Ecological site EX044B01A060
Overflow (Ov) LRU 01 Subset A

Last updated: 9/08/2023
Accessed: 05/02/2024

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 and borders two MLRAs: 43B Central Rocky Mountains and Foothills and 46 Northern and Central Rocky Mountain Foothills.

The major watersheds of this MLRA are those of the Missouri and Yellowstone Rivers and their associated headwaters such as the Beaverhead, Big Hole, Jefferson, Ruby, Madison, Gallatin, and Shields Rivers. These waters allow for extensive irrigation for crop production in an area that would generally only be compatible with rangeland and grazing. The Missouri River and its headwaters are behind several reservoirs that supply irrigation water, hydroelectric power, and municipal water. Limited portions of the MLRA are west of the Continental Divide along the Clark Fork River.

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

The MLRA consists of one Land Resource Unit (LRU) and seven climate based LRU subsets. These subsets are based on a combination of Relative Effective Annual Precipitation (REAP) and frost free days. Each subset expresses a distinct set of plants that differentiate it from other LRU subsets. Annual precipitation ranges from a low of 9 inches to a high 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 edge of the MLRA at the border with MLRA 43B. Frost free days also vary widely from less than 30 days in the Big Hole Valley to around 110 days in the warm valleys along the Yellowstone and Missouri Rivers.

The plant communities of the MRLA are highly variable, but the dominant community is a cool-season grass and shrub-steppe community. Warm-season grasses have an extremely limited extent in this MLRA. Most subspecies of big sagebrush are present, to some degree, across the MLRA.

LRU notes

MLRA 44B has one LRU that covers the entire MLRA. The LRU has been broken into seven climate subsets based on a combination of Relative Effective Annual Precipitation (REAP) and frost free days. Each combination of REAP and frost free days results in a common plant community that is shared across the subset. Each subset is giving a letter designation of A through F for sites that do not receive additional water and Y for sites that receive additional water.

LRU 01 Subset A has a REAP of nine to 14 inches (228.6-355.6mm) with a frost free days range of 70 to 110 days. This combination of REAP and frost free days results in a nearly treeless sagebrush steppe landscape.

The soil moisture regime is Ustic, dry that borders on Aridic and has a Frigid soil temperature regime.

Classification relationships

Mueggler and Stewart. 1980. Grassland and Shrubland habitat types of Western Montana
1. *Artemisia tridentata*/Agropyron spicatum h.t.
2. Potentilla fruticosa/Festuca scabrella h.t. (rare)
3. Agropyron spicatum/Bouteloua gracilis h.t.

Montana Natural Heritage Program Vegetation Classification
1. Rocky Mountain Lower Montane-Foothills Riparian Woodland/Shrubland

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

Ecological site concept

The Overflow ecological site is an upland site formed from alluvium. Slopes less than 15 percent. The site receives additional moisture from a water table or flooding. It is moderately deep to very deep and has no root-restrictive layers within 20 inches (50cm). The surface of the site has less than five percent stone cover. The site does not have a saline or saline-sodic influence and is not strongly or violently effervescent.

Associated sites

EX044B01A032	**Loamy (Lo) LRU 01 Subset A** The Loamy ecological site is typically adjacent to the Overflow site. It shares similar species as well as some basic community pathways and drivers.

Similar sites

R044BP801MT	**Bottomland** The Subirrigated ecological site tends to be lower in the landscape than the Overflow site but may express a similar state and transition model. Plant production is much greater as a result of water table closer to the soil surface.
EX044B01A032	**Loamy (Lo) LRU 01 Subset A** The Loamy ecological site is typically adjacent to the Overflow site. It shares similar species but does not receive additional plant-available moisture resulting in lower production potential.

Table 1. Dominant plant species

Tree	Not specified

Shrub	(1) *Artemisia tridentata ssp. tridentata* (2) *Symphoricarpos albus*
Herbaceous	(1) *Leymus cinereus* (2) *Pascopyrum smithii*

Legacy ID

R044BA060MT

Physiographic features

This ecological site is occurs mostly in narrow, ephemeral draingeaways, swales, and floodplains. This location on the landscape allows for the site to receive additional moisture in the form of runoff from adjacent sites as a result of a precipitation event and not a result of a water table.

Table 2. Representative physiographic features

Landforms	(1) Intermontane basin > Flood plain (2) Intermontane basin > Drainageway (3) Intermontane basin > Swale
Flooding duration	Very brief (4 to 48 hours) to brief (2 to 7 days)
Flooding frequency	Rare to frequent
Elevation	4,500–6,300 ft
Slope	0–15%
Water table depth	40 in

Climatic features

The Central Rocky Mountain Valleys of MLRA 44B have a continental climate and occur predominantly east of the Continental Divide. 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 LRU 01 Subset A is 12 inches and the frost free period averages 78 days. Precipitation is highest in May and June. Some of Montana’s driest areas are located in sheltered mountain valleys because of the rain-shadow effects on the leeside of some ranges.

Table 3. Representative climatic features

Frost-free period (characteristic range)	70-110 days
Freeze-free period (characteristic range)	110-140 days
Precipitation total (characteristic range)	9-14 in
Frost-free period (actual range)	70-110 days
Freeze-free period (actual range)	110-140 days
Precipitation total (actual range)	9-14 in
Frost-free period (average)	78 days
Freeze-free period (average)	125 days
Precipitation total (average)	12 in

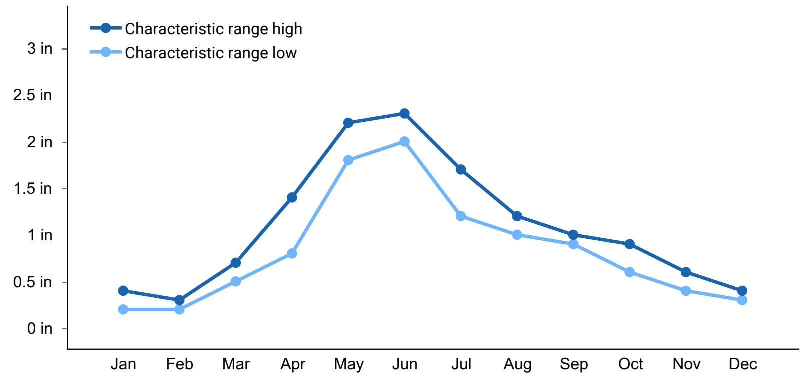


Figure 1. Monthly precipitation range

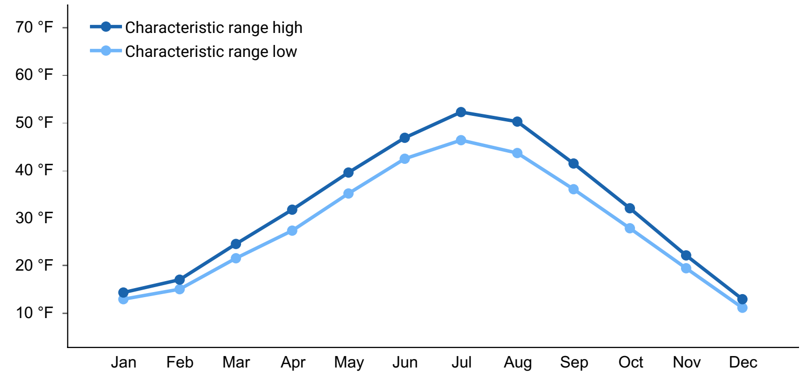


Figure 2. Monthly minimum temperature range

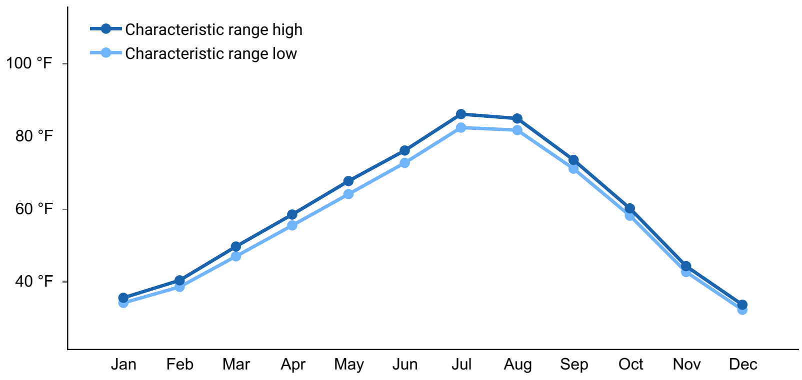


Figure 3. Monthly maximum temperature range

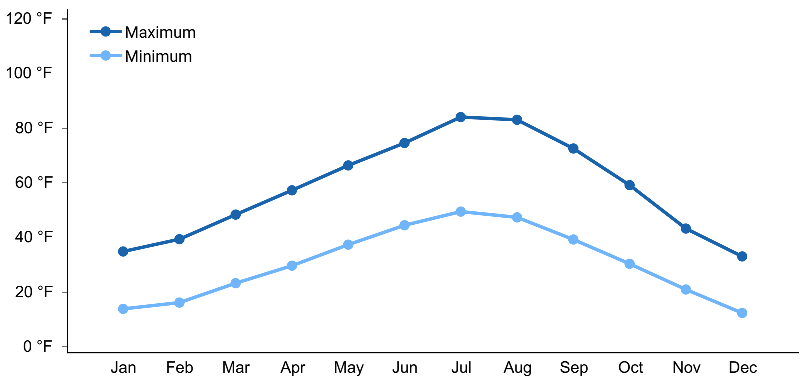


Figure 4. Monthly average minimum and maximum temperature

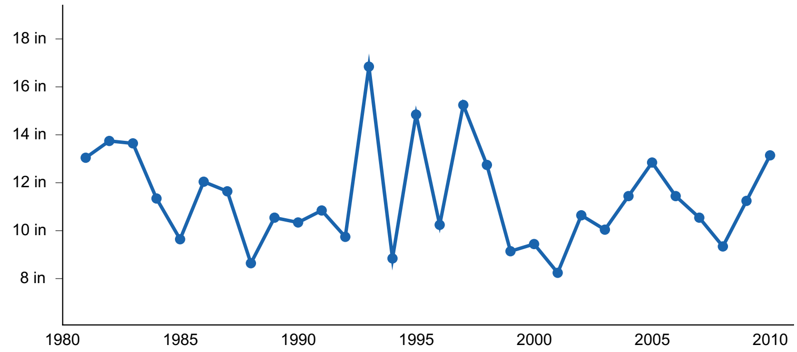


Figure 5. Annual precipitation pattern

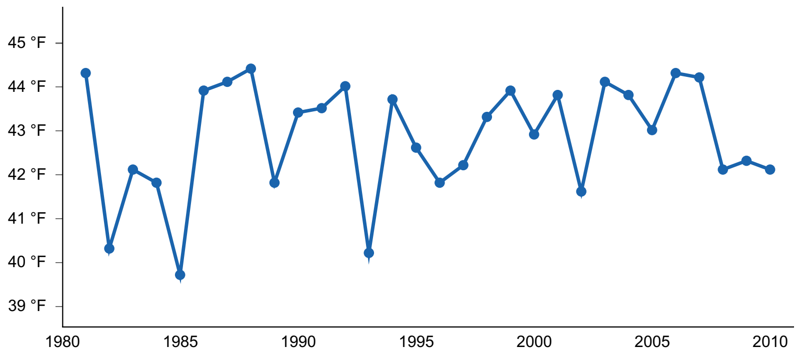


Figure 6. Annual average temperature pattern

Climate stations used

- (1) HELENA RGNL AP [USW00024144], Helena, MT
- (2) GARDINER [USC00243378], Gardiner, MT
- (3) DILLON AP [USW00024138], Dillon, MT
- (4) DEER LODGE 3 W [USC00242275], Deer Lodge, MT
- (5) TRIDENT [USC00248363], Three Forks, MT
- (6) BOULDER [USC00241008], Boulder, MT
- (7) DILLION U OF MONTANA WESTERN [USC00242409], Dillon, MT
- (8) ENNIS [USC00242793], Ennis, MT
- (9) TWIN BRIDGES [USC00248430], Sheridan, MT
- (10) TOWNSEND [USC00248324], Townsend, MT

Influencing water features

The site exists in ephemeral drainageways and swales where additional water is received in response to precipitation events. Surface and subsurface water runoff from nearby areas. The site may have a water table greater than 40 inches deep and, if present, is very seasonal in nature.

Wetland description

Site does not express wetland characteristics.

Soil features

The soils associated with this ecological site are moderately deep to very deep with moderate permeability. The parent material is alluvium. Typical soil surface textures are variable. Common soil series in this ecological site include Rivra and Bearmouth. These soils may exist across multiple ecological sites due to natural variations in slope, texture, rock fragments, and pH. An onsite soil pit and the most current ecological site key are required to classify an ecological site.

Table 4. Representative soil features

Parent material	(1) Alluvium–igneous, metamorphic and sedimentary rock
Drainage class	Moderately well drained to well drained
Soil depth	40 in
Surface fragment cover <=3"	0–5%
Surface fragment cover >3"	0–2%
Available water capacity (0-40in)	1.5–7.9 in
Electrical conductivity (0-40in)	0–2 mmhos/cm
Soil reaction (1:1 water) (0-40in)	6.3–8

Ecological dynamics

The Overflow (Ov) ecological site reference plant community is dominated by basin wildrye (*Leymus cinereus*), bluebunch wheatgrass (*Pseudoroegneria spicata*), and green needlegrass (*Nassella viridula*). Subdominant species may include western wheatgrass (*Pascopyrum smithii*), thickspike wheatgrass (*Elymus lanceolatus*), basin big sage (*Artemisia tridentata* ssp. tridentata), and slender wheatgrass (*Elymus trachycaulus*). This potential is suggested by investigations showing a predominance of perennial grasses on near-pristine range sites (Ross et al., 1973). In the reference plant community, shrubs are a relatively minor vegetative component.

As the community changes away from reference, rhizomatous grasses tend to increase. If allowed to continue, non-native sod-forming grasses tend to take over the site. Throughout this time, bare ground tends to be relatively low; in fact, a sodbound site may actually have less bare ground than the reference. However, due to the short rooted nature of the sod-forming grasses, headcutting and gully erosion can occur.

Historical records indicate that, prior to the introduction of livestock (cattle and sheep) during the late 1800s, elk and bison grazed this ecological site. Grazed areas received periodic high intensity, short duration grazing pressure due to bison's nomadic nature and herd structure. Livestock forage was noted as being minimal in areas recently grazed by bison (Lesica and Cooper 1997). Meriwether Lewis documented that he was met by 60 Shoshone warriors on horseback in August 1805, and the Corps of Discovery was later supplied with horses by the same band of Shoshone. This suggests that the areas near the modern-day Montana towns of Twin Bridges, Dillon, Grant, and Dell were grazed by an untold number of horses for nearly 50 years prior to the large introduction of cattle and sheep. The gold boom of the 1860s brought the first herds of livestock overland from Texas, and homesteaders began settling the area. During this time, cattle were the primary domestic grazers in the area. In the 1890s, sheep production increased by more than 400 percent and dominated the livestock industry until the 1930s. Since then, cattle production has dominated the region's livestock industry (Wyckoff and Hansen 2001).

Natural fire was a major ecological driver of this entire ecological site. Fire tended to restrict tree and sagebrush growth to small patches and promote an herbaceous plant community. The natural fire return interval was highly variable, ranging up to 100 years; however, it was likely shorter than 35 years (Arno and Gruell 1983). Since the great fires of 1910, there has been a significant increase in fire suppression, resulting in an increase in sagebrush and coniferous trees.

Some of the major invasive species that can occur on this site include (but are not limited to) spotted knapweed (*Centaurea stoebe*), leafy spurge (*Euphorbia esula*), sulphur cinquefoil (*Potentilla recta*), Canada thistle (*Cirsium arvense*), dandelion (Taraxicum spp.), and Kentucky bluegrass (*Poa pratensis*). Invasive weeds have a high impact on this ecological site.

Plant Communities and Transitions
A state and transition model (STM) for the Overflow 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.

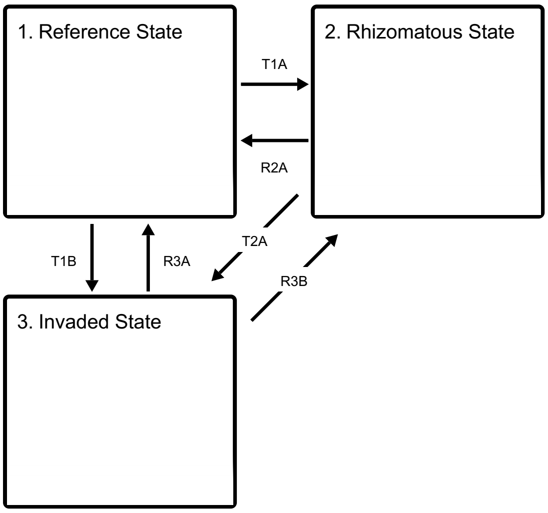
The plant communities within the same ecological site will differ across the MLRA due to the naturally occurring variability in weather, soils, and aspect. The biological processes on this site are complex; therefore, representative values are presented in a land management context. The species lists 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.

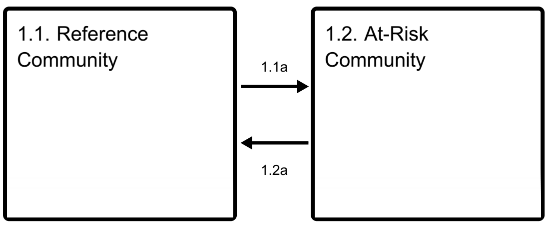
Although there is considerable qualitative experience supporting the pathways and transitions within the state and transition model (STM), no quantitative information exists that specifically identifies threshold parameters between grassland types and invaded types in this ecological site. For information 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

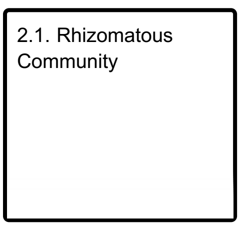
Ecosystem states



State 1 submodel, plant communities



State 2 submodel, plant communities



State 3 submodel, plant communities

3.1. Invaded Community

State 1
Reference State

The Reference State of this ecological site consists of two known potential plant communities (the 1.1 Reference Community and the 1.2 Wheatgrass community). These are described below but are generally characterized by a mid-statured, cool-season grass community with limited shrub production. Community 1.1 is dominated by basin wildrye and bluebunch wheatgrass. Community 1.2 has a codominance of bluebunch wheatgrass and western wheatgrass with a decrease in basin wildrye and an increase in basin big sagebrush. These communities may meld into each other due to the varying conditions that occur in Southwest Montana, particularly during dry cycles.

Dominant plant species

- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub
- common snowberry (*Symphoricarpos albus*), shrub
- shrubby cinquefoil (*Dasiphora fruticosa*), shrub
- basin wildrye (*Leymus cinereus*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- green needlegrass (*Nassella viridula*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- common yarrow (*Achillea millefolium*), other herbaceous
- mountain goldenbanner (*Thermopsis montana*), other herbaceous
- goldenrod (*Solidago*), other herbaceous
- Rocky Mountain iris (*Iris missouriensis*), other herbaceous

Community 1.1
Reference Community

In the Reference Community, basin wildrye, green needlegrass, and western wheatgrass are dominant. On the driest of overflow sites, bluebunch wheatgrass is present as a codominant species, but is often reduced to a subdominant species as moisture is increased. Nebraska sedge and Baltic rush are minor components of the reference state in areas with higher precipitation or that receive more additional moisture within this LRU. Basin big sagebrush and snowberry (*Symphoricarpos albus*) are two dominant shrubs. Minor components of wild rose (*Rosa woodsii*), silver buffaloberry (*Shepherdia argentea*), and shrubby cinquefoil (*Dasiphora fruticosa*) may exist. Basin big sagebrush may not exist in areas that have frequent short-term flooding or ponding. In this situation, silver buffaloberry or shrubby cinquefoil tend to replace big sagebrush.

Dominant plant species

- basin big sagebrush (*Artemisia tridentata ssp. tridentata*), shrub
- common snowberry (*Symphoricarpos albus*), shrub
- Woods' rose (*Rosa woodsii*), shrub
- basin wildrye (*Leymus cinereus*), grass
- green needlegrass (*Nassella viridula*), grass
- bluebunch wheatgrass (*Pseudoroegneria spicata*), grass
- western wheatgrass (*Pascopyrum smithii*), grass
- slender wheatgrass (*Elymus trachycaulus ssp. trachycaulus*), grass
- mountain goldenbanner (*Thermopsis montana*), other herbaceous
- common yarrow (*Achillea millefolium*), other herbaceous
- cinquefoil (*Potentilla*), other herbaceous
- goldenrod (*Solidago*), other herbaceous

Table 5. Annual production by plant type

Plant Type	Low (Lb/Acre)	Representative Value (Lb/Acre)	High (Lb/Acre)
Grass/Grasslike	1515	1750	2130
Forb	130	150	185
Shrub/Vine	96	110	135
Total	**1741**	**2010**	**2450**

Community 1.2
At-Risk Community

The At-Risk Community is distinguished by a plant community dominated by midstatured bunchgrasses and rhizomatous grasses, with an increase in forbs and shrubs. This is typically a result of non-prescribed grazing removing some of the basin wildrye and green needlegrass. In fact, green needlegrass may be absent from this community or be at such a low density that it no longer contributes to the structural integrity of the community. Western yarrow may increase significantly in this community. This community is extremely susceptible to invasive non-native species due to an increase in bare ground expected due to a reduction of basal area occupied by the larger bunchgrasses. In this community, Kentucky bluegrass possibly exists in a trace amount, which poses a risk to the hydrologic function, biotic integrity, and site stability due to its shallow root structure and ability to overtake areas. Non-native forbs will easily invade this community, especially if bare ground increases with the removal of the taller bunchgrasses.

Pathway 1.1a
Community 1.1 to 1.2

The community pathway from the Reference Community (1.1) to the At-Risk Community (1.2) is primarily driven by improper grazing. When vigor declines enough for plants to die or become smaller, species with higher grazing tolerance (in this ecological site, that would be Western wheatgrass) increase in vigor and production as they access the resources previously used by basin wildrye. The decrease in species composition by weight of tall bunchgrasses to be equal to that of rhizomatous grasses, specifically western wheatgrass and thickspike wheatgrass, indicates that the reference plant community has shifted to the At-Risk Community (1.2). The driver for community shift 1.1A is improper grazing management or prolonged drought. This shift is triggered by the loss of vigor of basin wildrye, soil erosion, or prolonged drought coupled with improper grazing. Blaisdell (1958) stated that drought and warmer-than-normal temperatures are known to advance plant phenology by as much as one month. During drought years, plants may be especially sensitive or reach a critical stage of development earlier than expected.

Pathway 1.2a
Community 1.2 to 1.1

The At-Risk Community (1.2) will return to the Reference Community (1.1) with proper grazing management and appropriate grazing intensity. Favorable moisture conditions will facilitate or accelerate this transition. It may take several years of favorable conditions for the community to transition back to a wildrye-dominated state. The driver for this community shift (1.2A) is the increased vigor of basin wildrye, resulting in increased biomass production and dominance of the plant community. The trigger for this shift is the change in grazing management favoring basin wildrye. These triggers are generally conservative grazing management styles such as deferred or rest rotations utilizing moderate grazing (less than 50 percent use) combined with favorable growing conditions such as cool, wet springs. These systems tend to promote increases in soil organic matter, which promotes microfauna and can increase infiltration rates. Inversely, long periods of rest at a time when this state is considered stable may not result in an increase in native bunchgrasses, and it has been suggested (Noy-Meir 1975) that these long periods of rest or underutilization may actually drive the system to a lower level of stability by creating large amounts of standing biomass, dead plant caudex centers, and gaps in the plant canopy.

State 2
Rhizomatous State

State 2, Rhizomatous State, has been altered by long term unmanaged, heavy grazing. Western wheatgrass and thickspike wheatgrass are dominant with a reduction in taller grasses such as basin wildrye and bluebunch wheatgrass. Basin big sagebrush dominates the shrub community.

Community 2.1
Rhizomatous Community

This plant community is primarily dominated by rhizomatous grasses such as western wheatgrass and thickspike wheatgrass, with limited amounts of mid-statured bunchgrasses. This community often has an increased presence of basin big sagebrush. Native "increaser" forbs will begin to dominate the forb community (western yarrow, goldenrod), with potentially invasive species such as common dandelion also present. Overall, production is reduced, as is litter cover. Because of the lower organic matter and shallower rooting depth of existing plants, the Rhizomatous Community has more bare ground than the reference, which may affect site stability. Hydrologic function is impaired as a response to reduced deep-rooted bunchgrasses and increased evapotranspiration. The transition from reference is in response to long-term drought, unmanaged grazing, or, in limited cases, increased fire frequency.

State 3
Invaded State

Heavy disturbance has allowed for bare ground and invasive species to dominate the site. Native plants may persist however dominance has been transferred to non-native grasses and forbs. Hydrologic function is nearly lost as runoff is increased. Site Stability is greatly reduced from Reference due to reduce soil organic matter and subsequent change of soil microbiota

Community 3.1
Invaded Community

The Invaded Community consists primarily of non-native grasses and forbs. Many of these species are considered noxious weeds, such as Canada thistle, sulphur cinquefoil, and leafy spurge. Kentucky bluegrass is the primary grass species, with common dandelion frequently being the dominant forb. Other introduced grasses such as smooth brome (Bromus inermus), Canada bluegrass (*Poa compressa*), and quackgrass (*Elymus repens*) exist in smaller amounts. These non-native grasses are incredibly successful in the Overflow site as they are shallow rooted and are better able to utilize increased soil moisture. Associated with this community are typically poor site stability and altered hydrologic function. As Kentucky bluegrass and other rhizomatous species increase, bare ground tends to increase. These shallow-rooted species are not able to hold the site.

Transition T1A
State 1 to 2

The Reference State (1) transitions to the Altered State (2) if taller bunchgrasses, by dry weight, decrease to below 15 percent or if bare ground cover increases beyond 10 percent. The driver for this transition is the loss of taller bunchgrasses, which creates open areas in the plant canopy with bare soil. Soil erosion reduces soil fertility, which drives transitions to the Altered State. There are several other key factors signaling the approach of transition T1A: increases in soil physical crusting, an increase in rhizomatous grasses, decreases in cover of cryptogamic crusts, decreases in soil surface aggregate stability, and/or evidence of erosion including water flow patterns, the development of plant pedestals, and litter movement. The trigger for this transition is improper grazing management and/or long-term drought, leading to a decrease in tall bunchgrass composition to less than 15 percent and a reduction in total plant canopy cover.

Transition T1B
State 1 to 3

Rapid invasion of the Reference State is often a result of repeated heavy disturbance from non-managed grazing (often combined with prolonged drought), stressing native bunchgrasses. Seeds of non-native grasses and forbs readily germinated in the bare ground between bunchgrass culms.

Restoration pathway R2A
State 2 to 1

The Altered 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 (via seeding or sprig planting in the case of basin wildrye). Examples of mechanical treatment may be brush control, while cultural treatments may include prescribed grazing, targeted brush browsing, or prescribed burning. Low-intensity prescribed fires are used to reduce competitive increaser plants like needle and thread and Sandberg bluegrass. A low-intensity fire will also reduce big sagebrush densities. Fire should be carefully planned or avoided in areas prone to annual grass infestation. The drivers for this restoration pathway are reclamation efforts along with proper grazing management.

Transition T2A
State 2 to 3

With continued disturbance, the Alerted State can deteriorate, losing the majority of the native bunchgrasses as well as reducing the native rhizomatous grasses. Non-managed grazing is the driver of this transition. Limited impacts from prolonged drought may influence this transition as well. Non-native species that are disturbance-tolerant or adapted compete for limited resources, reducing the vigor of native species.

Restoration pathway R3A
State 3 to 1

Restoration of the Invaded State (3) to the Reference State (1) requires substantial energy input. The drivers for the restoration pathway are the removal of invasive species, restoration of native bunchgrass species, persistent management of invasive species, and proper grazing management. Without continued control, invasive species are likely to return (probably rapidly) due to the presence of seeds and/or other viable material in the soil and management related practices that increase soil disturbance. If invaded by conifer encroachment, treatment depends on the condition of the rangeland. Sites that have transitioned from the Rhizomatous State (2) to the Invaded State (3) may be severely lacking in soil and vegetative properties that will allow for restoration to the Reference State. Hydrologic function damage may be irreversible, especially with accelerated gully erosion.

Restoration pathway R3B
State 3 to 2

If invasive species are removed before remnant populations of bunchgrass are drastically reduced, the Invaded State (3) can revert to the Rhizomatous state. The driver for the reclamation pathway is weed management without reseeding. Continued Integrated Pest Management (IPM) will be required as many of the invasive species that can occupy the Invaded State have extended dormant seed life. The trigger is invasive species control.

Additional community tables

Table 6. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production (Lb/Acre)	Foliar Cover (%)
Grass/Grasslike					
1				–	
	basin wildrye	LECI4	*Leymus cinereus*	345–975	–
	western wheatgrass	PASM	*Pascopyrum smithii*	175–485	–
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	0–300	–
	green needlegrass	NAVI4	*Nassella viridula*	0–245	–
	slender wheatgrass	ELTRS	*Elymus trachycaulus ssp. subsecundus*	85–200	–
	Grass-like, perennial	2GLP	*Grass-like, perennial*	0–120	–
	Grass, perennial	2GP	*Grass, perennial*	0–120	–
	Nebraska sedge	CANE2	*Carex nebrascensis*	0–120	–
	mountain rush	JUARL	*Juncus arcticus ssp. littoralis*	0–120	–
	slender wheatgrass	ELTRT	*Elymus trachycaulus ssp. trachycaulus*	0–110	–
Forb					
2				–	
	mountain goldenbanner	THMO6	*Thermopsis montana*	15–120	–
	northwestern Indian paintbrush	CAAN7	*Castilleja angustifolia*	20–120	–
	goldenrod	SOLID	*Solidago*	0–115	–
	common yarrow	ACMI2	*Achillea millefolium*	20–115	–
	silverweed cinquefoil	ARAN7	*Argentina anserina*	10–100	–
	American licorice	GLLE3	*Glycyrrhiza lepidota*	0–85	–
	Rocky Mountain iris	IRMI	*Iris missouriensis*	0–60	–
	Forb, dicot, perennial	2FDP	*Forb, dicot, perennial*	0–60	–
	Forb, monocot, perennial	2FMP	*Forb, monocot, perennial*	0–60	–
	sagebrush buttercup	RAGL	*Ranunculus glaberrimus*	0–15	–
	foothill deathcamas	ZIPA2	*Zigadenus paniculatus*	0–10	–
	nettleleaf giant hyssop	AGUR	*Agastache urticifolia*	0–10	–
Shrub/Vine					
3				–	
	basin big sagebrush	ARTRT	*Artemisia tridentata ssp. tridentata*	10–120	–
	silver buffaloberry	SHAR	*Shepherdia argentea*	0–100	–
	chokecherry	PRVI	*Prunus virginiana*	0–100	–
	common snowberry	SYAL	*Symphoricarpos albus*	0–85	–
	Woods' rose	ROWO	*Rosa woodsii*	0–25	–

Animal community

The Overflow ecological site of the Central Rocky Mountains Valleys, LRU 01 Subset A, provides a variety of wildlife habitat for an array of species. Prior to the settlement of this area, large herds of antelope, elk, and bison roamed. Though the bison that once utilized this landscape have been replaced with domestic livestock, wildlife still utilizes this largely intact landscape for habitat.

The relatively high grass component of the Reference Community provides excellent nesting cover for multiple neotropical migratory birds as well as hiding habitat for larger animals.

The greater sage grouse are likely to use the majority of the states in this ecological site because of the abundance of forbs and insects due to the favorable soil moisture.Even in an Altered State, sage grouse will utilize the increased forb and shrub cover for both foraging and hiding cover. This site would be considered critical habitat for most lifestages of the greater sage grouse.

Managed livestock grazing is suitable on this site due to the potential to produce an abundance of high-quality forage. This is often a preferred site for grazing by livestock, and animals tend to congregate in these areas. In order to maintain the productivity of this site, grazing on adjoining sites with less production must be managed carefully to make sure utilization on this site is not excessive. Management objectives should include maintenance or improvement of the native plant community. Careful management of the timing and duration of grazing is important. Shorter grazing periods and adequate deferment during the growing season are recommended for plant maintenance, health, and recovery.

Continual non-prescribed grazing of this site will be injurious, will alter the plant composition and production over time, and will result in the transition to the Altered State. The transition to other states will depend on the duration of poorly managed grazing as well as other circumstances such as weather conditions and fire frequency.

The Altered State is subject to further degradation to the Invaded State. Management should focus on grazing management strategies that will prevent further degradation, such as seasonal grazing deferment or winter grazing where feasible. Communities within this state are still stable and healthy under proper management. Forage quantity and/or quality may be substantially decreased from the Reference State.

Grazing is possible in the Invaded State. Invasive species are generally less palatable than native grasses. Forage production is typically greatly reduced in this state. Sites infested with invasive species face an increased risk of further degradation due to their aggressive nature.Grazing has to be carefully managed to avoid further soil loss and degradation and possible livestock health issues.

Prescriptive grazing can be used to manage invasive species. In some instances, carefully targeted grazing (sometimes in combination with other treatments) can reduce or maintain the species composition of invasive species.

Hydrological functions

The hydrologic cycle functions best in the Reference State (1) with good infiltration and deep percolation of rainfall; however, the cycle degrades as the vegetation community declines. Rapid rainfall infiltration, high soil organic matter, good soil structure, and good porosity accompany high bunchgrass canopy cover. High ground cover reduces rain drop impact on the soil surface, which keeps erosion and sedimentation transport low. Water leaving the site will have minimal sediment load, which allows for high water quality in associated streams. High rates of infiltration will allow water to move below the rooting zone during periods of heavy rainfall. The Reference Community (1.1) should have no rills or gullies present and drainage ways should be vegetated and stable. Water flow patterns, if present, will be barely observable. Plant pedestals are essentially non-existent. Plant litter remains in place and is not moved by wind or water.

Improper grazing management results in a community shift to the At Risk Community (1.2). This plant community has a similar canopy cover, but only slightly higher bare ground. Therefore, the hydrologic cycle is functioning at a level similar to the water cycle in the Reference Community (1.1).

In the Invaded State (3) canopy and ground cover are greatly reduced compared to the Reference State (1), which impedes the hydrologic cycle. Infiltration will decrease and runoff will increase due to reduced ground cover, presence of shallow-rooted species, rainfall splash, soil capping, reduced organic matter, and poor structure. Sparse ground cover and decreased infiltration can combine to increase frequency and severity of flooding within a watershed. Soil erosion is accelerated, quality of surface runoff is poor, and sedimentation increases.

Recreational uses

This site provides some limited recreational opportunities for hiking, horseback riding, big game and upland bird hunting. The forbs have flowers that appeal to photographers. This site provides valuable open space.

Inventory data references

Information presented was derived from the site's Range Site Description (Overflow 9 –14" P.Z., 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, 9/08/2023

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.

Author(s)/participant(s)	Grant Petersen

Contact for lead author	grant.petersen@usda.gov
Date	03/26/2019
Approved by	Kirt Walstad
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** Rills are not present in the reference condition.

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2. **Presence of water flow patterns:** Water flow patterns are not present in the reference condition.

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3. **Number and height of erosional pedestals or terracettes:** None

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4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** Bare ground is low (<5 percent). Bare ground refers to exposed mineral soil not covered by litter, rock, basal cover, plant cover, standing dead, lichen and/or moss.

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5. **Number of gullies and erosion associated with gullies:** None present

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6. **Extent of wind scoured, blowouts and/or depositional areas:** None Present

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7. **Amount of litter movement (describe size and distance expected to travel):** Extremely limited litter movement may exist after high precipitation events. Size of litter and distance traveled varies by species however if litter movement does occur it is rarely more than a few inches.

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8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** Site has strong resistance to erosion due to both high amounts of deep fibrous rooted plants, high organic matter and fungal hyphae. Soil Stability values under plant canopy will be 6 with areas of bare ground having rating of 5. A horizon is 6-10 inches thick. Biotic crust and root mat may be present

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** Soil surface structure will be medium to strong granular. Dark A horizon from 6 to 10 inches thick. Color tends to have a moist (rubbed) Value of 3 and Chroma of 3 or darker. Local geology may affect color in which it is important to reference the Official Series Description (OSD) for characteristic range.

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** Infiltration is moderately rapid. The mixed fibrous rooting depth of dominant

bunchgrasses combined with the taproots of forbs and shrubs in reference state allows for good infiltration. Canopy cover currently adequate for site protection varies however in reference canopy percentage often exceeds 100% in Reference State with even distribution of mid-statured bunchgrasses. An even distribution of tall and mid stature bunchgrasses (65-75% of site production), cool season rhizomatous grasses (10% of site production) along with a mix of shortgrasses, forbs and shrubs (5-15%).

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11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):** Not present, some soils profiles may contain an abrupt transition to an Argillic horizon which can be interpreted as compaction however the soil structure will typically fine to medium subangular blocky whereas a compaction layer will tend to be structureless.

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

    Dominant: Tall and Mid-Statured cool season bunchgrasses (Basin wildrye, Green needlegrass, bluebunch wheatgrass, slender wheatgrass)

    Sub-dominant: Shrubs ≥ Cool season rhizomatous grasses = Cool season shortgrasses ≥ Forbs > subshrubs

    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 is 3% or less.

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14. **Average percent litter cover (%) and depth (in):** Total litter cover ranges from 50 to 70%. Most litter is irregularly distributed on the soil surface and is less than .25 inch.

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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 2010 lbs per acre. Low: 1740 High 2450 lbs per acre. 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 species on this ecological site include (but not limited to) dandelion, annual brome spp., spotted knapweed, yellow toadflax, leafy spurge, Kentucky bluegrass, Ventenata

    Native species such as rocky mtn Juniper, big sagebrush, Sandberg's bluegrass, etc. when their populations are significant enough to affect ecological function, indicate site condition departure.

17. **Perennial plant reproductive capability:** Density of plants indicates that plants reproduce at level sufficient to fill available resources. 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.