United States Department of Agriculture
Natural Resources Conservation Service
Ecological Site Description

Section I: Ecological Site Characteristics

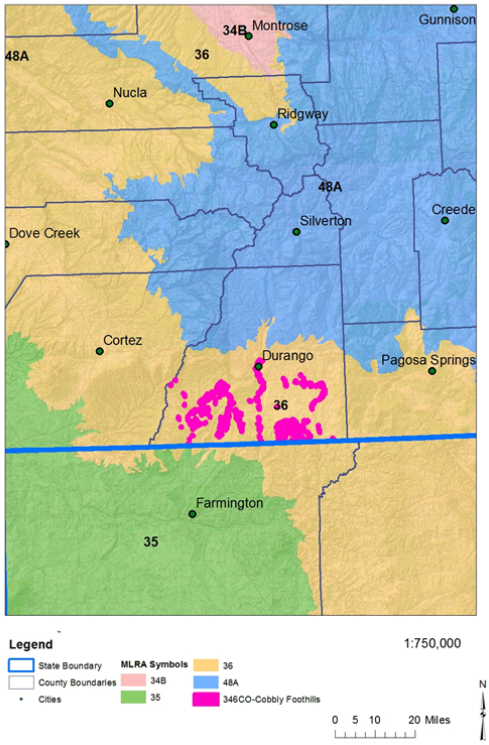
Ecological Site Identification and Concept

Site stage: **Provisional**

Provisional: an ESD at the provisional status represents the lowest tier of documentation that is releasable to the public. It contains a grouping of soil units that respond similarly to ecological processes. The ESD contains 1) enough information to distinguish it from similar and associated ecological sites and 2) a draft state and transition model capturing the ecological processes and vegetative states and community phases as they are currently conceptualized. The provisional ESD has undergone both quality control and quality assurance protocols. It is expected that the provisional ESD will continue refinement towards an approved status.

Site name: **Cobbly Foothills**
Pinus edulis - Juniperus osteosperma / Artemisia tridentata - Cercocarpus montanus / Pascopyrum smithii - Achnatherum hymenoides
(twoneedle pinyon - Utah juniper / big sagebrush - alderleaf mountain mahogany / western wheatgrass - Indian ricegrass)
Site type: Rangeland
Site ID: R036XY346CO
Major land resource area (MLRA): 036-Southwestern Plateaus, Mesas, and Foothills

Cobbly Foothills



Location Map

Cobbly Foothills ecological site is found on generally nearly level to undulating mesas, ridge tops, old terraces, and slope breaks 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 Foothill/Upland regions. This zone is 12 to 16 inches of precipitation and has a mesic temperature regime. This site has bimodal precipitation that is dominated by big sagebrush, and scattered pinyon and juniper.

Ecological Site Concept

The 36X Cobbly Foothills ecological site was drafted from the existing Cobbly Foothills Range Site 39 (NRCS, April, 1986). This site was written prior to MLRA 36 being recognized in Colorado and this area was called MLRA 39 when it was written. This site occurs on generally nearly level to undulating mesas, ridge tops, old terraces, and slope breaks. The soils surface is cobbly loam or gravelly loam textures. Soils are derived from cobbly alluvium and/or glacial outwash derived from mixed sources, cobbly, glacial outwash and/or alluvium, alluvium and/or cobbly outwash and/slope alluvium derived from mixed sources, mainly Pliocene outwash. It is a Sagebrush community with scattered Pinyon and Utah Juniper. It has an aridic ustic moisture regime and mesic temperature regime. The effective precipitation ranges from 12 to 16 inches.

Physiographic Features

The topography of this site is generally nearly level to undulating mesas, ridge tops, old terraces, and slope breaks. It is dissected by canyons and draws in some places forming a dendritic drainage pattern. Slopes range between 0 and 20 percent. Slopes do not have a significant influence on plant growth, however, aspect may play an important role in plant diversity. Elevation ranges from 6000 to 7500 feet.

Landform: (1) Mesa
(2) Terrace
(3) Ridge

	Minimum	Maximum
Elevation (feet):	6000	7500
Slope (percent):	0	20
Water table depth (inches):	60	60
Flooding		
Frequency:	None	None
Ponding		
Frequency:	None	None
Runoff class:	Low	Medium

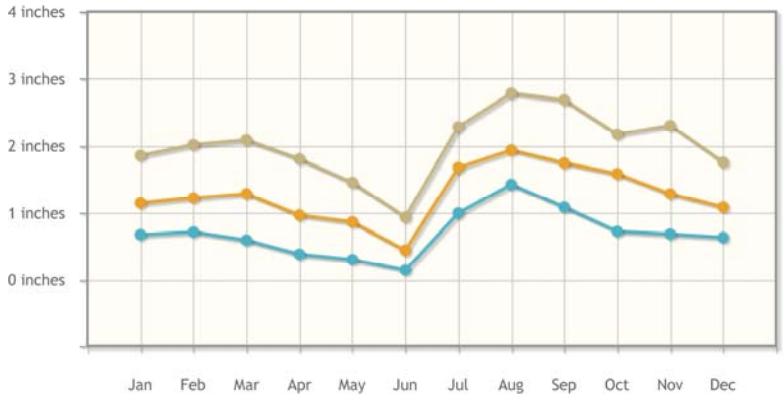
Climatic Features

Average annual precipitation is about 15 to 18 inches. Of this, approximately 45-50% falls as snow, and 50-60% falls as rain between April 1 and November 1. Summer moisture is mostly from thundershowers in July, August, September, and October. The driest period is usually from May to June; and June is normally the driest month. There is fall growth from late summer rains on this site during July, August and September, usually from the warm season plants. The average annual total snowfall is 80 inches. The snow depth usually ranges from 1 to 8 inches. The highest winter snowfall record in this area is 152 inches which occurred in 1972-1973. The lowest snowfall record is 30.5 inches during the 1966-1967 winter. The frost-free period typically ranges from 135 to 165 days. The last spring frost is the first of May to the end of May. The first fall frost is the end of September to the end of October. Mean daily annual air temperature is about 37ºF to 62ºF, averaging about 31ºF for the winter and 69ºF in the summer. Summer temperatures of mid-90ºF to low 100ºF are not unusual. The coldest winter temperature recorded was -20ºF on January 13, 1963 and the warmest winter temperature recorded was 68ºF on February 4, 19343. The coldest summer temperature recorded was 27ºF on June 5, 1999. The hottest day on record is 102ºF on July 24, 1936. Wide yearly and seasonal fluctuations are common for this climatic zone. Data taken from Western Regional Climate Center (2017) for Mesa Verde National Park, Colorado Climate Station. Most Climate station in this LRU (Land Resource Unit) are high end (17 to 18") of the precipitation range.

	Averaged
Frost-free period (days):	105
Freeze-free period (days):	134
Mean annual precipitation (inches):	17.96

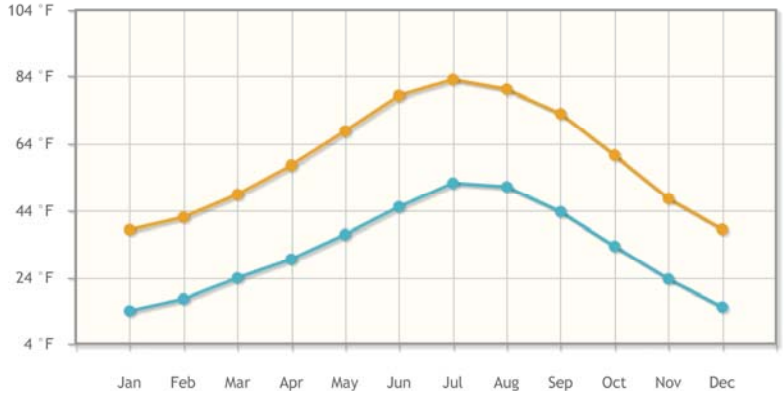
Monthly Precipitation (Inches):

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	1.86	2.02	2.09	1.81	1.46	0.94	2.29	2.79	2.69	2.18	2.31	1.76
Medium	1.15	1.23	1.29	0.97	0.87	0.45	1.68	1.94	1.75	1.59	1.29	1.09
Low	0.68	0.72	0.60	0.39	0.31	0.15	1.00	1.43	1.09	0.73	0.69	0.64



Monthly Temperature (°F):

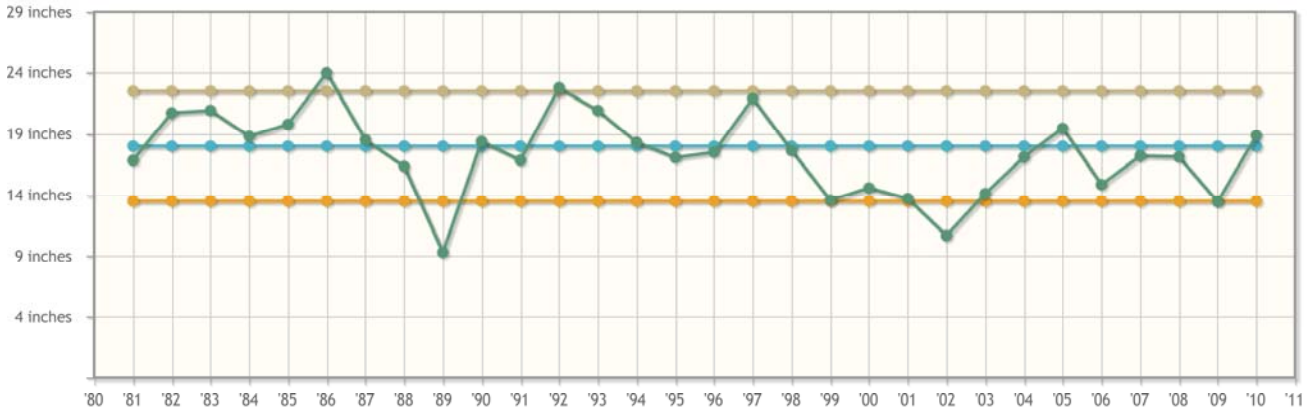
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
High	39.2	42.9	49.7	58.4	68.6	79.2	83.9	81.0	73.8	61.4	48.5	39.3
Low	14.8	18.4	24.7	30.4	37.8	46.0	53.1	52.0	44.5	34.3	24.4	16.0



30 Year Annual Rainfall (inches):

1981 N	1982 N	1983 N	1984 N	1985 N	1986 H	1987 N	1988 N	1989 D	1990 N	1991 N	1992 H	1993 N	1994 N	1995 N
16.82	20.71	20.91	18.79	19.77	23.95	18.5	16.33	9.31	18.37	16.83	22.75	20.9	18.29	17.05
1996 N	1997 N	1998 N	1999 N	2000 N	2001 N	2002 D	2003 N	2004 N	2005 N	2006 N	2007 N	2008 N	2009 D	2010 N
17.48	21.88	17.62	13.56	14.57	13.7	10.66	14.1	17.1	19.44	14.84	17.19	17.11	13.43	18.84

D-Drought N-Normal H-Heavy



Climate stations: (1) FT LEWIS [USC00053016], La Plata County CO 81326. Period of record 1981-2010
(2) MANCOS [USC00055327], Montezuma County CO 81328. Period of record 1981-2010
(3) MESA VERDE NP [USC00055531], Montezuma County CO 81330. Period of record 1981-2010

(4) YELLOW JACKET 2 W [USC00059275], Montezuma County CO 81335. Period of record 1981-2010

Influencing Water Features

No water features are associated with this site.

Wetland Description (Cowardin System)		
System	Subsystem	Class
None	N/A	N/A

Representative Soil Features

The soils that make up this site are moderately deep to deep. Deep soils are more common. The surface texture is usually gravelly or cobbly loam about 3 to 8 inches thick. The surface layer texture is usually a loam with 18-22% clay. The subsurface can be loam, sandy clay loam, or clay loam with approximately 26-40% clay and is commonly very gravelly or very cobbly. The soil has an argillic and calcic horizons. Depth to argillic ranges from 3 to 34 inches and depth to calcic ranges from 25 to 60 inches. The most common parent materials are cobbly alluvium and/or glacial outwash derived from mixed sources, cobbly, glacial outwash and/or alluvium, alluvium and/or cobbly outwash and/slope alluvium derived from mixed sources, mainly Pliocene outwash.

This site is correlated to mapunits in CO669 (La Plata County Area)

Major soils associated with this site are:

Durango
Harlan
Sedillo

Parent materials
Kind: Alluvium, Outwash, Slope alluvium
Surface texture: (1)Cobbly Loam
(2)Gravelly Loam
Subsurface texture group: Loamy

	Minimum	Maximum
Surface fragments <=3" (% cover):	0	10
Surface fragments >3" (% cover):	0	20
Subsurface fragments <=3" (% volume):	10	30
Subsurface fragments >3" (% volume):	5	20

Drainage class: Well drained
Permeability class: Moderately slow to moderate

	Minimum	Maximum
Depth (inches):	60	
Available water capacity (inches):	3.20	5.60
Electrical conductivity (mmhos/cm):	0	0
Sodium adsorption ratio:	0	0
Calcium carbonate equivalent (percent):	0	10
Soil reaction (1:1 water):	6.6	8.4

Plant Communities

Ecological Dynamics of the Site

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)

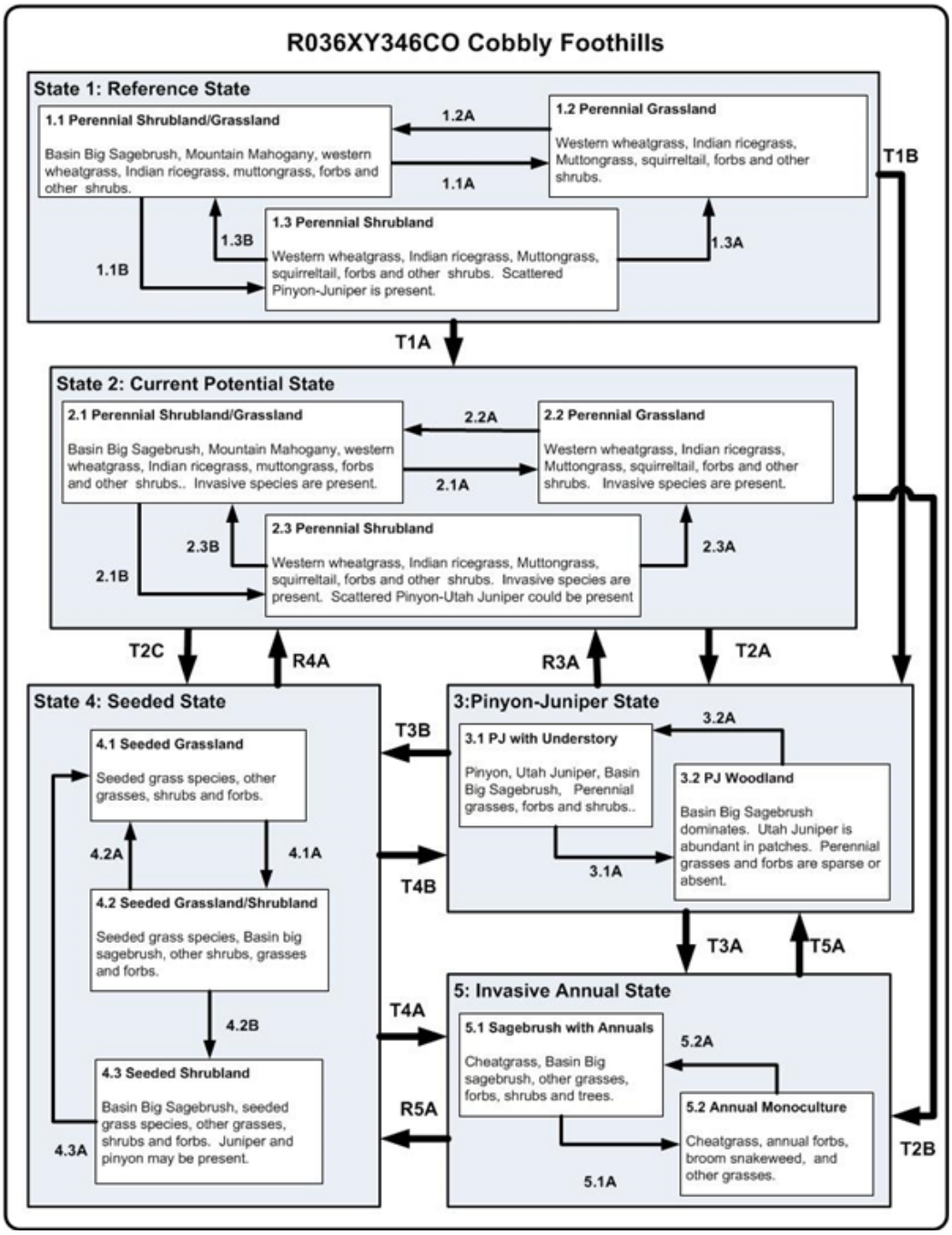
and can vary up to 4 fold. The precipitation and climate of MLRA 36 are conducive to producing Pinyon/juniper, and sagebrush complexes with high productive sites in the bottoms of the canyons. Predominant species on the Colorado Plateau are Wyoming big sagebrush (Artemisia tridentata var. wyomingensis), 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 characterized by big sagebrush. It is not a sagebrush steppe, but a sagebrush shrub-land where there is naturally less understory herbaceous production, more bare ground, and biological crusts are common (Boyle and Reeder, 2005). Recovery from fire, grazing, or other disturbances is usually slower and attempts at land restoration are less successful than in the sagebrush steppe (West 1983). The sites in this are developed with the natural influences of grazing, fire, climatic variability (i.e. extended drought) and insect herbivory. This area has climatic fluctuations and prolonged droughts are common. 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 ability for an ecological site to carry fire depends primarily on the present fuel load and plant moisture content—sites with small fuel loads will burn more slowly and less intensely than sites with large fuel loads. Fire is an important aspect of big sagebrush dominated ecological sites. Fire intervals are historically 10-70 years (Howard, 1999) and fires are typically patchy, forming mosaics. Shrub vegetation is able to reestablish from seed dispersal from the adjacent non burned sagebrush stands; however the process is relatively slow. Fire also decreases the extent of Utah juniper/pinyon pine invasions, which allows the historic plant community to maintain integrity. When the plant community is burned shrubs decrease, while perennial and annual grasses increase. The perennial shrubs associated with this site are able to recover at a faster rate than the invading trees. When the site is degraded by the presence of invasive annuals, the fire return interval is shortened due to increased fuels. The shortened fire return interval is often sufficient to suppress the native plant community.

Sagebrush sites were treated as one vegetation dynamic type when developing the provision ecological site initiative for MLRA 36. These sites will need to be altered as more data and knowledge in the future becomes available. 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 Diagram



STM

Legend

Legend

1.1A, 2.1A, 4.2A – fire, insect herbivory, and/or drought
1.1B, 2.1B , 1.2A, 2.2A, 4.1A, 4.2B – lack of fire, time without disturbance and improper grazing
1.3A, 2.3A, 1.3B, 2.3B, 3.2A, R3A, 4.3A – fire, vegetation treatments, insect herbivory, drought, and/or tree encroachment removal
T1A - invasive species establishment, improper grazing, fire, surface disturbances, and/or extended droughts.
T1B, T2A, 3.1A,T4B – fire suppression, time without disturbance, insect herbivory, and tree encroachment
T2B, T3A, T4A – invasive species establishment, frequent fire and/or long term drought
T2C, T3B – Seeding and removal of tree encroachment
R4A – Lack of disturbance, and/or removal of encroached PJ
5.1A – Frequent fire, and/or drought
5.2A, T5B – fire suppression and/or seeding
T5A – treat invasive species, and seeding

Legend

State 1: Reference State

This state includes the biotic communities that become established on the ecological site under the natural disturbance regime prior to pre-European settlement. The main pathways on this site are fire and drought. Drought is frequent on this site. Historically, fires were of mixed severity, and various sizes. The fire frequency was 10-70 years in Big Sagebrush communities that occur in the uplands. The reference state is generally dominated by Wyoming big sagebrush, needle-and-thread, western wheatgrass, Indian ricegrass, galleta, other native perennial grasses and native perennial and annual forbs which creates a diverse understory. Soil crusts are a very important part of this community. Crusts recycle nutrients, aid in moisture retention, fix nitrogen, fix carbon, and stabilize the soil reducing wind and water erosion (Belnap, 1994; Belnap and Gillette, 1998; Beymer and Klopatek 1991). The reference state is self-sustaining and resistant to change due to high resistance to natural disturbances and high resilience following natural disturbances.

The primary drivers in the reference state include fire, insect herbivory, and fluctuations in climate (drought or wet periods) and grazing by livestock and wildlife. For example, improper grazing can results in a loss of herbaceous understory, the establishment of non-native invasive plants, and a reduction in the fire return interval. When natural disturbances occur, the rate of recovery is variable due to disturbance intensity. Once invasive plants establish, return to the reference state may not be possible.

The following is from the 1986 Range site:

Western wheatgrass, Indian ricegrass, bottlebrush, and needle-and-thread dominate the grass species on the site making up 45-60 percent of the total annual production of the site. Fendler threeawn and muttongrass are the sub-dominant grass species. Many numerous forbs and shrubs enhance the wildlife values and add color to this site in early spring.

If ecological retrogression is cattle induced, desirable grass species will decrease. However, if retrogression is sheep induced, desirable forbs, shrubs, and grasses will be reduced. Deterioration of the site caused by the overgrazing of cattle will decrease western wheatgrass and Indian ricegrass. Further deterioration by overgrazing will increase Fendler threeawn, small soapweed, basin big sagebrush, broom snakeweed, and plains pricklypear cactus. With severe depletion of the natural grasses, species such as cheatgrass and tumbling Russian thistle will invade the site along with other annuals.

Community Phase 1.1: Perennial Shrubland/Grassland

This community phase is dominated by Basin big sagebrush, western wheatgrass, Indian ricegrass, muttongrass, and squirreltail. This phase has the most diverse understory of native perennial grasses and forbs. Common shrubs are bitterbrush, Gambel's oak, and mountain mahogany. Abundance, and production of warm or cool season herbaceous plants and forb production are dependent on the timing of precipitation, and can vary widely between years. The sagebrush will be a mixed age stand. Biological crusts (lichen, moss, and cyanobacteria) should be present but are variable based on plant community and state. Small amounts of low woody and semi-woody plants such as, yellow rabbitbrush, and broom snakeweed are common.

Community Phase Pathway 1.1A
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. 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).

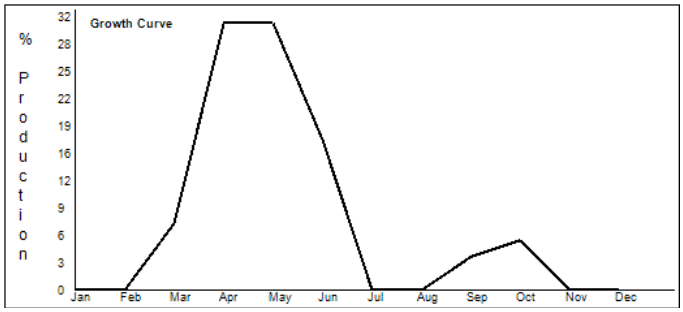
Community Phase Pathway 1.1B
This transition is from the native shrub and perennial warm and cool season grass state, to a state that is dominated by big sagebrush. This pathway happens when fire does not occur within the historical fire regime interval for the site. Improper continuous grazing of perennial grasses will speed up this pathway. This will lead to an old decadent stand of sagebrush with little to no understory. This allows the possibility of Utah juniper and/or two-needle pinyon to become established on the site.

Plant Growth Curve

Growth curve number:	CO0103
Growth curve name:	MLRA 36 - Foothills Mesic
Growth curve description:	MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Community Phase 1.2: Perennial Grassland

This post-fire community would be dominantly characterized by perennial grasses and native forbs (annual and perennial). This community would exist for short time period until sagebrush began to become established and set seed. Scattered, sparse sagebrush may be present and will increase with time. This site would stay in grassland if fire returned to this site and did not allow big sagebrush time to re-seed and establish.

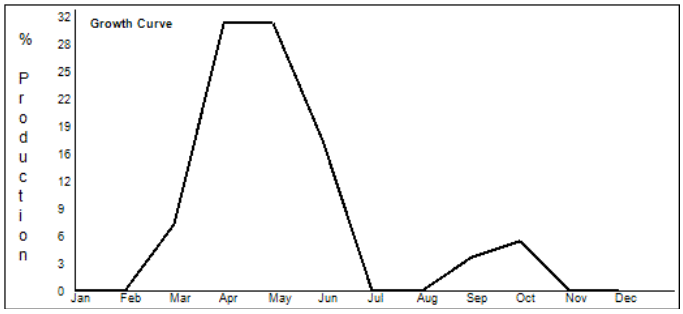
Community Phase Pathway 1.2A
This pathway favors shrub establishment. This pathway is cause by time without disturbance (i.e. fire) and favorable conditions for young sagebrush establishment

Plant Growth Curve

Growth curve number:	CO0103
Growth curve name:	MLRA 36 - Foothills Mesic
Growth curve description:	MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Community Phase 1.3: Perennial 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 be present and tree canopy cover would be 0-15%. Biological crusts are typically well developed in the interspaces; however, bare ground is most common in this community phase. Improper grazing use can aid the establishment of pinyon and juniper seedlings through reduced competition, exposure of mineral soil, and reduction of fuel to carry fires. This combined with increasing control of fires has caused large portions of the site to be taken over by pinyon and juniper since the coming of livestock. 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.

The following is from the 1986 range site:

The plant community is about 45 to 65 percent grasses, 5 to 10 percent forbs, and 20 to 30 percent shrubs, air-dry weight. This community has 10 to 15 percent juniper and pinyon trees.

Vegetation density is approximately 8 to 12 percent. (1)

Community Phase Pathway 1.3A
This pathway is caused by naturally occurring fires 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.

Community Phase Pathway 1.3B
Pathways can be one or more of the following: brush treatments, seeding, insect herbivory/pathogen, proper grazing, drought, and fire. Insect herbivory and/or root and stem pathogen die-off will thin the stands and allow perennial plants to establish if it is properly grazed.

Perennial Shrubland Plant Species Composition

Grass/Grasslike

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High	Foliar cover (percent) Low	High
1					540	780		
		Indian ricegrass	ACHY	*Achnatherum hymenoides*	120	180		
		Fendler's threeawn	ARPUF	*Aristida purpurea var. fendleriana*	10	25		
		squirreltail	ELEL5	*Elymus elymoides*	20	60		
		needle and thread	HECO26	*Hesperostipa comata*	10	35		
		western wheatgrass	PASM	*Pascopyrum smithii*	420	480		
		muttongrass	POFE	*Poa fendleriana*	60	120		

Forb

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High	Foliar cover (percent) Low	High
2					60	120		
		bulbous springparsley	CYBU	*Cymopterus bulbosus*	0	10		
		Gordon's buckwheat	ERGO	*Eriogonum gordonii*	0	10		
		desert trumpet	ERIN4	*Eriogonum inflatum*	0	10		
		Maximilian sunflower	HEMA2	*Helianthus maximiliani*	0	35		
		longleaf phlox	PHLO2	*Phlox longifolia*	0	10		
		woolly plantain	PLPA2	*Plantago patagonica*	0	25		
		scarlet globemallow	SPCO	*Sphaeralcea coccinea*	0	25		

Shrub/Vine

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High	Foliar cover (percent) Low	High
3					240	360		
		big sagebrush	ARTR2	*Artemisia tridentata*	180	240		
		fourwing saltbush	ATCA2	*Atriplex canescens*	0	35		
		alderleaf mountain mahogany	CEMO2	*Cercocarpus montanus*	60	180		
		longflower rabbitbrush	CHDE2	*Chrysothamnus depressus*	0	35		
		broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0	35		
		plains pricklypear	OPPO	*Opuntia polyacantha*	0	25		
		antelope bitterbrush	PUTR2	*Purshia tridentata*	60	120		
		Gambel oak	QUGA	*Quercus gambelii*	60	120		
		charming woodyaster	XYVE	*Xylorhiza venusta*	0	10		
		soapweed yucca	YUGL	*Yucca glauca*	0	50		

Tree

Group	Group name	Common name	Symbol	Scientific name	Annual Production (pounds per acre) Low	High	Foliar cover (percent) Low	High
4					120	180		
		Utah juniper	JUOS	*Juniperus osteosperma*	60	120		
		Rocky Mountain juniper	JUSC2	*Juniperus scopulorum*	20	60		
		twoneedle pinyon	PIED	*Pinus edulis*	120	180		

Annual Production by Plant Type

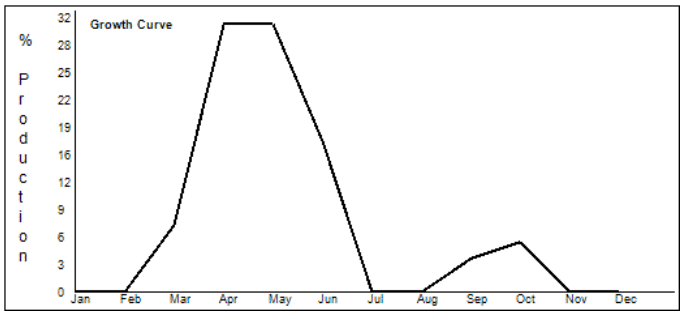
Plant type	Annual Production (lbs/ac) Low	Representative value	High
Grass/Grasslike	335	660	850
Forb	55	90	130
Shrub/Vine	205	300	420
Tree	105	150	200
Total	700	1200	1600

Plant Growth Curve

Growth curve number: CO0103
Growth curve name: MLRA 36 - Foothills Mesic
Growth curve description: MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Transition T1A

The native understory in the reference state has been invade by non-native species. Plant may include cheatgrass, Russian thistle, and annual wheatgrass. Some invasive plants can become established in undisturbed and healthy native plant communities. Possible events that can cause this transition include improper domestic livestock, severe surface disturbances, fire, and/or extended droughts.

Transition T1B

This transition is from the native shrub and perennial warm and cool season grass state, to a state that is dominated by two-needle pinyon and Utah juniper encroachment. Events include time without disturbance, insect herbivory, and continuous season long grazing of perennial grasses. Once junipers reach 50 years old they are much harder to kill with fire (Miller and Eddleman, 2001). 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.

State 2: Current Potential State

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

Community Phase 2.1: Perennial Shrubland/Grassland

This community phase is dominated by Basin big sagebrush, western wheatgrass, Indian ricegrass, muttongrass, and squirreltail. This phase has the most diverse understory of native perennial grasses and forbs. Common shrubs are bitterbrush, Gambel's oak, and mountain mahogany. This phase has the most diverse understory of native perennial grasses and forbs. Abundance, and production of warm or cool season herbaceous plants and forb production are dependent on the timing of precipitation, and can vary widely between years. The sagebrush will be a mixed age stand. Biological crusts (lichen, moss, and cyanobacteria) should be present but are variable based on plant community and state. Small amounts of low woody and semi-woody plants such as, rubber rabbitbrush, and broom snakeweed are common. Nonnative invasive species, such as cheatgrass are present but in insignificant amounts.

Community Phase Pathway 2.1A
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.

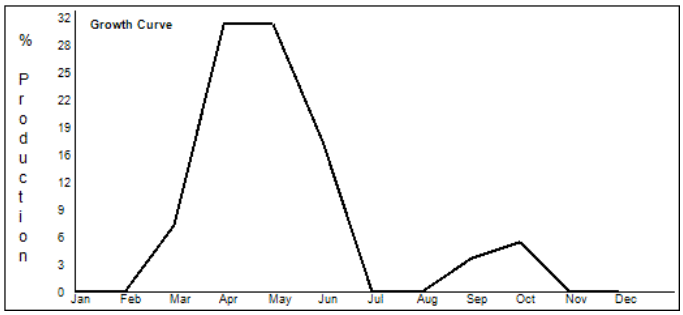
Community Phase Pathway 2.1B
This transition is from the native shrub and perennial warm and cool season grass state, to a state that is dominated by big sagebrush. This pathway happens when fire does not occur within the historical fire regime interval for the site. Improper continuous grazing of perennial grasses will speed up this pathway. This will lead to an old decadent stand of sagebrush with little to no understory. This allows the possibility of Utah juniper and/or two-needle pinyon to become established on the site.

Plant Growth Curve

Growth curve number:	CO0103
Growth curve name:	MLRA 36 - Foothills Mesic
Growth curve description:	MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Community Phase 2.2: Perennial Grassland

This post-fire community would be dominantly characterized by perennial grasses and native forbs (annual and perennial). Annual plant production is high in this phase due to the grass production. This community would exist for short time period until sagebrush began to become established and set seed. Scattered, sparse sagebrush may be present and will increase with time. This site would stay in grassland if fire returned to this site and did not allow big sagebrush time to re-seed and establish. Nonnative invasive species, such as cheatgrass are present but in insignificant amounts.

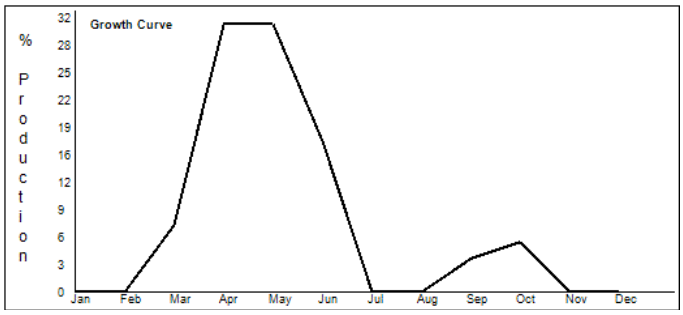
Community Phase Pathway 2.2A
This pathway favors shrub establishment. This pathway is cause by time without disturbance (i.e. fire) and favorable conditions for young sagebrush establishment.

Plant Growth Curve

Growth curve number:	CO0103
Growth curve name:	MLRA 36 - Foothills Mesic
Growth curve description:	MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Community Phase 2.3: Perennial 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 be present and tree canopy cover would be 0-10%. Biological crusts are typically well developed in the interspaces; however, bare ground is most common in this community phase. Improper grazing use can aid the establishment of pinyon and juniper seedlings through reduced competition, exposure of mineral soil, and reduction of fuel to carry fires. This combined with increasing control of fires has caused large portions of the site to be taken over by pinyon and juniper since the coming of livestock. 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.

Community Phase Pathway 2.3A
This pathway is caused by naturally occurring fires, vegetation treatments, 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.

Community Phase Pathway 2.3B
Pathways can be one or more of the following: brush treatments, seeding, insect herbivory/pathogen, proper grazing, drought, and fire. Insect herbivory and/or root and stem pathogen die-off will thin the stands and allow perennial plants to establish if it is properly grazed.

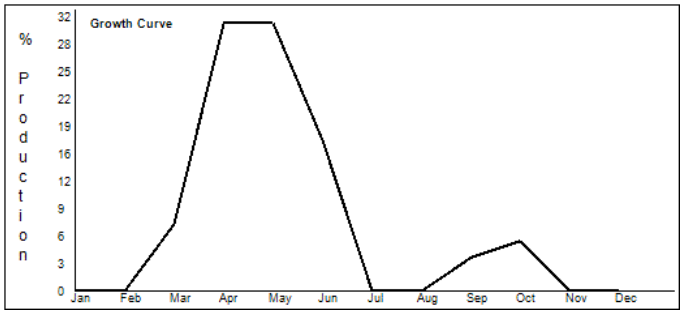
Plant Growth Curve

Growth curve number:	CO0103
Growth curve name:	MLRA 36 - Foothills Mesic

Growth curve description: MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Transition T2A

This transition is from the native shrub and perennial warm and cool season grass state, to a state that is dominated by two-needle pinyon and Utah juniper. Events include time without disturbance, insect herbivory, continuous season long grazing of perennial grasses, and tree invasion. Once junipers reach 50 years old they are much harder to kill with fire (Miller and Eddleman, 2001). 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 T2B

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 T2C

This transition is from a big sagebrush dominated state, to a state that has been seeded with introduced perennial grasses. High energy inputs are needed for this transition. Sagebrush and/or trees will need to be removed with vegetation treatment techniques (I.e. chemical, mechanical, or fire) and introduced species that are adapted to the area and adapted to management needs have been seeded and become established.

State 3: Pinyon-Juniper State

It is thought that pinyon and juniper, with an understory of mostly perennial grasses, may dominate the site in the longtime absence of fire, but lightning fires following warm dry early summer weather are a natural feature of the region. This could have maintained much of the site in a grassland cover, as reported by many early settlers except for occasional trees and isolated patches. Such vegetation is the basis for the potential described here. Without fire, simulated clearing methods may be necessary to maintain it (SCS, 1975, Miller and Tausch 2002). This state typically occurs when there is a long time span between fires. The transition to this state also has a reduction in fine fuels plays a part in increasing the fire return intervals once the site has transition to this pinyon-juniper state. Thus, state can persist for long time periods until the conditions needed for a fire occur or vegetation treatments are done to move the community to a different state.

Community Phase 3.1: PJ with Understory

It is dominated by a dense closed canopy of Utah juniper and pinyon. They will be with a sparse understory of big sagebrush with little to no grass or forbs. Also, Invasive annuals grasses and forbs will be present in the understory.

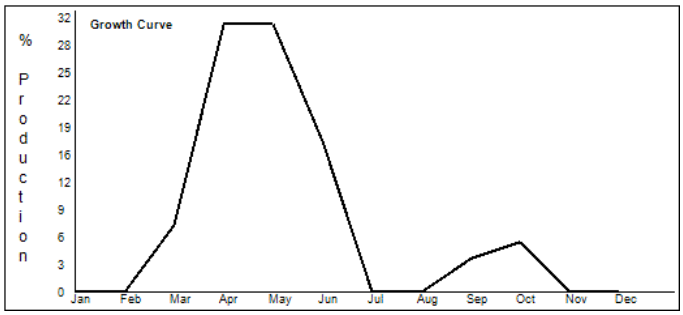
Community Phase Pathway 3.1A
Events include time without disturbance, insect herbivory, continuous season long grazing of perennial grasses, and continued tree invasion until they dominate the site.

Plant Growth Curve

Growth curve number: CO0103
Growth curve name: MLRA 36 - Foothills Mesic
Growth curve description: MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Community Phase 3.2: PJ Woodland

This state has an overstory of Utah juniper and/or two-needle pinyon with an understory of big sagebrush. There is very little herbaceous or other plant growth on this site. The production and infiltration is low. Erosion is high, and the associated watersheds will become less stable and have more runoff.

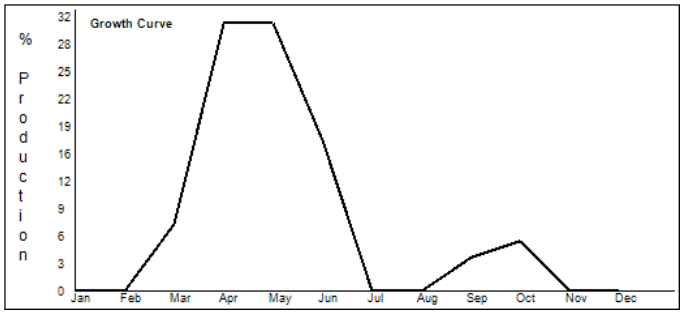
Community Phase Pathway 3.2A
Occurs when trees are removed naturally (fire, drought, insects or other pathogens) and/or by vegetation treatments (i.e. mechanical, chemical).

Plant Growth Curve

Growth curve number:	CO0103
Growth curve name:	MLRA 36 - Foothills Mesic
Growth curve description:	MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Transition T3A

This transition is from a two needle pinyon and Utah juniper state, to a state that is dominated by invasive species. Events would include establishment of invasive species, fire, and other methods of tree removal with an understory that is dominated by invasive annual species (i.e. cheatgrass).

Transition T3B

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.

Restoration Pathway R3A

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.

State 4: Seeded State

This state results from seeding introduced perennial grasses (i.e. crested wheatgrass and Russian wildrye). Native perennial grasses, forbs and shrubs may be included in the seed mix. This state behave similar community dynamics to the current potential state community. Other vegetation treatments may be necessary to get to this state, they include chaining, mowing, disking, prescribed burning and other techniques which manipulate the plant community. Applying vegetation treatments to plant communities to either the invasive annuals or juniper encroachment states to create a seeded state is often the first step in assisted restoration to plant communities an intermediate step to get to the Current Potential State. The seeded state could persist for long periods of time with proper management. Native grasses and forbs may reestablish over time from nearby seed sources. Big sagebrush will typically reestablish in 30-40 years.

Community Phase 4.1: 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.

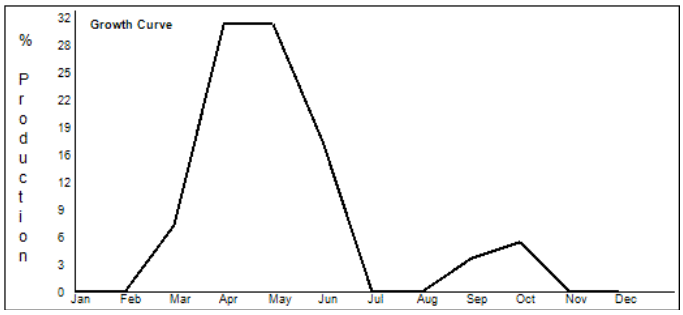
Community Phase Pathway 4.1A
Time without disturbance and climatic conditions that favor establishment of sagebrush will assist this pathway. Improper grazing on the grasses species can favor shrub establishment and reduce their competitiveness. Also, several consecutive years of droughts can reduce grass cover.

Plant Growth Curve

Growth curve number:	CO0103
Growth curve name:	MLRA 36 - Foothills Mesic
Growth curve description:	MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Community Phase 4.2: Seeded Grassland/Shrubland

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

Community Phase Pathway 4.2A
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.

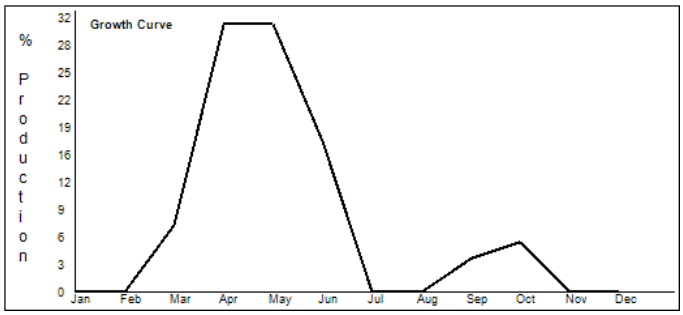
Community Phase Pathway 4.2B
This pathway favors shrub establishment. This pathway is cause by time without disturbance (i.e. fire) and favorable conditions for young sagebrush establishment. Also, Pinyon and juniper will start to encroach under these condition. Improper continuous grazing of perennial grasses will speed up this pathway. This will lead to an old decadent stand of sagebrush with little to no understory.

Plant Growth Curve

Growth curve number:	CO0103
Growth curve name:	MLRA 36 - Foothills Mesic
Growth curve description:	MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Community Phase 4.3: 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.

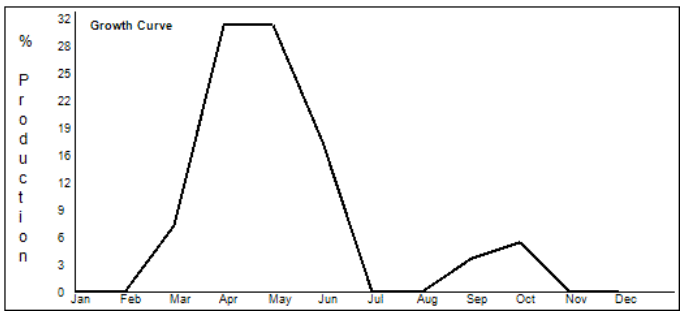
Community Phase Pathway 4.3A
This pathway is caused by naturally occurring fires, vegetation treatments (chemical and mechanical), and/or insect herbivory removes the shrubs and possible trees if they have encroached on this site. It reverts the system back to a grassland phase. Depending on the amount of understory present, grasses and forbs may need to be reseeded to aid reestablishment.

Plant Growth Curve

Growth curve number:	CO0103
Growth curve name:	MLRA 36 - Foothills Mesic
Growth curve description:	MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Transition T4A

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.

Transition T4B

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.

Restoration Pathway R4A

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.

State 5: Invasive Annual State

This state is dominated by invasive annual species. Invasive annual species can including cheatgrass, Russian thistle, kochia, halogeton, storksbill geranium, and annual mustards. Generally as ecological conditions deteriorate and perennial vegetation decreases due to

disturbance (fire, over grazing, drought, off road vehicle overuse, erosion, etc.) annual forbs and grasses will invade the site. The presence of these species will depend on soil properties and moisture availability; however, these invaders are highly adaptive and can flourish in many locations. Once established, complete removal is difficult but suppression may be possible.

Community Phase 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.

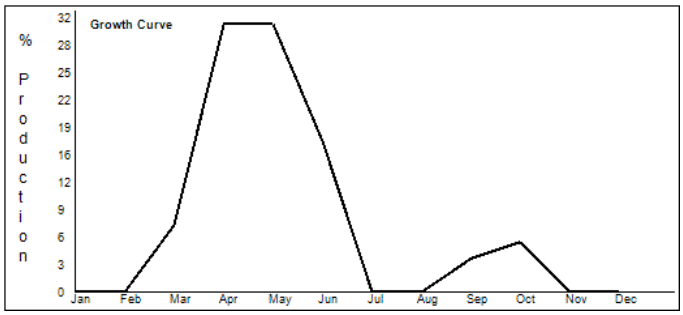
Community Phase Pathway 5.1A
This pathway occurs when frequent fire or drought remove the big sagebrush, and favor the establishment of cheatgrass or other invasive annuals. In a degraded sagebrush community, cheatgrass will take advantage of the increased interspaces between plants will typically establish 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.

Plant Growth Curve

Growth curve number:	CO0103
Growth curve name:	MLRA 36 - Foothills Mesic
Growth curve description:	MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Community Phase 5.2: Annuals 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.

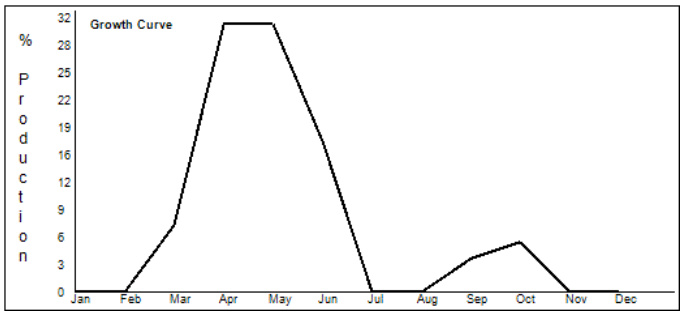
Community Phase Pathway 5.2A
This pathway occurs when there is a longer fire return interval. Longer fire return intervals can be enabled by using fire suppression and fire breaks to allow perennial vegetation to a change to get established. Along with this seeding and/or proper grazing may allow native perennial plants to return to this community. This pathway has very intensive energy inputs.

Plant Growth Curve

Growth curve number:	CO0103
Growth curve name:	MLRA 36 - Foothills Mesic
Growth curve description:	MLRA 36

Percent Production by Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	8	32	32	18	0	0	4	6	0	0



Transition T5A

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 T5A

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.

Section II: Ecological Site Interpretations

Animal Community

The following is from 1986 Range Site:

WILDLIFE INTERPRETATIONS:

This range site provides habitats which support a resident animal community that is characterized by deer, cottontail rabbit, jackrabbit, coyote, and various raptors.

The following is from 1986 Range Site:

GRAZING INTERPRETATIONS:

This site provides some spring and summer forage for sheep, cattle, horses, and small mammals.

This range site is stable and can withstand grazing pressure in accordance with management techniques. Overgrazing will completely remove western wheatgrass and Indian ricegrass from the plant community, leaving the less palatable species for grazing.

Vegetative palatability will influence proper use considerations. The season, kind of grazing animal, past grazing use, and associated plant species will directly influence the variation in animal preference for forages under various conditions of this range site.

If sheep ae the principle grazers of this site, then 25 to 35 percent of the annual production will be unpalatable or out of reach, while if cattle are the main users, 15 to 20 percent of the production will not be available for use.

Guide to initial stocking rates:

Stocking rates are based on an average growing season. Based on 1200 pounds of forage (air-dry) per animal unit month. (This figure takes into account the vegetation that disappears through trampling, small herbivores, etc., which amounts to approximately 7.9 pounds per day under normal conditions.)

Condition Class - Percent Climax Vegetation - (Ac/AUM) (AUM/Ac)

Excellent - 76-100% - (2.33-3.12) (.43-.32)
Good - 51-75% - (3.22-4.55) (.31-.22)
Fair - 26-50% - (4.76-9.09) (.21-.11)
Poor - 0-25% - (10.00+) (.10)

Plant Preference by Animal Kind

Animal kind: Mature antelope

Common name	Scientific name	Plant part	J	F	M	A	M	J	J	A	S	O	N	D

Indian ricegrass	*Achnatherum hymenoides*	Leaves	N	N	N	P	P	P	N	N	N	D	D	D
Fendler threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
basin big sagebrush	*Artemisia tridentata subsp. tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Leaves	P	P	P	D	D	D	D	D	D	P	P	P
longflower rabbitbrush	*Chrysothamnus depressus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bulbous springparsley	*Cymopterus bulbosus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail	*Elymus elymoides*	Entire plant	U	U	U	D	D	D	U	U	U	U	U	U
Gordon's buckwheat	*Eriogonum gordonii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
desert trumpet	*Eriogonum inflatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broom snakeweed	*Gutierrezia sarothrae*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
needle and thread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Maximilian sunflower	*Helianthus maximiliani*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Utah juniper	*Juniperus osteosperma*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
plains pricklypear	*Opuntia polyacantha*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
western wheatgrass	*Pascopyrum smithii*	Leaves	N	N	N	D	D	D	N	N	N	N	N	N
longleaf phlox	*Phlox longifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
twoneedle pinyon	*Pinus edulis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
woolly plantain	*Plantago patagonica*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
muttongrass	*Poa fendleriana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
antelope bitterbrush	*Purshia tridentata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gambel oak	*Quercus gambelii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
scarlet globemallow	*Sphaeralcea coccinea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
charming woodyaster	*Xylorhiza venusta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
soapweed yucca	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal kind: Mature cattle

Common name	Scientific name	Plant part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Leaves	D	D	P	P	P	D	U	U	U	D	D	D
Fendler threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
basin big sagebrush	*Artemisia tridentata subsp. tridentata*	Entire plant	X	X	N	N	N	N	N	N	X	X	X	X
fourwing saltbush	*Atriplex canescens*	Leaves	P	P	P	D	D	D	D	D	D	P	P	P
longflower rabbitbrush	*Chrysothamnus depressus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bulbous springparsley	*Cymopterus bulbosus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail	*Elymus elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Gordon's buckwheat	*Eriogonum gordonii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
desert trumpet	*Eriogonum inflatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broom snakeweed	*Gutierrezia sarothrae*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Maximilian sunflower	*Helianthus maximiliani*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Utah juniper	*Juniperus osteosperma*	Entire plant	E	E	E	E	E	E	E	E	E	E	E	E
plains pricklypear	*Opuntia polyacantha*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western wheatgrass	*Pascopyrum smithii*	Leaves	U	U	U	P	P	P	D	D	U	U	D	U
longleaf phlox	*Phlox longifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
twoneedle pinyon	*Pinus edulis*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
woolly plantain	*Plantago patagonica*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
muttongrass	*Poa fendleriana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
antelope bitterbrush	*Purshia tridentata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gambel oak	*Quercus gambelii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet globemallow	*Sphaeralcea coccinea*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
charming woodyaster	*Xylorhiza venusta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
soapweed yucca	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal kind: Mule deer

Common name	Scientific name	Plant part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Leaves	N	N	N	P	P	P	N	N	N	D	D	D
Fendler threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
basin big sagebrush	*Artemisia tridentata subsp. tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
fourwing saltbush	*Atriplex canescens*	Leaves	P	P	P	D	D	D	D	D	D	P	P	P
longflower rabbitbrush	*Chrysothamnus depressus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bulbous springparsley	*Cymopterus bulbosus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail	*Elymus elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Gordon's buckwheat	*Eriogonum gordonii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
desert trumpet	*Eriogonum inflatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

broom snakeweed	*Gutierrezia sarothrae*	Entire plant	U	U	U	U	U	U	U	U	U	U	U
needle and thread	*Hesperostipa comata*	Entire plant	U	U	U	D	D	D	D	D	U	U	U	U
Maximilian sunflower	*Helianthus maximiliani*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Utah juniper	*Juniperus osteosperma*	Entire plant	D	D	X	X	X	X	X	X	D	D	D	D
plains pricklypear	*Opuntia polyacantha*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western wheatgrass	*Pascopyrum smithii*	Leaves	N	N	N	D	D	D	N	N	N	N	N	N
longleaf phlox	*Phlox longifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
twoneedle pinyon	*Pinus edulis*	Entire plant	X	X	X	X	X	X	X	X	X	X	X	X
woolly plantain	*Plantago patagonica*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
muttongrass	*Poa fendleriana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
antelope bitterbrush	*Purshia tridentata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gambel oak	*Quercus gambelii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
scarlet globemallow	*Sphaeralcea coccinea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
charming woodyaster	*Xylorhiza venusta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
soapweed yucca	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal kind: Mature elk

Common name	Scientific name	Plant part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Leaves	D	D	P	P	P	D	U	U	U	D	D	D
Fendler threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
basin big sagebrush	*Artemisia tridentata subsp. tridentata*	Entire plant	X	X	X	N	N	N	N	N	X	X	X	X
fourwing saltbush	*Atriplex canescens*	Leaves	P	P	P	D	D	D	D	D	D	P	P	P
longflower rabbitbrush	*Chrysothamnus depressus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bulbous springparsley	*Cymopterus bulbosus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail	*Elymus elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Gordon's buckwheat	*Eriogonum gordonii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
desert trumpet	*Eriogonum inflatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broom snakeweed	*Gutierrezia sarothrae*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread	*Hesperostipa comata*	Entire plant	D	D	D	P	P	P	D	D	D	D	D	D
Maximilian sunflower	*Helianthus maximiliani*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Utah juniper	*Juniperus osteosperma*	Entire plant	X	X	X	X	X	X	X	X	X	X	X	X
plains pricklypear	*Opuntia polyacantha*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western wheatgrass	*Pascopyrum smithii*	Entire plant	U	U	U	P	P	P	D	D	U	U	D	U
longleaf phlox	*Phlox longifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
twoneedle pinyon	*Pinus edulis*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
woolly plantain	*Plantago patagonica*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
muttongrass	*Poa fendleriana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
antelope bitterbrush	*Purshia tridentata*	Entire plant	P	P	P	D	D	D	D	D	D	P	P	P
Gambel oak	*Quercus gambelii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
scarlet globemallow	*Sphaeralcea coccinea*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
charming woodyaster	*Xylorhiza venusta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
soapweed yucca	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal kind: Adult horses

Common name	Scientific name	Plant part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Fendler's threeawn	*Aristida purpurea var. fendleriana*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
basin big sagebrush	*Artemisia tridentata subsp. tridentata*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
fourwing saltbush	*Atriplex canescens*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
longflower rabbitbrush	*Chrysothamnus depressus*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
bulbous springparsley	*Cymopterus bulbosus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail	*Elymus elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Gordon's buckwheat	*Eriogonum gordonii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
desert trumpet	*Eriogonum inflatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broom snakeweed	*Gutierrezia sarothrae*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Maximilian sunflower	*Helianthus maximiliani*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
Utah juniper	*Juniperus osteosperma*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
plains pricklypear	*Opuntia polyacantha*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western wheatgrass	*Pascopyrum smithii*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
longleaf phlox	*Phlox longifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
twoneedle pinyon	*Pinus edulis*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
woolly plantain	*Plantago patagonica*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U

muttongrass	*Poa fendleriana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
antelope bitterbrush	*Purshia tridentata*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Gambel oak	*Quercus gambelii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
scarlet globemallow	*Sphaeralcea coccinea*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
charming woodyaster	*Xylorhiza venusta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
soapweed yucca	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Animal kind: Mature sheep

Common name	Scientific name	Plant part	J	F	M	A	M	J	J	A	S	O	N	D
Indian ricegrass	*Achnatherum hymenoides*	Leaves	N	N	N	P	P	P	N	N		D	D	D
Fendler threeawn	*Aristida purpurea var. longiseta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
basin big sagebrush	*Artemisia tridentata subsp. tridentata*	Entire plant	X	X	N	N	N	N	N	N	X	X	X	X
fourwing saltbush	*Atriplex canescens*	Leaves	P	P	P	D	D	D	D	D	D	P	P	P
alderleaf mountain mahogany	*Cercocarpus montanus*	Entire plant	D	D	P	P	P	P	P	P	D	D	D	D
Douglas' dustymaiden	*Chaenactis douglasii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
bulbous springparsley	*Cymopterus bulbosus*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
squirreltail	*Elymus elymoides*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Gordon's buckwheat	*Eriogonum gordonii*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
desert trumpet	*Eriogonum inflatum*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
broom snakeweed	*Gutierrezia sarothrae*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
needle and thread	*Hesperostipa comata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Maximilian sunflower	*Helianthus maximiliani*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
Utah juniper	*Juniperus osteosperma*	Entire plant	E	E	E	E	E	E	E	E	E	E	E	E
plains pricklypear	*Opuntia polyacantha*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
western wheatgrass	*Pascopyrum smithii*	Leaves	N	N	N	D	D	D	N	N	N	N	N	N
longleaf phlox	*Phlox longifolia*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
twoneedle pinyon	*Pinus edulis*	Entire plant	N	N	N	N	N	N	N	N	N	N	N	N
woolly plantain	*Plantago patagonica*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
muttongrass	*Poa fendleriana*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
antelope bitterbrush	*Purshia tridentata*	Entire plant	P	P	P	P	P	P	P	P	P	P	P	P
Gambel oak	*Quercus gambelii*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
scarlet globemallow	*Sphaeralcea coccinea*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D
charming woodyaster	*Xylorhiza venusta*	Entire plant	U	U	U	U	U	U	U	U	U	U	U	U
soapweed yucca	*Yucca glauca*	Entire plant	D	D	D	D	D	D	D	D	D	D	D	D

Legend: P=Preferred; D=Desirable; U=Undesirable; N=Not consumed; E=Emergency; T=Toxic; X=Used, but degree of utilization unknown

Hydrology 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

Fine Soils

Durango - C

Fine-Loamy Soils

Harlan - B

Loamy-Skeletal Soils

Sedillo - C

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms (Soil Survey Staff, 2015).

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

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

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

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

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

Recreational Uses

The following is from 1986 Range Site:

This site has medium value regarding recreational uses and natural beauty. Deer hunting provides fair recreation on the site. The numerous forbs that bloom from spring through mid-summer give this site an aesthetically pleasing appearance.

Wood Products

The original states that wood products are not applicable to this site. However, one cannot think that fence posts, firewood, and pinyon nuts could not be utilized on this site.

Other Information

The following is from 1986 Range Site:

Major Poisonous Plants to Livestock:

Woody aster affects sheep in spring and early summer when more palatable forage is not available. The poisoning is cumulative. Symptoms most evident include impairment of vision, appetite and evidence of abdominal pain with paralysis.

Broom snakeweed affects both cattle and sheep when forage is scarce. Poisoning is not common but will occur on overgrazed ranges. Causing abortion in cattle or may produce weak, underweight calves. Losses are sporadic and will occur when 10-20% of the body weight of green material is consumed in 1/2 to 20 weeks.

Gambel oak affects cattle and sheep early spring during budding and leafing and after a frost. As leaves mature, toxicity decreases. Cattle my graze up to 50% for their diet without showing signs of sickness; more than 75% of their diet will cause death. Oak tannins is suspected of causing death. Symptoms of oak poisoning include constipation, feces are dry and appear in small pellets. They are often surrounded with mucous, and even blood, and my become watery later, but are always scanty and always dark in color. The animal loses its appetite, appears gaunt, the coat becomes rough, nose is dry and cracked, and the animal may die in 2 weeks to a month.

Supporting Information

Associated Sites

Site name	Site ID	Site narrative
Foothill Valley	*R036XY347CO*	Foothill Valley is located in valley bottoms, toe slopes and flood plain steps. The soils are moderately deep to deep. Surface textures range from sandy loam to clay loam. This site has Basin Big Sagebrush as the dominated shrub.

Similar Sites

Site name	Site ID	Site narrative
Mountain Pinyon	*R036XY114CO*	Mountain Pinyon is a gentle sloped (<25% slope) site with very shallow and shallow soils that are loamy in texture. This site is dominated by Pinyon, Utah Juniper. This site may have oakbrush in the understory. This site is in the 12 to 16 inch precipitation zone of foothills/upland.

Shallow Loamy Mesa Top - (Pinyon-Juniper)	*R036XY141CO*	Shallow Loamy Mesa Top is a gentle sloped (<25% slope) site with very shallow and shallow soils that are loamy in texture. This site is dominated by Pinyon, Utah Juniper, muttongrass and Indian ricegrass. This site is in the 15 to 18 inch precipitation zone of foothills/upland.
Loamy Mesa Top - (Pinyon-Juniper)	*R036XY142CO*	Loamy Mesa Top is a gentle sloped (<15% slope) site with moderately deep to deep soils that are coarse loamy in texture. This site is shallow to calcic horizon. The typical profile is border-line skeletal which reduces the water holding capacity of this site. It is dominated by Pinyon, Utah Juniper, muttongrass and Indian ricegrass. This site is in the 15 to 18 inch precipitation zone of foothills/upland.
Loamy Foothills	*R036XY284CO*	Loamy Foothills occurs on hills, benches and mesas on moderately deep to deep loamy textured soils derived from alluvium, slope alluvium eolian deposits, and colluvium. It is a Wyoming big sagebrush – Muttongrass community. It has an aridic ustic moisture regime and mesic temperature regime. The effective precipitation ranges from 12 to 16 inches.
Stony Foothills	*R036XY287CO*	Stony Foothill is a gentle sloped (<25% slope) site with moderately deep to deep soils that are loamy-skeletal in texture. This site is dominated by Pinyon, Utah Juniper. This site may have oakbrush in the understory. This site is in the 12 to 16 inch precipitation zone of foothills/upland.
Clayey Foothills	*R036XY289CO*	Clayey Foothills occurs on benches, foot-slopes, fans, and valley. Soils are moderately deep to deep and have marine shale as parent materials. The soil textures are clay loam to clay. Dominant plants are Wyoming Big Sagebrush and western wheatgrass. This site has a high potential for shrink swell.
Sandy Foothills	*R036XY310CO*	Site occurs on rolling uplands on mesas. Soils are deep sandy loams to loamy sands. Dominant plants are needle-and-thread, western wheatgrass, Wyoming big sagebrush, and balsamroot.
Steep Colluvial Slopes	*R036XY445CO*	Steep Colluvial Slopes is a very steep (>25% slope) sloped site with very shallow to shallow soils that are clayey in texture. This site is dominated by Utah Juniper and pinyon. This site may have Wyoming big sagebrush in the understory. This site has higher precipitation (12 to 16") than Semidesert Loam (8 to 12"). The temperature is slightly cooler than the semidesert site. Foothill site will be found at elevations above the semidesert site. The soils are similar in nature.
Southwestern Mountain - (Pinyon-Juniper)	*R036XY446CO*	Southwestern Mountain (Pinyon-Juniper) is a gentle sloped (<25% slope) site with very shallow and shallow soils that are loamy or loamy-skeletal in texture. This site is dominated by Pinyon, Utah Juniper, Wyoming big sagebrush, muttongrass and Indian ricegrass. This site may have oakbrush in the understory. This site is in the 12 to 16 inch precipitation zone of foothills/upland.

State Correlation
This site has been correlated with the following states: CO

Type Locality

State:	CO
County:	La Plata
General legal description:	Mesa Mountain southwest of Ignacio, Colorado.

Hierarchical 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:
313Aa - San Juan Basin-Mesa Verde Subsection <313A Grand Canyon Section < 313 Colorado Plateau Semi-Desert (Cleland, et al., 2007).

313Be - San Juan Basin North Subsection <313B Navaho Canyonlands Section < 313 Colorado Plateau Semi-Desert (Cleland, et al., 2007).

EPA:
20c Semiarid Benchlands and Canyonlands, < 20 Colorado Plateau < 10.I Cold Deserts < 10 North American Deserts (Griffith, 2006).

USGS: Colorado Plateau Province (Canyonlands Section)

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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.

Site Authors

Suzanne Mayne Kinney

Certifications
NRCS Science and Technology Certified by Rachel Murph (9/18/2017)

Quality Assurance
Provisional Status Verfied by Scott Woodall (12/21/2017)

Reference Sheet

Certification: Reference Sheet Certified by Rachel Murph (9/18/2017)

Author(s)/participant(s): Suzanne Mayne-Kinney

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Date: 5/19/2017 **MLRA:** 036X **Ecological Site:** Cobbly Foothills R036XY346CO This *must* be verified based on soils and climate (see Ecological Site Description). Current plant community cannot be used to identify the ecological site.

Composition (indicators 10 and 12) based on: X Annual Production, Foliar Cover, Biomass

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Indicators. For each indicator, describe the potential for the site. Where possible, (1) use numbers, (2) include expected range of values for above- and below-average years for **each** community and natural distrurbance regimes within the reference state, when appropriate and (3) cite data. Continue descriptions on separate sheet.

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1. **Number and extent of rills:** None to very rare. Any rills present should be short in length (less than 6 feet long) and only occur where increased runoff occurs on lower part of steeper slopes and areas below exposed bedrock. Old rills should be weathered and muted in appearance. An increase in rill formation may be seen after disturbance events such as recent fire or thunderstorms.

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2. **Presence of water flow patterns:** Rare. If present, short (less than 8 feet long) and usually disconnected with numerous debris dams. They are stable. Flow patterns typically flow around perennial plant bases and rock fragments. They usually show no evidence of erosion. They are more evident after recent thunderstorms.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals are very rare and may form at the base of plants that occur on the edge of flow paths. Terracettes are very rare to rare, forming behind debris dams of small to medium sized litter (up to 2 inches in diameter) may form in water flow patterns. These debris dams may accumulate smaller litter (leaves, grass and forb stems) and sediment. Terracettes or debris dams are more obvious following intense rainfall events.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, standing dead, lichen, moss, plant canopy are not bare ground):** In the reference state bare ground ranges from 15 to 25%. Areas with well-developed biological soil crust should not be counted as bare ground. Areas with poorly developed biological soils crust that are interpreted as functioning as bare ground (therefore they would be susceptible to raindrop splash erosion) should be recorded as bare ground. This site can have up to 6% surface rock cover. Ground cover is based on first raindrop impact, and bare ground is the opposite of ground cover. Ground cover + bare ground = 100%. Extended drought can cause bareground to increase.

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5. **Number of gullies and erosion associated with gullies:** None to very rare. Any gullies present are sparsely located across the landscape and are usually caused by run-in water from adjacent sites that are dominated by exposed bed rock or dissected slopes. If present gullies have been re-stabilized by perennial vegetation.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None to very few. Shrubs break the wind and reduce the potential for wind erosion. The surface fragments armor the soil surface and help to reduce the potential for wind erosion.

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7. **Amount of litter movement (describe size and distance expected to travel):** Most litter accumulates at base of plants. Woody stems from trees are not moved unless present in water flow patterns, rills, or gullies.

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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):** Stability class rating is 2 to 4 in the interspaces at the soil surface. With cover the expected values are 4 to 6.

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9. **Soil surface structure and SOM content (include type and strength of structure, and A-horizon color and thickness):** Soil organic matter content ranges from 0.5-2%. Soils are deep in depth. The surface soils of this site are usually cobbly loam or gravelly loam. Soils are cobbly, gravels and/or stone filled. Structure is weak very fine granular structure to moderate fine granular structure. The soil surface (A horizon) ranges from 3 to 8 inches in depth. Refer to soil survey for more detailed information about your specific site.

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10. **Effect on plant community composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Bare spaces are small, rounded in shape, and are unconnected. The diverse grass, forb, shrub functional/ structural groups and any well-developed biological soil crusts (moss, pinnacled lichen, and light cyanobacteria) (when present), reduce raindrop impact and slows overland flow providing increased time for infiltration.

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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, there may be layers of calcium carbonate or other naturally occurring hard layers found in the soil subsurface. These should not be considered to be compaction layers.

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground weight using symbols: >>, >, = to indicate much greater than, greater than, and equal to) with dominants and sub-dominants and "others" on separate lines:**
    Dominant: cool season rhizomatous grass (western wheatgrass) > cool season bunchgrasses (Indian ricegrass, muttongrass, needle-and-thread, squirreltail)
    Sub-dominant: = shrubs (Basin big sagebrush, bitterbrush, gambel oak, true mountain mahogany) >
    Other: forbs (longleaf phlox, wooly indianwheat, scarlet globemallow, onion spring parsley, buckwheats,)> Trees (Pinyon pine, Utah Juniper, Rocky Mountain Juniper)
    Additional: There may be scattered pinyon and/or Utah Juniper trees on this site where is more skeletal and/or depth to calcic horizon is shallow.

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Typical minimal. During years with average to above average precipitation, there should be very little recent mortality or decadence apparent in either the shrubs or grasses. Some mortality of bunchgrass and other shrubs may occur during very severe (long term) droughts.

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14. **Average percent litter cover (5-15%) and depth (inches):** Litter cover ranges from 5-15% at a depth of 0.25 to 0.5 inches. Most litter is at the base and under the canopy of the plants.

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15. **Expected annual production (this is TOTAL above-ground production, not just forage production):** 700 lbs. /ac. low precipitation years, 1200 lbs. /ac. average precipitation years, 1600 lbs. /ac. above average precipitation years. After extended drought or the first growing season following wildfire, production may be significantly reduced by 400 - 650 lbs. /ac. or more.

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

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17. **Perennial plant reproductive capability:** All plants have the ability to reproduce in most years. Limitations are weather related, wildfire, natural disease, inter-species competition, and insects may temporarily reduce reproductive capability. Increased tree canopy will result in decreased understory reproductive capability.

Reference Sheet Approval

Approval	Date
Rachel Murph, State Rangeland Management Spec., USDA NRCS Colorado	9/18/2017