USDA Natural Resources
Conservation Service

Ecological site R036XY328CO
Semidesert Clay Loam

Accessed: 05/18/2024

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.

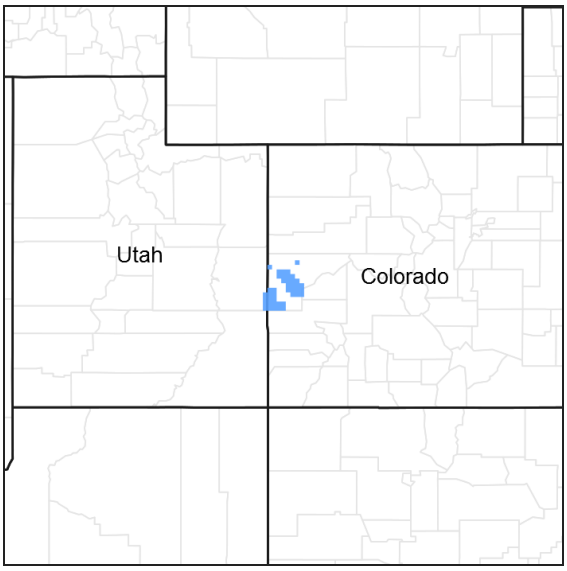

Figure 1. Mapped extent

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): 036X–Southwestern Plateaus, Mesas, and Foothills

Semidesert Clay Loam ecological site is found on benches and valley bottoms in MLRA 36 (Southwestern Plateaus Mesas and Foothills). The MLRA 36 is illustrated orange color on the map. The ecological site locations as assigned in soil survey map units are shown in pink color.

The site concept was established within the MLRA 36 Semidesert regions. This zone is 8 to 12 inches of precipitation and has a mesic temperature regime. This site has bimodal precipitation that is dominated by Wyoming big sagebrush.

Classification relationships

NRCS & BLM:
Major Land Resource Area 36, Southwestern Plateaus Mesas and Foothills (United States Department of Agriculture, Natural Resources Conservation Service, 2006).

USFS:
341Ba-Mancos Shale Lowlands-Grand Valley, 341Bo-North Uncompahgre Plateau, 341Bg-Northeast Flank, and 341Bd-Salt Anticline Benchlands Subsections <341B Northern Canyonlands Section < 341 Intermountain Semi-desert and Desert (Cleland, et al., 2007).

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

USGS:
Colorado Plateau Province (Canyonlands section)

Ecological site concept

The 36X Semidesert Clay Loam was drafted from the existing Semidesert Clay Loam Range Site 34X, 35, 48A, (SCS, December, 1988). This site was written prior to MLRA 36 being mapped in Colorado and this area was in MLRA 34X when it was written. This site occurs on alluvial fans, terraces and fan terraces on moderately deep to deep clayey textured soils derived from alluvium and colluvium from calcareous shale, clayey shale, and shale and sandstone. It is a Wyoming big sagebrush community. It has an ustic aridic moisture regime and mesic temperature regime. The effective precipitation ranges from 8 to 12 inches.

Associated sites

R036XY110CO	**Shallow Clay Loam (pinyon-Utah juniper)** Shallow Clay Loam Pinyon-Juniper is a gentle sloped (<25-30% slope) site with shallow soils that are clayey in texture. This site is dominated by Utah Juniper and scattered pinyon. This site may have Wyoming big sagebrush in the understory.
R036XY325CO	**Semidesert Loam** Semidesert Loam are loamy texture soils. Particle control section is fine-loamy. Clay content is higher in these soils than those found in Semidesert Sandy Loam. Both are a Wyoming big sagebrush dominated site. Indian Ricegrass and galleta are the dominant grass on this site. The soils on this site are moderately deep to very deep
R036XY405CO	**Loamy Bottom** Loamy bottom occurs on drainage-ways, floodplains and alluvial fans. This site is in a run-in position on the landscape. Soils are deep. Soil textures are generally loams. Dominant vegetation is basin wildrye, muttongrass, basin big sagebrush, and western wheatgrass. This site is a bottom site with Basin Big Sagebrush. Sometimes refer to as Foothill Swale in nearby MLRAs.

Similar sites

R036XY325CO	**Semidesert Loam** Semidesert Loam are loamy texture soils. Clay content is higher in these soils than those found in Semidesert Sandy Loam. Both are a Wyoming big sagebrush dominated site. Indian Ricegrass and galleta are the dominant grass on this site. The soils on this site are moderately deep to very deep.
R036XY326CO	**Semidesert Sandy Loam** Semidesert Sandy Loam is on coarse texture soils. Clay content is lower in these soils than those found in Semidesert Loam. Both are a Wyoming big sagebrush dominated site. Needle-and-thread is the dominant grass on this site. The soils on this site are moderately deep to very deep.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata subsp. wyomingensis*
Herbaceous	(1) *Pascopyrum smithii* (2) *Elymus elymoides*

Physiographic features

This site occurs on alluvial fans, terraces and fan terraces. Slopes range from 1 to 10 percent. The site can occur on all exposures. Elevation for the site ranges from 5200 to 6700 feet above sea level.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Terrace
Flooding frequency	None
Ponding frequency	None
Elevation	1,585–2,042 m
Slope	1–15%
Aspect	Aspect is not a significant factor

Climatic features

Average annual precipitation is about 9 to 12 inches. This area is located where there is winter precipitation and summer monsoonal rains meet. Of this, 45-50% falls as snow, and 50-55% falls as rain. Snow usually falls from November to March. Rains are falls April 1 thru October 31. The driest period is usually May to June. Plant growth begins late March and early April. Cool-season plants start a dormancy period during June. Summer thundershowers are common in July to September. The summer moisture will favor growth from the warm season plants. When late summer and fall rains occur, warm-season plants accelerate growth, and some regrowth occurs on cool-season species. Shrub species continue growth through the entire growing season. The average annual total snowfall is 17.8 inches. The highest winter snowfall record in this area is 44.8 inches which occurred in 1972-1973. The lowest snowfall record is zero inches during the 1999-2000 winter. The highest yearly precipitation recorded was 19.02 in 2015 and the lowest was 5.17 in 1989. Mean daily annual air temperature is about 50ºF to 54ºF, averaging about 33ºF for the winter and 61ºF through the growing season, March through October. Summer temperatures of 100ºF or more are not unusual. The frost-free period typically ranges from 125 to 165 days at Hovenweep NM (national monument). The last spring frost is the first part of May to the end of May. The first fall frost is the end of September to the middle of October. Mean annual temperature ranges from 55 to 49ºF. Average annual temperature is 51.9ºF. The coldest winter temperature recorded was -24ºF on December 24, 1990 and the coldest summer temperature recorded was 26ºF on June 12, 1970. The hottest day on record is 106 ºF on July 15, 1998. Wide yearly and seasonal fluctuations are common for this climatic zone. Data taken from Western Regional Climate Center (2017) for Hovenweep NM, Utah Climate Station. Hovenweep NM is on the Western edge of the MLRA. Hovenweep NM is the only station occurring in the MLRA in this zone. It is on the upper end of precipitation. There is a need for climate date in the zone.

Table 3. Representative climatic features

Frost-free period (average)	131 days
Freeze-free period (average)	146 days
Precipitation total (average)	279 mm

Climate stations used

- (1) HOVENWEEP NM [USC00424100], Monticello, UT

Influencing water features

None

Soil features

Soils of this site are fine, and deep (60"+). This site is found on alluvial fans, pediments, terraces and fan terraces. They formed in colluvium and alluvium derived from cretaceous age shale (Mancos Shale). Soil surface textures range from 28 to 35% clay. The surface horizon ranges from 2 to 7 inches in thickness. The subsoil at 20" ranging from 37 to 45% clay (silty clay loam, clay loam or silty clay).

Runoff and the hazard of water erosion is high. Permeability is slow but available water capacity is moderate. Soils

are well-drained.

Soils correlated to this site are: Burrocreek, Onioncreek in CO677 (Ridgeway Area) and Dominguez in CO680 (Mesa County).

There is a similar site called Semidesert Clay Loam in MLRA 34B where it occurs on Wasatch shale and the Dominguez soil is used (CO682 - Douglas Plateau).

Table 4. Representative soil features

Parent material	(1) Alluvium–calcareous shale (2) Colluvium–sandstone and shale
Surface texture	(1) Silty clay loam (2) Clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow to moderately slow
Soil depth	152 cm
Surface fragment cover <=3"	0%
Surface fragment cover >3"	0%
Available water capacity (0-101.6cm)	15.75–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	2–20%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–2
Soil reaction (1:1 water) (0-101.6cm)	7.9–8.6
Subsurface fragment volume <=3" (Depth not specified)	0–10%
Subsurface fragment volume >3" (Depth not specified)	0–10%

Ecological dynamics

MLRA 36 occurs on the higher elevation portion of the Colorado Plateau. The Colorado Plateau is a physiographic province which exists throughout eastern Utah, western Colorado, western New Mexico and northern Arizona. It is characterized by uplifted plateaus, canyons and eroded features. The Colorado Plateau 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 36 is characterize by broken topography, and lack of perennial water sources. This area has a long history of past prehistoric human use for thousands of years. MLRA 36 shows archaeological evidence indicating that pinyon-juniper woodlands where modified by prehistoric humans and not pristine and thus where altered at the time of European settlement (Cartledge & Propper, 1993). This area also included natural influences of herbivory, fire, and climate. This area rarely served as habitat for large herds of native herbivores or large frequent historic fires due to the broken topography. This site is extremely variable and plant community composition will vary with the water fluctuations on this site.

There is a winter-summer bimodal precipitation pattern on this part of the Colorado Plateau. Meaning that this site developed under climatic conditions that include wet, cold winters, and hot, dry summers with summer rains. This area has climatic fluctuations and prolonged droughts are common occurrences. Between an above average year

and a drought year, forbs are the most dynamic (Passey et.al. 1982) and can vary up to 4 fold. The precipitation and climate of MLRA 36 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 (*A. tridentata* var. vaseyana), and black sagebrush (*A. nova*), Basin Big Sagebrush (*A. tridentata* var. tridentata), Utah Juniper (Juniperus utahensis) and Pinyon (*Pinus edulis*).

This site is influenced by many of the natural disturbances typical of MLRA 36, particularly by fire. Wyoming big sagebrush typically is the dominant plant species; however, with the removal of big sagebrush following a burn, perennial grasses generally dominate the community. Wyoming big sagebrush will begin to re-establish itself in the community within 2-10 years following a fire, given a seed source and average precipitation (Johnson and Payne, 1968). However, it may take more than 10 years for big sagebrush to re-establish in unfavorable conditions (Howard, 1999). Invasive species, particularly cheatgrass, may reduce the resilience of this site following wildfire or management disturbances. Other plants likely to invade this site are annual sunflower, annual mustards, sticktight, and Russian thistle. Any disturbance that reduces the vigor or establishment of perennial plants will increase the likelihood of establishment of invasive annuals in the understory. (Boyle and Reeder, 2005).

Caution should be used to protect this site from establishment and increased dominance of annual invasive species, particularly cheatgrass, by maintaining or increasing the vigor and establishment of perennial species through proper management. Proximity to roads or other seed vectors will increase the likelihood of invasion by non-native species (Davies and Sheley, 2007). Continuous season-long grazing and/or heavy stocking rates may decrease the vigor and establishment of perennial grass species.

The following is from the 1988 Range site (SCS, 1988):

In climax conditions, this plant community is primarily grass with an overstory of scattered Wyoming big sagebrush. The plant community consists of about 50 percent grass, 15 percent forbs, and 35 percent shrubs (air-dry weight of current season's growth). Dominant grasses are western wheatgrass, bottlebrush squirreltail, galleta, and Salina wildrye. Less abundant grasses are Indian ricegrass, muttongrass, and Sandberg bluegrass.

Major forbs present in the plant community include fernleaf biscuitroot, foothill deathcamas, hollyleaf clover, sego lily, tapertip onion, and threadleaf groundsel. Shrubs that occur on this site are Wyoming big sagebrush, fourwing saltbush, and shadscale. Small amounts of prickly pear are present in some areas.

If ecological retrogression is cattle induced, the desirable plants such as Indian ricegrass, muttongrass, Salina wildrye, and tapertip onion will decrease due to selective spring and summer grazing. If retrogression is caused by winter grazing by sheep, fourwing saltbush and shadscale are reduced. Wyoming big sagebrush will take on a hedged appearance with heavy winter use by sheep or deer.

Plants likely to invade the site and become a part of the plant community when the range is in deteriorated condition are Russian thistle, kochia, cheatgrass, dandelion, black greasewood, wavyleaf thistle, halogeton, bur buttercup, mustard, bulbous bluegrass, and Utah juniper. In a severely deteriorated condition, production on this site will be reduced to 50-100 pounds per acre of available forage. At his stage, the plant community is made up of a few shrubs and some invaders.

Variability in climate, soils, aspect and complex biological processes will cause the plant communities to differ. These factors contributing to annual production variability include wildlife use, drought, and insects. Factors contributing to special variability include soil texture, depth, rock fragments, slope, aspect, and micro-topography. The species lists are representative and not a complete list of all occurring or potentially occurring species on this site. The species lists are not intended to cover the full range of conditions, species and responses of the site. The State & 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

R036XY328CO Semidesert Clay Loam

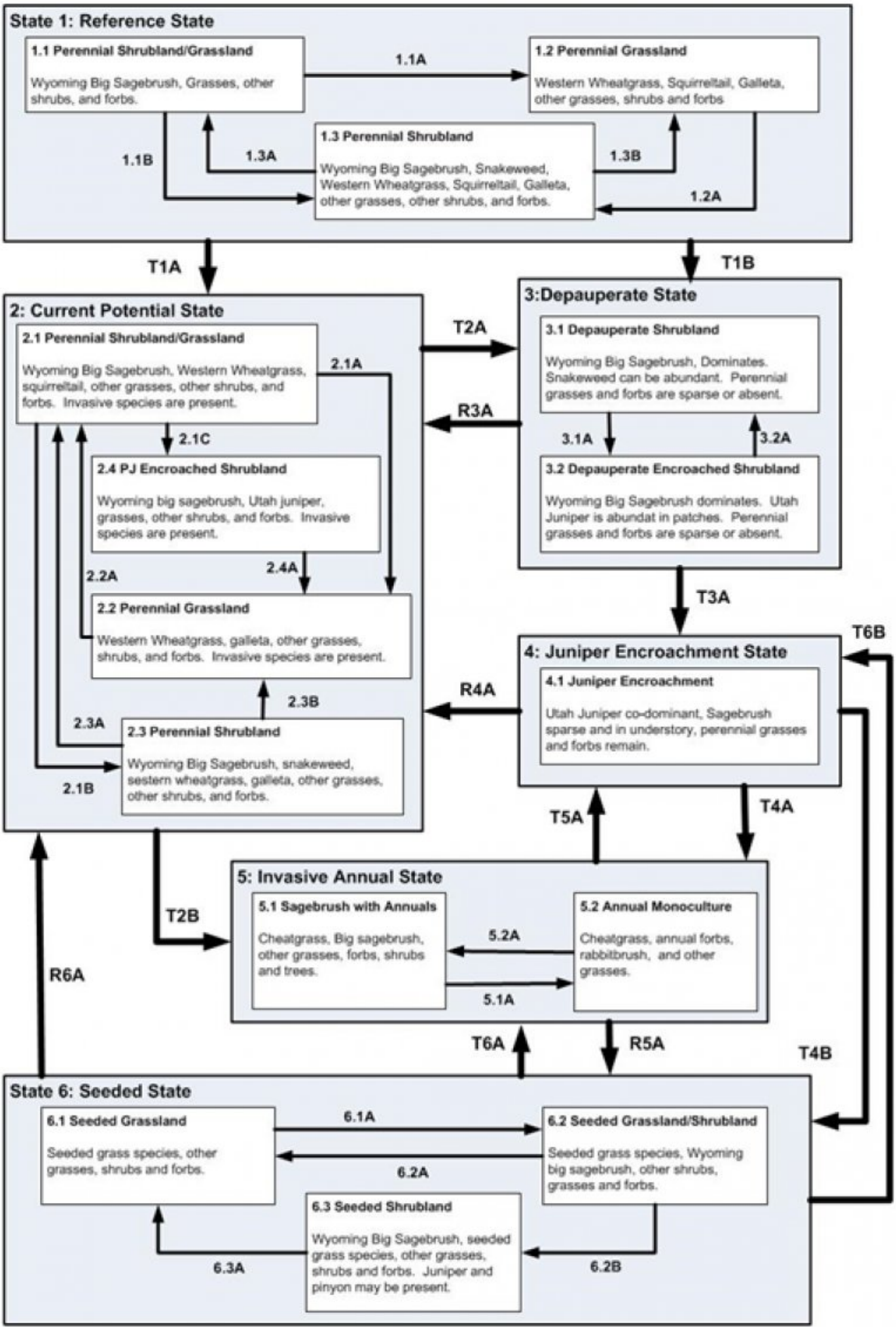

Figure 6. STM

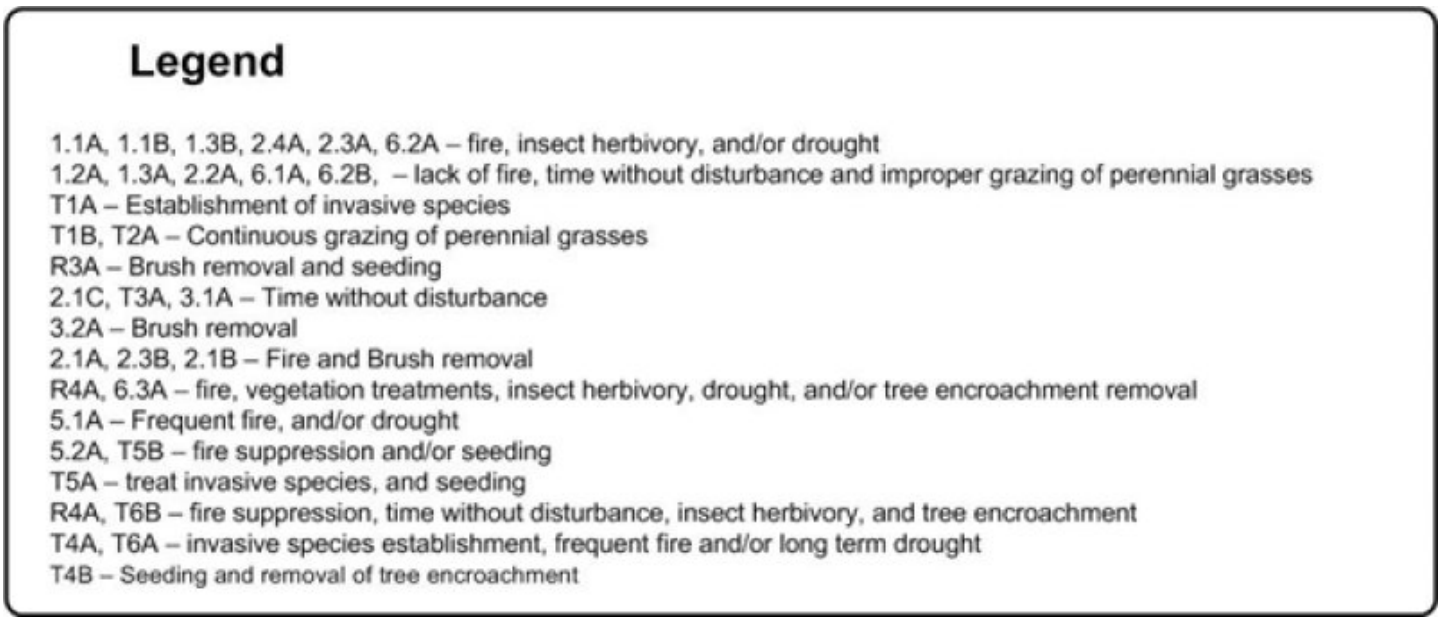

Figure 7. STM Legend

State 1
Reference State

The reference state represents the expected historical plant communities and ecological dynamics of this site, without the effects of improper grazing, altered fire regime, non-native species, or other human disturbances. The reference state is dominated by big sagebrush and/or perennial grasses. The reference state is self-sustaining, meaning it is resistant to natural disturbances and exhibits high resilience following natural disturbances (Briske et al., 2008). All community phases are at risk of non-native/invasive plant establishment when a seed source and germination sites are available.

Community 1.1
Perennial Shrubland/Grassland

Perennial grasses co-dominate the site with Wyoming big sagebrush and other shrubs.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	308	392	560
Shrub/Vine	196	275	392
Forb	56	118	168
Total	**560**	**785**	**1120**

Figure 9. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Community 1.2
Perennial Grassland

This phase is dominated by perennial native grasses including western wheatgrass, squirreltail, galleta and salina wildrye.

Figure 10. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Community 1.3
Perennial Shrubland

Wyoming big sagebrush is the dominant plant in the perennial shrubland phase. Western Wheatgrass, Squirreltail, galleta and Salina Wildrye dominate the understory, along with a variety of other native perennial grasses. Forbs are a minor component of the plant community.

Figure 11. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Pathway 1.1A
Community 1.1 to 1.2

Fire removes big sagebrush and perennial bunchgrasses quickly recover and dominate. The natural fire return interval is highly variable depending on fuel levels and climate, but is expected to range between 10-70 years (Howard, 1999) in areas dominated by Wyoming big sagebrush.

Pathway 1.1B
Community 1.1 to 1.3

Low intensity fire, pathogens, or extended drought thin big sagebrush (Winward, 2004). The natural fire return interval is widely variable depending on fuel levels and climate, and is expected to be between 10-70 years in Wyoming big sagebrush communities (Howard, 1999). Perennial grasses and fourwing saltbush re-sprout, and the grasses dominate the site.

Pathway 1,2A
Community 1.2 to 1.3

Time without disturbance can result in a natural increase in sagebrush dominance (Welch and Criddle, 2003). Grazing of perennial grasses may decrease the time required for this pathway.

Pathway 1.3A
Community 1.3 to 1.1

Fire removes big sagebrush and perennial bunchgrasses quickly recover and dominate. The natural fire return interval is highly variable depending on fuel levels and climate, but is expected to range between 10-70 years (Howard, 1999) in areas dominated by Wyoming big sagebrush.

Pathway 1.3B
Community 1.3 to 1.2

Low intensity fire, pathogens, or extended drought thin big sagebrush (Winward, 2004). The natural fire return interval is widely variable depending on fuel levels and climate, and is expected to be between 10-70 years in Wyoming big sagebrush communities (Howard, 1999). Perennial grasses and fourwing saltbush re-sprout, and the grasses dominate the site.

State 2

Current Potential State

The current potential state is similar in structure and function to the reference state, however invasive species are present in all community phases. The current potential state is generally dominated by big sagebrush and perennial grasses, but has an additional phase due to juniper encroachment as a result of fire suppression. The current potential state is less resilient than the reference state due to the presence of non-native/invasive species in the plant community.

Community 2.1
Perennial Shrubland/Grassland

Perennial grasses co-dominate the site with Wyoming big sagebrush and other shrubs. Non-native species are present but not dominant.

Figure 12. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Community 2.2
Perennial Grassland

This phase is dominated by perennial native grasses. Non-native species are present but not dominant.

Figure 13. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Community 2.3
Perennial Shrubland

Wyoming big sagebrush is the dominant plant in the perennial shrubland phase. Western Wheatgrass, squirreltail, galleta and salina wildrye dominate the understory, along with a variety of other native perennial grasses. Forbs are a minor component of the plant community. Non-native species are present but not dominant.

Figure 14. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Community 2.4
PJ Encroached Shrubland

This phase is dominated by Wyoming big sagebrush. Pinyon and/or Utah juniper may dominate in patches, and many young trees are scattered throughout the sagebrush-dominated areas. Perennial grasses noticeably decrease, especially in areas where pinyon and juniper dominate. This reduces the resilience of the site by improving the germination site availability for non-native invasive species, especially following a burn.

Figure 15. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Pathway 2.1A
Community 2.1 to 2.2

Fire removes big sagebrush, perennial bunchgrasses quickly recover and dominate. The natural fire return interval is highly variable depending on fuel levels and climate, but is expected to range between 10-70 years (Howard, 1999) in areas dominated by Wyoming big sagebrush.

Pathway 2.1B
Community 2.1 to 2.3

Low intensity fire, pathogens, or extended drought thin big sagebrush (Winward, 2004). The natural fire return interval is widely variable depending on fuel levels and climate, and is expected to be between 10-70 years in Wyoming big sagebrush communities (Howard, 1999). Perennial grasses and fourwing saltbush re-sprout, and the grasses dominate the site.

Pathway 2.1C
Community 2.1 to 2.4

Extended time without disturbance, most commonly fire return intervals greater than about 70 years, promote pinyon and juniper establishment and growth in the community.

Pathway 2.2A
Community 2.2 to 2.1

Time without disturbance can result in a natural increase in sagebrush dominance (Welch and Criddle, 2003). Grazing of perennial grasses may decrease the time required for this pathway.

Pathway 2.3A
Community 2.3 to 2.1

Time without disturbance can result in a natural increase in sagebrush dominance (Welch and Criddle, 2003). Grazing of perennial grasses may decrease the time required for this pathway.

Pathway 2.3B
Community 2.3 to 2.2

Fire removes Wyoming big sagebrush, perennial bunchgrasses quickly recover and dominate. The natural fire return interval is highly variable depending on fuel levels and climate, but is expected to range between 10-70 years (Howard, 1999) in areas dominated by Wyoming big sagebrush.

Pathway 2.4A
Community 2.4 to 2.2

Fire removes big sagebrush, pinyon and juniper. Perennial grasses resprout quickly and dominate the site, except in patches where they were eliminated by pinyon and juniper dominance. These patches may be more susceptible to invasion by non-native/invasive species.

State 3
Depauperate State

This state occurs when native perennial grasses are removed by excessive grazing. Native forbs are also reduced. The fire return interval is greatly increased due to a lack of fine fuels. The prolonged fire return interval facilitates establishment of Utah juniper.

Community 3.1
Depauperate Shrubland

This community phase is the result of excessive grazing or other disturbance that removes perennial grasses and native forbs from the understory. Wyoming big sagebrush dominates and overall production is greatly reduced.

Figure 16. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Community 3.2
Depauperate Encroached Shrubland

This community phase occurs when Utah juniper begins to dominate the site in patches due to prolonged time without fire or other shrub-controlling disturbance.

Figure 17. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Pathway 3.1A
Community 3.1 to 3.2

Prolonged time without fire or other brush-controlling disturbance promotes establishment and dominance of Utah juniper in patches.

Pathway 3.2A
Community 3.2 to 3.1

Brush management can thin Utah juniper and return the site to phase 3.1.

State 4
Juniper Encroachment State

This state occurs due to lack of fire or other brush controlling disturbance. Utah juniper performs well on this ecological site in the absence of disturbance, and eventually outcompetes Wyoming big sagebrush for water and nutrients. The result is a juniper dominated state with little to no Wyoming big sagebrush, perennial grasses, or forbs in the understory.

Community 4.1
Juniper Encroachment

This is the only phase in the fire-resistant, self-perpetuating state dominated by Utah juniper.

Figure 18. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

State 5
Invasive Annual State

This state is dominated by invasive annual species. Invasive annual species can including cheatgrass, Russian thistle, kochia, halogeton, storksbill geranium, and annual mustards. 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. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible.

Community 5.1
Sagebrush with Annuals

This state will look big sagebrush with an invasive annual species understory. Frequently, sagebrush canopy cover will be dense due to little to none perennial understory being present. Cheatgrass, and other annual introduced species are now present in the understory. It can function as a plant community this way unless the fire return interval decreases to less than 5 years (Whisenant 1986). Then it will transition to an Annual grasses phase (5.2). This phase is at risk for becoming a cheatgrass-dominated grassland.

Figure 19. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Community 5.2
Annual Monoculture

This community is characterized by an almost a complete monoculture of cheatgrass and/or other invasive annuals. This community can be long-lasting phase if fires and disturbance continue to be frequent.

Figure 20. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Pathway 5.1A
Community 5.1 to 5.2

This pathway occurs when frequent fire or drought remove the big sagebrush, and favor the establishment of cheatgrass or other invasive annuals. In a degraded sagebrush community, cheatgrass will take advantage of the increased interspaces between plants will typically establish in the interspaces. Once annuals get established it creates a fine fuel load which will decrease the fire return interval. With more frequent fires, sagebrush can be eliminated from the site and a monocultures of invasive annuals can become established. These monocultures can persist for long time periods. Frequent fires also prevent the re-establishment of sagebrush on the site.

Pathway 5.2A
Community 5.2 to 5.1

This pathway occurs when there is a longer fire return interval. Longer fire return intervals can be enabled by using fire suppression and fire breaks to allow perennial vegetation to a change to get established. Along with this seeding and/or proper grazing may allow native perennial plants to return to this community. This pathway has very intensive energy inputs.

State 6
Seeded State

This state results from seeding introduced perennial grasses (i.e. crested wheatgrass and Russian wildrye). Native perennial grasses, forbs and shrubs may be included in the seed mix. This state behave similar community dynamics to the current potential state community. Other vegetation treatments may be necessary to get to this state, they include chaining, mowing, disking, prescribed burning and other techniques which manipulate the plant community. Applying vegetation treatments to plant communities to either the invasive annuals or juniper encroachment states to create a seeded state is often the first step in assisted restoration to plant communities an

intermediate step to get to the Current Potential State. The seeded state could persist for long periods of time with proper management. Native grasses and forbs may reestablish over time from nearby seed sources. Big sagebrush will typically reestablish in 30-40 years.

Community 6.1
Seeded Grassland

This community is dominated by seeded plants such as crested wheatgrass, Russian wildrye, smooth brome, and intermediate and pubescent wheatgrasses. Big sagebrush has little to no production in this phase. This site has high production due to the seed grass production. This production typically is higher than the current potential or reference state. This site usually has low species diversity.

Figure 21. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Community 6.2
Seeded Grassland/Shrubland

This phase has big sagebrush co-dominant with the seeded grass.

Figure 22. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Community 6.3
Seeded Shrubland

This community consists big sagebrush with sparse understory. Sagebrush canopy cover would typically be greater than 35%. Scattered Utah juniper and maybe two-needle pinyon might have encroached. Two-needle pinyon and Utah juniper are natural invaders if stands are found adjacent to this site. Trees left uncontrolled can form dense stands and eventually dominate the site. Nonnative invasive species, such as cheatgrass are present but in insignificant amounts. Biological crusts are typically well developed in the interspaces; however, bare ground is most common in this community phase.

Figure 23. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
		20	30	30	10			5	5		

Pathway 6.1A
Community 6.1 to 6.2

Time without disturbance and climatic conditions that favor establishment of sagebrush will assist this pathway. Improper grazing on the grasses species can favor shrub establishment and reduce their competitiveness. Also, several consecutive years of droughts can reduce grass cover.

Pathway 6.2A
Community 6.2 to 6.1

This transition is caused by naturally occurring fires, herbivory of sagebrush, and/or drought that suppresses sagebrush establishment. These events tend to favor grass establishment. With a mature sagebrush community, this pathway can be caused by high intensity fire that burns hot enough to remove big sagebrush and PJ, if it has

started to encroach. Low-intensity fire after sagebrush has had a chance to set seed, improper grazing and or browsing by native ungulates, and possible stem-root pathogens will revert a young sagebrush community to a grassland with the potential to become a sagebrush-grass community once again (Winward, 2004). Vegetation treatments (mechanically, prescribed fire, chemically, etc.) can also be employed to imitate the natural disturbances regime.

Pathway 6.2B
Community 6.2 to 6.3

This pathway favors shrub establishment. This pathway is cause by time without disturbance (i.e. fire) and favorable conditions for young sagebrush establishment. Also, Pinyon and juniper will start to encroach under these condition. Improper continuous grazing of perennial grasses will speed up this pathway. This will lead to an old decadent stand of sagebrush with little to no understory.

Pathway 6.3A
Community 6.3 to 6.1

This pathway is caused by naturally occurring fires, vegetation treatments (chemical and mechanical), and/or insect herbivory removes the shrubs and possible trees if they have encroached on this site. It reverts the system back to a grassland phase. Depending on the amount of understory present, grasses and forbs may need to be reseeded to aid reestablishment.

Transition T1A
State 1 to 2

Invasive species are present on the site. The current potential state is less resilient than the reference state due to the presence of non-native/invasive species in the plant community.

Transition T1B
State 1 to 3

Continuous grazing of perennial species and lack of disturbance over a very long time span.

Transition T2A
State 2 to 3

Continuous grazing of perennial species and lack of disturbance over a very long time span.

Transition T2B
State 2 to 5

This transition is from big sagebrush dominated state, to a state that is dominated by invasive species. Events include establishment of invasive species, fire (<5-20 years), continuous season long grazing of perennial grasses, long term drought.

Restoration pathway R3A
State 3 to 2

Brush management and seeding to adapted perennial grasses, forbs and shrubs under favorable climatic conditions may result in a restoration of state 2 from the depauperate state 3.

Transition T3A
State 3 to 4

This transition is expected to occur when fire or other juniper-controlling disturbance has been absent from the site for at least 150 years. Sagebrush becomes very decadent and Utah juniper outcompetes all species for water and other resources

Restoration pathway R4A
State 4 to 2

Pathways can be one or more of the following: brush treatments, seeding, insect herbivory/pathogen, proper grazing, drought, and/or fire. This pathway requires lots of energy input into the system.

Transition T4A
State 4 to 5

This transition is from big sagebrush dominated state, to a state that is dominated by invasive species. Events include establishment of invasive species, fire (<5-20 years), continuous season long grazing of perennial grasses, long term drought.

Transition T4B
State 4 to 6

Seeding of introduced/native species (grasses and forbs) is the pathway to state 4. Also, trees are usually removed by mechanical or chemical treatments. This transition requires energy input into the system.

Transition T5A
State 5 to 4

This transition requires fire return intervals to length and fire suppression may be necessary to interrupted the shorten fire return intervals that occur when cheatgrass and other annuals invade. Juniper will encroach onto the site with time and lack of fire. Seeding may be necessary to establish perennial plants. This could require significant energy inputs to make this transition happen.

Restoration pathway R5A
State 5 to 6

Invasive annuals will need to be treated and dominance suppress enough to allow desired seeded species the ability to complete so that they can become established. Seeding of introduced species is the pathway to state 4. This transition will be difficult and require substantial inputs and management of the site. It may not be practical on a large scale. Research is needed for species adapted to compete with annual invasive plants, and seeding techniques to add with successful transition from the invasive annual state.

Restoration pathway R6A
State 6 to 2

This return path could possible occur as a result of long time frames without disturbance. Native plants from adjacent site would slow establish in the seeded state. Proper grazing from livestock and wildlife which would favor the establishment of native plants. Removal of the Utah juniper and Pinyon as they encroach would also be necessary.

Transition T6B
State 6 to 4

This transition is from the big sagebrush-seeded grass state to a state that is dominated by two-needle pinyon and Utah juniper. Events include, fire suppression, time without disturbance, insect herbivory, continuous season long grazing of perennial grasses, and tree invasion. As canopy density increase, bare ground will increase further increasing the fire return interval, accelerating erosion, increasing run-off and further affecting the watershed functionality. This transition also favors the establishment of invasive annual species such as cheatgrass.

Transition T6A
State 6 to 5

This transition is from a seeded state, to a state that is dominated by invasive species. Events include increased of invasive species, shortened fire return interval, and long term drought. Improper continuous season long grazing of perennial grasses can reduce the time needed for this pathway.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Grasses**			308–476	
	Sandberg bluegrass	POSE	*Poa secunda*	28–112	–
	James' galleta	PLJA	*Pleuraphis jamesii*	56–112	–
	Grass, perennial	2GP	*Grass, perennial*	28–112	–
	squirreltail	ELEL5	*Elymus elymoides*	56–112	–
	saline wildrye	LESA4	*Leymus salinus*	56–112	–
	western wheatgrass	PASM	*Pascopyrum smithii*	56–112	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	28–84	–
	muttongrass	POFE	*Poa fendleriana*	28–84	–
Forb					
2	**forbs**			56–168	
	tapertip onion	ALAC4	*Allium acuminatum*	0–17	–
	sego lily	CANU3	*Calochortus nuttallii*	0–17	–
	shaggy fleabane	ERPU2	*Erigeron pumilus*	0–17	–
	fernleaf biscuitroot	LODI	*Lomatium dissectum*	0–17	–
	hollyleaf clover	TRGY	*Trifolium gymnocarpon*	0–17	–
	foothill deathcamas	ZIPA2	*Zigadenus paniculatus*	0–17	–
Shrub/Vine					
3	**shrubs**			224–336	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	112–196	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	28–84	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	28–84	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–22	–

Animal community

The following section is from the 1988 range site:

GRAZING INTERPRETATIONS:
Most of this site is in poor conditions and has only limited value for grazing by domestic livestock. When the site is in a high condition class, it can be quite valuable for grazing during the fall, winter and spring. Grazing needs to be rotated so each area is rested every three or four years. Most of the native species are palatable and nutritious. Livestock access is not a problem on this site, however, distance to water may create problems with grazing distribution. Where there is enough grass to respond to brush management, Wyoming big sagebrush can be controlled when it has become a problem. A good grass cover is needed to prevent excessive erosion. On “poor” range condition sites, seeding may be a more practical alternative than many years of deferment. Species to consider should include western wheatgrass, and Indian ricegrass. Fourwing saltbush is a desirable addition to the mix of domestic livestock and wildlife.

Stocking rates given below are based on continuous use for the entire growing season, and are intended only as an initial guide. Forage needs are calculated on the basis of 900 lbs of air dry forage per animal unit month (AUM). To maintain proper use and allow for forage that disappears through trampling, small herbivore use, weather, etc., 35 percent of the palatable forage produced is considered available for grazing by large herbivores.

Condition	Percent	Ac/AUM	AUM/Ac
Excellent	76-100	3.7	.27
Good	51-75	5	.20
Fair	26-50	8	.125
Poor	0-25	10+	.10

Adjustment to the initial stocking rates should be made as needed to obtain proper use. With specialized grazing systems, large livestock breeds, uncontrolled big game herbivores, inaccessibility, dormant season use presence of introduced species, etc., stocking rate adjustments will be required. Some areas in fair and poor condition cannot be grazed due to low production caused by previous overgrazing. Therefore these figures can vary widely especially in the lower range condition class.

Depending on climatic conditions, in some years palatable annuals such as cheatgrass may produce large amounts of forage that is available for only a short time. Intensive grazing programs on these areas followed by deferment is an excellent management tool to utilize these annuals but still allow recovery of the perennial vegetation normally associated with this site.

POISONOUS PLANTS:
Greasewood is poisonous in the spring. Cattle and sheep are affected.
Effects and symptoms:
Poisoning is “acute”. Early signs of poisoning (4-6 hours after animals eat toxic amounts) are dullness, loss of appetite, lowering of the head, reluctance to follow the band and irregular gait. Advanced signs are drooling, nasal discharge, progressive weakening, rapid shallow breathing, and coma. Cattle may die after eating 3 to 3.5 pounds in a short time.
Sheep may die after consuming 2 pounds of green leaves and fine stems in a short period of time without other forage.

Halogeton is poisonous when growing rapidly in spring (April-June). Sheep are affected.
Effects and symptoms:
Poisoning is “acute”. Signs of poisoning occur in 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, animals unable 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 pounds 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.

Foothills deathcamas mostly affects sheep but can also affect cattle and horses. The type of poison is various alkaloids and is acute. The problem is most serious when other forage is scarce.

“Accumulative” - Poisoning effect increases in severity by successive additions of the poisonous plant. Symptoms appear weeks or months after poisonous plants are first eaten.

“Acute” – Symptoms appear within a few hours after poisonous plant has been eaten.

PRESCRIBED BURNING:
Prescribed burning is an excellent tool if brush management is needed. Deferment followed by good grazing management is needed after burning obtaining max benefits to the vegetation, domestic livestock and wildlife.

WILDLIFE INTERPRETATIONS:
This site is important mule deer and elk winter range. Other species commonly found in the area include white-tailed jackrabbit, cottontail rabbit, mourning dove, coyote, badger, striped skunk, golden eagle, red-tailed hawk, American

kestrel, several species of ground squirrels, and white-tailed prairie dogs. Occasionally chuckar and bobcat can also be found on this site.

Improvement of range condition by brush control has multiple impacts on wildlife values. An increased in availability, of grasses improves winter habitat for elk. A decrease in tall brush reduces the available critical winter forage for mule deer. Overall, an improved range condition benefits most of the wildlife species. However, if brush control is used to reduce woody species to less than 25% of the annual production this site, overall wildlife values decrease dramatically.

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 found 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, the 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.

Soils Hydrologic Group

Burrocreek C
Onioncreek C
Dominguez C

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 (Soil
Survey Staff, 2015).

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, 2015).

Recreational uses

The following section is from the 1988 range site:

This site is in the very warm area just above the saltdesert sites and below the foothill and mountain sites. Therefore, it is usually not used for recreation purposes. There may be some limited hunting of small game, but the site is usually too low in elevation for big game hunting during hunting seasons due to big game migration patterns.

Wood products

The site is generally treeless. The Utah juniper that are allowed to invade the site are generally slow growing.

Other information

Plant Preference Table from 1988 Range Site.

Type locality

Location 1: Garfield County, CO	
Township/Range/Section	TT85N RR97W SSec 7
General legal description	South part of sec 7, T8N, R97W in Garfield County, Colorado

Other references

Boyle, S. A. and D. R. Reeder. 2005. Colorado sagebrush: a conservation assessment and strategy. Grand Junction: Colorado Division of Wildlife.

Briske, D. D., B. T. Bestlemeyer, T. K. Stringham, and P. L. Shaver. 2008. Recommendations for development of resilience-based state-and-transition models. Rangeland Ecology and Management 61:359-367.

Howard, Janet L. 1999. *Artemisia tridentata* subsp. wyomingensis. In: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis/ [2012, February 21].

Johnson, James R. and Payne, Gene F. 1968. Sagebrush reinvasion as affected by some environmental influences. Journal of Range Management. 21: 209-213. [1280]

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.

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.

Soil Conservation Service (SCS). December 1988. Range Site Description for Semidesert Clay Loam #328. : 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 [2/2/2017].

Western Regional Climate Center. Retrieved from http://www.wrcc.dri.edu/summary/Climsmco.html on Feb 2, 2017

Welch, Bruce L; Craig Criddle. 2003. Countering misinformation concerning big sagebrush. Research Paper RMRS-RP-40. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Whisenant, S. G. 1986. Herbicide use in Artemisia and Chrysothamnus communities: Reducing damage to non-target species. In E.D. McArthur and B.L. Welch, Compilers, Proceedings – Symposium on the Biology of Artemisia and Chrysothamnus pp 115-121 USDA Forest Service Gen. tech. rep. INT-200. 398pp. Ogden, UT.

Winward, A. H. 2004. Sagebrush of Colorado: taxonomy, distribution, ecology, and management. Denver. Colorado Division of Wildlife.

Contributors

Suzanne Mayne Kinney

Acknowledgments

Project Staff:
Suzanne Mayne-Kinney, Ecological Site Specialist, NRCS MLRA, Grand Junction SSO
Chuck Peacock, MLRA Soil Survey Leader, NRCS MLRA Grand Junction SSO

Program Support:
Rachel Murph, NRCS CO State Rangeland Management Specialist, Denver
Scott Woodhall, NRCS MLRA Ecological Site Specialist-QA Phoenix, AZ
Eva Muller, Regional Director, Rocky Mountain Regional Soil Survey Office, Bozeman, MT
B.J. Shoup, CO State Soil Scientist, Denver
Eugene Backhaus, CO State Resource Conservationist, Denver

Partners/Contributors:

Those involved in developing earlier versions of this site description include: Bob Rayer, retired NRCS Soil Scientist; Herman Garcia, retired CO State RMS and NRCS MLRA Ecological Site Specialist-QA Phoenix, AZ.

--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 36 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.

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)	Suzanne Mayne-Kinney
Contact for lead author	
Date	03/09/2017
Approved by	Rachel Murph, State Rangeland Management Spec., USDA NRCS Colorado
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None to few. Any rills present should be somewhat short in length (less than 6 feet long) and are very shallow which follow the surface micro-features. An increase in rill formation may be seen after disturbance events such as recent fire or thunderstorms in adjacent landscape settings where increased runoff may accumulate (such as areas below exposed bedrock). Such rill development should usually be limited to slopes exceeding 20%.

---

2. **Presence of water flow patterns:** Flow patterns wind around perennial plant bases and show little to slight evidence of erosion. They are short, stable and usually disconnected. There is minor evidence of deposition. On gently sloping (< 10 % slopes) locations within the site, water flow patterns are infrequent and usually less than 3 feet. Longer water flow patterns may be found on steeper slopes (>20 %). Numerous small debris dams maybe obvious after rainfall events.

---

3. **Number and height of erosional pedestals or terracettes:** Some pedestals and terracettes may be apparent near long lived perennial plants that are associated with water flow patterns. Pedestals that occur may be found on steeper slopes (> 20 %) and usually associated with water flow patterns. Loss of plant cover can result in well-developed biological soil crust forming. This interspaces between well-developed biological soil crusts may resemble pedestals but they are actually a characteristic of the crust formation.

---

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** 15–30% bare ground is common. Ground cover is based on the first raindrop impact, and bare ground is the opposite of ground cover. Well-developed biological soil crusts should not be recorded as bare ground. Poorly developed biological soil crusts that are interpreted as functioning as bare ground (therefore they would be susceptible to raindrop splash erosion) should be recorded as bare ground. Extended drought can cause bare ground to increase.

---

5. **Number of gullies and erosion associated with gullies:** None to few. Some gullies may be present in landscape settings where increased runoff may accumulate (such as areas below exposed bedrock). Such gully development is expected to be limited to slopes exceeding 20% and adjacent to sites where runoff accumulation occurs. Any gullies present should show little sign of accelerated erosion and should be stabilized with perennial vegetation.

---

6. **Extent of wind scoured, blowouts and/or depositional areas:** Very minor evidence of wind generated soil movement Wind scoured (blowouts) and depositional areas are rarely present.

7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water movement. 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 grass leaves and small twigs (grass stems) may accumulate in soil depressions adjacent to plants. Woody stems are not likely to move.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil surface textures are silty clay loam and clay loam. These soils have a water erosion hazard of slight or moderate. There is high resistance to wind erosion.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The surface layer is silty clay loam or clay loam, 2 to 7 inches thick. Refer to soil survey for more detailed information about your specific site.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Vascular plants and well developed biological soil crusts will break raindrop impact and splash erosion. Spatial distribution of vascular plants and interspaces between well developed biological soil crusts (where present) provide detention storage and surface roughness that slows runoff allowing time for infiltration. Interspaces between plants and 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.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Naturally occurring soil horizons may be harder than the surface because of an accumulation of clay (soil texture change) or calcium carbonate and should not be considered as compaction layers.

12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

    Dominant: Perennial grasses (squirreltail, saline wildrye, western wheatgrass, galleta) > non-sprouting shrubs (Wyoming Big Sagebrush)>

    Sub-dominant: sprouting shrubs (fourwing saltbush) = forbs

    Other:

    Additional: Functional/structural groups may appropriately contain non-native species if their ecological function is the same as the native species in the reference state (e.g. Crested wheatgrass and Russian wildrye etc.) The perennial grass/non-sprouting shrub functional groups are expected on this site. Perennial and annual forbs can be expected to vary widely in their expression in the plant community based upon departures from average growing conditions. Disturbance regime includes drought, insects, and fire. Assumed fire cycle of 50-70+ years. Following a recent disturbance such as fire or drought that removes the woody vegetation, forbs and perennial grasses (herbaceous species) may dominate the community. If a disturbance has not occurred for an extended period of time, woody species

may continue to increase crowding out the perennial herbaceous understory species. In either case, these conditions would reflect a functional community phase within the reference state.

---

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** All age classes of perennial grasses should be present under average to above average growing conditions with age class expression likely subdued during below average years. Slight decadence in the principle shrubs could occur near the end of the fire cycle or during and following an extended drought. Expect more decadence on bunchgrasses with lack of disturbance. In general, a mix of age classes may be expected with some dead and decadent plants present.

---

14. **Average percent litter cover (%) and depth (in):** (10-20%). Variability may occur due to weather. Litter cover declines during and following a drought as the plants are not producing the litter.

---

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 500 lbs./ac, low precipitation years, 700 lbs./ac/ average precipitation years, 1000 lbs./ac above average precipitation years. After extended drought or the first growing season following a wildfire, production may be significantly reduced by 200-400 lbs./ac.

---

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:** Yellow rabbitbrush, Cheatgrass, Purple Threeawn, Broom snakeweed & introduced annual forbs (Filaree, Russian thistle, sticktight).

---

17. **Perennial plant reproductive capability:** All perennial plants should have the ability to reproduce sexually or asexually in most years. The only limitations are weather-related, wildfire, natural diseases and insects. Yellow rabbitbrush sprouts vigorously following fire.
