USDA Natural Resources
Conservation Service

Ecological site R036XY038CO
Wet Meadow

Last updated: 1/16/2025
Accessed: 05/12/2025

General information

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

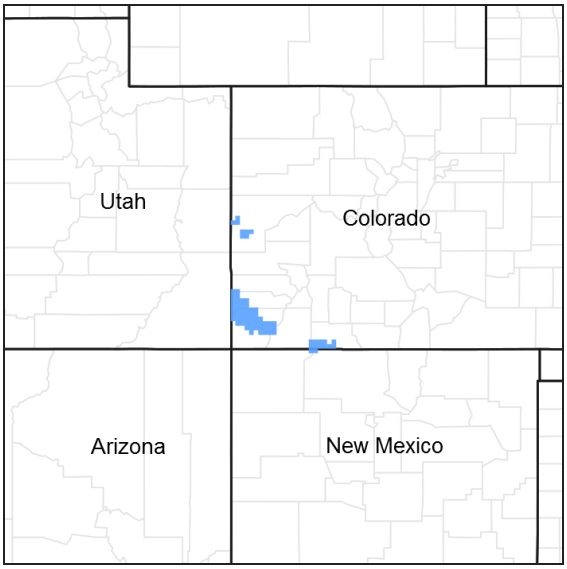

Figure 1. Mapped extent

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

MLRA notes

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

Wet Meadow ecological site is found on drainageways, swales, and draws 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 western wheatgrass, sedges, and other native perennial grasses.

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 <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 Wet Meadow was drafted from the existing Swale Meadows (R048AY243CO) Range Site from MLRA 48X, (SCS, August, 1975). The site number and draft description was created when Ute Mountain and Montezuma County was being soil mapped in the 1990 and late 2000's. This site was unwritten prior to MLRA 36 being mapped in Colorado and this area was in other MLRAs when it was written. This site is in concept only from the NASIS data. This site occurs on drainageways, swales, and draws. The soils are deep with loamy textures of sandy loam, loams to clay loams. Soils are derived from alluvium. It is a grass community with western wheatgrass, sedges, and other native perennial grasses. It has an aridic ustic moisture regime and mesic temperature regime. The effective precipitation ranges from 12 to 16 inches.

Associated sites

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.
R036XY289CO	**Clayey Foothills** 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.
R036XY347CO	**Foothill Valley** 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
R035XY413CO	**Alkali Bottom** The site 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.

Similar sites

R048AY241CO	**Mountain Meadow** Mountain Meadow occurs in mountain valley, swales, parks and around potholes. This site is in a run-in position on the landscape. Soils are deep to very deep. Soil textures are generally sandy loams to clay. Dominant vegetation is tufted hairgrass, Nebraska sedge, slender wheatgrass, and willows. This site is frigid/cryic and Typic Ustic (16-20" precipitation).
R036XB008NM	**Meadow** Meadow occurs on valley floor and mountain valleys. Soils are deep. Soil textures are generally loam, clay loam, and silty clay loam. Dominant vegetation is western wheatgrass, sedges, rushes, mountain brome, slender wheatgrass, and muttongrass. This site has a minor component of trees.
R036XY405CO	**Loamy Bottom** Loamy bottom occurs on drainage-ways, floodplains and alluvial fans. This site is in a run-in position on the landscape. Soils are deep. Soil textures are generally loams. Dominant vegetation is basin wildrye, muttongrass, basin big sagebrush, and western wheatgrass

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.
F036XA005NM	**Riverine Riparian** Riverine Riparian occurs on V-shaped and U-shaped valley, overflow stream (channel) This site has a perennial stream. Dominant vegetation is Fremont cottonwood, coyote willow, western wheatgrass and Nebraska sedge.

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pascopyrum smithii* (2) *Leymus cinereus*

Physiographic features

This site occurs in draws, drainageways, swales, flood plains, flood-plain steps, and terraces. Slopes are from 0 to 3% degree with direction not affecting the site. Elevation ranges from 5400 feet to 7400 feet above sea level.

Table 2. Representative physiographic features

Landforms	(1) Drainageway (2) Draw (3) Swale
Flooding duration	Very brief (4 to 48 hours) to very long (more than 30 days)
Flooding frequency	None to frequent
Ponding frequency	None
Elevation	1,646–2,256 m
Slope	0–3%
Water table depth	15–152 cm
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) LA SAL 1SW [USC00424947], Monticello, UT
- (2) CORTEZ [USC00051886], Cortez, CO
- (3) NORTHDALE [USC00055970], Dove Creek, CO
- (4) BLANDING [USC00420738], Blanding, UT
- (5) YELLOW JACKET 2 W [USC00059275], Yellow Jacket, CO
- (6) URAVAN [USC00058560], Naturita, CO

Influencing water features

This site has a water table. The water table ranges from 6 to 60" in depth. It can be associated with running water. The water features have not be classified at this time.

Soil features

Soils are deep to very deep (60+ inches). These soils are loamy textured. The soils are dark in color for the organic matter that occurs on this site. It is common for this site to have a mollic epipedon. This site may have a peat layer occurring. Redox features are commonly found in the soils between 0 and 60 inches in depth. The surface layer texture is usually a loam or clay loam with 18-31% clay. Gravelly sandy loam, gravelly loam and gravelly clay loam are also possible surface textures. The subsoils are loamy textured. The subsurface is usually a loam, clay loam or sandy clay loam with approximately 26-32% clay.

The soils show signs of poor drainage. They are wet most of the year, but in late summer they may show signs of drought. The variability of the duration and height of the water table causes considerable variation in plant growth over the site. The parent materials are alluvium derived from sandstone and shale, and mixed sources. The soil moisture and temperature regimes are ustic aridic and mesic respectively.

This ecological site has been used in the following Soil Surveys: CO671 (Cortez Area) CO670 (Ute Mountain Area), CO672 (Animas-Dolores Area) and NM678 (Santa Fe National Forest Area, New Mexico, Parts of Mora, Rio Arriba, Sandoval and San Miguel Counties).

Typical soils assigned to this ecological site are:

Fine Loamy - Pogo, Umnarg and Winner
Loamy-Skeletal – Tesajo
Fine-silty - Irak

Table 4. Representative soil features

Parent material	(1) Alluvium–sandstone and shale
Surface texture	(1) Loam (2) Clay loam (3) Gravelly sandy loam
Family particle size	(1) Loamy
Drainage class	Very poorly drained to moderately well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	152 cm
Surface fragment cover <=3"	0–25%

Surface fragment cover >3"	0–5%
Available water capacity (0-101.6cm)	10.16–20.32 cm
Calcium carbonate equivalent (0-101.6cm)	0–5%
Electrical conductivity (0-101.6cm)	0–8 mmhos/cm
Sodium adsorption ratio (0-101.6cm)	0
Subsurface fragment volume <=3" (Depth not specified)	0–20%
Subsurface fragment volume >3" (Depth not specified)	0–40%

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*).

The productivity and composition of this plant community would have been quite stable, although varying with the climate because it would have been affected by runoff from streams originating at higher elevations in adjacent mountains. The water table usually persisted throughout the year, causing poorly-aerated soils. The water table is fed by spring snow melt, groundwater and monsoonal rains. Following very wet winters, the melting snow pack would have caused a high and widespread surge of flooding. Wet meadows are areas where it floods frequently or has a shallow water table with some wetland properties. Wet Meadows are a small portion of the landscape footprint. Less than 1% of the landscape in the southwest are characterized as wetlands and wet meadows is just one of several wetland types that occur (Ramstead, 2012). This site is important part of the landscape as it often serves as habitat for plants, birds and other wildlife.

Wet meadows in the southwest are one of the most altered ecosystem types by humans. They are used for livestock and wildlife grazing, many locations have small dams with ponds or stock tanks. In irrigated meadows, roads are commonly built through or adjacent to them, they are prone to invasive species and can be impacted by wildfires in the surrounding upland areas. (Ramstead et al., 2012)

Meadows with tufted hairgrass as a major component are very sensitive to water table fluctuations. A study in Oregon showed that when the water table is lowered it favored increases in Kentucky bluegrass and perennial forbs in the species composition. While increase in the water table favored sedges and rush establishment. (Walsh, 1995) In the mountain west, Kentucky bluegrass is well adapted to the meadow with seasonally high water tables and midsummer drought. Kentucky bluegrass has become dominated on many meadows which once had a larger component of tufted hairgrass. (Uchytil, 1993)

Records of fire with wet meadows are lower elevations are rare to non-existent. The communities listed do not include wet meadows for fire regimes. In general, Intermountain riparian communities have been found to have a fire interval of 20 to 370 years (USDA, 2012a). While southwestern desert grasslands have a fire interval of 10-833 years (USDA, 2012b). Another source states that meadows have a fire return interval of 30 to 60 years (Landfire, 2007). The second source covers 2 ecological sites. It covers the upper precipitation end of wet meadow, and mountain meadows ecological site from an adjacent MLRA (48A). This site is not described in the fire regime literature that is available at this time. The data available is for general vegetation types in the United States: no specific data for wet meadows on Colorado Plateau is available at this time.

These sites will need to be updated as more data and knowledge in the future becomes available. Lower elevation meadow sites in general do not have a lot of data and studies conducted on them in this area. This area has a deficiency in research in general. The majority of the research that has occurred in this area has been in sagebrush and pinyon-juniper ecological sites. Current wet meadow research at this time occurs in the next climatic subset up from this site (i.e. it is wetter and colder than this site) and would be classified as mountain meadow, if any of the research occurred in Colorado. 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

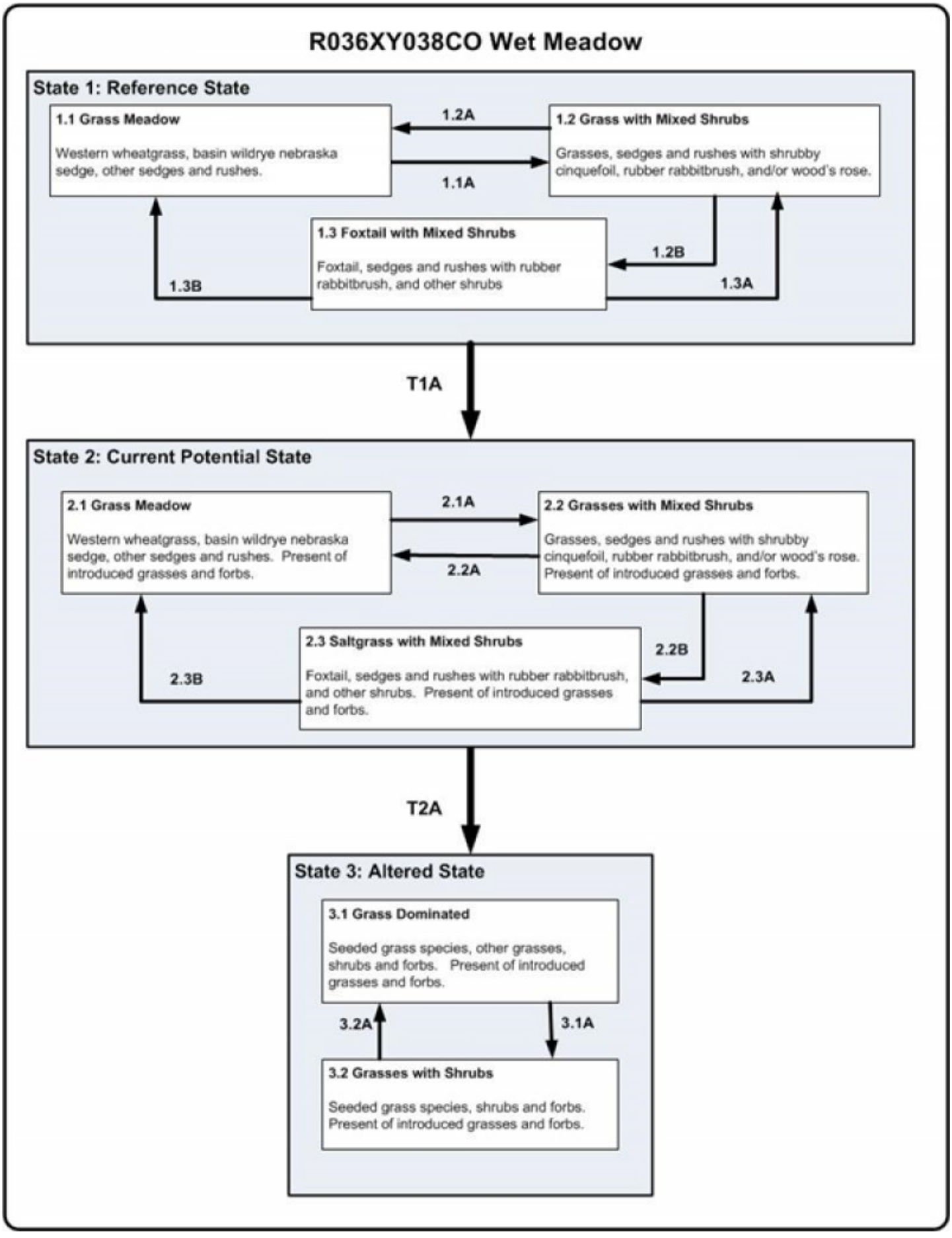
R036XY038CO Wet Meadow
State 1: Reference State
1.1 Grass Meadow
Western wheatgrass, basin wildrye nebraska sedge, other sedges and rushes.
1.2A
1.1A
1.2 Grass with Mixed Shrubs
Grasses, sedges and rushes with shrubby cinquefoil, rubber rabbitbrush, and/or wood's rose.
1.3 Foxtail with Mixed Shrubs
Foxtail, sedges and rushes with rubber rabbitbrush, and other shrubs
1.2B
1.3A
1.3B
T1A
State 2: Current Potential State
2.1 Grass Meadow
Western wheatgrass, basin wildrye nebraska sedge, other sedges and rushes. Present of introduced grasses and forbs.
2.1A
2.2A
2.2 Grasses with Mixed Shrubs
Grasses, sedges and rushes with shrubby cinquefoil, rubber rabbitbrush, and/or wood's rose. Present of introduced grasses and forbs.
2.3 Saltgrass with Mixed Shrubs
Foxtail, sedges and rushes with rubber rabbitbrush, and other shrubs. Present of introduced grasses and forbs.
2.2B
2.3A
2.3B
T2A
State 3: Altered State
3.1 Grass Dominated
Seeded grass species, other grasses, shrubs and forbs. Present of introduced grasses and forbs.
3.2A
3.1A
3.2 Grasses with Shrubs
Seeded grass species, shrubs and forbs. Present of introduced grasses and forbs.

Figure 6. STM

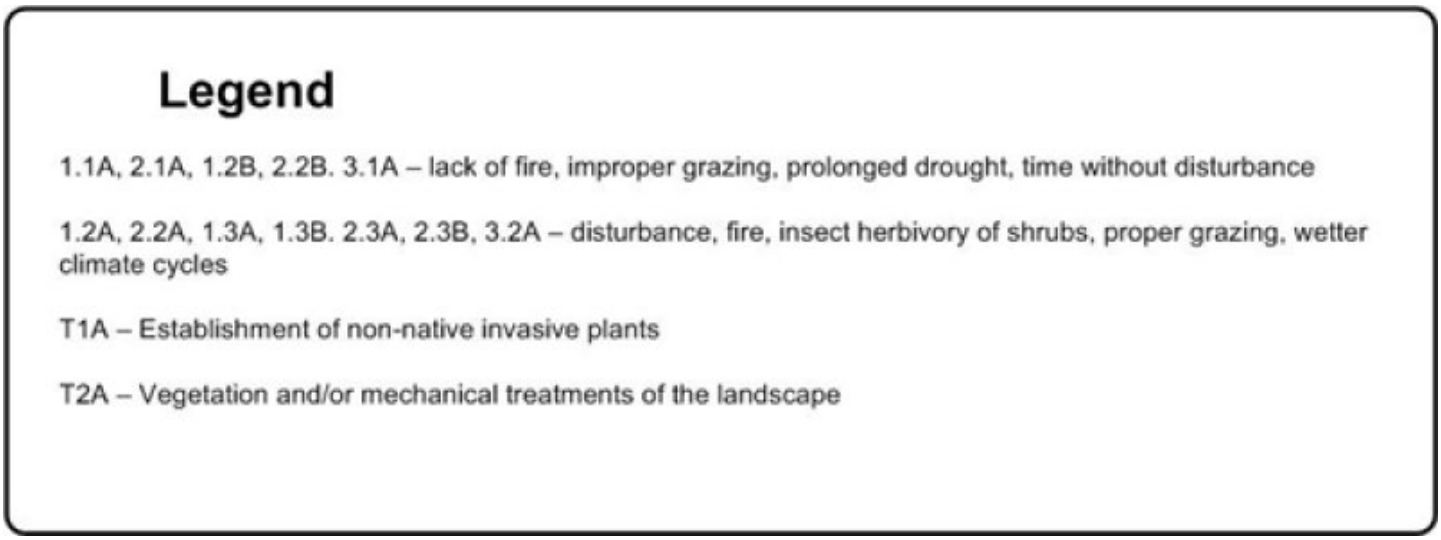

Figure 7. Legend

State 1
Reference

This state includes the biotic communities that become established on the ecological site under the natural disturbance regime prior to pre- European settlement. This site takes advantage of supplemental water from intermittent flooding frequency and a water table. This is generally a salt free wet to moist meadow occurring in the foothill zone. At the lower elevations it intergrades into a salt meadow ecological site Western wheatgrass dominates over slender wheatgrass, tufted hairgrass, sedges and rushes. Basin wildrye becomes significant on the drier edges of the site. Forbs found include yarrow, herbaceous sage, Solomon-plume, herbaceous cinquefoil, milkweed, shootingstar, aster, and paintbrush. Sometimes small swamp areas occur and they include cattail, bulrush, and horsetail. As this site deteriorates, the water table drops, causing rubber rabbitbrush and foxtail barley (*Hordeum jubatum*) to increase. Grasses such as tufted hairgrass, basin wildrye will decrease. The species composition will vary due to historical use, varying precipitation and water table and fire frequency. Drier sites will have a greater risk of foxtail barley incursion than wetter areas.

Community 1.1
Grass Meadow

This is generally a salt free wet to moist meadow occurring in the foothill zone. Western wheatgrass dominates over slender wheatgrass, tufted hairgrass, sedges and rushes. Basin wildrye becomes significant on the drier edges of the site. Forbs found include yarrow, herbaceous sage, Solomon-plume, herbaceous cinquefoil, milkweed, shootingstar, aster, and paintbrush. Small swamp areas include cattail, bulrush, and horsetail. Abundance, and production of herbaceous plants and forb production are dependent on the timing of precipitation, and can vary widely between years.

Table 5. Annual production by plant type

Plant Type	Low (Kg/Hectare)	Representative Value (Kg/Hectare)	High (Kg/Hectare)
Grass/Grasslike	1451	1877	2242
Forb	224	336	476
Shrub/Vine	6	28	84
Total	**1681**	**2241**	**2802**

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
Grass and Mixed Shrub

This plant community is a result of time without disturbance, mainly from fire, and prolonged drought. Herbaceous cinquefoil and wood's rose will increase as the site gets drier. As this site deteriorates due to improper grazing tufted hairgrass, basin wildrye, slender wheatgrass and forbs decrease while Kentucky bluegrass, western wheatgrass, rushes, rubber rabbitbrush, and yellow rabbitbrush increase. Foxtail barley, povertyweed, and cheatgrass are most likely to invade this site.

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

Community 1.3
Foxtail and Mixed Shrub

Upland shrubs will increase on this site as it gets drier. Rubber rabbitbrush and big sagebrush may increase, if present near the site. Foxtail may replace wetter species if the grazing pressure is great and there has been a prolonged drought.

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

Pathway 1.1A
Community 1.1 to 1.2

This pathway happens when disturbance such as fire does not occurs within the historical fire regime interval for the site. Improper continuous grazing of perennial grasses will speed up this pathway. Improper grazing will cause Baltic rush, and rubber rabbitbrush to increase and Nebraska sedge, tufted hairgrass, and basin wildrye to decrease. Also, prolonged drought with decreased water tables will progress along this pathway.

Pathway 1.2A
Community 1.2 to 1.1

This pathway is caused by naturally occurring fires and/or insect herbivory removes the shrubs. It reverts the system back to a grassland phase. Proper grazing practices which allow for recover of tufted hairgrass, Nebraska sedge, and other grass species will also help this pathway. Also, wetter climatic cycles will help to decrease shrubs as the shrubs that would occur here naturally don't like to be in areas of standing water for extended periods of time.

Pathway 1.2B
Community 1.2 to 1.3

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. Improper grazing will cause, foxtail, and rubber rabbitbrush to increase and basin wild rye to decrease. Also, prolonged drought with decreased water tables will progress along this pathway.

Pathway 1.3B
Community 1.3 to 1.1

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. These events tend to favor

grass establishment. Also, brush management and proper grazing can benefit this pathway.

Pathway 1.3A
Community 1.3 to 1.2

This transition is caused by naturally occurring fires, herbivory of shrubs, and/or wetter periods that suppresses shrub establishment. These events tend to favor grass establishment. Also, brush management and proper grazing can benefit this pathway.

State 2
Current Potential

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. Kentucky bluegrass can become a dominant in this plant community. The current potential state is less resilient than the reference state due to the presence of non-native/invasive species in the plant community. Annual herbaceous weedy plants have increased, but occur in small patches. Invasive species present can include knapweeds, Canada thistle, and curly dock.

Community 2.1
Grass Meadow

This plant community is comprised of tufted hairgrass, sedges, and rushes with few scattered rubber rabbitbrush. Kentucky bluegrass may be found in this phase. Abundance, and production of herbaceous plants and forb production are dependent on the timing of precipitation, and can vary widely between years. Nonnative invasive species, such as thistles, knotweeds, dandelion, and povertyweed are present but in insignificant amounts.

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

Community 2.2
Grass and Mixed Shrub

This plant community is a result of time without disturbance, mainly from fire and prolonged drought. Western wheatgrass and rubber rabbitbrush will have increased in abundance and basin wildrye will have decreased. Nonnative invasive species, such as thistles, knotweeds, dandelion, and povertyweed are present but in insignificant amounts.

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 2.3
Foxtail and Mixed Shrub

Foxtail and Baltic rush dominates the plant community. Also, rubber rabbitbrush has increased. Foxtail may replace the other perennial if the grazing pressure is great and there has been a prolonged drought. Nonnative invasive species, such as thistles, knotweeds, dandelion, and povertyweed are present but in insignificant amounts.

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 2.1A
Community 2.1 to 2.2

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. Improper grazing will cause rubber rabbitbrush to increase and basin wildrye to decrease. Also, prolonged drought with decreased water tables will progress along this pathway.

Pathway 2.2A
Community 2.2 to 2.1

This pathway is caused by naturally occurring fires and/or insect herbivory removes the shrubs. It reverts the system back to a grassland phase. Proper grazing practices which allow for recover of tufted hairgrass, Nebraska sedge and other grass species will also help this pathway. Also, wetter climatic cycles will help to decrease shrubs as the shrubs that would occur here naturally don’t like to be in areas of standing water for extended periods of time.

Pathway 2.2B
Community 2.2 to 2.3

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. Improper grazing will cause, foxtail, and rubber rabbitbrush to increase and basin wild rye to decrease. Also, prolonged drought with decreased water tables will progress along this pathway.

Pathway 2.3B
Community 2.3 to 2.1

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. These events tend to favor grass establishment. Also, brush management and proper grazing can benefit this pathway.

Pathway 2.3A
Community 2.3 to 2.2

This transition is caused by naturally occurring fires, herbivory of shrubs, and/or wetter periods that suppresses shrub establishment. These events tend to favor grass establishment. Also, brush management and proper grazing can benefit this pathway.

State 3
Altered

This state results from seeding introduced perennial grasses. Some of the potential grass found may include the following: meadow foxtail, orchardgrass, meadow barley, timothy and smooth brome. 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 mowing, disking, prescribed burning and other techniques which manipulate the plant community. 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.

Community 3.1
Grass Dominated

This community is dominated by seeded plants. Shrubs has little to no production in this phase. This site has high production due to the seed grass production. This production typically is higher than the current potential or reference state. This site usually has low species diversity.

Figure 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 3.2
Grass and Shrub

This community consists shrubs with grasses. Nonnative invasive species, such as thistles, knotweeds, dandelion, and povertyweed are present but in insignificant amounts.

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 3.1A
Community 3.1 to 3.2

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

Pathway 3.2A
Community 3.2 to 3.1

This transition is caused by naturally occurring fires, proper grazing of grass and forb species, herbivory of shrubs, and/or wetter periods that suppresses shrub establishment. These events tend to favor grass establishment. Vegetation treatments (mechanically, prescribed fire, chemically, etc.) can also be employed to imitate the natural disturbances regime.

Transition T1A
State 1 to 2

The native understory in the reference state has been invade by non-native species. Plant may include thistles, knotweeds, dandelion, and povertyweed. 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 T2A
State 2 to 3

This transition is triggered by management decisions and actions. This transition, to a state that has been seeded with introduced perennial grasses. High energy inputs are needed for this transition. Brush 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. Water diversion maybe used to enhance or alter this site hydrological regime.

Additional community tables

Table 6. Community 1.1 plant community composition

				Annual Production	Foliar Cover

Group	Common Name	Symbol	Scientific Name	Annual Production (Kg/Hectare)	Foliar Cover (%)
Grass/Grasslike					
1				1345–2018	
	western wheatgrass	PASM	*Pascopyrum smithii*	168–448	–
	Grass, perennial	2GP	*Grass, perennial*	22–280	–
	sedge	CAREX	*Carex*	112–280	–
	Nebraska sedge	CANE2	*Carex nebrascensis*	112–224	–
	foxtail barley	HOJU	*Hordeum jubatum*	28–224	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	0–112	–
	basin wildrye	LECI4	*Leymus cinereus*	28–112	–
	Sandberg bluegrass	POSE	*Poa secunda*	22–112	–
	tufted hairgrass	DECE	*Deschampsia cespitosa*	22–112	–
	slender wheatgrass	ELTR7	*Elymus trachycaulus*	0–56	–
	horsetail	EQUIS	*Equisetum*	0–56	–
	bulrush	SCIRP	*Scirpus*	0–56	–
	broadleaf cattail	TYLA	*Typha latifolia*	0–56	–
	rush	JUNCU	*Juncus*	0–56	–
	saltgrass	DISP	*Distichlis spicata*	0–28	–
Forb					
2				224–448	
	Forb, perennial	2FP	*Forb, perennial*	22–224	–
	common yarrow	ACMI2	*Achillea millefolium*	22–112	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	22–112	–
	showy milkweed	ASSP	*Asclepias speciosa*	22–112	–
	Wyoming Indian paintbrush	CALI4	*Castilleja linariifolia*	22–112	–
	Rocky Mountain beeplant	CLSE	*Cleome serrulata*	22–112	–
	darkthroat shootingstar	DOPU	*Dodecatheon pulchellum*	22–112	–
	Rocky Mountain iris	IRMI	*Iris missouriensis*	22–112	–
	plantain	PLANT	*Plantago*	22–112	–
	white heath aster	SYER	*Symphyotrichum ericoides*	22–112	–
	cinquefoil	POTEN	*Potentilla*	0–56	–
	feathery false lily of the valley	MARAR	*Maianthemum racemosum ssp. racemosum*	0–56	–
	milkweed	ASCLE	*Asclepias*	0–56	–
Shrub/Vine					
3				0–56	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	0–22	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	0–22	–
	shrubby cinquefoil	DAFRF	*Dasiphora fruticosa ssp. floribunda*	0–22	–
	rubber rabbitbrush	ERNAN5	*Ericameria nauseosa ssp. nauseosa var. nauseosa*	0–22	–
	skunkbush sumac	RHTRT	*Rhus trilobata var. trilobata*	0–22	–
	Woods' rose	ROWO	*Rosa woodsii*	0–22	–

	narrowleaf willow	SAEX	*Salix exigua*	0–22	–

Animal community

The following is from 1975 Range Site:

WILDLIFE INTERPRETATIONS:
This site offers a high value rating for bison, elk, and upland game birds. It offers a medium value rating for antelope, deer, cottontail, jackrabbit, and waterfowl.

GRAZING INTERPRETATIONS:
This site offers a high value for cattle, sheep, and horses.

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
Pogo - C/D
Umnarg - C
Winner - C

Loamy-Skeletal
Tesajo - C

Fine-silty
Irak - 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 1975 Range Site:

Medium value.

Wood products

None.

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--Site Development and Testing Plan--:

This site is mostly concept with the data from soil survey updated. 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 on 08/17/2017.
Contact for lead author	
Date	08/17/2017
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** No rills should be present. A very slight amount of rill development may be observed following large storm events or spring runoff periods, but they should heal within the following growing season.

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2. **Presence of water flow patterns:** None to Rare. Any flow patterns present should be sinuous and wind around perennial plant bases. They should be stable with only minor evidence of deposition. This site is periodically inundated with runoff water from adjacent sites. It also acts as a filter and trap sediment.

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3. **Number and height of erosional pedestals or terracettes:** None. A few plants may show very minor pedestalling where they are adjacent to any water flow patterns present, but there will be no exposed roots. Terracettes are not present.

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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% bare ground on wetter areas and 10-15% bare ground on drier edges/areas. Extended drought can cause bareground to increase.

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5. **Number of gullies and erosion associated with gullies:** None to rare. Due to off-site influence. If present, edges rounded and vegetated.

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None. No evidence of soil movement by wind. Wind scoured (blowouts) and depositional areas are not present.

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7. **Amount of litter movement (describe size and distance expected to travel):** Typically slight. The majority of litter accumulates in place at the base of plant canopies. However during major flooding events this site slows water flow and captures litter and sediment.

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 4-5 at soil surface.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soils are typically deep and poorly drained. Surface texture ranges from fine sandy loams to clay loams with weak fine to moderate medium granular structure, moderate fine subangular blocky structure or weak thick platy structure. The A-horizon can be up to 8 inches or more deep. Obvious mottled.

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Diverse grass, sedge/rush, shrub and forb functional/structural groups and diverse root structure/patterns reduces raindrop impact slows overland flow providing increased time for infiltration to occur. However, the high water table inherent to this site has more effect on infiltration than does plant community. The amount of sodium in the soil can affect infiltration and facilitate water accumulation on the surface.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** None. This site will normally have textural changes within the profile. These should not be mistaken for compaction layers.

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

    Dominant: cool season rhizomatous grass >> cool season bunchgrass >

    Sub-dominant: sedges/rushes >

    Other: forbs > shrubs

    Additional:

13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Minimal. Decadence and mortality may occur due to drought and lack of disturbance.

14. **Average percent litter cover (%) and depth (in):** 40-60% litter cover and ranges from 0.50 to 1.0 inches in depth. Litter cover declines during and following extended drought.

15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** 1500 lbs./ac. low precip years; 2000 lbs./ac. average precip years; 2500 lbs./ac. above average precip years. After extended drought, production may be reduced by 350 – 800 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: Kentucky bluegrass, dandelion, Canada thistle, mustards, and other weeds. Big sagebrush and rabbitbrush can invade edges of swale due to water table fluctuations.

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17. **Perennial plant reproductive capability:** The only limitations are weather-related, wildfire, natural disease, inter-species competition, wildlife, and insects that may temporarily reduce reproductive capability.
