UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

ECOLOGICAL SITE DESCRIPTION

ECOLOGICAL SITE CHARACTERISTICS

Site Type: Rangeland

Site ID: R043AA138MT

Site Name: Shallow Droughty

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

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

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.

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.

Predominant Landforms: (1) Hills
(2) Mountains
(3) Moraines

	Minimum	Maximum
Elevation (feet):	2,600	7,000
Slope (percent):	0%	55%
Water Table Depth (inches):	> 42	
Flooding:		
Frequency:	None	None
Duration:	None	None
Ponding:		
Depth (inches):	None	None
Frequency:	None	None
Duration:	None	None

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.

	Minimum	Maximum
Frost-free period (days):	70	110
Freeze-free period (days):	105	120
Annual effective precipitation (inches):	13	17

Monthly precipitation (inches) and temperature (degrees F) distribution:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precip. Avg.	1.56	.99	.98	.94	1.63	1.71	.97	.87	1.29	1.04	1.38	1.57
Temp. Min.	16	19	25	30	37	45	48	47	38	30	25	18
Temp. Max.	32	39	42	57	68	75	83	85	71	57	41	32

Climate Stations:

MT245009 Libby Dam, Montana period of records 1969-1986

REPRESENTATIVE 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.

Predominant Parent Materials:
Kind: colluvium and residuum
Origin:

Typical Surface Texture (< 2 mm): (1) Loam
(2) Silt loam
(3) Clay loam

Typical Textural Family: Loamy-skeletal

	Minimum	Maximum
Surface Fragments ≤ 10” (% cover)	0%	15%
% Coarse Fragments > 2 mm (% volume in surface 20”)	35%	
Drainage Class	Well	
Permeability Class	Moderately slow	Moderately rapid
Depth to Bedrock (inches)	10”	20”
Electrical Conductivity (mmhos/cm) within 4” Depth	0	1
Sodium Absorption Ratio within 16” Depth	0	12
Calcium Carbonate Equivalent within Surface 10”	0	< 20%
Soil Reaction within Surface 4”	6.3	8.2
Available Water Capacity (inches)	2”	4”

COMMUNITY PHASES

Ecological Dynamics of the Site

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.

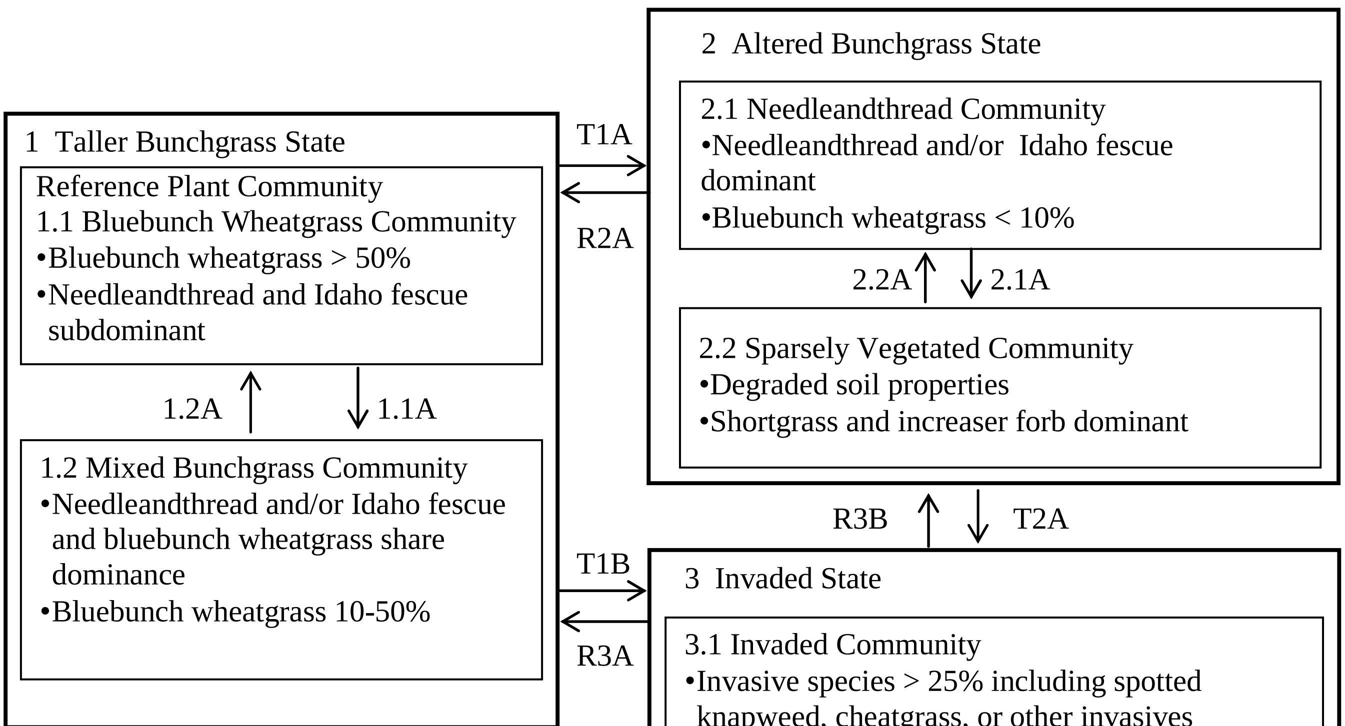
Rangeland Health Reference Worksheets have been posted for this site on the Montana NRCS Web site (www.mt.nrcs.usda.gov) in Section II of the eFOTG under (F) Ecological Site Descriptions (ESD).

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.



Legend

1.1A Improper Grazing Management, Soil Erosion
1.2A Proper Grazing Management
2.1A Improper Grazing Management, Soil Erosion
2.2A Proper Grazing Management
T1A Overgrazing, Soil Erosion
T1B Introduction of Weedy Propagules, Overgrazing
T2A Introduction of Weedy Propagules
R2A Range Seeding, Proper Grazing Management
R3A Weed Management, Proper Grazing Management, Range Seeding
R3B Weed Management

Figure 1. State and Transition Model: Shallow Droughty R043AA138MT

STATE 1 SECTION

State Number: **1**

State Name: **Taller Bunchgrass State**

State Narrative:
This state is characterized by cool-season bunchgrasses and is represented by two communities that differ mainly in the percent composition of bluebunch wheatgrass and needleandthread (*Hesperostipa comata*). Shrubs and forbs are a minor component in this state.

Community Phase Number: 1.1

Community Phase Name: Reference Plant Community – Bluebunch Wheatgrass Community

Community Phase Narrative:
The Bluebunch Wheatgrass Community (1.1) is dominated by bluebunch wheatgrass, a taller cool-season bunchgrass with a minor component of forbs and low-growing shrubs. Bluebunch wheatgrass is typically the dominant species in the Bluebunch Wheatgrass Community (1.1). Rough fescue (*Festuca campestris*) occurs in the reference community in the more mesic portion of the LRU, increasing to approximately 20% of species composition by dry weight in the wetter end of the LRU. Needleandthread, Idaho fescue (*Festuca Idahoensis*), Sandberg bluegrass (*Poa secunda),* and prairie junegrass (*Koeleria macrantha*) are subdominant. Many common forb species exist on this site, including arrowleaf balsamroot (*Balsamorhiza sagittata*). Low-growing shrub species, including fringed sagewort (*Artemisia frigida*), are present as a minor part of the community.

The Taller Bunchgrass State (1) generally occurs on the Shallow Droughty site in areas where proper grazing management practices have been implemented over a long period. The Bluebunch Wheatgrass Community (1.1) can be maintained through the implementation of properly managed grazing that provides adequate growing-season deferment to allow establishment of taller grass propagules and/or the recovery of vigor of stressed plants.

The Bluebunch Wheatgrass Community (1.1) in general is resistant to change with proper grazing management and near normal precipitation. However, bluebunch wheatgrass lacks resistance to grazing during the spring growing season. Subdominant species, such as needleandthread, tolerate higher grazing pressure and may increase in cover under prolonged drought conditions. This increase drives the community shift to the Mixed Bunchgrass Plant Community (1.2).

The Bluebunch Wheatgrass Community (1.1) is moderately resilient. This community will return to dynamic equilibrium (1.2A) following a relatively short period of stress such as drought or short-term overgrazing, provided the return of favorable or normal growing conditions occurs along with implementation of proper grazing management. This equilibrium will occur if canopy cover did not fall below 50%, and bluebunch wheatgrass did not fall below 10% of species composition.

Bluebunch wheatgrass lacks resistance to grazing during the critical growing period: spring. Bluebunch wheatgrass may decline in vigor and production if grazed in the spring more than one year in three (McLean and Wikeem 1985, Wilson et al. 1960).

Periodic fire increases the resilience of the Bluebunch Wheatgrass Community (1.1) by reducing competition and canopy cover of less fire-tolerant species. Fire also removes decadent herbaceous material, particularly from taller bunchgrasses, which promotes increased vigor and seedling establishment. Timing and intensity of a fire are critical components that can have varying positive or negative effects on this plant community. Fire does increase risk of invasion from invasive species, most notably cheatgrass. At least two growing seasons of rest are recommended to allow for plants to recover after fire.

Increaser species on this site are generally endemic species released by disturbance. These subdominant species of grasses, forbs, and shrubs are more tolerant to grazing pressure than bluebunch wheatgrass. Improper grazing management can reduce vigor of bluebunch wheatgrass, which can lead to reduced plant size or plant death. Species with high grazing tolerance will increase in production as they use resources made available by the decrease in bluebunch wheatgrass. Improper grazing management can also lead to degraded soil properties through compaction, erosion, decrease in organic matter, and increase in exposure because of reduction in litter cover. Needleandthread grass is not only more tolerant to higher grazing pressure but can also grow on less fertile soils than bluebunch wheatgrass (USDA/NRCS 2007).

Under improper grazing management, the Bluebunch Wheatgrass Community (1.1) shifts to the Mixed Bunchgrass Community (1.2). If overgrazing continues, invasive grass and forb species can move into the plant community and the site can transition to the Invaded State (3).

While the Bluebunch Wheatgrass Community (1.1) is resilient to degradation under proper management, the community remains at risk of invasion by aggressive nonnative species because of the ability of spotted knapweed, leafy spurge, and cheatgrass to invade healthy rangelands and the widespread presence of propagules. Healthy plant communities are most resilient to invasives although many examples exist of well-managed areas that have been invaded by spotted knapweed. Due to the ability of spotted knapweed and other aggressive species to invade any community, all communities, including the Reference Plant Community (1.1) are “at risk communities” to cross the threshold to the Invaded State (3).

Invasives may impact this plant community even if the site does not yet have a critical population of invasives. Almost all reference sites had at least trace amounts of spotted knapweed and/or cheatgrass. It is believed that most sites with trace amounts have been chemically treated for invasives at some point. These treatments would have decreased other broad-leafed species (forbs and shrubs). It is likely that this site had more potential for forb and shrub production than found on current reference sites.

Rock cover on the soil surface is minimal and does impact productivity of this site. Plant basal cover is expected to be about 10 to 20%, and bare ground is expected to be between 10 to 20%. The soils of this site have high soil stability values. There should be no signs of current erosion occurring on the site.

The following production figures do not represent the lowest or highest possible production for the Reference Plant Community (1.1). For example, the high figure is not the most production that can occur in a wet year in the most mesic portion of the LRU. These figures represent the normal range of variation of production in a normal year in the representative portion of the LRU.

Even the most stable communities exist within a range of dynamic equilibrium of species composition. The following table shows an example of species composition; the example is not the only mix of species possible in the Bluebunch Wheatgrass Community (1.1).

Species List - Reference Plant Community – 1.1

Plant Type - Grass/Grasslike — 80% of Community Composition

Group Number	Group Name	Scientific Plant Symbol	Common Name	Scientific Plant Name	Annual Production in Pounds/Acre Low	Annual Production in Pounds/Acre High
1	***Cool Season Bunchgrasses (75%)**				***638**	***1350**
		PSSP6	bluebunch wheatgrass	*Pseudoroegneria spicata*	595	1260
		FEID	Idaho fescue	*Festuca idahoensis*	170	250
		FECA4	rough fescue	*Festuca campestris*	0	250
		HECO26	needleandthread	*Hesperorostipa comata*	170	250
		ACHNA	needlegrass spp.	*Achnatherum spp.*	85	125
2	***Shortgrasses/ Rhizomatous Grasses/ Grasslikes (5%)**				***43**	***63**
		KOMA	prairie junegrass	*Koeleria macrantha*	22	32
		POSE	Sandberg bluegrass	*Poa secunda*	22	32
		CAREX	sedge spp.	*Carex spp.*	22	32
		PPGG	other perennial grasses		22	32

Plant Type - Forbs — 10% of Community Composition

Group Number	Group Name	Scientific Plant Symbol	Common Name	Scientific Plant Name	Annual Production in Pounds/Acre Low	Annual Production in Pounds/Acre High
3	***Forbs (10%)**				***85**	***125**
		ACMI2	western yarrow	*Achillea millefolium*	43	63
		ARCO5	ballhead sandwort	*Arenaria congesta*	43	63
		ARLU	cudweed sagewort	*Artemisia lucoviciana*	43	63
		ASTER	aster spp.	*Aster spp.*	43	63
		ASTRA	milkvetch spp.	*Astragalus spp.*	43	63
		BASA3	arrowleaf balsamroot	*Balsamorhiza sagittata*	43	63
		CALOC	mariposa lily	*Calochortus*	43	63
		CEAR4	field chickweed	*Cerastium arvense*	43	63
		COLI2	narrowleaf mountain trumpet	*Collomia linearis*	43	63
		ERIGE2	fleabane spp.	*Erigeron spp.*	43	63
		ERIOG	buckwheat spp.	*Eriogonum spp.*	43	63
		EUME17	Eurybia merita	*subalpine aster*	43	63
		HEVI4	hairy goldenaster	*Heterotheca villosa*	43	63
		LIRU4	western stoneseed	*Lithospermum ruderale*	43	63
		LOTR2	nineleaf biscuitroot	*Lomatium triternatum*	43	63
		LUSE4	silky lupine	*Lupinus sericeus*	43	63
		PENST	beardtongue spp.	*Penstemon spp.*	43	63
		PHLOX	phlox spp.	*Phlox spp.*	43	63
		PLPA2	woolly plantain	*Plantago patagonica*	43	63
		POLYG4	knotweed spp.	*Polygonum spp.*	43	63

		POTEN	cinquefoil spp	*Potentilla spp.*	43	63
		ZIVE	meadow deathcamas	*Zigadenus venenosus*	43	63
		PPFF	other perennial forbs		43	63
		AAFF	other annual forbs		43	63

Plant Type - Shrubs — 10% of Community Composition

Annual Production in Pounds/Acre

Group Number	Group Name	Scientific Plant Symbol	Common Name	Scientific Plant Name	Low	High
4	***Shrubs (10%)**				***85**	***125**
		ARFR4	fringed sage	*Artemisia frigida*	43	63
		ROWO	Woods' rose	*Rosa woodsii*	43	63
		SYAL	common snowberry	*Symphoricarpos albus*	43	63
		PPSS	other shrubs		43	63

* When calculating pounds allowable for a plant group, the production for that group cannot exceed the annual production in pounds per acre at the low- or high-expected production for the group--for individual species in a group, the maximum production allowable for each species is shown not to exceed the low- or high-production value depending on the location of this site in that LRU. This means if the site potential is closer to the lower parameters of the LRU (precipitation, soil properties), use the low values as a maximum. If the site potential is closer to the higher parameters of the LRU, use the high values as a maximum. If the site potential of the site is in the middle of the LRU, choose a value in the middle of the low and high as the maximum.

Community 1.1 Annual Production by Plant Type Table

Plant Type	Annual Production* (lbs/ac)		
	Low	**RV**	**High**
Grass/Grasslikes	680	840	1000
Forbs	85	105	125
Shrubs/Vines	85	105	125
Trees	0	0	0
Totals	850	1050	1250

* Low represents production in a normal year at the dry end of the LRU; RV is the Representative Value for production of the LRU. High represents production at the wet end of LRU.

Percent Canopy and Ground Cover by Material Type

Summary Category	Low	High
Canopy Cover	45	60
Bare Ground	10	20
Basal Cover	10	20
Total Ground Cover	80	90
Total Litter	45	60

Soil Surface Cover

Soil Surface Category	Low	High
Bedrock	0	2
Boulders	0	3
Cobbles	0	5
Duff	0	0
Embedded Litter	0	3
Gravel	0	30
Visible Lichen	0	3
Moss	0	20
Soil	55	70
Stones	0	3
Basal Hits	10	20

Plant Growth Curve

Growth Curve Number:
Growth Curve Name: 43A - Uplands
Growth Curve Description: Includes all upland sites in 43A

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	5	25	40	15	10	5	0	0	0

Community Phase Number: 1.2

Community Phase Name: Mixed Bunchgrass Community

Community Phase Narrative:
Needleandthread and Idaho fescue tolerate grazing pressure better than bluebunch wheatgrass and are better adapted to less fertile soil conditions than bluebunch wheatgrass. They increase in species composition when more palatable and less grazing tolerant plants decrease because of improper grazing management. Needleandthread and/or Idaho fescue and bluebunch wheatgrass share dominance in the Mixed Bunchgrass Community (1.2). Other grass species that are more tolerant to grazing and are likely to increase compared to the Reference Plant Community (1.1), include Sandberg bluegrass and prairie junegrass. Some increaser forbs species include western yarrow (*Achillea millefolium*), hoods phlox (*Phlox hoodii*), scarlet globemallow (*Sphaeralcea coccinea*), hairy goldenaster (*Heterotheca villosa*), and pussytoes (*Antennaria spp.*). Fringed sagewort is a shrub that also increases under prolonged drought or heavy grazing.

Heavy continuous grazing will reduce plant cover, litter, and mulch. Bare ground will increase and expose the soil to erosion. Litter and mulch will move off-site as plant cover declines. As long as the canopy cover remains > 50% and production of bluebunch wheatgrass is > 10% of total biomass production, the site can return to the Bluebunch Wheatgrass Community (Pathway 1.2A) under proper grazing management and favorable growing conditions.

Needleandthread and/or Idaho fescue will continue to increase until it makes up 80% or more of species composition. Once bluebunch wheatgrass has been reduced to < 10% and canopy cover has decreased to below 50%, it may be difficult for the site to recover to the Reference Plant

Community (1.1). The risk of soil erosion increases when canopy cover decreases to below 50%. As soil properties degrade, there will be loss of organic matter, reduced litter, compaction, and reduced soil fertility. Degraded soil properties increase the difficulty of reestablishing rough fescue plants and returning to the Reference Plant Community (1.1).

The Mixed Bunchgrass Community (1.2) is the "At-Risk" Plant Community for this ecological site. When overgrazing continues, increaser species such as needleandthread and native forb species become more dominant: and this triggers the change to the Altered Bunchgrass State (2) or the Invaded State (3). Until the Mixed Bunchgrass Community (1.2) crosses the threshold into the Needleandthread Community (2.1) or the Invaded Community (3.1), this community can be managed toward the Bluebunch Wheatgrass Community (1.1) using prescribed grazing and strategic weed control. It may take several years to achieve this recovery, depending on growing conditions, vigor of remnant bluebunch wheatgrass plants, and aggressiveness of weed treatments.

Community Phase Pathway 1.1A

Bluebunch wheatgrass loses vigor when overgrazed. When vigor declines enough for plants to die or become smaller, species with high grazing tolerance (most often needleandthread and/or Idaho fescue) increase in vigor and production as they use the resources previously used by bluebunch wheatgrass. Decrease of species composition by weight of bluebunch wheatgrass to < 50% indicates that the plant community has shifted to the Mixed Bunchgrass Community (1.2). The driver for community this community pathway is improper grazing management. This shift is triggered by the loss of vigor of bluebunch wheatgrass.

Community Phase Pathway 1.2A

The Mixed Bunchgrass Community (1.2) will return to the Bluebunch Wheatgrass Community (1.1) with proper grazing management that provides sufficient critical growing season deferment in combination with proper grazing intensity. Favorable moisture conditions will facilitate or accelerate this transition. The driver for this community shift (1.2A) is the increase in vigor of bluebunch wheatgrass to the point that it represents more than 50% of species composition. The trigger for this shift is the change in grazing management that favors bluebunch wheatgrass.

Transition T1A

The Taller Bunchgrass State (1) transitions to the Altered Bunchgrass State (2) if plant canopy cover declines to < 50% and bluebunch wheatgrass decreases to below 10% by dry weight. The trigger for this transition is the loss of taller bunchgrasses, which creates open spots of bare soil. Soil erosion is accompanied by decreased soil fertility driving the transitions to the Altered Bunchgrass State (2). There are several key factors signaling the approach of transition T1A: increases in soil physical crusting, decreases in cover of cryptogamic crusts, decreases in soil surface aggregate stability, and/or evidence of erosion, including water flow patterns, development of plant pedestals, and litter movement. The driver for this transition is improper grazing management and/or long-term drought leading to a decrease in bluebunch wheatgrass composition to < 10%.

Transition T1B

Regardless of grazing management, without some form of weed management (chemical, mechanical, or biological control), the Taller Bunchgrass State (1) can transition to the Invaded State (3) if aggressive invasive species, such as spotted knapweed and cheatgrass are introduced, even if the herbaceous component of the reference community is thriving. Healthy plant communities are most resilient to invasives. Long-term stress conditions for native species (e.g., overgrazing, drought, and fire) accelerate the process. If populations of invasive species reach critical levels, the site transitions to the Invaded State (3). The driver for this transition is the presence of aggressive invasive species.

Restoration Pathway R2A
The Altered Bunchgrass State (2) has lost soil or vegetation attributes to the point that recovery to the Taller Bunchgrass State (1) will require reclamation efforts, such as soil rebuilding, intensive mechanical treatments, and/or revegetation. The drivers for this restoration pathway are reclamation efforts and proper grazing management. The trigger is restoration efforts.

Restoration Pathway R3A
Restoration of the Invaded State (3) to the Taller Bunchgrass State (1) requires substantial energy input. The drivers for this restoration pathway are removal of invasive species, restoration of native bunchgrass species, ongoing management of invasives, and proper grazing management. Without maintenance, invasive species are likely to return (probably rapidly) because of the presence of propagules in the soil and increase in soil disturbance. The drivers for this reclamation pathway are treatments to reduce or remove invasive/noxious species in combination with favorable growing conditions. The trigger is invasive species control.

STATE 2 SECTION

State Number: **2**

State Name: **Altered Bunchgrass State**

State Narrative:
This state is characterized by having < 10% bluebunch wheatgrass and < 50% canopy cover. It is represented by two communities that differ in the percent composition of needleandthread and/or Idaho fescue, production, and soil degradation. Production in this state is considerably lower than in the Taller Bunchgrass State (1). Some native plants tend to increase under prolonged drought and/or heavy grazing practices. A few of these species may include needleandthread, Sandberg bluegrass, western yarrow, scarlet globemallow, hairy goldenaster, and fringed sagewort.

Community Phase Number: 2.1

Community Phase Name: Needleandthread Community

Community Phase Narrative:
Long-term grazing mismanagement with continuous growing-season pressure will reduce total productivity of the site and lead to an increase of bare ground. Once plant cover is reduced, the site is more susceptible to erosion and degradation of soil properties. Soil erosion or reduced soil fertility will create reduced plant production. This soil erosion or loss of soil fertility and degradation of soil properties indicates the transition the Altered Bunchgrass State (2) because it creates a threshold that requires input of energy to return to the Taller Bunchgrass State (1). The

transition to the Needleandthread Community (2.1) may be exacerbated by extended drought conditions.

Needleandthread dominates the Needleandthread Community (2.1). Bluebunch wheatgrass makes up < 10% of species composition by dry weight, and the remaining bluebunch wheatgrass plants tend to be scattered and low in vigor. Increaser and invader species will become more common and will create more competition for bluebunch wheatgrass in the community. This compaction makes it difficult for bluebunch wheatgrass to increase in a shorter period with simply a change in grazing management alone. Therefore, an input of energy will be required for the community to return to the Taller Bunchgrass State (1). Proper grazing management over a longer period of time is a successful strategy to increase cover and production of bluebunch wheatgrass. Canopy cover decreases compared to the Mixed Bunchgrass Community (1.2) to below 50%. Wind and water may be eroding soil from the plant interspaces. Soil fertility is reduced, soil compaction is increased, and resistance to soil surface erosion has declined compared to the Taller Bunchgrass State (1).

This community has crossed a threshold compared to the Mixed Bunchgrass Community (1.2) because of soil erosion, loss of soil fertility, or degradation of soil properties which causes a critical shift in the ecology of the site. The affects of soil erosion can alter the hydrology, soil chemistry, soil microorganisms, and soil physics to the point where intensive restoration is required to restore the site to another state or community. Simply changing grazing management cannot create sufficient change to restore the site within a reasonable period. Restoration will require a considerable input of energy to return to the Taller Bunchgrass State (1). This state has lost soil or vegetation attributes to the point that recovery to the Taller Bunchgrass State (1) will require reclamation efforts, i.e., soil rebuilding, intensive mechanical treatments, and/or reseeding.

The transition to this community could occur because of overgrazing (often because of failure to adjust stocking rates in response to declining forage production because of increased dominance of unpalatable invasive species), long-term lack of fire, warming climate, or extensive drought. If heavy grazing continues, plant cover, litter, and mulch will further decrease and bare ground will further increase, exposing the soil to accelerated erosion. Litter and mulch will move off-site as plant cover declines. The Needleandthread Community will then shift to a Sparsely Vegetated Community (2.2). Introduction or expansion of invasive species will further drive the plant community to the Invaded State (3).

Community Phase Number: 2.2

Community Phase Name: Sparsely Vegetated Community

Community Phase Narrative:
Very sparse plant cover and soil surface erosion characterize this community. Grass and forb cover may be very sparse or clumped (canopy cover < 25%). Weeds, annual species, or shortgrass species dominate the plant community. Mid-stature perennial bunchgrass species (e.g., needleandthread) may exist, but only in patches.

In this community phase there may be a significant amount of bare ground, and large gaps may occur between plants. Potential exists for soils to erode to the point that irreversible damage may occur. If further soil erosion occurs, there will be a critical negative shift in the ecological processes of the site. Soil erosion combined with lack of organic matter deposition because of sparse vegetation, creates changes to the hydrology, soil chemistry, soil microorganisms, and soil physics to the point where intensive restoration is required to restore the site to another state or community. Simply changing management (i.e., improving grazing management) cannot create sufficient change to restore the site within a reasonable period.

This plant community may be in a terminal state that will not return to the reference state because of degraded soil properties and loss of higher successional native plant species.

Community Phase Pathway 2.1A
With continued overgrazing, bunchgrasses and perennial forbs can decrease in the Needleandthread Community (2.1). Loss of larger bunchgrasses and rhizomatous grasses will increase bare soil and allow increased soil erosion. This shift is frequently accompanied by decreased soil fertility and diminished soil properties. Decreased plant vigor drives this shift. This shift is triggered by continued overgrazing or extended drought in a Needleandthread Community (2.1) with poor vigor. Lack of mid-stature bunchgrasses and low production indicates a community shift to the Sparsely Vegetated Community (2.2).

Community Phase Pathway 2.2A
If a Sparsely Vegetated Community (2.2) is properly managed for several years and growing conditions are favorable, annual production of perennial bunchgrasses and rhizomatous grasses may increase over time, and the site may shift back to the Needleandthread Community (2.1). The driver for this shift is increased vigor of bunchgrasses and rhizomatous grasses. The trigger is improved grazing management and growing conditions over a long period.

Transition T2A
Invasive species can occupy the Altered Bunchgrass State (2) and drive it to the Invaded State (3). The Altered Bunchgrass State is at risk of this transition, if invasive propagules are present. The driver for this transition is the presence of critical population levels (> 25%) of invasive species. The trigger is the presence of propagules of invasive species.

Restoration Pathway R2A
The Altered Bunchgrass State (2) has lost soil or vegetation attributes to the point that recovery to the Taller Bunchgrass State (1) will require reclamation efforts such as soil rebuilding, intensive mechanical treatments, and/or revegetation. The drivers for this restoration pathway are reclamation efforts and proper grazing management. The trigger is restoration efforts.

Restoration Pathway R3B
If invasive species are removed without sufficient remnant populations of reference community species (particularly bluebunch wheatgrass), the Invaded State (3) is likely to return to the Altered Bunchgrass State (2) instead of the Taller Bunchgrass State (1). The driver for the reclamation pathway is weed management without reseeding. The trigger is invasive species control.

STATE 3 SECTION

State Number: **3**

State Name: **Invaded State**

State Narrative:
The single community described below characterizes this state.

Community Phase Number: 3.1

Community Phase Name: Invaded Community

Community Phase Narrative:
The Invaded State (3) is characterized by > 25% of invasive species: spotted knapweed, leafy spurge, sulphur cinquefoil, and/or cheatgrass are the dominant invasive species in MLRA 43A. Introduced invasive plant species have been identified as one of the greatest threats to the integrity and productivity of native rangeland ecosystems and conservation of indigenous biodiversity (DiTomaso 2000: Mack et al. 2000). In addition to environmental consequences damages caused and costs incurred to control invasive plants are several billion dollars each year in the United States (Pimentel et al. 2000).

Invasives are the driving factor throughout western Montana and they are a focal part of the ecology of MLRA 43A. Their ability to take over and dominate a site has become a big concern. Improper grazing management has contributed to the spread of these species.

The potential for altered ecosystem structure and function is high in the Invaded State (3) and can occur in many ways. The increase in invasive species, especially noxious weeds, can lead to a reduction of the native bunchgrasses and an increase in the proportion of bare ground, which often results in reduced infiltration rates and increased surface runoff and erosion. Invasion by cheatgrass reduces above and below ground biomass (Ogle et al. 2003), increases plant litter, changes plant community canopy architecture (Belnap and Phillips 2001), reduces soil biota richness and abundance, reduces plant community richness (Belnap et al. 2005), increases wildfire frequency (Whisenant 1990), and potentially facilitates invasion by other noxious or invasive plants. Dense populations of invasive species can cause soil loss to increase because of lack of surface cover (Lacey et al. 1989).

Early in the invasion process, there is a lag phase where invasive plant populations remain small and localized before expanding exponentially (Hobbs and Humphries 1995). Based on research conducted in noxious weed-invaded plant communities in Montana, it is reasonable to estimate that 25% dry-weight composition of invasive plant species is the point in the invasion process where spread and abundance increase exponentially and where a plant community has crossed a threshold (Masters and Sheley 2001). For aggressive invasive species (i.e., spotted knapweed), this threshold could be < 10%.

Once invasive species dominate the site, either in species composition by weight or in their impact on the community the threshold has been crossed to the Invaded State (3). Once invasive species such as spotted knapweed, cheatgrass, and leafy spurge become established, they are very difficult to eradicate. Therefore considerable effort should be placed in preventing plant communities from crossing a threshold to the Invaded State (3) through early detection and proper management. Preventing new invasions is by far the most cost-effective control strategy and typically places an emphasis on education. Control measures used on the noxious plant species influencing this ecological site include chemical, biological, and cultural control methods. The best success has been found with an integrated weed management strategy that incorporates one or several of these options along with education and prevention efforts (DiTomaso 2000).

Production in the invaded community may vary greatly. A site dominated by spotted knapweed, where soil fertility and chemistry remain near potential, may have production near that of the reference community. A site with degraded soils and infestation of cheatgrass may produce only 10-20% of the reference community.

Invasive plant species have effective reproductive strategies, long seed viability in the soil seed bank, and/or allelopathic properties (Williamson and Fitter 1996). Spotted knapweed has allelopathic properties whereby its roots exude catechin, which may limit the growth and establishment of other plant species (Callaway and Vivanco 2007; Bais et al. 2002), thus promoting its own success. An in-vitro experiment showed that other weeds like Dalmatian toadflax (*Linaria dalmatica*), kochia (*Kochia scoparia*), diffuse knapweed (*Centaurea diffusa*), and crops, such as wheat (*Triticum aestivum*), showed mortality on the fourteenth day after addition of root exudates from spotted knapweed (Bais et al. 2002). This allelopathic property creates highly resilient communities.

Cheatgrass has the ability to establish rapidly and attain community dominance following disturbances such as wildfire (Young and Evans 1978) or other disturbances that create bare soil. Cheatgrass is a successful invader because it has the ability to respond rapidly to increases in resource availability (Norton et al. 2004: Lowe et al. 2003) as well as to compete for water (Pellant 1996).

Cheatgrass was introduced into the United States in packing materials, ship ballast, and likely as a contaminant of crop seed. Cheatgrass was first found in the United States near Denver, Colorado, in the late 1800s. In the late 1800s and early 1900s, cheatgrass spread explosively in the ready-made seed-beds prepared by the trampling livestock hooves of overstocked rangelands. Cheatgrass has developed into a severe weed in several agricultural systems throughout North America, particularly western pastureland, rangeland, and winter wheat fields (NRCS 2009). Today, cheatgrass is found in most of the western states having reached its range of current distribution by 1930. In fact, a survey of 11 western states showed that cheatgrass was present on at least 60 million acres (Pellant 1996).

After arriving in 1893 on the San Juan Islands in Washington, spotted knapweed had established in over 24 counties in three northwestern states by 1924, with several large infestations near Missoula, Montana (Sheley et al. 2005). By 1975, spotted knapweed had spread into most of the western counties of Montana, and today it is found in every county in Montana.

Leafy spurge, a native to Eurasia, was sighted in Park County, Montana as early as 1925 and has since been found in every county in Montana. Overgrazing by livestock has contributed to the spread of leafy spurge (Sheley et al. 2005).

Restoration Pathway R3A

Restoration of the Invaded State (3) to the Taller Bunchgrass State (1) requires substantial energy input. The drivers for this restoration pathway are removal of invasive species, restoration of native bunchgrass species, ongoing management of invasives, and proper grazing management. Without maintenance, invasive species are likely to return (probably rapidly) because of the presence of propagules in the soil and increase in soil disturbance. The drivers for this reclamation pathway are treatments to reduce or remove invasive/noxious species in combination with favorable growing conditions. The trigger is invasive species control.

Restoration Pathway R3B

If invasive species are removed without sufficient remnant populations of reference community species (particularly bluebunch wheatgrass), the Invaded State (3) is likely to return to the Altered Bunchgrass State (2) instead of the Taller Bunchgrass State (1). The driver for the reclamation pathway is weed management without reseeding. The trigger is invasive species control.

ECOLOGICAL SITE INTERPRETATIONS

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.

Stocking Rate Adjustments by Slope and Distance to Water on Rangelands for Cattle

Percent Slope	Distance to Water	% Acres Grazable
0% - 20%	0 - 1 mile	100%
	> 1 - 1.5 miles	75%
	> 1.5 - 2 miles	50%
	> 2 - 2.5 miles	25%
	> 2.5 miles	0%
21% - 40%	0 - 1 mile	75%
	> 1 - 1.5 miles	50%
	> 1.5 - 2 miles	25%
	> 2 miles	0%
41% - 60%	0 - 1 mile	50%
	> 1 - 1.5 miles	25%
	> 1.5 miles	0%
> 60%	0 - 1 miles	25%
	> 1 mile	0%

<u>Hydrology Functions</u>:
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.

Wood Products:
None

Other Products:
None

Plant Preference by Animal Kind:
This rating system provides general guidance as to animal preference for plant species. It also indicates possible competition between kinds of herbivores for various plants. Grazing preference changes from time to time, especially between seasons, and between animal kinds and classes. Grazing preference does not necessarily reflect the ecological status of the plant within the plant community.

Legend: P=Preferred D=Desirable U=Undesirable E=Emergency

N=Non-consumed T=Toxic Blank=Unknown or no data

Winter (W) = Jan., Feb., Mar. Spring (SP) = Apr., May, June
Summer (SU) = July, Aug., Sept. Fall (F) = Oct., Nov., Dec.

Animal Kind: Cattle and Sheep

	Cattle				Sheep			
PLANT NAME	**W**	**SP**	**SU**	**F**	**W**	**SP**	**SU**	**F**
Green needlegrass	P	P	P	P	P	P	P	P
Western wheatgrass	P	D	D	P	D	D	D	D
Rough fescue	P	D	P	P	D	D	D	D
Idaho fescue	P	D	P	P	D	D	D	D
Bluebunch wheatgrass	P	D	P	P	D	D	D	D
Kentucky bluegrass	D	D	D	D	D	D	D	D
Needleandthread	D	D	D	D,T	D	D	D	D
Sandberg bluegrass	D	D	D	D	D	D	D	D

Animal Kind: Cattle and Sheep (continued)

	Elk				Deer			
PLANT NAME	**W**	**SP**	**SU**	**F**	**W**	**SP**	**SU**	**F**
Threadleaf and needleleaf	D	P	P	D	D	P	D	D
Canada bluegrass	D	D	D	D	D	D	D	D
Prairie junegrass	D	D	D	D	D	P	D	D
Plains muhly	D	D	D	D	D	D	D	D
Blue grama	D	D	D	D	D	P	P	D
Buffalograss	D	D	D	D	D	D	D	D
Cheatgrass	U	D	N	N	U	P	U	U
Blacksamson	N	D	D	D	D	P	P	D
Prairieclover spp.	N	D	D	D	D	D	D	D
Dotted gayfeather	N	P	P	P	D	P	D	D
Milkvetch spp.	N	D,T	D,T	D,T	D,T	P,T	D,T	D,T
American vetch	N	P	P	D	N	P	P	D
Prairie coneflower	N	D	D	D	D	D	D	D
Wild onion	N	P	P	N	N	P	P	N
Hood’s phlox	N	N	N	N	U	U	U	U
Pussytoes spp.	N	N	N	N	U	U	U	U
Wild parsley	N	D	D	U	N	D	D	U
Green sagewort	N	N	N	N	N	N	N	N
Scarlet globemallow	N	D	D	D	N	D	D	D
Twogrooved poisonvetch	N	T	T	T	N	T	T	T
White point loco	N	T	T	T	T,N	T,N	T,N	T,N
Low larkspur	N	N,T	N,T	N	N	D,T	D,T	N
Death camas	N	T	T	N	N	T	T	N
Winterfat	P	P	P	P	P	D	D	P
Nuttall’s saltbush	P	P	P	P	P	P	P	P
Prairie rose	N	N	N	N	D	D	D	D
Silver sagebrush	D	D	D	D	D	D	D	D
Green and rubber rabbitbrush	U	U	U	U	U	U	U	U
Wyoming big sagebrush	N	N	N	N	P	D	D	P
Mountain big sagebrush	N	N	N	N	D	U	D	D
Douglas-fir	N	N	N	N	U	U	U	U
Ponderosa pine	N	N	N	N	U	N	N	N
Rocky Mountain juniper	N	N	N	N	U	N	N	N
Greasewood	N	N	N,E	N,E	D	U, T	U	D
Fringed sagewort	N	N	N	N	U	U	U	U
Yucca	N	N	N	N	D	D	D	D
Broom snakeweed	N	N	N	U	U	U	U	U
Plains pricklypear	N	N	N	N	U	U	U	U

Animal Kind: Deer and Elk

	Elk				Deer			
PLANT NAME	**W**	**SP**	**SU**	**F**	**W**	**SP**	**SU**	**F**
Perennial grasses	P	P	P	P	D	P,D	D	D
Red threeawn	N	N	N	N	N	N	N	N
Annual grasses	N	P,D	N	D	N	P,D	N	D
Sedges	D	P	P	P	D	P	P	P
Blacksamson	P	P	P	P	D	D	D	D
Prairieclover spp.	P	P	P	P	P	P	P	P
Dotted gayfeather	D	P	D	D	D	P	P	P
Milkvetch spp.	D	P	P	D	D	D	D	D

Animal Kind: Deer and Elk (continued)

	Elk				Deer			
PLANT NAME	**W**	**SP**	**SU**	**F**	**W**	**SP**	**SU**	**F**
Scurfpea spp.	N	D	D	D	D	D	D	D
Hairy goldenaster	E	E	E	E	E	E	E	E
Goldenrod spp.	D	P	P	P	D	D	D	D
American licorice	P	P	D	D	D	P	D	D
Prairie coneflower	D	P	P	D	D	P	D	D
American vetch	P	P	P	P	D	P	P	P
Hood’s phlox	U	U	U	U	U	U	U	U
Wild parsley	U	D	U	U	U	D	U	U
Green sagewort	N	N	N	N	N	N	N	N
Scarlet globemallow	D	D	D	D	D	D	D	D
Twogrooved poisonvetch	N, T	N, T	N, T	N, T	N, T	N, T	N, T	N, T
White point loco	N, T	N, T	N, T	N, T	N, T	N, T	N, T	N, T
Death camas	N, T	N, T	N, T	N, T	N, T	N, T	N, T	N, T
Larkspur spp.	N, T	N, T	N, T	N, T	N, T	N, T	N, T	N, T
Winterfat	P	P	P	P	P	P	P	P
Prairie rose	U	U	U	U	E	D	E	E
Silver sagebrush	D	D	P	D	P	P	D	P
Wyoming big sagebrush	P	P	P	P	P	P	D	D
Mountain big sagebrush	D	U	D	D	D	U	D	D
Douglas-fir	U	U	U	U	U	U	U	U
Ponderosa pine	U	U	U	U	U	U	U	U
Rabbitbrush spp.	D	D	D	D	D	D	D	D
Rocky Mountain juniper	N	N	N	N	D	D	D	D
Fringed sagewort	D	U	U	D	D	U	U	D
Green sagewort	N	N	N	N	N	N	N	N
Plains pricklypear	N	N	N	N	N	N	N	N
Broom snakeweed	N	N	D	N	D	D	P	P

SUPPORTING INFORMATION

Associated Sites

Site Name:	**Site Number:**	**Narrative:**
Droughty	43AA036MT	
Droughty Steep	43AA038MT	

Similar Sites

Site Name	Site ID	Site Narrative
Droughty	43AA036MT	This site differs by having deeper soils (> 20" deep).
Droughty Steep	43AA038MT	This site differs by being on slopes > 15% and by having deeper soils.
Shallow Loamy	43AA136MT	This site differs by the soil being non-skeletal.
Shallow to Gravel	43AA134MT	Site differs by being deeper than 20" and consisting of loamy skeletal instead of sandy skeletal material at the 10-20" depth.
Shallow Sandy	43AA133MT	Site differs in surface texture and is not skeletal.
Very Shallow	43AA170MT	This site differs by having shallower soils (< 10" deep).

Inventory Data References (narrative):

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 rangetrained personnel (i.e., professional opinion of agency specialists, observations of land managers, and outside scientists).

Inventory Data References:

Data Source	# of Records	Sample Period	State	County

No data was collected for this ESD. Data from other LRUs and ecological sites was analyzed when deriving the data.

State Correlation:

This site has been correlated with the following states:
Montana

Authors and Description Approval:

Description Date: May 2009

Description Author(s): Synergy Resource Solutions, Inc., W. Lujan, N. Svendsen, K. Walstad, J. Siddoway, M. Hansen

Description Approval: Jon Siddoway

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Revisions:

Reviser:

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Revision Date:

Revision Notes:

Other References:

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