Ecological site R043AA138MT
Shallow Droughty (Swdr)
LRU 43A-A

Last updated: 4/15/2025
Accessed: 04/21/2026

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): 043A–Northern Rocky Mountains

For further information regarding MLRAs, refer to: http://soils.usda.gov/survey/geography/mlra/index.html

LRU notes

Land Resource Unit (LRU) 43A-A: • Moisture Phase: xeric, ustic • Temperature Phase: frigid • Dominant Cover: rangeland • Representative Value (RV) Effective Precipitation: 13-17 inches • RV Frost-Free Days: 70-110 days

Ecological site concept

Site Concept: Site does not receive any additional water. Soils are: • not coarse-granular clay. • not highly fractured lithic bedrock to soil surface. • shallow (10-20” deep). • not strongly or violently effervescent within surface mineral 4”. • skeletal.

Associated sites

R043AA036MT	**Droughty (Dr) LRU 43A-A**
R043AA038MT	**Droughty Steep (Drstp) LRU 43A-A**

Similar sites

R043AA038MT	**Droughty Steep (Drstp) LRU 43A-A** This site differs by being on slopes >15% and by having deper soils.
R043AA036MT	**Droughty (Dr) LRU 43A-A** This site differs by having deeper soils (>20

Table 1. Dominant plant species

Tree	Not specified

Shrub	Not specified
Herbaceous	(1) *Pseudoroegneria spicata*

Physiographic features

The Shallow Droughty (SwDr) ecological site (R043AA138MT) is located within LRU “A” in MLRA “43A.” This ecological site typically occurs on hills, mountains, moraines, hillslopes, alluvial fans, and escarpments. The slope ranges from 0% to 55%. This site occurs on all exposures; effect of aspect can be significant in LRU assignment.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Mountain (3) Moraine
Elevation	790 – 2,130 m
Slope	0 – 60 %
Water table depth	110 cm
Aspect	E, S, W

Climatic features

The dissected Northern Rocky Mountains of MLRA 43A are considered to have a maritime climate. Precipitation is fairly evenly distributed throughout the year with less than about 35% of the annual precipitation occurring during the growing season in Montana. Rainfall occurs as high-intensity, convective thunderstorms in the spring and fall. Most of the precipitation in the winter is snow or rain on fully or partially frozen ground. Average precipitation for LRU-A is 15”, and the frost-free period averages 90 days.

See Climatic Data Sheet for more details (Section II of the Field Office Technical Guide: http://efotg.nrcs.usda.gov/efotg_locator.aspx?map=MT) or reference the following climatic Web site: http://www.wrcc.dri.edu/climsum.html.

Table 3 Representative climatic features

Frost-free period (average)	110 days
Freeze-free period (average)	120 days
Precipitation total (average)	430 mm

Influencing water features

Soil features

These soils are typically shallow well-drained soils that formed in colluvium and residuum. Soil consists of a loamy-skeletal or clayey-skeletal soil material (averages > 35% rock fragments by volume in 10-20” layer). This skeletal material decreases the water-holding capacity of the ecological site. Skeletal soil material may or may not be present to the surface. Surface textures (2 mm) usually range from very fine sandy loam to silty clay loam, and are typically gravelly to very gravelly.

Table 4. Representative soil features

Surface texture	(1) Loam (2) Silt loam (3) Clay loam
Family particle size	(1) Loamy
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	30 – 50 cm
Surface fragment cover <=3"	Not specified
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	5.08 – 10.16 cm
Calcium carbonate equivalent (0-101.6cm)	0 – 20 %
Electrical conductivity (0-101.6cm)	Not specified
Sodium adsorption ratio (0-101.6cm)	0 – 10
Soil reaction (1:1 water) (0-101.6cm)	6.3 – 8.2

Subsurface fragment volume <=3" (Depth not specified)	Not specified
Subsurface fragment volume >3" (Depth not specified)	Not specified

Ecological dynamics

The Shallow Droughty ecological site is characterized by the production and composition of plant species in the Reference Plant Community, which is defined by soils, precipitation, and the temperature regime influencing the site. The presumed Reference Plant Community type of this site is dominated by cool-season perennial bunchgrass species, primarily bluebunch wheatgrass (Pseudoroegneria spicata) with minor components of perennial forbs and low-growing shrubs. LRU-A occurs in the Rocky Mountains of western Montana, on rangelands with a xeric and ustic soil moisture phase, a frigid soil temperature phase, 13-17” of effective precipitation, and between 70 and 110 consecutive frost-free days annually. This site is characterized by shallow soils which are loamy-skeletal or clayey-skeletal at 10-20” depth.

The majority of precipitation comes early in the form of snow and spring rain. Summers are usually dry. The growing season is short and cool; primary growth typically occurs between May and July, and dominant plants are those that have adapted to these conditions.

In response to disastrous fires in 1910, new firefighting policies were established. Wildland fire suppression became an important driving factor in the ecology of western rangelands. Livestock grazing during the late 1800s and early 1900s often occurred at very heavy levels. Heavy grazing resulted in a severe reduction in fine fuels, which further reduced potential for natural fires. These two actions altered the natural fire interval.

Fire suppression, along with fine-fuels reduction, has interfered with the natural fire interval; many areas have not burned for over 100 years (Arno and Gruell 1986). Prior to 1900, the average natural fire return intervals were probably shorter than 35 years for this MLRA. Historic fire frequency may have ranged from 15 to 75 years. Trees and non-sprouting shrubs were restricted to small patches or widely spaced plants. Following fire on medium-textured soils, perennial bunchgrasses apparently recovered in a few years and were present to fuel subsequent fires, which suppressed woody species and kept them as a minor component of the community (Arno and Gruell 1983).

Historical records indicate, prior to the introduction of livestock (cattle and sheep) during the late 1800s, elk and bison grazed this ecological site. Evidence shows periodic use by bison was in large numbers and concentrations (Lesica and Cooper 1997). Forage for livestock was noted as minimal in areas recently grazed by bison (Lesica and Cooper 1997).

Significant livestock grazing has occurred on most of this ecological site in western Montana for more than 100 years (beginning with the 1860s gold boom and subsequent settlement through 1900). Indian horse herds were present and numerous for several hundred years prior. The primary type of European livestock grazed in this region has historically transitioned between sheep and cattle with early grazing (pre-1890) dominated by the cattle industry. In the 1890s Montana sheep production began to increase dramatically (> 400%) and dominated the cattle industry for approximately four decades. By the 1930s livestock production once again favored the cattle industry, which continues to dominate livestock grazing in the region today (Wyckoff and Hansen 2001). The Shallow Droughty ecological site is relatively accessible and many examples were subject to heavy and/or season-long grazing until 1970 or later.

Invasive species are an important part of the ecology of MLRA 43A. Notable invasive species include spotted knapweed (Centaurea stoebe), leafy spurge (Euphorbia esula), sulphur cinquefoil (Potentilla recta), and cheatgrass (Bromus tectorum). Most sites in MLRA 43A are impacted by these invasives. Sites are either currently invaded or have been treated to kill invasives, which reduces the production and changes the composition of forbs and shrubs. Even where invasives are not present, the threat of invasion drives management of this site.

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

Rangeland Health Reference Worksheets have been posted for this site on the Montana NRCS Web site (www.mt.nrcs.usda.gov) in Section II of the eFOTG under (F) Ecological Site Descriptions (ESD).

Plant Communities and Transitional Pathways
A STM for the Shallow Droughty ecological site (43AA138MT) is depicted in Figure 1. Thorough descriptions of each state, transition, plant community, and pathway follow the model. This model is based on available experimental research, field observations, and

interpretations by experts and is likely to change as knowledge increases.

Plant communities will differ across the MLRA because of 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. The species lists are not intended to cover every situation or the full range of conditions, species, and responses for the site.

Both percent species composition by weight and percent canopy cover are used in this ESD. Most observers find it easier to visualize or estimate percent canopy for woody species (trees and shrubs). Canopy cover drives the transitions between communities and states because of the influence of shade and interception of rainfall. 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 species composition for the site. Calculating similarity index requires use of species composition by dry weight.

State and transition model

Figure 3. 43AA138MT Shallow Droughty

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)
Grass/Grasslike					
1	**Cool Season Bunchgrasses**			715-1513	
	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	667-1412	–
	rough fescue	FECA4	*Festuca campestris*	0-280	–
	Idaho fescue	FEID	*Festuca idahoensis*	191-280	–
	needle and thread	HECO26	*Hesperostipa comata*	191-280	–
	needlegrass	ACHNA	*Achnatherum*	95-140	–
2	**Shortgrasses/Rhizomatous Grasses/ Grasslikes**			48-71	
	Grass, perennial	2GP	*Grass, perennial*	25-36	–
	sedge	CAREX	*Carex*	25-36	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	25-36	–
	Sandberg bluegrass	POSE	*Poa secunda*	25-36	–
Forb					
3	**Forbs**			95-140	
	Forb, annual	2FA	*Forb, annual*	48-71	–
	Forb, perennial	2FP	*Forb, perennial*	48-71	–
	common yarrow	ACMI2	*Achillea millefolium*	48-71	–
	ballhead sandwort	ARCO5	*Arenaria congesta*	48-71	–
	white sagebrush	ARLU	*Artemisia ludoviciana*	48-71	–
	aster	ASTER	*Aster*	48-71	–
	milkvetch	ASTRA	*Astragalus*	48-71	–
	arrowleaf balsamroot	BASA3	*Balsamorhiza sagittata*	48-71	–
	mariposa lily	CALOC	*Calochortus*	48-71	–
	field chickweed	CEAR4	*Cerastium arvense*	48-71	–
	tiny trumpet	COLI2	*Collomia linearis*	48-71	–
	fleabane	ERIGE2	*Erigeron*	48-71	–
	buckwheat	ERIOG	*Eriogonum*	48-71	–
	subalpine aster	EUME17	*Eurybia merita*	48-71	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	48-71	–
	western stoneseed	LIRU4	*Lithospermum ruderale*	48-71	–

	nineleaf biscuitroot	LOTR2	*Lomatium triternatum*	48-71	–
	silky lupine	LUSE4	*Lupinus sericeus*	48-71	–
	beardtongue	PENST	*Penstemon*	48-71	–
	phlox	PHLOX	*Phlox*	48-71	–
	woolly plantain	PLPA2	*Plantago patagonica*	48-71	–
	knotweed	POLYG4	*Polygonum*	48-71	–
	cinquefoil	POTEN	*Potentilla*	48-71	–
	meadow deathcamas	ZIVE	*Zigadenus venenosus*	48-71	–
Shrub/Vine					
4	**Shrubs**			95-140	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	48-71	–
	prairie sagewort	ARFR4	*Artemisia frigida*	48-71	–
	Woods' rose	ROWO	*Rosa woodsii*	48-71	–
	common snowberry	SYAL	*Symphoricarpos albus*	48-71	–

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 2.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 2.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 3.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Animal community

Livestock grazing is suitable on this site because of the potential to produce high quality forage. This site may be preferred for grazing by livestock, and animals may congregate in these areas, however if slopes are > 15% and distance from water is too great, livestock grazing will be limited. Management objectives should include maintenance or improvement of rangeland health attributes of this ecological site. Careful management of timing, intensity and duration of grazing to minimize grazing re-growth and providing adequate rest is important. Shorter grazing periods and changing season of use during the growing season are recommended for plant maintenance, health and recovery. Continuous grazing with improper stocking rates throughout the growing season in pastures year after year will be detrimental, will alter the plant composition and production over time, and will result in a transition to the Mixed Bunchgrass Community (1.2) or potentially hasten a change to the Invaded State (3.1). Transition to other states will depend on how well the site is managed over time with grazing animals as well as other circumstances such as weather conditions over a period of time. The transition to the Mixed Bunchgrass Community (1.2) can be the result of long-term, continuous grazing and/or repeated critical growing season grazing (early season grazing during stem elongation). This transition can also occur due to a combination of overgrazing and drought. Repeated grazing during stem elongation (generally mid-April through mid-June), can have detrimental affects, especially on the taller key bunchgrass species. Repeated spring grazing and/or repeated and prolonged summer grazing depletes stored carbohydrates, resulting in poor vigor of key forage plants over time and eventual death of these cool-season grasses – this can lead to an increase in less desirable native species and/or noxious weeds. The Mixed Bunchgrass Community (1.2) can occur across the entire ecological site or can occur in a mosaic with higher and/or lower states. This is most notable in areas that attract additional grazing, such as water sources or salting locations. The Mixed Bunchgrass Community (1.2) is subject to further degradation to the Altered Bunchgrass State (2) or Invaded State (3). Management should focus on grazing management strategies that will prevent further degradation. Forage quantity and/or quality may be substantially reduced compared to the Reference Plant Community (1.1). In the Altered Bunchgrass State (2), forage production is substantially reduced compared to the Taller Bunchgrass State (1). Grazing is possible in the Invaded State (3), but invasive species are generally much less palatable than native grasses and forage production is greatly reduced in this state. Grazing should be carefully managed to avoid soil loss and degradation of soil properties as well as to ensure adequate livestock health. Prescriptive grazing should be included in a conservation plan to maintain vigor of key native plant species while targeting the invasive species problem. In some instances, carefully targeted grazing (sometimes in combination with other treatments) can reduce or eliminate populations of invasive species. Distance to drinking water and slope can reduce grazing capacity within a management unit. Adjustments should only be made for the area that is considered necessary for reduction of animal numbers. For example 30% of a management unit may have 25% slopes and distances of > 1 mile from water; therefore the adjustment is only calculated for 30% of the unit (50% reduction on 30% of management unit). The table below is a general guide for ranches in Montana (Ricketts et al. 2004). Fencing, slope length, management, access, terrain and breeds are all factors that can increase or decrease the percent of grazable acres within a management unit. Adjustments should be made that incorporate pasture conditions when calculating stocking rates.

Hydrological functions

The water cycle functions best in the Taller Bunchgrass State (1) with good infiltration and deep percolation of rainfall. The water cycle degrades as the vegetation community declines. Rapid rainfall infiltration, high soil organic matter, good soil structure, and good porosity accompany high total ground cover of around 85%. High ground cover reduces raindrop 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 Rough Fescue Community (1.1) should have no rills or gullies present, and drainageways should be vegetated and stable. Improper grazing management results in a community shift to the Mixed Bunchgrass Community (1.2). This plant community has slightly reduced canopy cover, but bare ground will be 20%. Therefore, the water cycle is functioning at a level similar to the Rough Fescue Community (1.1). Compared to the Rough Fescue Community (1.1), infiltration rates are slightly reduced and surface runoff is slightly higher. In the Altered Bunchgrass State (2) and the Invaded State (3) canopy and ground cover are greatly reduced compared to the Taller Bunchgrass State (1), which impairs the water cycle. Infiltration will decrease and runoff will increase because of reduced ground cover, 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, and big game and upland bird hunting. The forbs have flowers that appeal to photographers. This site provides valuable open space.

Wood products

None

Other products

None

Other information

None

Inventory data references

Information presented was derived from NRCS clipping data, literature, field observations (based on three sampled sites and observations from numerous others), and personal contacts with range-trained personnel (i.e., professional opinion of agency specialists, observations of land managers, and outside scientists).

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Approval

Kirt Walstad, 4/15/2025

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	03/01/2010
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:** **Slopes on this site range from 0% to 55%. Rills should not occur in the Taller Bunchgrass State on slopes less than 15%. As slope increases so will the number and length of rills. Rills on steep slopes (>35%) should be <5 feet long.**

2. **Presence of water flow patterns:** **Water flow patterns are generally not evident in the reference state especially on slopes <4%. Following occasional (5 – 30 % probability), heavy thunderstorms and winter thaw events, common short, sinuous, discontinuous flow patterns may be apparent on 8%-35% slopes. On steeper slopes (>35%) water flow patterns may become more evident and there may be areas which show accumulations of litter due to water movement.**

3. **Number and height of erosional pedestals or terracettes:** **Very slight to slight on slopes <8%. Occasionally pedestals up to 0.5 inches may be encountered. As slopes increase pedestals may become more numerous and prominent.**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):** **Bare ground should be between 10%-20% - bare areas tend to be inconspicuous and not connected.**

5. **Number of gullies and erosion associated with gullies:** **Gullies should not occur in the Taller Bunchgrass State. If there is evidence of past erosion that has created gullies, these areas should be stabilized and have no active erosion.**

6. **Extent of wind scoured, blowouts and/or depositional areas:** **Appearance or evidence of these erosional features on the landscape would not be present on this site.**

7. **Amount of litter movement (describe size and distance expected to travel):** **Litter will be evident across this site representing organic debris from the vegetation of the functional/structural groups and will not move. A severe convection storm or a significant thaw event could cause litter to move short distances, especially on slopes greater than 6%.**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):** **Resistance to erosion will be high with soil stability values of 5 or 6; areas of bare soil on this site may have values between 3 and 5 if not under plant canopy.**

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9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):** **Structure is granular at the soil surface. Organic matter is about 1.5%. The surface horizon is 4 to 8 inches thick.**

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10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:** **The reference plant community (1.1) is dominated by bluebunch wheatgrass which will maximize infiltration and minimize runoff throughout the site. With the increase of needleandthread in Plant community (1.2) infiltration may decrease and runoff may increase but overall this plant community will have only slight affects on infiltration and runoff.**

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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):** **A compaction layer would not be expected on this ecological site. A platy soil surface structure would indicate a departure from the reference state.**

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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: Plant community 1.1 - Taller cool season bunchgrasses (bluebunch wheatgrass) >> mid-stature cool season bunchgrasses (needleandthread) > perennial forbs = shrubs > cool season rhizomatous grasses (western wheatgrass), shortgrasses (prairie junegrass) and grasslikes (sedges). Plant community 1.2 – bluebunch wheatgrass and needleandthread share dominance – the other functional/structural groups will remain the same in descending order.

    Sub-dominant:

    Other:

    Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):** **Plant mortality for all functional groups will be low, but there will be some natural mortality of functional groups over time. Prolonged droughts and/or excessive rest may show increases in mortality and decadence for all plant groups.**

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14. **Average percent litter cover (%) and depth (in):** **Note: the majority of the litter in the plant community in the Taller Bunchgrass State will be non-persistent.**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):** **850 #/acre – 1250 #/acre for the reference community (1.1) with a RV of 1050 #/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:** **Cheatgrass, knapweed spp., leafy spurge, sulphur cinquefoil, dalmatian toadflax, Japanese brome, broom snakeweed, fringed sagewort, salsify and dandelion.**

17. **Perennial plant reproductive capability:** **All native plants are capable of reproducing sexually and/or vegetatively.**