USDA Natural Resources
Conservation Service

Ecological site EX044B01Y080
Riparian Meadow (RM) LRU 01 Subset Y

Last updated: 9/07/2023
Accessed: 04/17/2024

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.

MLRA notes

Major Land Resource Area (MLRA): 044B–Central Rocky Mountain Valleys

Major Land Resource Area (MLRA) 44B, Central Rocky Mountain Valleys, is nearly 3.7 million acres of southwest Montana. This MLRA borders two other MLRAs: 43B, Central Rocky Mountains and Foothills, and 46, Northern and Central Rocky Mountain Foothills.
The major watersheds of this MLRA are the Missouri and Yellowstone Rivers and their associated headwaters, such as the Beaverhead, Big Hole, Jefferson, Ruby, Madison, Gallatin, and Shields Rivers. Limited portions of the MLRA are west of the Continental Divide along the Clark Fork River. These waters allow for extensive irrigation for crop production in an area that is generally only compatible with rangeland and grazing. The Missouri River and its headwaters are behind several reservoirs used for irrigation water, hydroelectric power, and municipal water.

The primary land use of this MLRA is production agriculture (grazing, small grain production, and hay) with limited mining. Urban development is high, with large expanses of rangeland being converted to subdivisions for a rapidly growing population.

MLRA 44B consists of one Land Resource Unit (LRU) and seven climate-based LRU subsets. Annual precipitation ranges from a low of 9 inches to a high of near 24 inches. The driest areas tend to be in the valley bottoms of southwest Montana, in the rain shadow of the mountains. The wettest portions tend to be near the edges of the MLRA, where it borders MLRA 43B. Frost-free periods also vary greatly, with less than 30 days in the Big Hole Valley to approximately 110 days in the warm valleys along the Yellowstone and Missouri Rivers.

MLRA 44B’s plant communities are highly variable but are dominated by a cool-season grass and shrub-steppe community on the rangeland and a mixed coniferous forest in the mountains. Warm-season grasses occupy an extremely limited extent and number of species in this MLRA. Most subspecies of big sagebrush are present, to some extent, across the MLRA.

LRU notes

The LRU 01 Subset Y central concept is being used as an ubiquitous system where sites have access to additional moisture, reducing their reliance on precipitation. Sites that receive reduced precipitation have the ability to produce similar plant communities as those that receive more precipitation.

Classification relationships

EPA Ecoregions of Montana, Second Edition:
Level I: Northwestern Forested Mountains
Level II: Western Cordillera
Level III: Middle Rockies & Northern Great Plains
Level IV: Paradise Valley
Townsend Basin

Dry Intermontane Sagebrush Valleys
Shield-Smith Valleys

National Hierarchical Framework of Ecological Units:
Domain: Dry
Division: M330 – Temperate Steppe Division – Mountain Provinces
Province: M332 –Middle Rocky Mountain Steppe – Coniferous Forest – Alpine Meadow
Section: M332D – Belt Mountains Section
M332E – Beaverhead Mountains Section
Subsection: M332Ej – Southwest Montana Intermontane Basins and Valleys
M332Dk – Central Montana Broad Valleys

Montana Natural Heritage Program:
- Alpine-Montane Wet Meadow

Grassland and Shrubland habitat types of Western Montana
- Deschampsia caespitosaa/Carex spp. Habitat Type

Ecological site concept

• Site receives additional effective moisture
• Site is located within the floodplain/riparian zone
• Soil not saline (EC less than 4 within the surface 4 inches mineral soil)
• Soil not considered organic (less than 8 inches thick organic layer above mineral soil)
• Site not in closed depression
• Seasonal high water table 12 to 24 inches from ground surface.

Associated sites

EX044B01Y081	**Riparian Subirrigated (RSb) LRU 01 Subset Y** The Riparian Subirrigated ecological site occupies neighboring floodplain positions and shares similar plant communities. The water table of this site is 24 to 40 inches below the ground surface.

Similar sites

EX044B01Y081	**Riparian Subirrigated (RSb) LRU 01 Subset Y** The Riparian Subirrigated ecolgocial site shares similar plant communities and state and transition models. This site is drier than the Riparian Meadow site due to its location on the floodplain and depth to seasonal water table. Natural, long term hydrological shifts in riparian zone may cause the Riparian Meadow site to transition to the Riparian Subirrigated site.

Table 1. Dominant plant species

Tree	Not specified
Shrub	(1) *Salix* (2) *Dasiphora fruticosa*
Herbaceous	(1) *Deschampsia cespitosa* (2) *Carex nebrascensis*

Legacy ID

R044BY080MT

Physiographic features

This site occurs within the floodplain adjacent to perennial streams and natural seeps. Slopes are nearly level to less than two percent.

Table 2. Representative physiographic features

Landforms	(1) Intermontane basin > Flood plain (2) Intermontane basin > Stream terrace
Flooding duration	Brief (2 to 7 days)
Flooding frequency	Occasional to very rare
Elevation	4,800–6,500 ft
Slope	0–2%
Water table depth	12–24 in

Climatic features

The Central Rocky Mountain Valleys MLRA has a continental climate. Fifty to sixty percent of the annual long-term average total precipitation falls between May and August. Most of the precipitation in the winter is snow on frozen ground. Average precipitation for this MLRA is slightly more than 14 inches, and the frost-free period averages 52 days. Precipitation is highest in May and June, with winter and spring snowstorms contributing to the total. Some of Montana's driest areas are located in sheltered mountain valleys due to the rain-shadow effect of being on the leeside of some mountain ranges.

Table 3. Representative climatic features

Frost-free period (characteristic range)	24-77 days
Freeze-free period (characteristic range)	62-115 days
Precipitation total (characteristic range)	11-17 in
Frost-free period (actual range)	3-96 days
Freeze-free period (actual range)	36-125 days
Precipitation total (actual range)	10-22 in
Frost-free period (average)	52 days
Freeze-free period (average)	92 days
Precipitation total (average)	14 in

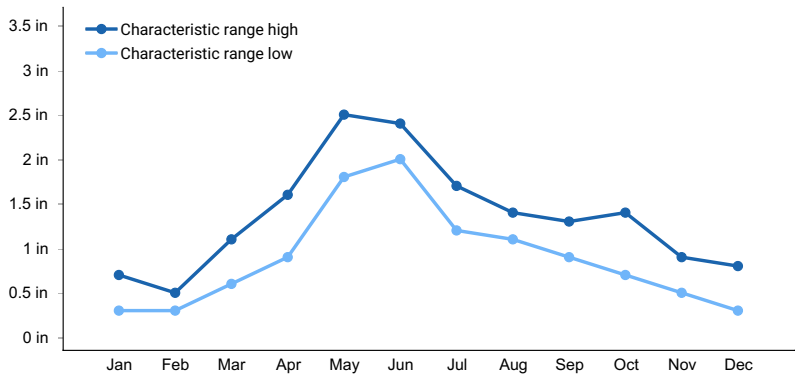


Figure 1. Monthly precipitation range

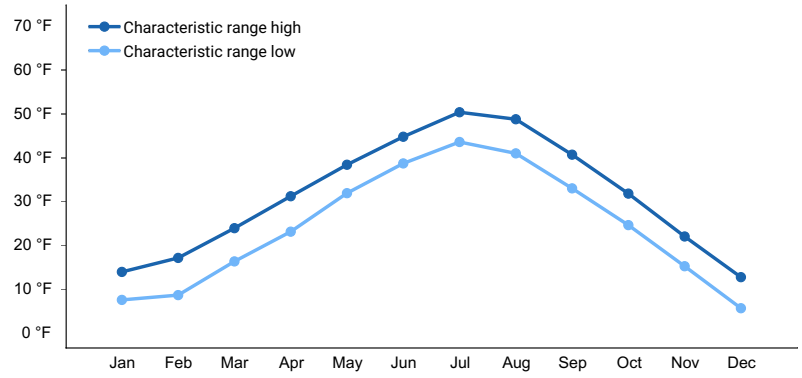


Figure 2. Monthly minimum temperature range

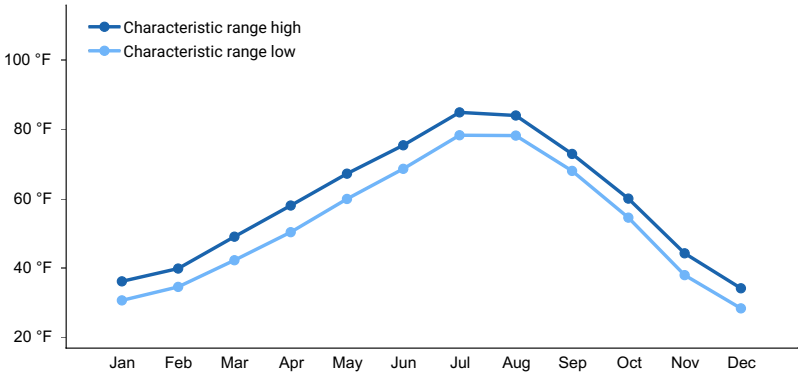


Figure 3. Monthly maximum temperature range

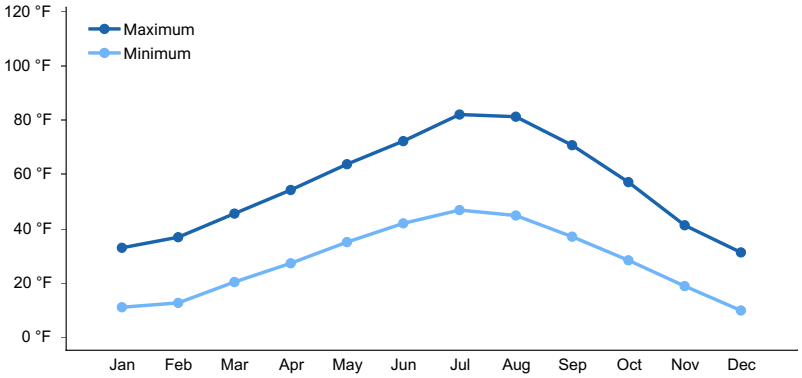


Figure 4. Monthly average minimum and maximum temperature

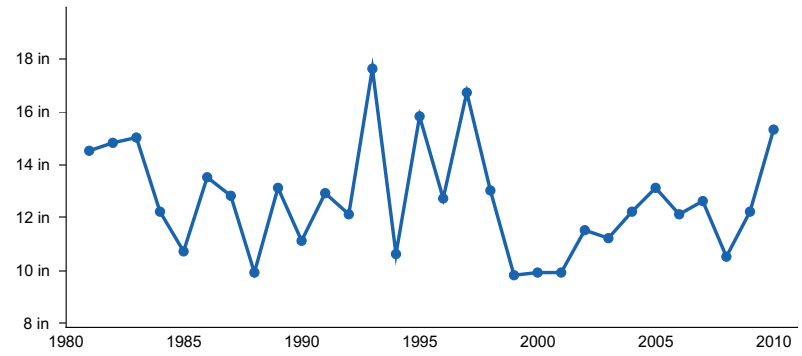


Figure 5. Annual precipitation pattern

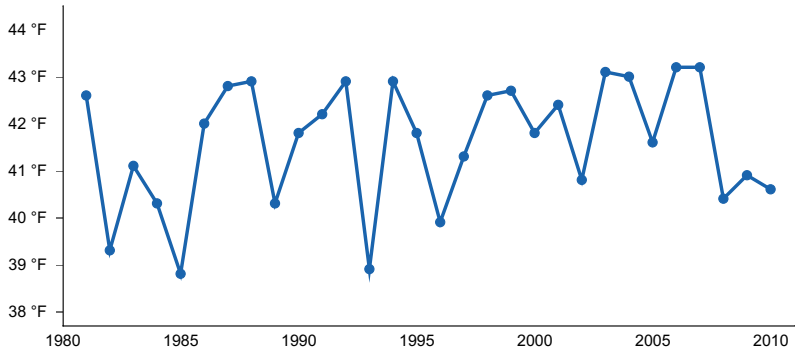


Figure 6. Annual average temperature pattern

Climate stations used

- (1) HEBGEN DAM [USC00244038], West Yellowstone, MT
- (2) LAKEVIEW [USC00244820], Lima, MT
- (3) BOZEMAN GALLATIN FLD [USW00024132], Belgrade, MT
- (4) DEER LODGE 3 W [USC00242275], Deer Lodge, MT
- (5) DILLION U OF MONTANA WESTERN [USC00242409], Dillon, MT
- (6) GLEN 2 E [USC00243570], Dillon, MT
- (7) ENNIS [USC00242793], Ennis, MT
- (8) BOULDER [USC00241008], Boulder, MT
- (9) GARDINER [USC00243378], Gardiner, MT
- (10) TOWNSEND [USC00248324], Townsend, MT
- (11) TRIDENT [USC00248363], Three Forks, MT
- (12) TWIN BRIDGES [USC00248430], Sheridan, MT
- (13) WHITE SULPHUR SPRNGS 2 [USC00248930], White Sulphur Springs, MT
- (14) DILLON AP [USW00024138], Dillon, MT
- (15) HELENA RGNL AP [USW00024144], Helena, MT
- (16) DIVIDE [USC00242421], Wise River, MT
- (17) WISDOM [USC00249067], Wisdom, MT
- (18) JACKSON [USC00244447], Jackson, MT
- (19) LIVINGSTON MISSION FLD [USW00024150], Livingston, MT
- (20) LIVINGSTON 12 S [USC00245080], Livingston, MT
- (21) VIRGINIA CITY [USC00248597], Virginia City, MT
- (22) WEST YELLOWSTONE [USC00248857], West Yellowstone, MT
- (23) BIG SKY 2WNW [USC00240775], Gallatin Gateway, MT
- (24) WILSALL 8 ENE [USC00249023], Wilsall, MT
- (25) BUTTE BERT MOONEY AP [USW00024135], Butte, MT

Influencing water features

The Riparian Meadow (RM) ecological site is associated with perennial streams, rivers, and flowing springs. This site has a permanent water table between 12 and 24 inches below the soil surface. Seasonally significant subsurface water movement exists due to the site's location adjacent to active streams, creeks, and rivers. It is rarely to occasionally flooded from streambank overflow. Periods of inundation are very brief. Typically, flooding is associated with spring snowmelt from March to early June.

Wetland description

The Riparian Meadow ecological site is directly associated with multiple Rosgen Classified Streams. The primary Rosgen classification stream types include E3, E4, E5, and E6.

E-classified streams are low-gradient, meandering riffle-pool streams with a low width-to-depth ratio and little deposition. These systems are very efficient at moving sediment, stable, and well vegetated. They have a high meander-to-width ratio. These occur in broad valleys and meadows.

These wetlands typically support wet emergent vegetation but are not capable of supporting species such as cattails.

Soil features

The soils of this ecological site are alluvium of mixed origin with highly variable surface textures. These soils are hydric due to the permanent water table and flooding events. The water table is 12 to 24 inches below the soil surface. However, the coarse texture of the subsurface soil may not directly express traditional redoximorphic features associated with such sites. Soils tend to be deep or very deep. Surface textures tend to be loam, silt loam, very fine sandy loam, and fine sandy loam. As previously stated, subsurface horizons will often be coarse-grained, allowing for moderate to rapid permeability. These sites tend to be classified as poorly to very poorly drained due to the presence of a permanent water table, but water transmission will be moderate.

Common soil series in this ecological site include (but are not limited to) Beavrock, Dutchhollow, and Mooseflat.

Table 4. Representative soil features

Parent material	(1) Alluvium–igneous, metamorphic and sedimentary rock
Surface texture	(1) Loam (2) Silt loam (3) Very fine sandy loam
Family particle size	(1) Fine-loamy over sandy or sandy-skeletal
Drainage class	Poorly drained to very poorly drained
Permeability class	Moderate to rapid
Soil depth	40 in
Surface fragment cover <=3"	0–10%
Surface fragment cover >3"	0–5%
Available water capacity (0-40in)	4.4–7 in
Soil reaction (1:1 water) (0-40in)	4.5–8.4
Subsurface fragment volume <=3" (0-40in)	0–24%
Subsurface fragment volume >3" (0-40in)	0–15%

Ecological dynamics

The Riparian Meadow (RM) ecological site is characterized by the production and composition of the Reference Plant Community, which is defined primarily by its location near actively flowing streams and rivers and depth to the seasonal water table between 12 and 24 inches of soil surface. The Riparian Meadow site tends to be a stable community when in its reference state, but can vary drastically if stream morphology changes.

The reference plant community is dominated by multiple obligate and facultative wetland grasses, sedges, and forbs. As defined by the US Fish and Wildlife Service, obligate wetland species almost always exist in wetland conditions, while facultative wetland species exist primarily in wetlands but may also exist in non-wetland sites. The primary species include Nebraska sedge (Carex nebraskensis), Northwest Territory sedge (*Carex utriculata*), water sedge (Carex aquaillis), tufted hairgrass (*Deschampsia cespitosa*), Baltic rush (Juncus articus), field mint (*Mentha arvensis*), and leafy aster (*Symphyotrichum foliaceum*).

The Riparian Meadow ecological site occurs across a relatively large landscape. Slight variations within the plant community occur due to elevation, stream size, seasonal water table depth, and frost-free days. Structurally, these systems function very similarly: deep-rooted herbaceous plants create stable riparian systems able to dissipate stream energy, trap sediment, and store water.

Natural disturbances such as flooding and fire are common. The Reference Plant Community is typically resistant to these impacts, but repeated grazing events may reduce its resilience, which can trigger changes within the community and cause it to transition to other states.

The Riparian Meadow ecological site is considered resistant to invasion; however, non-native species will invade if not managed, especially during extended droughts. Non-native grass species are often the most common invaders. The list includes such species as Kentucky bluegrass (*Poa pratensis*), creeping meadow foxtail (*Alopecurus arundinaceus*), smooth brome (*Bromus inermis*), timothy (*Phleum pratense*), reed canarygrass (Phlarais arudinacea), common reedgrass (Phragmites communis), quackgrass (*Elymus repens*), and redtop bentgrass (*Agrostis gigantea*). Noxious weeds that may invade include Canada thistle (*Cirsium arvense*), whitetop (*Cardaria draba*), gypsyflower (*Cynoglossum officinale*), locally known as houndstongue, and leafy spurge (*Euphorbia esula*). This is not a comprehensive list of species, and others may occur.

Plant Communities and Transitional Pathways
A state and transition model for this ecological site is depicted below. Thorough descriptions of each state, transition, plant community, and pathway follow the model. This model is based on available experimental research, field data, field observations, and interpretations by experts. It is likely to change as knowledge increases.

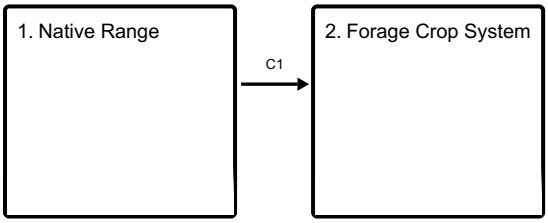
The plant communities within the same ecological site will differ across the MLRA due to the naturally occurring variability in weather, soils, and aspect. The biological processes on this site are complex; therefore, representative values are presented in a land management context. The species lists are representative and are not botanical descriptions of all species occurring, or potentially occurring, on this site. They are intended to cover the core species and the known range of conditions and responses.

Both percent species composition by weight and percent canopy cover are referenced in this document. Canopy cover drives the transitions between communities and states because of the influence of shade, the interception of rainfall, and the competition for available water. Species composition by dry weight remains an important descriptor of the herbaceous community and of the community as a whole. Woody species are included in the species composition for the site. Calculating the similarity index requires species composition by dry weight.

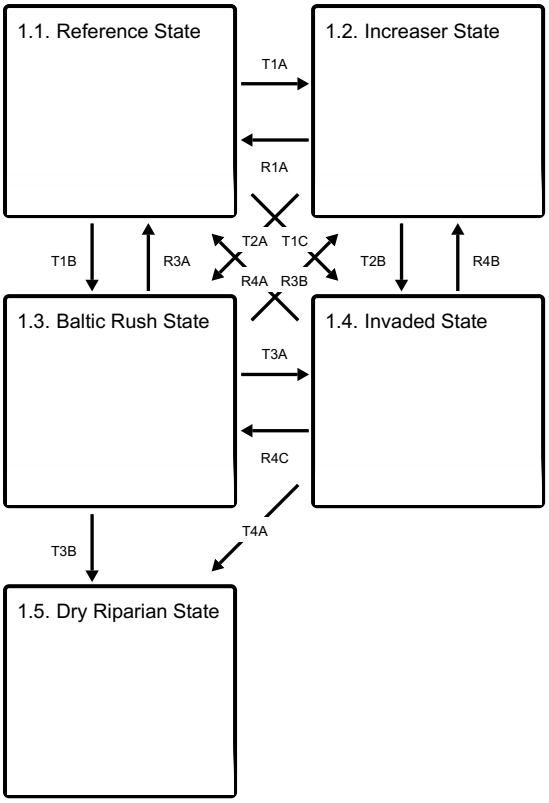
Although there is considerable qualitative experience supporting the pathways and transitions within the State and Transition Model (STM), no quantitative information exists that specifically identifies threshold parameters between grassland types and invaded types in this ecological site. For information on STMs, see the following citations: Bestelmeyer et al. (2003), Bestelmeyer et al. (2004), Bestelmeyer and Brown (2005), and Stringham et al. (2003).

State and transition model

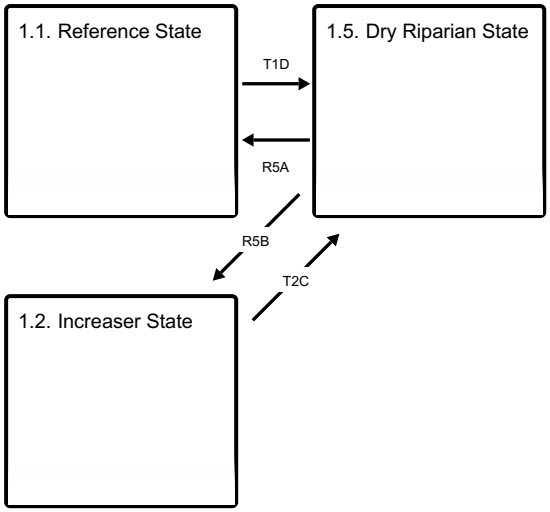
Land uses



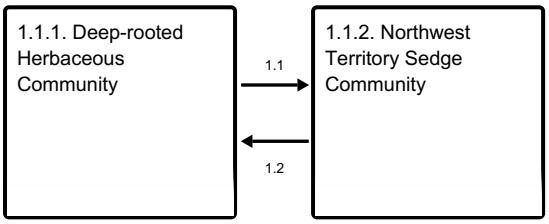
Land use 1 submodel, ecosystem states



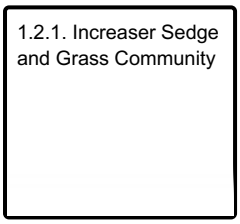
States 1, 5 and 2 (additional transitions)



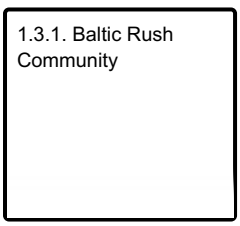
State 1 submodel, plant communities



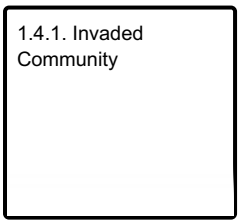
State 2 submodel, plant communities



State 3 submodel, plant communities



State 4 submodel, plant communities



State 5 submodel, plant communities

1.5.1. Drying/Pioneer Community

Land use 2 submodel, ecosystem states

2.1. Forage Crop State

State 1 submodel, plant communities

2.1.1. Forage Crop Community

Land use 1
Native Range

The site is in native condition, meaning it has not been altered by farming or other practices in an attempt to produce non-native crops such as livestock pasture forage or hay.

State 1.1
Reference State

This state contains two communities that are dominated by tall, deep-rooted sedges and grasses with various forbs. Shrubs are limited to a small percentage of the community and are often absent. The Deep-Rooted Herbaceous Community (1.1) is a diverse community of tall sedges and grasses, while the Northwest Territory Sedge Community (1.2) is a near monoculture of Northwest Territory sedge with small components of other grasses and sedges.

Community 1.1.1
Deep-rooted Herbaceous Community

This is a diverse community dominated by tall sedges (Northwest Territory, Nebraska, and water) and grasses (tufted hairgrass and bluejoint reedgrass). Subdominant sedges and grasses include slender wheatgrass, meadow barley, and Baltic rush. Forbs vary slightly based on depth to the water table but typically include goldenrod, groundsel, elephant's head lousewort, field mint, leafy aster, cinquefoils, and willowherbs. Shrubs are absent or rare. This community is typically resistant to disturbance; however, repeated unmanaged grazing events may change this community into the Northwest Territory Sedge Community (1.2).

Dominant plant species

- willow (*Salix*), shrub
- Nebraska sedge (*Carex nebrascensis*), grass
- Northwest Territory sedge (*Carex utriculata*), grass
- arctic rush (*Juncus arcticus*), grass
- water sedge (*Carex aquatilis*), grass
- willowherb (*Epilobium*), other herbaceous
- lousewort (*Pedicularis*), other herbaceous
- Indian paintbrush (*Castilleja*), other herbaceous
- cinquefoil (*Potentilla*), other herbaceous

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	4125	4325	4675
Forb	235	240	275
Shrub/Vine	90	100	200
Total	**4450**	**4665**	**5150**

Table 6. Ground cover

Tree foliar cover	0%
Shrub/vine/liana foliar cover	0-5%
Grass/grasslike foliar cover	65-90%

Forb foliar cover	5-7%
Non-vascular plants	0-1%
Biological crusts	0%
Litter	65-70%
Surface fragments >0.25" and <=3"	0-3%
Surface fragments >3"	0-1%
Bedrock	0%
Water	0-1%
Bare ground	0%

Table 7. Soil surface cover

Tree basal cover	0%
Shrub/vine/liana basal cover	1-5%
Grass/grasslike basal cover	25-50%
Forb basal cover	3-5%
Non-vascular plants	0%
Biological crusts	0%
Litter	65-70%
Surface fragments >0.25" and <=3"	0%
Surface fragments >3"	0%
Bedrock	0%
Water	0-1%
Bare ground	0%

Table 8. Woody ground cover

Downed wood, fine-small (<0.40" diameter; 1-hour fuels)	0-1%
Downed wood, fine-medium (0.40-0.99" diameter; 10-hour fuels)	0-1%
Downed wood, fine-large (1.00-2.99" diameter; 100-hour fuels)	0%
Downed wood, coarse-small (3.00-8.99" diameter; 1,000-hour fuels)	0%
Downed wood, coarse-large (>9.00" diameter; 10,000-hour fuels)	0%
Tree snags** (hard***)	0%
Tree snags** (soft***)	0%
Tree snag count** (hard***)	
Tree snag count** (hard***)	

*** Decomposition Classes: N - no or little integration with the soil surface; I - partial to nearly full integration with the soil surface.**

**** >10.16cm diameter at 1.3716m above ground and >1.8288m height--if less diameter OR height use applicable down wood type; for pinyon and juniper, use 0.3048m above ground.**

***** Hard - tree is dead with most or all of bark intact; Soft - most of bark has sloughed off.**

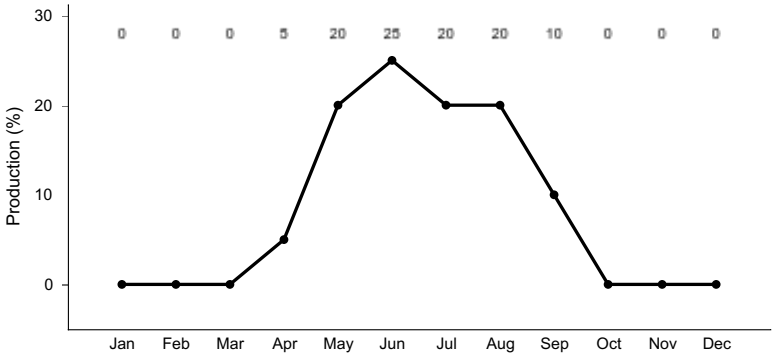


Figure 8. Plant community growth curve (percent production by month). MT0816, Permanent water table. All sites with a permanent water table..

Community 1.1.2
Northwest Territory Sedge Community

The Northwest Territory Sedge Community is approaching a monoculture of Northwest Territory sedge with a few taller sedges and grasses, such as Nebraska sedge and tufted hairgrass, in small patches. This state is a result of repeated, unmanaged grazing events or as a result of a long-term drying trend drought or lose of hydrologic connection to the riparian system that contributes to the site's water table. The vigorous root system of Northwest Territory sedge makes recolonization difficult for other deep-rooted species. This adaptation also makes this community very stable and resistant to erosive forces often associated with rare or occasional flooding. It also makes the site resistant to invasion from non-native species.

Pathway 1.1
Community 1.1.1 to 1.1.2

This transition is triggered by multiple unmanaged grazing events or as a result of a long-term drought causing a lowering of the water table.

Pathway 1.2
Community 1.1.2 to 1.1.1

Long-term conservative grazing management in the form of a rest rotation with an emphasis on short-duration grazing events during the growing season. This will ensure the growing points of deep-rooted sedges and grasses are not utilized. This may be accomplished with temporary wire fencing, as these sites are often a small component of larger pastures. Off-site water developments may help draw livestock away from these sites, too. However, grazing management is key to this transition.

State 1.2
Increaser State

This state consists of 1 community (Increaser Sedges and Grasses). The site is a result of repeated overgrazing. This state may also be associated with a lowering of the water table due to a short-term drought. Small-wing sedge, Baltic rush, creeping spikerush, and foxtail barley.

Community 1.2.1
Increaser Sedge and Grass Community

Disturbance from overgrazing or, in limited cases, the temporary lowering of the water table associated with extreme drought has reduced deep-rooted sedges and grasses. These deep-rooted sedges and grasses lose dominance in the community to shorter, shallow-rooted sedges, rushes, and grasses. Species include Baltic rush, spikerush, smallwing sedge, foxtail barley, and fowl bluegrass. The Increaser Sedge and Grass Community typically loses site stability as a result of reduced rooting depth and mass. This may allow the erosive forces of nearby streams to accelerate bank erosion or straighten it completely in a flooding event. This site is susceptible to a rapid transition to the Invaded State or to the Baltic Rush State if heavy grazing is allowed to continue or if the water table

is not returned.

State 1.3
Baltic Rush State

The Baltic Rush State is a result of overgrazing combined with a systematic wetting and drying of the site. Grazing animals have removed deep-rooted species nearly completely. Species not suited for grazing often dominate the community.

Community 1.3.1
Baltic Rush Community

This community is comprised of only a few species with a high dominance of Baltic rush; however, creeping spikerush, foxtail barley, and meadow barley may also exist. These species tend to have shallower roots when compared to those species in the Reference State (1). The majority of these species are deemed unsuited for grazing. Soil hummocking may be associated with this plant community as a result of livestock trailing and compaction (Booth et al. 2014), as well as frost heave-associated hummocking in areas with increased silt content (Smith et al. 2012). Smith et al. state that for every increase in silt percentage, there is a 12 percent increase in the odds of a hummock. The fine silt particles are more susceptible to frost heaving, which helps create hummocks.

State 1.4
Invaded State

The Invaded State (4) includes many non-native species that have come to dominate riparian areas. Some species may include: orchard grass, timothy, Kentucky bluegrass, non-native thistles, Russian olive, leafy spurge, spotted knapweed, houndstongue, foxtail barley, and/or whitetop mustard. Often, sites are a combination of pasture grasses and invading weeds. The site is considered to be in a terminal state, meaning these sites are likely to never return to Reference, regardless of management.

Community 1.4.1
Invaded Community

Communities in this state may be structurally indistinguishable from the Reference state except that invasive or noxious species exceed 20 percent of species composition by dry weight. Although there is no research to document the level of 20 percent, this is estimated to be the point in the invasion process following the lag phase based on the interpretation of Masters and Sheley (2001). For aggressive invasive species (i.e., leafy spurge), a 20 percent threshold could be less than 10 percent. Early in the invasion process, there is a lag phase where the invasive plant populations remain small and localized for long periods before expanding exponentially (Hobbs and Humphries 1995). Production in the invaded community may vary greatly. A site dominated by Canada thistle, where soil fertility and chemistry remain near potential, may have production near that of the reference community. A site with degraded soils may produce only 10 to 20 percent of the reference community. Once invasive species dominate the site, either in species composition by weight or in their impact on the community, the threshold has been crossed to the Invaded State (4). As invasive species such as reed canarygrass, spotted knapweed, houndstongue, and leafy spurge become established, they become very difficult to eradicate. Therefore, considerable effort should be put into preventing plant communities from crossing a threshold into the Invaded State through early detection and moderate grazing management. Preventing new invasions is, by far, the most cost-effective control strategy and typically places an emphasis on education. Control measures used on the noxious plant species impacting this ecological site include chemical, biological, and cultural control methods. The best success has been found with an integrated pest management (IPM) strategy that incorporates one or several of these options along with education and prevention efforts (DiTomaso 2000).

State 1.5
Dry Riparian State

The Dry Riparian State (5) is characterized by a general loss of hydrology associated with the downcutting of a stream or stream meandering. This results in a grass-dominated community with drier shrubs. No trees exist in this community either as a result of a lack of seed sources or a lack of potential (many smaller riparian systems are not

capable of supporting tree growth). Basin wildrye, tufted hairgrass, slender wheatgrass, and reedgrass will be dominant; remnants of wetland species such as Baltic rush, meadow barley, and Northwest Territory sedge will also be present in limited amounts. This state is at risk of being invaded by non-native species, especially pasture species associated with neighboring pasture and hayland. This state can return to the Reference State (1) if hydrology is restored. This typically requires a stream to meander back to its previous path. In the situation where the stream has downcut, the transition is irreversible, and the trend is toward the creation of a new ecological site once it has cut far enough. At the point that a stream has been downcut beyond the point of return, this site will transition to the Stream Terrace ecological site. If the site was altered with the intent of producing hay and pasture species, see the Forage Crop System Land Use Communities.

Community 1.5.1
Drying/Pioneer Community

This community exists as a direct result of loss of hydrologic connectivity to the nearby stream or spring. Adapted plants are easily removed and replaced as they lose vigor. Species such as meadow barley, Baltic rush, spikerush, foxtail barley, and weedy forbs will establish. This change may or may not be associated with grazing, however unmanaged grazing can accelerate the process.

Transition T1A
State 1.1 to 1.2

The Reference State (1) transitions to the Increaser State (2) if beaked sedge, by dry weight, decreases to below 10 percent. The driver for this transition is the loss of taller sedges, which creates spaces between bunches that are then occupied by rhizomatous sedges and grasses. Soil erosion typically does not occur, but there is a slight decrease in soil fertility, driving transitions to the Increaser State. There are several other key factors signaling the approach of transition T1A: increases in soil physical crusting, an increase in rhizomatous sedges, decreases in litter cover, decreases in soil surface aggregate stability, and/or evidence of erosion, including water flow patterns and litter movement. The trigger for this transition is inappropriate grazing management and/or long-term drought, leading to a decrease in Northwest Territory sedge composition to less than 10 percent and a reduction in total plant canopy cover. Inappropriate grazing for the Riparian Meadow ecological site can be variable, but is generally defined as the utilization of herbaceous growth beyond 65 percent and/or browse utilization beyond 50 to 60 percent of riparian shrub species during the growing season.

Transition T1B
State 1.1 to 1.3

Repeated overgrazing changes the plant community to a shorter grass and grasslike community. This affects site stability and hydrology (reduced infiltration and increased runoff). Soil compaction may also be present if alluvium is of fine particle size. Improper grazing for this site can be variable, but is generally defined as the utilization of herbaceous growth beyond 65 percent and/or browse utilization beyond 50 to 60 percent of riparian shrub species during the growing season.

Constraints to recovery. The Baltic Rush State has had many of the deep-rooted bunchgrasses and sedges removed from the plant community, making restoration to the Reference State nearly impossible. Soil compaction as a result of livestock, which often results in hummocking, also poses a barrier to restoration, especially if equipment is needed to modify the site to improve hydrologic function.

Conservation practices

Channel Bank Vegetation
Prescribed Burning
Fence
Riparian Herbaceous Cover
Prescribed Grazing

Transition T1C
State 1.1 to 1.4

Sites are invaded by noxious weeds or introduced pasture grasses. Pasture grasses are a result of invasion from neighboring sites. Improper grazing may be a trigger for invasion, but flooding may transport seeds to freshly deposited alluvium. Often, no one mechanism will drive this transition. Improper grazing for the Riparian Meadow ecological site can be variable, but is generally defined as the utilization of herbaceous growth beyond 65 percent and/or browse utilization beyond 50 to 60 percent of riparian shrub species during the growing season.

Constraints to recovery. Introduced grasses and noxious weed control are exceedingly challenging near water resources. Removal of these species will be necessary to return the site to its Reference State. The level of invasion will dictate the amount and type of conservation practices necessary for recovery.

Transition T1D
State 1.1 to 1.5

The site has lost connectivity to the nearby stream as a result of stream meandering or downcutting.

Restoration pathway R1A
State 1.2 to 1.1

The Increaser State (2) has lost soil or vegetation attributes to the point that recovery to the Reference State (1) will require reclamation efforts such as soil rebuilding, intensive mechanical and cultural treatments, and/or revegetation. Examples of mechanical treatment may be brush control, while cultural treatments may include prescribed grazing or targeted brush browsing. The drivers for this restoration pathway are reclamation efforts along with proper grazing management. Proper grazing management regimes may vary, but typically include rest rotation with light to moderate grazing, reduced "hot" season grazing in July and August to prevent grazing use during the critical growth period of shrubs, as well as grazing events being reduced to shorter than 30 days to prevent regrazing of forage species.

Conservation practices

Prescribed Burning
Fence
Riparian Herbaceous Cover
Stream Habitat Improvement and Management
Prescribed Grazing
Range Planting

Transition T2A
State 1.2 to 1.3

Improper grazing changes the plant community to a shorter grass and grasslike community. This affects site stability and hydrology (reduced infiltration and increased runoff). Soil compaction may also be present if alluvium is of fine particle size. Improper grazing for the Riparian Meadow ecological site can be variable, but is generally defined as the utilization of herbaceous growth beyond 65 percent and/or browse utilization beyond 50 to 60 percent of riparian shrub species during the growing season.

Transition T2B
State 1.2 to 1.4

Sites are invaded by noxious weeds or introduced pasture grasses. Pasture grasses may be a result of invasion from neighboring sites. Improper grazing may be a trigger for invasion, but flooding may transport seeds to freshly deposited alluvium. Improper grazing for the Riparian Meadow ecological site can be variable, but is generally defined as the utilization of herbaceous growth beyond 65 percent and/or browse utilization beyond 50 to 60

percent of riparian shrub species during the growing season.

Transition T2C
State 1.2 to 1.5

The site has lost connectivity to the nearby stream as a result of stream meandering or downcutting.

Restoration pathway R3A
State 1.3 to 1.1

Improved grazing practices (change of season of use, conservative stocking rates), range planting, and water impoundments (beaver dams, log jams, or dam analogs) to help with increasing the water table on the nearby stream.

Conservation practices

Prescribed Burning
Fence
Riparian Herbaceous Cover
Prescribed Grazing
Range Planting
Wetland Restoration

Restoration pathway R3B
State 1.3 to 1.2

Improved grazing practices (change of season of use, conservative stocking rates), range planting, and water impoundments (beaver dams, log jams, or dam analogs) to help with increasing the water table on the nearby stream.

Transition T3A
State 1.3 to 1.4

Sites are invaded by noxious weeds or introduced pasture grasses. Pasture grasses may be a result of invasion from neighboring sites. Improper grazing may be a trigger for invasion, but flooding may transport seeds to freshly deposited alluvium. Improper grazing for the Riparian Meadow ecological site can be variable, but is generally defined as the utilization of herbaceous growth beyond 65 percent and/or browse utilization beyond 50 to 60 percent of riparian shrub species during the growing season.

Transition T3B
State 1.3 to 1.5

The site has lost connectivity to the nearby stream as a result of stream meandering or downcutting.

Restoration pathway R4A
State 1.4 to 1.1

Removal of non-native species is a challenge with the water table so near the surface. If invasion is minor, simple grazing techniques such as spot grazing with livestock trained to eat weeds may reduce the vigor of invasive species. Often, this requires the application of a physical removal method, such as pulling, or chemical removal. As invasion increases, control and restoration methods change and will require greater inputs of energy and finances to achieve results. A non-native grass invasion may result in a permanently invaded state. Species such as Kentucky bluegrass, quackgrass, creeping meadow foxtail, or reed canarygrass have few methods of control and are often rapid spreaders. Prevention is key for these species, though few sites across the MLRA do not have at least one of them.

Restoration pathway R4B
State 1.4 to 1.2

Removal of non-native species is a challenge with the water table so near the surface. If invasion is minor, simple grazing techniques such as spot grazing with livestock trained to eat weeds may reduce the vigor of invasive species. Often, this requires the application of a physical removal method, such as pulling, or chemical removal. As invasion increases, control and restoration methods change and will require greater inputs of energy and finances to achieve results. A non-native grass invasion may result in a permanently invaded state. Species such as Kentucky bluegrass, quackgrass, creeping meadow foxtail, or reed canarygrass have few methods of control and are often rapid spreaders. Prevention is key for these species, though few sites across the MLRA do not have at least one of them.

Restoration pathway R4C
State 1.4 to 1.3

Removal of non-native species is a challenge with the water table so near the surface. If invasion is minor, simple grazing techniques such as spot grazing with livestock trained to eat weeds may reduce the vigor of invasive species. Often, this requires the application of a physical removal method, such as pulling, or chemical removal. As invasion increases, control and restoration methods change and will require greater inputs of energy and finances to achieve results. A non-native grass invasion may result in a permanently invaded state. Species such as Kentucky bluegrass, quackgrass, creeping meadow foxtail, or reed canarygrass have few methods of control and are often rapid spreaders. Prevention is key for these species, though few sites across the MLRA do not have at least one of them.

Transition T4A
State 1.4 to 1.5

The site has lost hydrologic connectivity to the nearby stream as a result of stream meandering or downcutting.

Restoration pathway R5A
State 1.5 to 1.1

Grazing management (timing and amount to improve native grass and grasslike species establishment), range planting, brush management to remove unwanted drier species, and water control structures such as a natural beaver dam, an analog beaver dam (manmade), or other control structures if hydrologic connectivity is not naturally restored. As stream dynamics return, the increase in soil moisture will allow wetland species to return over time.

Restoration pathway R5B
State 1.5 to 1.2

Grazing management (timing and amount to improve native grass and grasslike species establishment), range planting, brush management to remove unwanted drier species, and water control structures such as a natural beaver dam, an analog beaver dam (manmade), or other control structures if hydrologic connectivity is not naturally restored. As stream dynamics return, the increase in soil moisture will allow wetland species to return over time.

Land use 2
Forage Crop System

The site has been manipulated by machinery for the production of forage crop systems. The site may have also been leveled to increase irrigation efficiency. The hydrology of the site is severely altered, with both drainage and irrigation ditches cut to facilitate water movement suited to forage production. This site will not return to its native condition due to the introduced pasture grasses' resilience and the modified hydrology.

State 2.1
Forage Crop State

State consists of a single community that has been modified for the production of Forage Crop Resources.

Community 2.1.1
Forage Crop Community

A single community developed for the purpose of livestock grazing or hay. Due to the high permanent water table some of these sites may have been altered to drain the water table to allow for equipment to manipulate or level the area. This site may also be irrigated once a forage crop is established. Species composition is nearly exclusively creeping meadow foxtail.

Dominant plant species

- creeping meadow foxtail (*Alopecurus arundinaceus*), grass

Conversion C1
Land use 1 to 2

Rangeland is altered for the production of forage crops (hay and pasture). This often includes 1 or more of the following: plowing or discing, leveling, and cutting of ditches to irrigate and/or drain the site.

Additional community tables

Table 9. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1	**Deeprooted Grasses and Grasslikes**			3460–3890	
	Northwest Territory sedge	CAUT	*Carex utriculata*	1080–1730	25–35
	Nebraska sedge	CANE2	*Carex nebrascensis*	400–850	45–60
	water sedge	CAAQ	*Carex aquatilis*	225–650	10–15
	tufted hairgrass	DECE	*Deschampsia cespitosa*	425–600	5–15
	northern reedgrass	CASTI3	*Calamagrostis stricta ssp. inexpansa*	100–250	0–3
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	150–225	3–5
	bluejoint	CACA4	*Calamagrostis canadensis*	0–160	0–5
2	**Increaser Grasses and Grasslikes**			430–640	
	sedge	CAREX	*Carex*	200–600	5–15
	arctic rush	JUAR2	*Juncus arcticus*	100–250	5–10
	meadow barley	HOBR2	*Hordeum brachyantherum*	100–175	3–5
	bulrush	SCIRP	*Scirpus*	0–150	0–3
Forb					
3	**Forbs**			220–245	
	slender cinquefoil	POGR9	*Potentilla gracilis*	20–80	0–2
	wild mint	MEAR4	*Mentha arvensis*	20–80	0–2
	elephanthead lousewort	PEGR2	*Pedicularis groenlandica*	10–60	0–1
	goldenrod	SOLID	*Solidago*	0–50	0–1
	silverweed cinquefoil	ARAN7	*Argentina anserina*	10–50	0–1
	willowherb	EPILO	*Epilobium*	0–50	0–1
	geranium	GERAN	*Geranium*	0–20	0–1
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–20	0–1
Shrub/Vine					
4	**Shrubs**			90–115	
	redosier dogwood	COSE16	*Cornus sericea*	0–50	0–3
	Booth's willow	SABO2	*Salix boothii*	0–20	0–3
	Drummond's willow	SADR	*Salix drummondiana*	0–20	0–3
	Bebb willow	SABE2	*Salix bebbiana*	0–20	0–3
	narrowleaf willow	SAEX	*Salix exigua*	0–20	0–3
	shrubby cinquefoil	DAFR6	*Dasiphora fruticosa*	0–20	0–2
	willow	SALIX	*Salix*	0–20	0–1
	water birch	BEOC2	*Betula occidentalis*	0–20	0–1

Animal community

Livestock grazing is suitable on this site. This site has the potential to produce a large amount of high-quality forage but is sensitive to improper grazing management. Livestock will seek out this site throughout the year, especially in the summer, so careful management is necessary to maintain species composition and production. Management objectives should include maintenance or improvement of the vegetation community. Shorter grazing periods and adequate re-growth after grazing are recommended for plant recovery and to protect stream banks against high-flow events.

Management considerations could include: rotation grazing, rest, prescribed utilization levels, off-site water development, varying the season of use, developing riparian pastures, providing alternative forage sources (i.e., new seedings or special use pastures, brush management, prescribed burning, and using supplements as ways to attract livestock to other areas of a pasture), stocking rates, stock density, armored water gaps, using a different breed or class of livestock, culling animals that spend too much time in the riparian area, alternating pasture entry locations, and herding. Season-long use of this site can be detrimental and will alter the plant community over time. Because of the wet soils often associated with this ecological site, soil compaction, and streambank shearing can result from improper grazing.

The herbaceous component can be increased by providing rest on a regular basis, followed by late-season use the next year. This treatment helps restore the plant's vigor and aids seed dispersal. Avoiding or limiting use during the hotter part of the year is also recommended. Recommended grazing periods for the hot season (generally July 1 through September 15) should be no more than 14 days without rest between grazing events. During other times of the grazing season, the recommended grazing period is up to 28 days.

Management strategies discussed above apply best to plant communities that are near or similar to their potential composition. When the dominant community is comprised of non-native grasses, additional rest often helps with the re-establishment of the native species. Often, extra rest will help restore some of the stability and natural hydrology of the site. Extra rest is intended to maintain more above ground production. This growth then helps trap sediment during flood or overflow events. Over time, the trapped sediment restores the stream banks and begins to restore or enlarge the riparian area. The stream's cross section often becomes narrower and deeper as riparian areas are expanded. This often results in raising the water column or water table in the system. Restoring hydrology (i.e., making the site wet again) will cause a shift back to the native herbaceous component of the site.

In situations where the stream has been incised and there is minimal potential for restoring original hydrology, yet there is still a significant component of willows and other woody species that are desirable to maintain, rest needs to be included in the management plan to aid with the maintenance of the woody species and to establish several age classes. Without frequent flooding to provide habitat for new seedling establishment, these plants will depend on vegetative means for reproduction. Rest and deferment allow that to happen. The rest period needs to be long enough to allow the new sprouts to grow out of reach of the grazing or browsing animal. These areas can often be safely utilized at a time of year when the herbaceous component is lush. The stream's cross section often changes as riparian areas are expanded. Consider techniques that help draw the animals out of these areas.

A site in communities in States 3, 4, or 5 will need rest annually until the site has stabilized and the plant community begins to move toward the Reference State. The rest treatment maintains more above-ground production, which in turn traps more sediment during overflow events. The additional sediment rebuilds banks and helps restore the riparian area to its potential extent. Often, a change in the stream's width/depth ratio results in raising the water table. As the water table level rises, the plants will shift to primarily obligate species. The Reference State and Increaser State species on this ecological site are predominantly obligate or facultative-wet.

Drought management and monitoring plans should be included as part of a comprehensive plan provided to the land owner or decision-maker. Control of noxious and other undesirable weeds should also be a part of the plan. Management of this ecological site needs to be included as part of a plan for all grazing lands.

This ecological site provides important habitat for many wildlife species. It is an important source of forage for grazing animals (i.e., herbivores). The seeds produced by the sedges and other plants are an important source of food for waterfowl and other birds.

The type of wildlife is somewhat dependent on site factors such as the size of the stream and the surrounding area. It is critical habitat for ducks, geese, and other migratory waterfowl. The site will be used for resting during migration and for nesting and rearing if there is open water available for a long enough time period.

These sites often provide a critical source of protein during migration. If the stream this site is associated with is large enough, animals such as muskrats may also use the site.

There have been no species identified with special emphasis specific to this site. However, bald eagles and peregrine falcons will use the habitats provided by this ecological site, adjacent sites, and the associated stream for

portions of their life cycle.

Hydrological functions

Soils have been classified into hydrologic soil groups and are defined by NRCS soil scientists. The soils associated with this ecological site are generally in Hydrologic Soil Group B. The infiltration rates for these soils are moderate when thoroughly wet with a moderate rate of water transmission. The runoff potential for this site is low.

This ecological site receives and generates runoff. The site is typically wet, receiving the majority of its moisture from its hydrologic connection with streamflow and water table fluctuations.

Runoff is characterized by surface flooding from overbank flows. On-site precipitation is generally considered a minor source of runoff at this site. As the streamflow subsides, runoff typically becomes subsurface return flows.

Any condition that would cause an increased instantaneous runoff peak (e.g., poorly designed clearcutting in the watershed) could degrade the channel, causing headcutting. An incised stream (Rosgen G or F type) is often the result.

Downcutting (incisement) would be a catastrophic event for this ecosystem. Channel downcutting will increase subsurface drainage, lower the seasonal water table, reduce the frequency of overbank flow, and reduce the duration of near-surface saturation. Bank erosion will increase.

The stream, in time, will adjust to a lower base elevation. However, the result of downcutting will be a new floodplain at a lower elevation, a lower water table elevation, a less floodprone width, and a smaller adjacent riparian and wetland area. The dominant vegetation in the previous riparian/wetland area will change (i.e., from obligative and facultative-wet to facultative, etc.). Given enough time, these conditions will eventually result in this site becoming either a Stream Terrace, or an upland site, depending on the resulting depth of the water table.

The vegetative community can also be changed for other reasons, such as if the water table drops during the growing season due to a lowering of the base elevation of adjacent streams or several years of drought conditions.

Plant cover affects overbank flow and runoff in several ways. The foliage and litter maintain the soil's infiltration potential by preventing the impact of raindrops from sealing the soil surface. Some of the precipitation will be intercepted by the plants and withheld from the initial runoff. Vegetation, including litter, forms numerous barriers to water flow, lengthening the time of concentration, dissipating energy, and reducing the peak discharge.

The hydrologic condition of this site has a significant effect on overbank flow. The hydrologic condition considers the effects of cover, including litter, and management on infiltration. Good hydrologic conditions indicate that the site usually has a lower runoff potential. A good hydrologic condition for this site also indicates that the site should remain stable and functional after high-flow events.

Erosion is minor for sites with high similarity. Sites with high similarity generally have enough cover and litter to optimize infiltration, minimize runoff and erosion, minimize streambank erosion, and have a good hydrologic condition. The deep root systems of the willows, sedges, and grasses in the Reference Plant Community will help maintain or improve site stability and function, as well as reduce erosion.

Sites in states 3, 4, or 5 are generally considered to be in less than good hydrologic condition. However, sites may still exhibit a high percentage of cover. The cover is often from shallow-rooted species (e.g., Kentucky bluegrass, redtop) that cannot hold the banks together during high-flow events, etc.

On-site precipitation will seldom be necessary to keep the root zone at field capacity during the growing season. The root zone should have free water available from stream overflow in the early part of the growing season and from the water table within two feet of the surface the remainder of the year. Plant cover and litter help retain soil moisture for use by the plants.

Recreational uses

This site provides multiple recreational opportunities for fishing, hiking, horseback riding, big game hunting, and bird

hunting. Some plants have flowers that appeal to photographers. This site provides valuable open space.

Wood products

None

Other products

none

Inventory data references

Information presented was derived from the site's Range Site Description (Riparian Meadow, Northern Rocky Mountain Valleys, South, East of Continental Divide), NRCS clipping data, literature, field observations, and personal contacts with range-trained personnel (i.e., used professional opinion of agency specialists, observations of land managers, and outside scientists).

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Approval

Kirt Walstad, 9/07/2023

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.

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Date	03/01/2020
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills will not be present

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2. **Presence of water flow patterns:** Water flow patterns as a result of flooding may be present and are part of the natural dynamics of the system. These flow patterns tend to stabilize quickly as a result of healthy deep root plants present.

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3. **Number and height of erosional pedestals or terracettes:** Pedestals are not evident in the reference condition

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is 0 due to high amounts of plant production and litter amounts.

5. **Number of gullies and erosion associated with gullies:** Active gullies are not present in the reference condition however historic, healed gullies may be present in response to old flooding events.

6. **Extent of wind scoured, blowouts and/or depositional areas:** Wind scoured, or depositional areas are not evident in the reference condition.

7. **Amount of litter movement (describe size and distance expected to travel):** Litter movement is not associated with this site; however, under exceptional flooding conditions, all size classes of litter may move hundreds of feet to areas of small debris dams.

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Soil Surface Stable with Stability Ratings of 5-6 (both under canopy and interspaces). Root mats may be present.

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** A horizon is 8-11 inches thick and sometimes under an organic root mat (Oe horizon). Colors can be variable due to mixed origins of alluvium however are considered dark with Munsell Color Values typically 3 or less with Chromas of 2 or less. This suggests high organic matter content. Several soils common on this site will have thin organic layers up to 3 inches above mineral A horizon. Structure of the A horizon is medium granular however in areas that receive more frequent water inundation the granular structure may part to a weak platy structure as a result of eluviation. Official Series Description (OSD) for characteristic range. https://soilseries.sc.egov.usda.gov/osdname.aspx

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** The high amounts of fine to coarse fibrous roots from the grasses and sedges combined with the deep coarse roots of the shrubs creates areas of moderate to rapid infiltration. Runoff is naturally very low and considered poorly drained. Site often absorbs runoff from neighboring sites. Organic horizons offer buffering capacity. Evenly distributed across the site, shrubs, bunchgrasses, and deep-rooted sedges improve infiltration while rhizomatous grass and shrubs protect the surface from runoff forces. An even distribution of shrubs (5-10 percent), tall sedges and bunchgrasses (55-65 percent), cool season increases sedges & grasses (20-25 percent), forbs (1-10 percent), and trees (0-1 percent) create efficient infiltration and reduce runoff.

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Site will not have a compaction layer. Areas that receive frequent inundation may express a platy E horizon or have weak platy structure in the A horizon. These characteristics may be mistaken for compaction. Compaction layers on this site are often associated with site hummocking and often exhibit massive (sometimes known called structureless) subsoil.

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: Tall, cool season, perennial bunchgrasses & sedges

    Sub-dominant: Shrubs = perennial, increaser bunchgrasses/grasslikes > forbs >> trees

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** Mortality in herbaceous species is not evident. Species with bunch growth forms may have some natural mortality in centers.

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14. **Average percent litter cover (%) and depth (in):** Total litter cover ranges from 65 to 75 percent. Most litter is irregularly distributed on the soil surface, which may be up to 1 inch thick.

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** Average annual production is 4700 pounds per acres (lbs/ac) or 5268 kilograms per hectare (kg/ha)
    Low: 4500 lbs/ac or 5044 kg/ha
    High 5150 lbs/ac or 5772 kg/ha

    Production varies based on effective precipitation and natural variability of soil properties for this ecological site.

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:** Potential invasive (including noxious) species (native and non-native). Non-native species common on this site include (but not limited to): Kentucky bluegrass, Canada bluegrass, smooth brome, creeping meadow foxtail, houndstongue, leafy spurge, Canada thistle, whitetop, sulphur cinquefoil, purple loosestrife, Russian olive, salt cedar (Tamarisk), and paleyellow iris

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17. **Perennial plant reproductive capability:** In the reference condition, all plants are vigorous enough for reproduction either by seed or rhizomes in order to balance natural mortality with species recruitment. Density of plants indicates that plants reproduce at level sufficient to fill available resource.
