub community, but disturbed communities are more susceptible to invasion and domination. If growing conditions are conducive to invaders and the disturbance is not removed, these plants can create dense monocultures that can alter the nutrient cycling, erosion rates, and the fire regime of the area.

Fire Ecology
The ability for an ecological site to carry fire depends primarily on the present fuel load and plant moisture content. Fire was a typical disturbance in the historic climax plant community for this ecological site. The natural fire return interval is 30-100 years, where fires typically occur in the fall. When the site is degraded by the presence of invasive plants, the fire return interval may be shortened due to increased flashy fuels. The shortened fire return interval in the presence of invasive annual species is often sufficient to suppress the native plant community.

Other references

Baily, R.G. 1995. Description of the ecoregions of the United Sates. Available http://www.fs.fed.us/land/ecosysmgmt/ecoreg1_home.html. Accessed February 27, 2008.

Belnap, J. and S.L. Phillips. 2001. Soil biota in an ungrazed grassland: response to annual grass (Bromus tectorum) invasion. Ecological Applications. 11:1261-1275

Chapin, S.F., B.H. Walker, R.J. Hobbs, D.U. Hooper, J.H. Lawton, O.E. Sala, and D. Tilman. 1997. Biotic control over the functioning of ecosystems. Science. 277:500-504

Cox R.D. and V.J. Anderson. 2004. Increasing native diversity of cheatgrass-dominated rangeland through assisted succession. Journal of Range Management. 57:203-210,

Howard, Janet L. 2003. Atriplex canescens. In: Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/. Accessed on February 25, 2008.

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

National Engineering Handbook. US Department of Agriculture, Natural Resources Conservation Service. Available: http://www.info.usda.gov/CED/Default.cfm#National%20Engineering%20Handbook. Accessed February 25, 2008.

NRCS Grazing Lands Technology Institute. 2003. National Range and Pasture Handbook. Fort Worth, TX, USA: US Department of Agriculture, Natural Resources Conservation Service, 190-VI-NRPH.

NPS.gov. 2008. Canyonlands National Park. Nature and Science. Available: http://www.nps.gov/cany/naturescience/. Accessed on January 4, 2008.

Tilley, D.J. 2007. Reintroducing native plants to the American West. Aberdeen Plant Materials Center, Aberdeen, ID, USA: US Department of Agriculture. Available: http://plant-materials.nrcs.usda.gov/idpmc/publications.html. Accessed February 22, 2008.

Utah Climate Summaries. 2008. Available: http://www.wrcc.dri.edu/summary/climsmut.html. Accessed on February 25, 2008.

Utah Division of Wildlife Resources. 2007.
Woods, A.J., D.A. Lammers, S.A. Bryce, J.M. Omernik, R.L. Denton, M. Domeier, and J.A. Comstock. 2001. 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

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Rangeland health reference sheet

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

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Date	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):** 25 – 30% 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.

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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):** This site should have an erosion rating of 5 or 6 under plant canopies and a rating of 4 to 5 in the interspaces with an average rating of 5 using the soil stability kit test.

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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 the modal soil (Medburn FSL, Saline 2-4%, soil survey area: 611, Tooele). This site has 4correlated soils, resulting in variation of each of these attributes. Unless working on a location with the modal soil, it is critical to supplement this description with the soil-specific information from the published soil survey.

   Soil surface horizon is typically 8 inches deep. Structure is typically weak medium subungular blocky. Color is typically pale brown (10YR 6/3), brown (10YR 4/3) moist. An ochric horizon extends to a depth of 8 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 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.

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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 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: squirreltail, greasewood, Wyoming big sagebrush

    Sub-dominant: Sandberg bluegrass, Indian ricegrass

    Other: The perennial grass/sprouting shrub (greasewood) functioning group is expected on this site.

    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.

    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 may substitute for mid stature cool season perennial native bunchgrasses.). Biological soil crust is variable in its expression on this site and is measured as a component of ground cover. Forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions.

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** 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 20-30% 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):** 575 #/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:** Snakeweed, halogeton, and Russian thistle

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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.
