Ecological site R044AA161MT
Thin Clayey (Tcy)
LRU 44A-A

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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): 044A–Northern Rocky Mountain Valleys

For further information regarding MLRAs, refer to: http://soils.usda.gov/survey/geography/mlra/index.html Land Resource Unit (LRU) 44A-A: • Moisture Phase: xeric, dry - ustic, dry • Temperature Phase: frigid warm • Dominant Cover: rangeland • Representative Value (RV) Effective Precipitation: 10-14 inches • RV Frost-Free Days: 90-120 days Site Concept: Site does not receive any additional water. Soils are • not saline or saline-sodic. • not coarse-granular clay. • moderately deep, deep, or very deep with less than 15% stone and boulder cover. • not skeletal within 20” of soil surface. Not strongly or violently effervescent in surface mineral 4”. Slope is > 15%. Soils do not have a mollic epipedon. Clay content is > 32% in surface mineral 4”.

Associated sites

R044AA162MT	**Thin Loamy (Tlo) LRU 44A-A** The Thin Clayey site has more than 32% clay content, whereas the Thin Loamy has less than 32% clay content.
R044AA136MT	**Shallow Loamy (Swlo) LRU 44A-A**

Similar sites

R044AA001MT	**Clayey (Cy) LRU 44A-A** This site differs by being on slopes <15%.
R044AA162MT	**Thin Loamy (Tlo) LRU 44A-A**

Table 1. Dominant plant species

Tree	Not specified
Shrub	Not specified
Herbaceous	(1) *Pseudoroegneria spicata*

Physiographic features

The Thin Clayey (TCy) ecological site (R044AA161MT) is located within LRU “A” in MLRA “44A”. This ecological site usually occurs on moderately steep to steep hills and lake plains. The slope is > 15%. This site occurs on all exposures; effect of aspect can be significant in LRU assignment.

Table 2. Representative physiographic features

Landforms	(1) Hill (2) Lake plain
Elevation	550 – 1,520 m
Slope	20 – 50 %
Water table depth	110 cm
Aspect	E, S, W

Climatic features

The dissected Northern Rocky Mountain Valleys of MLRA 44A 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 12” and the frost-free period averages 105 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)	120 days
Freeze-free period (average)	140 days
Precipitation total (average)	360 mm

Influencing water features

Soil features

Soil is moderately deep to very deep and surface textures (2mm) range from clay loam to clay; clay content is > 32%. Structure is weak to nonexistent in the subsoil; this decreases the stability of the site.

Table 4. Representative soil features

Surface texture	(1) Clay (2) Silty clay loam (3) Clay loam
Family particle size	(1) Clayey
Drainage class	Well drained
Permeability class	Moderately slow to moderately rapid
Soil depth	50 cm
Available water capacity (0-101.6cm)	8.89 – 17.78 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

Ecological dynamics

The Thin Clayey ecological site is characterized by the production and composition of plant species in the Reference Plant Community, which is defined by soils, precipitation, and temperature regime influencing the site. The presumed Reference Plant Community of this site is dominated by cool-season perennial bunchgrass species, primarily bluebunch wheatgrass (Pseudoroegneria spicata) with minor components of perennial forbs and Wyoming big sagebrush (Artemisia tridentata). LRU-A occurs in the valleys of western Montana, on rangelands with a xeric, dry or ustic, dry soil moisture phase, a frigid, warm soil temperature phase, 10-14” of effective precipitation, and between 90 and 120 consecutive frost-free days annually. This site is characterized by medium-fine to fine textured surface horizons and soils without a mollic epipedon and slopes are greater than 15%.

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 currently 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 in large numbers and concentrations. 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 1860’s 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 1890’s Montana sheep production began to dramatically 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 Thin Clayey 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 44A. Notable invasive species include spotted knapweed (Centaurea stoebe), leafy spurge (Euphorbia esula), sulphur cinquefoil (Potentilla recta), and cheatgrass (Bromus tectorum). Invasive species impact almost every site in MLRA 44A. Sites are either currently invaded or have been treated to kill invasives, which can reduce production and change 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 Thin Clayey ecological site (44AA161MT) 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 differ across the MLRA because 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. 44AA161MT Thin Clayey

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**			471-863	

	bluebunch wheatgrass	PSSP6	*Pseudoroegneria spicata*	471-863	–
	green needlegrass	NAVI4	*Nassella viridula*	67-123	–
2	**Shortgrasses/Rhizomatous Grasses/Grasslikes**			67-123	
	Grass, perennial	2GP	*Grass, perennial*	34-62	–
	sedge	CAREX	*Carex*	34-62	–
	thickspike wheatgrass	ELLA3	*Elymus lanceolatus*	34-62	–
	prairie Junegrass	KOMA	*Koeleria macrantha*	34-62	–
	western wheatgrass	PASM	*Pascopyrum smithii*	34-62	–
	Sandberg bluegrass	POSE	*Poa secunda*	34-62	–
Forb					
3	**Forbs**			67-123	
	Forb, annual	2FA	*Forb, annual*	34-62	–
	Forb, perennial	2FP	*Forb, perennial*	34-62	–
	common yarrow	ACMI2	*Achillea millefolium*	34-62	–
	onion	ALLIU	*Allium*	34-62	–
	rosy pussytoes	ANRO2	*Antennaria rosea*	34-62	–
	twin arnica	ARSO2	*Arnica sororia*	34-62	–
	aster	ASTER	*Aster*	34-62	–
	milkvetch	ASTRA	*Astragalus*	34-62	–
	narrowleaf blue eyed Mary	COLI	*Collinsia linearis*	34-62	–
	bastard toadflax	COUM	*Comandra umbellata*	34-62	–
	tall annual willowherb	EPBR3	*Epilobium brachycarpum*	34-62	–
	fleabane	ERIGE2	*Erigeron*	34-62	–
	buckwheat	ERIOG	*Eriogonum*	34-62	–
	hairy false goldenaster	HEVI4	*Heterotheca villosa*	34-62	–
	flax	LINUM	*Linum*	34-62	–
	desertparsley	LOMAT	*Lomatium*	34-62	–
	thinleaved owl's-clover	ORTE2	*Orthocarpus tenuifolius*	34-62	–
	beardtongue	PENST	*Penstemon*	34-62	–
	Missouri goldenrod	SOMI2	*Solidago missouriensis*	34-62	–
	scarlet globemallow	SPCO	*Sphaeralcea coccinea*	34-62	–
Shrub/Vine					
4	**Shrubs**			67-123	
	Shrub (>.5m)	2SHRUB	*Shrub (>.5m)*	34-62	–
	prairie sagewort	ARFR4	*Artemisia frigida*	34-62	–
	Wyoming big sagebrush	ARTRW8	*Artemisia tridentata ssp. wyomingensis*	34-62	–
	yellow rabbitbrush	CHVI8	*Chrysothamnus viscidiflorus*	34-62	–
	rubber rabbitbrush	ERNA10	*Ericameria nauseosa*	34-62	–
	Woods' rose	ROWO	*Rosa woodsii*	34-62	–

Table 6. Community 1.2 plant community composition

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

Table 7. Community 1.3 plant community composition

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

Table 8. Community 2.1 plant community composition

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

Table 9. Community 2.2 plant community composition

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

Table 10. Community 3.1 plant community composition

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

Table 11. Community 4.1 plant community composition

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

Animal community

Livestock grazing is suitable on this site due to 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 the Shrubland Community (1.3) or potentially hasten a change to the Invaded State (4). 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) or the Shrubland Community (1.3) 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) and the Shrubland Community (1.3) 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) or the Shrubland Community (1.3) is subject to further degradation to the Altered State (2), the Sparsely Vegetated State (3) or the Invaded State (4). 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. In the Altered State, forage production is substantially reduced compared to the Taller Bunchgrass State. Grazing is possible in the Sparsely Vegetated State and the Invaded State, but forage production is greatly reduced in both states. 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) but infiltration is low on the Clayey Site. The water cycle degrades as the vegetation community declines. With total ground cover averaging around 85%, raindrop impact on the soil surface is reduced, 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. The Bluebunch Wheatgrass Community (1.1) should have no rills or gullies present and drainageways should be vegetated and stable. Improper grazing management results in the transition to the Altered State (2). This state has reduced canopy cover, and increased bare ground. Therefore, infiltration is reduced and runoff increased due to reduced ground cover, rainfall splash, soil capping, reduced organic matter, and poor structure. In the Sparsely Vegetated State (3) and the Invaded State (4) 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 two sampled sites and observations from numerous others), 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, 2/05/2022

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)	W. Lujan, N. Svendsen, J. Alexander, K. Walstad, J. Siddoway, M. Hansen
Contact for lead author	NRCS Missoula Area Office
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 range from 15% to 50%. Rills are rare in the Taller Bunchgrass State on slopes between 15%-35%. On slopes >35%, plant cover, basal area and litter are generally reduced and narrow rills <5 feet long may be present.

2. **Presence of water flow patterns:** Water flow patterns are generally rare in the reference state. Following occasional (5 – 30 % probability), heavy thunderstorms and winter thaw events, short, sinuous, discontinuous flow patterns may be apparent. On the 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 <20%. 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 is expected to 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.

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 3 to 6 inches thick. Mollic epipedon is not present.

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.

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 common on this ecological site. Some discontinuous, weak platy soil surface structure may be present.**

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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) >>> cool season rhizomatous grasses (western wheatgrass), shortgrasses (prairie junegrass) and grasslikes (sedges) = perennial forbs = shrubs. Plant community 1.2 – bluebunch wheatgrass and shortgrasses/ rhizomatous grasses 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):** **600 #/acre – 1100 #/acre for the reference community (1.1) with a RV of 850 #/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.**

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