USDA Natural Resources
Conservation Service

Ecological site R036XY326CO
Semidesert Sandy Loam

Last updated: 12/12/2024
Accessed: 05/11/2025

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.

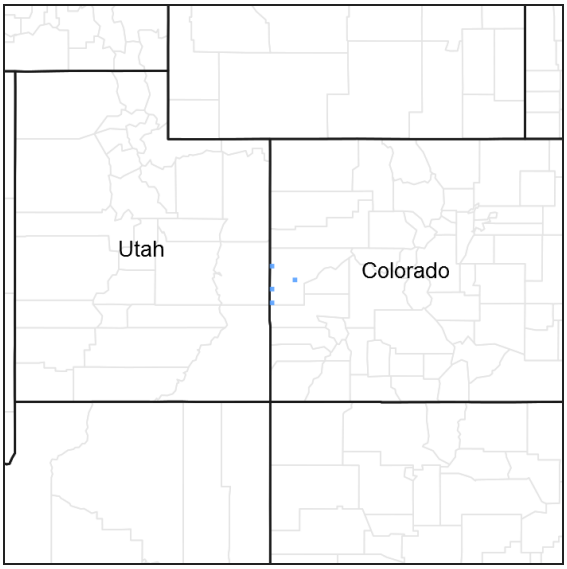


Figure 1. Mapped extent

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 Sandy 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, 341Bq-South Uncompahgre Plateau, and 341Bd-Salt Anticline Benchlands Subsections <341B Northern Canyonlands Section < 341

Intermountain Semi-desert and Desert (Cleland, et al., 2007).

313Ac- Monument Upwarp Subsection <313A Grand Canyon Section < 313 Colorado Plateau Semi-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 Sandy Loam was drafted from the existing Semidesert Sandy 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 mesas on moderately deep to deep soils with sandy loam textured soils derived from alluvium, eolian deposits, and residuum, from sandstone. It is a Wyoming big sagebrush-Needle and Thread community. It has an ustic aridic moisture regime and mesic temperature regime. The effective precipitation ranges from 8 to 12 inches.

Associated sites

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

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.
R036XY328CO	**Semidesert Clay Loam** Semidesert Clay Loam is on clayey texture soils. Clay content is higher in these soils than those found in Semidesert Loam and Semidesert Sandy Loam. Both are a Wyoming big sagebrush dominated site. Western wheatgrass/thickspike wheatgrass is the dominant grass on Semidesert Clay Loam. 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) *Hesperostipa comata*

Physiographic features

This site occurs on alluvial fans, fan terraces, mesas, and valley floors. Slopes usually range from 3 to 15 percent. Elevation for the site ranges from 5000 to 7000 feet above sea level. This site occurs on all aspects.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Terrace (3) Mesa

Flooding frequency	None
Ponding frequency	None
Elevation	4,900–6,600 ft
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)	11 in

Climate stations used

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

Influencing water features

None

Soil features

Soils on this site are moderately deep to deep (40"+) and well drained. They formed in alluvium, and/or eolian sands derived chiefly from sandstone.

The surface is fine sandy loam with clay ranging from 10 to 16%. The surface ranges commonly 3 to 5" in depth. The subsoil is a sandy loam with clay ranging from 12 to 16%.

Soils associated with this site are: Begay and Mivida.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone
Surface texture	(1) Fine sandy loam
Family particle size	(1) Sandy
Drainage class	Well drained
Permeability class	Moderately rapid
Soil depth	60 in
Surface fragment cover <=3"	0–6%
Surface fragment cover >3"	0%
Available water capacity (0-40in)	4.7–6.1 in
Calcium carbonate equivalent (0-40in)	0–10%
Electrical conductivity (0-40in)	0–2 mmhos/cm
Sodium adsorption ratio (0-40in)	0
Soil reaction (1:1 water) (0-40in)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–6%
Subsurface fragment volume >3" (Depth not specified)	0%

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

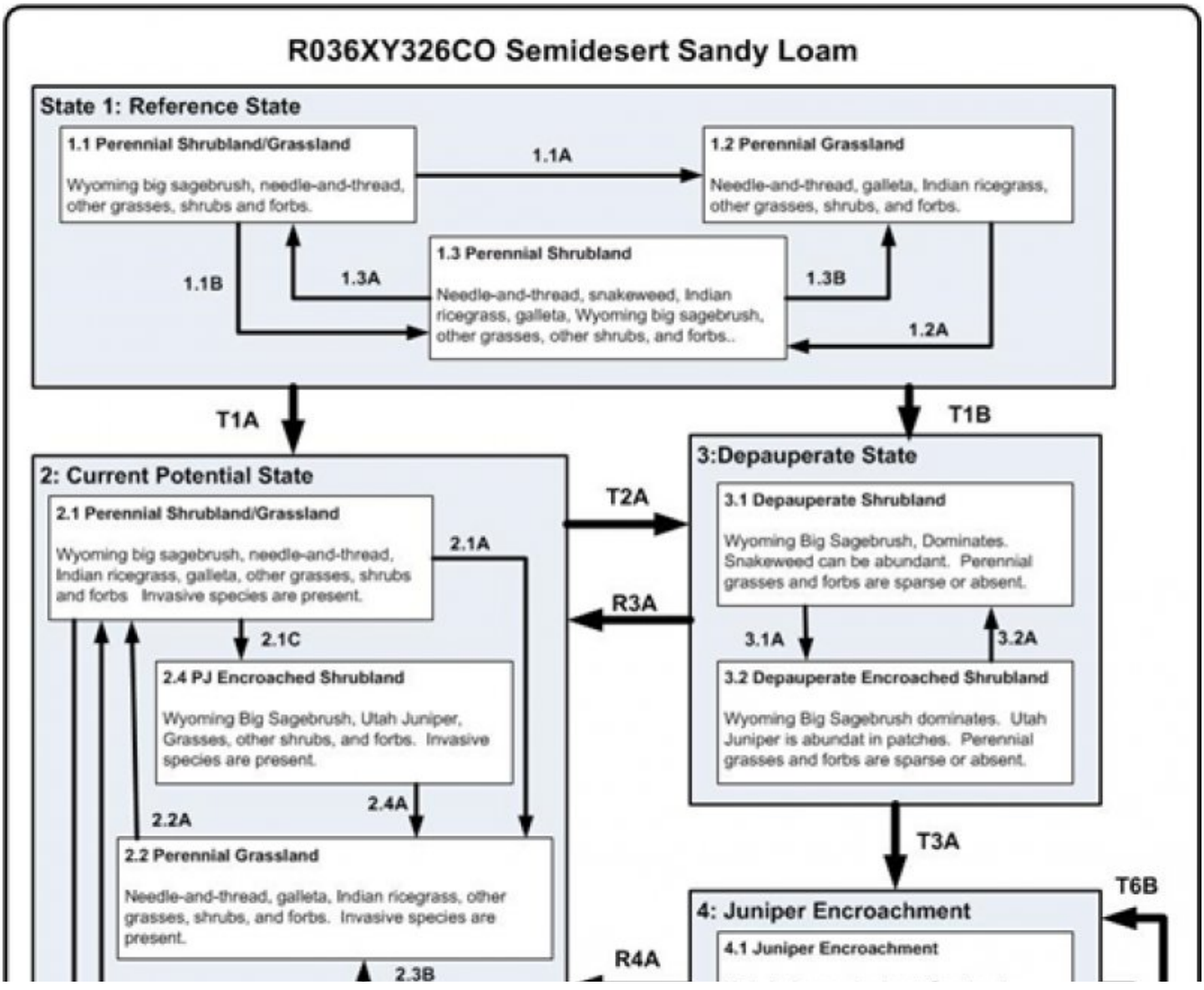
(Howard, 1999). Invasive species, particularly cheatgrass, may reduce the resilience of this site following wildfire or management disturbances. Other plants likely to invade this site are annual sunflower, annual mustards, sticktight, and Russian thistle.

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.

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



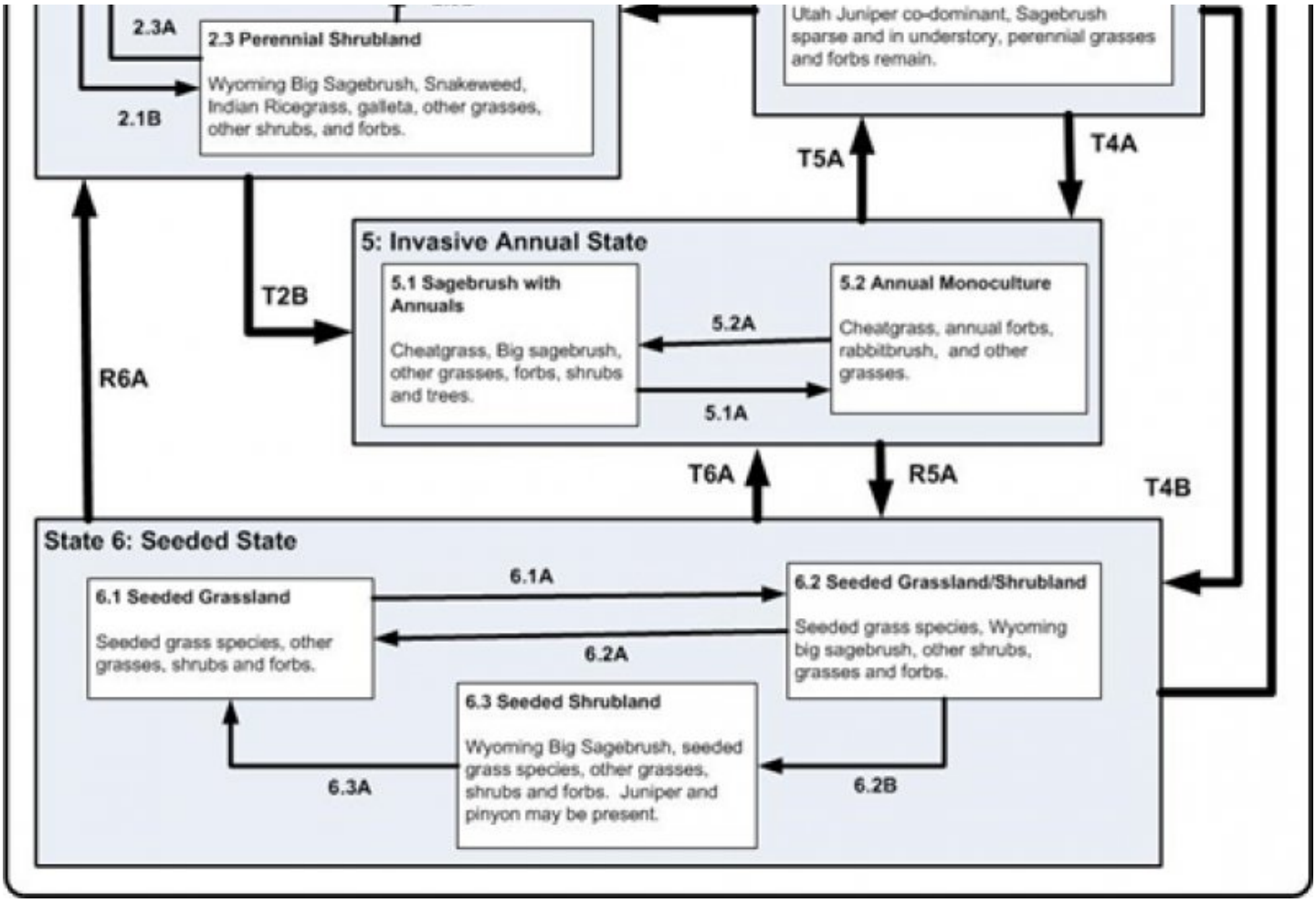


Figure 6. STM

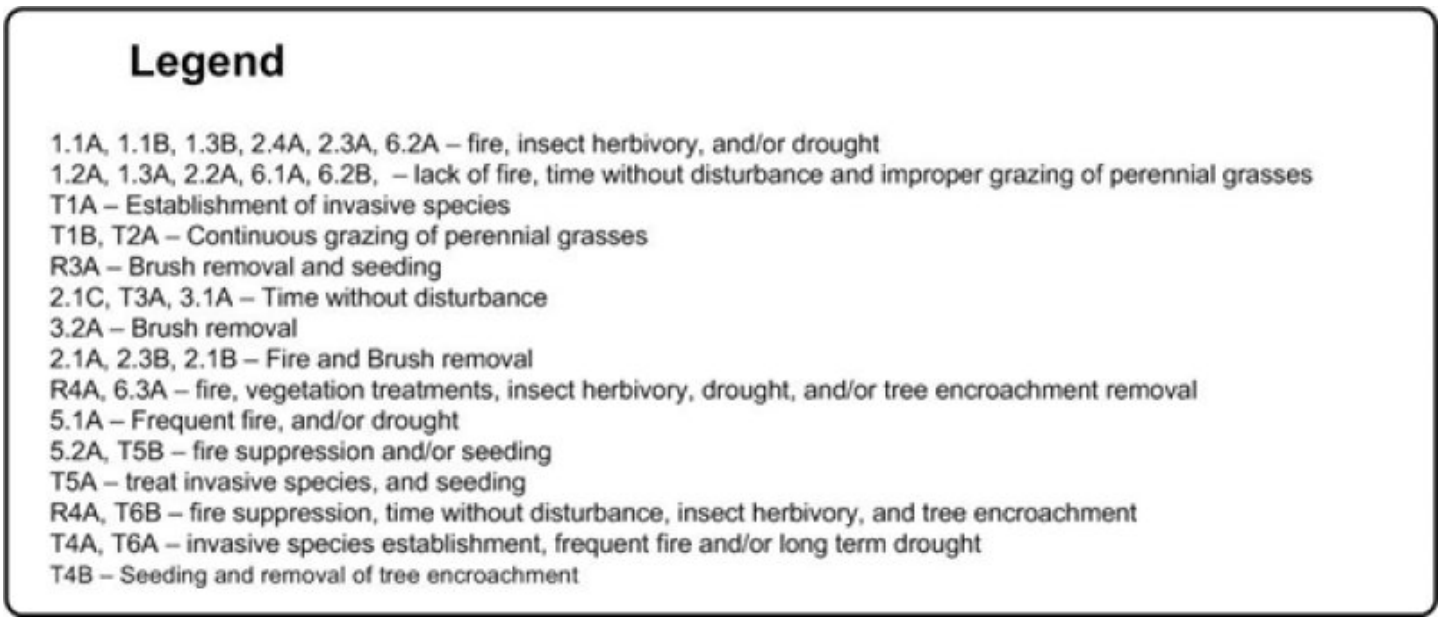


Figure 7. STM Legend

State 1
Reference

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. The following is from the 1988 Range site (SCS, 1988): If retrogression is sheep induced, palatable species such as Indian ricegrass, Salina wildrye, Wyoming big sagebrush, fourwing saltbush,

shadscale, and winterfat will decrease. Less palatable species will increase in relative amounts. As retrogression continues, production declines due to lower plant vigor. Plants that invade the site include cheatgrass, mustard, Russian thistle, kochia, and scattered Utah juniper. Basal area (the area of ground surface covered by perennial vegetation measured at ground level) is approximately 15 percent when near the potential plant community.

Community 1.1
Perennial Shrubland and Grassland

Perennial grasses co-dominate the site with big sagebrush and/or fourwing saltbush. The following is from the 1988 Range site (SCS, 1988): The plant community is about 45 to 75 percent grasses, 5 to 15 percent forbs, and 20 to 40 percent shrubs (air-dry weight of current season's growth). Dominant grasses are needle-and-thread, streambank wheatgrass, Salina wildrye, Indian ricegrass, galleta, and blue grama. Less abundant grasses include Sandberg bluegrass, red threeawn, sand dropseed, and bottlebrush squirreltail. Forbs present in the plant community include scarlet globemallow, wormwood, Hoods phlox, yellow cryptantha, and littleleaf pussytoes. Shrubs and half-shrubs that occur on this site are Wyoming big sagebrush, small low rabbitbrush, broom snakeweed, fourwing saltbush, shadscale, and winterfat.

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	275	440	550
Shrub/Vine	175	280	350
Forb	50	80	100
Total	**500**	**800**	**1000**

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

Dominant grasses are needle-and-thread, streambank wheatgrass, Salina wildrye, Indian ricegrass, galleta, and blue grama. Less abundant grasses include Sandberg bluegrass, red threeawn, sand dropseed, and bottlebrush squirreltail. Forbs are a minor component of the plant community. Fourwing saltbush is often present but not dominant. Forbs present in the plant community include scarlet globemallow, wormwood, Hoods phlox, yellow cryptantha, and littleleaf pussytoes.

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.

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, 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

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 1.2A
Community 1.2 to 1.1

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 1.3A
Community 1.3 to 1.1

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 1.3B
Community 1.3 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.

State 2
Current Potential

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 and Grassland

Perennial grasses co-dominate the site with big sagebrush and/or fourwing saltbush. 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. Needle-and-thread and Indian Ricegrass dominate the understory, along with a variety of other native perennial grasses. Forbs are a minor component of the plant community. Fourwing saltbush is often present. 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
Pinyon-Juniper 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

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 2.1C
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

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 2.3B
Community 2.3 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 2.4A
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

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

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

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

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 and 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 nonnative/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 (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				350–550	
	needle and thread	HECO26	*Hesperostipa comata*	80–200	–
	saline wildrye	LESAS	*Leymus salinus ssp. salinus*	40–80	–
	James' galleta	PLJA	*Pleuraphis jamesii*	40–80	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	40–80	–
	blue grama	BOGR2	*Bouteloua gracilis*	40–80	–
	thickspike wheatgrass	ELLA3	*Elymus lanceolatus*	40–80	–
	squirreltail	ELEL5	*Elymus elymoides*	20–40	–
	purple threeawn	ARPU9	*Aristida purpurea*	15–40	–
	Sandberg bluegrass	POSE	*Poa secunda*	15–40	–
	sand dropseed	SPCR	*Sporobolus cryptandrus*	15–40	–
	Grass, perennial	2GP	*Grass, perennial*	0–25	–
	sixweeks fescue	VUOC	*Vulpia octoflora*	0–10	–
Forb					
2				40–150	
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	5–25	–
	Forb, perennial	2FP	*Forb, perennial*	0–25	–
	tarragon	ARDR4	*Artemisia dracunculus*	5–25	–
	Brenda's yellow cryptantha	CRFL5	*Cryptantha flava*	0–15	–
	largeflower skeletonplant	LYGR	*Lygodesmia grandiflora*	0–15	–
	spiny phlox	PHHO	*Phlox hoodii*	0–15	–
	woolly plantain	PLPA2	*Plantago patagonica*	0–15	–
	littleleaf pussytoes	ANMI3	*Antennaria microphylla*	0–15	–
Shrub/Vine					
3				150–325	
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	80–120	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	40–60	–
	shadscale saltbush	ATCO	*Atriplex confertifolia*	30–60	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	15–40	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	15–40	–
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–25	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	8–20	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	8–20	–

Animal community

This section is from the 1988 range site.

GRAZING INTERPRETATIONS:
This site provides good fall, winter and spring grazing for sheep. Heavy spring use every year will cause a decline in plant vigor and cause range condition to go down. Fields should be rested from spring grazing a minimum of once every four years to prevent this range condition decline.

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, weathering, etc., 35 percent of the palatable forage produced is considered available for grazing by large herbivores.
Ac/AUM AUM/Ac
Exc 76-100 4.1-5.5 .24
Good 51-75 5.5-8.2 .17
Fair 26-50 8.2-16.6 .10
Poor 0-25 16.6-20+ .05

Condition---- Exc------- Good----- Fair------ Poor
Acres/AUM 4.1-5.5--- 5.5-8.2-- 8.2-16.6-- 16.6-20+
AUMs/Acre .24 -------.17 ------.10 -------.05

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, etc., stocking rate adjustments will be required.

Depending on climatic and condition, 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.

WILDLIFE INTERPRETATIONS:
Wildlife species associated with this site include desert cottontail, white-tailed jackrabbit, coyote, badger, American kestrel, turkey vulture, red-tailed hawk, ferruginous hawk, golden eagle, bald eagle and various song birds such as mourning dove, sage sparrow, sage thrasher, and Bewick's wren. There is seasonal use by mule deer and pronghorn. During sever winters these areas are critical winter range for mule deer.

Range use that encourages shrub growth will improve critical winter habitat for mule deer. This however may not coincide with maintaining or improving range condition. In general, all range practices that promote good range use and maintain or improve range condition will improve or maintain wildlife habitat for all species.

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

Begay A
Mivida A

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

This section is from the 1988 range site.

A few flowering plants are present during spring and fall. Hunting pronghorn, coyotes and rabbits along with bird watching provide limited opportunities for recreation. The deer generally have not migrated to this site by deer hunting season.

Wood products

This section is from the 1988 range site.

This site has no potential for growing wood products commercially. Living snow fences and windbreaks may be grown with supplemental irrigation water. Species to consider for these purposes are juniper, pinyon, and Russian olive.

Other information

This section is from the 1988 range site.

MAJOR POISONOUS PLANTS:
Broom snakeweed is poisonous to cattle and sheep. It is a cumulative poison. Selenium is the poisonous principle

and causes problems when growing on cretaceous or Eocene shales. Problems occur when forage is scarce and broom snakeweed makes up greater than 10% of the diet.

ENDANGERED PLANTS AND ANIMALS:
It is probable that bald eagles and peregrine falcons use this site for food hunting.

This site is generally grazed during the winter and spring. It lends itself to “low frequency” grazing systems. Care needs to be exercised to prevent year after year use during the spring. This can be very detrimental to range condition. This site is subject to severe wind erosion if the vegetative cover has been grazed excessively.

The site is in Montrose and Norwood Field Offices.

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Approval

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--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
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Date	03/09/2017
Approved by	Kirt Walstad
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%.

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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.

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3. **Number and height of erosional pedestals or terracettes:** Plants should show little or no pedestalling. Terracettes should be absent or few. 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.

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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.

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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.

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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.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place with some redistribution caused by water 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.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** This site should have a soil stability rating of 4 to 5 under vegetation canopies and a ratio of 2 to 3 in the interspaces. The average should be a 3. Vegetation cover, litter, biological soil crusts and surface rock reduce erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** The surface layer is fine sandy loams, 2 to 5 inches thick. The A horizon is weakly developed, but the A horizon would be expected to be more strongly developed under plant canopies. It is important if you are sampling to observe the A horizon under plant canopies as well as the interspaces. Refer to soil survey for more detailed information about your

specific site.

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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.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** These soils are not easily compacted. Many of the soils have a weak granular structure.

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

    Dominant: Perennial Grasses (Needle-and-thread, Indian ricegrass, squirreltail) > non-sprouting shrubs (Wyoming Big Sagebrush)>

    Sub-dominant: Spouting Shrubs (fourwing saltbush, winterfat) = forbs (scarlet globemallow, wooly plantain) = rhizomatous grasses (blue grama, thickspike wheatgrass, galleta)

    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.

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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.

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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, 800 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:** Cheatgrass, yellow rabbitbrush, 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 and snakeweed sprouts vigorously following fire.