Ecological site R034BY328CO
Semidesert Clay Loam

Last updated: 9/23/2020
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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 034B–Warm Central Desertic Basins and Plateaus

Semidesert Clay Loam ecological site is on benches and valley bottoms in MLRA 34B (Warm Central Desertic Basins and Plateaus). The site concept was established within the semidesert regions of MLRA 34B. This site receives 8 to 12 inches of precipitation and has a mesic temperature regime. The site has bimodal precipitation and supports dominantly Wyoming big sagebrush.

Classification relationships

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

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

M331HI-Divide and Plateau Creeks Uplands ≤ M331H North Central Highlands and Rocky Mountains ≤ M331 Southern Rocky Mountain Steppe-Open Woodland-Coniferous Forest-Alpine Meadow

M341Bb-Book Cliffs-Paradox Basin ≤ M341B Tavaputs Plateau ≤ M341 Nevada-Utah Mountains Semi-desert-Coniferous Forest-Alpine Meadow

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

Ecological site concept

This description of 34B Semidesert Clay Loam was drafted from the existing description of the Semidesert Clay Loam range site in MLRAs 34X, 35, and 48A (USDA-SCS, 1988). The existing description was written prior to mapping of other MLRAs in Colorado, and this area was in MLRA 34X when that description was written. This site is on alluvial fans, terraces, and fan terraces. The soils are moderately deep and deep, and they are clayey. They formed in alluvium and colluvium derived from calcareous shale, clayey shale, and shale and sandstone. The site supports a Wyoming big sagebrush community. It has an ustic bordering on aridic moisture regime and a mesic temperature regime. The effective precipitation ranges from 9 to 12 inches.

Associated sites

R034BY006UT	**Alkali Flat (Greasewood)** The characteristic soils of this site are very deep, contain salts (alkali), and are moderately well drained. The soils formed in alluvium derived mainly from sedimentary parent material. The site has slopes of 0 to 8 percent. The dominant vegetation is greasewood.
R034BY212UT	**Semidesert Loam (Wyoming Big Sagebrush)** The characteristic soils of this site are deep and well drained. They formed in alluvium and colluvium derived mainly from mixed sedimentary parent material. The soils generally are fine-loamy and have a surface layer of loam, fine sandy loam, or silty clay loam.

Similar sites

R034BY212UT	**Semidesert Loam (Wyoming Big Sagebrush)** The characteristic soils of this site are deep and well drained. They formed in alluvium and colluvium derived mainly from mixed sedimentary parent material. The soils generally are fine-loamy and have a surface layer of loam, fine sandy loam, or silty clay loam.
R034BY216UT	**Semidesert Sandy Loam (Fourwing Saltbush)** The characteristic soils of this site are deep and well drained. They formed in mixed alluvium and windblown deposits derived mainly from sandstone. The soils generally are coarse-loamy and have a surface layer of sandy loam.
R034BY244UT	**Semidesert Stony Loam (Salina Wildrye)** The characteristic soils of this site are 20 to 40 inches deep over gypsiferous shale, and they are moderately well drained. They formed in alluvium over residuum derived mainly from sandstone and shale. The soils commonly have a surface layer of cobbly fine sandy loam. Silty clay loam and silty clay extend to a depth of 20 to 40 inches.

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 is on alluvial fans, terraces, and fan terraces. Slopes range from 1 to 12 percent. The site is on all exposures. Elevation ranges from 5,000 to 6,600 feet above sea level.

Table 2. Representative physiographic features

Landforms	(1) Alluvial fan (2) Terrace
Flooding frequency	None
Ponding frequency	None
Elevation	1,524–2,012 m
Slope	1–12%
Aspect	Aspect is not a significant factor

Climatic features

The average annual precipitation is about 8 to 12 inches. This area is located where winter precipitation and summer monsoonal rains meet. Of the yearly precipitation, 45 to 50 percent occurs as snow and 50 to 55 percent occurs as rain. Snow usually falls in November through March, and rain falls from April 1 through October 31. The driest periods are usually December through February and in June. Plant growth begins late in March and early in April. The dormancy period for cool-season plants starts in June. Summer thundershowers are common in July through September. The summer moisture favors the growth of warm-season plants. When rain is received late in summer and in fall, the growth of warm-season plants accelerates and some regrowth of cool-season species occurs. Shrub species continue to grow through the entire growing season.

The average annual total snowfall is 14.0 inches. The highest winter snowfall on record is 55.4 inches, which occurred in the 1915-1916 winter. The lowest snowfall on record is 0 inches, which occurred in the 1933-1934 and 1966-1967 winters. The highest yearly precipitation on record is 19.37 inches, which occurred in 1983, and the lowest is 4.68 inches, which occurred in 1956. The average daily annual air temperature is 54 degrees F. The daily air temperature averages about 32 degrees F in winter and 64 degrees F during the growing season, March through October. Summer temperatures of 100 degrees F or more are common. The frost-free period typically ranges from 160 to 200 days at Palisade, Colorado. The last frost in spring occurs between the first part of April and the end of April. The first frost in fall occurs between the end of September and the end of October. The coldest winter temperature on record is -23 degrees F, which occurred on January 1, 1913, and the coldest summer temperature on record is 33 degrees F, which occurred on August 23, 1934. The hottest day on record is 111 degrees F, which occurred on July 5, 1937. Wide yearly and seasonal fluctuations are common for this climatic zone. Data are from the Western Regional Climate Center (2018) for the Palisade, Colorado, climate station.

Table 3. Representative climatic features

Frost-free period (average)	113 days
Freeze-free period (average)	147 days
Precipitation total (average)	279 mm

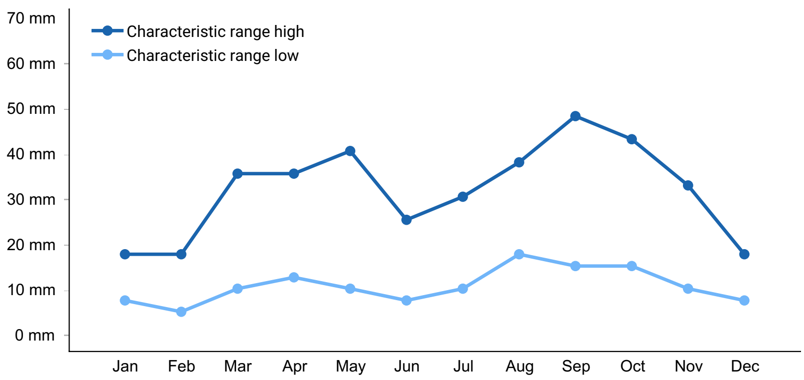


Figure 1. Monthly precipitation range

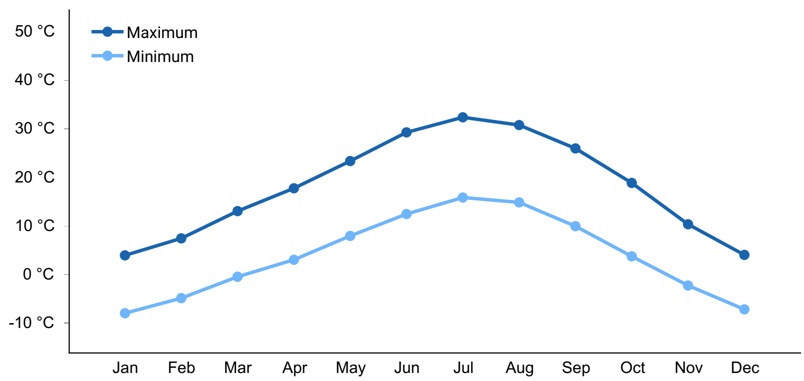


Figure 2. Monthly average minimum and maximum temperature

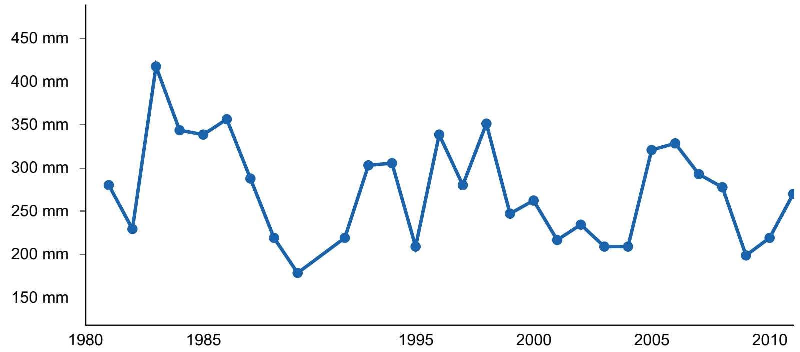


Figure 3. Annual precipitation pattern

Climate stations used

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

Influencing water features

None

Soil features

This site is on alluvial fans, terraces, and fan terraces. The soils of the site are fine and deep (60 inches or more). They formed in alluvium derived from clayey Mancos shale, Wasatch interbedded alluvium or residuum derived from sandstone and shale, or Wasatch alluvium or residuum derived from shale. The surface layer is 27 to 37 percent clay and commonly is 3 to 7 inches thick. The subsoil at a depth of 20 inches is 40 to 50 percent clay and is silty clay loam, clay loam, clay, or silty clay.

Runoff and the hazard of water erosion are high. Permeability is slow, but the available water capacity is moderate. The soils are well drained.

Dominguez soils in the soil survey areas of CO680 (Mesa County), CO682 (Douglas Plateau Area), and CO660 (Grand Mesa-West Elks Area) are correlated to this site.

Table 4. Representative soil features

Parent material	(1) Alluvium–clayey shale (2) Alluvium–sandstone and shale (3) Residuum–sandstone and shale
Surface texture	(1) Clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Slow
Soil depth	152 cm
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0%
Available water capacity (Depth not specified)	15.75–20.32 cm
Calcium carbonate equivalent (Depth not specified)	0–10%
Electrical conductivity (Depth not specified)	0–4 mmhos/cm

Sodium adsorption ratio (Depth not specified)	0
Soil reaction (1:1 water) (Depth not specified)	7.9–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–5%
Subsurface fragment volume >3" (Depth not specified)	0%

Ecological dynamics

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

The precipitation pattern on this part of the Colorado Plateau is winter-summer bimodal. This means that this site developed under climatic conditions of wet, cold winters and hot, dry summers with summer rains. This area has climatic fluctuations, and prolonged droughts are common. Between a year with above-average precipitation and a drought year, forbs are the most dynamic (Passey et al., 1982) and production can vary up to fourfold. The precipitation and climate of MLRA 34B are conducive to producing pinyon/juniper and sagebrush complexes with highly productive sites at the bottom of the canyons. Dominant species on the Colorado Plateau are Wyoming big sagebrush (*Artemisia tridentata* var. wyomingensis), mountain big sagebrush (*A. tridentata* var. vaseyana), 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 34B, particularly fire. Wyoming big sagebrush typically is the dominant plant species; however, perennial grasses generally become dominant after a burn. Wyoming big sagebrush will begin to re-establish in the community within 2 to 10 years following a fire if a seed source is available and precipitation is average (Johnson and Payne, 1968). It may take more than 10 years for big sagebrush to re-establish under unfavorable conditions (Howard, 1999). Invasive species, particularly cheatgrass, may reduce the resilience of this site after a wildfire or management disturbance. Other plants likely to invade the site are annual sunflower, annual mustards, sticktight, and Russian thistle. Any disturbance that reduces the vigor or restricts establishment of perennial plants will increase the likelihood that invasive annuals will establish in the understory (Boyle and Reeder, 2005).

Maintaining or increasing the vigor and establishment of perennial species through proper management helps to protect this site from annual invasive species, particularly cheatgrass. Areas proximal to roads or other seed vectors are at increased risk for invasion by non-native species (Davies and Sheley, 2007). Continuous, season-long grazing and heavy stocking rates may decrease the vigor and establishment of perennial grasses.

The following is from the 1988 range site description (USDA-SCS, 1988) (with edits):

Under climax conditions, the 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.

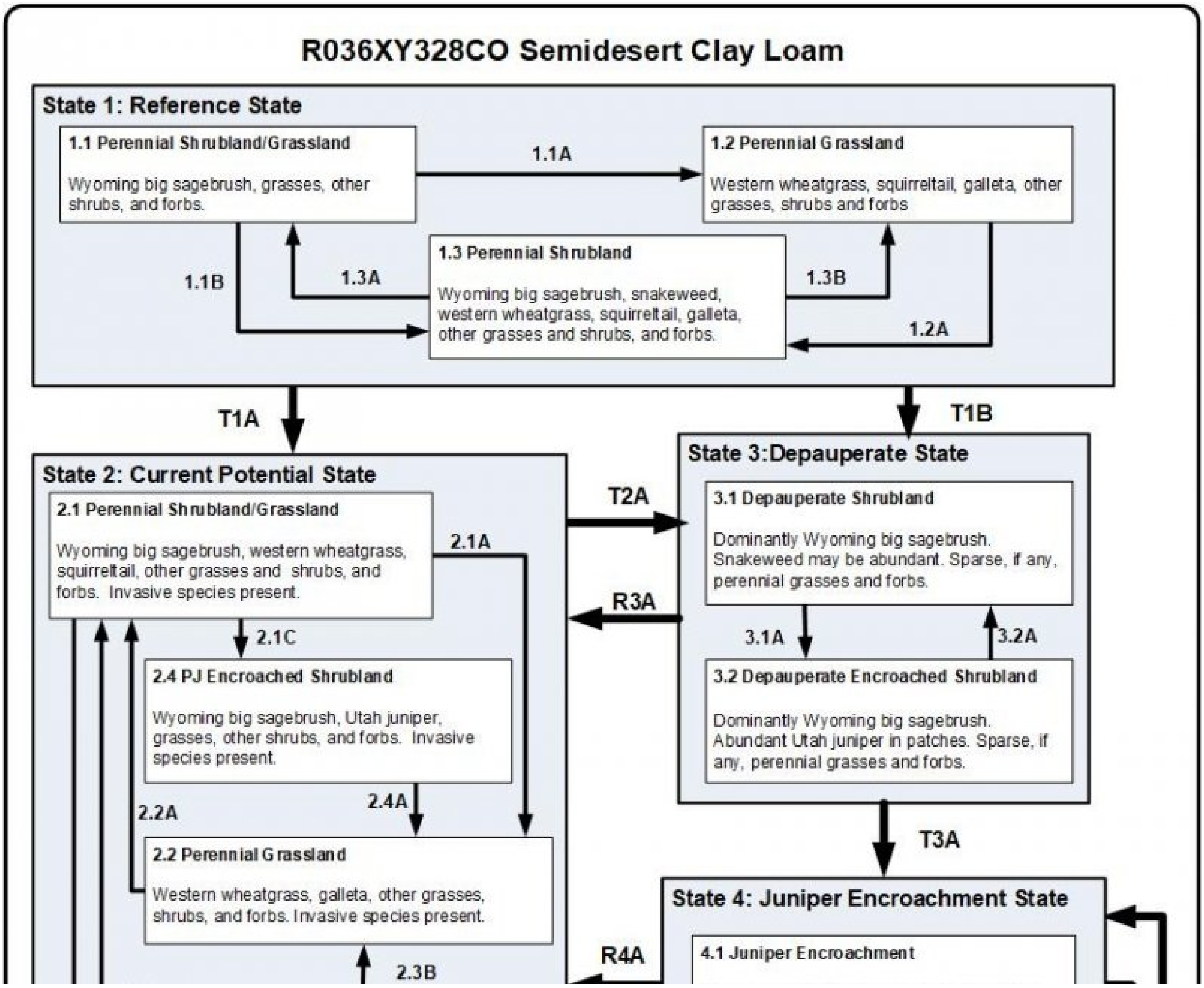
Major forbs in the plant community include fernleaf biscuitroot, foothill deathcamas, hollyleaf clover, sego lily, tapertip onion, and threadleaf groundsel. Shrubs include Wyoming big sagebrush, fourwing saltbush, and shadscale. Small amounts of prickly pear are in some areas.

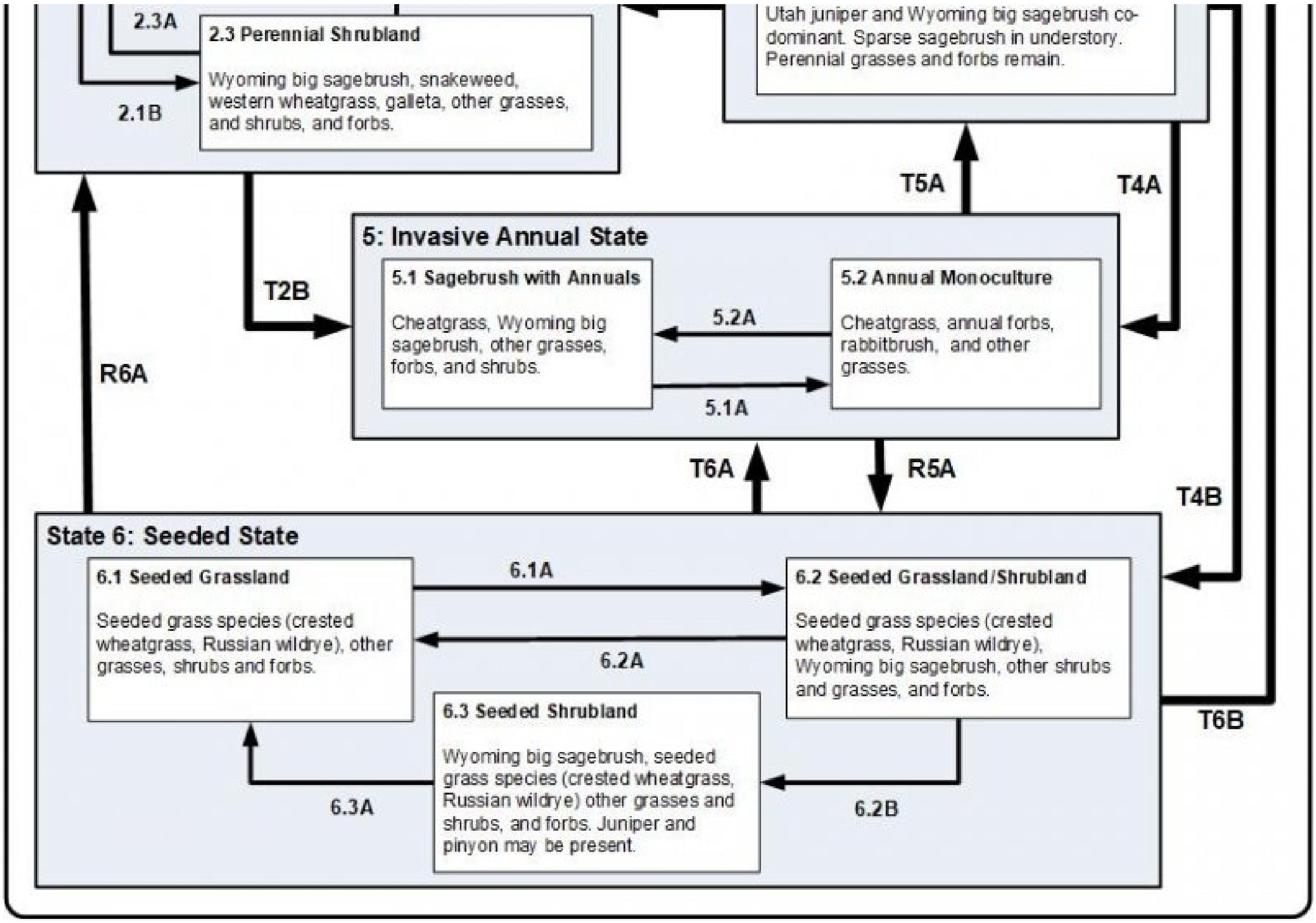
If ecological retrogression is induced by cattle, the desirable plants such as Indian ricegrass, muttongrass, Salina wildrye, and tapertip onion will decrease in abundance due to selective grazing in spring and summer. If retrogression is due to winter grazing by sheep, the abundance of fourwing saltbush and shadscale will decrease. Wyoming big sagebrush will have a hedged appearance as a result of extensive use in winter by sheep or deer.

Plants likely to invade the site and become a part of the plant community when the range is in a deteriorated condition are Russian thistle, kochia, cheatgrass, dandelion, black greasewood, wavyleaf thistle, Halogeton, bur buttercup, mustard, bulbous bluegrass, and Utah juniper. Production in severely deteriorated areas is reduced by 50 to 100 pounds per acre of available forage. In this condition, the plant community consists of a few shrubs and some invaded species.

Variability in climate, soils, aspect, and complex biological processes results in differing plant communities. Factors that contribute to variability in annual production include wildlife use, drought, and insects. Factors that contribute to variability in species include soil texture, soil depth, rock fragment content, slope, aspect, and micro-topography. The species lists are representative; they do not list all present or potential species on this site. They are not intended to cover the full range of conditions, species, and responses of the site. The state-and-transition model for this site is based on available research, field observations, and interpretations by experts, and it could change as knowledge increases. As more data are collected, some of the 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 shows the most common plant communities.

State and transition model





Legend

1.1A, 1.1B, 1.3B, 2.4A, 2.3A, 6.2A – Fire, insect herbivory, and/or drought
1.2A, 1.3A, 2.2A, 6.1A, 6.2B, – Lack of fire, time without disturbance and improper grazing of perennial grasses
T1A – Establishment of invasive species
T1B, T2A – Continuous grazing of perennial grasses
R3A – Brush removal and seeding
2.1C, T3A, 3.1A – Time without disturbance
3.2A – Brush removal
2.1A, 2.3B, 2.1B – Fire and brush removal
R4A, 6.3A – Fire, vegetation treatments, insect herbivory, drought, and/or tree encroachment removal
5.1A – Frequent fire, and/or drought
5.2A, T5B – Fire suppression and/or seeding
T5A – Treat invasive species, and seeding
R4A, T6B – Fire suppression, time without disturbance, insect herbivory, and tree encroachment
T4A, T6A – Invasive species establishment, frequent fire and/or long term drought
T4B – Seeding and removal of tree encroachment

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, an altered fire regime, introduction of non-native species, or other human disturbances. The reference state is dominantly Wyoming big sagebrush and perennial grasses. It is self-sustaining, which means it is resistant to natural disturbances and exhibits high resilience following natural disturbances (Briske et al., 2008). All community phases are at risk for establishment of non-native, invasive plants if a seed source and germination sites are available.

Community 1.1
Perennial Shrubland/Grassland

Perennial grasses are co-dominant with Wyoming big sagebrush and other shrubs in this community.

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**

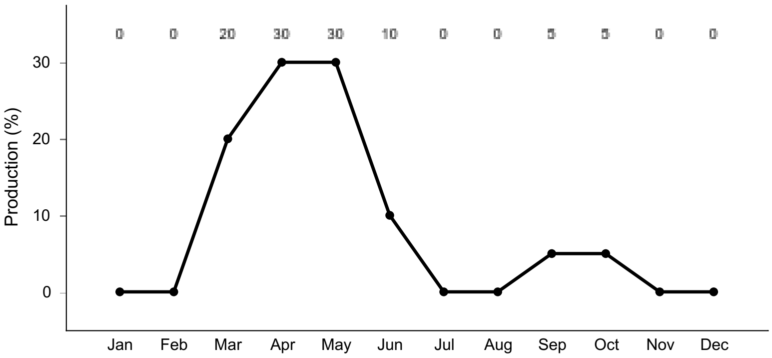


Figure 6. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Community 1.2
Perennial Grassland

This community is dominantly perennial native grasses, including western wheatgrass, squirreltail, galleta, and Salina wildrye.

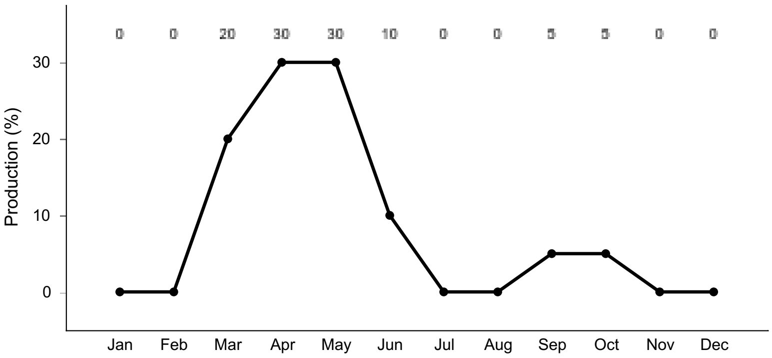


Figure 7. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Community 1.3
Perennial Shrubland

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

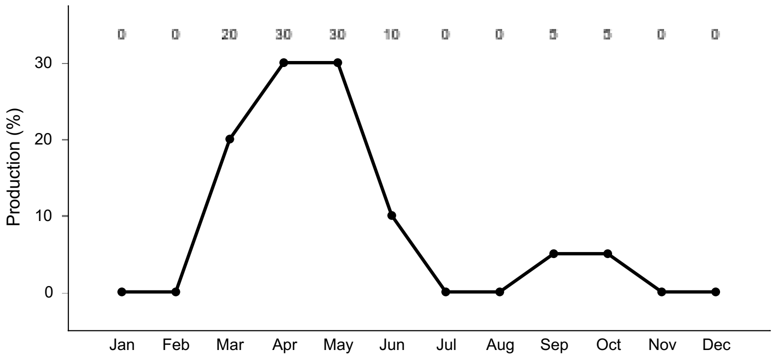


Figure 8. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Pathway 1.1A
Community 1.1 to 1.2

Fire removes Wyoming big sagebrush, and perennial bunchgrasses quickly recover and become dominant. The natural fire return interval is highly variable depending on the fuel levels and climate, but it is expected to be 10 to 70 years in Wyoming big sagebrush communities (Howard, 1999).

Pathway 1.1B
Community 1.1 to 1.3

Low-intensity fires, pathogens, and extended drought reduce the abundance of Wyoming big sagebrush (Winward, 2004). The natural fire return interval is widely variable depending on the fuel levels and climate, but it is expected to be 10 to 70 years in Wyoming big sagebrush communities (Howard, 1999). Perennial grasses and fourwing saltbush resprout, and the grasses become dominant.

Pathway 1.2A
Community 1.2 to 1.3

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

Pathway 1.3A
Community 1.3 to 1.1

Fire removes Wyoming big sagebrush, and perennial bunchgrasses quickly recover and become dominant. The natural fire return interval is highly variable depending on the fuel levels and climate, but it is expected to be 10 to 70 years (Howard, 1999) in Wyoming big sagebrush communities.

Pathway 1.3B
Community 1.3 to 1.2

Low-intensity fires, pathogens, and extended drought reduce the abundance of Wyoming big sagebrush (Winward, 2004). The natural fire return interval is widely variable depending on the fuel levels and climate, but it is expected to be 10 to 70 years in Wyoming big sagebrush communities (Howard, 1999). Perennial grasses and fourwing saltbush resprout, and the grasses become dominant.

State 2
Current Potential State

The current potential state is similar in structure and function to the reference state; however, invasive species are in all community phases of the current potential state. It generally is dominantly big sagebrush and perennial grasses, but it 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.

Community 2.1
Perennial Shrubland/Grassland

Perennial grasses are co-dominant with Wyoming big sagebrush and other shrubs in this community. Non-native species are present, but they are not dominant.

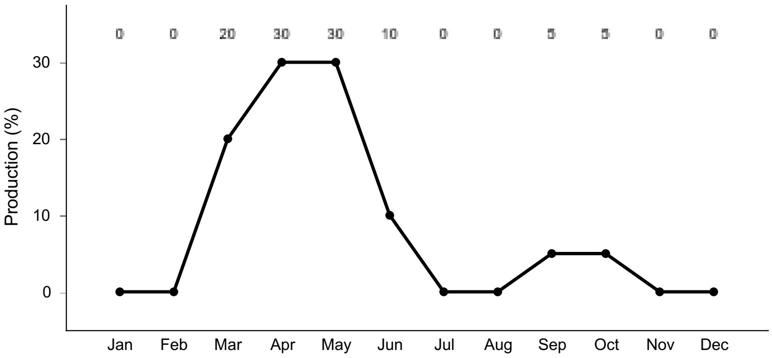


Figure 9. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Community 2.2
Perennial Grassland

Perennial native grasses are dominant in this community. Non-native species are present, but they are not dominant.

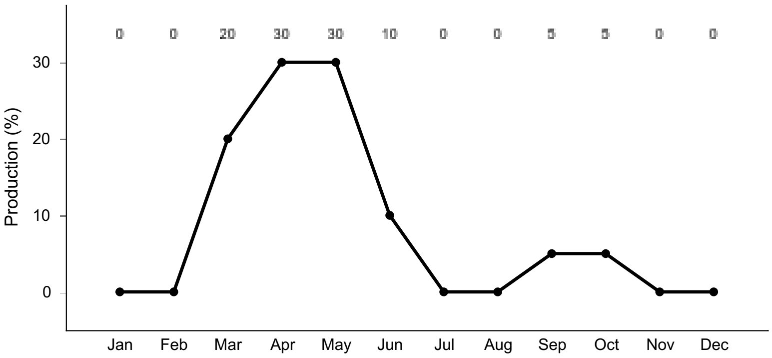


Figure 10. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Community 2.3
Perennial Shrubland

Wyoming big sagebrush is dominant in the perennial shrubland phase. Western wheatgrass, squirreltail, galleta, and Salina wildrye are dominant in 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 they are not dominant.

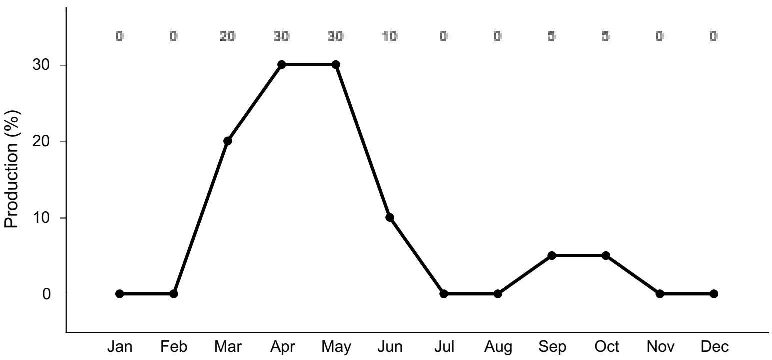


Figure 11. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Community 2.4
PJ Encroached Shrubland

This phase consists dominantly of Wyoming big sagebrush. Pinyon or Utah juniper may be dominant in patches, and many young trees are scattered throughout. The abundance of perennial grasses is limited, especially in areas where pinyon and juniper are dominant. The resilience of the site is affected by the increased availability of germination sites for non-native invasive species, especially following a burn.

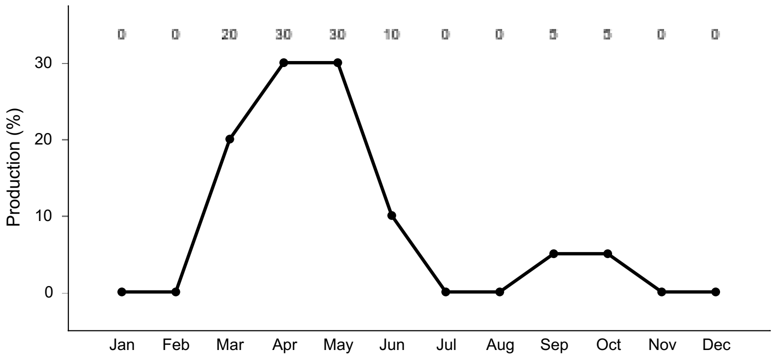


Figure 12. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Pathway 2.1A
Community 2.1 to 2.2

Fire removes Wyoming big sagebrush, and perennial bunchgrasses quickly recover and become dominant. The natural fire return interval is highly variable depending on the fuel levels and climate, but it is expected to be 10 to 70 years in Wyoming big sagebrush communities (Howard, 1999).

Pathway 2.1B
Community 2.1 to 2.3

Low-intensity fires, pathogens, and extended drought decrease the abundance of Wyoming big sagebrush (Winward, 2004). The natural fire return interval is widely variable depending on the fuel levels and climate, but it is expected to be 10 to 70 years in Wyoming big sagebrush communities (Howard, 1999). Perennial grasses and fourwing saltbush resprout, and the grasses become dominant.

Pathway 2.1C
Community 2.1 to 2.4

Extended periods without disturbance. The fire return interval commonly is more than 70 years.

Pathway 2.2A
Community 2.2 to 2.1

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

Pathway 2.3A
Community 2.3 to 2.1

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

Pathway 2.3B
Community 2.3 to 2.2

Fire removes Wyoming big sagebrush, and perennial bunchgrasses quickly recover and become dominant. The natural fire return interval is highly variable depending on the fuel levels and climate, but it is expected to be 10 to 70 years in Wyoming big sagebrush communities (Howard, 1999).

Pathway 2.4A
Community 2.4 to 2.2

Fire removes Wyoming big sagebrush, pinyon, and juniper. Perennial grasses resprout quickly and become dominant, except in patches where they were eliminated by a dominance of pinyon and juniper. These patches may be more susceptible to invasion by non-native species.

State 3
Depauperate State

This state is in areas where the native perennial grasses are removed by excessive grazing. The abundance of native forbs is also reduced. The fire return interval is increased due to a lack of fine fuels, which facilitates establishment of Utah juniper.

Community 3.1
Depauperate Shrubland

This community phase is the result of excessive grazing or other disturbances that remove perennial grasses and native forbs from the understory. Wyoming big sagebrush is dominant, and overall production is greatly reduced.

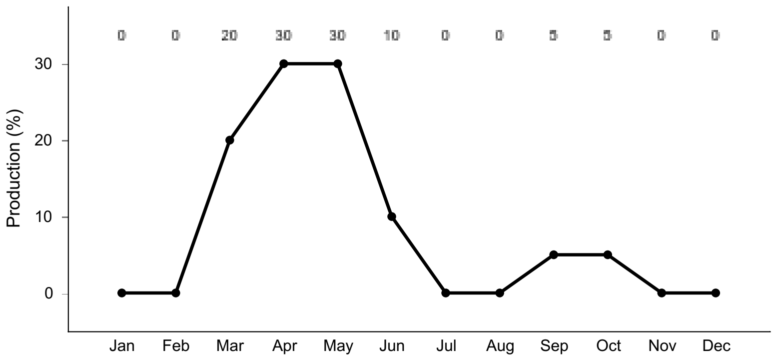


Figure 13. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Community 3.2
Depauperate Encroached Shrubland

This community phase is in areas where Utah juniper begins to become dominant in patches due to prolonged periods without fire or other shrub-controlling disturbances.

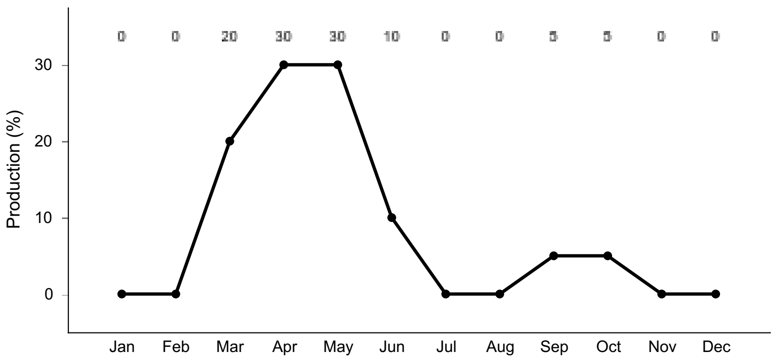


Figure 14. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Pathway 3.1A
Community 3.1 to 3.2

Prolonged periods without fire or other brush-controlling disturbances promote the establishment and dominance of Utah juniper in patches.

Pathway 3.2A
Community 3.2 to 3.1

Brush management can reduce the abundance of Utah juniper and help to return the site to community phase 3.1.

State 4
Juniper Encroachment State

This state occurs due to prolonged periods without fire or other brush-controlling disturbances. Utah juniper thrives in this ecological site in the absence of disturbance, and it eventually outcompetes Wyoming big sagebrush for water and nutrients. The result is a juniper-dominant state that has little, if any, Wyoming big sagebrush, perennial grasses, and forbs in the understory.

Community 4.1
Juniper Encroachment

This is the only community phase in the fire-resistant, self-perpetuating state that is dominantly Utah juniper.

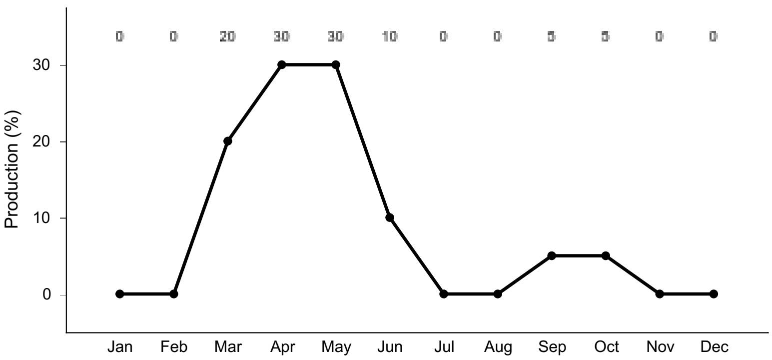


Figure 15. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

State 5
Invasive Annual State

This state is dominantly invasive annual species. These species include cheatgrass, Russian thistle, kochia, Halogeton, storksbill geranium, and annual mustards. Generally, annual forbs and grasses will invade the site as ecological conditions deteriorate and perennial vegetation decreases in abundance due to disturbances such as fire, overgrazing, drought, off-road vehicle use, and erosion. The presence of invasive annual species depends on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible.

Community 5.1
Sagebrush with Annuals

This community consists of Wyoming big sagebrush and an understory of invasive annual species. Commonly, the sagebrush canopy cover is dense because few, if any, perennial species are in the understory. Cheatgrass and other annual, introduced species are in the understory. This plant community is functional unless the fire return interval decreases to less than 5 years (Whisenant, 1986). Under those conditions, it will transition to an annual grasses phase (5.2). Community 5.1 is at risk for becoming cheatgrass(annual)-dominant grassland.

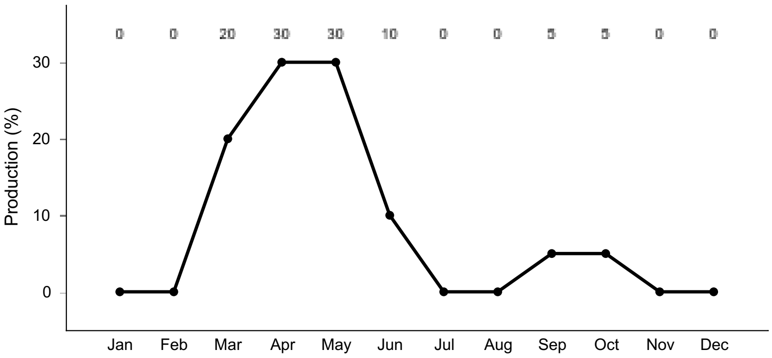


Figure 16. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Community 5.2
Annual Monoculture

This community is characterized by a nearly complete monoculture of cheatgrass and other invasive annuals. The community can last for long periods if fires and other disturbances are frequent.

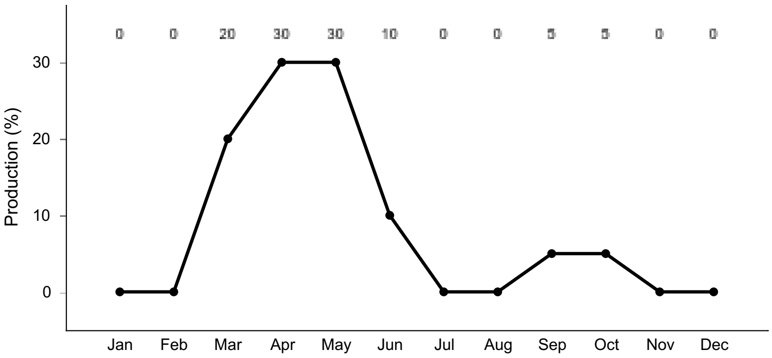


Figure 17. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Pathway 5.1A
Community 5.1 to 5.2

This pathway occurs when frequent fires or drought remove the Wyoming big sagebrush, which favors the establishment of cheatgrass or other invasive annuals. In a degraded sagebrush community, cheatgrass typically will establish in the interspaces between plants. Annuals create a fine fuel load, which decreases the fire return interval. Frequent fires can eliminate the sagebrush from the site, and a monoculture of invasive annuals can become established and persist for long periods. Frequent fires also prevent re-establishment of sagebrush.

Pathway 5.2A
Community 5.2 to 5.1

This pathway occurs when the fire return interval is increased by fire suppression and use of firebreaks. An increase in the fire return interval along with seeding and proper grazing may allow native perennial plants to re-establish in this community. This pathway requires intensive inputs of energy.

State 6
Seeded State

This state results from seeding introduced perennial grasses such as crested wheatgrass and Russian wildrye. Native perennial grasses, forbs, and shrubs may be included in the seed mix. This state has community dynamics similar to those of the current potential state. Other vegetation treatments may be needed, including chaining, mowing, disking, prescribed burning, and other techniques that manipulate the plant community. Under proper management, the seeded state could persist for long periods. Over time, native grasses and forbs may re-establish from nearby seed sources. Shrubs typically will re-establish within 30 to 40 years.

Community 6.1
Seeded Grassland

This community is dominantly seeded plants such as crested wheatgrass, Russian wildrye, smooth brome, and intermediate and pubescent wheatgrasses. Little, if any, Wyoming big sagebrush is produced in this phase. The production of the seeded plants is high. Typically, production is higher than in the current potential or reference state. This community commonly has a low diversity of species.

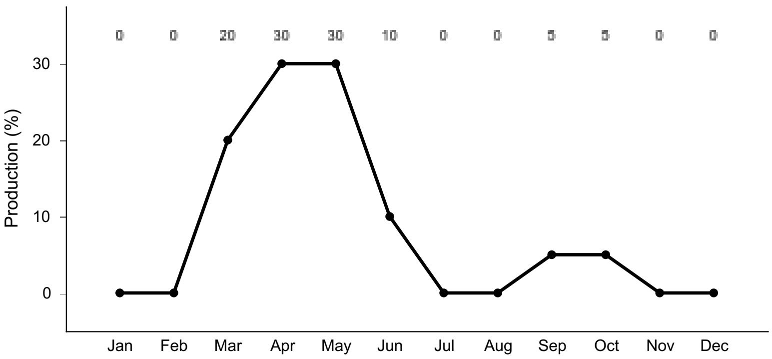


Figure 18. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Community 6.2
Seeded Grassland/Shrubland

Wyoming big sagebrush is co-dominant with seeded grass in this community.

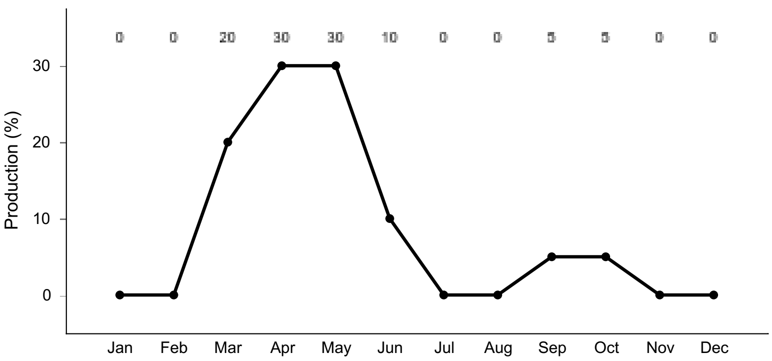


Figure 19. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Community 6.3
Seeded Shrubland

This community consists of Wyoming big sagebrush and a sparse understory. The sagebrush canopy cover typically is more than 35 percent. Scattered Utah juniper and two-needle pinyon may have encroached. These trees are natural invaders from stands adjacent to this site. The trees can form dense stands and eventually become dominant in the site. Non-native invasive species, such as cheatgrass, are present in small amounts. Biological crusts typically are well developed in the interspaces; however, bare ground is common in this community phase.

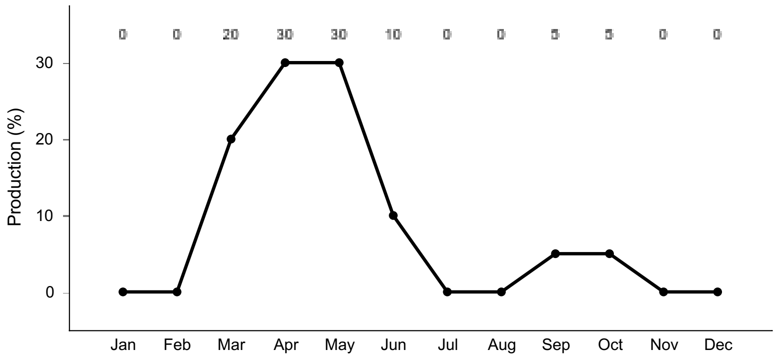


Figure 20. Plant community growth curve (percent production by month). CO0102, Semidesert Sites.

Pathway 6.1A
Community 6.1 to 6.2

Periods without disturbance and climatic conditions that favor establishment of sagebrush drive this pathway. Improper grazing of the grasses can favor shrub establishment and reduce the competitiveness of the grasses. Several consecutive years of drought also can reduce the grass cover.

Pathway 6.2A
Community 6.2 to 6.1

This transition is caused by naturally occurring fires, herbivory of sagebrush, and drought that suppresses sagebrush establishment. These events tend to favor grass establishment. In a mature sagebrush community, this pathway can be caused by high-intensity fires that remove Wyoming big sagebrush and encroaching pinyon and juniper. Low-intensity fires after sagebrush has set seed, improper grazing, browsing by native ungulates, and stem-root pathogens can cause a young sagebrush community to revert to grassland that has the potential to become a sagebrush-grass community again (Winward, 2004). Vegetation treatments such as mechanical or chemical treatment and prescribed fire can be used to imitate the natural disturbance regime.

Pathway 6.2B
Community 6.2 to 6.3

This pathway favors establishment of shrubs. It results from periods without disturbances such as fire and favorable conditions for establishment of young sagebrush. Pinyon and juniper will start to encroach under these conditions. Improper continuous grazing of perennial grasses accelerates this pathway and leads to a decadent stand of sagebrush and little, if any, understory.

Pathway 6.3A
Community 6.3 to 6.1

This pathway is caused by naturally occurring fires, chemical and mechanical treatment of vegetation, and insect herbivory that remove the shrubs and encroached trees. The pathway reverts the ecological system back to a grassland phase. Depending on the amount of understory present, it may be necessary to reseed grasses and forbs.

Transition T1A
State 1 to 2

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

Transition T1B
State 1 to 3

Continuous grazing of perennial species and lack of disturbance for a very long period.

Transition T2A
State 2 to 3

Continuous grazing of perennial species and lack of disturbance for a very long period.

Transition T2B
State 2 to 5

This transition is from a state that is dominantly Wyoming big sagebrush to one that is dominantly invasive species. Events include establishment of invasive species; fire (return interval of less than 5 to 20 years); continuous, season-long grazing of perennial grasses; and long-term drought.

Restoration pathway R3A
State 3 to 2

Brush management and seeding of 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 disturbances have been absent from the site at least 150 years. Sagebrush becomes decadent, and Utah juniper outcompetes all species for water and other resources.

Restoration pathway R4A
State 4 to 2

Pathway drivers include brush treatment, seeding, insect herbivory or pathogen, proper grazing, drought, and fire. This pathway requires an extensive input of energy.

Transition T4A
State 4 to 5

This transition is from a state that is dominantly Wyoming big sagebrush to a state that is dominantly invasive species. Drivers include establishment of invasive species; fire (return interval of less than 5 to 20 years); continuous, season-long grazing of perennial grasses; and long-term drought.

Transition T4B
State 4 to 6

Seeding of introduced or native species (grasses and forbs) is the pathway to state 4. Trees commonly are removed by mechanical or chemical treatments. This transition requires an input of energy.

Transition T5A
State 5 to 4

This transition requires lengthening the fire return interval. Fire suppression may be needed to interrupt the fire return interval, which has been shortened by the invasion of cheatgrass and other annuals. Juniper will encroach onto the site during periods without fire. Seeding may be needed to establish perennial plants. This transition may require a significant input of energy.

Restoration pathway R5A
State 5 to 6

Treatment and suppression of invasive annuals is needed to allow desired seeded species to complete and become established. Seeding of introduced species is the pathway to state 4. This transition is difficult; it requires a substantial input of energy and management. It may not be practical on a large scale.

Restoration pathway R6A
State 6 to 2

A long period without disturbance could result in this return pathway. Native plants from adjacent sites would slowly become established in the seeded state. Proper grazing by livestock and wildlife would favor the establishment of native plants. Removal of encroached Utah juniper and pinyon would be necessary.

Transition T6B
State 6 to 4

This transition is from a state consisting of big sagebrush and seeded grass to a state that is dominantly 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 the density of the canopy increases, the amount of bare ground will increase. This will increase the fire return interval, accelerate erosion, increase runoff, and further affect the functionality of the watershed. This transition 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 dominantly invasive species. Events include increased invasive species, a shortened fire return interval, and long-term drought. Improper continuous, season-long grazing of perennial grasses can decrease the time needed for this transition.

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	
	squirreltail	ELEL5	*Elymus elymoides*	56–112	–
	saline wildrye	LESA4	*Leymus salinus*	56–112	–
	western wheatgrass	PASM	*Pascopyrum smithii*	56–112	–
	James' galleta	PLJA	*Pleuraphis jamesii*	56–112	–
	Sandberg bluegrass	POSE	*Poa secunda*	28–112	–
	Grass, perennial	2GP	*Grass, perennial*	28–112	–
	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 is from the 1988 range site description (with edits)—

Grazing Interpretations:
Most of this site is in poor condition and has limited value for grazing by domestic livestock. When the site is in excellent condition, it can be valuable for grazing in fall, winter, and spring. Rotate grazing so each area is rested every 3 or 4 years. Most of the native species are palatable and nutritious. This site is accessible to livestock; however, the distance to water may create problems with grazing distribution. In areas that have enough grass to respond to brush management, Wyoming big sagebrush can be controlled. A good grass cover is needed to prevent excessive erosion. In areas that are in poor condition, seeding may be a more practical alternative to many years of deferment. Species to consider for seeding include western wheatgrass and Indian ricegrass. Fourwing saltbush is a desirable addition to the mix for domestic livestock and wildlife.

Stocking rates given below are based on continuous use for the entire growing season, and they are intended for use only as an initial guide. Forage needs are calculated on the basis of 900 pounds of air-dry forage per animal unit month (AUM). To maintain proper use and allow for forage that is unavailable due to trampling, small herbivore use, and 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 for proper use. Adjustments are required due to use of specialized grazing systems, use by large livestock breeds and uncontrolled big game herbivores, inaccessibility, dormant season use, and presence of introduced species. Some areas in fair and poor condition cannot be grazed due to low production caused by previous overgrazing. Stocking rates can vary widely, especially in areas of fair or poor condition.

Depending on climatic conditions, palatable annuals such as cheatgrass may produce large amounts of forage that is available for a short period in some years. Intensive grazing in these areas followed by deferment is an excellent management tool for using these annuals but also allowing for recovery of the perennial vegetation normally associated with the site.

Poisonous Plants:
Greasewood is poisonous in spring. Cattle and sheep are affected.
Effects and symptoms.—Poisoning is acute. Early signs of poisoning (4 to 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 and shallow breathing, and coma. Cattle may die after eating 3.0 to 3.5 pounds in a short period. Sheep may die after consuming 2 pounds of green leaves and fine stems in a short period without consuming 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 within 9 to 11 hours. Early signs are dullness, loss of appetite, lowering of the head, and reluctance to follow the band. Advanced signs are drooling with white or reddish froth about the mouth, progressive weakening, inability to stand, rapid and shallow breathing, and coma followed by a violent struggle for air. Sheep can tolerate small amounts when eaten with other forage. About 0.75 pounds will kill sheep that have been without feed for a day. About 1.1 pounds will kill sheep that have been feeding on other forage.

Foothills deathcamas mostly affects sheep, but it can also affect cattle and horses. The type of poison is various alkaloids, and it 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 to obtain maximum benefits to the vegetation for domestic livestock and wildlife use.

Wildlife Interpretations:
This site provides important winter range for mule deer and elk. Other species commonly in the site 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. Chukar and bobcat may also be in this site.

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

Hydrological functions

Soils originally were 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 in a specific climatic region will have a similar runoff response if the depth to a restrictive layer or water table, the transmission rate of water, texture, structure, and the degree of swelling when saturated are similar. Four hydrologic soil groups are recognized (A, B, C, and D). For specific definitions of each group, see the National Engineering Handbook, Chapter 7, Part 630, Hydrology (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 maximum yearly wetness (thoroughly wet),
—unfrozen soil,
—bare soil surface, and
—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 that has 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 the hydrologic cover conditions and hydrologic soil groups.

Hydrologic Soil Groups

Dominguez series—Group 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 mainly 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 mainly 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 mainly of clays that have a high potential for shrinking and swelling, 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

Recreational uses

The following section is from the 1988 range site description (with edits)—

This site is in the very warm area just above the saltdesert sites and below the foothill and mountain sites; therefore, it commonly is not used for recreation. Some limited hunting of small game may be available, but the site generally is too low in elevation for big game hunting due to migration patterns during the hunting season.

Wood products

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

Type locality

Location 1: Garfield County, CO	
Township/Range/Section	T85N R97W S7
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. Colorado Division of Wildlife. Grand Junction, Colorado.

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.

Cartledge, T.R., and J.G. Propper. 1993. Pinon-Juniper ecosystems through time: Information and insights from the past. In General Technical Report RM-236—Managing Pinon-Juniper Ecosystems for Sustainability and Social Needs.

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

Cleland, D.T.; J.A. Freeouf; J.E. Keys, Jr.; G.J. Nowacki; C. Carpenter; and W.H. McNab. 2007. Ecological subregions: Sections and subsections of the conterminous United States. Map scale 1:3,500,000. A.M. Sloan, cartographer. U.S. Department of Agriculture, Forest Service, General Technical Report WO-76. Washington, D.C.

Davies, K. W. and R.L. Sheley. 2007. A Conceptual Framework for Preventing Dispersal of Invasive Plants. Weed Science 55:178-184.

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

Howard, Janet L. 1999. *Artemisia tridentata* subsp. wyomingensis. In Fire Effects Information System. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Available at https://www.feis-crs.org/feis/. Accessed February 21, 2012.

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

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

Passey, H.B., W.K. Hugie, E.W. Williams, and D.E. Ball. 1982. Relationships between soil, plant community, and climate on rangelands of the Intermountain west. U.S. Department of Agriculture, Soil Conservation Service, Technical Bulletin No. 1669.

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

United States Department of Agriculture, Natural Resources Conservation Service. National Engineering Handbook. Available at https://www.nrcs.usda.gov/wps/portal/nrcs/detail//?cid=nrcs141p2_024573. Accessed

February 25, 2008.

United States Department of Agriculture, Natural Resources Conservation Service. Web Soil Survey. Available at http://websoilsurvey.nrcs.usda.gov/. Accessed February 2, 2017.

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

United States Department of Agriculture, Natural Resources Conservation Service, Grazing Lands Technology Institute. 2003. National Range and Pasture Handbook. Revision 1.

United States Department of Agriculture, Soil Conservation Service. 1988. Range site description for Semidesert Clay Loam (328). Denver, Colorado.

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

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

Whisenant, S.G. 1986. Herbicide use in Artemisia and Chrysothamnus communities: Reducing damage to non-target species. In Proceedings - Symposium on the Biology of Artemisia and Chrysothamnus. E.D. McArthur and B.L. Welch, compilers. U.S. Department of Agriculture, Forest Service, General Technical Report INT-200. Pages 115-121. Ogden, Utah.

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

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Approval

Scott Woodall, 9/23/2020

Acknowledgments

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Those involved in developing earlier versions of this site description include Bob Rayer, retired NRCS soil scientist, and Herman Garcia, retired State rangeland management specialist and MLRA ecological site specialist (quality assurance).

Site Development and Testing:
Future work is needed to validate and further refine the information in this provisional ecological site description (pESD). This will include field activities to collect low-, medium-, and high-intensity samples, soil correlation, and analysis of data.

Additional information and data are required to refine the plant production and annual production data in the tables for this ecological site. The extent of MLRA 36 requires further investigated.

Field testing of the information in this pESD is required. As this pESD progresses to the approved level, reviews will be conducted by the technical team, quality control and quality assurance staff, and peers.

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	05/18/2018
Approved by	Scott Woodall
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** None or few. Any rills present are somewhat short (less than 6 feet long) and very shallow, which follows the surface microfeatures. An increase in rill formation may occur after disturbances such as recent fires or thunderstorms in adjacent areas where increased runoff may accumulate (such as areas adjacent to exposed bedrock). Rill development commonly is limited to slopes of more than 20 percent.

2. **Presence of water flow patterns:** Water flow patterns wind around the base of perennial plants and exhibit little or slight evidence of erosion. They are short, stable, and usually disconnected. There is minor evidence of deposition. In gently sloping areas (less than 10 percent slopes) of the site, visible water flow patterns are infrequent and usually less than 3 feet long. Longer water flow patterns may be on the steeper slopes (more than 20 percent). Numerous small debris dams may be seen after rainfall.

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 are on the steeper slopes (more than 20 percent) and usually are associated with water flow patterns. Loss of plant cover can result in formation of a well-developed biological crust on the soil. The interspaces between areas that have a crust 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):** Commonly, 15 to 30 percent of the ground is bare. Ground cover is based on the first raindrop impact,

and bare ground is the opposite of ground cover. Areas that have a well-developed biological crust on the soil should not be recorded as bare ground. Areas that have a poorly developed biological crust that is interpreted as functioning similar to bare ground (susceptible to raindrop splash erosion) should be recorded as bare ground. Extended drought can increase the extent of bare ground.

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5. **Number of gullies and erosion associated with gullies:** None or few. Some gullies may be in areas where runoff may accumulate (such as adjacent to exposed bedrock). Gully development is expected to be limited to slopes of more than 20 percent and adjacent to sites where runoff accumulates. The gullies should show little sign of accelerated erosion and should be stabilized by 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 rare.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter resides in place, but some redistribution is caused by water movement. Minor removal of litter may occur in flow patterns and rills, and deposition occurs at points of obstruction. A majority of the litter accumulates at the base of plants. Some grass leaves and small twigs (grass stems) may accumulate in depressions of the soil 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):** The surface layer of the soils is silty clay loam, clay loam, or loam. The hazard of water erosion is slight or moderate. The soils have a 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 of the soils is silty clay loam, clay loam, or loam and is 2 to 7 inches thick. Refer to the soil survey for more detailed information about a 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 crusts on the soil will limit the impact of raindrops and splash erosion. Spatial distribution of vascular plants and interspaces between areas of biological crust provide detention storage and surface roughness, which slow runoff and allow time for infiltration. The interspaces between plants and areas of biological crust may serve as water flow patterns during episodic runoff events, and natural erosion is expected in severe storms. When the abundance of perennial grasses decreases, which increases the amount of bare ground, runoff is expected to increase and associated infiltration decrease.

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

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

Dominant: 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). 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 on departures from average growing conditions. Disturbance regime includes drought, insects, and fire. Assumed fire cycle of 50 to 70 years or more. Following a recent disturbance, such as fire or drought, that removes the woody vegetation, forbs and perennial grasses (herbaceous species) may become dominant in the community. If a disturbance has not occurred for an extended period, woody species may continue to increase and crowd out the perennial herbaceous species in the understory. 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 or above-average growing conditions, and age class expression likely is 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. More decadence of bunchgrasses is expected with a 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 to 20 percent. Variability may occur due to weather. Litter cover declines during and following a drought because the plants are not producing litter.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 500 pounds per acre in low precipitation years, 700 pounds in average precipitation years, and 1,000 pounds in above-average precipitation years. After extended drought or during the first growing season after a wildfire, production may be significantly reduced by 200 to 400 pounds per acre.

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

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