Ecological site R034BY404CO
Semidesert Stony Loam (Shadscale)

Last updated: 9/09/2023
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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): 034B–Warm Central Desertic Basins and Plateaus

Semidesert Stony Loam (Shadscale) ecological site occurs on benches and mesa tops in MLRA 34B (Warm Central Desertic Basins and Plateaus). The site concept was established within MLRA 34B in the transition from Semidesert Climate Zone. This zone has 8 to 12 inches of precipitation and a mesic temperature regime. This site has bimodal precipitation and is dominated by shadscale and winterfat. The data are being collected in Mesa and Delta Counties, Colorado, where this site is known to occur.

Classification relationships

NRCS & BLM:
Major Land Resource Area 34B, Warm Central Desertic Basins and Plateaus (USDA-NRCS, 2006).

USFS:
341Ba-Mancos Shale Lowlands-Grand Valley < 341B Northern Canyon Lands Section < 341 Intermountain Semidesert and Desert (Cleland et al., 2007).

EPA:
20b Shale Deserts and Sedimentary Basins and 20c Semiarid Benchlands and Canyonlands, < 20 Colorado Plateau < 10.1 Cold Deserts < 10 North American Deserts (Griffith, 2006).

USGS:
Colorado Plateau Province (Canyonlands section)

Ecological site concept

The description of 34B Semidesert Stony Loam (Shadscale) was drafted from the existing description of Stony Saltdesert Range Site (R034XY404CO, August 1975). This site occurs on high terraces, fan remnants, old alluvial fans, mesas, pediments, and benches around the base of the Grand Mesa in Mesa and Delta Counties, Colorado. The soils are deep and loamy textured and derived from alluvium and slope alluvium over subsurface material from Mancos Shale. The site supports a shadscale-winterfat-galleta community. It has an ustic aridic moisture regime and a mesic temperature regime. The effective precipitation ranges from 8 to 12 inches per year. Because of the salinity of the soils on this site, the actual precipitation is less effective for the plants. This site occurs between the mat saltbush and pinyon-juniper zones.

Associated sites

R034BY106UT	**Desert Loam (Shadscale)** Characteristic soils of this site are deep to very deep and well drained. They formed in alluvium derived mainly from sedimentary parent materials. The soils are fine-loamy with a surface texture of loam to fine sandy loam. This site occurs on alluvial fans, fan terraces, stream terraces, hillslopes, and tops of mesas and buttes.
R034BY117UT	**Desert Shallow Clay (Mat Saltbush)** Characteristic soils of this site are 10 to 40 inches deep over shale and well drained. They formed in residuum derived mainly from shale. Soil textures are clay loam to silty clay. This site occurs on low rolling shale hills, benches, escarpments, and dissected pediment slopes. Dominant vegetation is mat saltbush.
R034BY212UT	**Semidesert Loam (Wyoming Big Sagebrush)** Characteristic soils of this site are deep and well drained. They formed in alluvium and colluvium derived mainly from mixed sedimentary parent materials. The soils are generally fine-loamy with a surface layer of loam, fine sandy loam, or silty clay loam.

Similar sites

R034BY240UT	**Semidesert Silt Loam (Winterfat)** Characteristic soils of this site are very deep and well drained. They formed in mixed alluvium derived mainly from sedimentary parent materials. The soils have a surface layer of silt loam. This site occurs on alluvial fans and drainage bottoms. Slopes are mostly 2 to 4 percent.Characteristic soils of this site are very deep and well drained. They formed in mixed alluvium derived mainly from sedimentary parent materials. The soils have a surface layer of silt loam. This site occurs on alluvial fans and drainage bottoms. Slopes are mostly 2 to 4 percent.
R034BY244UT	**Semidesert Stony Loam (Salina Wildrye)** Characteristic soils of this site are 20 to 40 inches deep over gypsiferous shale and moderately well drained. They formed in alluvium over residuum derived mainly from sandstone and shale. The soils commonly have a surface layer of cobbly fine sandy loam. Silty clay loam and silty clay extend to depths of 20 to 40 inches and overlie gypsiferous shale.
R034BY202UT	**Semidesert Bouldery Loam (Shadscale)** This site occurs on dissected alluvial fans and fan terraces. Slopes mostly range from 3 to 20 percent. Characteristic soils of this site are over 60 inches deep over sandstone or shale and well drained. They formed in alluvium derived mainly from sandstone and shale. The soils have a surface layer of very bouldery fine sandy loam and a subsurface layer very stony and cobbly sandy loam.
R034BY248UT	**Semidesert Very Steep Loam (Shadscale)** This site occurs on canyon escarpments. Slopes range from 50 to 70 percent. Characteristic soils of this site are 20 to 40 inches deep over shale and sandstone and are well drained. They formed in colluvium and residuum derived mainly from shale and sandstone. The soils commonly have a surface layer of stony sandy clay loam. The underlying material is silty clay loam and overlies soft weathered shale. Hard shale is at depths of 20 to 40 inches.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Atriplex confertifolia*
Herbaceous	(1) *Pleuraphis jamesii*

Physiographic features

This site is located in the valley on fan remnants, old alluvial fans, mesas, pediments, valley sides, and benches around the base of the Grand Mesa in Mesa and Delta Counties, Colorado. It is on some of the side slopes of the benches and mesas where its vegetation is still armoring the soil surface. Slopes typically range from 3 to 25 percent but can be as much as 60 percent on the armored side slopes.

Elevation ranges from 4,800 to 6,500 feet above sea level.

Table 2. Representative physiographic features

Landforms	(1) Mesa (2) Pediment (3) Fan remnant
Flooding frequency	None
Ponding frequency	None
Elevation	4,800–6,500 ft
Slope	3–25%
Aspect	Aspect is not a significant factor

Climatic features

Average annual precipitation is about 8 to 12 inches. This area is located where winter precipitation and summer monsoonal rains meet. Of the yearly precipitation, 45 to 50 percent occurs as snow and 50 to 55 percent occurs as rain. Snow usually falls from November to March. Rain falls from April 1 through October 31. The driest periods are usually from December through February and in June. Plant growth begins in late March and early April. The dormancy period for cool-season plants starts during June. Summer thundershowers are common from July to September. The summer moisture favors the growth of warm-season plants. When late summer and fall rains occur, the growth of warm-season plants accelerates and some regrowth of cool-season species occurs. Shrub species continue to grow through the entire growing season. The average annual total snowfall is 14.0 inches. The highest winter snowfall on record is 55.4 inches, which occurred in the 1915-1916 winter. The lowest snowfall on record is 0 inches, which occurred during the 1933-34 and 1966-1967 winters. The highest yearly precipitation on record is 19.37, which occurred in 1983, and the lowest is 4.68, which occurred in 1956. The mean daily annual air temperature is 54 degrees Fahrenheit. The daily air temperature averages about 32 degrees Fahrenheit in the winter and 64 degrees Fahrenheit through the growing season, March through October. Summer temperatures of 100 degrees Fahrenheit or more are not unusual. The frost-free period typically ranges from 160 to 200 days at Palisade, Colorado. The last spring frost occurs between the first part of April and the end of April. The first fall frost occurs between the end of September and the end of October. The coldest winter temperature on record is -23 degrees Fahrenheit, which occurred on January 1, 1913, and the coldest summer temperature on record is 33 degrees Fahrenheit, which occurred on August 23, 1934. The hottest day on record is 111 degrees F, which occurred on July 5, 1937. Wide yearly and seasonal fluctuations are common for this climatic zone. Data were taken from the Western Regional Climate Center (2018) for Palisade, Colorado Climate Station.

Table 3. Representative climatic features

Frost-free period (average)	113 days
Freeze-free period (average)	147 days
Precipitation total (average)	11 in

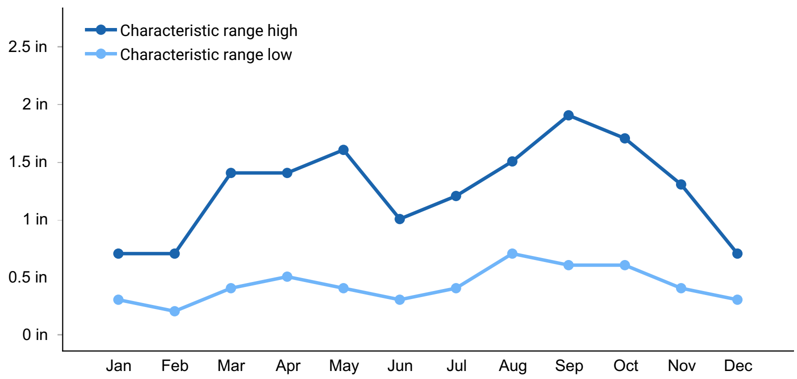


Figure 1. Monthly precipitation range

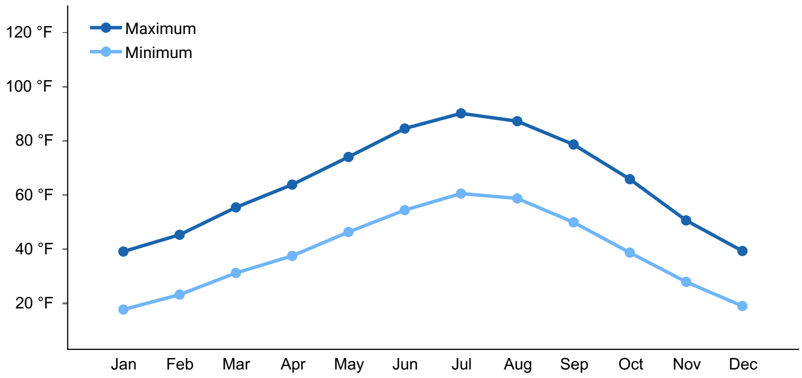


Figure 2. Monthly average minimum and maximum temperature

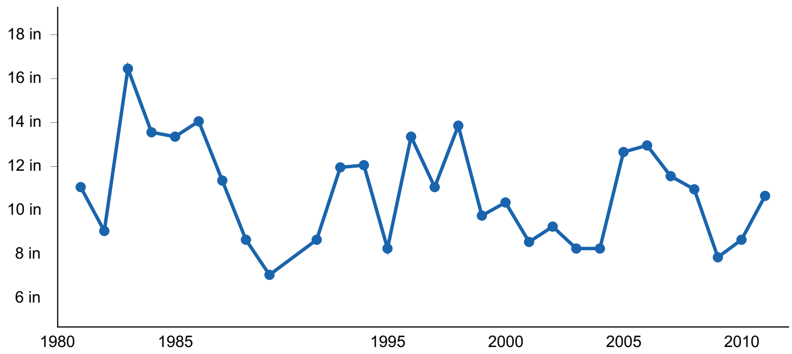


Figure 3. Annual precipitation pattern

Climate stations used

- (1) MONTROSE #2 [USC00055722], Montrose, CO
- (2) PALISADE [USC00056266], De Beque, CO

Influencing water features

None

Wetland description

None

Soil features

Soils are typically deep (60 or more inches) but moderately deep soils are included in some areas. Shadscale prefers well drained, moderately saline soils (Simonin, 2001). The surface layer textures commonly are loam, sandy loam, or sandy clay loam with 16 to 25 percent clay. The surface layer has weak platy structure parting to fine or medium granular structure. The soils typically have a calcic horizon. The subsurface layer is loam or clay loam with 22 to 32 percent clay. The presence of gypsum in the subsurface layer is common and causes a lower pH. Parent materials are alluvium derived from basalt outwash over residuum of Mancos Shale and colluvium derived from basalt alluvium over weathered residuum from Mancos Shale. Basalt rocks cover the surface of this site. Shadscale is considered an indicator of salinity in the subsoil because it prefers saline soils where salt concentrations are greatest deeper in the soil profile (36 to 60 inches) and relatively lower in the surface layers (0 to 18 inches). In a greenhouse setting, moderate levels of salt (50 ml/l) were favorable for growth and higher levels were damaging (Simonin, 2001). The levels of salinity in the soils can accentuate the effects of the low rainfall that occurs in this area (Wein and West, 1971).

Utaline and Uffens soils are examples of the modal concept of this site.

This site’s modal concept is deep loamy and loamy-skeletal soils. Soils data are based on field work (2014-2015) and the soil surveys of Mesa County (CO680) and the Paonia Area (CO679).

Figure 5. Soil pit in Semidesert Stony Loam (Shadscale) site

Table 4. Representative soil features

Parent material	(1) Colluvium–basalt (2) Outwash–basalt (3) Residuum–clayey shale
Surface texture	(1) Stony loam (2) Cobbly sandy clay loam (3) Very cobbly sandy loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate
Soil depth	60 in
Surface fragment cover <=3"	5–25%
Surface fragment cover >3"	10–30%
Available water capacity (0-40in)	2.8–5 in
Calcium carbonate equivalent (0-40in)	0–30%
Electrical conductivity (0-40in)	0–4 mmhos/cm
Sodium adsorption ratio (0-40in)	0–10
Soil reaction (1:1 water) (0-40in)	7.9–9
Subsurface fragment volume <=3" (Depth not specified)	10–25%
Subsurface fragment volume >3" (Depth not specified)	20–40%

Ecological dynamics

MLRA 34B occurs in the lower elevation valleys of the northeastern part of the Colorado Plateau. The Colorado Plateau is a physiographic province located throughout eastern Utah, western Colorado, western New Mexico, and northern Arizona. It is characterized by uplifted plateaus, canyons, and eroded features. It lies south of the Uintah Mountains, north of the Mogollon transition area, west of the Rocky Mountains, and east of the central Utah highlands. The higher elevation portion of the Colorado Plateau, which is represented by MLRA 34B, is characterized by broken topography, large flat valleys, and a lack of perennial water sources. This area has a long history of human use (thousands of years). Archaeological evidence in nearby pinyon-juniper woodlands indicates areas modified by prehistoric humans and areas left pristine until European settlement (Cartledge and Propper, 1993). This area was also subjected to natural influences of herbivory, fire, and climate. Due to the broken topography, it rarely was used as habitat for large herds of native herbivores and rarely had large, frequent fires. This site is extremely variable; plant community composition varies with water fluctuations.

The precipitation pattern on this part of the Colorado Plateau is winter-summer bimodal. This means that this site developed under climatic conditions of wet, cold winters and hot, dry summers with summer monsoonal rains. This area has climatic fluctuations, and prolonged droughts are common; as it is located on the most northern end of the monsoonal rain belt. Between a year with above-average precipitation and a drought year, forbs are the most dynamic (Passey et al., 1982) and can vary up to fourfold. The precipitation and climate of MLRA 34B are conducive to producing pinyon/juniper and sagebrush complexes with high productive sites in the bottoms of the canyons. Predominant species on the Colorado Plateau are Wyoming big sagebrush (*Artemisia tridentata* var. wyomingensis), mountain big sagebrush (*Artemisia tridentata* var. vaseyana), black sagebrush (*Artemisia nova*), basin big sagebrush (*Artemisia tridentata* var. tridentata), Utah juniper (Juniperus utahensis), and pinyon (*Pinus edulis*).

This plant community evolved where drought is common and can be quite severe. The growing season usually starts in early to late March on this site. A study of shadscale's ecology in western Colorado showed that shadscale begins vegetative growth in early to mid-March and blooms in late March to mid-April. Late bloom occurs from mid-April to early May. Fruiting generally occurs in early May to mid-June with seed ripening in mid-June to early July (Simonin, 2001). Shadscale establishment is from seed. Salt-desert communities have historically served as winter grazing areas for cattle and sheep. According to oral communications with early settlers, livestock was first brought into the Grand Valley between 1880 and 1890. At that time the area had thousands of cattle imported into it (Lusby, 1979). In addition, starting around 1915, large bands of sheep were moved across the valley on the way from winter range in Utah and the Grand Valley to summer range in the Colorado Mountains (Lusby, 1979). Heavy unrestricted grazing occurred during European settlement until 1934, when the Taylor Grazing Act was passed.

The most common disturbances on this site are high amounts of off-highway vehicle use, improper livestock grazing, drought, and erosion. The weather plays a large role in the disturbance regime in the salt desert. During droughty periods, perennial grasses decrease; during periods of normal and above-average precipitation, perennial grasses increase. Plant production on this site fluctuates with the amount of precipitation. The timing of the precipitation influences which annuals will be present on the site and their production. The common annual invaders on this site include cheatgrass, Halogeton, stork's bill, and annual mustards. As site conditions deteriorate from disturbance, native perennial vegetation decreases and annual invasive species can establish. Seedings for salt-desert shrub communities in the western U.S. have not been very effective (Wien and West, 1971). Seedling emergence and early establishment depend on the precipitation. Droughts, which are common in these areas, can cause seeding to fail. As a result, complete removal of annual invasives, once established, may not be possible; suppression is more likely.

Fire occurrence in this system is dependent on the fuel load and plant moisture content. Shadscale-dominant salt-desert shrub communities with native range grasses produced relatively low amounts of fine fuels. This lack of continuous fuels to carry fires made fire rare to nonexistent in shadscale communities (Simonin, 2001). Thus, Semidesert Stony Loam (Shadscale) likely evolved with very low fire frequency. Shadscale is fire intolerant and does not readily recover from fire. The slow post-fire recovery of shadscale allows for easy invasion and subsequent replacement by cheatgrass in western rangelands (Simonin, 2001). Introduction of annual invasive grasses has greatly altered fire regimes where shadscale is a major vegetative component. These annuals increase fire frequency under wet to near-normal summer moisture conditions (Simonin, 2001). Heavy winter and spring rains can generate fuels by producing abundant stands of annual forbs and grasses. Fine fuels generated by annual grasses are long lived because grass biomass decomposes slowly under the continually low atmospheric moisture conditions inherent to the arid regions. In general, wet years followed by dry years increase the probability of fire, with large fires most likely in July or August. Fuel loads for shadscale/black greasewood have been measured at 250 to 750 pounds per acre (Simonin, 2001).

Variability in climate, soils, aspect, and complex biological processes cause the plant communities to differ. Factors contributing to annual production variability include wildlife use, drought, and insects. Factors contributing to species variability include soil texture, soil depth, rock fragments, slope, aspect, and micro-topography. The species lists are representative and do not include all occurring or potentially occurring species on this site. The lists are not intended to cover the full range of conditions, species, and responses of the site. The state-and-transition model depicted for this site is based on available research, field observations, and interpretations by experts and could change as knowledge increases. As more data is collected, some of these plant communities may be revised or removed and new ones may be added. The following diagram does not necessarily depict all the transitions and states that this site may exhibit, but it does show some of the most common plant communities.

State and transition model

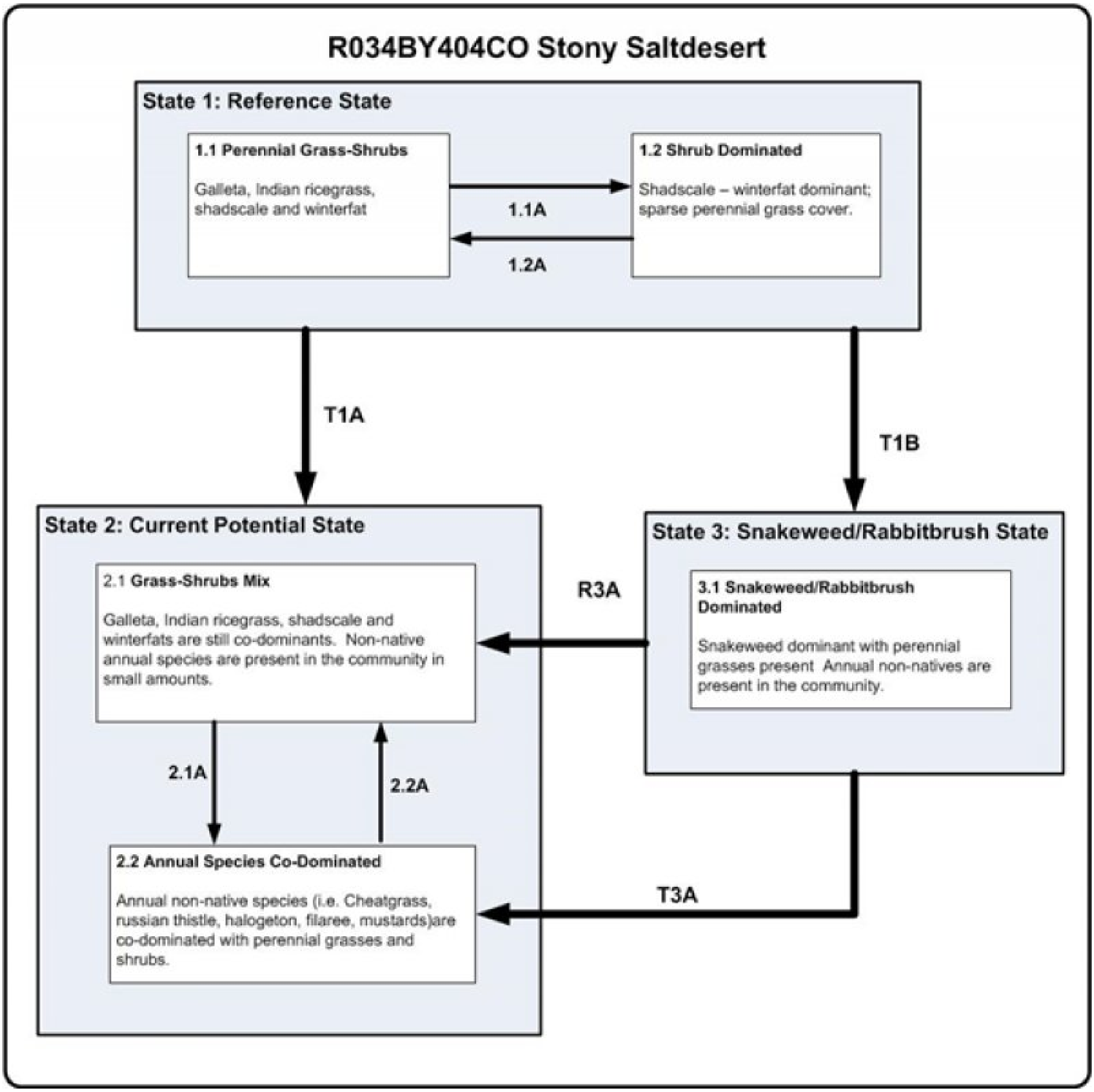


Figure 6. State-and-transition model for the Semidesert Stony Loam (Shadscale) ecological site

Legend

1.1A, 2.1A – improper grazing of grasses, drought during the summer, lack of small scale fires
1.2A, 2.2A – time without disturbance, Insect and pathogen outbreaks, drought during the winter, small scale fires, proper grazing of perennial grasses, wetter climate periods during the summer
T1A – Establishment of non-native invasive plants
T1B – Surface disturbances, improper grazing, drought and/or fire
T3A – Brush treatment of rabbitbrush/snakeweed; improper grazing of perennial grasses, fire in short intervals
R3A – wetter climate cycles, proper grazing of perennial grasses, treatment of non-natives, treatment of rabbitbrush/snakeweed.

Figure 7. Legend for state-and-transition model

State 1
Reference State

This state represents the natural ecological dynamics of the Semidesert Stony Loam (Shadscale) site. There are two dominant plant community phases in the Reference State. Drought, native herbivory, and fire are natural disturbances that change the pathways between community phases. Simonin (2001) states that the successional timeline of a shadscale community is generally slow in areas that have been grazed as well as those that have not been grazed. The state is dominated by warm-season perennial grasses (galleta) and shadscale. This plant community evolved in areas where drought is common and can be quite severe. Winterfat is a subdominant species on this site. It can become dominant if fire just scorches it tops and shadscale must regrow from seed (West, 1992). Which annual forbs occur and their production depend greatly on the season's moisture and timing. The surface gravel, cobbles, and stones weathered from basalt help to armor the soil against erosion.

Community 1.1
Perennial Grasses - Shrub

Figure 8. Community Phase 1.1 in early summer during a wet year

Figure 9. Close up of site in Community Phase 1.1

Figure 10. Community Phase 1.1 during a wet year

Figure 11. Close up of site in Community Phase 1.1

Figure 12. Community Phase 1.1 in early spring

With only about 30 percent of the annual production of native vegetation from shrubs, this site has a grassland-shrub aspect. Galleta is the dominant grass. Another dominant native grass is Indian ricegrass. Shadscale and winterfat are the dominant shrubs. Globemallow and cleftleaf wild heliotrope are the dominant forbs. Trees do not grow naturally on this site. Bare ground makes up approximately 40 to 50 percent of the surface on average. Biological crusts, when present, cover approximately 5 percent of the surface and are characterized by light cyanobacteria in the interspaces with moss in some places. Surface rock fragments (30 to 40 percent) can be very prevalent and are characterized by gravel, cobbles, and stones weathered from basalt.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	225	325	425
Shrub/Vine	110	175	250
Forb	65	100	125
Total	**400**	**600**	**800**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	10-25%
Grass/grasslike foliar cover	15-30%
Forb foliar cover	1-5%
Non-vascular plants	0%
Biological crusts	1-10%
Litter	25-35%
Surface fragments >0.25" and <=3"	20-35%
Surface fragments >3"	5-15%
Bedrock	0%
Water	0%
Bare ground	40-60%

Table 7. Canopy structure (% cover)

Height Above Ground (Ft)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.5	–	5-15%	10-30%	1-5%
>0.5 <= 1	–	15-25%	5-25%	0-3%
>1 <= 2	–	0-2%	1-15%	0-2%
>2 <= 4.5	–	–	–	–
>4.5 <= 13	–	–	–	–
>13 <= 40	–	–	–	–
>40 <= 80	–	–	–	–
>80 <= 120	–	–	–	–
>120	–	–	–	–

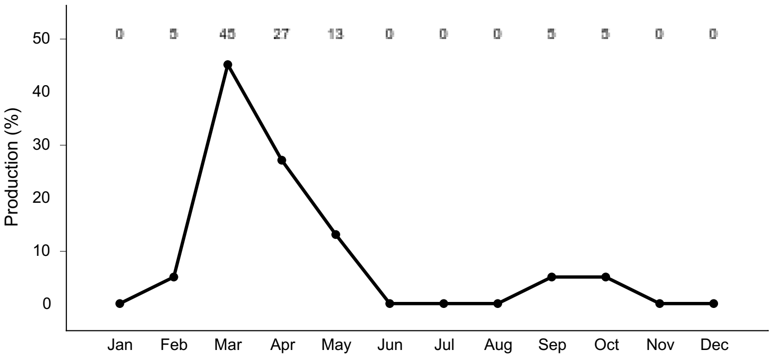


Figure 14. Plant community growth curve (percent production by month). CO0101, MLRA 34B-Salt Desert Sites. MLRA 34B.

Community 1.2
Shrub Dominated

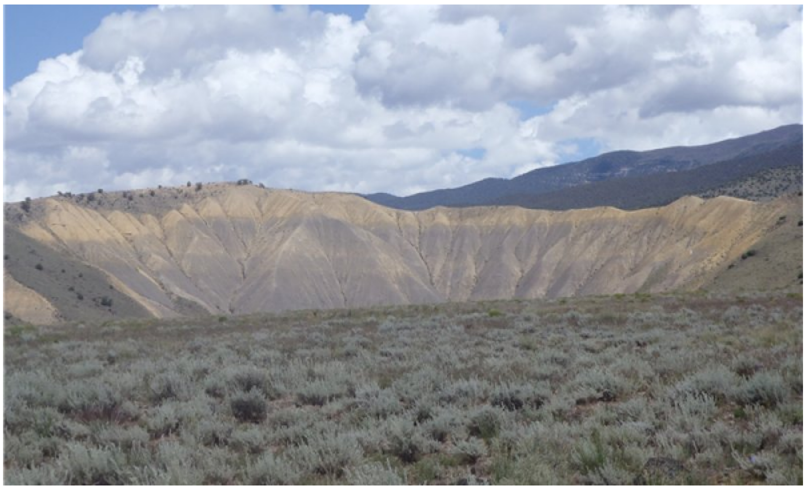


Figure 15. Shrub Dominated Phase

Figure 16. Shrub Dominated Phase in foreground

This community is characterized by shadscale and winterfat with little to no perennial forbs or grasses. The sparsely occurring perennial grasses are dominated by galleta. Forb production varies from year to year and fluctuates with climatic conditions. Bare ground makes up approximately 50 to 60 percent of the surface on average. Biological crusts (when present) cover approximately 5 to 10 percent of the surface and are characterized by light cyanobacteria in the interspaces with moss in some places. Surface rock fragments (30 to 40 percent) can be very prevalent and are characterized by gravel, cobbles, and stones weathered from basalt.

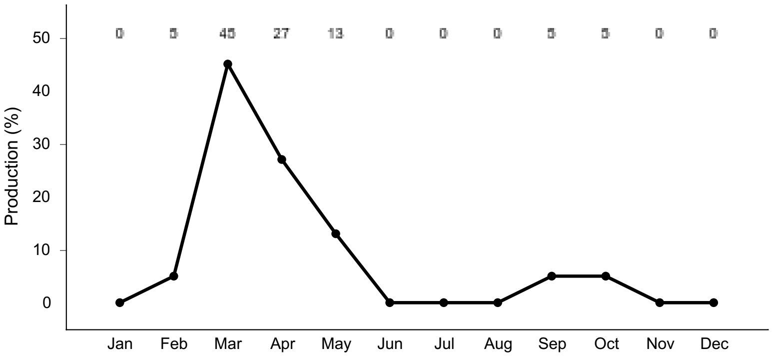
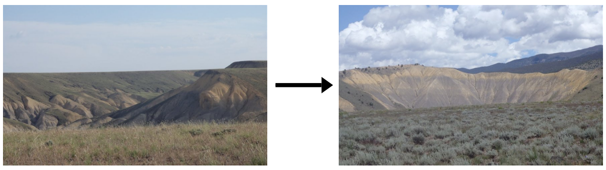


Figure 17. Plant community growth curve (percent production by month). CO0101, MLRA 34B-Salt Desert Sites. MLRA 34B.

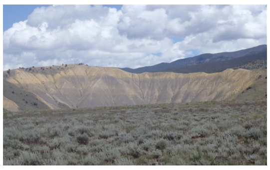
Pathway 1.1A
Community 1.1 to 1.2



Perennial Grasses - Shrub **Shrub Dominated**

This phase is characterized by loss of perennial grasses and forbs. One or more of the following drivers may cause this pathway: improper grazing of the perennial grasses, lack of small-scale fires, periods without disturbance, and prolonged drought especially during the spring and summer. The drivers in this pathway reduce the vigor of native perennial plants.

Pathway 1.2A
Community 1.2 to 1.1



Shrub Dominated **Perennial Grasses - Shrub**

This pathway’s drivers consist of one or more of the following: proper grazing of perennial grasses, prolonged winter and fall drought (which decreases the amount of shrubs), wetter periods during the summer when grasses are actively growing, or small-scale fires.

State 2
Current Potential State

This state functions very similar to State 1. The main difference is how the plant community reacts once non-native annual invasive species are established in the understory. The most common annuals are cheatgrass and Halogeton. The primary disturbance mechanism is weather fluctuation. However, livestock grazing may influence the ecological dynamics of the site. The current potential state has less ability to resist change and less resilience following disturbances.

Community 2.1
Grass – Shrub Mix

Figure 18. Annual invasives mixed with native plants in Community Phase 2.1

Figure 19. Landscape with cheatgrass in Community Phase 2.1

Figure 20. Close up of annuals and native plants in Community Phase 2.1

Figure 21. Close up of site in Community Phase 2.1

This site is typically dominated by shadscale and galleta but annual invasive species are now present. Dominant annuals are cheatgrass and Halogeton. Other perennial or invasive grasses, shrubs, and forbs may also be present, and cover is variable. This community is at risk if it receives enough moisture for the annual weeds to flourish. The risk of fire is now greater and can occur when there is sufficient fine fuels to carry it. Fire converts this site into one dominated by cheatgrass and non-native annual forbs.

Community 2.2
Annual Species Co-Dominated

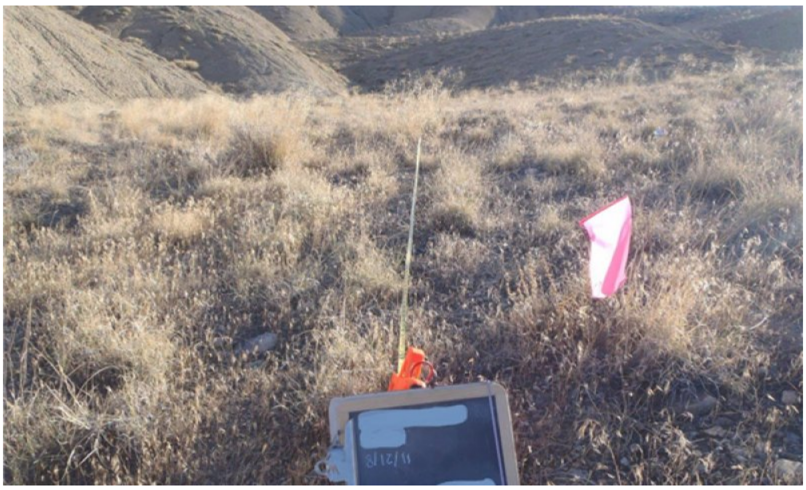


Figure 22. Transect view of Community Phase 2.2

Figure 23. Close up of site in Community Phase 2.2

This state is dominated by invasive species, of which cheatgrass and Halogeton are the most common. Other common annual weeds include Russian thistle, annual mustards, stork’s bill, and annual kochia (summer cypress). Native annual chenopods may increase significantly from trace amounts as the ecological condition deteriorates. Grasses decline drastically under continued deterioration and may nearly disappear. Shadscale or winterfat may or may not be present. The primary disturbance mechanisms are fire, improper livestock grazing, and drought. One or more invasive species have increased to the point where they influence or drive the disturbance regime and nutrient cycle. Research has shown that plant species differ substantially in their effects on soil water content and temperature and on the frequency and intensity of disturbance. After invasive plants have established, a site’s fundamental nutrient cycling processes, root pores, mycorrhizal associations, microbial species, and soil organic material change (Belnap and Phillips, 2001). These alterations can eventually create ecologically impoverished sites that are very difficult to restore to functionally diverse perennial herbaceous and woody communities. The competitiveness of the annual forbs and grasses, and the ability of these species to quickly establish after a disturbance, make this state extremely resistant to change and resilient after a disturbance. Periods without disturbance may enable some native vegetation to re-establish. Natural fluctuations in weather and fire (if fine fuel accumulation is adequate) allow for the continued dominance of invasive plant species.

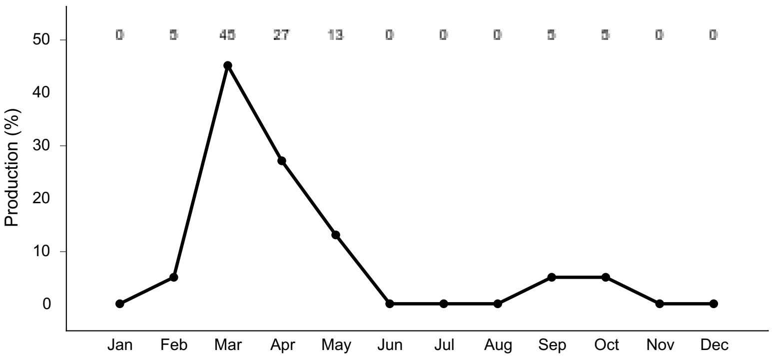


Figure 24. Plant community growth curve (percent production by month). CO0101, MLRA 34B-Salt Desert Sites. MLRA 34B.

Pathway 2.1A
Community 2.1 to 2.2

Grass – Shrub Mix

Annual Species Co-Dominated

This phase is characterized by loss of perennial grasses and forbs. One or more of the following drivers may cause this pathway: improper livestock grazing, heavy browsing by wildlife, prolonged drought, surface disturbances, and fire. The disturbances reduce the site’s vigor. Fire can be more of a driver in this pathway than others on this site.

Pathway 2.2A
Community 2.2 to 2.1

Annual Species Co-Dominated

Grass – Shrub Mix

Periods without disturbance combined with normal and above-normal precipitation and proper livestock grazing may enable some native vegetation to re-establish. Once invasive species are present in the plant community, suppressing the annuals will be difficult and could require intensive management. This return pathway requires a long-term commitment.

State 3
Snakeweed/Rabbitbrush State

This state is caused by surface disturbance, such as by mining and development of roads and utility and pipeline corridors. It is dominated by broom snakeweed and yellow rabbitbrush, with reduced occurrence of shadscale and winterfat from the Reference State (1). The dominant grass is still galleta. Dominant forbs are globemallow and cleftleaf wild heliotrope. Periods without disturbance may enable limited native vegetation to re-establish. Drought, improper livestock grazing, or continued surface disturbances favor the continued dominance of broom snakeweed and yellow rabbitbrush. Because of the competitiveness of broom snakeweed and its ability to quickly establish after a disturbance, this state is extremely resistant to change.

Community 3.1
Snakeweed/Rabbitbrush Dominated

Figure 25. Site dominated by snakeweed in State 3

Figure 26. Site dominated by snakeweed in State 3

This plant community phase is characterized by a dominance of broom snakeweed and yellow rabbitbrush, where native grasses, shrubs, and forbs may also be present. Bare ground makes up approximately 40 to 60 percent of the surface on average. Biological crusts (when present) cover approximately 5 to 10 percent of the surface and are characterized by light cyanobacteria in the interspaces with moss in some places. Surface rock fragments (30 to 50 percent) can be very prevalent and are characterized by gravel, cobbles, and stones weathered from basalt.

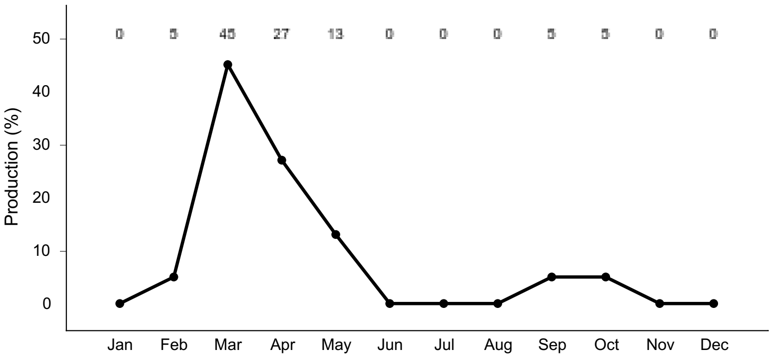


Figure 27. Plant community growth curve (percent production by month). CO0101, MLRA 34B-Salt Desert Sites. MLRA 34B.

Transition T1A
State 1 to 2

This transition occurs when the non-native invasive species become established on the site. Pathways to drive this transition can include one or more of the following: brush treatments, improper livestock grazing, wildlife browsing, prolonged drought, fire, if enough fine fuels, and surface disturbances such as off-road vehicle use, and road and pipeline development.

Transition T1B
State 1 to 3

This transition occurs when broom snakeweed and rabbitbrush increase in dominance. Pathway drivers typically include mechanical disturbances such as mining, pipeline development or other large surface disturbance, and improper grazing. Natural pathways are drought and fire.

Transition T3A
State 2 to 3

Pathway drivers include one or more of the following: brush treatments, improper grazing of perennial grasses, fire in shorter intervals, and continued surface disturbances. The main driver on this pathway is surface disturbance. This would transition to plant community 2.2.

Restoration pathway R3A
State 3 to 2

Adequate and above-normal precipitation at the right time, combined with proper grazing of perennial grasses, enables native vegetation to re-establish. Treatment of non-natives and rabbitbrush/snakeweed may be required. This would transition it to Plant Community 2.1.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Native Warm Season Perennial Rhizomatous Grasses**			225–325	
	James' galleta	PLJA	*Pleuraphis jamesii*	200–375	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–25	–
2	**Native Cool Season Bunchgrasses**			20–100	
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	15–75	–
	squirreltail	ELEL5	*Elymus elymoides*	10–75	–
	needle and thread	HECO26	*Hesperostipa comata*	0–25	–
	Sandberg bluegrass	POSE	*Poa secunda*	0–25	–
Forb					
3	**Perennial Native Forbs**			25–100	
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	25–50	–
	buckwheat	ERIOG	*Eriogonum*	5–35	–
	western blanketflower	GASP	*Gaillardia spathulata*	0–25	–
	povertyweed	IVAX	*Iva axillaris*	0–25	–
	desertparsley	LOMAT	*Lomatium*	0–25	–
	woodyaster	XYLOR	*Xylorhiza*	0–25	–
	aster	ASTER	*Aster*	0–25	–
	milkvetch	ASTRA	*Astragalus*	0–25	–
	evening primrose	OENOT	*Oenothera*	0–25	–
4	**Annual Native Forbs**			5–35	
	cleftleaf wildheliotrope	PHCR	*Phacelia crenulata*	10–35	–
	mustard	BRASS2	*Brassica*	0–25	–
	tansymustard	DESCU	*Descurainia*	0–25	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–15	–
Shrub/Vine					
5	**Native Shrubs**			125–250	
	shadscale saltbush	ATCO	*Atriplex confertifolia*	50–150	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	50–150	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	5–35	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	5–25	–
	shortspine horsebrush	TESP2	*Tetradymia spinosa*	5–25	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–25	–
	kingcup cactus	ECTR	*Echinocereus triglochidiatus*	0–15	–

Animal community

Grazing Interpretations:

The site has a low value rating for cattle and horses and a medium value rating for sheep (USDA-SCS, 1975).

Wildlife Interpretations (by Ed Neilson, retired Area 1 Wildlife Biologist)

Pronghorns are the primary large wild ungulate that use the site but are not abundant. Mule deer may occasionally inhabit the site, especially during severe winters. Coyote and badger are the most common mammalian predators.

Other common wildlife mammals include desert cottontail, white-tailed jackrabbit, white-tailed prairie dog (in locations where soils are not very cobbly), and deer mouse.

Prairie dogs are a keystone species in the less cobbly areas of this site. They alter the environment in intensely grazing areas near their burrows, often changing the vegetation to State 2 conditions. Their burrows provide habitat for cottontails, jackrabbits, snakes, and burrowing owls, and they are food for coyotes, badgers, falcons, hawks, and eagles.

Avian species commonly associated with the site are western meadowlark, loggerhead shrike, horned lark, and mourning dove. Brewer's sparrow and sage sparrow may also occasionally be found when the site has sagebrush. Some avian predators that may use the site are prairie falcon, red-tailed hawk, and golden eagle.

Amphibians and reptiles that may be found, depending on the state, include Great Basin spadefoot, short-horned lizard, longnose leopard lizard, sagebrush lizard, eastern fence lizard, western whiptail, plateau striped whiptail, striped whipsnake, bull snake, and western rattlesnake.

Hydrological functions

Soils were originally assigned to hydrologic soil groups based on measured rainfall, runoff, and infiltrometer data (Musgrave, 1955). Since the initial work was done to establish these groupings, assignment of soils to hydrologic soil groups has been based on the judgment of soil scientists. Assignments are made based on comparison of the characteristics of unclassified soil profiles with profiles of soils already placed into hydrologic soil groups. Most of the groupings are based on the premise that soils within a climatic region that are similar in depth to a restrictive layer or water table, transmission rate of water, texture, structure, and degree of swelling when saturated will have similar runoff responses. Four (4) hydrologic soil groups are recognized (A-D). For specific definitions of each hydrologic soil group, see the National Engineering Handbook, Chapter 7, Part 630 Hydrology, or visit: http://policy.nrcs.usda.gov/OpenNonWebContent.aspx?content=22526.wba.

The hydrologic soil groups are based on the following factors:
- intake and transmission of water under the conditions of maximum yearly wetness (thoroughly wet)
- soil not frozen
- bare soil surface
- maximum swelling of expansive clays

The slope of the soil surface is not considered when assigning hydrologic soil groups. In its simplest form, a hydrologic soil group is determined by the water transmitting soil layer with the lowest saturated hydraulic conductivity and depth to any layer that is more or less water impermeable (such as a fragipan or duripan) or depth to a water table (if present) (Caudle et al., 2013). The runoff curve numbers are determined by field investigations using hydrologic cover conditions and hydrologic soil groups.

Soil Series Hydrologic Group
Meeteetse C
Uffens C
Utaline B

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture.

These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission (Soil Survey Staff: Web Soil Survey, August 2015).

Recreational uses

The site may provide aesthetic appeal for recreation and natural beauty. Recreation would include hunting, hiking, and use of off-highway vehicles.

Wood products

The site is not suited for production of wood products.

Other information

The site occurs in the Delta, Grand Junction, and Montrose Field offices.

INTERPRETATIONS FOR POISONOUS PLANTS: Halogeton is poisonous during its rapid growth period in spring (April to June). Sheep are affected.

Effects and symptoms: Poisoning is “acute.” Signs of poisoning occur within 2 to 6 hours after an animal eats a fatal amount, and death occurs in 9 to 11 hours. Early signs are dullness, loss of appetite, lowering of the head, and reluctance to follow the band. Advanced signs are drooling with white or reddish froth about the mouth, progressive weakening, inability to stand, rapid and shallow breathing, and coma followed by violent struggle for air.

Sheep can tolerate small amounts when eaten with other forage. About .75 pound will kill sheep that have been without feed for a day. It takes 1.1 pounds to kill sheep that have been feeding on other forage.

“Acute” – Symptoms appear within a few hours after poisonous plant has been eaten (USDA-SCS, 1975).
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Inventory data references

--Site Development and Testing Plan--

Future work to validate and further refine the information in this Provisional Ecological Site Description is necessary. This will include field activities to collect low-, medium-, and high-intensity sampling, soil correlations, and analysis of that data.

Additional information and data is required to refine the Plant Production and Annual Production tables for this ecological site. The extent of MLRA 34B must be further investigated.

Field testing of the information contained in this Provisional ESD is required. As this ESD is moved to the Approved ESD level, reviews from the technical team, quality control, quality assurance, and peers will be conducted.

Type locality

Location 1: Delta County, CO	
Township/Range/Section	T4S R3E S13

General legal description	Near Delta-Mesa County line north of US Highway 50; SE1/4, NW1/4, Sec 13, T4S, R3E.

Other references

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.

Caudle, D., H. Sanchez, J. DiBenedetto, C. Talbot, and M. Karl. 2013. Draft Interagency Ecological Site Handbook for Rangelands. US Dept. of Agriculture. Washington D.C

Cartledge, T. R., and J. G. Propper. 1993. Pinon-Juniper Ecosystems through Time: Information and Insights from the Past. In Gen. Tech. RM-236 - Managing Pinon-Juniper Ecosystems for Sustainability and Social Needs.

Cleland, D.T.; Freeouf, J.A.; Keys, J.E., Jr.; Nowacki, G.J.; Carpenter, C; McNab, W.H. 2007. Ecological Subregions: Sections and Subsections of the Conterminous United States.[1:3,500,000], Sloan, A.M., cartog. Gen. Tech. Report WO-76. Washington, DC: U.S. Department of Agriculture, Forest Service.

Griffith, G.E.; Omernik, J.M.; McGraw, M.M.; Jacobi, G.Z.; Canavan, C.M.; Schrader, T.S.; Mercer, D.; Hill, R.; and Moran, B.C., 2006. Ecoregions of New Mexico (color poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,400,000).

Lusby, G. C. 1979. Effects of Grazing on Runoff and Sediment Yield from Desert Rangeland at Badger Wash in Western Colorado, 1953- 73. Geological Survey Paper 1532-1. P 1-41. US Government Printing Office Washington D.C.

Musgrave, G.W. 1955. How much of the rain enters the soil? In Water: U.S. Department of Agriculture Yearbook. Washington, D.C. P. 151-159.

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.

Passey, H. B., W. K. Hugie, E. W. Williams, and D. E. Ball. 1982. Relationships between soil, plant community, and climate on rangelands of the Intermountain west. USDA, Soil Conservation Service, Tech. Bull. No. 1669.

Simonin, Kevin A. 2001. Atriplex confertifolia. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ Accessed [8/10/2015].

Soil Conservation Service (SCS). August 1975. Range Site Description for Stony Saltdesert #404: USDA, Denver Colorado

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.nrcs.usda.gov/. Accessed [8/10/2015].

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296.

Wein, R.W and N. E. West. 1971. Seedling Survival on Erosion Control Treatments in a Salt Desert Area. Journal of Range Mangement, 24, 352 – 357.

West, N. E, 1992. Effects of Fire on Salt-Desert Shrub Rangelands. p. 71-74. In Monsen. Stephen B.; Kitchen, Stanley G., comps. 1994. Proceedings-ecology and management of annual rangelands; 1992 May 18-21; Boise, ID. Gen. Tech. Rep INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 416 p.

Western Regional Climate Center. Retrieved from http://www.wrcc.dri.edu/summary/Climsmco.html on May 17, 2018.

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Approval

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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.

Author(s)/participant(s)	John Murray – Original written on 05/01/2005 Updated by Suzanne Mayne-Kinney on 8/11/2015
Contact for lead author	
Date	08/11/2015
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None to slight. A slight increase in rill development may occur on steeper slopes or on areas located below exposed bedrock, or other water shedding areas, where increased runoff may occur. If present, shallow and short and usually after a rainfall event and should heal after the next growing season.

2. **Presence of water flow patterns:** None to slight. If present, short and usually disconnected with debris dams and vegetative barriers obvious after rainfall events.

3. **Number and height of erosional pedestals or terracettes:** Slight pedestalling infrequent, occurring in or near flow paths usually around shrubs. Minor evidence of pedestals after intense rainfall events.

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Expect 40-60% bare ground. Extended drought can cause bare ground to increase. Basalt cobbles and stones are obvious on the surface and are inherent to the site and not considered bare ground.

5. **Number of gullies and erosion associated with gullies:** Rare, depending on landscape position. Edges should be muted or rounded with vegetated side slopes. Usually caused by off-site influence.

6. **Extent of wind scoured, blowouts and/or depositional areas:** None to Slight on exposed areas. The gravels and rocl fragments on the soil surface help armor it and reduce the potential for wind erosion.

7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement associated with flow paths and disturbed areas. Movement is typically short (1-2 feet), but can be moderate under intense rainfall events.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have a stability rating of 4 to 6 under the plant canopies, and a rating of 2 to 4 in the interspaces. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion. Soil surface is stabilized by decomposing organic matter. Biological crusts (lichens, algae, cyanobacteria, mosses) may be present on or just below soil surface.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soils are very deep and well drained. Surface texture ranges from sandy loam to very cobbly loam. The A-horizon ranges from 4-9 inches in depth with moderate granular to weak platy structure. Rock fragments are obvious.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Grass, forb and shrub canopy reduce raindrop impact. Basal cover of cool season bunchgrasses and rhizomatous characteristic of galleta aid in slowing overland flow allowing time for infiltration. Grass and shrub canopy, basal cover, and inherent interspaces between plants allow for some overland flow, providing a lost opportunity for infiltration to occur, especially during or after high intensity rainfall events. Soil texture promotes infiltration.

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

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: Native Warm Season Perennial Rhizomatous Grasses >= Native Shrubs >>

    Sub-dominant: Perennial Native Forbs >= Native Cool Season Bunchgrasses >>>

    Other: Annual Native Forbs

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Typically minimal. Expect slight shrub and grass mortality/decadence during and following drought or lack of disturbance.

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14. **Average percent litter cover (%) and depth (in):** 25-35% litter cover at 0.25 inch depth. Litter cover declines during and following extended drought.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 400bs./ac. low precipitation years; 600 lbs./ac. average precipitation years; 800 lbs./ac. above average precipitation years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 100 – 250 lbs./ac. or more.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Cheatgrass, halogeton, annual mustards, storksbill, Russian thistle, annual wheatgrass, and other noxious weeds.

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17. **Perennial plant reproductive capability:** Variable due to unreliable moisture availability. The only limitations are weather related,
    wildfire, natural disease, inter-species competition, wildlife, and insects that may temporarily reduce reproductive capability. This site is temperature driven with most of the growing accruing during the cool winter months.
