USDA Natural Resources Conservation Service

Ecological site R036XY405CO
Loamy Bottom

Accessed: 05/06/2024

General information

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

Figure 1. Mapped extent

Areas shown in blue indicate the maximum mapped extent of this ecological site. Other ecological sites likely occur within the highlighted areas. It is also possible for this ecological site to occur outside of highlighted areas if detailed soil survey has not been completed or recently updated.

MLRA notes

Major Land Resource Area (MLRA): 036X–Southwestern Plateaus, Mesas, and Foothills

Loamy Bottom ecological site is found on drainageways, flood plains, draws, narrow canyon bottoms and alluvial fans in MLRA 36 (Southwestern Plateaus Mesas and Foothills). The MLRA 36 is illustrated orange color on the map. The ecological site locations as assigned in soil survey map units are shown in pink color.

The site concept was established within the MLRA 36 Semidesert and Foothill/Upland regions. This is a run in site. This zone is 12 to 16 inches of precipitation and has a mesic temperature regime. This site has bimodal precipitation that is dominated by basin big sagebrush, western wheatgrass, muttongrass and Indian ricegrass.

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, and 313Ab - Canyon of Ancients-Blanding Basin Subsections <313A Grand Canyon Section < 313 Colorado Plateau Semi-desert (Cleland, et al., 2007).

341Be Dove Creek-Egnar Plains Subsection <341B Northern Canyonlands Section < 341 Intermountain Semi-

Desert and Desert (Cleland, et al., 2007).

EPA:
20a Monticello-Cortez Uplands and 20c Semiarid Benchlands and Canyonlands, < 20 Colorado Plateau < 10.l Cold Deserts < 10 North American Deserts (Griffith, 2006).

USGS: Colorado Plateau Province (Canyonlands Section)

Ecological site concept

The 36X Loamy Bottom was drafted for MLRA 36 when the Cortez (NRCS, 2001) and Ute Mountain Soil Surveys (NRCS, 2008) were conducted. This site occurs on drainageways, flood plains, draws, narrow canyon bottoms and alluvial fans. The soils are deep with loamy textures. Common textures are loam and clay loam. Soils are derived from alluvium from sandstone and shale or mixed sources. It is a basin big sagebrush community with western wheatgrass, muttongrass and Indian ricegrass. It can have an aridic ustic moisture regime and mesic temperature regime. The effective precipitation ranges from 12 to 16 inches.

Associated sites

R035XY015UT	**Sandy Bottom** Sandy Bottom is found on flood plains, steam terraces, narrow valley and valley flats. This site is in a run-in position on the landscape. Soils are deep from sandstone. Surface and subsurface textures are fine sandy loam, loamy fine sand, and fine sand. Dominant plants are four-wing saltbush, Indian ricegrass, galleta, and needle-and-thread. Precipitation is 6 to 12 inches.
R035XY413CO	**Alkali Bottom** Alkali Bottom is found on terraces, drainage-ways and alluvial valley floors. This site is in a run-in position on the landscape. Soils are deep from shale and sandstone. Soils are moderate to strongly alkaline. Surface textures are sandy loam, clay loam or silty clay loam. Subsurface textures are silty clay loam. Dominant plants are alkali sacaton, inland saltgrass, basin wildrye, and greasewood.
R036XY038CO	**Wet Meadow** Wet meadow occurs on drainage-ways, swale, floodplains and draws. This site is in a run-in position on the landscape. Soils are deep with a water table. Soil textures are generally sandy loams, loams and clay loams. Dominant vegetation is western wheatgrass, sedges, Nebraska sedge, slender wheatgrass, and basin wildrye. There are no salts present on this site.
R036XY111CO	**Steep Shallow Clay Loam (pinyon-Utah juniper)** Steep Shallow Clay Loam Pinyon-Juniper is a very steep sloped (> 25% slopes) site with shallow soils that are clayey in texture. This site is dominated by Utah Juniper and scattered pinyon. This site may have Wyoming big sagebrush in the understory. This site is in the 8 to 12 inch precipitation zone of semidesert.
R036XY266CO	**Salt Meadow** Salt meadow occurs on drainage-ways, floodplains and alluvial fans. This site is in a run-in position on the landscape. Soils are deep. Soil textures are generally clay loams and silty clay loams. There are salts present on this site. Dominant vegetation is alkali sacaton, saltgrass, basin wildrye, and western wheatgrass. Site is mesic.
R036XY284CO	**Loamy Foothills** 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.
R036XY445CO	**Steep Colluvial Slopes** 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.

Similar sites

R035XY003UT	**Alkali Bottom (Greasewood)** Alkali Bottom is found on flood plains, steam terraces, near stream channels and in valley floors. This site is in a run-in position on the landscape. Soils are deep from sandstone and shale. Surface textures are loamy sand, fine sandy loam and clay loam. Soils are high in salinity. Dominant plants are greasewood, Indian ricegrass, galleta and needle-and-thread. Precipitation is 7 to 11 inches.
R035XY015UT	**Sandy Bottom** Sandy Bottom is found on flood plains, steam terraces, narrow valley and valley flats. This site is in a run-in position on the landscape. Soils are deep from sandstone. Surface and subsurface textures are fine sandy loam, loamy fine sand, and fine sand. Dominant plants are four-wing saltbush, Indian ricegrass, galleta, and needle-and-thread. Precipitation is 6 to 12 inches.
R035XY011UT	**Loamy Bottom (Basin Big Sagebrush)** Loamy Bottom is found on flood plains, steam terraces, drainageways, and alluvial flats. This site is in a run-in position on the landscape. Soils are deep from sandstone. Surface and subsurface textures are fine sandy loam, loam, sandy loam and loamy fine sand. Dominant plants are basin big sagebrush, basin wildrye, Indian ricegrass, muttongrass, and western wheatgrass. Precipitation is 12 to 16 inches.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Artemisia tridentata subsp. tridentata*
Herbaceous	(1) *Elymus cinereus*

Physiographic features

This site occurs on drainageways, draws, floodplains, and alluvial fans in narrow canyon bottoms with intermittent drainages flowing through them. Slopes typically range from 0-6%, and elevations are generally 6000-7400 ft.

Table 2. Representative physiographic features

Landforms	(1) Drainageway (2) Flood plain (3) Draw
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	None to rare
Ponding frequency	None
Elevation	1,829–2,256 m
Slope	0–6%
Aspect	Aspect is not a significant factor

Climatic features

Average annual precipitation is about 12 to 16 inches. Of this, 40-50% falls as snow, and 40-45% falls between May 1 and September 30. Summer moisture is mostly from thundershowers in late July, August, and September. The driest period is usually from April to early June; and June is normally the driest month. There is fall growth from late summer rains on this site during August and September, usually from the warm season plants. The average annual total snowfall is 38.3 inches. The highest winter snowfall record in this area is 117.5 inches which occurred in 1978-1979. The lowest snowfall record is 3.0 inches during the 1937-1938 winter. This area is located where there is winter precipitation and summer monsoonal rains. Moisture that comes during summer will favor the warm season plants. Mean daily annual air temperature is about 48ºF to 52ºF, averaging about 31ºF for the winter and 60ºF through the growing season, March through October. Summer temperatures of 100ºF or more are not unusual. The frost-free period typically ranges from 110 to 130 days. The last spring frost is the end of April to the end of May and the first fall frost is the first week of October to the end of October. Mean annual temperature ranges from 64 to 37ºF. The coldest winter temperature recorded was -23ºF on February 8, 1933 and the coldest summer temperature

recorded was 28ºF on June 3, 1908. The hottest day on record is 110 ºF on June 22, 1905. Wide yearly and seasonal fluctuations are common for this climatic zone. Data taken from Western Regional Climate Center (2015) for Blanding, Utah, Colorado Climate Station. Blanding is on the Western edge of the MLRA. Most Climate station in this LRU (Land Resource Unit) are either on the low end of the range (~12”) or the high end (15 to 16”) of the precipitation range. Blanding and Uravan are the only ones in the middle and Blanding has the longest record.

Table 3. Representative climatic features

Frost-free period (average)	122 days
Freeze-free period (average)	147 days
Precipitation total (average)	356 mm

Climate stations used

- (1) CORTEZ [USC00051886], Cortez, CO
- (2) NORTHDALE [USC00055970], Dove Creek, CO
- (3) BLANDING [USC00420738], Blanding, UT
- (4) URAVAN [USC00058560], Naturita, CO
- (5) LA SAL 1SW [USC00424947], Monticello, UT
- (6) YELLOW JACKET 2 W [USC00059275], Yellow Jacket, CO

Influencing water features

None

Soil features

Soils are deep (60+ inches). These soils are fine-loamy and fine-silty in texture. The surface layer texture is usually a loam or clay loam with 18-31% clay. The subsoils are loamy textured. The subsurface is usually a loam or clay loam with approximately 25-31% clay. The most common parent materials are alluvium from sandstone and shale or mixed sources. The soil moisture and temperature regimes are aridic ustic and mesic respectively.

This ecological site has been used in the following Soil Surveys: CO670 (Ute Mountain Area) and CO671 (Cortez Area).

Typical soils assigned to this ecological site are:

Fine-Loamy – Ramper
Fine-Silty - Ackmen

Non-typical soils assigned to this ecological site (most likely belonging to a sandy bottom ecological site):

Coarse-Loamy - Radnik

When soil salinities are high, soil textures are loamy, and locations are dominated by greasewood most likely the site is an alkali bottom, and not a loamy bottom.

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale
Surface texture	(1) Loam (2) Clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderate

Soil depth	152 cm
Surface fragment cover <=3"	0–8%
Surface fragment cover >3"	0–2%
Available water capacity (0-101.6cm)	13.97–17.78 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–4 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0–1
Soil reaction (1:1 water) (0-101.6cm)	7.4–8.4
Subsurface fragment volume <=3" (Depth not specified)	0–8%
Subsurface fragment volume >3" (Depth not specified)	0–3%

Ecological dynamics

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

There is a winter-summer bimodal precipitation pattern on this part of the Colorado Plateau. Meaning that this site developed under climatic conditions that include wet, cold winters, and hot, dry summers with summer rains. This area has climatic fluctuations and prolonged droughts are common occurrences. Between an above average year and a drought year, forbs are the most dynamic (Passey et.al. 1982) and can vary up to 4 fold. The precipitation and climate of MLRA 36 are conducive to producing Pinyon/juniper, and sagebrush complexes with high productive sites in the bottoms of the canyons. Predominant species on the Colorado Plateau are Wyoming big sagebrush (*Artemisia tridentata* var. wyomingensis), mountain big sagebrush (*A. tridentata* var. vaseyana), and black sagebrush (*A. nova*), Basin Big Sagebrush (*A. tridentata* var. tridentata), Utah Juniper (Juniperus utahensis) and Pinyon (*Pinus edulis*).

This ecological site is located in draws, small valley bottoms and drainage-ways on the Colorado Plateau. Herbivory and fire are the dominant disturbance factors in the sagebrush biome (Boyd et. al., 2014). Removal or repeatedly detrimental application of either of these disturbances on the system and/or the landscape can result in a shift of the ecological dynamics of this system. The ecological dynamics of the associated uplands are influential to the dynamics of this site. Excessive runoff and erosion from degraded uplands can increase concentrated flow and increased potential erosion towards gully formation. This site is located in the bottoms where fire occurred more frequently, removing brush and keeping it in a grassland state.

The plant community on this site is very productive and relatively resilient compared to its surrounding uplands. It has deep soils with good water holding capacity that receive a large amount of moisture from run-in and overflow water. Because of these factors many of these sites are now or once were cleared and converted to agricultural lands depending on their accessibility.

This site is dominated by perennial grasses but shrub species are present with Basin Big Sagebrush. Although, this site evolved with grazing and is relatively durable, it will be affected negatively with continuous heavy grazing pressure. Livestock are attracted to these sites because they are so productive and these sites lie in low areas with gentle slopes. Proper distribution of livestock is critical. Appropriate placement of fencing, water, and salt/supplement is necessary. Heavy grazing combined with drought and/or lack of fire, will cause this site to become shrub dominant. As shrubs increase and perennials are weakened due to heavy grazing and/or drought, undesirable annuals such as cheatgrass may invade the site. As perennial grasses with fibrous root systems are replaced by weaker annuals, erosion may occur more rapidly. Runoff from the uplands can cause channels to form and incise dropping the water table. As soils dry out, greasewood may begin to invade into these sites. This seems to occur more frequently at lower elevations.

A greasewood site occurs in the similar ecological site (Alkali Bottom) in MLRA 35. The 2 bottom sites have not been broken out very well in published soil surveys and this will be need to be done in the future. The greasewood site occurs on soils that are high in salinity and alkalinity. Loamy bottom can transition in to an alkali bottom on the landscape. This typically occurs in the lower ends of the drainages, possibly because of salt accumulations from upstream or salt layers that are exposed through erosion and where the landscape has transitioned into the warmer portion of mesic temperature regime.

Soils, topographic location, climate, periodic droughts and fire influenced the stabilization of the Reference State on this site as was the case on most drainage-ways and draws ecological sites. The Reference State is presumed to be as found by European settlers in the early 1800's developed under the prevailing climate over time along with the soils in their topographic location. Grazing and/or browsing by wildlife influenced the plant community as well. Sagebrush below 8500 feet has been slower to recover from settlement of the west (Winward, 2004). This site has been found to have basin big sagebrush.

Fire size prior to 1850 were most likely a large number of small to medium size mosaic burns and since 1980 can be typified by a few very large fires due to human caused changes (Evers, et al, 2011). This change in fire return intervals and intensities was cause by fire suppression and reduced fine-fuels from livestock grazing practices around the late 1800’s and early 1900’s. Since fire is not always available to be applied, then other shrub management may necessary from time to time to help keep the community in balance. Treatment response will vary among sites due to differences in vegetation composition and abundance, soils, elevation, aspect, slope and climate (McIver, et al, 2010).

Natural fire played an important role in the function of most upland sites. Fire keeps sagebrush stands from getting too dense, while invigorating other sprouting shrubs. Fire helped to keep a balance between the grasses, forbs and shrubs. Plant community dynamics were improved by opening up canopies and stimulating forb growth creating a mosaic of different age classes and species composition. Shrubs which re-sprout (yellow rabbitbrush, rubber rabbitbrush), are suppressed for a time allowing grasses to dominate. If periodic fire or some other method of brush control is not used, then sagebrush will slowly increase and can begin to dominate the site.

There has been shrub die-off in several sagebrush taxa in the past 10-15 years due to several factors. The two dominant factors are disease/pathogens and drought. Die-off due to disease/pathogens is believed to be tied to disease or stem/root pathogens occurring in dense over-mature sagebrush stands throughout the west. While in some areas, when the factors of drought and heavy browsing occurring in conjunction with disease/pathogens complete areas are dying.

Small wet areas can occur occasionally when the bottoms are very narrow and small, allowing for more water accumulation. This may support willows, sedges and rushes and may be a small inclusion of a wet meadow or salt meadow ecological site. Cottonwoods (Fremont and/or Narrowleaf) can occasionally be found in these inclusion areas. Cottonwood are reported to be a facultative wetland species which are tolerant of frequent and prolonged flooding and are not drought resistant (Simonin, 2001). This site is typically too dry to sustain cottonwoods.

A weedy community that has not been depicted on the model can arise if domestic grazing is completely excluded or if there is repetitive, season-long, heavy domestic or wild ungulate use. With grazing exclusion, a thick thatch of residual litter build-up results in shading and a reduction of health, vigor and production of all plants. Improper domestic and wild ungulate grazing use results in preferred species being repeatedly clipped which decreases their health, vigor and production. Both make a site susceptible to invasion by noxious and/ unsuited species.

Few, of any fire histories have been conducted on basin big sagebrush. It is suggests that fire return intervals in basin big sagebrush are intermediate between mountain big sagebrush and Wyoming big sagebrush (Tirmenstein, 1999). Wyoming big sagebrush communities are less prone to fire than mountain big sagebrush. Wyoming big sagebrush communities in the western United States have fire return intervals ranging from 10-115 years (West and Hassan 1985, Evers, et al, 2011, Johnson, 2000). Fire return intervals for Wyoming big sagebrush vary greatly depending on locale differences in precipitation and temperature. The fire return interval habitats with mountain big sagebrush is 10 to 40 years (Boyd et. al., 2014, Johnson, 2000). Johnson (2000) states that basin big sagebrush fire regime is 12 to 43 years. LANDFIRE models fire regimes of Basin and Wyoming Big Sagebrush communities have been found to have a fire interval of 33 to 116 years (USDA, 2012). LANDFIRE data is for general vegetation types in the United States: no specific data for basin big sagebrush dominated sites exist on Colorado Plateau at available at this time.

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

State and transition model

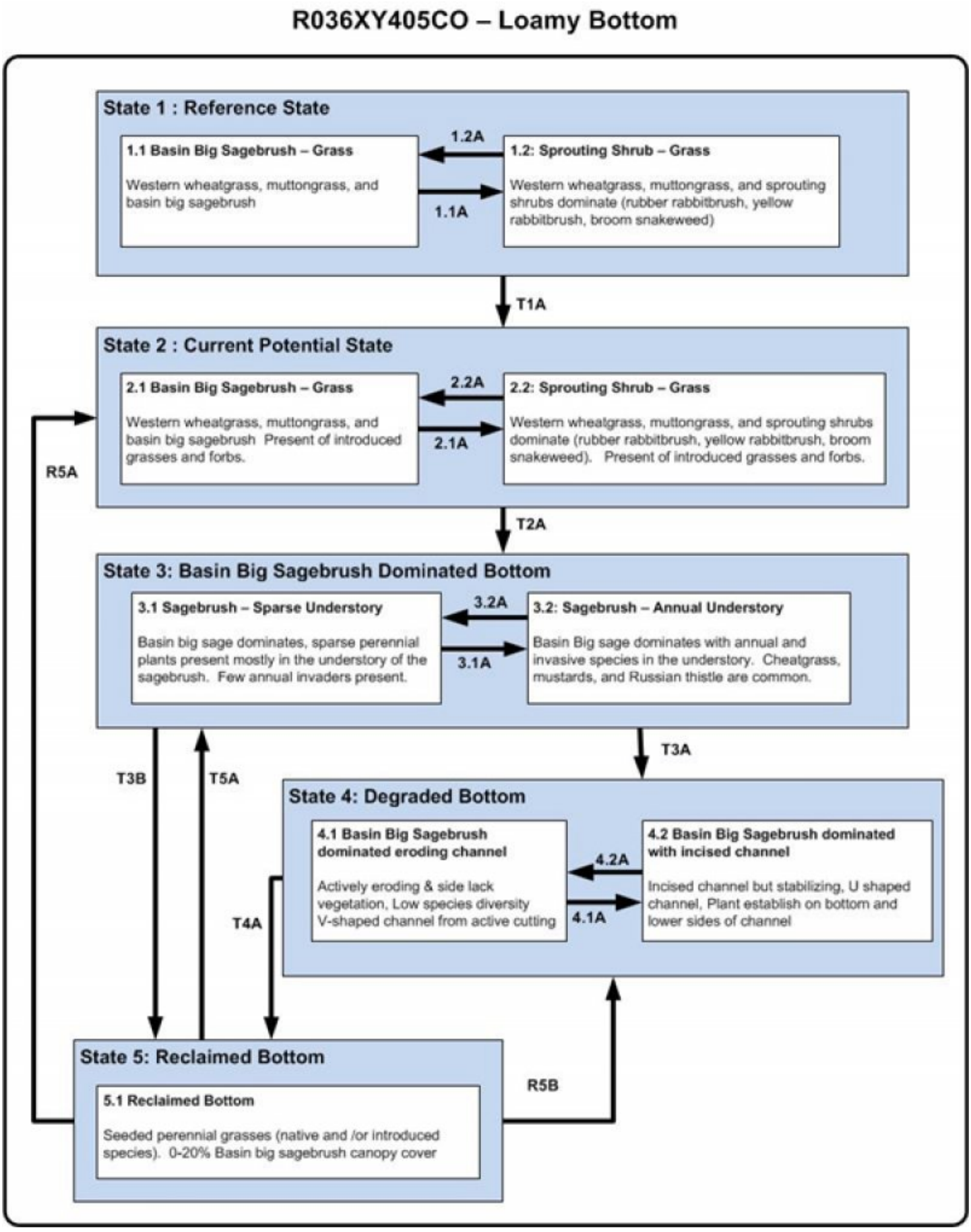
R036XY405CO – Loamy Bottom
State 1 : Reference State
1.1 Basin Big Sagebrush – Grass
Western wheatgrass, muttongrass, and basin big sagebrush
1.2A
1.1A
1.2: Sprouting Shrub – Grass
Western wheatgrass, muttongrass, and sprouting shrubs dominate (rubber rabbitbrush, yellow rabbitbrush, broom snakeweed)
T1A
State 2 : Current Potential State
2.1 Basin Big Sagebrush – Grass
Western wheatgrass, muttongrass, and basin big sagebrush Present of introduced grasses and forbs.
2.2A
2.1A
2.2: Sprouting Shrub – Grass
Western wheatgrass, muttongrass, and sprouting shrubs dominate (rubber rabbitbrush, yellow rabbitbrush, broom snakeweed). Present of introduced grasses and forbs.
R5A
T2A
State 3: Basin Big Sagebrush Dominated Bottom
3.1 Sagebrush – Sparse Understory
Basin big sage dominates, sparse perennial plants present mostly in the understory of the sagebrush. Few annual invaders present.
3.2A
3.1A
3.2: Sagebrush – Annual Understory
Basin Big sage dominates with annual and invasive species in the understory. Cheatgrass, mustards, and Russian thistle are common.
T3A
T3B
T5A
State 4: Degraded Bottom
4.1 Basin Big Sagebrush dominated eroding channel
Actively eroding & side lack vegetation, Low species diversity V-shaped channel from active cutting
4.2A
4.1A
4.2 Basin Big Sagebrush dominated with incised channel
Incised channel but stabilizing, U shaped channel, Plant establish on bottom and lower sides of channel
T4A
State 5: Reclaimed Bottom
5.1 Reclaimed Bottom
Seeded perennial grasses (native and /or introduced species). 0-20% Basin big sagebrush canopy cover
R5B

Figure 6. STM

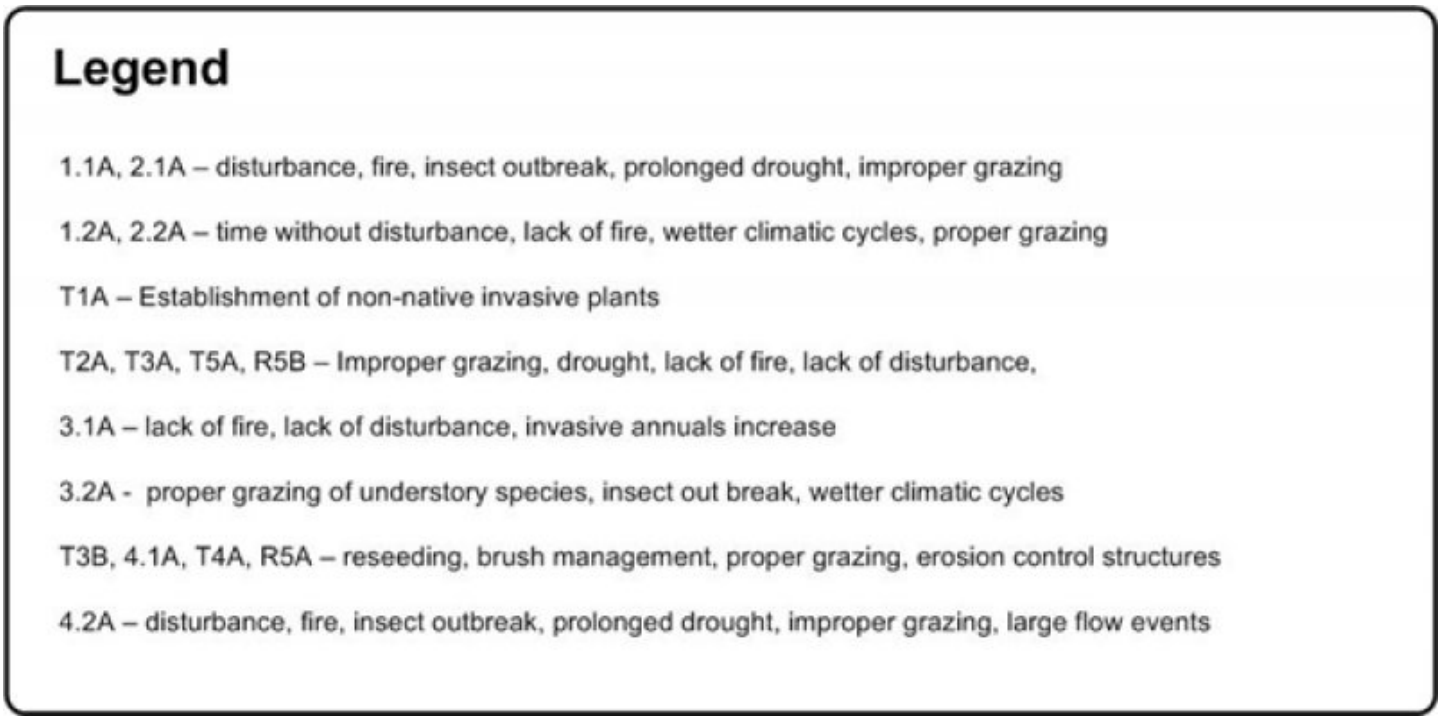

Figure 7. Legend

State 1
Reference State

The reference state contains plant communities presumed to occur prior to the introduction of nonnative plants, livestock grazing, and other modern disturbances. Basin big sagebrush dominance depends on time since fire, insect outbreak or extended drought. In both communities the grasses are the dominant component. It is a very diverse community with 10-20 or more species present throughout the site. This diversity adds to a site's stability. Often, decreasing diversity can be one of the first indicators of site deterioration. Key species that indicate a pristine and functioning system include. Species that often act as increasers with disturbance and indicate a deteriorating site include: basin big sagebrush, white sagebrush, squirreltail, foxtail barley, broom snakeweed, and rabbitbrush. This site has less than 20% big sagebrush canopy cover. The percentage of shrubs in this state will fluctuate depending on frequency and intensity of disturbances such as fire, or grazing. Typically the sage brush increases until fire is introduced to the system. Following the fire, rabbitbrush and annual forbs will increase creating a rabbitbrush phase that will be phased out as perennial grasses and sagebrush reestablish themselves. The following is from the 1982 range site: 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 due to overgrazing by cattle will decrease western wheatgrass, muttongrass, Indian ricegrass, New Mexico feathergrass, and bottlebrush squirreltail. Further deterioration by overgrazing will increase basin big sagebrush, rabitbrush, broom snakeweed, plains prickly pear and foxtail barley. With severe depletion of the natural grasses, species such as cheatgrass, Russian thistle, Italian cocklebur, and 5-stem tamarisk will invade the site.

Community 1.1
Basin Big Sagebrush – Grass

The following is from the 1982 range site: The plant community is about 65 to 80% grasses, 5 to 15% forbs, and 20 to 30% shrubs, air-dry weight. Western wheatgrass, dominates the plant species, making up from 25 to 35% of the total annual production on the site. Muttongrass and Indian ricegrass are sub-dominant grass species. Basin big sagebrush, four-wing saltbush, rubber rabbitbrush and numerous other shrubs and forbs enhance the wildlife habitat, add color to the site, and variety to the diet of grazing animals.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	673	942	1143
Shrub/Vine	280	392	476
Forb	168	235	286
Total	**1121**	**1569**	**1905**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-20%
Grass/grasslike foliar cover	5-10%
Forb foliar cover	5-10%
Non-vascular plants	0%
Biological crusts	0-15%
Litter	10-25%
Surface fragments >0.25" and <=3"	0-8%
Surface fragments >3"	0-2%
Bedrock	0%
Water	0%
Bare ground	0-10%

Table 7. Canopy structure (% cover)

Height Above Ground (M)	Tree	Shrub/Vine	Grass/ Grasslike	Forb
<0.15	–	0-5%	0-4%	0-4%
>0.15 <= 0.3	–	0-5%	0-4%	0-4%
>0.3 <= 0.6	–	5-10%	–	–
>0.6 <= 1.4	–	10-20%	–	–
>1.4 <= 4	–	0-10%	–	–
>4 <= 12	–	–	–	–
>12 <= 24	–	–	–	–
>24 <= 37	–	–	–	–
>37	–	–	–	–

Figure 9. Plant community growth curve (percent production by month). CO0103, MLRA 36 - Foothills Mesic. MLRA 36.

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 1.2
Sprouting Shrub – Grass

Sprouting shrubs make up most of the shrub component. Rabbitbrush is a re-sprouter and will increase after disturbance. This phase is usually the result of fire that eliminates basin big sagebrush dominance for the space of several years. Sagebrush will begin to re-establish in the community following fire, and will steadily increase in the community until it becomes co-dominant with the perennial grass. However it can be difficult to move this

community back to the community phase 1.1.

Figure 10. Plant community growth curve (percent production by month). CO0103, MLRA 36 - Foothills Mesic. MLRA 36.

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

Pathway 1.1A
Community 1.1 to 1.2

Sprouting shrubs increase due to disturbance. Stand-replacing fire of sagebrush is the most common historical cause of this community pathway. Sagebrush decreases and perennial grasses, forbs, and sprouting shrubs (i.e. rabbitbrush) dominate the site. Insect outbreak, low intensity fires, and prolonged drought may also result in a substantial decrease in sagebrush, but do not necessarily eliminate it from the community. Repetitive burning of big sagebrush favors rabbitbrush and perennial grasses. Mechanical and chemical removal of sagebrush can often release rabbitbrush on this site. This may be a timing of treatment issue or one related to the weather patterns in years surrounding the treatment. Chemical treatment, physical means (i.e. mowing) and/or prescribed fire often are attempted to remove invading sagebrush.

Pathway 1.2A
Community 1.2 to 1.1

This pathway results from the establishment and natural increase of basin big sagebrush into the plant community years following a fire. Proper grazing use, herbivory on sprouting shrubs, and time should allow this community to transition to plant community 1.1. Brush management practices may be necessary if the rabbitbrush and bareground has increased. Repetitive brush treatment may be needed.

State 2
Current Potential State

The current potential state is similar to the reference state, however invasive species are present in all community phases. This state is generally dominated by big sagebrush, however depending on disturbance history, native grasses, forbs, or other shrubs may dominate the site. Primary disturbance mechanisms include fire, native herbivore grazing, insect outbreak, domestic livestock grazing and surface disturbances, (i.e. road and pipeline development and off road vehicle (OHV) use). Timing of these disturbances dictates the ecological dynamics that occur. The current potential state is self-sustaining; but is losing resistance to change due to lower resistance to disturbances and lower resilience following disturbances. When disturbances occur, the rate of recovery is variable depending on severity. The current potential state is similar in structure and function to the reference state, however invasive and non-natives species are present in all community phases. The current potential state is generally dominated by perennial grasses.

Community 2.1
Basin Big Sagebrush – Grass

Phase 2.1 is similar to the reference plant community in composition and ecological function, but it allows for the presence of non-native/invasive species. The following is from the 1982 range site: The plant community is about 65 to 80% grasses, 5 to 15% forbs, and 20 to 30% shrubs, air-dry weight. Western wheatgrass, dominates the plant species, making up from 25 to 35% of the total annual production on the site. Muttongrass and Indian ricegrass are sub-dominant grass species. Basin big sagebrush, four-wing saltbush, rubber rabbitbrush and numerous other shrubs and forbs enhance the wildlife habitat, add color to the site, and variety to the diet of grazing animals.

Figure 11. Plant community growth curve (percent production by month). CO0103, MLRA 36 - Foothills Mesic. MLRA 36.

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 2.2
Sprouting Shrub – Grass

Sprouting shrubs make up most of the shrub component. Phase 2.2 annual production is dominated by perennial grasses. It is similar to phase 1.2 in composition and ecological function, but allows for non-native/invasive species to be present. Sprouting shrubs make up most of the shrub component. Rabbitbrush is a re-sprouter and will increase after disturbance. This phase is usually the result of fire that eliminates basin big sagebrush dominance for the space of several years. Sagebrush will begin to re-establish in the community following fire, and will steadily increase in the community until it becomes co-dominant with the perennial grass. However it can be difficult to move this community back to the community phase 2.1.

Figure 12. Plant community growth curve (percent production by month). CO0103, MLRA 36 - Foothills Mesic. MLRA 36.

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

Pathway 2.1A
Community 2.1 to 2.2

Sprouting shrubs increase due to disturbance. Stand-replacing fire of sagebrush is the most common historical cause of this community pathway. Sagebrush decreases and perennial grasses, forbs, and sprouting shrubs (i.e. rabbitbrush) dominate the site. Insect outbreak, low intensity fires, and prolonged drought may also result in a substantial decrease in sagebrush, but do not necessarily eliminate it from the community. Repetitive burning of big sagebrush favors rabbitbrush and perennial grasses. Mechanical and chemical removal of sagebrush can often release rabbitbrush on this site. This may be a timing of treatment issue or one related to the weather patterns in years surrounding the treatment. Chemical treatment, physical means (i.e. mowing) and/or prescribed fire often are attempted to remove invading sagebrush.

Pathway 2.2A
Community 2.2 to 2.1

This pathway results from the establishment and natural increase of basin big sagebrush into the plant community years following a fire. Proper grazing use, herbivory on sprouting shrubs, and time should allow this community to transition to plant community 2.1. Brush management practices may be necessary if the rabbitbrush and bareground has increased. Repetitive brush treatment may be needed.

State 3
Basin Big Sagebrush Dominated Bottom

This state arises when there has been prolonged fire suppression along with heavy grazing and/or drought. Basin big sagebrush is now the dominant species contributing the majority production. The depleted understory state occurs when perennial grasses have been lost from the understory. Perennial forbs may also be reduced. This state is may not be capable of carrying a stand replacing fire that removes big sagebrush due to a reduction in fine fuels. If improper grazing continues to occur shrubs will continue to increase and perennial grasses will begin to be replaced by annuals such as cheatgrass. The hydrologic function of this community is still intact throughout the entirety of the bottom. Meaning, there is no bench or entrenched/incised channel. The water has access to the entirety of the bottom for flooding and energy dissipation purposes. This state is a very unstable state at the edge of a very major threshold and this would be the latest time to treat the site, with the least amount of energy, and expect to restore it to the current potential plant community. Without treatment there is high probability of a transition to a greatly degraded state with a high flow event that could permanently alter the hydrologic function of the site. This state may return to the current potential state through prescribed fire or brush management by chemical or mechanical means followed by reseeding. Upland site degradation is a huge influence in allowing the progression of the transition from a site with functioning hydrology and preferred plant communities to this highly unstable community. Uplands that develop dense, aged sagebrush stands with little understory dewater a bottom by increasing overland flow and evaporative loss and decreasing a site’s ability to capture and store water. The removal of grasses and herbaceous litter from the soil surface decreases the site’s ability to slow water and allow for infiltration. Thus, water that once could have been safely transported, infiltrated, stored and moved to the bottom

at a later period is now added to the already erosive overland flow at the same time. Meaning, larger amounts of water and sediment are running onto the bottom more rapidly in a shorter period of time. These minor changes in the microclimate, especially on the periphery of the bottom, are enough to allow for the sagebrush to continue advancing into the bottom along with other obligate upland species and further perpetuating the drying.

Community 3.1
Sagebrush – Sparse Understory

The dominate plants have changed from perennial grasses and forbs to big sagebrush. Most perennial plants have been lost from the understory and the ones that are present are usually found under the shrub canopy. Basin big sagebrush continues to increase beyond the natural fire return interval due to lack of fuel to carry a fire. Moderate and large flow events can result in immense amounts of erosion. A bottom that was once a depositional zone prior to sagebrush invasion can become at risk for developing deeply eroded channels and contribute to higher stream sediment loads.

Figure 13. Plant community growth curve (percent production by month). CO0103, MLRA 36 - Foothills Mesic. MLRA 36.

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 3.2
Sagebrush – Annual Understory

This phase is dominated by basin big sagebrush in the overstory and annual introduced grasses and/or forbs in the understory.

Figure 14. Plant community growth curve (percent production by month). CO0103, MLRA 36 - Foothills Mesic. MLRA 36.

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

Pathway 3.1A
Community 3.1 to 3.2

With Basin big sagebrush increasing and sagebrush decadence increasing, cover changes in this communities can brought on by prolonged drought, lack of fire, surface disturbances, (i.e. road and pipeline development and off road vehicle (OHV) use), and improper grazing use can create alterations in the plant community that can leave the soils at risk for erosion and alter the hydrological function. Improper grazing of perennial grasses during growth has favored non-native invasive species, primarily cheatgrass and/or Russian thistle, to co-dominate the understory. Few remnant plants may still persist under shrubs, but re-establishment and dominance by perennial grasses will not occur following a fire, or with the removal of grazing animals in the natural time frame.

Pathway 3.2A
Community 3.2 to 3.1

This pathway occurs when basin big sagebrush is reduced by fire, insect outbreak, wetter climatic cycles or other another disturbances. As perennial grasses are slowly establishing due to proper grazing and less competition from basin big sagebrush. There still is accelerated erosion that can lead to increased channelization in flow areas.

State 4
Degraded Bottom

This is a degraded state and the hydrology of this site has been altered. The plant community and surface debris are no longer capable of slowing runoff and dissipating the water’s erosive energy. In flow events, fine organic materials are not present to stabilize soil, slow water and allow infiltration. Instead, water from the uplands builds energy as it collects in the bottom and begins to form a channel. As the water becomes more channelized, the

bottom becomes even less capable of dissipating the energy and channelization increases moving down the system and a head-cut start moving up the system. This state has two fluctuating phases. Both phases have an entrenched channel where water has no access to the bottom floodplain and although vegetation in the channel may return to a community similar to the current potential (if not a little wetter), the majority of the bottom remains in the degraded sagebrush dominated state producing only a fraction of its original potential. The first community is the least stable with high levels of erosion occurring with any flow event. There is no vegetation on the sidewalls or the bottom of the channel. It has a distinctly V shaped channel profile that widens and deepens with every flow event. The second community is where healing is occurring and he bottom of the channel has become re-vegetated. The vegetation is similar to that of the current potential community with some exception. Since there is the same amount of water consolidated to a smaller area, the soils have a greater potential to show gleying and redoximorphic features that indicate low oxygen environments that are associated with the presence of a water table. Thus, plants that often inhabit the channel are those that have a greater tolerance for flooding. This means that often the amount of obligate and facultative wetland species are increased beyond that of the reference plant community. The channel vegetation helps to hold the channel in minor to moderate flooding events and prevent further degradation. Often sites in this phase develop U shaped profiles.

Community 4.1
Basin Big Sagebrush dominated eroding channel

This community is the least stable community within this state. This state has actively eroding channel with active head-cuts at the top of the eroding channel. There are high levels of erosion occurring with any flow event due to the lack of vegetation on the sidewalls and the bottom of the channel. Often there is a distinctly V shaped channel that widens and deepens with every flow event. Bareground has increased and herbaceous production has been reduced. There is very low species diversity and a majority of the forbs are gone from the community. The site is eroding to create a partially abandoned bottom that will look like a drier sagebrush bench above a narrower channel (bottom).

Figure 15. Plant community growth curve (percent production by month). CO0103, MLRA 36 - Foothills Mesic. MLRA 36.

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 4.2
Basin Big Sagebrush dominated with incised channel

The second community is where healing is occurring. The bottom of the channel has become re-vegetated with plants similar to that of the reference community with some exception. Since there is the same amount of water consolidated to a smaller are, the soils have a greater potential to show gleying and redoximorphic features that are associated with the presence of a water table. Thus, plants that often inhabit the channel are those that have a greater tolerance for prolonged flooding. This means that often the amount of obligate and facultative wetland species are increased beyond that of the reference plant community. The channel vegetation helps to stabilize the channel in minor to moderate flooding events. Often sites in this phase develop “U” shaped profiles. Side slopes remain denuded and thus there is still potential for erosion. There can be a sagebrush “bench” (elevated sagebrush topslopes with relict reference state vegetation) along a narrow and entrenched channel.

Figure 16. Plant community growth curve (percent production by month). CO0103, MLRA 36 - Foothills Mesic. MLRA 36.

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

Pathway 4.1A
Community 4.1 to 4.2

By stabilizing actively eroding areas with vegetation and ground cover the bottom can begin to heal and further deterioration can be reduced. Any practice that promotes vegetation will aid in this transition.

Pathway 4.2A
Community 4.2 to 4.1

Seasonal drought, improper grazing use, regional and fire, and large flow events can all contribute to this community's further degradation.

State 5
Reclaimed Bottom

This community is a man-made community. To get to this state requires a lot of inputs and hard work, but it can be done. Time, energy and resources are needed to restore the water table to the floor of the bottom and not the bottom of the channel.

Community 5.1
Reclaimed Bottom

This is the community phase after the work is done to restore the water table to the floor of the bottom. Often a large amount of dirt work, brush removal and the installation of check dams are required to reclaim the bottom community. Even then, the community may never be that of the reference plant community. Areas directly behind the check structures often have a higher water table and promote facultative and obligate wetland species. Areas directly below the structures are not getting the subterranean flow that was present in the original bottom and thus are drier and promote invasion by upland species that are not typical in the reference plant community. This site will need to be monitored to see if additional work will need to be done once original check dams fill up with sediment. This site could need to be seeded to help stabilize it.

Figure 17. Plant community growth curve (percent production by month). CO0103, MLRA 36 - Foothills Mesic. MLRA 36.

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
State 1 to 2

This transition is from the native perennial warm and cool season grass understory in the reference state to a state that contains invasive species. Plant may include cheatgrass, annual mustards, thistles, knotweeds, and dandelion. Events include establishment of invasive plant species, intense continuous grazing of perennial grasses, prolonged drought, and/or surface disturbances, etc. However, invasive species such as cheatgrass have been known to invade intact perennial plant communities with little to no disturbance. Once invasive species are found in the plant community a threshold has been crossed.

Transition T2A
State 2 to 3

This pathway occurs when perennial grasses are reduced in the understory due to improper grazing and/or drought during the growing period. With Basin big sagebrush increasing and sagebrush decadence increasing, cover changes in this communities can brought on by prolonged drought, lack of fire, and improper grazing use can create alterations in the plant community that can leave the soils at risk for erosion and alter the hydrological function. Also, lack of wet periods to drown out big sagebrush and increase completion from the shallower root grasses and forbs can cause this shift from State 2 to State 3 - sagebrush dominated. Few remnant plants may still persist under shrubs, but re-establishment and dominance by perennial grasses will not occur following a fire, or with the removal of grazing animals in the natural time frame. Nonnative species may co-dominate the understory.

Transition T3A
State 3 to 4

The site has become unstable. This is a very quick transition. Due to the lack of soil protection large flow events quickly destabilize the site and it transitions to the state with altered hydrological function (4). Anything that further

reduces ground cover, like improper grazing use and continued drought, has potential to quicken this transition. Fire suppression and lack of shrub management in decadent sagebrush uplands continue to promote altered hydrologic function and also aid in destabilizing the bottom. The lack of adequate herbaceous cover to dissipate water velocity and encourage infiltration result in the formation of gullies and head-cuts.

Transition T3B
State 3 to 5

To restore the site to the current potential state extreme inputs are necessary. This transition is from a big sagebrush dominated state, to a state that has been seeded with introduced or native perennial grasses. High energy inputs are needed for this transition. Sagebrush will need to be removed with vegetation treatment techniques (I.e. chemical, mechanical, or fire) and introduced or native species that are adapted to the area and adapted to management needs have been seeded and become established. Proper grazing use by both domestic animal and wildlife needs to occur. Often successful on small scales over very long periods of time, large scale restoration projects are not often able to be fully restored. This pathway would require continued sedimentation, proper grazing use, and proper hydrologic contributions. Management practices that restore upland community health and functioning are critical to restoring a sagebrush dominated bottom to the current potential state. Such practices can include shrub management, and reseeding. Erosion control structures may be necessary. This needs to be used in conjunction with proper grazing management. Several wet years in a row can also decrease big sagebrush, as big sagebrush does not like to have it roots in water for extended periods of time.

Transition T4A
State 4 to 5

Returning to the current potential state will be time, resource, and energy intensive. The water table needs to be restored to the floor of the bottom and not the bottom of the channel. Often a large amount of dirt work, brush removal and the installation of check dams are required to reclaim the bottom community. Check dam structures are used in an attempt to stop head-cuts, slow water, and catch sediments all in hopes of raising both the channel and the water table to allow for flooding access to the entire bottom and returning the hydrologic function. Reclaiming these bottom sites, also, include fixing all the problems that initially contribute to the degradation, including management practices that improve the contributing upland communities. A bottom cannot be restored by only changing problems within the site itself. The bottom’s health and success in restoring the functioning is directly tied the health and function of the surrounding uplands.

Restoration pathway R5A
State 5 to 2

This restorative pathway from the State 5 to the State 2 is very intensive. Often successful on small scales over very long periods of time, large scale restoration projects are not often able to be fully restored. This pathway would require continued sedimentation, proper grazing use, and proper hydrologic contributions. This community may reestablish the same hydrological function as in the reference state if the contributing upland sites provide the hydrologic contributions.

Transition T5A
State 5 to 3

Sagebrush encroachment with increasing sagebrush decadence and cover in adjacent upland communities brought on by prolonged drought, lack of fire, and improper grazing use can create alterations in the plant community that can leave the soils at risk for erosion and alter the hydrological function.

Restoration pathway R5B
State 5 to 4

This community becomes unstable, affects soil health and the hydrologic function as it is invaded by big sagebrush. The lack of adequate herbaceous cover to dissipate water velocity and encourage infiltration result in the formation of gullies and head-cuts. This is a very quick transition. Due to the lack of soil protection large flow events quickly destabilize the site and it transitions to the state with altered hydrological function (3). Anything that further reduces

ground cover, like improper grazing use and continued drought, has potential to quicken this transition. Fire suppression and lack of shrub management in decadent sagebrush uplands continue to promote altered hydrologic function and also aid in destabilizing the bottom.

Additional community tables

Table 8. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1	**Grass/Grasslike**			673–1121	
	western wheatgrass	PASM	*Pascopyrum smithii*	336–560	–
	muttongrass	POFE	*Poa fendleriana*	224–392	–
	Indian ricegrass	ACHY	*Achnatherum hymenoides*	56–168	–
	James' galleta	PLJA	*Pleuraphis jamesii*	0–84	–
	squirreltail	ELEL5	*Elymus elymoides*	0–84	–
	New Mexico feathergrass	HENE5	*Hesperostipa neomexicana*	0–56	–
	foxtail barley	HOJU	*Hordeum jubatum*	0–56	–
	poverty rush	JUTE	*Juncus tenuis*	0–56	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–56	–
	blue grama	BOGR2	*Bouteloua gracilis*	0–56	–
	alkali sacaton	SPAI	*Sporobolus airoides*	0–56	–
Forb					
2	**Forb**			112–280	
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	11–56	–
	Forb, perennial	2FP	*Forb, perennial*	0–45	–
	tarragon	ARDR4	*Artemisia dracunculus*	0–45	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	0–45	–
	northwestern Indian paintbrush	CAAND	*Castilleja angustifolia var. dubia*	0–45	–
	Fendler's sandmat	CHFE3	*Chamaesyce fendleri*	0–45	–
	desert trumpet	ERIN4	*Eriogonum inflatum*	0–45	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	0–45	–
	scarlet gilia	IPAG	*Ipomopsis aggregata*	0–45	–
	New Mexico groundsel	PANEM	*Packera neomexicana var. mutabilis*	11–34	–
Shrub/Vine					
3	**Shrubs**			336–616	
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	140–336	–
	fourwing saltbush	ATCA2	*Atriplex canescens*	56–168	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–112	–
	broom snakeweed	GUSA2	*Gutierrezia sarothrae*	0–112	–
	winterfat	KRLA2	*Krascheninnikovia lanata*	0–112	–
	Gambel oak	QUGA	*Quercus gambelii*	0–112	–
	peachleaf willow	SAAM2	*Salix amygdaloides*	0–112	–
	greasewood	SAVE4	*Sarcobatus vermiculatus*	0–28	–

	skunkbush sumac	RHTR	*Rhus trilobata*	0–28	–
	Woods' rose	ROWO	*Rosa woodsii*	0–28	–
	plains pricklypear	OPPO	*Opuntia polyacantha*	0–28	–
	wild crab apple	PERA4	*Peraphyllum ramosissimum*	0–28	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–28	–

Animal community

The following is from the 1982 Range Site:

Grazing

This site provided good spring, fall and winter forage for cattle, sheep, horses, deer, rabbits, field mice, and other small mammals. The animal forage preference generally changes as the spring season progresses onto summer, fall, and winter. The dominant grass species western wheatgrass, muttongrass and Indian ricegrass, are most desirable in the spring. Blue grama and galleta are the most desirable in the summer and fall. In addition, four-wing saltbush and winterfat are excellent forages throughout most of the year, especially during the winter season.

The vegetative palatability of each species 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.

Wildlife

This site has a high potential for wildlife habitat because of the great variety and abundance of grasses, forbs, and shrubs produced and the seasonal presence of water. This site provides habitat, at least part of the year, for cottontail rabbits, waterfowl, deer, upland game birds, non-game birds, small mammals and reptiles.

Hydrological functions

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

The hydrologic soil groups are based on the following factors:

-intake and transmission of water under the conditions of maximum yearly wetness (thoroughly wet)
- soil not frozen
- bare soil surface
- maximum swelling of expansive clays

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

Soils Hydrologic Group

Fine Loamy

Ackman - B

Fine-Silty
Ramper - C

Coarse-Loamy (non-typical)
Radnik - A

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

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

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

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

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

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

Recreational uses

The following is from the 1982 Range Site:

This site has many forbs that bloom from early spring to midsummer, which are aesthetically pleasing. Hunting for deer, upland game birds and cottontail rabbit is generally good to excellent on this site.

Wood products

None

Type locality

Location 1: Dolores County, CO	
Township/Range/Section	T39N R18W S17
General legal description	Cahone Canyon, 3 miles southwest of Cahone, (SE1/4,Sec. 17, T39N, R18W
Location 2: Dolores County, CO	
Township/Range/Section	T39 R19 S2
General legal description	Six Miles west of Cahone along Dove Creek, W1/2, Sec 2, T39N, R19W

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Contributors

Original Author Unknown

Jamin Johanson
Suzanne Mayne Kinney

Acknowledgments

Project Staff:

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

Program Support:

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

Partners/Contributors:
Those involved in developing earlier versions of this site description include: Herman Garcia, retired CO State RMS and NRCS MLRA Ecological Site Specialist-QA Phoenix, AZ.

--Site Development and Testing Plan--:

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

Additional information and data is required to refine the Plant Production and Annual Production tables for this ecological site. The extent of MLRA 36 must be further investigated.

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

Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	Written by Suzanne Mayne-Kinney - Adapted from R048AY285CO (Foothill Swale) which was originally written by J. Murray, C. Holcomb, L. Santana, F. Cummings, S. Jaouen on 1/19/2005.
Contact for lead author	
Date	08/22/2017
Approved by	Rachel Murph, State Rangeland Management Spec, USDA NRCS Colorado
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Very minor to no rills present. Very minor rill development may occur in sparsely vegetated areas. If rills are present, they should be widely spaced and not connected. Rill development may increase following large storm events, but should begin to heal during the following growing season. Frost heaving will accelerate recovery. Rill development may increase when run inflow enters site from adjacent sites that produce large amounts of runoff (i.e. steeper sites, rock outcrop). Site is essentially level and rills do not form.

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2. **Presence of water flow patterns:** Vegetation should be persistent in the channel. Flow patterns meander around rocks, litter, and perennial plant bases. They are stable with only minor evidence of deposition. This site is periodically inundated with runoff water due to its physiographic location, so water flow patterns are expected.

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3. **Number and height of erosional pedestals or terracettes:** Plants may have small pedestals (<1”) where they are adjacent to water flow patterns, but without exposed roots. Terracettes should be few and stable. Terracettes should be small (3-6”) and show little sign of active erosion. Some plants may appear to have a pedestal but rather than be formed by erosion, the only place litter accumulates and soil collects is at plant bases forming the appearance of a pedestal.

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Expect 5-15% bare ground. Extended drought can cause bare ground to increase. Herbaceous communities are most likely to have lower values. As species composition by shrubs increases, bare ground is likely to increase. Very few if any bare spaces of greater than 1 square foot. Sagebrush invasion is often one of the causes of decreased ground cover and is defiantly an indicator of declining health. Keeping vegetation/litter on the soil surface is the key to maintaining this ecosystem in a functioning condition.

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5. **Number of gullies and erosion associated with gullies:** Gullies may be present in areas. They would usually be expected in the lowest part of the site where water flows concentrate and/or in locations where there are concentrated flows into the site from an adjacent site/watershed. If present, gullies often have steep side walls but the bottoms would be mostly stabilized with perennial vegetation. Gullies may show more indication of erosion as the slope gets greater than 5 percent, or as influenced by adjacent steep sites/watershed that may be providing concentrated flow patterns.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** Very minor to no evidence of active wind-generated soil movement. Wind scoured (blowouts) and depositional areas are very rarely present. If present they have muted features and are mostly stabilized with vegetation and/or biological crust.

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7. **Amount of litter movement (describe size and distance expected to travel):** Due to run-in nature of this site, water flow patterns would be expected to be common with associated visible evidence of litter movement. Most litter resides in place with some redistribution caused by water movement. Litter movement occurs in flow patterns and rills with deposition occurring at points of obstruction and plant bases. However during major flooding events this site slows water and capture litter and sediment and thus large amounts of litter movement is not uncommon after large flow events. Often litter from adjacent sites/watershed contribute to litter noted on site.
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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 anticipated to be "2-5". Often the soil surface is not very stable because of frequent deposition and weak soil formation. Litter and vegetation are what maintain soil stability. This site should typically have a

soil stability rating of 4 at the soil surface.
Surface texture varies from loam to clay loam. Vegetation cover, litter, and surface rock reduce erosion.

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soils are typically deep and well drained. Soil surface horizon is 0 to 6 inches deep. Structure is weak coarse platy structure parting to moderate medium granular structure or moderate medium platy structure parting to moderate medium granular structure. Soils in areas that have never been degraded or drained by gullies may have multiple buried A horizons to a depth greater than 60 inches. However, soils in areas where degradation has occurred may see drastically reduced A horizons (7” or less).

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** With the topographic location of the site being in alluvial bottoms, drainage ways, and flood plains this site is one of the accumulation sites for runoff water. Diverse grass, forbs, and shrub functional/ structural groups with diverse root structures and patterns reduce raindrop impact, slow overland flow, and provide increased time for infiltration. When perennial grasses decrease, reducing ground cover and increasing bare ground, runoff is expected to increase and any associated infiltration reduced.

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. Naturally occurring soil horizons in the subsurface may be harder than the surface and should not be considered as compaction layers. This occurs naturally due to this sites lower landscape position (bottoms etc.), where fine soil particles (silts and clays) accumulates. The associated blocky and massive structures in the subsurface should not be mistaken for compaction.

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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: Cool Season Rhizomatous Grasses >= Cool Season Bunchgrasses >= Non-sprouting Shrubs >>

    Sub-dominant: Native Perennial Forbs > Warm season Rhizomatous Grasses > sprouting shrubs

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** 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. There may be partial mortality of individual bunchgrasses and shrubs during less severe drought.

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14. **Average percent litter cover (%) and depth (in):** 15-30% litter cover and ranges from 0.25 to 0.50 inches in depth. Litter cover declines during and following extended drought. Litter cover includes litter under plants. Most litter is fine litter. Excess litter may accumulate in absence of disturbance. Litter may decline due to drought but it is a major factor preventing erosion and site degradation and thus if depleted, even due to drought, rangeland health should reflect the vulnerability.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1000 lbs/ac low precip years; 1400 lbs/ac average precip years; 1700 lbs/ac above precip years. After extended drought production may be reduced by 500-1000 lbs/ac or more.

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

17. **Perennial plant reproductive capability:** All plants have the ability to reproduce. The limitations can be weather, wildfire, natural disease, inter-species competition, wildlife, excessive litter, or insect related. Any of these might temporarily reduce plant reproductive capability.