OPERATING PERMIT APPLICATION

MONTANA LIMESTONE RESOURCES

APPENDIX A-4

BASELINE VEGETATION REPORT

Revised March 2018

BASELINE VEGETATION INVENTORY

MONTANA LIMESTONE RESOURCES PROJECT

GRANITE COUNTY, MONTANA

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1.0 INTRODUCTION

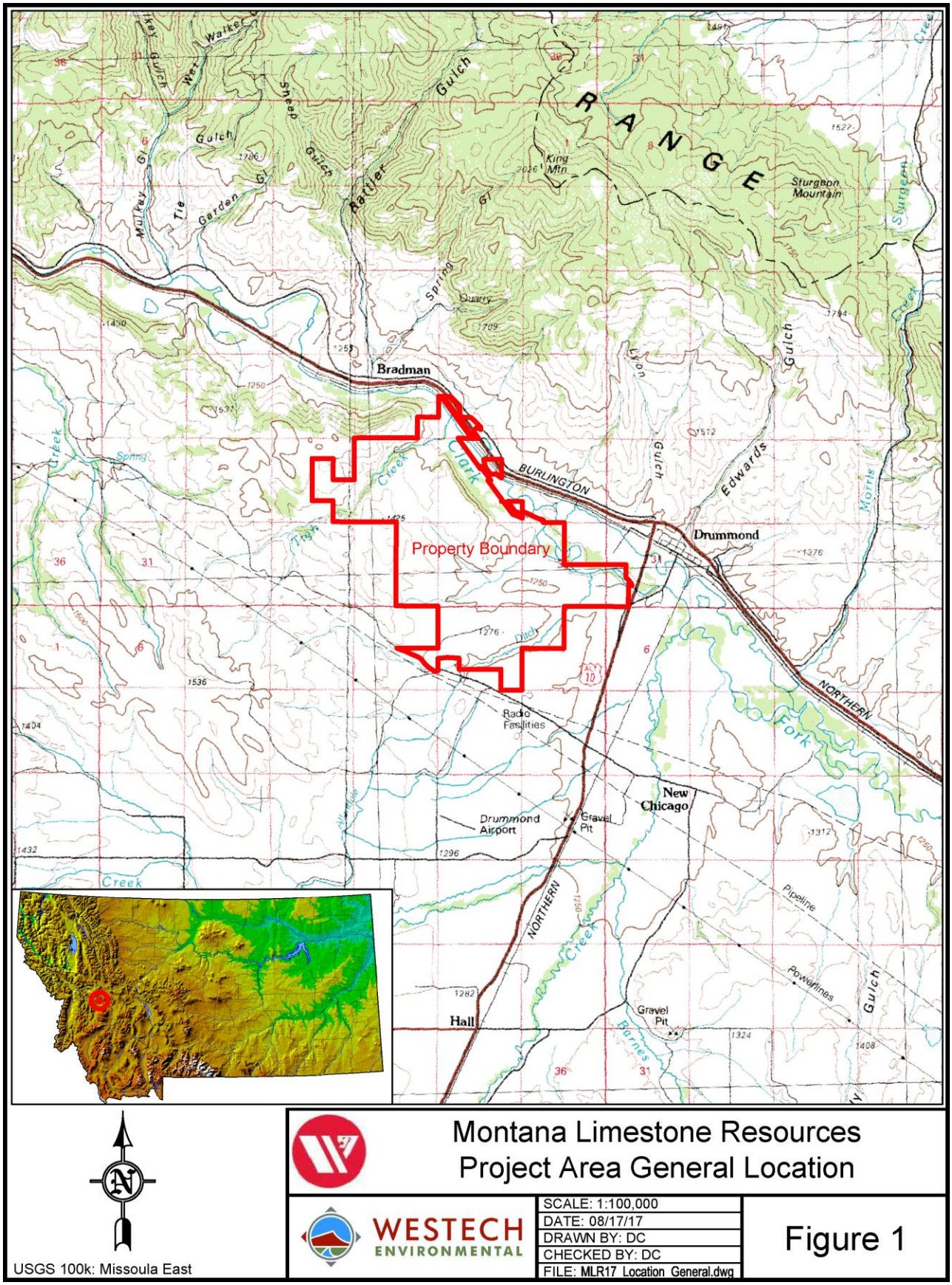
Montana Limestone Resources, LLC (MLR) contracted WESTECH Environmental Services, Inc. (WESTECH) to conduct a baseline vegetation inventory of their limestone project area approximately one mile west of Drummond, Montana in northeastern Granite County (Figure 1). The vegetation baseline was also designed to provide portions of a land use analysis of the study area, in particular to assess vegetation components of wildlife winter range, and the range condition of grazing lands. The study area (Figure 1) is located in all or portions of Sections 1 and 2, T10N, R13W; Section 31, T11N,R12W; and Sections 23, 25-28 and 34-36, T11N, R13W, comprising the former Bar-Four-Bar Ranch property totaling 3520 acres (5.5 square miles). The vegetation baseline was designed to address current and potential environmental concerns related to vegetation resources of the project area; the plan of study was reviewed with the Montana Department of Environmental Quality (MDEQ) to solicit agency comments. This inventory will be used to assist mine permitting and reclamation planning in accordance with the laws and regulations administered by MDEQ's Hard Rock Section.

The study area climate is continental, having cold winters and warm summers with a growing season extending from April to September in most years. Weather data collected at Drummond were examined for the 30-year period (NRCS 2003). The average annual temperature is 42.9 degrees Fahrenheit (F), ranging from an average minimum of 11.4 degrees F in January to an average maximum of 84.2 degrees F in July. During the growing season average temperatures range from 43 to 65 degrees F. Precipitation averages 13.4 inches annually, ranging from 0.6 inches in February to 1.9 inches in June, with the greatest precipitation occurring in May and June.

Geology of the area (Montana Bureau of Mines and Geology 2009) consists of Tertiary sedimentary formations at lower elevations in the southern portion of the study area. Higher elevations in the northern portion of the study area are comprised of a Mississippian carbonate formation (limestone), and Tertiary igneous formations comprised of andesite, basalt and rhyolite. The Clark Fork River floodplain comprises Quaternary unconsolidated alluvium.

In 2013, quantitative sampling was conducted in or near areas potentially affected by proposed mining operations (Figure 1 and Plate 1), comprising an intensive study area of approximately 1336 acres (2.1 square miles). Quantitative sampling was also conducted in the surrounding 2185 acre (3.4 square-mile) extensive study area in association with studies of wetland and riparian areas that may be affected by ancillary mine facilities such as access/haul roads and other linear disturbances projected for the operation.

The 2013 field inventory was conducted May 15, May 21 and June 7 (spring flora), July 2-3 (wetland/ riparian), July 9-13 (upland vegetation in the intensive study area), July 18 (wetland/riparian) and September 21 (riparian). Field investigators for the upland inventory were Ken Scow, Drake Barton, Ed Darfler and Kathy Lloyd. Field work for the Baseline Wetlands/Waters of the U.S. Inventory was led by Dean Culwell, with the hydrophytic vegetation data collected by Ken Scow and Ed Darfler, and GPS data recorded by Dan Culwell. Data analysis and report preparation were conducted by Ken Scow and Nancy Horn, with computer graphics by Dan Culwell.


Property Boundary
Bradman
Drummond
New Chicago
Hall
Drummond Airport
Gravel Pit
Radio Facilities
BURLINGTON
NORTHERN
Clark Fork
Sturgeon Mountain
King Mtn
RANGE
Montana Limestone Resources
Project Area General Location
WESTECH ENVIRONMENTAL
SCALE: 1:100,000
DATE: 08/17/17
DRAWN BY: DC
CHECKED BY: DC
FILE: MLR17 Location General.dwg
Figure 1
USGS 100k: Missoula East

2.0 METHODS

2.1 MAPPING/VEGETATION TYPE DELINEATION

Vegetation resources of the intensive study area were preliminarily office-mapped to the level of vegetation physiognomic type by interpretation of color ortho-photos (1 inch = 400 feet scale). Vegetation type designations were based on a combination of dominant plant species, topoedaphic features and disturbance/management history. The preliminary mapping was checked in the field by pedestrian and vehicular surveys, later verified by analysis of quantitative data, and modified as necessary. Derivation of the vegetation classification for the study area is explained in Section 3.1 of this report.

2.2 SAMPLE LOCATION AND SAMPLE SIZE

The preliminary vegetation map indicated the general delineation and distribution of physiognomic types and subtypes in the study area. A 100-foot grid was overlaid on the study area map to select sample sites using a stratified random procedure based on projected sample size for each physiognomic type and subtype. To ensure an even (yet stratified random) distribution of sample plots throughout narrow portions of Drainage Bottom mapping units, plot sites were sometimes selected where grid lines intersect drainage bottoms because grid points often do not fall within these narrow units. Sample sites were located in the field using the aerial photo-map and a hand-held GPS unit. Sample sites are shown on Plate 1.

Sample size varied by physiognomic type according to the variability and relative areal extent of each type, with more extensive types receiving proportionately more plots. In addition, certain vegetation types received preferential sampling, particularly wetland and riparian types. Sample size and distribution were based on professional judgment, with the intent of the baseline study to quantitatively characterize vegetation ecology within the study area and show variability within the availability of sample sites.

Sampling intensity among vegetation types was adjusted following pedestrian surveys and mapping refinements to allow a more confident prediction of satisfactory sample sizes and plot distribution.

2.3 QUANTITATIVE INVENTORY

Sampling of vegetation physiognomic types was conducted as described below for each component. Quantitative data were collected during the 2013 growing season on July 2-3, July 9-13, July 18 and September 21.

Plot dimensions at each sample site are listed below for each principal sample parameter:

1) estimation of canopy cover was made on a 0.01-acre circular plot centered on each randomly selected point;

2) shrub density was determined by recording all live individuals by species and health class in a 2 x 20-meter belt transect centered on each point;

3) tree density was estimated by recording all live individuals by species and diameter at breast height (dbh) class in a 0.1-acre circular plot centered on each point.

A color photograph (oblique) was taken at each sample site.

2.3.1 Canopy Cover

On each sample field form, location was recorded along with date, personnel, percent slope, aspect, topography and slope configuration. Each non-forested upland plot was also identified as to its occurrence in either a grassland (less than approximately 10 to 15 percent shrub cover) or shrub/grassland stand. The 10 to 15 percent shrub cover threshold was determined for the overall mapping unit in which the cover plot was located and did not necessarily reflect the shrub cover value estimated for the plot itself. The reason for this distinction in the field is that, for example, a grassland site may contain widely scattered shrubs or small clumps of shrubs, and a randomly located sample plot may happen to fall in such a site; although substantial shrub cover may be recorded for the plot, it should be shown to occur in a grassland mapping unit, and the data should be tabulated accordingly. Conversely, a random plot may fall in a relatively small opening with sparse shrub density in a stand otherwise clearly dominated by shrubs; although the plot may show scant shrub cover, it should be mapped in a shrub/grassland mapping unit and the data treated accordingly. With sufficient sample size, the natural range in variation of canopy cover can be properly recorded and compared between the two physiognomic types. Similarly, each drainage bottom plot was identified as to its occurrence in a specific physiognomic type/subtype determined by the overall map unit setting in which it was located.

In each 0.01-acre cover plot (11.8-feet radius), an ocular estimate was made of percent cover for ground cover classes, including bare ground, rock, litter, lichens, moss and basal vegetation to total 100 percent. Nonstratified canopy cover was estimated to the nearest percent in each plot for total live vascular plant cover, for each morphological (or functional) class category (tree, shrub, perennial graminoid, annual graminoid, perennial forb and annual/biennial forb), and for each vascular plant species. Ocular estimates of tree cover were made by walking around the plot and estimating the extent of tree canopy extending within a vertical projection of the plot perimeter.

Cover data are tabulated in the report by plot, and summarized by both community type and physiognomic type. Using these data, stratified cover values and relative cover values were generated in the office to evaluate composition and diversity.

2.3.2 Productivity

Predicted average yield data for grazing lands and croplands (including tame pasture) in the study area were obtained from the *Granite County Soil Survey,* the USDA Natural Resources Conservation Service (NRCS) website, and applicable NRCS publications. Yield data were directly correlated with ecological site and soils information derived from these sources and the MLR baseline soils inventory.

2.3.3 Shrub Density

Densities were determined for each shrub species by counting the number of live individuals rooted within a 2 x 20-meter belt transect centered on each sample point. Individuals were recorded as healthy (immature to mature) or decadent. Belt transects were aligned along the contour on slopes; on drainage bottoms, belt transects were aligned with the general direction of the drainage.

2.3.4 Tree Density

Tree density was recorded in a 0.1-acre circular plot (37.2-foot radius) centered on each sample point. Live trees greater than 6 inches tall were counted in each plot by species for the following diameter-at-breast-height (dbh) classes: less than 1-inch dbh, 1- to 4-inch dbh, 4- to 8-inch dbh, 8- to 12-inch dbh, 12- to 16-inch dbh, *etc*. For trees forking less than 4.5 feet above the base (ground level), the dbh of each stem was measured at 3.5 feet above the first indication of the fork (Avery 1967). The 0.1-acre plot and belt transect perimeters were measured with a fiberglass tape and marked with pin-flags prior to inventory.

2.3.5 Species Composition and Diversity

Species composition, origin, utility, seasonality and diversity parameters are inherently determined for each vegetation type using cover data. Species diversity was evaluated by determining the average number of vascular plant species per 0.01-acre plot in each community and physiognomic type. Species nomenclature and functional groups follow the recently published *Manual of Montana Vascular Plants* (Lesica 2012).

2.3.6 Species List/Sensitive Plants/Noxious Weeds

All vascular plant species encountered in the study area were recorded and a comprehensive list was compiled. This involved seasonal investigations from May 15 until September 21, 2013, including quantitative sampling, and qualitative and mapping surveys. Particular attention was given to the search for sensitive plant species, including taxa currently listed as rare, threatened or endangered by the Montana Natural Heritage Program (MTNHP), new Montana records, and taxa which may represent significant extensions of distribution records.

Taxa not readily identified in the field were collected and identified in the laboratory using a stereozoom binocular scope and taxonomic references including (but not limited to) Lesica (2012), Flora of North America Editorial Committee (1993+), Hitchcock *et al.* (1955-1969), Hitchcock and Cronquist (1973), Dorn (1984), Great Plains Flora Association (1986), Cronquist *et al.* (1972-2012), Gleason and Cronquist (1991) and Holmgren (1998). Nomenclature of vascular plant species in this report follows Lesica (2012).

Noxious weeds listed by the Montana County Weed Control Act and Granite County were qualitatively assessed for distribution and abundance, as well as quantitatively sampled on cover estimation plots.

2.3.7 Productivity and Utility Evaluation

Ecological sites were identified and mapped (Plate 2) using baseline soils inventory data along with existing Natural Resource Conservation Service soil survey information for Granite County. Productivity and recommended stocking rates (AUM/acre) were determined using NRCS (2003) technical guides. Carrying capacity of grazing land was then calculated based on computer-generated study area acreages.

2.3.8 Delineation of Hydrophytic Vegetation

Sites within the study area supporting hydrophytic vegetation were sampled concurrently with the baseline inventory, and were delineated on the vegetation map. These data were used to assist in completing (in conjunction with assessments of hydric soils and wetland hydrology) the baseline wetlands inventory and delineation for the study area, a more detailed examination and sub-meter (GPS) delineation of wetland vegetation community types. Wetlands mapping is presented in a separate baseline wetlands report for the MLR inventory area.

Wetlands in the study area are often associated with relatively small hillside seeps and aprons, or narrow streamside fringes. Such sites are generally missed by the stratified random procedure used to select vegetation sample sites, whereas these sites are specifically targeted for identification and delineation during the baseline wetland inventory. Accordingly, wetland cover/composition data were drawn from the wetland inventory to supplement the vegetation baseline database.

3.0 RESULTS

3.1 VEGETATION CLASSIFICATION

The MLR vegetation classification was based on published classifications of vegetation types that have been developed statewide for Montana. Grassland and Shrubland habitat types were identified following Mueggler and Stewart (1980), Forest habitat types follow Pfister *et al.* (1977), and Wetland/ Riparian types follow Hansen *et al*. (1995), with minor modifications based on comparisons with various western Montana and regional baseline inventories conducted during the past 35+ years in the region. Many of the studies reviewed to develop the MLR classification were summarized and synthesized in Culwell *et al.* (1987); these and more recent studies pertinent to the MLR region are listed in Appendix G.

Table 1 (Section 5.0) lists habitat types and community types for each physiognomic type sampled in the MLR baseline study area in 2013. Vegetation types were mapped (Plate 1) by habitat type or community type where practicable, however were occasionally mapped according to series rather than community type where dominant species varied so greatly at small-scale that a habitat- or community-level mapping delineation would be impractical.

Habitat types and vegetation community types are normally named for dominant, codominant and occasionally subdominant plant species, the two classification systems distinguished by recognition of species perceived to be the ecologically successional climax for a site (habitat types), or the species currently dominating a site (community types). These species, the most conspicuous in the MLR study area, are discussed in the following narrative by scientific name (binomial) and are listed below with common names. A complete list of all vascular plant species recorded in the MLR baseline study area is given in Appendix A.

There were four Grassland types identified in three series including the *Agropyron spicatum, Festuca idahoensis* and *Festuca campestris* series (Table 1). A Tame Pasture type was also identified, dominated by seeded, non-native perennial grasses.

Six upland Shrub/Grassland types were sampled in two series, dominated by *Artemisia tridentata* or *Symphoricarpos occidentalis*. Understories were dominated or distinguished variously by *Poa secunda*, *Agropyron smithii, Agropyron spicatum, Festuca idahoensis, Festuca campestris,* and *Poa pratensis.*

Of five Conifer Forest and Woodland types identified, three were in the *Pseudotsuga menziesii* series, and one each in the *Pinus ponderosa* and *Juniperus scopulorum* series. Understories were distinguished by *Agropyron spicatum, Festuca campestris* or *Physocarpus malvaceus*.

Dominant Plant Species in the MLR Baseline Study Area

BINOMIAL	COMMON NAME
GRASSES and SEDGES	
Agropyron repens	Quackgrass
Agropyron smithii	Western wheatgrass
Agropyron spicatum	Bluebunch wheatgrass
Agrostis stolonifera	Redtop
Alopecurus arundinaceus	Creeping meadow foxtail
Beckmannia syzigachne	American sloughgrass
Bromus inermis	Smooth brome
Bromus japonicus	Japanese brome
Bromus tectorum	Cheatgrass brome
Carex nebrascensis	Nebraska sedge
Carex pellita	Woolly sedge
Carex praegracilis	Clustered field sedge
Carex praticola	Meadow sedge
Carex sartwellii	Sartwell's sedge
Carex utriculata	Southern Beaked sedge
Eleocharis palustris	Common spikesedge
Elymus junceus	Russian wildrye
Festuca campestris	Rough fescue
Festuca idahoensis	Idaho fescue
Glyceria grandis	American mannagrass
Hordeum jubatum	Foxtail barley
Juncus balticus	Baltic rush
Koeleria macrantha	Jointed rush
Phleum pratense	Common timothy
Poa compressa	Canada bluegrass
Poa palustris	Fowl bluegrass
Poa pratensis	Kentucky bluegrass
Poa secunda	Sandberg's bluegrass
Schedonorus arundinaceus	Tall fescue
Schoenoplectus tabernaemontani	Softstem bulrush
Sphenopholis obtusata	Prairie wedgegrass
Stipa comata	Needle-and-thread
Stipa viridula	Green needlegrass
FORBS AND SUBSHRUBS	
Achillea millefolium	Common yarrow
Alyssum alyssoides	Pale alyssum
Antennaria microphylla	Littleleaf pussytoes
Arenaria congesta	Ballhead sandwort
Arnica sororia	Twin arnica
Artemisia frigida	Fringed sagewort
Balsamorhiza sagittata	Arrowleaf balsamroot
Berberis repens	Creeping Oregon grape
Carduus nutans	Musk thistle
Centaurea maculosa	Spotted knapweed
Cirsium arvense	Canada thistle

BINOMIAL	COMMON NAME
FORBS AND SUBSHRUBS (cont.)	
Cynoglossum officinale	Common hound's-tongue
Epilobium ciliatum	Common willow-herb
Erigeron compositus	Cutleaf daisy
Erigeron corymbosus	Long-leaved fleabane
Euphorbia esula	Leafy spurge
Filago arvensis	Field filago
Galium aparine	Cleavers
Galium boreale	Northern bedstraw
Geum macrophyllum	Large leaf avens
Geum triflorum	Prairiesmoke
Glycyrrhiza lepidota	American licorice
Gutierrezia sarothrae	Broom snakeweed
Linaria dalmatica	Dalmatian toadflax
Lithospermum ruderale	Western gromwell
Lomatium macrocarpum	Large-fruited lomatium
Lupinus sericeus	Silky lupine
Medicago lupulina	Black medic
Melilotus officinalis	Yellow sweetclover
Mentha arvensis	Field mint
Microsteris gracilis	Pink microsteris
Mimulus guttatus	Common monkey-flower
Myosotis laxa	Bay forget-me-not
Orthocarpus tenuifolius	Thinleaf owl clover
Phlox hoodii	Hood's phlox
Plantago major	Common plantain
Potentilla anserina	Common silverweed
Ranunculus cymbalaria	Rocky Mountain buttercup
Ranunculus macounii	Macoun's buttercup
Rorippa palustris	Marsh yellowcress
Selaginella densa	Compact clubmoss
Silene menziesii	Menzie's silene
Sium suave	Hemlock water-parsnip
Smilacina stellata	Starry false solomon's seal
Solidago missouriensis	Missouri goldenrod
Sphaeralcea coccinea	Scarlet globemallow
Symphyotrichum ascendens	Long-leaved aster
Symphyotrichum falcatum	Creeping white prairie aster
Taraxacum laevigatum	Smooth dandelion
Thalictrum dasycarpum	Purple meadowrue
Tragopogon dubius	Common salsify
Trifolium hybridum	Alsike clover
Typha latifolia	Common cattail
Veronica anagallis-aquatica	Water speedwell
Vicia americana	American vetch
Viola adunca	Early blue violet

BINOMIAL	COMMON NAME
SHRUBS and TREES	
Artemisia tridentata	Big sagebrush
Cornus sericea	Red-osier dogwood
Ericameria nauseosa	Rubber rabbitbrush
Juniperus scopulorum	Rocky Mountain juniper
Physocarpus malvaceus	Mallow ninebark
Pinus ponderosa	Ponderosa pine
Populus angustifolia	Narrowleaf cottonwood
Populus balsamifera	Black cottonwood
Populus tremuloides	Quaking aspen
Prunus virginiana	Common chokecherry

BINOMIAL	COMMON NAME
Pseudotsuga menziesii	Douglas-fir
Ribes aureum	Golden currant
Ribes setosum	Bristly gooseberry
Rosa woodsii	Wood's rose
Salix bebbiana	Bebb willow
Salix boothii	Blueberry willow
Salix drummondiana	Drummond willow
Salix eriocephala	Diamond willow
Salix exigua	Sandbar willow
Symphoricarpos occidentalis	Western snowberry

Scientific nomenclature follows Lesica (2012).

Three primary Riparian-Wetland (RW) types were classified according to physiognomic type, including Herbaceous, Shrub and Conifer-Deciduous Tree (Table 1). The Herbaceous RW type was sampled in seven mesophytic/hydrophytic habitat or community types dominated by various associations of *Poa pratensis, Agrostis stolonifera, Bromus inermis, Typha latifolia, Carex nebrascensis, Carex pellita* and *Carex utriculata*. The Shrub RW type includes a mesophytic low shrub community type in the *Symphoricarpos occidentalis* series, and a hydrophytic tall shrub community type codominated by *Salix exigua* and *Cornus sericea*. The Conifer-Deciduous Tree Riparian type was comprised of three mesophytic series, including two *Populus balsamifera* community types and one habitat type each in the *Juniperus scopulorum* and *Populus tremuloides* series. Understory dominants in Riparian Tree types reflected the main constituents of the Shrub RW community types, *Symphoricarpos occidentalis, Rosa woodsii, Cornus sericea,* and their most common associates including *Poa pratensis, Agrostis stolonifera, Ribes setosum* and *Salix bebbiana*.

The diversity of community types in the inventory area is largely representative of other, lower elevation study areas in west-central and southwestern Montana, as listed in the literature review table in Appendix G. All vegetation types identified in this study have been documented in previous studies in the region under the same or similar type names, as reviewed and summarized from published literature and unpublished technical reports by Culwell *et al.* (1987) and this updated review.

3.2 COMMUNITY TYPE DESCRIPTIONS

Following is a narrative description of habitat and community types identified for the MLR baseline study area. All summary tables are presented in Section 5.0. Table 1 identifies plot numbers and sample size by vegetation type (see Plate 1 for plot locations). Summary data are presented for cover/constancy in Tables 2 through 6, shrub density (Tables 7 through 10), tree density (Tables 11 through 14), ecological site/soils correlations (Table 15), vegetation/soils correlations (Table 16), and vegetation/ecological site correlations (Table 17). Summaries of rangeland productivity and stocking rates are given in Table 18, pastureland productivity and yield (Table 19), plant species of concern (Table 20), species diversity (Table 21), noxious weeds (Table 22), and acreage of vegetation types (Table 23).

The summary tables listed above are derived from the 2013 quantitative data presented by sample site in the Appendix Section 6.0, including cover/constancy (Appendix B), shrub density (Appendix C), tree density (Appendix D), and ecological site/soils correlations (Appendix E). Appendix F presents a summary of site parameters by vegetation type, and Appendix G summarizes a review of current literature concerning regional plant communities, providing context for the MLR vegetation type classification. Representative photographs are presented for each vegetation type in Appendix H.

For most data parameters, a weighted mean is given for all habitat types and communities composited within each physiognomic type. The physiognomic type means are not meant to be viewed as an ecological presentation, but can be used to facilitate practical comparisons with any future revegetation efforts on-site (*i.e.*, reclamation planning and evaluation of reclamation success).

The following habitat and community type descriptions are arranged for each physiognomic type to generally follow a gradient of site parameters, particularly soil texture (apparent water-holding capacity), topographic position and aspect (slope exposure). Departures from this arrangement are intended to account for species dominance and considerations of relative susceptibility to various disturbances, particularly grazing history, logging history and agricultural practices.

3.2.1 Grassland

Upland herbaceous communities or "grasslands" were identified according to two principal categories:

- Native Grassland (736 acres, or 55 percent of the intensive study area) that is completely dominated by native grass (and forb) species with, adventitious occurrences of introduced (exotic) species and relatively minor amounts of woody plants.
- Tame Pasture (68 acres, or 5 percent of the intensive study area) is land that has been seeded with introduced (exotic) species, primarily *Elymus junceus* in the intensive study area. Tame Pasture definitions are explained in Section 3.2.2.

There were four Native Grassland habitat types and communities identified in three series during the 2013 inventory, comprising 736 acres or 55 percent of total intensive study area acreage. The three Grassland series were dominated or distinguished by *Agropyron spicatum* (78 percent of Grassland acreage), *Festuca idahoensis* (3 percent), or *Festuca campestris* (19 percent). Grassland types accounted for 766 acres or 35 percent of the extensive study area, thus totaling 1500 acres or 43 percent of the entire MLR inventory area.

Grassland cover and constancy data are presented by sample site (plot) in Appendix Tables B1 through B3, and summarized by habitat and community type in Table 2. Shrub density data are given by plot in Appendix Table C1, and summarized for Grassland types in Table 7. Tree density data are presented by plot in Appendix Table D1, and summarized by Grassland type in Table 11.

A correlation of soils mapping units, ecological sites and community types is listed by plot in Appendix E, and summarized by parameter in Tables 15 through 17. Rangeland productivity values and stocking rates are shown in Table 18.

Plant species of concern listed by MTNHP (2013) for Granite, Powell and Missoula Counties are summarized in Table 20. A simple comparison of relative diversity among physiognomic types is presented in Table 21. The abundance of noxious weeds sampled in Grassland types is given in Table 22. Appendix F provides a synopsis of important site parameters (topographical position, slope gradient and aspect) recorded for MLR Grassland communities. A list of selected ecological literature pertinent to the MLR study area is synthesized in Appendix G. Acreage of vegetation types is given in Table 23. All vegetation sample site locations are shown on the vegetation type map (Plate 1).

In the following text, Grassland types are arranged approximately in order of xeric to mesic moisture regime, and lower to higher topographical position.

Agropyron spicatum/Poa secunda habitat type

The *Agropyron spicatum/Poa secunda* habitat type is abundant, occupying 202 acres (15 percent) of the MLR intensive study area. A total of nine plots were sampled, primarily on middle and upper slope positions of moderate to steep (10-70 percent) slope gradient. Aspect was variable, commonly easterly through southwesterly. The predominant ecological sites were silty and a complex of silty-shallow-rock outcrop, associated with the Windham-Lap-Rock outcrop complex and Roy-Shawmut-Danvers complex soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Agropyron spicatum/Poa secunda* h.t.**
n=9

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	33	Perennial	21	Shrub	4
Annual	15	Annual/Biennial	6	Tree	-
Agropyron spicatum	18	*Centaurea maculosa*	6	*Rosa woodsii*	2
Bromus tectorum	12	*Linaria dalmatica*	5	*Artemisia tridentata*	<1
Poa secunda	11	*Alyssum alyssoides*	3		
Bromus japonicus	3	*Achillea millefolium*	1		
Koeleria macrantha	1	*Balsamorhiza sagittata*	1		
Stipa comata	1	*Tragopogon dubius*	<1		
Poa pratensis	1	*Heterotheca villosa*	<1		
		Phlox hoodii	<1		

Shrub density averaged 663 live stems per acre, of which 36 percent was *Tetradymia canescens*, 29 percent *Rosa arkansana* and 24 percent was *Rosa woodsii*. Tree density was negligible in the *Agropyron spicatum/Poa secunda* habitat type.

Agropyron spicatum/Agropyron smithii habitat type

The *Agropyron spicatum/Agropyron smithii* habitat type is the most abundant Grassland type, occupying 370 acres (28 percent) of the MLR intensive study area. A total of 14 plots were sampled on lower to middle and upper slope positions of gentle to moderate (5-20 percent) and occasionally steep (25-50 percent) slope gradient. Aspect was very variable, commonly southerly and southwesterly (43 percent of sample sites) and northeasterly (36 percent). The *Agropyron spicatum/Agropyron smithii* habitat type was sampled on a variety of ecological sites, most commonly silty and a complex of silty-shallow-rock outcrop, associated with 10 of the 14 upland soils mapping units in the intensive study area, including the Shawmut cobbly loam, Roy-Shawmut-Danvers complex, and Windham-Lap-Rock outcrop complex soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Agropyron spicatum/Agropyron smithii* h.t.**
n=14

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	44	Perennial	23	Shrub	<1
Annual	7	Annual/Biennial	6	Tree	-
Agropyron spicatum	15	*Centaurea maculosa*	4		
Poa secunda	12	*Phlox hoodii*	2		
Agropyron smithii	11	*Antennaria microphylla*	2		
Bromus tectorum	4	*Alyssum alyssoides*	1		
Bromus japonicus	3	*Sphaeralcea coccinea*	1		
Koeleria macrantha	2	*Lupinus sericeus*	1		
Stipa comata	2	*Symphyotrichum falcatum*	1		
Stipa viridula	1	*Balsamorhiza sagittata*	1		
		Lewisia rediviva	1		
		Selaginella densa	1		
		Artemisia frigida	<1		
		Lomatium macrocarpum	<1		
		Filago arvensis	<1		

Shrub density averaged 571 live stems per acre, of which 51 percent was *Rosa woodsii* and 34 percent was *Amelanchier alnifolia*. Tree density was negligible in the *Agropyron spicatum/Agropyron smithii* habitat type, averaging 15 *Juniperus scopulorum* stems per acre among the 14 sample sites.

Festuca idahoensis/Agropyron spicatum habitat type

The *Festuca idahoensis/Agropyron spicatum* habitat type is infrequent, occupying 21 acres (2 percent) of the MLR intensive study area. One plot was sampled on a middle slope position of moderately steep (35 percent) slope gradient and northerly aspect. The ecological site was silty, associated with the Roy-Shawmut-Danvers soils complex. Plant species dominance is shown below, based on percent canopy cover rounded to the nearest percent.

***Festuca idahoensis/Agropyron spicatum* h.t.**
n=1

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	44	Perennial	75	Shrub	4
Annual	-	Annual/Biennial	3	Tree	-
Agropyron spicatum	24	*Lupinus sericeus*	16	*Ericameria nauseosa*	4
Festuca idahoensis	16	*Geum triflorum*	12		
Poa secunda	4	*Selaginella densa*	12		
		Achillea millefolium	9		
		Astragalus atropubescens	7		
		Erigeron corymbosus	4		
		Lomatium macrocarpum	3		
		Orthocarpus tenuifolius	3		
		Arenaria congesta	2		
		Arnica sororia	2		
		Crepis modocensis	2		
		Taraxacum laevigatum	2		

Shrub density averaged 1012 live stems per acre, of which 70 percent was *Ericameria nauseosa* and 30 percent was *Chrysothamnus viscidiflorus*. No trees were recorded in the 0.1-acre sample plot.

Festuca campestris /Agropyron spicatum habitat type

The *Festuca campestris /Agropyron spicatum* habitat type is common, occupying 142 acres (11 percent) of the MLR intensive study area. A total of five plots were sampled, primarily on lower and middle slope positions of gentle to moderately steep (6-35 percent) slope gradient. Aspects were northwesterly through northeasterly. The predominant ecological site was a silty-shallow-rock outcrop complex, associated primarily with the Windham-Lap-Rock outcrop complex and Braziel-Tolbert complex soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Festuca campestris /Agropyron spicatum* h.t.**
n=5

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	59	Perennial	34	Shrub	6
Annual	<1	Annual/Biennial	2	Tree	<1
Agropyron spicatum	24	*Antennaria microphylla*	6	*Ericameria nauseosa*	3
Poa secunda	13	*Phlox hoodii*	3	*Rosa woodsii*	2
Festuca campestris	11	*Gutierrezia sarothrae*	3	*Chrysothamnus viscidiflorus*	1
Festuca idahoensis	4	*Achillea millefolium*	2		
Stipa comata	2	*Arnica sororia*	2		
Agropyron smithii	2	*Lupinus sericeus*	2		
Koeleria macrantha	1	*Arenaria congesta*	2		
Poa pratensis	1	*Taraxacum laevigatum*	1		
		Solidago missouriensis	1		
		Geum triflorum	1		
		Erigeron corymbosus	1		
		Antennaria rosea	1		
		Astragalus adsurgens	1		
		Musineon divaricatum	<1		

Shrub density averaged about 1500 live stems per acre, of which 58 percent was *Rosa woodsii*, 19 percent *Krascheninnikovia lanata* and 16 percent was *Ericameria nauseosa*. Tree density was negligible in the *Festuca campestris /Agropyron spicatum* habitat type.

3.2.2 Tame Pasture

As explained in Section 3.2.1, upland herbaceous communities ("grasslands") were identified according to two principal categories, Native Grassland and Tame Pasture. The Tame Pasture type is based on considerations of land use (management-related activities), and refers to land that has been seeded or interseeded to introduced forage species of limited diversity that provides special or seasonal use for livestock, often on a more intensively managed basis than that which would occur if the land were native grazing land.

In the MLR extensive study area, tame pasture areas on the Clark Fork floodplain are regularly mowed and baled for hay production for livestock feed. These lowland pastures are predominantly various mixtures of *Bromus inermis, Dactylis glomerata* and *Poa compressa* in drier pastures, and *Schedonorus arundinaceus, Poa pratensis* and *Alopecurus pratensis* in moist pastures. Upland Tame Pasture in the intensive study area comprises areas apparently seeded decades ago but not reseeded since then, and currently dominated by introduced grasses (mostly *Elymus junceus)* but with a fair representation of reestablished native grass (mostly *Poa secunda*). In the MLR intensive study area, Tame Pasture occurred on 68 acres (5 percent of the study area), while Tame Pasture occupied 286 acres or 13 percent of the extensive study area thus totaling 354 acres or 10 percent of the entire MLR inventory area.

Tame Pasture cover and constancy data are presented by sample site in Appendix Table B4, and summarized in Table 2. Shrub density data are given by plot in Appendix Table C1, and summarized for Tame Pasture in Table 7.

A correlation of soils mapping units, ecological sites and community types is listed by plot in Appendix E, and summarized by parameter in Tables 15 through 17. Predicted cropland yields (NRCS 2003) are given in Table 19.

Tame Pasture species diversity is given by functional class, and compared with relative diversity among physiognomic types in Table 21. The abundance of noxious weeds sampled in the Tame Pasture type is presented in Table 22. Appendix F provides a synopsis of important site parameters (topographical position, slope gradient and aspect) recorded for the Tame Pasture type in the intensive study area. Acreage of vegetation types is given in Table 23. All vegetation sample site locations are shown on the vegetation type map (Plate 1).

Tame Pasture vegetation type

The Tame Pasture vegetation type is relatively common, occupying 68 acres (5 percent) of the MLR intensive study area. A total of eight plots were sampled, primarily on lower and middle slope positions (also swales) of mostly gentle (5-10 percent) slope gradient and variable aspect. The predominant pre-pasture ecological site was silty, most often associated with the Martinsdale loam and Quigley loam soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

Tame Pasture
n=8

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	68	Perennial	12	Shrub	-
Annual	6	Annual/Biennial	14	Tree	-
Elymus junceus	36	*Euphorbia esula*	5		
Poa pratensis	15	*Alyssum alyssoides*	3		
Agropyron repens	10	*Microsteris gracilis*	3		
Poa secunda	7	*Taraxacum laevigatum*	3		
Bromus tectorum	5	*Solidago missouriensis*	3		
Poa compressa	2	*Alyssum desertorum*	2		
Bromus japonicus	1	*Filago arvensis*	1		
		Sisymbrium altissimum	1		
		Medicago lupulina	1		

Shrub density averaged only 38 live stems per acre, comprised of volunteer *Artemisia tridentata* and *Rosa arkansana.* No trees were recorded in the eight 0.1-acre density plots sampled.

3.2.3 Shrubland

There were seven Shrubland habitat types and communities identified in three series during the 2013 inventory, comprising 290 acres or 22 percent of total intensive study area acreage. The five types in the *Artemisia tridentata* series were dominated or distinguished in the understory by *Poa secunda* (13 percent of acreage in the *Artemisia tridentata* series), *Agropyron smithii* (3 percent), *Agropyron spicatum* (33 percent), *Festuca idahoensis* (15 percent), or *Festuca campestris* (36 percent). In the other two series, *Symphoricarpos occidentalis/Poa pratensis* comprised 3 percent of Shrubland acreage in the intensive study area, and *Prunus virginiana/Agropyron spicatum* comprised 0.4 percent. Upland Shrubland types accounted for 441 acres or 20 percent of the extensive study area, thus totaling 731 acres or 21 percent of the entire MLR inventory area.

Shrubland cover and constancy data are presented by sample site (plot) in Appendix Tables B5 through B7, and summarized by habitat and community type in Table 3. Shrub density data are given by plot in Appendix Table C2, and summarized for Shrubland types in Table 8. Tree density data are presented by plot in Appendix Table D2, and summarized by Shrubland type in Table 12.

A correlation of soils mapping units, ecological sites and community types is listed by plot in Appendix E, and summarized by parameter in Tables 15 through 17. Rangeland productivity values and stocking rates are shown in Table 18.

Plant species of concern listed by MTNHP (2013) for Granite, Powell and Missoula Counties are summarized in Table 20. A simple comparison of relative diversity among physiognomic types is presented in Table 21. The abundance of noxious weeds sampled in Shrubland types is given in Table 22. Appendix F provides a synopsis of important site parameters (topographical position, slope gradient and aspect) recorded for MLR Shrubland communities. A list of selected ecological literature pertinent to the MLR study area is synthesized in Appendix G. Acreage of vegetation types is given in Table 23. All vegetation sample site locations are shown on the vegetation type map (Plate 1).

In the following text, Shrubland types are arranged approximately in order of xeric to mesic moisture regime, and lower to higher topographical position.

Artemisia tridentata/Poa secunda community type

The *Artemisia tridentata/Poa secunda* community type is relatively common, occupying 36 acres (3 percent) of the MLR intensive study area. Three plots were sampled on lower to upper slope positions of gentle to moderate (8-12 percent) slope gradient. Aspects were northerly and westerly. The ecological site was silty, associated with the Danvers clay loam, Quigley loam and Shawmut cobbly loam soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Artemisia tridentata/Poa secunda* c.t.**
n=3

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	31	Perennial	11	Shrub	41
Annual	2	Annual/Biennial	4	Tree	-
Poa secunda	17	*Centaurea maculosa*	3	*Artemisia tridentata*	40
Poa compressa	6	*Lupinus sericeus*	2	*Ericameria nauseosa*	1
Koeleria macrantha	4	*Antennaria microphylla*	1		
Bromus tectorum	2	*Antennaria parvifolia*	1		
Agropyron dasystachyum	1	*Microsteris gracilis*	<1		
Danthonia unispicata	1	*Solidago missouriensis*	<1		

Shrub density averaged 15,450 live stems per acre, of which 99 percent was *Artemisia tridentata,* substantially comprised of immature plants colonizing disturbed *Agropyron spicatum/Poa secunda* grassland sites. No trees were recorded in the 0.1-acre density sample plots.

Artemisia tridentata/Agropyron smithii community type

The *Artemisia tridentata/Agropyron smithii* community type is infrequent, occupying 8 acres (0.6 percent) of the MLR intensive study area. Two plots were sampled on terraces/benches of gentle (1-4 percent) slope gradient. Aspect was northeasterly and easterly. The ecological sites were silty and a silty-shallow-rock outcrop complex, associated with the Roy-Shawmut-Danvers complex and Windham-Lap-Rock outcrop complex soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Artemisia tridentata/Agropyron smithii* c.t.**
n=2

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	58	Perennial	42	Shrub	49
Annual	<1	Annual/Biennial	20	Tree	-
Agropyron smithii	19	*Alyssum alyssoides*	12	*Artemisia tridentata*	48
Poa secunda	10	*Taraxacum laevigatum*	9		
Stipa viridula	10	*Centaurea maculosa*	8		
Poa pratensis	9	*Carduus nutans*	7		
Stipa comata	7	*Achillea millefolium*	4		
Koeleria macrantha	3	*Lupinus sericeus*	4		
		Arnica sororia	4		
		Symphyotrichum falcatum	4		
		Vicia americana	3		
		Erigeron pumilus	3		
		Lithospermum ruderale	1		
		Phlox hoodii	1		

Shrub density averaged 3135 live stems per acre, entirely comprised of *Artemisia tridentata.* Tree density was negligible in the *Artemisia tridentata/Agropyron smithii* community type.

Artemisia tridentata/Agropyron spicatum habitat type

The *Artemisia tridentata/Agropyron spicatum* habitat type is common, occupying 94 acres (7 percent) of the MLR intensive study area. A total of four plots were sampled on middle and upper slope positions of gentle to moderate (10-15 percent) slope gradient. Aspect was variable, commonly northeasterly through southeasterly. The predominant ecological site was silty, associated with the Danvers clay loam soil at two of the four sample sites. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Artemisia tridentata/Agropyron spicatum* h.t.**
n=4

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	38	Perennial	23	Shrub	36
Annual	<1	Annual/Biennial	2	Tree	-
Agropyron spicatum	23	*Lupinus sericeus*	5	*Artemisia tridentata*	36
Poa secunda	10	*Vicia americana*	3		
Agropyron smithii	2	*Phlox hoodii*	2		
Koeleria macrantha	2	*Achillea millefolium*	2		
Festuca campestris	<1	*Antennaria microphylla*	2		
		Arnica sororia	1		
		Erigeron corymbosus	1		
		Linaria dalmatica	1		
		Centaurea maculosa	<1		

Shrub density averaged 5110 live stems per acre, of which 98 percent was *Artemisia tridentata.* Density of trees less than four inches dbh (diameter at breast height) averaged 78 *Juniperus scopulorum* stems per acre, 8 *Pinus ponderosa* per acre and 3 *Pseudotsuga menziesii* per acre.

Artemisia tridentata/Festuca idahoensis habitat type

The *Artemisia tridentata/Festuca idahoensis* habitat type is relatively common, occupying 43 acres (3 percent) of the MLR intensive study area. Three plots were sampled on benches and lower to middle slope positions of gentle to moderate (8-12 percent) slope gradient and northeasterly aspect. The ecological site was silty, associated mostly with the Danvers clay loam soil. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Artemisia tridentata/Festuca idahoensis* h.t.**
n=3

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	43	Perennial	28	Shrub	58
Annual	<1	Annual/Biennial	3	Tree	-
Agropyron spicatum	14	*Vicia americana*	9	*Artemisia tridentata*	58
Festuca idahoensis	11	*Lupinus sericeus*	4		
Poa secunda	9	*Arenaria congesta*	3		
Koeleria macrantha	3	*Achillea millefolium*	2		
Poa pratensis	3	*Antennaria microphylla*	2		
Poa compressa	1	*Taraxacum laevigatum*	1		
		Arnica sororia	1		
		Phlox hoodii	1		
		Orthocarpus tenuifolius	<1		

Shrub density averaged 7487 live stems per acre, entirely *Artemisia tridentata*. Density of trees less than four inches dbh (diameter at breast height) averaged 13 *Pseudotsuga menziesii* per acre and 7 *Pinus ponderosa* per acre.

Artemisia tridentata/Festuca campestris habitat type

The *Artemisia tridentata/Festuca campestris* habitat type is the most abundant shrubland type, occupying 100 acres (36 percent) of the MLR intensive study area. A total of seven plots were sampled, primarily on middle slope positions of gentle to moderate (5-20 percent), occasionally steeper (25-35 percent) slope gradient. Aspect was northeasterly at six of the seven sample sites. The predominant ecological sites were silty and a complex of silty-shallow-rock outcrop, associated with the Shawmut cobbly loam, Braziel-Tolbert gravelly loams, and Windham-Lap-Rock outcrop complex soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Artemisia tridentata/Festuca campestris* h.t.**
n=7

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	58	Perennial	39	Shrub	39
Annual	<1	Annual/Biennial	4	Tree	<1
Agropyron spicatum	16	*Lupinus sericeus*	11	*Artemisia tridentata*	37
Festuca campestris	15	*Arnica sororia*	5		
Festuca idahoensis	13	*Erigeron corymbosus*	3		
Poa secunda	7	*Orthocarpus tenuifolius*	3		
Poa pratensis	2	*Antennaria microphylla*	3		
Koeleria macrantha	2	*Achillea millefolium*	2		
Stipa viridula	1	*Solidago missouriensis*	2		
Carex petasata	1	*Arenaria congesta*	1		
		Geum triflorum	1		
		Astragalus atropubescens	1		
		Lithospermum ruderale	1		
		Penstemon procerus	1		

Shrub density averaged 5753 live stems per acre, of which 91 percent was *Artemisia tridentata* and five percent was *Artemisia tripartita*. Tree density was negligible in the *Artemisia tridentata/Festuca campestris* habitat type.

Symphoricarpos occidentalis/Poa pratensis community type

The *Symphoricarpos occidentalis/Poa pratensis* community type is infrequent, occupying 8 acres (0.6 percent) of the MLR intensive study area. One plot was sampled on a middle slope position of moderate (10 percent) slope gradient and northwesterly aspect. The ecological site was silty, associated with the Shawmut cobbly loam soil. Plant species dominance is shown below, based on percent canopy cover rounded to the nearest percent.

***Symphoricarpos occidentalis/Poa pratensis* c.t.**
n=1

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	91	Perennial	47	Shrub	15
Annual	-	Annual/Biennial	2	Tree	-
Poa pratensis	55	*Artemisia ludoviciana*	8	*Symphoricarpos occidentalis*	14
Stipa viridula	30	*Campanula rotundifolia*	5	*Rosa woodsii*	1
Agropyron smithii	4	*Lupinus sericeus*	4		
Bromus porteri	1	*Penstemon procerus*	4		
Festuca campestris	1	*Solidago missouriensis*	4		
		Achillea millefolium	3		
		Gaura coccinea	3		
		Geranium viscosissimum	3		
		Iris missouriensis	3		
		Antennaria microphylla	2		
		Taraxacum laevigatum	2		

Shrub density averaged 6780 live stems per acre, of which 64 percent was *Symphoricarpos occidentalis* and 36 percent was *Rosa woodsii*. No trees were recorded in the 0.1-acre density sample plot.

Prunus virginiana/Agropyron spicatum community type

The *Prunus virginiana/Agropyron spicatum* community type is a very minor type, occupying only 1 acre (0.1 percent) of the intensive study area. The type was associated with small rock outcrops on slopes and hill tops. It was not sampled quantitatively due to its limited extent. Codominant shrub associates with *Prunus virginiana* on these sites were *Amelanchier alnifolia* and *Ribes cereum.* The understory composition was similar to that of the *Artemisia tridentata/Agropyron spicatum* habitat type.

3.2.4 Conifer Forest And Woodland

Five upland Conifer Forest and Woodland habitat types and communities were identified in three series during the 2013 inventory, comprising 236 acres or 18 percent of total intensive study area acreage. The three Conifer series were dominated or distinguished by *Juniperus scopulorum* (24 percent of Conifer acreage), *Pinus ponderosa* (2 percent), or *Pseudotsuga menziesii* (74 percent). Each habitat or community type was named for the characteristic understory union, *i.e., Agropyron spicatum, Festuca campestris* or *Physocarpus malvaceus.* Conifer Forest and Woodland types accounted for about 260 acres or 12 percent of the extensive study area, thus totaling 495 acres or 14 percent of the entire MLR inventory area.

Conifer cover and constancy data are presented by sample site (plot) in Appendix Tables B8 through B10, and summarized by habitat and community type in Table 4. Shrub density data are given by plot in Appendix Table C3, and summarized for Conifer types in Table 9. Tree density data are presented by plot in Appendix Table D3, and summarized by Conifer type in Table 13.

A correlation of soils mapping units, ecological sites and community types is listed by plot in Appendix E, and summarized by parameter in Tables 15 through 17. Grazeable understory productivity values and stocking rates are shown in Table 18.

Plant species of concern listed by MTNHP (2013) for Granite, Powell and Missoula Counties are summarized in Table 20. A simple comparison of relative diversity among physiognomic types is presented in Table 21. The abundance of noxious weeds sampled in Conifer types is given in Table 22. Appendix F provides a synopsis of important site parameters (topographical position, slope gradient and aspect) recorded for MLR Conifer communities. A list of selected ecological literature pertinent to the MLR study area is synthesized in Appendix G. Acreage of vegetation types is given in Table 23. All vegetation sample site locations are shown on the vegetation type map (Plate 1).

In the following text, Conifer Forest and Woodland habitat and community types are arranged roughly in order of postulated successional status (using Pfister *et al.* 1977) as well as moisture regime (xeric to mesic). Site parameters and understory species composition were also taken into account.

Juniperus scopulorum/Agropyron spicatum community type

The *Juniperus scopulorum/Agropyron spicatum* community type is very common, occupying 58 acres (4 percent) of the MLR intensive study area. Five plots were sampled, all on middle slope positions of moderately steep to very steep (30-65 percent) slope gradient. Aspect was commonly easterly through southerly. The predominant ecological sites were complexes of silty-shallow-rock outcrop and Douglas-fir/snowberry-rock outcrop, often associated with the Windham-Lap-Rock outcrop complex and Whitecow-Rock outcrop complex soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Juniperus scopulorum/Agropyron spicatum* c.t.**
n=5

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	21	Perennial	14	Shrub	<1
Annual	4	Annual/Biennial	2	Tree	23
Agropyron spicatum	15	*Centaurea maculosa*	2	*Juniperus scopulorum*	23
Bromus japonicus	4	*Alyssum alyssoides*	2		
Agropyron smithii	2	*Balsamorhiza sagittata*	2		
Poa secunda	2	*Phlox hoodii*	1		
		Solidago missouriensis	1		
		Gutierrezia sarothrae	1		

Shrub density averaged only 61 live stems per acre, comprised of *Amelanchier alnifolia* and *Purshia tridentata*.

Density of trees greater than four inches dbh (diameter at breast height) averaged 48 *Juniperus scopulorum* stems per acre; trees less than four inches dbh averaged 602 *Juniperus scopulorum* stems per acre, 8 *Pseudotsuga menziesii* per acre, and 8 *Pinus ponderosa* per acre.

Pinus ponderosa/Agropyron spicatum habitat type

The *Pinus ponderosa/Agropyron spicatum* habitat type is infrequent, occupying only 4 acres (0.3 percent) of the MLR intensive study area. Two plots were sampled on a drainage bottom and a middle slope position of generally steep (40-60 percent) slope gradient. Aspects of the sample sites were northeasterly and southwesterly. Ecological sites included complexes of silty- shallow-rock outcrop and Douglas-fir/snowberry-rock outcrop, associated with the Windham-Lap-Rock outcrop complex and Whitecow-Rock outcrop complex soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Pinus ponderosa/Agropyron spicatum* h.t.**
n=2

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	7	Perennial	3	Shrub	1
Annual	<1	Annual/Biennial	2	Tree	62
Agropyron spicatum	5			*Pinus ponderosa*	49
Festuca campestris	2			*Juniperus scopulorum*	13
				Artemisia tridentata	1

Shrub density averaged 911 live stems per acre, of which 44 percent was *Symphoricarpos albus,* 39 percent *Rosa woodsii* and 11 percent was *Amelanchier alnifolia*.

Density of trees greater than four inches dbh (diameter at breast height) averaged 45 *Pinus ponderosa* per acre and 120 *Juniperus scopulorum* stems per acre; density of trees less than four inches dbh averaged 405 *Pinus ponderosa* per acre, 580 *Juniperus scopulorum* stems per acre and 20 *Pseudotsuga menziesii* per acre.

Pseudotsuga menziesii/Agropyron spicatum habitat type

The *Pseudotsuga menziesii/Agropyron spicatum* habitat type is relatively common, occupying 31 acres (2 percent) of the MLR intensive study area. Two plots were sampled, on middle and upper slope positions of steep to very steep (60-80 percent) slope gradient. Aspects of the sample sites were northeasterly and easterly. The ecological sites were Douglas-fir/snowberry and a silty-shallow-rock outcrop complex, associated with the Whitecow gravelly loam and the Windham-Lap-Rock outcrop complex soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Pseudotsuga menziesii/Agropyron spicatum* h.t.**
n=2

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	21	Perennial	12	Shrub	1
Annual	<1	Annual/Biennial	1	Tree	30
Agropyron spicatum	17	*Phlox hoodii*	4	*Juniperus scopulorum*	17
Poa secunda	3	*Linaria dalmatica*	3	*Pseudotsuga menziesii*	13
Koeleria macrantha	1	*Astragalus adsurgens*	2	*Amelanchier alnifolia*	1
		Solidago missouriensis	<1		

Shrub density averaged 354 live stems per acre, of which 43 percent was *Amelanchier alnifolia*, 29 percent *Ribes inerme*, 14 percent was *Acer glabrum* and 14 percent *Cornus sericea*.

Density of trees greater than four inches dbh (diameter at breast height) averaged 40 *Pseudotsuga menziesii* and 30 *Juniperus scopulorum* stems per acre; trees less than four inches dbh averaged 90 *Pseudotsuga menziesii* per acre and 440 *Juniperus scopulorum* stems per acre.

Pseudotsuga menziesii/Festuca campestris habitat type

The *Pseudotsuga menziesii/Festuca campestris* habitat type is common, occupying 51 acres (4 percent) of the MLR intensive study area. Three plots were sampled, primarily on deeply incised drainages, also on an upper slope position; slope gradients were steep to very steep (40-80 percent) on northerly aspects. The ecological sites were Douglas-fir/snowberry and a silty-shallow-rock outcrop complex, associated primarily with the Whitecow gravelly loam, cool and Whitecow gravelly loam soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Pseudotsuga menziesii/Festuca campestris* h.t.**
n=3

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	4	Perennial	3	Shrub	<1
Annual	<1	Annual/Biennial	1	Tree	98
Agropyron spicatum	2			*Pseudotsuga menziesii*	71
Festuca campestris	1			*Juniperus scopulorum*	26

Shrub density averaged 371 live stems per acre, of which 73 percent was *Prunus virginiana* and 27 percent was *Rosa acicularis*.

Density of trees greater than four inches dbh (diameter at breast height) averaged 136 *Pseudotsuga menziesii* per acre, 37 *Juniperus scopulorum* stems per acre, and 7 *Pinus ponderosa* per acre; trees less than four inches dbh averaged 167 *Pseudotsuga menziesii* per acre, 320 *Juniperus scopulorum* stems per acre, and 3 *Pinus ponderosa* per acre.

***Pseudotsuga menziesii/Physocarpus malvaceus* habitat type**

The *Pseudotsuga menziesii/Physocarpus malvaceus* habitat type is the most abundant Conifer Forest-Woodland type, occupying 93 acres (7 percent) of the MLR intensive study area. A total of 12 plots were sampled on a wide range of topography - 75 percent of sample sites were on lower, middle and upper slope positions of steep to very steep (45-95 percent) slope gradient; 25 percent of sample sites were on drainage bottoms of gentle (3-5 percent) slope gradient. Aspect was variable, commonly northerly and westerly (75 percent of samples) but also southerly and easterly (25 percent of samples). The sole ecological site was Douglas-fir/snowberry, associated with the Whitecow gravelly loam, cool soil at 11 of the 12 sample sites. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Pseudotsuga menziesii/Physocarpus malvaceus* h.t.**
n=12

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	11	Perennial	9	Shrub	14
Annual	2	Annual/Biennial	2	Tree	83
Agropyron spicatum	4	*Berberis repens*	2	*Pseudotsuga menziesii*	63
Festuca idahoensis	2	*Collinsia parviflora*	<1	*Juniperus scopulorum*	20
Poa pratensis	2	*Crepis atribarba*	<1	*Physocarpus malvaceus*	9
Bromus tectorum	2			*Symphoricarpos occidentalis*	3
Festuca campestris	1				
Stipa viridula	1				

Shrub density averaged 7622 live stems per acre, of which 60 percent was *Physocarpus malvaceus*, 30 percent *Symphoricarpos occidentalis* and 5 percent was *Acer glabrum*.

Density of trees greater than four inches dbh (diameter at breast height) averaged 238 *Pseudotsuga menziesii* per acre and 31 *Juniperus scopulorum* stems per acre; trees less than four inches dbh averaged 218 *Pseudotsuga menziesii* per acre, and 241 *Juniperus scopulorum* stems per acre.

3.2.5 Riparian and Wetland (RW) Vegetation Types

Three primary Riparian and Wetland vegetation types were identified in the MLR inventory area, and classified according to physiognomic type, including Herbaceous, Shrub, and Conifer-Deciduous Forest. Riparian and Wetland (RW) types collectively comprised 340 acres (10 percent) of the inventory area, almost entirely in the extensive study area, with only 0.25 acre (0.02 percent) of RW types located within the intensive study area. These communities are restricted to the Clark Fork floodplain, drainage bottoms and adjacent toeslopes, swales and sidehill seeps, sites which receive supplemental water from snow catchment, overflow, subirrigation or seepage. The following type descriptions are arranged with regard to the stratification of plant physiognomy.

The Herbaceous RW type was comprised of seven mesophytic/hydrophytic habitat and community types representing seven series dominated by various associations of *Poa pratensis, Agrostis stolonifera, Bromus inermis, Typha latifolia, Carex nebrascensis, Carex pellita* and *Carex utriculata.* Due to the mosaic distribution of these often small-scale communities, it would be impractical to map these sites on a species-dominance basis, therefore they are mapped according to physiognomic type. Herbaceous RW types totaled 143 acres, or 42 percent of total Riparian and Wetland vegetation type acreage, and 4 percent of the inventory area.

Woody RW types totaled 197 acres, or 58 percent of total Riparian and Wetland vegetation type acreage, and 6 percent of the inventory area. The Shrub RW type included two mesophytic/hydrophytic shrub community types in two series dominated by *Symphoricarpos occidentalis,* or codominated by *Salix exigua* and *Cornus sericea.* The Conifer-Deciduous Forest RW type was comprised of three mesophytic series, including the *Juniperus scopulorum/Cornus sericea* habitat type, two *Populus balsamifera* community types, and the *Populus tremuloides/Cornus sericea* habitat type.

Riparian and Wetland cover and constancy data are presented by sample site (plot) in Appendix Tables B11 and B12 (Herbaceous RW types) and Appendix Tables B13 and B14 (Woody RW types), and summarized by habitat and community type in Tables 5 and 6, respectively. Shrub density data are given by plot in Appendix Tables C4 and C5, and summarized for Riparian and Wetland types in Table 10. Tree density data are presented by plot in Appendix Table D4, and summarized by Riparian and Wetland type in Table 14.

A correlation of soils mapping units, ecological sites and community types is listed by plot in Appendix E, and summarized by parameter in Tables 15 through 17. Rangeland productivity values and stocking rates are shown in Table 18.

Plant species of concern listed by MTNHP (2013) for Granite, Powell and Missoula Counties are summarized in Table 20. A simple comparison of relative diversity among physiognomic types is presented in Table 21. The abundance of noxious weeds sampled in Riparian and Wetland types is given in Table 22. Appendix F provides a synopsis of important site parameters (topographical position, slope gradient and aspect) recorded for MLR Riparian and Wetland communities. A list of selected ecological

literature pertinent to the MLR study area is synthesized in Appendix G. Acreage of vegetation types is given in Table 23. All vegetation sample site locations are shown on the vegetation type map (Plate 1).

In the following text, Riparian and Wetland vegetation types are arranged first by physiognomic subtype (lower to taller vegetation stratum) and secondly, within each subtype, a moisture gradient from moderately mesophytic to clearly hydrophytic.

3.2.5.1 Herbaceous Riparian And Wetland Types

Poa pratensis community type

The *Poa pratensis* community type is infrequent, occupying minor portions of the MLR extensive study area. One plot was sampled on the Clark Fork floodplain terrace of gentle (2-6 percent) slope gradient. The ecological site was subirrigated, associated with Mccabe-Canarway complex, occasionally flooded soils. Plant species dominance is shown below, based on percent canopy cover rounded to the nearest percent.

***Poa pratensis* c.t.**
n=1

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	102	Perennial	25	Shrub	5
Annual	-	Annual/Biennial	<1	Tree	5
Poa pratensis	85	*Taraxacum officinale*	8	*Salix exigua*	5
Phleum pratense	10	*Mentha arvensis*	6	*Populus balsamifera*	3
Carex praegracilis	4	*Taraxacum laevigatum*	5	*Populus tremuloides*	2
Carex microptera	3	*Symphyotrichum ascendens*	3		
		Fragaria virginiana	1		

Agrostis stolonifera community type

The *Agrostis stolonifera* community type is uncommon in the MLR inventory area. Two plots were sampled on a middle slope position and an upland drainage bottom of gentle to moderately steep (5-35 percent) slope gradient. Aspect was northwesterly and northeasterly. The predominant ecological site was silty, associated with the Roy-Shawmut-Danvers complex and Braziel-Tolbert complex soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Agrostis stolonifera* c.t.**
n=2

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	108	Perennial	34	Shrub	<1
Annual	6	Annual/Biennial	3	Tree	4
Agrostis stolonifera	33	*Veronica anagallis-aquatica*	8	*Pseudotsuga menziesii*	4
Poa pratensis	28	*Cirsium arvense*	7		
Juncus balticus	21	*Plantago major*	7		
Carex nebrascensis	12	*Symphyotrichum ascendens*	6		
Hordeum jubatum	8	*Lactuca serriola*	2		
Alopecurus arundinaceus	6	*Veronica americana*	1		
Juncus bufonius	6	*Taraxacum laevigatum*	1		

Bromus inermis community type

The *Bromus inermis* community type is a relatively common floodplain riparian type in the MLR extensive study area. One plot was sampled on the Clark Fork floodplain terrace of gentle (1-4 percent) slope gradient. Aspect was northwesterly. The ecological sites was subirrigated, associated with the Mccabe-Canarway complex, occasionally flooded soils. Plant species dominance is shown below, based on percent canopy cover rounded to the nearest percent.

***Bromus inermis* c.t.**
n=1

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	33	Perennial	42	Shrub	<1
Annual	5	Annual/Biennial	10	Tree	1
Bromus inermis	22	*Euphorbia esula*	36	*Populus angustifolia*	1
Poa compressa	8	*Descurainia sophia*	5		
Bromus tectorum	3	*Glycyrrhiza lepidota*	4		
Alopecurus arundinaceus	2	*Microsteris gracilis*	2		
Bromus japonicus	2	*Achillea millefolium*	1		
Poa secunda	1	*Alyssum alyssoides*	1		
		Thlaspi arvense	1		

Typha latifolia community type

The *Typha latifolia* community type is well distributed but with restricted acreage in the MLR inventory area. Two plots were sampled, one on the Clark Fork floodplain terrace, the other on a creek terrace near the southern edge of the extensive study area, both on gentle (1-4 percent) slope gradients. Aspect was variable. The ecological sites were silty (toeslope seep) and subirrigated, associated with the Roy-Shawmut-Danvers complex and Mccabe-Canarway complex, occasionally flooded soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Typha latifolia* c.t.**
n=2

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	20	Perennial	95	Shrub	7
Annual	1	Annual/Biennial	<1	Tree	-
Schoenoplectus tabernaemontani	8	*Typha latifolia*	77	*Salix exigua*	3
Glyceria grandis	3	*Myosotis laxa*	5	*Salix bebbiana*	2
Agrostis stolonifera	2	*Ranunculus cymbalaria*	4	*Salix boothii*	1
Carex utriculata	2	*Epilobium ciliatum*	3	*Salix lasiandra*	1
Poa palustris	2	*Mimulus guttatus*	3		
Sphenopholis obtusata	2	*Galium trifidum*	2		
Eleocharis palustris	1	*Mentha arvensis*	1		
Beckmannia syzigachne	1	*Sium suave*	1		

Carex nebrascensis community type

The *Carex nebrascensis* community type is a common wetland type in the MLR inventory area. Three plots were sampled, including a creek bottom, a toeslope seep and an upland drainage bottom, all on gentle (1-5 percent) slope gradients. Aspect was variable, two southeasterly and one northerly. The predominant ecological site was silty, associated with the Con loam, Roy-Shawmut-Danvers complex and Windham-Lap-Rock outcrop complex soils mapping units. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Carex nebrascensis* c.t.**
n=3

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	103	Perennial	30	Shrub	-
Annual	-	Annual/Biennial	21	Tree	3
Agrostis stolonifera	24	*Melilotus officinalis*	9	*Populus tremuloides*	2
Alopecurus arundinaceus	23	*Ranunculus cymbalaria*	6	*Pinus ponderosa*	1
Carex nebrascensis	22	*Melilotus alba*	6		
Poa pratensis	14	*Medicago lupulina*	5		
Juncus balticus	9	*Epilobium ciliatum*	3		
Eleocharis palustris	5	*Potentilla anserina*	3		
Sphenopholis obtusata	2	*Trifolium hybridum*	3		
Bromus inermis	2	*Plantago major*	3		
		Trifolium pratense	2		
		Mimulus guttatus	1		
		Centaurea maculosa	1		
		Taraxacum officinale	1		
		Typha latifolia	1		
		Veronica americana	1		

Carex pellita habitat type

The *Carex pellita* habitat type is a relatively common wetland type in the MLR extensive study area. Two plots were sampled on the Clark Fork floodplain terrace on gentle (0-2 percent) slope gradients. The ecological sites were subirrigated and silty, associated with the Mccabe-Canarway complex, occasionally flooded and Straw silty clay loam soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Carex pellita* h.t.**
n=2

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	96	Perennial	47	Shrub	4
Annual	6	Annual/Biennial	2	Tree	7
Carex pellita	28	*Veronica anagallis-aquatica*	24	*Juniperus scopulorum*	4
Juncus balticus	17	*Potentilla anserina*	6	*Populus balsamifera*	3
Eleocharis palustris	14	*Mentha arvensis*	4	*Salix bebbiana*	2
Alopecurus arundinaceus	10	*Sium suave*	3	*Rosa woodsii*	1
Carex sartwellii	8	*Epilobium ciliatum*	2		
Poa pratensis	7	*Myosotis laxa*	2		
Beckmannia syzigachne	6	*Stachys palustris*	2		
Hordeum brachyantherum	4	*Rorippa palustris*	2		
Carex praegracilis	4	*Erigeron glabellus*	1		
Agrostis stolonifera	4	*Rumex occidentalis*	1		
		Symphyotrichum ascendens	1		
		Trifolium hybridum	1		

Carex utriculata habitat type

The *Carex utriculata* habitat type is a common wetland type in the MLR extensive study area. Three plots were sampled on the Clark Fork floodplain terrace on gentle (0-2 percent) slope gradients. The ecological site was subirrigated, associated with the Mccabe-Canarway complex, occasionally flooded soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Carex utriculata* h.t.**
n=3

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	101	Perennial	23	Shrub	9
Annual	<1	Annual/Biennial	3	Tree	3
Carex utriculata	88	*Myosotis laxa*	12	*Salix bebbiana*	3
Glyceria grandis	5	*Typha latifolia*	3	*Populus balsamifera*	3
Poa palustris	4	*Rorippa palustris*	3	*Salix exigua*	2
Agrostis stolonifera	1	*Mentha arvensis*	2	*Salix boothii*	2
Beckmannia syzigachne	<1	*Rumex occidentalis*	1		
		Sium suave	<1		

3.2.5.2 Shrub Riparian And Wetland Types

***Symphoricarpos occidentalis* community type**

The *Symphoricarpos occidentalis* community type is a common woody riparian type in the MLR extensive study area. One plot was sampled on the Clark Fork floodplain terrace of gentle (1-4 percent) slope gradient. The ecological site was subirrigated, associated with the Gregson silt loam, rarely flooded soil. Plant species dominance is shown below, based on percent canopy cover rounded to the nearest percent.

***Symphoricarpos occidentalis* c.t.**
n=1

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	66	Perennial	18	Shrub	55
Annual	28	Annual/Biennial	14	Tree	-
Poa pratensis	34	*Artemisia ludoviciana*	4	*Symphoricarpos occidentalis*	54
Agropyron smithii	28	*Descurainia sophia*	4	*Ericameria nauseosa*	1
Bromus tectorum	28	*Achillea millefolium*	3		
Stipa comata	2	*Erigeron glabellus*	3		
Muhlenbergia richardsonis	1	*Agoseris glauca*	2		
		Phacelia linearis	2		
		Tragopogon dubius	2		

Shrub density averaged 34,300 live stems per acre, entirely *Symphoricarpos occidentalis.* No trees were recorded in the 0.1-acre density sample plot.

Salix exigua-Cornus sericea community type

The *Salix exigua-Cornus sericea* community type is a common woody RW type in the MLR extensive study area. Two plots were sampled on the Clark Fork floodplain terrace of gentle (0-4 percent) slope gradient. The ecological site was subirrigated, associated with Mccabe-Canarway complex, occasionally flooded soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Salix exigua-Cornus sericea* c.t.**
n=2

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	61	Perennial	25	Shrub	160
Annual	-	Annual/Biennial	5	Tree	2
Poa pratensis	33	*Cirsium arvense*	8	*Cornus sericea*	50
Agrostis stolonifera	12	*Taraxacum laevigatum*	5	*Salix exigua*	47
Agropyron repens	7	*Geum macrophyllum*	3	*Rosa woodsii*	13
Carex atherodes	3	*Mentha arvensis*	3	*Salix bebbiana*	12
Eleocharis palustris	3	*Urtica dioica*	2	*Salix boothii*	8
Poa palustris	2	*Cynoglossum officinale*	2	*Ribes aureum*	7
Carex pellita	2	*Ranunculus macounii*	2	*Symphoricarpos occidentalis*	7
		Scutellaria galericulata	1	*Salix drummondiana*	5
		Galium aparine	1	*Ribes setosum*	5
		Thlaspi arvense	1	*Salix eriocephala*	4
				Rubus idaeus	3
				Juniperus scopulorum	2
				Ribes americanum	1

Woody plant density was recorded at one of the two sample sites, where shrub density was 7083 live stems per acre, of which 30 percent was *Cornus sericea,* 16 percent *Salix exigua,* 11 percent was *Ribes setosum,* 11 percent *Rosa woodsii,* 11 percent *Rubus idaeus,* 10 percent *Salix boothii* and 10 percent was *Symphoricarpos occidentalis*.

Tree density was negligible in the *Salix exigua-Cornus sericea* community at 10 *Juniperus scopulorum* stems per acre in the 1 to 4-inch dbh class. Tall shrub species were also counted in the 0.1-acre tree density plot sampled, totaling 419 tall shrub stems per acre (Appendix Table C5), comprised of 31 percent *Cornus sericea,* 27 percent *Salix boothii,* 25 percent *Salix exigua,* 8 percent *Salix bebbiana,* 5 percent *Salix eriocephala,* and 3 percent *Salix drummondiana.*

3.2.5.3 Conifer-Deciduous Forest Riparian And Wetland Types

***Juniperus scopulorum-Cornus sericea* habitat type**

The *Juniperus scopulorum-Cornus sericea* habitat type is a relatively common woody riparian type in the MLR extensive study area. One plot was sampled on the Clark Fork floodplain terrace of gentle (0-3 percent) slope gradient. The ecological site was subirrigated, associated with the Mccabe-Canarway complex, occasionally flooded soils. Plant species dominance is shown below, based on percent canopy cover rounded to the nearest percent.

***Juniperus scopulorum/Cornus sericea* h.t.**
n=1

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	5	Perennial	2	Shrub	12
Annual	-	Annual/Biennial	4	Tree	108
Poa pratensis	3	*Cynoglossum officinale*	2	*Juniperus scopulorum*	88
Bromus inermis	1	*Viola adunca*	1	*Populus balsamifera*	14
		Carduus nutans	1	*Symphoricarpos occidentalis*	8
		Verbascum thapsus	1	*Populus angustifolia*	6
				Ribes setosum	2
				Rosa woodsii	2

Shrub density averaged 3845 live stems per acre, of which 63 percent was *Symphoricarpos occidentalis,* 29 percent *Ribes setosum* and 8 percent was *Rosa woodsii*.

Density of trees greater than four inches dbh (diameter at breast height) averaged 10 *Populus balsamifera* per acre and 400 *Juniperus scopulorum* stems per acre; trees less than four inches dbh averaged 140 *Populus angustifolia* per acre and 250 *Juniperus scopulorum* stems per acre.

Populus balsamifera/Symphoricarpos occidentalis community type

The *Populus balsamifera/Symphoricarpos occidentalis* community type is the most abundant woody riparian type in the MLR inventory area. Two plots were sampled on the Clark Fork floodplain terrace of gentle (0-4 percent) slope gradient. The ecological site was subirrigated, associated with the Mccabe-Canarway complex, occasionally flooded soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Populus balsamifera/Symphoricarpos occidentalis* c.t.**
n=2

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	12	Perennial	14	Shrub	98
Annual	-	Annual/Biennial	4	Tree	117
Poa pratensis	11	*Silene menziesii*	4	*Populus balsamifera*	74
		Galium boreale	3	*Rosa woodsii*	47
		Smilacina stellata	3	*Symphoricarpos occidentalis*	44
		Cynoglossum officinale	2	*Juniperus scopulorum*	28
		Viola adunca	2	*Populus angustifolia*	15
		Galium aparine	1	*Prunus virginiana*	3
				Clematis ligusticifolia	3
				Ribes setosum	2

Shrub density averaged 25,200 live stems per acre, of which 51 percent was *Symphoricarpos occidentalis,* 31 percent *Rosa woodsii,* 13 percent was *Prunus virginiana* and 2 percent was *Ribes setosum*.

Density of trees greater than four inches dbh (diameter at breast height) averaged 95 *Populus balsamifera* per acre, 40 *Populus angustifolia* per acre and 35 *Juniperus scopulorum* stems per acre; trees less than four inches dbh averaged 330 *Juniperus scopulorum* stems per acre, 15 *Populus balsamifera* per acre and 5 *Pseudotsuga menziesii* per acre.

Populus balsamifera/Cornus sericea **community type**

The *Populus balsamifera/Cornus sericea* community type is a relatively common woody riparian type in the MLR extensive study area, representing a successionally advanced, less disturbed stage of the *Populus balsamifera/Symphoricarpos occidentalis* community type. One plot was sampled on the Clark Fork floodplain terrace of gentle (0-2 percent) slope gradient. The ecological site was subirrigated, associated with the Mccabe-Canarway complex, occasionally flooded soils. Plant species dominance is shown below, based on percent canopy cover rounded to the nearest percent.

Populus balsamifera/Cornus sericea **c.t.**
n=1

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	26	Perennial	20	Shrub	75
Annual	-	Annual/Biennial	<1	Tree	74
Carex praticola	13	*Solidago missouriensis*	14	*Symphoricarpos occidentalis*	48
Carex pellita	9	*Achillea millefolium*	2	*Populus balsamifera*	42
Agrostis stolonifera	4	*Thalictrum dasycarpum*	2	*Juniperus scopulorum*	22
				Rosa woodsii	12
				Populus tremuloides	10
				Cornus sericea	10
				Salix eriocephala	3
				Prunus virginiana	2

Shrub density averaged 13,862 live stems per acre, of which 72 percent was *Symphoricarpos occidentalis* and 27 percent was *Rosa woodsii*.

Density of trees greater than four inches dbh (diameter at breast height) averaged 50 *Populus tremuloides* per acre, 30 *Populus balsamifera* per acre and 10 *Juniperus scopulorum* stems per acre; trees less than four inches dbh averaged 600 *Juniperus scopulorum* stems per acre, 80 *Populus tremuloides* per acre and 10 *Populus angustifolia* per acre.

Populus tremuloides/Cornus sericea habitat type

The *Populus tremuloides/Cornus sericea* habitat type is a common woody riparian type in the MLR extensive study area. Two plots were sampled on the Clark Fork floodplain terrace of gentle (0-1 percent) slope gradient. The ecological site was subirrigated, associated with the Mccabe-Canarway complex, occasionally flooded soils. Plant species dominance is shown below, based on mean percent canopy cover rounded to the nearest percent.

***Populus tremuloides/Cornus sericea* h.t.**
n=2

GRAMINOIDS		FORBS		WOODY PLANTS	
Class/Species	Percent Cover	Class/Species	Percent Cover	Class/Species	Percent Cover
Perennial	68	Perennial	33	Shrub	69
Annual	-	Annual/Biennial	3	Tree	85
Poa pratensis	38	*Glycyrrhiza lepidota*	8	*Populus tremuloides*	70
Agrostis stolonifera	26	*Cirsium arvense*	7	*Symphoricarpos occidentalis*	48
Calamagrostis rubescens	2	*Thalictrum dasycarpum*	6	*Juniperus scopulorum*	15
Bromus inermis	2	*Geum macrophyllum*	2	*Salix bebbiana*	9
		Silene menziesii	2	*Prunus virginiana*	5
		Carduus nutans	2	*Rosa woodsii*	4
		Solidago gigantea	2	*Cornus sericea*	3
		Galium boreale	2	*Ribes setosum*	1
		Cynoglossum officinale	1		
		Berberis repens	1		
		Solidago missouriensis	1		

Shrub density averaged 20,135 live stems per acre, of which 76 percent was *Symphoricarpos occidentalis,* 12 percent *Rosa woodsii,* 6 percent *Ribes setosum,* 3 percent *Ribes aureum,* 2 percent *Cornus sericea* and 1 percent *Prunus virginiana.*

Density of trees greater than four inches dbh (diameter at breast height) averaged 265 *Populus tremuloides* per acre and 50 *Juniperus scopulorum* stems per acre; trees less than four inches dbh averaged 205 *Populus tremuloides* per acre and 150 *Juniperus scopulorum* stems per acre.

3.3 PRODUCTIVITY AND UTILITY

The primary land uses in the MLR study area are livestock grazing (rangeland) and hay production (tame pasture). NRCS (2003) presents recommended stocking rates for the applicable soils in Granite County, relative to good-excellent condition (HCPC). Additionally, NRCS (2003) gives long-term irrigated and nonirrigated hay yields by soils mapping unit that can be expected under a high level of management. Information pertinent to the MLR study area is summarized below.

3.3.1 Rangeland

Appendix E identifies the soil mapping unit and ecological site for each vegetation plot sampled in the study area in 2013. Soil types are correlated with ecological sites in Table 15. Vegetation habitat types and community types are correlated with soil types in Table 16, and with ecological sites in Table 17.

The NRCS uses long-term data to predict productivity for each "Historic Climax Plant Community (HCPC)" to represent range in excellent condition, and indicates productivity for years of normal precipitation and temperature patterns. Annual production was determined for each soil mapping unit in the inventory area using the long-term data (NRCS 2003) developed for ecological sites in Major Land Resource Area 44 (MLRA 44W-Northern Rocky Mountain Valleys, West) in the 15 to 19-inch and 10 to 14-inch mean annual precipitation zones. Production data derived from NRCS (2003) are presented in Tables 15 and 18.

Productivity varies considerably among vegetation types in the study area, depending on current condition and the ecological sites involved. Potential rangeland productivity listed in Table 18 is projected for recommended stocking rates and estimated grazing capacity in the intensive and extensive study areas. Hypothetical grazing capacity calculated for HCPC (not current condition) rangeland was estimated at 1228 animal unit months (annually) for the inventory area as a whole.

In recent management of the study area, 300 yearling calves are brought each year to the ranch to graze. The yearlings' average weight gain over a five-month grazing season (early May to late September) is 600 pounds. The yearlings are sold when they reach 800 to 900 pounds. Additionally, the ranch has a 160-acre state lease in the southwestern quarter of Section 36. The grazing permit on the state lease allows for 14 head of cattle per month (14 AUM). The ranch inventory area is divided into eight pastures on which the cattle are rotated over the course of a year.

3.3.2 Cropland

Hay is the only crop grown in the inventory area. In the MLR extensive study area, tame pasture areas on the Clark Fork floodplain are regularly mowed and baled for hay production for livestock feed. These lowland pastures are predominantly various mixtures of *Bromus inermis, Dactylis glomerata* and *Poa compressa* in drier pastures, and *Schedonorus arundinaceus, Poa pratensis* and *Alopecurus pratensis* in moist pastures. Upland Tame Pasture in the intensive study area comprises areas apparently seeded

decades ago but not reseeded since then, and currently dominated by introduced grasses (mostly *Elymus junceus)* but with a fair representation of reestablished native grass (mostly *Poa secunda*). In the MLR intensive study area, Tame Pasture occurred on 68 acres (5 percent of the study area), while Tame Pasture occupied 286 acres or 13 percent of the extensive study area thus totaling 354 acres or 10 percent of the entire MLR inventory area.

Based on compilation of long-term annual production data, the NRCS (2003) has determined representative values for total non-irrigated and irrigated hay production for pertinent soils in the MLR intensive and extensive study areas (Table 19). Upland Tame Pasture in the intensive study area can be expected to produce 27.5 non-irrigated AUM's per acre. The total predicted yield of grass hay in the extensive study area is expected (NRCS 2003) to average 1.0 ton per acre in non-irrigated pastures, and 3.5 tons per acre in irrigated pastures (Table 19). Grass-legume hay in the extensive study area can be expected to yield 4.3 irrigated tons per acre based on NRCS (2003) productivity guidelines. In recent practice, grass hay and grass-alfalfa hay on the Clark Fork River floodplain is harvested twice a year within the study area, producing 1.5 tons per acre each harvest, thus averaging approximately 3 tons per acre annually (Charlie Moody, ranch manager, personal communication, January 21, 2014).

3.3.3 Timber Productivity

Timbered areas in the inventory area do not generally constitute a commercial timber resource. Much of forest and savannah tree density in the study area is composed of non-commercial Rocky Mountain juniper, or mid-size Douglas-fir and limited ponderosa pine (Table 13). Merchantable trees are present only as relatively small stands, often associated with steep and very steep terrain.

3.4 SPECIES LIST/MTNHP-LISTED SPECIES

Appendix A is a list of vascular plant taxa identified during the 2013 quantitative and mapping inventory of the MLR vegetation baseline study area. A total of 367 taxa were identified, with forbs (255 species) comprising the majority (69 percent). Forbs included 180 perennial taxa (156 native, 19 introduced and 5 fern allies), and 75 annual/biennial taxa (47 native and 28 introduced). Of 68 grasses and grass-like plants identified (19 percent of the total), there were 62 perennial taxa (49 native and 13 introduced), and 6 annual taxa (3 native and 3 introduced). The 44 woody plant taxa (12 percent of the total) recorded in the study area included 37 shrubs and vines, and 7 tree species. Species numbers are listed by class below.

No federally listed or proposed endangered or threatened plant species are known to occur in the vicinity of the MLR study area, and none were recorded during the 2013 baseline vegetation inventory. The Montana Natural Heritage Program (2013) website lists "plant species of concern or SOC" for Montana. A search of MTNHP's records (MTNHP 2013) for Granite, Powell and Missoula Counties found 62 plant species of concern, including 20 taxa listed for Granite County, of which five are in common with Missoula and/or Powell County. The remaining 42 plant taxa of concern are listed for Missoula and/or Powell Counties, but are not currently listed for Granite County, as shown in Table 20.

CLASS	NUMBER OF SPECIES	
	MLR Study Area (2013) 5.5 square miles	Percent
Native Perennial Graminoid	49	*13.4*
Introduced Perennial Grass	13	*3.5*
Native Annual Graminoid	3	*0.8*
Introduced Annual Grass	3	*0.8*
Native Perennial Forb and Subshrub	156	*42.5*
Introduced Perennial Forb	19	*5.2*
Ferns and Allies	5	*1.4*
Native Annual/Biennial Forb	47	*12.8*
Introduced Annual/Biennial Forb	28	*7.6*
Native Shrub and Vine	36	*9.8*
Introduced Shrub and Vine	1	*0.3*
Native Tree	7	*1.9*
TOTAL	**367**	***100***

None of the SOC taxa listed for Granite County were identified in the MLR study area during the 2013 vegetation inventory, in which 367 vascular plant species were identified.

3.5 PLANT SPECIES DIVERSITY

The diversity of vascular plant species was evaluated by determining the average number of species per plot in each general vegetation physiognomic type (Table 21). These data are summarized from the cover data presented by community type in Appendix B. Although these tallies are dependent on sample size, Table 21 provides a generalized assessment of the relative diversity of species by functional class among physiognomic types, particularly for those with similar sample sizes.

3.6 WEEDS

State-listed noxious weeds are given on the "Montana Noxious Weed List, Effective December, 2013" (Montana Department of Agriculture 2014). Ten state-listed weed species (one Priority 2A and nine Priority 2B), and one Priority 3 regulated plant species were encountered on the study area during the 2013 MLR baseline inventory.

Priority 2A noxious weeds are common in isolated areas of Montana. Management criteria will require eradication or containment where less abundant. Management shall be prioritized by local weed districts. One Priority 2A species was recorded on the MLR study area:

- Perennial pepperweed (*Lepidium latifolium*)

Priority 2B noxious weeds are abundant in Montana and widespread in many counties of the state. Management criteria will require eradication or containment where less abundant. Management shall be prioritized by local weed districts. These weeds are capable of rapid spread and render land unfit or greatly limit beneficial uses. The nine species recorded in the study area included:

- Canada thistle (*Cirsium arvense*)
- Field bindweed (*Convolvulus arvensis*)
- Leafy spurge (*Euphorbia esula*)
- Whitetop (*Lepidium chalepense*)
- Russian knapweed (*Acroptilon repens*)
- Spotted knapweed (*Centaurea maculosa*)
- Dalmatian toadflax (*Linaria dalmatica*)
- Common tansy (*Tanacetum vulgare*)
- Houndstongue (*Cynoglossum officinale*)

Priority 3 species are "regulated plants" (not Montana-listed noxious weeds). These regulated plants have the potential to have significant negative impacts. The plant may not be intentionally spread or sold other than as a contaminant in agricultural products. One Priority 3 species was recorded on the MLR study area:

- Cheatgrass brome (*Bromus tectorum*)

The distribution of 104 sample plots throughout vegetation communities in the study area provides a fair assessment of the relative abundance of vascular plant species among community types, including state-listed noxious weed species. Vascular plant canopy cover and constancy data are summarized in Tables 2 through 6, and an excerpt of noxious weed data is presented by species and vegetation type in Table 22.

Presently, 32 Priority 1 and 2 species are listed for Montana statewide. Of the ten state-listed noxious weeds species found in the study area, seven species were recorded during the quantitative inventory of randomly distributed cover plots. The remaining three species were recorded during qualitative surveys of the study area. In addition to noxious weeds listed for Montana state-wide, many counties have independently listed various other troublesome weed species targeted for control. Of 56 Montana counties, 21 have not designated such additional target weed species, including Granite County and nearby Missoula County (Montana Department of Agriculture 2013). Caraway (*Carum carvi)* is on the county list for neighboring Powell County. Many Montana counties have listed musk thistle (*Carduus nutans)*, black henbane (*Hyoscyamus niger)* and/or flannel mullein (*Verbascum thapsus)* as problematic weeds – all three were recorded in the MLR study area, and are added below to the list of weed abundance and distribution summarized from Table 22.

Noxious Weed Abundance and Distribution (Percent Cover/Constancy) by Physiognomic Type, MLR Baseline Study Area, 2013.

	Grassland n=29	Tame Pasture and Roadsides n=8	Shrubland n=20	Conifer Forest and Woodland n=24	Riparian and Wetland (RW)	
					Herbaceous RW n=14	Woody RW n=9
NOXIOUS WEEDS						
Acroptilon repens		X				
Centaurea maculosa	3.9/45	0.2/25	1.7/55	0.5/25	0.4/14	0.1/22
Cirsium arvense		0.5/13			1.2/43	3.4/44
Convolvulus arvensis		X				
Cynoglossum officinale				<0.1/4	X	1.4/67
Euphorbia esula		5.4/38	0.1/10		2.6/7	
Lepidium appelianum		X				
Lepidium latifolium					<0.1/7	
Linaria dalmatica	2.0/34		0.4/30	0.3/21	<0.1/7	
Tanacetum vulgare				0.1/4		<0.1/11
PROBLEMATIC WEEDS						
Carduus nutans	<0.1/7	0.3/25	0.7/15	0.1/8	<0.1/14	0.7/33
Hyoscyamus niger		X				
Verbascum thapsus		X		<0.1/4		0.1/11

n = number of quantitative sample sites
x = present in the type, not recorded at a sample site

The three most common weeds in the MLR study area, particularly in uplands, were *Centaurea maculosa* (spotted knapweed), *Linaria dalmatica* (Dalmatian toadflax) and *Euphorbia esula* (leafy spurge). On more mesic sites in drainage bottoms and on the Clark Fork floodplain, the most common weed species were *Cirsium arvense* (Canada thistle), *Cynoglossum officinale* (common houndstongue) and, again, *Euphorbia esula*. Two noxious weed species, *Lepidium latifolium* (perennial or broad-leaved pepperweed) and *Tanacetum vulgare* (common tansy), were recorded with minor cover values at limited sites in riparian community types. Three noxious weed species, *Acroptilon repens* (Russian knapweed), *Convolvulus arvensis* (field bindweed) and *Lepidium appelianum* (globe-podded hoarycress or whitetop), were noted as sporadic occurrences in tame pasture and disturbed roadside locations.

Of the three potentially problematic weed species recorded, *Carduus nutans* (musk thistle) was by far the most common, occurring in every vegetation physiognomic type present in the study area.

4.0 REFERENCES CITED

Allewalt, J. and K.L. Scow. 2013.
Upper Missouri Wetland Mitigation Bank, 2013 Annual Monitoring Report. Unpublished technical report for EcoAsset Management LLC, by WESTECH Environmental Services, Inc., Helena, Montana. 12 p. + 64 p. appendices.

Avery, T.E. 1967.
Forest Measurements. McGraw-Hill, New York City. 290 p.

Beaver, J. and K.L. Scow. 2011.
Upper Clark Fork Wetland Mitigation Bank, 2010 Annual Monitoring Report. Unpublished technical report for Nevada Spring Creek Partners LLC, by WESTECH Environmental Services, Inc., Helena, Montana. 19 p. + 71 p. appendices + map.

Cooper, S.V., K.E. Neiman and D.W. Roberts. 1991.
Forest Habitat Types of Northern Idaho: A Second Approximation. General Technical Report INT-236. USDA Forest Service Intermountain Research Station, Ogden, Utah. 143 p.

Cooper, S.V. and K.L. Scow. 1998.
Vegetation Resources In: Potter et al. Easement Documentation Report, 1998. Unpublished technical report for The Nature Conservancy of Montana by Western Technology and Engineering, Inc., Helena, Montana and Montana Natural Heritage Program, Helena, Montana. 29 p. + 19 p. appendices + 22 p. photos + map.

Cronquist, A., A.H. Holmgren, N.H. Holmgren, J.L. Reveal and P.K. Holmgren. 1972-2012.
Intermountain Flora. Six Volumes. The New York Botanical Garden, New York City.

Culwell, L.D., L.A. Larsen and P. Lesica. 1985.
Loon Lake Conservation Easement Documentation Report, 1985. Unpublished technical report for The Nature Conservancy Big Sky Field Office by Western Technology and Engineering, Inc., Helena, Montana. 38 p. + 35 p. appendices + 5 p. photos + 2 maps.

Culwell, L.D. and K.L. Scow. 1982.
Vegetation Inventory of the Jardine Project Area, Park County, Montana, 1981. Unpublished technical report for Homestake Mining Co. by Western Technology and Engineering, Inc., Helena, Montana. 84 p.+ 94 p. appendices + map.

Culwell, L.D. and K.L. Scow. 1993.
Vegetation Inventory of the Diamond Hill Exploration Area, Broadwater County, Montana, 1993. Unpublished technical report for Pegasus Gold Corporation by Western Technology and Engineering, Inc., Helena, Montana. 23 p.+ 5 p. appendix + map.

Culwell, L.D. and K.L. Scow. 2003.
2002 Vegetation Monitoring, Beal Mountain Mine Land Application Disposal Area, Silver Bow County, Montana. Unpublished technical report for Montana Department of Environmental Quality, Environmental Management Bureau by WESTECH Environmental Services, Inc., Helena, Montana. 33 p. + 27 p. appendices + map.

Culwell, L.D. and K.L. Scow. 2005.
Vegetation Update, Montanore Project, Lincoln and Sanders Counties, Montana. Unpublished technical report for Mines Management, Inc., by WESTECH Environmental Services, Inc., Helena, Montana. 40 p. + 24 p. appendices + 4 maps.

Culwell, L.D., K.L. Scow and L.A. Larsen. 1984.
Vegetation Inventory of the Montana Tunnels Study Area, Jefferson County, Montana. Unpublished technical report for Centennial Minerals, Inc., by Western Technology and Engineering, Inc., Helena, Montana. 87 p. + 75 p. appendices + map.

Culwell, L.D., K.L. Scow, L.A. Larsen and J. Beaver. 1998.
Vegetation Resources Baseline Inventory, Yellowstone Pipeline Bitterroot Range Project. Unpublished technical report for Maxim Technologies, Inc. by Western Technology and Engineering, Inc., Helena, Montana. 150 p. + 118 p. tables + 19 maps.

Culwell, L.D., K.L. Scow, L.A. Larsen and C. Durran. 1990.
Vegetation Resources of the Little Rocky Mountains Environmental Study Area, 1990. Unpublished technical report for Zortman Mining, Inc., by Western Technology and Engineering, Inc., Helena, Montana. 108 p. + 126 p. appendices + 4 maps.

Culwell, L.D., K.L. Scow, L.A. Larsen, J. Elliott, K. Gallagher and E. Spotts. 1993.
Wetlands Inventory of the McDonald Project Area, Lewis and Clark County, Montana. Unpublished technical report for Seven-Up Pete Joint Venture by Western Technology and Engineering, Inc. (Helena), Northwest Resource Consultants (Helena) and Schafer and Associates (Bozeman). ~150 p.

Culwell, L.D., K.L Scow, L.A. Larsen and A. Kratz. 1987.
Guide to the Natural Vegetation of Montana. Unpublished draft report for the Montana Natural Heritage Program by Western Technology and Engineering, Inc., Helena, Montana. 389 p.

Dorn, R.D. 1984.
Vascular plants of Montana. Mountain West Publishing, Cheyenne, Wyoming. 176 p.

Flora of North America Editorial Committee, eds. 1993+.
Flora of North America North of Mexico. 16+ volumes. Oxford University Press, New York and Oxford.

Gleason, H.A. and A. Cronquist. 1991.
Manual of Vascular Plants of Northeastern United States and Adjacent Canada. Second edition. The New York Botanical Garden, New York City. 910 p.

Great Plains Flora Association. 1986.
Flora of the Great Plains. University Press of Kansas, Lawrence. 1392 p.

Hansen, P.L., R.D. Pfister, K. Boggs, B.J. Cook, J. Joy, and D.K. Hinckley. 1995.
Classification and Management of Montana's Riparian and Wetland Sites. Montana Forest and Conservation Experiment Station, University of Montana, Missoula. 646 p.

Hironaka, M., M.A. Fosberg and A.H. Winward. 1983.
Sagebrush-Grass Habitat Types of Southern Idaho. Forest, Wildlife and Range Experiment Station Bulletin No. 35. University of Idaho, Moscow. 44 p.

Hitchcock, C.L., A. Cronquist, M. Ownbey and J.W. Thompson. 1955-1969.
Vascular Plants of the Pacific Northwest. Volumes 1-5. University of Washington Press, Seattle.

Hitchcock, C.L. and A. Cronquist. 1973.
Flora of the Pacific Northwest. University of Washington Press, Seattle. 730 p.

Holmgren, N.H. 1998.
Illustrated Companion to Gleason and Conquist's Manual: Illustrations of the Vascular Plants of Northeastern United States and Adjacent Canada. The New York Botanical Garden, New York City. 937 P.

Kartesz, J.T. 1994.
A Synonymized Checklist of the Vascular Flora of the United States, Canada and Greenland. Second edition. Timber Press. Portland, Oregon. 2 volumes.

Larsen, L.A., L.D. Culwell and K.L. Scow. 1987.
Vegetation Inventory, Lewis and Clark Caverns State Park, Jefferson County, Montana. Unpublished technical report for Montana Department of Fish, Wildlife and Parks by Western Technology and Engineering, Inc., Helena, Montana. (in prep).

Lesica, P. 2012.
Manual of Montana Vascular Plants. Botanical Research Institute of Texas Press. Fort Worth, Texas. 771 p.

Lichvar, R. 2012.
The National Wetland Plant List. ERDC/CRREL TN-12-11. Hanover, NH: U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory.
http://wetland_plants.usace.army.mil/

Montana Bureau of Mines and Geology. 2009.
Geologic Map 62E of Montana. Field Notebook. 57 p.

Montana Department of Agriculture. 2014.
Montana Noxious Weed Program. Available on the web at: http://agr.mt.gov/agr/Programs/Weeds

Montana Natural Heritage Program (MTNHP). 2013.
Species of Concern. Available on the web at: http://nhp.nris.Montana.gov/plants/index.asp (accessed November, 2013).

Mueggler, W.F. and W.L. Stewart. 1980.
Grassland and Shrubland Habitat Types of Western Montana. USDA Forest Service General technical report INT-66. Intermountain Forest and Range Experiment Station, Ogden, Utah. 154 p.

Natural Resources Conservation Service (NRCS). 2003.
Soil Survey of Granite County Area, Montana. USDA and Montana Agricultural Experiment Station. 329 p. Part I and 903 p. Part II + maps.

Natural Resources Conservation Service (NRCS). 2012.
Soil Survey Geographic (SSURGO) Database for Granite County Area, Montana. Available online at http://solidatamart.nrcs.usda.gov Accessed December 2013.

Pfister, R.D., B.L. Kovalchik, S.F. Arno and R.C. Presby. 1977.
Forest Habitat Types of Montana. USDA Forest Service Gen. Technical Rept. INT-34. Intermountain Forest and Range Experiment Station, Ogden, Utah. 174 p.

Roberts, D.W. 1980.
Forest Habitat Types of the Bear's Paw Mountains and Little Rocky Mountains, Montana. Master's Thesis. University of Montana, Missoula. 116 p.

Roberts, D.W., J.I. Sibbernsen and R.D. Pfister. 1979.
Forest and Woodland Habitat Types of Northcentral Montana, Vol. 2: The Missouri River Breaks. School of Forestry, University of Montana. IFRES for Bureau of Land Management, State Office, Research Division, Billings, Montana. YA-512-CT6-84. 24 p.

Scow, K.L. 1988.
Vegetation Survey, Yellow Band Project, Beaverhead County, Montana, 1988. Unpublished technical report for Noranda Exploration, Inc. by Western Technology and Engineering, Inc., Helena, Montana. 20 p. + 13 p. appendices.

Scow, K.L. 1989.
Vegetation Resources, In: CIMC Yellowstone Talc Mine, Madison County, Montana (Vol. I), Comprehensive Amendment to Hard Rock Operating Permit #00005/00005A. Unpublished technical report for Montana Department of State Lands by Cyprus Minerals Company and Western Technology and Engineering, Inc., Helena, Montana. 13 p. + appendices (P. Johnson and J. Ryan, 1982 baseline vegetation survey, 38 p. + 12 p. appendices).

Scow, K.L. 1990.
Dancing Prairie Preserve Vegetation Inventory, 1989. Unpublished technical report for The Nature Conservancy, Big Sky Field Office by Western Technology and Engineering, Inc., Helena, Montana.
15 p. + 19 p. appendices.

Scow, K.L. 1995a.
Baseline Vegetation Inventory, Basin Gulch Project Area, Granite County, Montana. Unpublished technical report for Cable Mountain Mining, by Western Technology and Engineering, Inc., Helena, Montana.
54 p. + 75 p. appendices + map.

Scow, K.L. 1995b.
Baseline Vegetation Inventory - Phase 2, GSM Permit Area, Jefferson County, Montana, 1995. Unpublished technical report for Golden Sunlight Mines, Inc. by Western Technology and Engineering, Inc., Helena, Montana. 83 p. + 121 p. appendices + 84 p. addenda + 2 maps.

Scow, K.L. 1997.
Baseline Vegetation Inventory, Norris Gold Project, Madison County, Montana, 1996. Unpublished technical report for Miltop, Inc., by Western Technology and Engineering, Inc., Helena, Montana. 44 p. + 53 p. appendices + map.

Scow, K.L. 2001.
Vegetation Monitoring Report for the Limestone Hills and Fort Harrison Properties, 2001. Unpublished technical report for Montana Army National Guard by WESTECH Environmental Services, Inc., Helena, Montana. 22 p.+ 51 p. appendices + 2 maps.

Scow, K.L. 2005a.
Baseline Vegetation Inventory, South Extension, Indian Creek Project, Montana, 2005. Unpublished technical report for Graymont Western US, Inc. by WESTECH Environmental Services, Inc., Helena, Montana. 37 p. + 81 p. appendices + map.

Scow, K.L. 2005b.
Vegetation Monitoring Report for the Limestone Hills and Fort Harrison Properties, 2004. Unpublished technical report for Montana Department of Military Affairs, Environmental Division by WESTECH Environmental Services, Inc., Helena, Montana. 38 p. + 49 p. appendices + 2 maps.

Scow, K.L. 2006a.
Correlation of Mule Deer Winter Range and Mountain Mahogany Acreages in DFWP Hunting District 380, 2006. Unpublished technical report for Graymont Western US, Inc. (Indian Creek Project) by WESTECH Environmental Services, Inc., Helena, Montana. 3 p.

Scow, K.L. 2006b.
Vegetation Report for the Limestone Hills Training Area Withdrawal and LEIS. Unpublished technical report for Tetra Tech, EMI by WESTECH Environmental Services, Inc., Helena, Montana. 15 p. + 9 p. appendix.

Scow, K.L. 2009.
Baseline Vegetation Inventory, South Amendment, Bull Mountains Mine, Montana. Unpublished technical report for Signal Peak Energy, LLC by WESTECH Environmental Services, Inc., Helena, Montana. 103 p. + 183 p. appendices + map.

Scow, K.L. and J. Beaver. 1999a.
Vegetation/Land Condition Report for the Fort Harrison Property, 1998. Unpublished technical report for Montana Army National Guard Environmental Office, by WESTECH Environmental Services, Inc., Helena, Montana. 35 p. + 85 p. appendices + map.

Scow, K.L. and J. Beaver. 1999b.
Vegetation/Land Condition Report for the Limestone Hills Property, 1998. Unpublished technical report for Montana Army National Guard Environmental Office, by WESTECH Environmental Services, Inc., Helena, Montana. 40 p. + 142 p. appendices + map.

Scow, K.L. and J. Beaver. 1999c.
Vegetation Resources, In: Peters Easement Documentation Report, 1999. Unpublished technical report for The Montana Nature Conservancy by WESTECH Environmental Services, Inc., Helena, Montana. 48 p. + 33 p. appendices + 9 p. photos + 3 maps.

Scow, K.L. and J. Beaver. 1999d.
Vegetation Resources, In: Staudenmeyer Easement Documentation Report, 1999. Unpublished technical report for The Montana Nature Conservancy by WESTECH Environmental Services, Inc., Helena, Montana. 44 p. + 30 p. appendices + 15 p. photos + map.

Scow, K.L. and L.D. Culwell. 1988.
Vegetation/Agricultural Resources of the Beal Project Area, 1987. Revised Permit Application (Appendix C) for Beal Mountain Mining Company, Inc. by Western Technology and Engineering, Inc., Helena, Montana. 58 p. + 9 p. appendix + map.

Scow, K.L. and L.D. Culwell. 1990.
Baseline Vegetation Inventory, Seven-Up Pete Project Study Area, Lewis and Clark County, Montana, 1990. Unpublished technical report for Phelps Dodge Corporation by Western Technology and Engineering, Inc., Helena, Montana. (in prep).

Scow, K.L. and L.D. Culwell. 1994.
Baseline Vegetation Inventory, Elkhorn Project Area, Jefferson County, Montana, 1989-1993. Unpublished technical report for Santa Fe Pacific Gold Corporation by Western Technology and Engineering, Inc., Helena, Montana. 115 p. + 266 p. appendices + 4 maps.

Scow, K.L., L.D. Culwell and J. Elliott. 1993.
Baseline Vegetation Inventory, McDonald Study Area, Lewis & Clark County, Montana, 1991-1992. Unpublished technical report for Seven-Up Pete Joint Venture by Western Technology and Engineering, Inc., Helena, Montana. 96 p. + 126 p. appendices + map.

Scow, K.L., L.D. Culwell and L.A. Larsen. 1986.
Vegetation Inventory of the Chartam Project Area, Broadwater County, Montana. Unpublished technical report for Western Energy Company by Western Technology and Engineering, Inc., Helena, Montana. 91 p. + 3 p. photographs + 7 p. summary + 2 maps.

Scow, K.L., L.D. Culwell and L.A. Larsen. 1987a.
Valley View Hills Baseline Easement Report, 1985. Unpublished technical report for The Nature Conservancy Big Sky Field Office by Western Technology and Engineering, Inc., Helena, Montana. 43 p. + 68 p. appendices + 6 p. photos + 2 maps.

Scow, K.L., L.D. Culwell and L.A. Larsen. 1987b.
Vegetation Inventory of The Rock Creek Study Area, Sanders County, Montana. Unpublished technical report for ASARCO, Inc. by Western Technology and Engineering, Inc., Helena, Montana. 68 p. + 73 p. appendices + photos + 4 maps.

Scow, K.L., L.D. Culwell and L.A. Larsen. 1989a.
Vegetation Inventory of the Basin Creek Mine Study Area, 1989. Unpublished technical report for Basin Creek Mining, Inc., by Western Technology and Engineering, Inc., Helena, Montana. 25 p. + 13 p. appendices + map.

Scow, K.L., L.D. Culwell and L.A. Larsen. 1989b.
Vegetation Inventory of the Paupers Dream Study Area, 1988. Unpublished technical report for Hydrometrics, Inc. and Pangea Mining, Inc., by Western Technology and Engineering, Inc., Helena, Montana. 23 p. + 13 p. appendices + map.

Scow, K.L., L.D. Culwell and L.A. Larsen. 1992.
Baseline Vegetation Inventory, New World Project Area, Park County, Montana (1989-1992). Unpublished technical report for Crown Butte Mines, Inc., by Western Technology and Engineering, Inc., Helena, Montana. 119 p. + 199 p. appendices + map.

Steele, R., S.V. Cooper, D.M. Ondov, D.W. Roberts and R.D. Pfister. 1983.
Forest Habitat Types of Eastern Idaho – Western Wyoming. USDA Forest Service General Technical Report INT-144. Intermountain Forest and Range Experiment Station, Ogden, Utah. 122 p.

Steele, R., R.D. Pfister, R.A. Ryker and J.A. Kittams. 1981.
Forest Habitat Types of Central Idaho. USDA Forest Service General Technical Report INT-114. Intermountain Forest and Range Experiment Station, Ogden, Utah. 138 p.

Thompson, L.S. and J. Kuijt. 1976.
Montane and Subalpine Plants of the Sweetgrass Hills, Montana and Their Relation to Early Postglacial Environments of the Northern Great Plains. Canadian Field Naturalist 90:432-448.

Tuhy, J.S. and S. Jensen. 1982.
Riparian Classification for the Upper Salmon/Middle Fork Salmon Rivers, Idaho. Final Report to USDA Forest Service by White Horse Associates, Smithfield, Utah. 200 p.

WESTECH Environmental Services, Inc. 2009.
Williams Property Lazy Y 3 Ranch Conservation Easement – Baseline Ecological Inventory, July 2009. Unpublished technical report for Prickly Pear Land Trust by WESTECH, Helena, Montana. 6 p. + 83 p. appendices + 3 maps.

WESTECH Environmental Services, Inc. 2010.
Milburn Property Conservation Easement – Baseline Ecological Inventory, October 2010. Unpublished technical report for Prickly Pear Land Trust by WESTECH, Helena, Montana. 7 p. + 56 p. appendices + 3 maps.

WESTECH Environmental Services, Inc. 2012.
Aspen Trails Property Conservation Easement – Baseline Ecological Inventory, September 2012. Unpublished technical report for Prickly Pear Land Trust by WESTECH, Helena, Montana. 8 p. + 78 p. appendices + 3 maps.

Western Technology and Engineering, Inc. 1988.
Vegetation Analysis, Kendall Venture Study Area, Fergus County, Montana. Unpublished technical report for Hydrometrics, Inc. and Kendall Venture by Western Technology and Engineering, Inc., Helena, Montana. 32 p.

Western Technology and Engineering, Inc. 1991a.
Baseline Range Condition Evaluation and Inventory of Sensitive Plant Species for the Bar None Ranch, Broadwater and Gallatin Counties, Montana, 1990 (Sixteen Mile Creek Conservation Easement). Unpublished technical report for The Nature Conservancy by Western Technology and Engineering, Inc., Helena, Montana. 23 p. + 105 p. appendices + 7 p. photos + map.

Western Technology and Engineering, Inc. 1991b.
Baseline Range Condition Evaluation and Inventory of Sensitive Plant Species for the Flying D Ranch, Madison and Gallatin Counties, Montana, 1990 (Spanish Peaks Conservation Easement). Unpublished technical report for The Nature Conservancy by Western Technology and Engineering, Inc., Helena, Montana. 24 p. + 140 p. appendices + 10 p. photos + map.

Youngblood, A., W. Padgett and A. Winward. 1985.
Riparian Community Type Classification of Eastern Idaho and Western Wyoming. USDA Forest Service R4-Ecology 85-01. Ogden, Utah. 78 p.

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APPENDICES

MONTANA LIMESTONE RESOURCES VEGETATION BASELINE

(Data by Sample Site)

APPENDIX	SAMPLE PARAMETERS	PAGE
A	List of Vascular Plant Species	A-i
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APPENDIX A

List of Vascular Plant Species Identified in the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

Appendix A
List of Vascular Plant Species Identified for the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

Binomial	Code	Common Name
NATIVE PERENNIAL GRAMINOIDS		
Agropyron dasystachyum (Elymus lanceolatus*)	Agr das	Thickspike wheatgrass
Agropyron smithii (Elymus smithii, Pascopyrum smithii*)	Agr smi	Western wheatgrass
Agropyron spicatum (Elymus spicatus, Pseudoroegneria spicata)	Agr spi	Bluebunch wheatgrass
Agropyron trachycaulum (Agropyron caninum, Elymus trachycaulus*)	Agr tra	Slender wheatgrass
Alopecurus aequalis*	Alo aeq	Shortawn foxtail
Aristida purpurea (Aristida longiseta, Aristida fendleriana)	Ari pur	Purple threeawn
Bouteloua gracilis	Bou gra	Blue grama
Bromus carinatus (Bromus marginatus)	Bro car	Mountain brome
Bromus porteri (Bromus anomalus)	Bro por	Nodding brome
Calamagrostis canadensis*	Cal can	Bluejoint reedgrass
Calamagrostis montanensis	Cal mon	Plains reedgrass
Calamagrostis rubescens	Cal rub	Pinegrass
Carex atherodes*	Car ath	Slough sedge
Carex athrostachya*	Car ato	Slender-beaked sedge
Carex eleocharis (Carex duriuscula*, Carex stenophylla)	Car ele	Needleleaf sedge
Carex filifolia	Car fil	Threadleaf sedge
Carex microptera*	Car mic	Small-winged sedge
Carex nebrascensis*	Car neb	Nebraska sedge
Carex pellita* (Carex lanuginosa)	Car pel	Woolly sedge
Carex petasata*	Car pet	Liddon's sedge
Carex praegracilis*	Car pra	Clustered field sedge
Carex praticola*	Car prt	Meadow sedge
Carex rossii	Car roi	Ross sedge
Carex sartwellii*	Car sar	Sartwell's sedge
Carex stipata*	Car sti	Sawbeak sedge
Carex tahoensis (Carex xerantica, Carex petasata*)	Car tah	Dryland sedge
Carex utriculata* (Carex rostrata)	Car utr	Southern beaked sedge
Danthonia unispicata	Dan uni	One-spike oatgrass
Eleocharis palustris* (Eleocharis erythropoda, Eleocharis macrostachya)	Ele pal	Common spikesedge
Elymus cinereus (Leymus cinereus*)	Ely cin	Basin wildrye
Elymus glaucus*	Ely gla	Blue wildrye
Festuca campestris (Festuca scabrella, Festuca altaica*)	Fes cam	Rough fescue
Festuca idahoensis*	Fes ida	Idaho fescue
Glyceria borealis*	Gly bor	Northern mannagrass
Glyceria grandis*	Gly gra	American mannagrass
Hordeum brachyantherum* (Hordeum caespitosum)	Hor bra	Meadow barley
Hordeum jubatum*	Hor jub	Foxtail barley
Juncus balticus (Juncus arcticus* var. balticus)	Jun bal	Baltic rush
Juncus nodosus*	Jun nod	Jointed rush
Koeleria macrantha (Koeleria cristata, Koeleria pyramidata)	Koe mac	Prairie junegrass
Muhlenbergia richardsonis*	Muh ric	Mat muhly
Oryzopsis hymenoides (Achnatherum hymenoides*)	Ory hym	Indian ricegrass
Poa fendleriana (Poa cusickii)	Poa fen	Mutton bluegrass
Poa secunda* (Poa juncifolia, Poa nevadensis, Poa sandbergii, Poa scabrella)	Poa sec	Sandberg's bluegrass
Schoenoplectus tabernaemontani* (Scirpus validus)	Sch tab	Softstem bulrush
Scirpus microcarpus*	Sci mic	Panicled bulrush
Sphenopholis obtusata*	Sph obt	Prairie wedgegrass
Stipa comata (Hesperostipa comata, Stipa curtiseta)	Sti com	Needle-and-thread
Stipa viridula (Nassella viridula)	Sti vir	Green needlegrass

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Binomial	Code	Common Name
INTRODUCED PERENNIAL GRAMINOIDS		
Agropyron cristatum (Agropyron desertorum)	Agr cri	Crested wheatgrass
Agropyron repens (Elymus repens*, Elytrigia repens)	Agr rep	Quackgrass
Agrostis stolonifera* (Agrostis alba)	Agr sto	Redtop
Alopecurus arundinaceus*	Alo aru	Creeping meadow foxtail
Alopecurus pratensis*	Alo pra	Meadow foxtail
Bromus inermis*	Bro ine	Smooth brome
Dactylis glomerata*	Dac glo	Orchard-grass
Elymus junceus (Psathyrostachys juncea*)	Ely jun	Russian wildrye
Phleum pratense*	Phl pra	Common timothy
Poa compressa*	Poa com	Canada bluegrass
Poa palustris*	Poa pal	Fowl bluegrass
Poa pratensis*	Poa pra	Kentucky bluegrass
Schedonorus arundinaceus (Festuca arundinacea*)	Sch aru	Tall fescue
NATIVE ANNUAL GRAMINOIDS		
Beckmannia syzigachne*	Bec syz	American sloughgrass
Juncus bufonius*	Jun buf	Toad rush
Vulpia octoflora* (Festuca octoflora)	Vul oct	Sixweeks fescue
INTRODUCED ANNUAL GRAMINOIDS		
Bromus briziformis*	Bro bri	Rattlesnake brome
Bromus japonicus (Bromus arvensis*)	Bro jap	Japanese brome
Bromus tectorum	Bro tec	Cheatgrass brome
NATIVE PERENNIAL FORBS AND SUBSHRUBS		
Achillea millefolium*	Ach mil	Common yarrow
Agoseris glauca*	Ago gla	Prairie agoseris
Allium cernuum*	All cer	Nodding onion
Allium textile	All tex	Textile onion
Anemone patens	Ane pat	Pasqueflower
Antennaria dimorpha	Ant dim	Low pussytoes
Antennaria microphylla	Ant mic	Littleleaf pussytoes
Antennaria neglecta* (Antennaria howellii)	Ant neg	Field pussytoes
Antennaria parvifolia	Ant par	Small-leaf pussytoes
Antennaria rosea	Ant ros	Rosy pussytoes
Antennaria umbrinella*	Ant umb	Umber pussytoes
Apocynum cannabinum*	Apo can	Hemp dogbane
Arenaria congesta (Eremogone congesta)	Are con	Ballhead sandwort
Arnica chamissonis*	Arn cha	Meadow arnica
Arnica cordifolia	Arn cor	Heartleaf arnica
Arnica sororia	Arn sor	Twin arnica
Artemisia dracunculus	Art dra	False-tarragon sagewort
Artemisia frigida	Art fri	Fringed sagewort
Artemisia ludoviciana*	Art lud	Cudweed sagewort
Asclepias speciosa*	Asc spe	Showy milkweed
Astragalus adsurgens	Ast ads	Prairie milkvetch
Astragalus agrestis*	Ast agr	Field milkvetch
Astragalus atropubescens (Astragalus stenophyllus)	Ast atr	Kelsey's milkvetch
Astragalus cibarius	Ast cib	Browse milkvetch
Astragalus crassicarpus	Ast cra	Groundplum milkvetch
Astragalus drummondii	Ast dru	Drummond's milkvetch
Astragalus miser	Ast mis	Weedy milkvetch
Astragalus purshii	Ast pur	Pursh's milkvetch
Balsamorhiza sagittata	Bal sag	Arrowleaf balsamroot
Berberis repens (Mahonia repens)	Ber rep	Creeping Oregon-grape

Appendix A
List of Vascular Plant Species Identified for the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

Binomial	Code	Common Name
Besseya wyomingensis	Bes wyo	Wyoming kittentail
Boechera calderi	Boe cal	Calder's rockcress
Boechera pendulocarpa (Arabis holboellii var. pendulocarpa, Boechera holboellii*)	Boe pen	Pendulous holboell's rockcress
Campanula rotundifolia*	Cam rot	Roundleaf harebell
Castilleja pallescens	Cas pal	Pale paintbrush
Cerastium arvense*	Cer arv	Field chickweed
Chamerion angustifolium* (Epilobium angustifolium, Chamaenerion angustifolium)	Cha ang	Fireweed
Cirsium undulatum*	Cir und	Wavyleaf thistle
Comandra umbellata*	Com umb	Pale bastard toadflax
Crepis acuminata	Cre acu	Tapertip hawksbeard
Crepis atribarba	Cre atr	Slender hawksbeard
Crepis intermedia	Cre int	Gray hawksbeard
Crepis modocensis	Cre mod	Low hawksbeard
Crepis occidentalis	Cre occ	Western hawksbeard
Crepis runcinata*	Cre run	Meadow hawksbeard
Cryptantha spiculifera (Cryptantha interrupta)	Cry spi	Pointed cryptantha
Cymopterus glaucus	Cym gla	Gray spring parsley
Delphinium bicolor	Del bic	Low larkspur
Dodecatheon conjugens*	Dod con	Slimpod shooting star
Douglasia montana	Dou mon	Rocky Mountain douglasia
Drymocallis arguta* (Potentilla arguta)	Dry arg	Tall cinquefoil
Drymocallis glandulosa (Potentilla glandulosa*)	Dry gla	Sticky cinquefoil
Epilobium ciliatum* (Epilobium glandulosum)	Epi cil	Common willow-herb
Erigeron compositus	Eri com	Cutleaf daisy
Erigeron corymbosus	Eri cor	Long-leaved fleabane
Erigeron glabellus*	Eri gla	Smooth fleabane
Erigeron pumilus	Eri pum	Shaggy fleabane
Erigeron speciosus	Eri spe	Showy fleabane
Erigeron subtrinervis	Eri sub	Three nerve fleabane
Eriogonum umbellatum	Eri umb	Sulfur buckwheat
Eurybia conspicua (Aster conspicuus)	Eur con	Western showy aster
Fragaria virginiana*	Fra vir	Virginia strawberry
Fritillaria pudica	Fri pud	Yellow bell
Gaillardia aristata	Gai ari	Blanket-flower
Galium boreale*	Gal bor	Northern bedstraw
Galium trifidum*	Gal trf	Small bedstraw
Gaura coccinea	Gau coc	Scarlet gaura
Geranium viscosissimum*	Ger vis	Sticky geranium
Geum macrophyllum*	Geu mac	Large leaf avens
Geum triflorum*	Geu tri	Prairiesmoke
Glycyrrhiza lepidota*	Gly lep	American licorice
Gutierrezia sarothrae	Gut sar	Broom snakeweed
Helenium autumnale*	Hel aut	Common sneezeweed
Heracleum lanatum (Heracleum maximum*, Heracleum sphondylium)	Her lan	Cow parsnip
Heterotheca villosa (Chrysopsis villosa)	Het vil	Hairy goldenaster
Heuchera cylindrica	Heu cyl	Roundleaf alumroot
Heuchera parvifolia	Heu par	Littleleaf alumroot
Hieracium scouleri (Hieracium albertinum, Hieracium cynoglossoides)	Hie sco	Woolly hawkweed
Ionactis alpina (Aster scopulorum)	Ion alp	Crag aster
Iris missouriensis*	Iri mis	Rocky Mountain iris
Lactuca pulchella (Lactuca oblongifolia, Lactuca tatarica*)	Lac pul	Chicory lettuce
Lewisia rediviva	Lew red	Bitterroot
Linum lewisii (Linum perenne)	Lin lew	Blue flax
Lithophragma parviflorum	Lit par	Smallflower fringecup
Lithospermum incisum	Lit inc	Yellow gromwell
Lithospermum ruderale	Lit rud	Western gromwell

Appendix A
List of Vascular Plant Species Identified for the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

Binomial	Code	Common Name
Lomatium cous	Lom cou	Cous biscuitroot
Lomatium macrocarpum	Lom mac	Large-fruited lomatium
Lomatium triternatum	Lom tri	Nine-leaf lomatium
Lupinus polyphyllus* (Lupinus wyethii)	Lup pol	Many-leaved lupine
Lupinus sericeus	Lup ser	Silky lupine
Lysimachia ciliata*	Lys cil	Fringed loosestrife
Mentha arvensis*	Men arv	Field mint
Mertensia oblongifolia*	Mer obl	Oblongleaf bluebells
Mimulus guttatus*	Mim gut	Common monkey-flower
Minuartia nuttallii (Arenaria nuttallii)	Min nut	Nuttall's sandwort
Moehringia lateriflora* (Arenaria lateriflora)	Moe lat	Bluntleaf sandwort
Musineon divaricatum	Mus div	Leafy musineon
Myosotis laxa*	Myo lax	Bay forget-me-not
Opuntia fragilis	Opu fra	Brittle pricklypear
Opuntia polyacantha	Opu pol	Plains pricklypear
Oxytropis besseyi	Oxy bes	Bessey's locoweed
Penstemon eriantherus	Pen eri	Fuzzytongue penstemon
Penstemon nitidus	Pen nit	Waxleaf penstemon
Penstemon procerus*	Pen pro	Littleflower penstemon
Perideridia montana (Perideridia gairdneri*)	Per mon	Gairdner's yampa
Phacelia hastata	Pha has	Silverleaf phacelia
Phlox hoodii	Phl hoo	Hood's phlox
Phlox longifolia	Phl lon	Long-leaf phlox
Physaria spatulata (Lesquerella alpina var. spatulata)	Phy spa	Spatula-leaf bladderpod
Polemonium pulcherrimum	Pol pul	Showy polemonium
Polygonum amphibium (Polygonum coccineum, Persicaria amphibia*)	Pol amp	Water ladysthumb
Potentilla anserina (Argentina anserina*)	Pot ans	Common silverweed
Potentilla gracilis*	Pot gra	Slender cinquefoil
Prosartes trachycarpa* (Disporum trachycarpum)	Pro tra	Wartberry fairy-bell
Prunella vulgaris*	Pru vul	Self-heal
Pyrrocoma integrifolia (Haplopappus integrifolius)	Pyr int	Entire-leaved goldenweed
Ranunculus aquatilis* (Ranunculus longirostris, Ranunculus subrigidus)	Ran aqu	Hairleaf water buttercup
Ranunculus cymbalaria*	Ran cym	Rocky Mountain buttercup
Ranunculus glaberrimus*	Ran gla	Sagebrush buttercup
Ranunculus gmelinii*	Ran gme	Gmelin's buttercup
Ranunculus macounii*	Ran mac	Macoun's buttercup
Ranunculus uncinatus*	Ran uni	Little buttercup
Rumex occidentalis*	Rum occ	Western dock
Rumex salicifolius (Rumex triangulivalvis*)	Rum sal	Willow dock
Schoenocrambe linifolia	Sch lin	Flaxleaf plainsmustard
Scutellaria galericulata*	Scu gal	Marsh skullcap
Sedum lanceolatum	Sed lan	Lanceleaf stonecrop
Senecio canus (Packera cana)	Sen can	Woolly groundsel
Senecio integerrimus*	Sen int	Western groundsel
Senecio serra	Sen ser	Tall goundsel
Silene drummondii (Lychnis drummondii)	Sil dru	Drummond campion
Silene menziesii*	Sil men	Menzie's silene
Sisyrinchium idahoense*	Sis ida	Idaho blue-eyed grass
Sium suave*	Siu sua	Hemlock water-parsnip
Smilacina stellata (Maianthemum stellatum*)	Smi ste	Starry false solomon's seal
Solidago gigantea*	Sol gig	Giant goldenrod
Solidago missouriensis	Sol mis	Missouri goldenrod
Sphaeralcea coccinea	Sph coc	Scarlet globemallow
Stachys palustris (Stachys pilosa*)	Sta pal	Swamp hedge-nettle
Stellaria longipes*	Ste lon	Longstalk starwort

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Binomial	Code	Common Name
Stenotus acaulis (Haplopappus acaulis)	Ste aca	Cushion goldenweed
Symphyotrichum ascendens* (Aster chilensis)	Sym asc	Long-leaved aster
Symphyotrichum campestre (Aster campestris)	Sym cam	Meadow aster
Symphyotrichum falcatum* (Aster falcatus)	Sym fal	Creeping white prairie aster
Symphyotrichum laeve* (Aster laevis)	Sym lae	Smooth aster
Thalictrum dasycarpum*	Tha das	Purple meadowrue
Townsendia hookeri	Tow hoo	Hooker's townsendia
Typha latifolia*	Typ lat	Common cattail
Urtica dioica*	Urt dio	Stinging nettle
Valeriana dioica*	Val dio	Northern valerian
Veronica americana*	Ver ame	American speedwell
Vicia americana*	Vic ame	American vetch
Viola adunca*	Vio adu	Early blue violet
Viola nuttallii	Vio nut	Yellow prairie violet
Zigadenus venenosus (Toxicoscordion venenosum*)	Zig ven	Meadow death-camas
INTRODUCED PERENNIAL FORBS		
Acroptilon repens (Centaurea repens)	Acr rep	Russian knapweed
Centaurea maculosa (Centaurea stoebe)	Cen mac	Spotted knapweed
Cirsium arvense*	Cir arv	Canada thistle
Convolvulus arvensis	Con arv	Field bindweed
Euphorbia esula	Eup esu	Leafy spurge
Lepidium appelianum (Cardaria pubescens*)	Lep app	Globe-podded hoarycress
Lepidium latifolium*	Lep lat	Broad-leaved pepperweed
Linaria dalmatica	Lin dal	Dalmatian toadflax
Medicago sativa*	Med sat	Alfalfa
Plantago major*	Pla maj	Common plantain
Rumex crispus*	Rum cri	Curl dock
Silene vulgaris (Silene cucubalus)	Sil vul	Bladder campion
Tanacetum vulgare*	Tan vul	Common tansy
Taraxacum laevigatum	Tar lae	Red-seeded dandelion
Taraxacum officinale*	Tar off	Common dandelion
Trifolium hybridum*	Tri hyb	Alsike clover
Trifolium pratense*	Tri pra	Red clover
Trifolium repens*	Tri rep	White Dutch clover
Veronica anagallis-aquatica*	Ver ana	Water speedwell
FERNS AND ALLIES		
Cystopteris fragilis*	Cys fra	Brittle bladder-fern
Equisetum arvense*	Equ arv	Common horsetail
Equisetum laevigatum*	Equ lae	Smooth horsetail
Selaginella densa	Sel den	Compact clubmoss
Woodsia scopulina	Woo sco	Rocky Mountain woodsia
NATIVE ANNUAL/BIENNIAL FORBS		
Amaranthus retroflexus*	Ama ret	Rough pigweed
Androsace occidentalis*	And occ	Western rockjasmine
Artemisia biennis*	Art bie	Biennial wormwood
Boechera divaricarpa (Arabis divaricarpa, Arabis confinis, Boechera grahamii*)	Boe div	Spreading-pod rockcress
Boechera retrofracta (Arabis holboellii var. retrofracta, Boechera holboellii*)	Boe ret	Reflexed Holboell's rockcress
Callitriche palustris* (Callitriche verna)	Cal pal	Common water-starwort
Cardamine pensylvanica*	Car pes	Pennsylvania bittercress
Chenopodium fremontii*	Che fre	Fremont's goosefoot
Chenopodium leptophyllum*	Che lep	Slimleaf goosefoot
Chenopodium pratericola	Che pra	Slimleaf goosefoot

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Binomial	Code	Common Name
Chenopodium simplex (Chenopodium gigantospermum, Chenopodium hybridum)	Che sim	Mapleleaf goosefoot
Cleome serrulata*	Cle ser	Rocky Mountain bee-plant
Collinsia parviflora	Col par	Blue-eyed Mary
Collomia linearis*	Col lin	Narrow-leaf collomia
Descurainia incana* (Descurainia richardsonii)	Des inc	Richardson's tansymustard
Descurainia pinnata	Des pin	Pinnate tansymustard
Draba nemorosa	Dra nem	Woods draba
Dracocephalum parviflorum* (Moldavica parviflora)	Dra par	American dragonhead
Ellisia nyctelea*	Ell nyc	Nyctelea
Epilobium brachycarpum (Epilobium paniculatum)	Epi bra	Autumn willow-herb
Erigeron divergens	Eri div	Spreading fleabane
Erysimum cheiranthoides*	Ery che	Treacle mustard
Euphorbia glyptosperma	Eup gly	Corrugate-seeded spurge
Euphorbia serpyllifolia	Eup ser	Thyme-leaf spurge
Galium aparine*	Gal apa	Cleavers
Grindelia squarrosa*	Gri squ	Curlycup gumweed
Hackelia deflexa	Hac def	Nodding stickseed
Helianthus petiolaris	Hel pet	Prairie sunflower
Lappula redowskii	Lap red	Western stickseed
Lepidium densiflorum*	Lep den	Prairie pepperweed
Lepidium virginicum	Lep vir	Virginia pepperweed
Linanthus septentrionalis	Lin sep	Northern linanthus
Madia glomerata*	Mad glo	Cluster tarweed
Microsteris gracilis*	Mic gra	Pink microsteris
Orthocarpus luteus*	Ort lut	Yellow owl clover
Orthocarpus tenuifolius	Ort ten	Thinleaf owl clover
Parietaria pensylvanica*	Par pen	Pellitory
Phacelia linearis	Pha lin	Threadleaf phacelia
Plantago patagonica	Pla pat	Woolly plantain
Polygonum douglasii*	Pol dou	Douglas knotweed
Polygonum erectum*	Pol ere	Erect knotweed
Polygonum ramosissimum*	Pol ram	Bush smartweed
Potentilla biennis*	Pot bie	Biennial cinquefoil
Potentilla norvegica*	Pot nor	Norwegian cinquefoil
Ranunculus sceleratus*	Ran sce	Celery-leaved buttercup
Rorippa palustris* (Rorippa islandica)	Ror pal	Marsh yellowcress
Solanum triflorum	Sol tri	Cut-leaved nightshade
INTRODUCED ANNUAL/BIENNIAL FORBS		
Alyssum alyssoides	Aly aly	Pale alyssum
Alyssum desertorum	Aly des	Desert alyssum
Amaranthus hybridus	Ama hyb	Smooth pigweed
Asperugo procumbens*	Asp pro	Madwort
Camelina microcarpa*	Cam mic	Littlepod falseflax
Capsella bursa-pastoris*	Cap bur	Shepherd's purse
Carduus nutans*	Car nut	Musk thistle
Cirsium vulgare*	Cir vul	Bull thistle
Cynoglossum officinale*	Cyn off	Common hound's-tongue
Descurainia sophia	Des sop	Flixweed tansymustard
Filago arvensis (Logfia arvensis)	Fil arv	Field filago
Hyoscyamus niger	Hyo nig	Black henbane
Kochia scoparia (Bassia scoparia*)	Koc sco	Belvedere summercypress
Lactuca serriola*	Lac ser	Prickly lettuce
Lepidium perfoliatum*	Lep per	Clasping pepperweed
Malva neglecta (Malva rotundifolia)	Mal neg	Dwarf mallow
Medicago lupulina*	Med lup	Black medick

Appendix A
List of Vascular Plant Species Identified for the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

Binomial	Code	Common Name
Melilotus alba	Mel alb	White sweetclover
Melilotus officinalis*	Mel off	Yellow sweetclover
Myosotis micrantha (Myosotis stricta*)	Myo mic	Blue scorpion-grass
Polygonum aviculare* (Polygonum arenastrum)	Pol avi	Prostrate knotweed
Silene noctiflora	Sil noc	Night-flowering silene
Sisymbrium altissimum*	Sis alt	Tumblemustard
Sisymbrium loeselii	Sis loe	Loesel tumblemustard
Thlaspi arvense*	Thl arv	Fanweed
Tragopogon dubius	Tra dub	Common salsify
Verbascum thapsus*	Ver tha	Flannel mullein
Veronica verna	Ver ver	Spring speedwell
NATIVE SHRUBS AND VINES		
Acer glabrum*	Ace gla	Rocky Mountain maple
Alnus incana*	Aln inc	Thinleaf alder
Amelanchier alnifolia*	Ame aln	Western serviceberry
Arctostaphylos uva-ursi*	Arc uva	Kinnikinnick
Artemisia tridentata	Art tri	Big sagebrush
Artemisia tripartita	Art trp	Three-tip sagebrush
Chrysothamnus viscidiflorus	Chr vis	Green rabbitbrush
Clematis ligusticifolia*	Cle lig	Western virgins-bower
Clematis occidentalis	Cle occ	Western clematis
Cornus sericea (Cornus stolonifera, Cornus alba*)	Cor ser	Red-osier dogwood
Ericameria nauseosa (Chrysothamnus nauseosus)	Eri nau	Rubber rabbitbrush
Krascheninnikovia lanata (Ceratoides lanata)	Kra lan	Winterfat
Philadelphus lewisii	Phi lew	Mockorange
Physocarpus malvaceus	Phy mal	Mallow ninebark
Prunus virginiana*	Pru vir	Common chokecherry
Purshia tridentata	Pur tri	Antelope bitterbrush
Ribes americanum*	Rib ame	American black currant
Ribes aureum* (Ribes odoratum)	Rib aur	Golden currant
Ribes cereum	Rib cer	Wax currant
Ribes inerme*	Rib ine	Whitestem gooseberry
Ribes setosum (Ribes oxyacanthoides*)	Rib set	Bristly gooseberry
Rosa acicularis*	Ros aci	Prickly rose
Rosa arkansana*	Ros ark	Prairie rose
Rosa woodsii*	Ros woo	Wood's rose
Rubus idaeus*	Rub ida	Red raspberry
Salix bebbiana*	Sal beb	Bebb willow
Salix boothii* (Salix myrtillifolia)	Sal boo	Blueberry willow
Salix drummondiana*	Sal dru	Drummond willow
Salix eriocephala var. watsonii (Salix lutea*)	Sal eriw	Yellow willow
Salix exigua*	Sal exi	Sandbar willow
Salix lasiandra* var. caudata	Sal las	Whiplash willow
Shepherdia canadensis*	She can	Canada buffaloberry
Sorbus scopulina*	Sor sco	Cascade mountain-ash
Symphoricarpos albus*	Sym alb	Common snowberry
Symphoricarpos occidentalis*	Sym occ	Western snowberry
Tetradymia canescens	Tet can	Gray horsebrush
INTRODUCED SHRUBS AND VINES		
Solanum dulcamara*	Sol dul	Bittersweet nightshade

Appendix A
List of Vascular Plant Species Identified for the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

Binomial	Code	Common Name
NATIVE TREES		
Betula occidentalis*	Bet occ	Water birch
Juniperus scopulorum	Jun sco	Rocky Mountain juniper
Pinus ponderosa*	Pin pon	Ponderosa pine
Populus angustifolia*	Pop ang	Narrowleaf cottonwood
Populus balsamifera* (Populus trichocarpa)	Pop bal	Black cottonwood
Populus tremuloides*	Pop tre	Quaking aspen
Pseudotsuga menziesii*	Pse men	Douglas-fir

Scientific nomenclature follows Lesica (2012). The more recent, most commonly used synonyms, partial synonyms/combinations, and misapplied names are given in parentheses. These, as well as common names, are taken from a variety of sources including:

Cronquist, A., A.H. Holmgren, N. H. Holmgren, J.L. Reveal and P.K. Holmgren. 1972-2012.
Intermountain Flora . 6 volumes. The New York Botanical Garden, New York City.

Flora of North America Editorial Committee, eds. 1993+.
Flora of North America North of Mexico. 16+ volumes. Oxford University Press, New York and Oxford.

Gleason, H.A. and A. Cronquist. 1991.
Manual of Vascular Plants of Northeastern United States and Adjacent Canada. Second edition. The New York Botanical Garden, New York City. 910 p.

Great Plains Flora Association. 1986.
Flora of the Great Plains . University Press of Kansas, Lawrence. 1392 p.

Hitchcock, C.L., A. Cronquist, M. Ownbey and J.W. Thompson. 1955-1969.
Vascular Plants of the Pacific Northwest . 5 volumes. University of Washington Press, Seattle.

Kartesz, J.T. 1994.
A Synonymized Checklist of the Vascular Flora of the United States, Canada and Greenland. Second edition. Timber Press. Portland, Oregon. 2 volumes.

Lesica, P. 2012.
Manual of Montana Vascular Plants. Botanical Research Institute of Texas Press. Fort Worth, Texas. 771 p.

Lichvar, R. 2012.
The National Wetland Plant List . ERDC/CRREL TN-12-11. Hanover, NH: U.S. Army Engineer Research and Development Center, Cold Regions Research and Engineering Laboratory. http://wetland_plants.usace.army.mil/

*An asterisk indicates nomenclature appearing on the National Wetland Plant List (Lichvar 2012). Taxa with no asterisk do not appear on the NWPL, and are to be considered "Upland" species in the context of wetland inventories; additionally, the 2012 NWPL rates wetland plants at only the species level and does not distinguish among infraspecific taxa in assigning wetland ratings.

APPENDIX B
Percent Canopy Cover and Constancy by Plot for Vegetation Types Identified in the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

TABLE	VEGETATION TYPE[1]	PAGE
	GRASSLAND	
B1	*Agropyron spicatum/Poa secunda* habitat type	B-1
B2	*Agropyron spicatum/Agropyron smithii* habitat type	B-4
B3	*Festuca idahoensis/Agropyron spicatum* habitat type	B-10
	Festuca campestris/Agropyron spicatum habitat type	
	TAME PASTURE	
B4	Tame Pasture	B-15
	SHRUBLAND	
B5	*Artemisia tridentata/Poa secunda* community type	B-17
	Artemisia tridentata /Agropyron smithii community type	
B6	*Artemisia tridentata/Agropyron spicatum* habitat type	B-20
	Artemisia tridentata/Festuca idahoensis habitat type	
B7	*Artemisia tridentata/Festuca campestris* habitat type	B-23
	Symphoricarpos occidentalis/Poa pratensis community type	
	FOREST AND WOODLAND	
B8	*Juniperus scopulorum/Agropyron spicatum* community type	B-29
	Pinus ponderosa/Agropyron spicatum habitat type	
B9	*Pseudotsuga menziesii/Agropyron spicatum* habitat type	B-34
	Pseudotsuga menziesii/Festuca campestris habitat type	
B10	*Pseudotsuga menziesii/Physocarpus malvaceus* habitat type	B-38
	RIPARIAN AND WETLAND	
B11	*Poa pratensis* community type	B-43
	Agrostis stolonifera community type	
	Bromus inermis community type	
	Typha latifolia community type	
B12	*Carex nebraskensis* community type	B-48
	Carex pellita habitat type	
	Carex utriculata habitat type	
B13	*Symphoricarpos occidentalis* community type	B-53
	Salix exigua-Cornus sericea community type	
B14	*Juniperus scopulorum/Cornus sericea* habitat type	B-57
	Populus balsamifera/Symphoricarpos occidentalis community type	
	Populus balsamifera/Cornus sericea community type	
	Populus tremuloides/Cornus sericea habitat type	

[1]Grassland and shrubland habitat types were identified following Mueggler and Stewart (1980); Forest habitat types follow Pfister *et al.* (1977), and Wetland/Riparian types follow Hansen *et al.* (1995).

All plot locations are shown on the vegetation type map (Plate 1).

Wetlands in the study area are often associated with relatively narrow streamside fringes. Such sites are generally missed by the stratified random procedure used to select vegetation sample sites, whereas these sites are specifically targeted for identification and delineation during the baseline wetland inventory. Accordingly, selected riparian and wetland cover/composition data were drawn from the wetland inventory to supplement the vegetation baseline database. These sample sites are prefixed with "RW" (see Table 1).

Footnotes for the tables in Appendix B:

Trace cover values were assigned 0.3 percent for each 0.01-acre canopy cover estimation plot.
Constancy values apply only to species recorded in the 0.01-acre plots.
Binomials follow Lesica (2012).

APPENDIX B
Percent Canopy Cover and Constancy by Plot for Vegetation Types Identified in the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

Site Parameters:

Topography codes:

Ben = Bench	Low, Lower = Lower slope	Swa = Swale
Bnk = Bank	Mid = Mid slope	Ter = Terrace
Bot = Bottom	Plat = Plateau	Toe = Toeslope
Brk = Breaks	Rid = Ridge	Upper = Upper slope
Flo = Floodplain	Sho = Shoulder	

Configuration codes:

S = Straight	V = Concave
U = Undulating	X = Convex

Slope Aspect and Photo Azimuth: All compass readings are magnetic north, *i.e.,* the compass declination was set at zero.

Table B1

Percent Canopy Cover by Class and Species for Nine Sample Sites in the *Agropyron spicatum/Poa secunda* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Agropyron spicatum/Poa secunda* h.t.**										
	PLOT NUMBER									**Mean**	***Con-***
	42	48	50	53	54	55	56	59	70	**Cover**	***stancy***
										n=9	
SITE PARAMETERS*											
Slope (percent)	65	5	12	15	35-45	30	12-14	12-14	35-50		
Aspect (degrees mag. north)	158	344	144	220	070	144	148	180	120		
Topography	Mid	Mid	Mid	Low-Mid	U-Sho.	Mid	Upper	Mid-U	Low-Mid		
Configuration	Convex	Concave	Convex	Convex	Convex	Convex	Convex	Concave	Convex		
Photo # (Digital)	338-339	299-300	727-728	770-771	768-769	766-767	164-165	173-175	777-778		
Photo azimuth	220-040	260-080	080-260	130-310	170-350	055-235	240-062	278-180	040-220		
Investigator	DB/KL	DB/KL	KS/ED	KS/ED	KS/ED	KS/ED	ED	ED	KS/KL		
Date	7/12/13	7/11/13	7/11/13	7/12/13	7/12/13	7/12/13	7/9/13	7/10/13	7/13/13		
GROUND COVER											
Bare Ground		42	30	25	34	69	30	36	14	**31.11**	***89***
Rock	65	0.3	40	45	44	9	40	30	62	**37.26**	***100***
Litter	32	51	10	13	12	18	24	28	20	**23.11**	***100***
Lichens		2	3	10	3	0.3	0.3	0.3	0.3	**2.13**	***89***
Moss		1	14	4	4	0.3				**2.59**	***56***
Basal Vegetation	3	4	3	3	3	3	5	5	4	**3.67**	***100***
VEGETATION STRUCTURE (nonstratified cover)											
Total Vegetation	79	67	28	38	38	62	52	68	76	**56.44**	***100***
Perennial Graminoids	37	41	18	23	22	21	32	58	23	**30.56**	***100***
Annual Graminoids	35	1	6	5	12	8	6	13	42	**14.22**	***100***
Perennial Forbs and Subshrubs	20	21	6	12	7	42	16	22	28	**19.33**	***100***
Annual/Biennial Forbs	2	11	0.3	2	1	3	4	4	20	**5.26**	***100***
Shrubs	16	2				1	9		2	**3.33**	***56***
Trees 0.01-acre											
Trees 0.1-acre	4								1	**0.56**	***22***
CLASS\SPECIES											
NATIVE PERENNIAL GRAMINOIDS											
Agropyron smithii									2	**0.22**	***11***
Agropyron spicatum	37	1	10	6	8	12	18	58	10	**17.78**	***100***
Danthonia unispicata		0.3								**0.03**	***11***
Festuca campestris								0.3		**0.03**	***11***
Koeleria macrantha		3	0.3	1		3	2	2	0.3	**1.29**	***78***
Poa secunda	0.3	25	8	18	14	5	8	6	12	**10.70**	***100***
Stipa comata						2	10			**1.33**	***22***
TOTAL NPG	**37.3**	**29.3**	**18.3**	**25.0**	**22.0**	**22.0**	**38.0**	**66.3**	**24.3**	**31.39**	***100***
INTRODUCED PERENNIAL GRAMINOIDS											
Poa compressa		5								**0.56**	***11***
Poa pratensis		12								**1.33**	***11***
TOTAL IPG	**0.0**	**17.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.89**	***11***
INTRODUCED ANNUAL GRAMINOIDS											
Bromus briziformis		0.3	0.3		4					**0.51**	***33***
Bromus japonicus		1	4		5		6	3	4	**2.56**	***67***
Bromus tectorum	35	0.3	2	5	5	8		11	40	**11.81**	***89***
TOTAL IAG	**35.0**	**1.6**	**6.3**	**5.0**	**14.0**	**8.0**	**6.0**	**14.0**	**44.0**	**14.88**	***100***

Table B1

Percent Canopy Cover by Class and Species for Nine Sample Sites in the *Agropyron spicatum/Poa secunda* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Agropyron spicatum/Poa secunda* h.t.**										
	PLOT NUMBER									**Mean**	***Con-***
	42	48	50	53	54	55	56	59	70	**Cover**	***stancy***
										n=9	
NATIVE PERENNIAL FORBS AND SUBSHRUBS											
Achillea millefolium		3	0.3	0.3	0.3	2	1	1	0.3	**0.91**	***89***
Allium textile					0.3					**0.03**	***11***
Antennaria microphylla		3								**0.33**	***11***
Antennaria parvifolia								0.3		**0.03**	***11***
Artemisia dracunculus		0.3							1	**0.14**	***22***
Artemisia frigida		2	0.3	0.3	0.3	0.3	0.3	0.3		**0.42**	***78***
Astragalus adsurgens							0.3			**0.03**	***11***
Astragalus agrestis								0.3		**0.03**	***11***
Astragalus drummondii		1							1	**0.22**	***22***
Astragalus purshii		0.3							0.3	**0.07**	***22***
Balsamorhiza sagittata								3	6	**1.00**	***22***
Campanula rotundifolia		0.3								**0.03**	***11***
Cirsium undulatum				0.3	0.3		0.3			**0.10**	***33***
Comandra umbellata							1			**0.11**	***11***
Erigeron compositus			1	3	1	0.3	0.3	0.3		**0.66**	***67***
Erigeron pumilus				0.3			0.3			**0.07**	***22***
Gaura coccinea		0.3					1	1	0.3	**0.29**	***44***
Gutierrezia sarothrae		1		2	0.3					**0.37**	***33***
Heterotheca villosa					0.3		6	0.3		**0.73**	***33***
Ionactis alpina							0.3			**0.03**	***11***
Lewisia rediviva								0.3		**0.03**	***11***
Linum lewisii	0.3				0.3	0.3				**0.10**	***33***
Lithospermum ruderale	1							0.3		**0.14**	***22***
Lomatium cous			0.3							**0.03**	***11***
Lomatium macrocarpum							0.3	5		**0.59**	***22***
Lomatium triternatum				0.3	0.3	0.3				**0.10**	***33***
Lupinus polyphyllus		0.3					1			**0.14**	***22***
Lupinus sericeus							2		2	**0.44**	***22***
Musineon divaricatum		0.3				0.3	1			**0.18**	***33***
Opuntia polyacantha				0.3			1	0.3	0.3	**0.21**	***44***
Penstemon eriantherus			0.3		0.3		0.3			**0.10**	***33***
Phacelia hastata	0.3									**0.03**	***11***
Phlox hoodii			0.3	2			0.3	3		**0.62**	***44***
Senecio canus			0.3							**0.03**	***11***
Solidago missouriensis		3				1	1			**0.56**	***33***
Sphaeralcea coccinea							0.3	0.3	1	**0.18**	***33***
Stenotus acaulis			0.3	2			0.3			**0.29**	***33***
Symphyotrichum falcatum							0.3	1	1	**0.26**	***33***
Vicia americana	0.3					0.3	1	0.3	2	**0.43**	***56***
TOTAL NPF	**1.9**	**14.8**	**3.1**	**10.8**	**3.7**	**4.8**	**19.6**	**17.0**	**15.2**	**10.10**	***100***
INTRODUCED PERENNIAL FORBS											
Centaurea maculosa		7	3	0.3	3	30		8		**5.70**	***67***
Linaria dalmatica	18			0.3	1	12		1	16	**5.37**	***67***
Taraxacum laevigatum		0.3	0.3	1		0.3				**0.21**	***44***
TOTAL IPF	**18.0**	**7.3**	**3.3**	**1.6**	**4.0**	**42.3**	**0.0**	**9.0**	**16.0**	**11.28**	***89***

Table B1

Percent Canopy Cover by Class and Species for Nine Sample Sites in the *Agropyron spicatum/Poa secunda* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Agropyron spicatum/Poa secunda* h.t.**										
	PLOT NUMBER									**Mean**	***Con-***
	42	48	50	53	54	55	56	59	70	**Cover**	***stancy***
										n=9	
NATIVE ANNUAL/BIENNIAL FORBS											
Boechera retrofracta									0.3	**0.03**	***11***
Collomia linearis		0.3						1		**0.14**	***22***
Epilobium brachycarpum		0.3							0.3	**0.07**	***22***
Microsteris gracilis		0.3								**0.03**	***11***
Phacelia linearis	0.3						0.3			**0.07**	***22***
Plantago patagonica									0.3	**0.03**	***11***
TOTAL NA/BF	**0.3**	**0.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**	**1.0**	**0.9**	**0.38**	***56***
INTRODUCED ANNUAL/BIENNIAL FORBS											
Alyssum alyssoides	0.3	4	0.3	0.3	0.3	1		1	18	**2.80**	***89***
Alyssum desertorum							2			**0.22**	***11***
Camelina microcarpa	1	0.3		1	0.3	1	0.3	0.3		**0.47**	***78***
Carduus nutans		0.3			0.3					**0.07**	***22***
Filago arvensis		0.3						1	1	**0.26**	***33***
Lepidium perfoliatum		0.3								**0.03**	***11***
Melilotus officinalis		6								**0.67**	***11***
Sisymbrium altissimum	0.3									**0.03**	***11***
Tragopogon dubius	0.3	0.3		1	0.3	1	2	1	1	**0.77**	***89***
TOTAL IA/BF	**1.9**	**11.5**	**0.3**	**2.3**	**1.2**	**3.0**	**4.3**	**3.3**	**20.0**	**5.31**	***100***
SHRUBS											
Artemisia tridentata		2					4		0.3	**0.70**	***33***
Prunus virginiana	4									**0.44**	***11***
Rosa arkansana									2	**0.22**	***11***
Rosa woodsii	14	0.3								**1.59**	***22***
Tetradymia canescens						1	5			**0.67**	***22***
TOTAL NATIVE SHRUBS	**18.0**	**2.3**	**0.0**	**0.0**	**0.0**	**1.0**	**9.0**	**0.0**	**2.3**	**3.62**	***56***
TREES 0.01-acre											
TOTAL TREES 0.01-acre	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.00**	***0***
TREES 0.1-acre											
Juniperus scopulorum									1	**0.11**	***11***
Pseudotsuga menziesii	4									**0.44**	***11***
TOTAL TREES 0.1-acre	**4.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.0**	**0.56**	***22***
TOTAL VEGETATION (Stratified)	**112.4**	**84.7**	**31.3**	**44.7**	**44.9**	**81.1**	**77.2**	**110.6**	**122.7**	**78.84**	***100***

[1]Footnotes are presented on cover page B-i.

Table B2

Percent Canopy Cover by Class and Species for 14 Sample Sites in the *Agropyron spicatum/Agropyron smithii* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Agropyron spicatum/Agropyron smithii* h.t.**															
	PLOT NUMBER														**Mean**	***Con-***
	43	44	49	52	57	60	61	62	63	64	65	66	69	71	**Cover**	***stancy***
															n=14	
SITE PARAMETERS*																
Slope (percent)	5	6	6	4-7	6-8	6-8	15-20	1-4	20-40	16	44	10-12	6-8	18		
Aspect (degrees mag. north)	050	052	062	230	159	360	170	030	225	212	044	104	196	320		
Topography	Mid	Mid	Upper	Lower	Ridge	Lower	U-M	L (Ben)	Upper	Lower	Lower	Upper	Ben	Upper		
Configuration	Straight	Concave	Convex	S (Und)	Convex	S (Und)	Concave	Straight	Und	Und	Und	Concave	S (V)	Straight		
Photo # (Digital)	268-269	272-273	258-259	772-773	170-172	710-713	716-717	718-719	787-789	314-315	312-313	167-169	779-780	350-351		
Photo azimuth	344-164	320-140	028-218	330-150	220-135	110-360	084-264	300-120	310-225	286-106	300-120	017-104	110-290	060-240		
Investigator	DB/KL	DB/KL	DB/KL	KS/ED	ED	KS	KS/ED	KS	KS/KL	DB/KL	DB/KL	ED	KS/KL	DB/ED		
Date	7/10/13	7/10/13	7/9/13	7/12/13	7/10/13	7/10/13	7/10/13	7/10/13	7/13/13	7/11/13	7/11/13	7/9/13	7/13/13	7/13/13		
GROUND COVER																
Bare Ground	36	22	43	44	40	48	28	28	46	64	53	20	30	46	**39.14**	***100***
Rock	0.3	0.3	9	0.3	4	1	14	26	24	21	35	26	12	0.3	**12.37**	***100***
Litter	57	63	31	50	48	40	50	30	22	12	10	48	35	32	**37.71**	***100***
Lichens	3	7	4	0.3	3	7	0.3	12	5			0.3	18	8	**4.85**	***86***
Moss	0.3	2	10				4		0.3					12	**2.04**	***43***
Basal Vegetation	4	6	3	5	5	4	4	4	3	3	2	5	5	2	**3.93**	***100***
VEGETATION STRUCTURE (nonstratified cover)																
Total Vegetation	67	78	52	66	62	53	72	68	54	49	31	68	50	68	**59.86**	***100***
Perennial Graminoids	52	58	35	46	56	39	26	56	22	23	17	45	32	43	**39.29**	***100***
Annual Graminoids	4	6	10	4	5	0.3	38	3				22	0.3	0.3	**6.64**	***79***
Perennial Forbs and Subshrubs	16	14	17	18	10	14	34	19	39	29	16	15	22	37	**21.43**	***100***
Annual/Biennial Forbs	11	15	3	12	5	4	6	3	0.3	1		13	1	2	**5.45**	***93***
Shrubs										8	0.3		0.3		**0.61**	***21***
Trees 0.01-acre																
Trees 0.1-acre									4	1					**0.36**	***14***

Table B2

Percent Canopy Cover by Class and Species for 14 Sample Sites in the *Agropyron spicatum/Agropyron smithii* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Agropyron spicatum/Agropyron smithii* h.t.**															
	PLOT NUMBER														**Mean**	***Con-***
	43	44	49	52	57	60	61	62	63	64	65	66	69	71	**Cover**	***stancy***
															n=14	
CLASS\SPECIES																
NATIVE PERENNIAL GRAMINOIDS																
Agropyron dasystachyum													1		**0.07**	***7***
Agropyron smithii	4	12	4	2	30	18	10	14	3	10	3	32	8	3	**10.93**	***100***
Agropyron spicatum	34	40	20	5	3	4	8	26	10	12	12	4	12	20	**15.00**	***100***
Aristida purpurea									1						**0.07**	***7***
Carex eleocharis				1									0.3		**0.09**	***14***
Carex filifolia			2												**0.14**	***7***
Festuca campestris	1	2		0.3		1				1					**0.38**	***36***
Festuca idahoensis		2													**0.14**	***7***
Koeleria macrantha	3	2	3	3	0.3	1			4			2	4	3	**1.81**	***71***
Oryzopsis hymenoides										2	2				**0.29**	***14***
Poa fendleriana						2									**0.14**	***7***
Poa secunda	8	8	10	38	35	4	7	22	0.3			5	10	20	**11.95**	***86***
Stipa comata	4			3			4		5			8			**1.71**	***36***
Stipa viridula						14						1			**1.07**	***14***
TOTAL NPG	**54.0**	**66.0**	**39.0**	**52.3**	**68.3**	**44.0**	**29.0**	**62.0**	**23.3**	**25.0**	**17.0**	**52.0**	**35.3**	**46.0**	**43.80**	***100***
INTRODUCED PERENNIAL GRAMINOIDS																
Poa compressa									0.3						**0.02**	***7***
Poa pratensis	2								0.3						**0.16**	***14***
TOTAL IPG	**2.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.6**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.19**	***14***
NATIVE ANNUAL GRAMINOIDS																
Vulpia octoflora				1											**0.07**	***7***
TOTAL NAG	**0.0**	**0.0**	**0.0**	**1.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.07**	***7***
INTRODUCED ANNUAL GRAMINOIDS																
Bromus japonicus	3	6	2		5			3				22	0.3	0.3	**2.97**	***57***
Bromus tectorum	1		9	3	0.3	0.3	38						0.3		**3.71**	***50***
TOTAL IAG	**4.0**	**6.0**	**11.0**	**3.0**	**5.3**	**0.3**	**38.0**	**3.0**	**0.0**	**0.0**	**0.0**	**22.0**	**0.6**	**0.3**	**6.68**	***79***

Table B2

Percent Canopy Cover by Class and Species for 14 Sample Sites in the *Agropyron spicatum/Agropyron smithii* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Agropyron spicatum/Agropyron smithii* h.t.**															
	PLOT NUMBER														**Mean**	***Con-***
	43	44	49	52	57	60	61	62	63	64	65	66	69	71	**Cover**	***stancy***
															n=14	
NATIVE PERENNIAL FORBS AND SUBSHRUBS																
Achillea millefolium	2	1	0.3	0.3	0.3		0.3					0.3		1	**0.39**	***57***
Allium textile										0.3	0.3			0.3	**0.06**	***21***
Antennaria dimorpha													0.3	4	**0.31**	***14***
Antennaria microphylla	2	2	2					0.3				5		10	**1.52**	***43***
Antennaria parvifolia									0.3					2	**0.16**	***14***
Apocynum cannabinum									1	2					**0.21**	***14***
Arenaria congesta	0.3	1		0.3								1		1	**0.26**	***36***
Arnica sororia	0.3					0.3								2	**0.19**	***21***
Artemisia frigida	0.3		0.3	3	1	0.3	1	3				0.3	0.3	1	**0.75**	***71***
Astragalus adsurgens			0.3						1	2	2				**0.38**	***29***
Astragalus cibarius	0.3														**0.02**	***7***
Astragalus drummondii	1	3			0.3										**0.31**	***21***
Astragalus purshii					0.3			0.3				0.3		0.3	**0.09**	***29***
Balsamorhiza sagittata							18								**1.29**	***7***
Boechera pendulocarpa									0.3						**0.02**	***7***
Campanula rotundifolia									0.3		1				**0.09**	***14***
Cirsium undulatum										1	0.3				**0.09**	***14***
Comandra umbellata									0.3						**0.02**	***7***
Crepis modocensis						0.3							1		**0.09**	***14***
Cryptantha spiculifera									0.3						**0.02**	***7***
Douglasia montana									0.3						**0.02**	***7***
Erigeron compositus						0.3	0.3					2	3		**0.40**	***29***
Erigeron corymbosus				0.3			0.3								**0.04**	***14***
Erigeron pumilus	0.3	0.3		0.3	0.3									0.3	**0.11**	***36***
Eriogonum umbellatum	0.3		1				0.3								**0.11**	***21***
Gaillardia aristata									0.3	0.3					**0.04**	***14***
Gaura coccinea			0.3				0.3			0.3	1				**0.14**	***29***
Gutierrezia sarothrae					0.3	2				3	0.3	0.3	0.3	0.3	**0.46**	***50***
Heterotheca villosa			1						0.3		1				**0.16**	***21***
Ionactis alpina				0.3	0.3	0.3							0.3	0.3	**0.11**	***36***
Lewisia rediviva				6	0.3	2		2				1	2	0.3	**0.97**	***50***
Linum lewisii									0.3					0.3	**0.04**	***14***
Lithospermum incisum									0.3						**0.02**	***7***
Lithospermum ruderale							0.3								**0.02**	***7***

Table B2

Percent Canopy Cover by Class and Species for 14 Sample Sites in the *Agropyron spicatum/Agropyron smithii* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Agropyron spicatum/Agropyron smithii* h.t.**															
	PLOT NUMBER														**Mean**	***Con-***
	43	44	49	52	57	60	61	62	63	64	65	66	69	71	**Cover**	***stancy***
															n=14	
Lomatium macrocarpum			0.3		1		2					0.3	7	0.3	**0.78**	***43***
Lomatium triternatum	0.3	0.3													**0.04**	***14***
Lupinus sericeus	5	2	3	3	0.3		2								**1.09**	***43***
Musineon divaricatum									0.3	0.3					**0.04**	***14***
Opuntia fragilis								0.3							**0.02**	***7***
Opuntia polyacantha			0.3	0.3	0.3	0.3	0.3	2				0.3	0.3		**0.29**	***57***
Penstemon eriantherus			0.3						0.3		0.3	0.3			**0.09**	***29***
Penstemon procerus										0.3					**0.02**	***7***
Phlox hoodii	0.3	2	2	1	2	3	0.3	9	2	3	4	1	2	3	**2.47**	***100***
Phlox longifolia	1														**0.07**	***7***
Physaria spatulata										0.3					**0.02**	***7***
Potentilla gracilis	0.3														**0.02**	***7***
Sedum lanceolatum														0.3	**0.02**	***7***
Smilacina stellata										0.3					**0.02**	***7***
Solidago missouriensis									0.3	3					**0.24**	***14***
Sphaeralcea coccinea	0.3	1		3	2	6	0.3	1		0.3		0.3	0.3	1	**1.11**	***79***
Stenotus acaulis			0.3						0.3		1				**0.11**	***21***
Symphyotrichum falcatum	1	2							0.3	9		2			**1.02**	***36***
Townsendia hookeri									0.3						**0.02**	***7***
Vicia americana				0.3	1	0.3	1	2		0.3		3		0.3	**0.59**	***57***
Zigadenus venenosus	0.3														**0.02**	***7***
TOTAL NPF	**15.3**	**14.6**	**11.4**	**18.1**	**9.7**	**15.1**	**26.7**	**19.9**	**8.8**	**25.7**	**11.2**	**17.4**	**16.8**	**28.0**	**17.05**	***100***
INTRODUCED PERENNIAL FORBS																
Centaurea maculosa	2		4				8		34	5	5				**4.14**	***43***
Linaria dalmatica	1		2				4		2						**0.64**	***29***
Taraxacum laevigatum	0.3	0.3		1	0.3	0.3								7	**0.66**	***43***
TOTAL IPF	**3.3**	**0.3**	**6.0**	**1.0**	**0.3**	**0.3**	**12.0**	**0.0**	**36.0**	**5.0**	**5.0**	**0.0**	**0.0**	**7.0**	**5.44**	***79***
FERNS AND ALLIES																
Selaginella densa													8	6	**1.00**	***14***
TOTAL FA	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**8.0**	**6.0**	**1.00**	***14***

Table B2

Percent Canopy Cover by Class and Species for 14 Sample Sites in the *Agropyron spicatum/Agropyron smithii* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Agropyron spicatum/Agropyron smithii* h.t.**															
	PLOT NUMBER														**Mean**	***Con-***
	43	44	49	52	57	60	61	62	63	64	65	66	69	71	**Cover**	***stancy***
															n=14	
NATIVE ANNUAL/BIENNIAL FORBS																
Androsace occidentalis														0.3	**0.02**	***7***
Collinsia parviflora					0.3										**0.02**	***7***
Collomia linearis		1		0.3			0.3								**0.11**	***21***
Epilobium brachycarpum	0.3	1				0.3		0.3				1			**0.21**	***36***
Lappula redowskii						0.3									**0.02**	***7***
Linanthus septentrionalis	0.3			0.3										0.3	**0.06**	***21***
Microsteris gracilis		0.3		2		1							0.3		**0.26**	***29***
Orthocarpus tenuifolius	3	8													**0.79**	***14***
Phacelia linearis			0.3												**0.02**	***7***
Plantago patagonica	1	1	0.3	0.3	0.3	1		1				1	0.3	1	**0.51**	***71***
Polygonum douglasii		0.3				0.3									**0.04**	***14***
TOTAL NA/BF	**4.6**	**11.6**	**0.6**	**2.9**	**0.6**	**2.9**	**0.3**	**1.3**	**0.0**	**0.0**	**0.0**	**2.0**	**0.6**	**1.6**	**2.07**	***79***
INTRODUCED ANNUAL/BIENNIAL FORBS																
Alyssum alyssoides		0.3	2		3	1	5		0.3	0.3		8			**1.42**	***57***
Alyssum desertorum				3				0.3					0.3	1	**0.33**	***29***
Camelina microcarpa					0.3	0.3	0.3								**0.06**	***21***
Filago arvensis	0.3			6	0.3	0.3		1				3	0.3	0.3	**0.82**	***57***
Melilotus officinalis						0.3									**0.02**	***7***
Sisymbrium altissimum		0.3													**0.02**	***7***
Tragopogon dubius	1	0.3	0.3	0.3	0.3	0.3	0.3	0.3		0.3		1		0.3	**0.34**	***79***
Veronica verna	6	4													**0.71**	***14***
TOTAL IA/BF	**7.3**	**4.9**	**2.3**	**9.3**	**3.9**	**2.2**	**5.6**	**1.6**	**0.3**	**0.6**	**0.0**	**12.0**	**0.6**	**1.6**	**3.73**	***93***
SHRUBS																
Amelanchier alnifolia										5					**0.36**	***7***
Krascheninnikovia lanata													0.3		**0.02**	***7***
Rosa woodsii										3	0.3				**0.24**	***14***
TOTAL SHRUBS	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**8.0**	**0.3**	**0.0**	**0.3**	**0.0**	**0.61**	***21***

Table B2

Percent Canopy Cover by Class and Species for 14 Sample Sites in the *Agropyron spicatum/Agropyron smithii* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Agropyron spicatum/Agropyron smithii* h.t.**															
	PLOT NUMBER														**Mean**	***Con-***
	43	44	49	52	57	60	61	62	63	64	65	66	69	71	**Cover**	***stancy***
															n=14	
TREES 0.01-acre																
TOTAL TREES 0.01-acre	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.00**	***0***
TREES 0.1-acre																
Juniperus scopulorum									4	1					**0.36**	***14***
TOTAL TREES 0.1-acre	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**4.0**	**1.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.36**	***14***
TOTAL VEGETATION (Stratified)	**90.5**	**103.4**	**70.3**	**87.6**	**88.1**	**64.8**	**111.6**	**87.8**	**69.0**	**64.3**	**33.5**	**105.4**	**62.2**	**90.5**	**80.64**	***100***

[1]Footnotes are presented on cover page B-i.

Table B3

Percent Canopy Cover by Class and Species for One Sample Site in the *Festuca idahoensis/Agropyron spicatum* and Five Sample Sites in the *Festuca campestris/Agropyron spicatum* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***FES IDA/AGR SPI* h.t.**			***FES CAM/AGR SPI* h.t.**						
	PLOT NUMBER	**Mean**	***Con-***	**PLOT NUMBER**					**Mean**	***Con-***
	68	**Cover**	***stancy***	46	47	51	58	67	**Cover**	***stancy***
		n=1							**n=5**	
SITE PARAMETERS*										
Slope (percent)	30-40			6	13	18-28	18-20	35		
Aspect (degrees mag. north)	020			020	314	036	026	334		
Topography	Mid			Lower	Lower	Upper	L-M	Mid		
Configuration	Convex			Convex	Concave	Convex	Und	X (S)		
Photo # (Digital)	781-783			262-263	303-304	738-740	176-178	753-755		
Photo azimuth	310-360			274-094	046-226	130-036	303-038	080-238		
Investigator	KS/KL			DB/KL	DB/KL	KS/ED	ED	KS/ED		
Date	7/13/13			7/10/13	7/11/13	7/11/13	7/10/13	7/12/13		
GROUND COVER										
Bare Ground	8	**8**	***100***	20	12	37	18	28	**23.00**	***100***
Rock	14	**14**	***100***		0.3	6	8	8	**4.46**	***80***
Litter	60	**60**	***100***	74	55	48	68	36	**56.20**	***100***
Lichens	12	**12**	***100***	0.3	18	5	0.3	23	**9.32**	***100***
Moss	0.3	**0.3**	***100***	0.3	10		0.3		**2.12**	***60***
Basal Vegetation	6	**6**	***100***	6	5	4	5	5	**5.00**	***100***
VEGETATION STRUCTURE										
(nonstratified cover)										
Total Vegetation	78	**78**	***100***	78	80	66	74	65	**72.60**	***100***
Perennial Graminoids	40	**40**	***100***	60	58	46	62	31	**51.40**	***100***
Annual Graminoids					1	0.3			**0.26**	***40***
Perennial Forbs and Subshrubs	64	**64**	***100***	25	21	28	32	44	**30.00**	***100***
Annual/Biennial Forbs	3	**3**	***100***	2	1	2	2	0.3	**1.46**	***100***
Shrubs	4	**4**	***100***	11	15	2		0.3	**5.66**	***80***
Trees 0.01-acre								1	**0.20**	***20***
Trees 0.1-acre					0.3			0.3	**0.12**	***40***

Table B3

Percent Canopy Cover by Class and Species for One Sample Site in the *Festuca idahoensis/Agropyron spicatum* and Five Sample Sites in the *Festuca campestris/Agropyron spicatum* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	FES IDA/AGR SPI h.t.			*FES CAM/AGR SPI* h.t.						
	PLOT NUMBER	Mean	*Con-*	PLOT NUMBER					Mean	*Con-*
	68	Cover	*stancy*	46	47	51	58	67	Cover	*stancy*
		n=1							n=5	
CLASS\SPECIES										
NATIVE PERENNIAL GRAMINOIDS										
Agropyron smithii				9					1.80	*20*
Agropyron spicatum	24	24	*100*	15	25	26	40	16	24.40	*100*
Festuca campestris				4	23	3	12	14	11.20	*100*
Festuca idahoensis	16	16	*100*		8	3	8	1	4.00	*80*
Koeleria macrantha				2		2	0.3	0.3	0.92	*80*
Poa secunda	4	4	*100*	25	9	10	16	4	12.80	*100*
Stipa comata				2		9			2.20	*40*
Stipa viridula				3					0.60	*20*
TOTAL NPG	**44.0**	44.0	*100*	**60.0**	**65.0**	**53.0**	**76.3**	**35.3**	57.92	*100*
INTRODUCED PERENNIAL GRAMINOIDS										
Poa pratensis				6					1.20	*20*
TOTAL IPG	**0.0**	0.0	0.0	**6.0**	**0.0**	**0.0**	**0.0**	**0.0**	1.20	*20*
INTRODUCED ANNUAL GRAMINOIDS										
Bromus briziformis					1	0.3			0.26	*40*
TOTAL IAG	**0.0**	0.0	0.0	**0.0**	**1.0**	**0.3**	**0.0**	**0.0**	0.26	*40*
NATIVE PERENNIAL FORBS AND SUBSHRUBS										
Achillea millefolium	9	**9**	*100*	3	1	2	2	1	1.80	*100*
Allium cernuum					0.3				0.06	*20*
Allium textile						1		0.3	0.26	*40*
Antennaria microphylla				1	2	3		22	5.60	*80*
Antennaria rosea							6		1.20	*20*
Arenaria congesta	2	**2**	*100*	2			4	2	1.60	*60*
Arnica sororia	2	**2**	*100*	5	1		2	1	1.80	*80*
Artemisia frigida	0.3	**0.3**	*100*	1	1	0.3	1	0.3	0.72	*100*
Artemisia ludoviciana				2					0.40	*20*
Astragalus adsurgens								5	1.00	*20*
Astragalus agrestis					0.3				0.06	*20*
Astragalus atropubescens	7	**7**	*100*		2				0.40	*20*
Astragalus cibarius								0.3	0.06	*20*
Astragalus purshii						0.3	1	1	0.46	*60*

Table B3

Percent Canopy Cover by Class and Species for One Sample Site in the *Festuca idahoensis/Agropyron spicatum* and Five Sample Sites in the *Festuca campestris/Agropyron spicatum* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***FES IDA/AGR SPI* h.t.**			***FES CAM/AGR SPI* h.t.**						
	PLOT NUMBER	**Mean**	***Con-***	**PLOT NUMBER**					**Mean**	***Con-***
	68	**Cover**	***stancy***	46	47	51	58	67	**Cover**	***stancy***
		n=1							**n=5**	
Besseya wyomingensis					0.3	0.3		2	**0.52**	***60***
Castilleja pallescens	1	**1**	***100***			1	0.3	0.3	**0.32**	***60***
Cerastium arvense					1				**0.20**	***20***
Cirsium undulatum							0.3		**0.06**	***20***
Crepis modocensis	2	**2**	***100***					0.3	**0.06**	***20***
Cryptantha spiculifera						0.3		0.3	**0.12**	***40***
Dodecatheon conjugens					0.3				**0.06**	***20***
Erigeron compositus	1	**1**	***100***			0.3	2		**0.46**	***40***
Erigeron corymbosus	4	**4**	***100***	1	0.3	1	0.3	2	**0.92**	***100***
Erigeron pumilus				0.3					**0.06**	***20***
Eriogonum umbellatum					1				**0.20**	***20***
Fritillaria pudica	0.3	**0.3**	***100***					0.3	**0.06**	***20***
Gaura coccinea				0.3			0.3		**0.12**	***40***
Geum triflorum	12	**12**	***100***		2		3	1	**1.20**	***60***
Gutierrezia sarothrae					2	6	0.3	3	**2.26**	***80***
Heterotheca villosa						0.3			**0.06**	***20***
Heuchera parvifolia	0.3	**0.3**	***100***							
Ionactis alpina								0.3	**0.06**	***20***
Lithophragma parviflorum					0.3				**0.06**	***20***
Lithospermum ruderale				0.3			0.3		**0.12**	***40***
Lomatium macrocarpum	3	**3**	***100***				0.3	0.3	**0.12**	***40***
Lomatium triternatum	0.3	**0.3**	***100***	0.3	0.3			0.3	**0.18**	***60***
Lupinus polyphyllus					2				**0.40**	***20***
Lupinus sericeus	16	**16**	***100***	5			4		**1.80**	***40***
Musineon divaricatum						4		0.3	**0.86**	***40***
Phlox hoodii	0.3	**0.3**	***100***	0.3		4	6	3	**2.66**	***80***
Phlox longifolia				0.3	0.3				**0.12**	***40***
Sedum lanceolatum					0.3		0.3	0.3	**0.18**	***60***
Senecio canus						0.3			**0.06**	***20***
Senecio integerrimus					0.3				**0.06**	***20***
Solidago missouriensis	0.3	**0.3**	***100***	5			1	0.3	**1.26**	***60***
Sphaeralcea coccinea				1			1		**0.40**	***40***
Stenotus acaulis								0.3	**0.06**	***20***
Symphyotrichum campestre					2				**0.40**	***20***
Symphyotrichum falcatum	0.3	**0.3**	***100***		4				**0.80**	***20***

Table B3

Percent Canopy Cover by Class and Species for One Sample Site in the *Festuca idahoensis/Agropyron spicatum* and Five Sample Sites in the *Festuca campestris/Agropyron spicatum* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***FES IDA/AGR SPI* h.t.**			***FES CAM/AGR SPI* h.t.**						
	PLOT NUMBER	**Mean**	***Con-***	**PLOT NUMBER**					**Mean**	***Con-***
	68	**Cover**	***stancy***	46	47	51	58	67	**Cover**	***stancy***
		n=1							**n=5**	
Vicia americana							0.3	2	**0.46**	***40***
Viola nuttallii				0.3					**0.06**	***20***
Zigadenus venenosus	0.3	**0.3**	***100***		0.3				**0.06**	***20***
TOTAL NPF	**61.4**	**61.4**	***100***	**28.1**	**24.3**	**24.1**	**35.7**	**49.2**	**32.28**	***100***
INTRODUCED PERENNIAL FORBS										
Centaurea maculosa						4			**0.80**	***20***
Taraxacum laevigatum	2	**2**	***100***	0.3	0.3	2	1	2	**1.12**	***100***
TOTAL IPF	**2.0**	**2.0**	***100***	**0.3**	**0.3**	**6.0**	**1.0**	**2.0**	**1.92**	***100***
FERNS AND ALLIES										
Selaginella densa	12	**12**	***100***							
TOTAL FA	**12.0**	**12.0**	***100***	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.00**	***0***
NATIVE ANNUAL/BIENNIAL FORBS										
Collomia linearis				0.3	0.3				**0.12**	***40***
Descurainia pinnata				0.3					**0.06**	***20***
Draba nemorosa				0.3					**0.06**	***20***
Epilobium brachycarpum					0.3				**0.06**	***20***
Lappula redowskii						0.3			**0.06**	***20***
Linanthus septentrionalis							0.3		**0.06**	***20***
Orthocarpus luteus				0.3	0.3		0.3		**0.18**	***60***
Orthocarpus tenuifolius	3	**3**	***100***		0.3	0.3		0.3	**0.18**	***60***
Phacelia linearis					0.3				**0.06**	***20***
Plantago patagonica							1		**0.20**	***20***
Polygonum douglasii	0.3	**0.3**	***100***	0.3	0.3		0.3		**0.18**	***60***
TOTAL NA/BF	**3.3**	**3.3**	***100***	**1.5**	**1.8**	**0.6**	**1.9**	**0.3**	**1.22**	***100***

Table B3

Percent Canopy Cover by Class and Species for One Sample Site in the *Festuca idahoensis/Agropyron spicatum* and Five Sample Sites in the *Festuca campestris/Agropyron spicatum* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	FES IDA/AGR SPI h.t.			*FES CAM/AGR SPI* h.t.						
	PLOT NUMBER	Mean	*Con-*	PLOT NUMBER					Mean	*Con-*
	68	Cover	*stancy*	46	47	51	58	67	Cover	*stancy*
		n=1							n=5	
INTRODUCED ANNUAL/BIENNIAL FORBS										
Alyssum alyssoides				0.3		1		0.3	0.32	*60*
Camelina microcarpa				0.3		0.3			0.12	*40*
Tragopogon dubius				0.3		0.3		0.3	0.18	*60*
TOTAL IA/BF	**0.0**	**0.0**	**0.0**	**0.9**	**0.0**	**1.6**	**0.0**	**0.6**	**0.62**	***60***
SHRUBS										
Chrysothamnus viscidiflorus	0.3	**0.3**	*100*		4	1			1.00	*40*
Ericameria nauseosa	4	**4**	*100*	1	13				2.80	*40*
Krascheninnikovia lanata						1		0.3	0.26	*40*
Rosa woodsii				10					2.00	*20*
Tetradymia canescens								0.3	0.06	*20*
TOTAL SHRUBS	**4.3**	**4.3**	***100***	**11.0**	**17.0**	**2.0**	**0.0**	**0.6**	**6.12**	***80***
TREES 0.01-acre										
Juniperus scopulorum								1	0.20	*20*
TOTAL TREES 0.01-acre	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.0**	**0.20**	***20***
TREES 0.1-acre										
Juniperus scopulorum					0.3			0.3	0.12	*40*
TOTAL TREES 0.1-acre	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**	**0.0**	**0.0**	**0.3**	**0.12**	***40***
TOTAL VEGETATION (Stratified)	**127.0**	**127.0**	***100***	**107.8**	**109.4**	**87.6**	**114.9**	**89.0**	**101.74**	***100***

[1]Footnotes are presented on cover page B-i.

Table B4

Percent Canopy Cover by Class and Species for Eight Sample Sites in the Tame Pasture Type, Montana Limestone Resources Baseline Study Area, 2013.

	TAME PASTURE									
	PLOT NUMBER								Mean	Con-
	73	75	76	77	78	79	80	81	Cover	stancy
									n=8	
SITE PARAMETERS*										
Slope (percent)	4	8-10	5-6	5-7	5	7	8-10	14		
Aspect (degrees mag. north)	032	018	278	240	290	240	075	340		
Topography	Bottom	Lower	Lower	Mid	U-Mid	Swale	Mid	Upper		
Configuration	Concave	S (V)	S (V)	Straight	Concave	Concave	Convex	X (S)		
Photo # (Digital)	248-249	747-748	745-746	743-744	741-742	734-735	732-733	736-737		
Photo azimuth	274-096	315-135	350-170	330-150	010-190	260-080	225-115	058-238		
Investigator	DB/KL	KS/ED	KS/ED	KS/ED	KS/ED	KS/ED	KS/ED	KS/ED		
Date	7/9/13	7/11/13	7/11/13	7/11/13	7/11/13	7/11/13	7/11/13	7/11/13		
GROUND COVER										
Bare Ground	8	23	68	80	72	20	76	63	51.25	100
Rock		0.3	0.3	0.3	5		1	0.3	0.90	75
Litter	86	70	26	16	18	75	18	32	42.63	100
Lichens	0.3		0.3	0.3					0.11	38
Moss										
Basal Vegetation	6	7	5	4	5	5	5	5	5.25	100
VEGETATION STRUCTURE (nonstratified cover)										
Total Vegetation	85	96	70	60	62	90	76	78	77.13	100
Perennial Graminoids	72	95	62	52	58	13	68	73	61.63	100
Annual Graminoids		0.3	1	5	0.3	27	12	0.3	5.74	88
Perennial Forbs and Subshrubs	32	0.3		0.3	3	50	3		11.08	75
Annual/Biennial Forbs	14	2	14	7	6	40	13	13	13.63	100
Shrubs										
Trees 0.01-acre										
Trees 0.1-acre										
CLASS\SPECIES										
NATIVE PERENNIAL GRAMINOIDS										
Poa secunda			14	4	3	3	18	10	6.50	75
TOTAL NPG	**0.0**	**0.0**	**14.0**	**4.0**	**3.0**	**3.0**	**18.0**	**10.0**	6.50	75
INTRODUCED PERENNIAL GRAMINOIDS										
Agropyron repens	3	74							9.63	25
Elymus junceus			54	48	56	2	58	66	35.50	75
Poa compressa	10	2							1.50	25
Poa pratensis	65	48				8			15.13	38
TOTAL IPG	**78.0**	**124.0**	**54.0**	**48.0**	**56.0**	**10.0**	**58.0**	**66.0**	61.75	100
INTRODUCED ANNUAL GRAMINOIDS										
Bromus briziformis			0.3					0.3	0.08	25
Bromus japonicus				4		2	4		1.25	38
Bromus tectorum		0.3	0.3	1	0.3	26	9	0.3	4.65	88
TOTAL IAG	**0.0**	**0.3**	**0.6**	**5.0**	**0.3**	**28.0**	**13.0**	**0.6**	5.98	88

Table B4

Percent Canopy Cover by Class and Species for Eight Sample Sites in the Tame Pasture Type, Montana Limestone Resources Baseline Study Area, 2013.

	TAME PASTURE									
	PLOT NUMBER								Mean	*Con-*
	73	75	76	77	78	79	80	81	Cover	*stancy*
									n=8	
NATIVE PERENNIAL FORBS AND SUBSHRUBS										
Achillea millefolium	0.3	0.3							0.08	*25*
Antennaria neglecta	1								0.13	*13*
Antennaria parvifolia	1								0.13	*13*
Artemisia frigida						1			0.13	*13*
Erigeron pumilus							0.3		0.04	*13*
Lewisia rediviva				0.3					0.04	*13*
Solidago missouriensis						22			2.75	*13*
Symphyotrichum ascendens						1			0.13	*13*
Vicia americana	0.3								0.04	*13*
TOTAL NPF	**2.6**	**0.3**	**0.0**	**0.3**	**0.0**	**24.0**	**0.3**	**0.0**	3.44	*63*
INTRODUCED PERENNIAL FORBS										
Centaurea maculosa						1	0.3		0.16	*25*
Cirsium arvense						4			0.50	*13*
Euphorbia esula	28				0.3	15			5.41	*38*
Medicago sativa					3	0.3			0.41	*25*
Taraxacum laevigatum	3					14	3		2.50	*38*
TOTAL IPF	**31.0**	**0.0**	**0.0**	**0.0**	**3.3**	**34.3**	**3.3**	**0.0**	8.99	*50*
NATIVE ANNUAL/BIENNIAL FORBS										
Androsace occidentalis	0.3								0.04	*13*
Collomia linearis	2								0.25	*13*
Dracocephalum parviflorum						0.3			0.04	*13*
Epilobium brachycarpum						0.3			0.04	*13*
Microsteris gracilis			4	3		4	7	2	2.50	*63*
Plantago patagonica			0.3	1				0.3	0.20	*38*
Solanum triflorum					0.3				0.04	*13*
TOTAL NA/BF	**2.3**	**0.0**	**4.3**	**4.0**	**0.3**	**4.6**	**7.0**	**2.3**	3.10	*88*
INTRODUCED ANNUAL/BIENNIAL FORBS										
Alyssum alyssoides	0.3	0.3		3	4	17			3.08	*63*
Alyssum desertorum			6		0.3		5	7	2.29	*50*
Camelina microcarpa	0.3				0.3	5	0.3		0.74	*50*
Carduus nutans	1	1							0.25	*25*
Descurainia sophia		0.3				2			0.29	*25*
Filago arvensis	0.3		3	0.3		3	1	4	1.45	*75*
Lactuca serriola					0.3	0.3			0.08	*25*
Medicago lupulina	8								1.00	*13*
Melilotus officinalis	1	0.3	0.3		1				0.33	*50*
Sisymbrium altissimum		0.3				9			1.16	*25*
Thlaspi arvense	0.3					2			0.29	*25*
Tragopogon dubius	1		0.3			2	0.3		0.45	*50*
TOTAL IA/BF	**12.2**	**2.2**	**9.6**	**3.3**	**5.9**	**40.3**	**6.6**	**11.0**	11.39	*100*
TOTAL VEGETATION (Stratified)	**126.1**	**126.8**	**82.5**	**64.6**	**68.8**	**144.2**	**106.2**	**89.9**	101.14	*100*

[1]Footnotes are presented on cover page B-i.

Table B5

Percent Canopy Cover by Class and Species for Three Sample Sites in the *Artemisia tridentata/Poa secunda* and Two Sample Sites in the *Artemisia tridentata/Agropyron smithii* Community Types, Montana Limestone Resources Baseline Study Area, 2013.

	***ART TRI/POA SEC* c.t.**					***ART TRI/AGR SMI* c.t.**			
	PLOT NUMBER			**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	28	30	74	**Cover**	***stancy***	40	41	**Cover**	***stancy***
				n=3				**n=2**	
SITE PARAMETERS*									
Slope (percent)	12	8	8-12			1-3	4		
Aspect (degrees mag. north)	064	290	020			090	026		
Topography	Lower	Upper	L-Mid			Terrace	L/Ben		
Configuration	Convex	Straight	Convex			S (V)	Straight		
Photo # (Digital)	260-261	297-298	246-247			714-715	702-703		
Photo azimuth	336-156	026-206	270-094			090-270	280-100		
Investigator	DB/KL	DB/KL	ALL			KS	KS		
Date	7/9/13	7/11/13	7/9/13			7/10/13	7/9/13		
GROUND COVER									
Bare Ground	58	40	43	**47.00**	***100***	14	28	**21.00**	***100***
Rock	0.3	1	0.3	**0.53**	***100***				
Litter	32	45	50	**42.33**	***100***	80	67	**73.50**	***100***
Lichens	5	6	3	**4.67**	***100***	0.3	0.3	**0.30**	***100***
Moss	1	4		**1.67**	***67***	0.3		**0.15**	***50***
Basal Vegetation	4	4	4	**4.00**	***100***	6	5	**5.50**	***100***
VEGETATION STRUCTURE (nonstratified cover)									
Total Vegetation	62	68	65	**65.00**	***100***	86	86	**86.00**	***100***
Perennial Graminoids	20	26	38	**28.00**	***100***	55	46	**50.50**	***100***
Annual Graminoids	0.3	5	0.3	**1.87**	***100***	0.3		**0.15**	***50***
Perennial Forbs and Subshrubs	10	12	8	**10.00**	***100***	38	36	**37.00**	***100***
Annual/Biennial Forbs	2	8	2	**4.00**	***100***	7	29	**18.00**	***100***
Shrubs	46	36	40	**40.67**	***100***	48	48	**48.00**	***100***
Trees 0.01-acre									
Trees 0.1-acre							0.3	**0.15**	***50***
CLASS\SPECIES									
NATIVE PERENNIAL GRAMINOIDS									
Agropyron dasystachyum	4			**1.33**	***33***				
Agropyron smithii						14	24	**19.00**	***100***
Agropyron spicatum							1	**0.50**	***50***
Carex filifolia			0.3	**0.10**	***33***				
Danthonia unispicata		2	1	**1.00**	***67***		0.3	**0.15**	***50***
Koeleria macrantha	6	3	3	**4.00**	***100***	2	3	**2.50**	***100***
Poa secunda	12	12	28	**17.33**	***100***	12	8	**10.00**	***100***
Stipa comata			0.3	**0.10**	***33***	1	12	**6.50**	***100***
Stipa viridula						20		**10.00**	***50***
TOTAL NPG	**22.0**	**17.0**	**32.6**	**23.87**	***100***	**49.0**	**48.3**	**48.65**	***100***
INTRODUCED PERENNIAL GRAMINOIDS									
Agropyron repens			2	**0.67**	***33***				
Poa compressa		11	7	**6.00**	***67***				
Poa pratensis						14	4	**9.00**	***100***
TOTAL IPG	**0.0**	**11.0**	**9.0**	**6.67**	***67***	**14.0**	**4.0**	**9.00**	***100***

Table B5

Percent Canopy Cover by Class and Species for Three Sample Sites in the *Artemisia tridentata/Poa secunda* and Two Sample Sites in the *Artemisia tridentata/Agropyron smithii* Community Types, Montana Limestone Resources Baseline Study Area, 2013.

	***ART TRI/POA SEC* c.t.**					***ART TRI/AGR SMI* c.t.**			
	PLOT NUMBER			**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	28	30	74	**Cover**	***stancy***	40	41	**Cover**	***stancy***
				n=3				**n=2**	
INTRODUCED ANNUAL GRAMINOIDS									
Bromus japonicus	0.3	0.3	0.3	**0.30**	***100***	0.3		**0.15**	***50***
Bromus tectorum		5		**1.67**	***33***				
TOTAL IAG	**0.3**	**5.3**	**0.3**	**1.97**	***100***	**0.3**	**0.0**	**0.15**	***50***
NATIVE PERENNIAL FORBS AND SUBSHRUBS									
Achillea millefolium	0.3		1	**0.43**	***67***	1	7	**4.00**	***100***
Antennaria microphylla	1	1	1	**1.00**	***100***	1	0.3	**0.65**	***100***
Antennaria parvifolia	2		1	**1.00**	***67***	0.3		**0.15**	***50***
Arnica sororia						8		**4.00**	***50***
Artemisia frigida	0.3	0.3	1	**0.53**	***100***		0.3	**0.15**	***50***
Astragalus purshii			0.3	**0.10**	***33***	0.3		**0.15**	***50***
Erigeron compositus	2			**0.67**	***33***				
Erigeron corymbosus		0.3		**0.10**	***33***		1	**0.50**	***50***
Erigeron pumilus	0.3		0.3	**0.20**	***67***	5		**2.50**	***50***
Gutierrezia sarothrae	0.3			**0.10**	***33***	0.3		**0.15**	***50***
Lithospermum ruderale						1	1	**1.00**	***100***
Lupinus sericeus	2	2	1	**1.67**	***100***	4	4	**4.00**	***100***
Musineon divaricatum						0.3	0.3	**0.30**	***100***
Penstemon eriantherus	0.3			**0.10**	***33***				
Phlox hoodii						1	1	**1.00**	***100***
Solidago missouriensis	0.3	2		**0.77**	***67***	0.3		**0.15**	***50***
Sphaeralcea coccinea						0.3		**0.15**	***50***
Stenotus acaulis	0.3			**0.10**	***33***				
Symphyotrichum falcatum		0.3		**0.10**	***33***	5	2	**3.50**	***100***
Vicia americana			1	**0.33**	***33***	3	3	**3.00**	***100***
TOTAL NPF	**9.1**	**5.9**	**6.6**	**7.20**	***100***	**30.8**	**19.9**	**25.35**	***100***
INTRODUCED PERENNIAL FORBS									
Centaurea maculosa	2	7	1	**3.33**	***100***	7	9	**8.00**	***100***
Euphorbia esula			0.3	**0.10**	***33***				
Linaria dalmatica	0.3	0.3		**0.20**	***67***				
Taraxacum laevigatum		0.3	0.3	**0.20**	***67***	6	12	**9.00**	***100***
TOTAL IPF	**2.3**	**7.6**	**1.6**	**3.83**	***100***	**13.0**	**21.0**	**17.00**	***100***
NATIVE ANNUAL/BIENNIAL FORBS									
Androsace occidentalis			0.3	**0.10**	***33***				
Boechera retrofracta	0.3	0.3	0.3	**0.30**	***100***				
Collomia linearis	0.3	0.3	0.3	**0.30**	***100***	0.3		**0.15**	***50***
Grindelia squarrosa		0.3		**0.10**	***33***				
Microsteris gracilis	0.3	2	0.3	**0.87**	***100***	0.3		**0.15**	***50***
Orthocarpus luteus		0.3		**0.10**	***33***				
Orthocarpus tenuifolius	0.3			**0.10**	***33***				
Plantago patagonica	0.3	0.3		**0.20**	***67***				
TOTAL NA/BF	**1.5**	**3.5**	**1.2**	**2.07**	***100***	**0.6**	**0.0**	**0.30**	***50***

Table B5

Percent Canopy Cover by Class and Species for Three Sample Sites in the *Artemisia tridentata/Poa secunda* and Two Sample Sites in the *Artemisia tridentata/Agropyron smithii* Community Types, Montana Limestone Resources Baseline Study Area, 2013.

	***ART TRI/POA SEC* c.t.**					***ART TRI/AGR SMI* c.t.**			
	PLOT NUMBER			**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	28	30	74	**Cover**	***stancy***	40	41	**Cover**	***stancy***
				n=3				**n=2**	
INTRODUCED ANNUAL/BIENNIAL FORBS									
Alyssum alyssoides	0.3	1	0.3	**0.53**	***100***	1	22	**11.50**	***100***
Alyssum desertorum			0.3	**0.10**	***33***				
Camelina microcarpa						0.3		**0.15**	***50***
Carduus nutans						4	10	**7.00**	***100***
Descurainia sophia							1	**0.50**	***50***
Filago arvensis		2	0.3	**0.77**	***67***				
Melilotus officinalis		0.3	0.3	**0.20**	***67***				
Tragopogon dubius	0.3	1	0.3	**0.53**	***100***	1		**0.50**	***50***
TOTAL IA/BF	**0.6**	**4.3**	**1.5**	**2.13**	***100***	**6.3**	**33.0**	**19.65**	***100***
SHRUBS									
Artemisia tridentata	46	35	38	**39.67**	***100***	48	48	**48.00**	***100***
Ericameria nauseosa		1	2	**1.00**	***67***				
Rosa woodsii						1		**0.50**	***50***
TOTAL SHRUBS	**46.0**	**36.0**	**40.0**	**40.67**	***100***	**49.0**	**48.0**	**48.50**	***100***
TREES 0.01-acre									
TOTAL TREES 0.01-acre	**0.0**	**0.0**	**0.0**	**0.00**	***0***	**0.0**	**0.0**	**0.00**	***0***
TREES 0.1-acre									
Juniperus scopulorum							0.3	**0.15**	***50***
TREES 0.1-acre	**0.0**	**0.0**	**0.0**	**0.00**	***0***	**0.0**	**0.3**	**0.15**	***50***
TOTAL VEGETATION (Stratified)	**81.8**	**90.6**	**92.8**	**88.40**	***100***	**163.0**	**174.2**	**168.60**	***100***

[1]Footnotes are presented on cover page B-i.

Table B6

Percent Canopy Cover by Class and Species for Four Sample Sites in the *Artemisia tridentata/Agropyron spicatum* and Three Sample Sites in the *Artemisia tridentata/Festuca idahoensis* Habitat Types, Montana Limestone Resources Baseline Study Area, 2013.

	***ART TRI/AGR SPI* h.t.**						***ART TRI/FES IDA* h.t.**				
	PLOT NUMBER				**Mean**	***Con-***	**PLOT NUMBER**			**Mean**	***Con-***
	26	31	36	37	**Cover**	***stancy***	35	39	72	**Cover**	***stancy***
					n=4					**n=3**	
SITE PARAMETERS*											
Slope (percent)	14	9	14-15	14-16			8-10	8	12		
Aspect (degrees mag. north)	070	278	060	144			052	036	032		
Topography	Upper	L-Mid	Mid	Mid			L-Ben	L-Mid	Low-Mid		
Configuration	Convex	Convex	Concave	Straight			Straight	S (Und)	Concave		
Photo # (Digital)	266-267	250-251	699-701	751-752			749-750	720-721	252-253		
Photo azimuth	318-138	330-138	310-130	056-236			155-335	310-120	300-120		
Investigator	DB/KL	DB/KL	KS/ED	KS/ED			KS/ED	KS	DB/KL		
Date	7/10/13	7/9/13	7/9/13	7/11/13			7/11/13	7/10/13	7/9/13		
GROUND COVER											
Bare Ground	38	41	24	50	**38.25**	***100***	4	30	40	**24.67**	***100***
Rock	1	0.3		18	**4.83**	***75***		24	1	**8.33**	***67***
Litter	56	46	69	27	**49.50**	***100***	88	33	45	**55.33**	***100***
Lichens	0.3	8	1	0.3	**2.40**	***100***	2	8	6	**5.33**	***100***
Moss	1	1	1	0.3	**0.83**	***100***	0.3	0.3	3	**1.20**	***100***
Basal Vegetation	4	4	5	4	**4.25**	***100***	6	5	5	**5.33**	***100***
VEGETATION STRUCTURE (nonstratified cover)											
Total Vegetation	66	54	78	62	**65.00**	***100***	86	70	78	**78.00**	***100***
Perennial Graminoids	49	37	30	23	**34.75**	***100***	38	42	36	**38.67**	***100***
Annual Graminoids				0.3	**0.08**	***25***		0.3		**0.10**	***33***
Perennial Forbs and Subshrubs	14	15	42	13	**21.00**	***100***	33	30	11	**24.67**	***100***
Annual/Biennial Forbs	1	2	1	0.3	**1.08**	***100***	3	0.3	3	**2.10**	***100***
Shrubs	24	18	58	44	**36.00**	***100***	66	44	65	**58.33**	***100***
Trees 0.01-acre											
Trees 0.1-acre	0.3			6	**1.58**	***50***	0.3		0.3	**0.20**	***67***
CLASS\SPECIES											
NATIVE PERENNIAL GRAMINOIDS											
Agropyron smithii	8		0.3		**2.08**	***50***	2			**0.67**	***33***
Agropyron spicatum	30	26	20	15	**22.75**	***100***	5	34	4	**14.33**	***100***
Carex eleocharis	0.3	0.3			**0.15**	***50***					
Carex tahoensis									0.3	**0.10**	***33***
Festuca campestris	1	2			**0.75**	***50***	0.3	1		**0.43**	***67***
Festuca idahoensis				2	**0.50**	***25***	12	4	16	**10.67**	***100***
Koeleria macrantha	1		3	2	**1.50**	***75***	4		5	**3.00**	***67***
Poa secunda	10	12	10	6	**9.50**	***100***	14	6	8	**9.33**	***100***
Stipa comata		1			**0.25**	***25***					
Stipa viridula	1				**0.25**	***25***					
TOTAL NPG	**51.3**	**41.3**	**33.3**	**25.0**	**37.73**	***100***	**37.3**	**45.0**	**33.3**	**38.53**	***100***
INTRODUCED PERENNIAL GRAMINOIDS											
Poa compressa									3	**1.00**	***33***
Poa pratensis	2				**0.50**	***25***	4		5	**3.00**	***67***
TOTAL IPG	**2.0**	**0.0**	**0.0**	**0.0**	**0.50**	***25***	**4.0**	**0.0**	**8.0**	**4.00**	***67***

Table B6

Percent Canopy Cover by Class and Species for Four Sample Sites in the *Artemisia tridentata/Agropyron spicatum* and Three Sample Sites in the *Artemisia tridentata/Festuca idahoensis* Habitat Types, Montana Limestone Resources Baseline Study Area, 2013.

	***ART TRI/AGR SPI* h.t.**						***ART TRI/FES IDA* h.t.**				
	PLOT NUMBER				**Mean**	***Con-***	**PLOT NUMBER**			**Mean**	***Con-***
	26	31	36	37	**Cover**	***stancy***	35	39	72	**Cover**	***stancy***
					n=4					**n=3**	
INTRODUCED ANNUAL GRAMINOIDS											
Bromus japonicus				0.3	**0.08**	***25***		0.3		**0.10**	***33***
TOTAL IAG	**0.0**	**0.0**	**0.0**	**0.3**	**0.08**	***25***	**0.0**	**0.3**	**0.0**	**0.10**	***33***
NATIVE PERENNIAL FORBS AND SUBSHRUBS											
Achillea millefolium	1	0.3	6		**1.83**	***75***	5	2	0.3	**2.43**	***100***
Antennaria microphylla	2	2	2		**1.50**	***75***	3	2	1	**2.00**	***100***
Antennaria parvifolia		0.3			**0.08**	***25***			2	**0.67**	***33***
Arenaria congesta			1	1	**0.50**	***50***	1	8		**3.00**	***67***
Arnica sororia	1	0.3	4		**1.33**	***75***	2	2		**1.33**	***67***
Artemisia frigida		1		0.3	**0.33**	***50***					
Artemisia ludoviciana	1				**0.25**	***25***					
Astragalus adsurgens		0.3		0.3	**0.15**	***50***					
Astragalus agrestis	0.3				**0.08**	***25***		0.3		**0.10**	***33***
Astragalus atropubescens		1			**0.25**	***25***	0.3			**0.10**	***33***
Astragalus cibarius				1	**0.25**	***25***					
Astragalus drummondii	0.3				**0.08**	***25***					
Astragalus purshii								0.3		**0.10**	***33***
Besseya wyomingensis		0.3			**0.08**	***25***					
Boechera pendulocarpa				0.3	**0.08**	***25***					
Castilleja pallescens	0.3	0.3	1		**0.40**	***75***	1		0.3	**0.43**	***67***
Drymocallis arguta	0.3				**0.08**	***25***					
Erigeron compositus		0.3		2	**0.58**	***50***		0.3		**0.10**	***33***
Erigeron corymbosus	0.3	0.3	3		**0.90**	***75***	0.3		0.3	**0.20**	***67***
Erigeron pumilus		0.3			**0.08**	***25***					
Eriogonum umbellatum	0.3				**0.08**	***25***					
Fritillaria pudica		0.3			**0.08**	***25***					
Gaura coccinea							0.3			**0.10**	***33***
Gutierrezia sarothrae	0.3				**0.08**	***25***					
Heterotheca villosa									0.3	**0.10**	***33***
Ionactis alpina		0.3			**0.08**	***25***					
Lewisia rediviva			1		**0.25**	***25***					
Lithospermum ruderale	0.3		1		**0.33**	***50***	0.3			**0.10**	***33***
Lomatium macrocarpum		0.3	1		**0.33**	***50***					
Lupinus sericeus	1	1	15	1	**4.50**	***100***	7	1	4	**4.00**	***100***
Phlox hoodii		5		3	**2.00**	***50***		4		**1.33**	***33***
Potentilla gracilis	0.3				**0.08**	***25***					
Silene drummondii							0.3			**0.10**	***33***
Solidago missouriensis							0.3		0.3	**0.20**	***67***
Sphaeralcea coccinea	0.3	0.3			**0.15**	***50***					
Symphyotrichum falcatum	2				**0.50**	***25***					
Vicia americana			10	3	**3.25**	***50***	12	14		**8.67**	***67***
Zigadenus venenosus			3		**0.75**	***25***					
TOTAL NPF	**11.0**	**13.9**	**48.0**	**11.9**	**21.20**	***100***	**32.8**	**33.9**	**8.5**	**25.07**	***100***
INTRODUCED PERENNIAL FORBS											
Centaurea maculosa	2	1	0.3		**0.83**	***75***			0.3	**0.10**	***33***
Euphorbia esula									1	**0.33**	***33***
Linaria dalmatica	2			2	**1.00**	***50***			2	**0.67**	***33***
Taraxacum laevigatum		0.3	1		**0.33**	***50***	4		0.3	**1.43**	***67***
TOTAL IPF	**4.0**	**1.3**	**1.3**	**2.0**	**2.15**	***100***	**4.0**	**0.0**	**3.6**	**2.53**	***67***

Table B6

Percent Canopy Cover by Class and Species for Four Sample Sites in the *Artemisia tridentata/Agropyron spicatum* and Three Sample Sites in the *Artemisia tridentata/Festuca idahoensis* Habitat Types, Montana Limestone Resources Baseline Study Area, 2013.

	***ART TRI/AGR SPI* h.t.**						***ART TRI/FES IDA* h.t.**				
	PLOT NUMBER				**Mean**	***Con-***	**PLOT NUMBER**			**Mean**	***Con-***
	26	31	36	37	**Cover**	***stancy***	35	39	72	**Cover**	***stancy***
					n=4					**n=3**	
NATIVE ANNUAL/BIENNIAL FORBS											
Boechera retrofracta	0.3				**0.08**	***25***	0.3		0.3	**0.20**	***67***
Collomia linearis	0.3	0.3	1		**0.40**	***75***			0.3	**0.10**	***33***
Epilobium brachycarpum	0.3				**0.08**	***25***					
Erigeron divergens		0.3			**0.08**	***25***					
Linanthus septentrionalis			0.3		**0.08**	***25***					
Microsteris gracilis	0.3	0.3			**0.15**	***50***	0.3		0.3	**0.20**	***67***
Orthocarpus luteus	0.3	0.3	0.3		**0.23**	***75***	0.3	0.3	0.3	**0.30**	***100***
Orthocarpus tenuifolius		0.3	0.3	0.3	**0.23**	***75***	0.3	0.3	2	**0.87**	***100***
Plantago patagonica		0.3			**0.08**	***25***					
Polygonum douglasii		0.3			**0.08**	***25***	0.3		0.3	**0.20**	***67***
TOTAL NA/BF	**1.5**	**2.1**	**1.9**	**0.3**	**1.45**	***100***	**1.5**	**0.6**	**3.5**	**1.87**	***100***
INTRODUCED ANNUAL/BIENNIAL FORBS											
Alyssum alyssoides				0.3	**0.08**	***25***		0.3		**0.10**	***33***
Filago arvensis		0.3			**0.08**	***25***					
Melilotus officinalis									0.3	**0.10**	***33***
Tragopogon dubius		0.3	0.3		**0.15**	***50***					
Veronica verna							2			**0.67**	***33***
TOTAL IA/BF	**0.0**	**0.6**	**0.3**	**0.3**	**0.30**	***75***	**2.0**	**0.3**	**0.3**	**0.87**	***100***
SHRUBS											
Artemisia tridentata	24	17	58	44	**35.75**	***100***	66	44	65	**58.33**	***100***
Ericameria nauseosa		1			**0.25**	***25***					
Rosa woodsii	0.3				**0.08**	***25***					
TOTAL SHRUBS	**24.3**	**18.0**	**58.0**	**44.0**	**36.08**	***100***	**66.0**	**44.0**	**65.0**	**58.33**	***100***
TREES 0.01-acre											
TOTAL TREES 0.01-acre	**0.0**	**0.0**	**0.0**	**0.0**	**0.00**	***0***	**0.0**	**0.0**	**0.0**	**0.0**	***0***
TREES 0.1-acre											
Juniperus scopulorum				5	**1.25**	***25***					
Pinus ponderosa				1	**0.25**	***25***	0.3			**0.10**	***33***
Pseudotsuga menziesii	0.3				**0.08**	***25***	0.3		0.3	**0.20**	***67***
TOTAL TREES 0.1-acre	**0.3**	**0.0**	**0.0**	**6.0**	**1.58**	***50***	**0.6**	**0.0**	**0.3**	**0.30**	***67***
TOTAL VEGETATION (Stratified)	**94.1**	**77.2**	**142.8**	**83.8**	**99.48**	***100***	**147.6**	**124.1**	**122.2**	**131.30**	***100***

[1]Footnotes are presented on cover page B-i.

Table B7

Percent Canopy Cover by Class and Species for Seven Sample Sites in the *Artemisia tridentata/Festuca campestris* Habitat Type and One Sample Site in the *Symphoricarpos occidentalis/Poa pratensis* Community Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Artemisia tridentata/Festuca campestris* h.t.**									***SYM OCC/POA PRA* c.t.**		
	PLOT NUMBER							**Mean**	***Con-***	**PLOT NUMBER**	**Mean**	***Con-***
	25	27	29	32	33	34	38	**Cover**	***stancy***	45	**Cover**	***stancy***
								n=7			**n=1**	
SITE PARAMETERS*												
Slope (percent)	8	16	4	12	15-18	32	25-30			10		
Aspect (degrees mag. north)	030	056	330	054	025	035	042			328		
Topography	Mid	Mid	Mid	Mid	Upper	U-Mid	Low-Mid			Mid		
Configuration	Concave	Convex	Straight	Und	Concave	Und	S (V)			Concave		
Photo # (Digital)	264-265	254-255	278-279	276-277	696-698	694-695	762-763			274-275		
Photo azimuth	300-120	340-160	040-220	326-146	310-130	134-314	140-010			056-236		
Investigator	DB/KL	DB/KL	DB/KL	DB/KL	KS/ED	KS/ED	KS/ED			DB/KL		
Date	7/10/13	7/9/13	7/11/13	7/10/13	7/9/13	7/9/13	7/12/13			7/10/13		
GROUND COVER												
Bare Ground	8	30	30	16	18	8	28	**19.71**	***100***	4	**4**	***100***
Rock	0.3	1	0.3		0.3		0.3	**0.31**	***71***			
Litter	84	50	50	60	74	80	66	**66.29**	***100***	89	**89**	***100***
Lichens	0.3	8	8	5	1	3	2	**3.90**	***100***	0.3	**0.3**	***100***
Moss	1	5	7	13	0.3	2		**4.04**	***86***			
Basal Vegetation	7	6	5	6	6	7	4	**5.86**	***100***	7	**7**	***100***
VEGETATION STRUCTURE (nonstratified cover)												
Total Vegetation	92	85	72	89	92	90	76	**85.14**	***100***	93	**93**	***100***
Perennial Graminoids	62	58	40	63	52	56	32	**51.86**	***100***	80	**80**	***100***
Annual Graminoids							0.3	**0.04**	***14***			
Perennial Forbs and Subshrubs	48	15	13	19	62	55	23	**33.57**	***100***	40	**40**	***100***
Annual/Biennial Forbs	1	4	4	1	3	6	6	**3.57**	***100***	1	**1**	***100***
Shrubs	18	57	38	26	38	48	44	**38.43**	***100***	15	**15**	***100***
Trees 0.01-acre						0.3		**0.04**	***14***			
Trees 0.1-acre	2					2	1	**0.71**	***43***			

Table B7

Percent Canopy Cover by Class and Species for Seven Sample Sites in the *Artemisia tridentata/Festuca campestris* Habitat Type and One Sample Site in the *Symphoricarpos occidentalis/Poa pratensis* Community Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Artemisia tridentata/Festuca campestris* h.t.**									***SYM OCC/POA PRA* c.t.**		
	PLOT NUMBER							**Mean**	***Con-***	**PLOT NUMBER**	**Mean**	***Con-***
	25	27	29	32	33	34	38	**Cover**	***stancy***	45	**Cover**	***stancy***
								n=7			**n=1**	
CLASS\SPECIES												
NATIVE PERENNIAL GRAMINOIDS												
Agropyron smithii										4	**4**	***100***
Agropyron spicatum	6	10	15	13	26	24	17	**15.86**	***100***			
Bromus carinatus	3							**0.43**	***14***			
Bromus porteri										1	**1**	***100***
Carex filifolia		2				0.3		**0.33**	***29***			
Carex petasata	4	1				1		**0.86**	***43***	0.3	**0.3**	***100***
Festuca campestris	6	10	8	26	18	30	9	**15.29**	***100***	1	**1**	***100***
Festuca idahoensis	30	35		16	4	2	1	**12.57**	***86***			
Koeleria macrantha	1		4	4	3		1	**1.86**	***71***			
Muhlenbergia richardsonis	2							**0.29**	***14***			
Poa fendleriana						5		**0.71**	***14***			
Poa secunda	4	8	18	8	1		7	**6.57**	***86***			
Stipa viridula	7			2				**1.29**	***29***	30	**30**	***100***
TOTAL NPG	**63.0**	**66.0**	**45.0**	**69.0**	**52.0**	**62.3**	**35.0**	**56.04**	***100***	**36.3**	**36.3**	***100***
INTRODUCED PERENNIAL GRAMINOIDS												
Agropyron repens	1							**0.14**	***14***			
Poa pratensis	8				6	1		**2.14**	***43***	55	**55**	***100***
TOTAL IPG	**9.0**	**0.0**	**0.0**	**0.0**	**6.0**	**1.0**	**0.0**	**2.29**	***43***	**55.0**	**55.0**	***100***
INTRODUCED ANNUAL GRAMINOIDS												
Bromus tectorum							0.3	**0.04**	***14***			
TOTAL IAG	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**	**0.04**	***14***	**0.0**	**0.0**	***0***

Table B7

Percent Canopy Cover by Class and Species for Seven Sample Sites in the *Artemisia tridentata/Festuca campestris* Habitat Type and One Sample Site in the *Symphoricarpos occidentalis/Poa pratensis* Community Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Artemisia tridentata/Festuca campestris* h.t.**									***SYM OCC/POA PRA* c.t.**		
	PLOT NUMBER							**Mean**	***Con-***	**PLOT NUMBER**	**Mean**	***Con-***
	25	27	29	32	33	34	38	**Cover**	***stancy***	45	**Cover**	***stancy***
								n=7			**n=1**	
NATIVE PERENNIAL FORBS AND SUBSHRUBS												
Achillea millefolium	2		3	1	4	4	0.3	**2.04**	***86***	3	**3**	***100***
Agoseris glauca										1	**1**	***100***
Anemone patens	1					0.3		**0.19**	***29***			
Antennaria microphylla	2	3	3	2	1	4	3	**2.57**	***100***	2	**2**	***100***
Antennaria parvifolia	1						0.3	**0.19**	***29***			
Antennaria umbrinella						1		**0.14**	***14***			
Arenaria congesta	0.3	1	1	0.3	1	4	2	**1.37**	***100***			
Arnica sororia	3	1		3	8	14	7	**5.14**	***86***			
Artemisia frigida				0.3	0.3		0.3	**0.13**	***43***			
Artemisia ludoviciana	1							**0.14**	***14***	8	**8**	***100***
Astragalus adsurgens			1		2			**0.43**	***29***			
Astragalus agrestis		0.3	0.3			1		**0.23**	***43***	0.3	**0.3**	***100***
Astragalus atropubescens		7	2					**1.29**	***29***			
Astragalus cibarius			0.3					**0.04**	***14***			
Astragalus drummondii				1				**0.14**	***14***			
Campanula rotundifolia	0.3							**0.04**	***14***	5	**5**	***100***
Castilleja pallescens		1	0.3	0.3		1		**0.37**	***57***			
Cirsium undulatum					0.3	1		**0.19**	***29***			
Crepis intermedia						0.3		**0.04**	***14***			
Crepis modocensis			0.3					**0.04**	***14***			
Dodecatheon conjugens						0.3		**0.04**	***14***			
Drymocallis arguta	1				2		1	**0.57**	***43***	1	**1**	***100***
Erigeron corymbosus	1		0.3	1	5	9	3	**2.76**	***86***			
Eriogonum umbellatum	1			0.3				**0.19**	***29***			
Gaillardia aristata							0.3	**0.04**	***14***	1	**1**	***100***
Galium boreale	2							**0.29**	***14***	0.3	**0.3**	***100***
Gaura coccinea					0.3		0.3	**0.09**	***29***	3	**3**	***100***
Geranium viscosissimum										3	**3**	***100***
Geum triflorum	4		0.3		1	3	2	**1.47**	***71***			
Heuchera parvifolia						1		**0.14**	***14***			
Hieracium scouleri	1							**0.14**	***14***			
Iris missouriensis										3	**3**	***100***
Lactuca pulchella										0.3	**0.3**	***100***

Table B7

Percent Canopy Cover by Class and Species for Seven Sample Sites in the *Artemisia tridentata/Festuca campestris* Habitat Type and One Sample Site in the *Symphoricarpos occidentalis/Poa pratensis* Community Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Artemisia tridentata/Festuca campestris* h.t.**									***SYM OCC/POA PRA* c.t.**		
	PLOT NUMBER							**Mean**	***Con-***	**PLOT NUMBER**	**Mean**	***Con-***
	25	27	29	32	33	34	38	**Cover**	***stancy***	45	**Cover**	***stancy***
								n=7			**n=1**	
Lithospermum ruderale	1				4	0.3	2	**1.04**	***57***			
Lomatium triternatum		1	0.3					**0.19**	***29***			
Lupinus sericeus	20	1	0.3	7	36	10	2	**10.90**	***100***	4	**4**	***100***
Penstemon procerus	4			1		2		**1.00**	***43***	4	**4**	***100***
Perideridia montana	0.3							**0.04**	***14***			
Phlox hoodii						4		**0.57**	***14***			
Potentilla gracilis	2							**0.29**	***14***	1	**1**	***100***
Schoenocrambe linifolia					0.3			**0.04**	***14***			
Sedum lanceolatum			0.3					**0.04**	***14***			
Senecio integerrimus	1	0.3			0.3			**0.23**	***43***			
Silene drummondii	0.3							**0.04**	***14***			
Solidago missouriensis	2			3	7			**1.71**	***43***	4	**4**	***100***
Sphaeralcea coccinea							0.3	**0.04**	***14***			
Symphyotrichum campestre					3			**0.43**	***14***			
Symphyotrichum falcatum										1	**1**	***100***
Vicia americana							1	**0.14**	***14***			
TOTAL NPF	**51.2**	**15.6**	**12.7**	**20.2**	**75.5**	**60.2**	**24.8**	**37.17**	***100***	**44.9**	**44.9**	***100***
INTRODUCED PERENNIAL FORBS												
Centaurea maculosa					3	2		**0.71**	***29***			
Linaria dalmatica						2		**0.29**	***14***			
Taraxacum laevigatum	0.3		0.3		2			**0.37**	***43***	2	**2**	***100***
TOTAL IPF	**0.3**	**0.0**	**0.3**	**0.0**	**5.0**	**4.0**	**0.0**	**1.37**	***57***	**2.0**	**2.0**	***100***

Table B7

Percent Canopy Cover by Class and Species for Seven Sample Sites in the *Artemisia tridentata/Festuca campestris* Habitat Type and One Sample Site in the *Symphoricarpos occidentalis/Poa pratensis* Community Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Artemisia tridentata/Festuca campestris* h.t.**									***SYM OCC/POA PRA* c.t.**		
	PLOT NUMBER							**Mean**	***Con-***	**PLOT NUMBER**	**Mean**	***Con-***
	25	27	29	32	33	34	38	**Cover**	***stancy***	45	**Cover**	***stancy***
								n=7			**n=1**	
NATIVE ANNUAL/BIENNIAL FORBS												
Boechera retrofracta			0.3					**0.04**	***14***			
Collinsia parviflora							0.3	**0.04**	***14***			
Collomia linearis	0.3	0.3						**0.09**	***29***	0.3	**0.3**	***100***
Descurainia pinnata	0.3							**0.04**	***14***			
Draba nemorosa				0.3				**0.04**	***14***			
Epilobium brachycarpum										0.3	**0.3**	***100***
Linanthus septentrionalis	0.3		0.3			1	1	**0.37**	***57***			
Microsteris gracilis		0.3	0.3					**0.09**	***29***			
Orthocarpus luteus	1			0.3	0.3			**0.23**	***43***	0.3	**0.3**	***100***
Orthocarpus tenuifolius		2	3	0.3	3	5	5	**2.61**	***86***			
Phacelia linearis		1						**0.14**	***14***			
Polygonum douglasii		0.3		0.3				**0.09**	***29***			
TOTAL NA/BF	**1.9**	**3.9**	**3.9**	**1.2**	**3.3**	**6.0**	**6.3**	**3.79**	***100***	**0.9**	**0.9**	***100***
INTRODUCED ANNUAL/BIENNIAL FORBS												
Alyssum desertorum							0.3	**0.04**	***14***			
Camelina microcarpa										0.3	**0.3**	***100***
Carduus nutans						0.3		**0.04**	***14***			
Thlaspi arvense										0.3	**0.3**	***100***
Tragopogon dubius		0.3						**0.04**	***14***	0.3	**0.3**	***100***
TOTAL IA/BF	**0.0**	**0.3**	**0.0**	**0.0**	**0.0**	**0.3**	**0.3**	**0.13**	***43***	**0.9**	**0.9**	***100***
SHRUBS												
Artemisia tridentata	16	56	38	24	38	46	44	**37.43**	***100***			
Artemisia tripartita				2		1		**0.43**	***29***			
Chrysothamnus viscidiflorus					0.3	2		**0.33**	***29***			
Ericameria nauseosa		1						**0.14**	***14***			
Rosa woodsii	2							**0.29**	***14***	1	**1**	***100***
Symphoricarpos occidentalis										14	**14**	***100***
TOTAL SHRUBS	**18.0**	**57.0**	**38.0**	**26.0**	**38.3**	**49.0**	**44.0**	**38.61**	***100***	**15.0**	**15.0**	***100***

Table B7

Percent Canopy Cover by Class and Species for Seven Sample Sites in the *Artemisia tridentata/Festuca campestris* Habitat Type and One Sample Site in the *Symphoricarpos occidentalis/Poa pratensis* Community Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Artemisia tridentata/Festuca campestris* h.t.**									***SYM OCC/POA PRA* c.t.**		
	PLOT NUMBER							**Mean**	***Con-***	**PLOT NUMBER**	**Mean**	***Con-***
	25	27	29	32	33	34	38	**Cover**	***stancy***	45	**Cover**	***stancy***
								n=7			**n=1**	
TREES 0.01-acre												
Juniperus scopulorum						0.3		**0.04**	***14***			
TOTAL TREES 0.01-acre	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**	**0.0**	**0.04**	***14***	**0.0**	**0.0**	***0***
TREES 0.1-acre												
Juniperus scopulorum						1	1	**0.29**	***29***			
Pseudotsuga menziesii	2					1		**0.43**	***29***			
TOTAL TREES 0.1-acre	**2.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.0**	**1.0**	**0.71**	***43***	**0.0**	**0.0**	***0***
TOTAL VEGETATION (Stratified)	**143.40**	**142.80**	**99.90**	**116.40**	**180.10**	**183.10**	**110.70**	**139.49**	***100***	**155.00**	**155.00**	**100**

[1]Footnotes are presented on cover page B-i.

Table B8

Percent Canopy Cover by Class and Species for Five Sample Sites in the *Juniperus scopulorum/Agropyron spicatum* Community Type and Two Sample Sites in the *Pinus ponderosa/Agropyron spicatum* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***JUN SCO/AGR SPI* c.t.**							***PIN PON/AGR SPI* h.t.**			
	PLOT NUMBER					**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	2	17	20	22	23	**Cover**	***stancy***	16	21	**Cover**	***stancy***
						n=5				**n=2**	
SITE PARAMETERS*											
Slope (percent)	55	26-40	46	66	35-55			25-75	60		
Aspect (degrees mag. north)	170	184	074	208	105			025	240		
Topography	Mid	Mid	Mid	Mid	Mid			Bank	U-Mid		
Configuration	Convex	Und	Und	Straight	Straight			S (Und)	Straight		
Photo # (Digital)	332-333	724-726	348-349	310-311	784-786			722-723	308-309		
Photo azimuth	082-262	090-250	330-150	280-100	025-085			294-114	294-114		
Investigator	DB/KL	KS/ED	DB/ED	DB/KL	KS/KL			KS/ED	DB/KL		
Date	7/12/13	7/10/13	7/13/13	7/11/13	7/13/13			7/10/13	7/11/13		
GROUND COVER											
Bare Ground	15	52	40	25	29	**32.20**	***100***	5	15	**10.00**	***100***
Rock	70	25	28	45	40	**41.60**	***100***	2	28	**15.00**	***100***
Litter	14	18	20	26	26	**20.80**	***100***	87	55	**71.00**	***100***
Lichens	0.3	0.3	2		1	**0.72**	***80***	0.3		**0.15**	***50***
Moss		2	7	1	1	**2.20**	***80***	3		**1.50**	***50***
Basal Vegetation	1	3	3	3	3	**2.60**	***100***	3	2	**2.50**	***100***
VEGETATION STRUCTURE (nonstratified cover)											
Total Vegetation	22	42	72	57	56	**49.80**	***100***	78	42	**60.00**	***100***
Perennial Graminoids	11	7	33	21	28	**20.00**	***100***	2	12	**7.00**	***100***
Annual Graminoids	0.3		20		0.3	**4.12**	***60***	0.3		**0.15**	***50***
Perennial Forbs and Subshrubs	6	15	12	7	23	**12.60**	***100***	2	2	**2.00**	***100***
Annual/Biennial Forbs	0.3	0.3	5	2	2	**1.92**	***100***	2	0.3	**1.15**	***100***
Shrubs		0.3	0.3			**0.12**	***40***	3		**1.50**	***50***
Trees 0.01-acre	8	26	24	34	24	**23.20**	***100***	74	32	**53.00**	***100***
Trees 0.1-acre	15	15	29	18	30	**21.40**	***100***	62	27	**44.50**	***100***

Table B8

Percent Canopy Cover by Class and Species for Five Sample Sites in the *Juniperus scopulorum/Agropyron spicatum* Community Type and Two Sample Sites in the *Pinus ponderosa/Agropyron spicatum* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***JUN SCO/AGR SPI* c.t.**							***PIN PON/AGR SPI* h.t.**			
	PLOT NUMBER					**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	2	17	20	22	23	**Cover**	***stancy***	16	21	**Cover**	***stancy***
						n=5				**n=2**	
CLASS\SPECIES											
NATIVE PERENNIAL GRAMINOIDS											
Agropyron smithii		2	8			**2.00**	***40***				
Agropyron spicatum	7	4	20	18	27	**15.20**	***100***	2	8	**5.00**	***100***
Aristida purpurea		0.3			0.3	**0.12**	***40***				
Carex rossii	0.3					**0.06**	***20***				
Festuca campestris		0.3		2		**0.46**	***40***		3	**1.50**	***50***
Koeleria macrantha			2	1		**0.60**	***40***		0.3	**0.15**	***50***
Oryzopsis hymenoides		0.3				**0.06**	***20***		1	**0.50**	***50***
Poa secunda	4		3	1	1	**1.80**	***80***				
TOTAL NPG	**11.3**	**6.9**	**33.0**	**22.0**	**28.3**	**20.30**	***100***	**2.0**	**12.3**	**7.15**	***100***
INTRODUCED PERENNIAL GRAMINOIDS											
Poa pratensis			1			**0.20**	***20***				
TOTAL IPG	**0.0**	**0.0**	**1.0**	**0.0**	**0.0**	**0.20**	***20***	**0.0**	**0.0**	**0.00**	***0***
INTRODUCED ANNUAL GRAMINOIDS											
Bromus japonicus			18		0.3	**3.66**	***40***				
Bromus tectorum	0.3		2			**0.46**	***40***	0.3		**0.15**	***50***
TOTAL IAG	**0.3**	**0.0**	**20.0**	**0.0**	**0.3**	**4.12**	***60***	**0.3**	**0.0**	**0.15**	***50***
NATIVE PERENNIAL FORBS AND SUBSHRUBS											
Achillea millefolium		0.3	1	0.3	1	**0.52**	***80***	0.3		**0.15**	***50***
Allium cernuum	0.3					**0.06**	***20***				
Allium textile		0.3		0.3		**0.12**	***40***				
Antennaria microphylla			0.3		0.3	**0.12**	***40***				
Antennaria neglecta								0.3		**0.15**	***50***
Apocynum cannabinum		1				**0.20**	***20***				
Artemisia frigida			0.3	0.3	0.3	**0.18**	***60***	0.3	0.3	**0.30**	***100***
Astragalus adsurgens		1				**0.20**	***20***		1	**0.50**	***50***
Astragalus cibarius		0.3				**0.06**	***20***				
Astragalus crassicarpus					0.3	**0.06**	***20***				
Astragalus drummondii			0.3			**0.06**	***20***				
Astragalus purshii			0.3			**0.06**	***20***				
Balsamorhiza sagittata			5		3	**1.60**	***40***				
Campanula rotundifolia	1					**0.20**	***20***	0.3		**0.15**	***50***

Table B8

Percent Canopy Cover by Class and Species for Five Sample Sites in the *Juniperus scopulorum/Agropyron spicatum* Community Type and Two Sample Sites in the *Pinus ponderosa/Agropyron spicatum* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***JUN SCO/AGR SPI* c.t.**							***PIN PON/AGR SPI* h.t.**			
	PLOT NUMBER					**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	2	17	20	22	23	**Cover**	***stancy***	16	21	**Cover**	***stancy***
						n=5				**n=2**	
Cerastium arvense	1			0.3		**0.26**	***40***				
Cirsium undulatum					0.3	**0.06**	***20***				
Cryptantha spiculifera				0.3		**0.06**	***20***				
Cymopterus glaucus	0.3					**0.06**	***20***				
Delphinium bicolor				0.3		**0.06**	***20***				
Drymocallis glandulosa				0.3		**0.06**	***20***				
Erigeron compositus	2			0.3		**0.46**	***40***		0.3	**0.15**	***50***
Galium boreale								0.3		**0.15**	***50***
Gaura coccinea				0.3	0.3	**0.12**	***40***				
Glycyrrhiza lepidota		0.3				**0.06**	***20***				
Gutierrezia sarothrae		0.3	2		3	**1.06**	***60***				
Heterotheca villosa					1	**0.20**	***20***				
Lithospermum incisum					0.3	**0.06**	***20***				
Lupinus sericeus								0.3		**0.15**	***50***
Minuartia nuttallii	0.3					**0.06**	***20***				
Musineon divaricatum		0.3				**0.06**	***20***				
Opuntia polyacantha		0.3	0.3		0.3	**0.18**	***60***				
Penstemon eriantherus	0.3	0.3				**0.12**	***40***		0.3	**0.15**	***50***
Penstemon nitidus				0.3		**0.06**	***20***				
Phlox hoodii	1	2	0.3	1	3	**1.46**	***100***				
Senecio canus	0.3	0.3		0.3	2	**0.58**	***80***				
Solidago missouriensis		2			4	**1.20**	***40***	0.3		**0.15**	***50***
Sphaeralcea coccinea			1		0.3	**0.26**	***40***				
Stenotus acaulis					2	**0.40**	***20***				
Symphyotrichum falcatum		1			2	**0.60**	***40***				
Vicia americana			1	0.3	0.3	**0.32**	***60***	0.3	0.3	**0.30**	***100***
TOTAL NPF	**6.5**	**9.7**	**11.8**	**4.6**	**23.7**	**11.26**	***100***	**2.4**	**2.2**	**2.30**	***100***
INTRODUCED PERENNIAL FORBS											
Centaurea maculosa		7	1	3		**2.20**	***60***	0.3		**0.15**	***50***
Linaria dalmatica	0.3		0.3	1	0.3	**0.38**	***80***				
Taraxacum laevigatum			0.3	0.3	0.3	**0.18**	***60***		0.3	**0.15**	***50***
TOTAL IPF	**0.3**	**7.0**	**1.6**	**4.3**	**0.6**	**2.76**	***100***	**0.3**	**0.3**	**0.30**	***100***

Table B8

Percent Canopy Cover by Class and Species for Five Sample Sites in the *Juniperus scopulorum/Agropyron spicatum* Community Type and Two Sample Sites in the *Pinus ponderosa/Agropyron spicatum* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***JUN SCO/AGR SPI* c.t.**							***PIN PON/AGR SPI* h.t.**			
	PLOT NUMBER					**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	2	17	20	22	23	**Cover**	***stancy***	16	21	**Cover**	***stancy***
						n=5				**n=2**	
NATIVE ANNUAL/BIENNIAL FORBS											
Boechera retrofracta									0.3	**0.15**	***50***
Collinsia parviflora								0.3		**0.15**	***50***
Collomia linearis			0.3			**0.06**	***20***	0.3		**0.15**	***50***
Descurainia incana									0.3	**0.15**	***50***
Descurainia pinnata								0.3		**0.15**	***50***
Ellisia nyctelea								0.3		**0.15**	***50***
Epilobium brachycarpum			0.3			**0.06**	***20***	0.3		**0.15**	***50***
Microsteris gracilis			0.3			**0.06**	***20***				
Phacelia linearis								0.3		**0.15**	***50***
Polygonum douglasii			0.3			**0.06**	***20***				
TOTAL NA/BF	**0.0**	**0.0**	**1.2**	**0.0**	**0.0**	**0.24**	***20***	**1.8**	**0.6**	**1.20**	***100***
INTRODUCED ANNUAL/BIENNIAL FORBS											
Alyssum alyssoides	0.3	0.3	3	2	2	**1.52**	***100***	0.3	0.3	**0.30**	***100***
Camelina microcarpa				0.3		**0.06**	***20***	0.3		**0.15**	***50***
Filago arvensis			1			**0.20**	***20***				
Thlaspi arvense								0.3		**0.15**	***50***
Tragopogon dubius	0.3		0.3		0.3	**0.18**	***60***				
TOTAL IA/BF	**0.6**	**0.3**	**4.3**	**2.3**	**2.3**	**1.96**	***100***	**0.9**	**0.3**	**0.60**	***100***
SHRUBS											
Amelanchier alnifolia		0.3				**0.06**	***20***				
Artemisia tridentata								2		**1.00**	***50***
Ericameria nauseosa			0.3			**0.06**	***20***				
Prunus virginiana								0.3		**0.15**	***50***
Ribes setosum								0.3		**0.15**	***50***
Symphoricarpos albus								0.3		**0.15**	***50***
TOTAL SHRUBS	**0.0**	**0.3**	**0.3**	**0.0**	**0.0**	**0.12**	***40***	**2.9**	**0.0**	**1.45**	***50***
TREES 0.01-acre											
Juniperus scopulorum	8	26	24	34	24	**23.20**	***100***	22	3	**12.50**	***100***
Pinus ponderosa								68	30	**49.00**	***100***
TOTAL TREES 0.01-acre	**8.0**	**26.0**	**24.0**	**34.0**	**24.0**	**23.20**	***100***	**90.0**	**33.0**	**61.50**	***100***

Table B8

Percent Canopy Cover by Class and Species for Five Sample Sites in the *Juniperus scopulorum/Agropyron spicatum* Community Type and Two Sample Sites in the *Pinus ponderosa/Agropyron spicatum* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***JUN SCO/AGR SPI* c.t.**							***PIN PON/AGR SPI* h.t.**			
	PLOT NUMBER					**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	2	17	20	22	23	**Cover**	***stancy***	16	21	**Cover**	***stancy***
						n=5				**n=2**	
TREES 0.1-acre											
Juniperus scopulorum	14	14	28	17	30	**20.60**	***100***	32	16	**24.00**	***100***
Pinus ponderosa		1		1		**0.40**	***40***	52	14	**33.00**	***100***
Pseudotsuga menziesii	1		1			**0.40**	***40***	0.3		**0.15**	***50***
TOTAL TREES 0.1-acre	**15.0**	**15.0**	**29.0**	**18.0**	**30.0**	**21.40**	***100***	**84.3**	**30.0**	**57.15**	***100***
TOTAL VEGETATION (Stratified)	**27.0**	**50.2**	**97.2**	**67.2**	**79.2**	**64.16**	***100***	**100.6**	**48.7**	**74.65**	***100***

[1]Footnotes are presented on cover page B-i.

Table B9

Percent Canopy Cover by Class and Species for Two Sample Sites in the *Pseudotsuga menziesii/Agropyron spicatum* and Three Sample Sites in the *Pseudotsuga menziesii/Festuca campestris* Habitat Types, Montana Limestone Resources Baseline Study Area, 2013.

	***PSE MEN/AGR SPI* h.t.**				***PSE MEN/FES CAM* h.t.**				
	PLOT NUMBER		Mean	***Con-***	**PLOT NUMBER**			**Mean**	***Con-***
	11	18	Cover	***stancy***	13	19	24	**Cover**	***stancy***
			n=2					**n=3**	
SITE PARAMETERS*									
Slope (percent)	82	55-65			72	10-80	10-80		
Aspect (degrees mag. north)	054	098			322	014	016		
Topography	Mid	Upper			Upper	Bot-Bank	Bot-Bank		
Configuration	Und	Convex			Straight	Concave	Und		
Photo # (Digital)	342-343	764-765			256-257	758-761	774-776		
Photo azimuth	140-320	015-195			232-048	194-080	196-130		
Investigator	DB/ED	KS/ED			DB/KL	KS/ED	KS/ED		
Date	7/13/13	7/12/13			7/9/13	7/12/13	7/12/13		
GROUND COVER									
Bare Ground	7	20	**13.50**	***100***	8	15	3	**8.67**	***100***
Rock	54	40	**47.00**	***100***	3	16	30	**16.33**	***100***
Litter	33	35	**34.00**	***100***	44	37	36	**39.00**	***100***
Lichens	4	0.3	**2.15**	***100***	2	1	0.3	**1.10**	***100***
Moss	1	1	**1.00**	***100***	40	28	28	**32.00**	***100***
Basal Vegetation	1	4	**2.50**	***100***	3	3	3	**3.00**	***100***
VEGETATION STRUCTURE (nonstratified cover)									
Total Vegetation	37	62	**49.50**	***100***	84	88	82	**84.67**	***100***
Perennial Graminoids	8	32	**20.00**	***100***	9	0.3	1	**3.43**	***100***
Annual Graminoids		0.3	**0.15**	***50***		0.3		**0.10**	***33***
Perennial Forbs and Subshrubs	4	19	**11.50**	***100***	4	2	2	**2.67**	***100***
Annual/Biennial Forbs	0.3	1	**0.65**	***100***		2	1	**1.00**	***67***
Shrubs	2		**1.00**	***50***		0.3	0.3	**0.20**	***67***
Trees 0.01-acre	24	32	**28.00**	***100***	82	88	82	**84.00**	***100***
Trees 0.1-acre	18	46	**32.00**	***100***	70	82	78	**76.67**	***100***

Table B9

Percent Canopy Cover by Class and Species for Two Sample Sites in the *Pseudotsuga menziesii/Agropyron spicatum* and Three Sample Sites in the *Pseudotsuga menziesii/Festuca campestris* Habitat Types, Montana Limestone Resources Baseline Study Area, 2013.

	***PSE MEN/AGR SPI* h.t.**				***PSE MEN/FES CAM* h.t.**				
	PLOT NUMBER		Mean	***Con-***	**PLOT NUMBER**			**Mean**	***Con-***
	11	18	Cover	***stancy***	13	19	24	**Cover**	***stancy***
			n=2					**n=3**	
CLASS\SPECIES									
NATIVE PERENNIAL GRAMINOIDS									
Agropyron spicatum	5	28	**16.50**	***100***	5		0.3	**1.77**	***67***
Festuca campestris					2		1	**1.00**	***67***
Festuca idahoensis					2			**0.67**	***33***
Koeleria macrantha	1	1	**1.00**	***100***					
Poa secunda	2	3	**2.50**	***100***					
Stipa comata		1	**0.50**	***50***					
Stipa viridula							0.3	**0.10**	***33***
TOTAL NPG	**8.0**	**33.0**	**20.50**	***100***	**9.0**	**0.0**	**1.6**	**3.53**	***67***
INTRODUCED PERENNIAL GRAMINOIDS									
Poa pratensis						0.3		**0.10**	***33***
TOTAL IPG	**0.0**	**0.0**	**0.00**	***0***	**0.0**	**0.3**	**0.0**	**0.10**	***33***
INTRODUCED ANNUAL GRAMINOIDS									
Bromus japonicus		0.3	**0.15**	***50***		0.3		**0.10**	***33***
Bromus tectorum		0.3	**0.15**	***50***					
TOTAL IAG	**0.0**	**0.6**	**0.30**	***50***	**0.0**	**0.3**	**0.0**	**0.10**	***33***
NATIVE PERENNIAL FORBS AND SUBSHRUBS									
Allium cernuum					0.3			**0.10**	***33***
Antennaria microphylla					0.3			**0.10**	***33***
Arnica cordifolia					1			**0.33**	***33***
Artemisia frigida		0.3	**0.15**	***50***					
Astragalus adsurgens		3	**1.50**	***50***					
Astragalus cibarius		0.3	**0.15**	***50***					
Astragalus miser							0.3	**0.10**	***33***
Balsamorhiza sagittata		0.3	**0.15**	***50***					
Besseya wyomingensis					0.3			**0.10**	***33***
Campanula rotundifolia							0.3	**0.10**	***33***
Delphinium bicolor					0.3			**0.10**	***33***
Erigeron compositus	1		**0.50**	***50***					
Erigeron corymbosus					0.3			**0.10**	***33***
Fragaria virginiana							0.3	**0.10**	***33***

Table B9

Percent Canopy Cover by Class and Species for Two Sample Sites in the *Pseudotsuga menziesii/Agropyron spicatum* and Three Sample Sites in the *Pseudotsuga menziesii/Festuca campestris* Habitat Types, Montana Limestone Resources Baseline Study Area, 2013.

	***PSE MEN/AGR SPI* h.t.**				***PSE MEN/FES CAM* h.t.**				
	PLOT NUMBER		Mean	***Con-***	**PLOT NUMBER**			**Mean**	***Con-***
	11	18	Cover	***stancy***	13	19	24	**Cover**	***stancy***
			n=2					**n=3**	
Gaillardia aristata		0.3	**0.15**	***50***					
Geum triflorum							0.3	**0.10**	***33***
Gutierrezia sarothrae		0.3	**0.15**	***50***					
Heuchera cylindrica						0.3	0.3	**0.20**	***67***
Lomatium triternatum		0.3	**0.15**	***50***					
Mertensia oblongifolia					0.3			**0.10**	***33***
Opuntia polyacantha		0.3	**0.15**	***50***					
Penstemon eriantherus		0.3	**0.15**	***50***					
Phlox hoodii	0.3	8	**4.15**	***100***					
Prosartes trachycarpa					0.3			**0.10**	***33***
Sedum lanceolatum					0.3			**0.10**	***33***
Senecio canus	1		**0.50**	***50***					
Smilacina stellata						0.3		**0.10**	***33***
Solidago missouriensis	1	0.3	**0.65**	***100***			0.3	**0.10**	***33***
Sphaeralcea coccinea		0.3	**0.15**	***50***					
Stenotus acaulis	0.3		**0.15**	***50***					
Symphyotrichum falcatum		0.3	**0.15**	***50***					
Valeriana dioica					2			**0.67**	***33***
Vicia americana		0.3	**0.15**	***50***					
Viola nuttallii						0.3		**0.10**	***33***
TOTAL NPF	**3.6**	**14.6**	**9.10**	***100***	**5.4**	**0.9**	**1.8**	**2.70**	***100***
INTRODUCED PERENNIAL FORBS									
Linaria dalmatica		6	**3.00**	***50***					
Taraxacum laevigatum	0.3		**0.15**	***50***		0.3	0.3	**0.20**	***67***
TOTAL IPF	**0.3**	**6.0**	**3.15**	***100***	**0.0**	**0.3**	**0.3**	**0.20**	***67***
FERNS AND ALLIES									
Cystopteris fragilis						1		**0.33**	***33***
TOTAL FA	**0.0**	**0.0**	**0.00**	***0***	**0.0**	**1.0**	**0.0**	**0.33**	***33***

Table B9

Percent Canopy Cover by Class and Species for Two Sample Sites in the *Pseudotsuga menziesii/Agropyron spicatum* and Three Sample Sites in the *Pseudotsuga menziesii/Festuca campestris* Habitat Types, Montana Limestone Resources Baseline Study Area, 2013.

	***PSE MEN/AGR SPI* h.t.**				***PSE MEN/FES CAM* h.t.**				
	PLOT NUMBER		Mean	***Con-***	**PLOT NUMBER**			**Mean**	***Con-***
	11	18	Cover	***stancy***	13	19	24	**Cover**	***stancy***
			n=2					**n=3**	
NATIVE ANNUAL/BIENNIAL FORBS									
Boechera divaricarpa	0.3		**0.15**	***50***					
Collinsia parviflora						0.3	0.3	**0.20**	***67***
Collomia linearis						0.3		**0.10**	***33***
Descurainia incana							0.3	**0.10**	***33***
Galium aparine						1		**0.33**	***33***
TOTAL NA/BF	**0.3**	**0.0**	**0.15**	***50***	**0.0**	**1.6**	**0.6**	**0.73**	***67***
INTRODUCED ANNUAL/BIENNIAL FORBS									
Alyssum alyssoides		1	**0.50**	***50***			0.3	**0.10**	***33***
Asperugo procumbens							0.3	**0.10**	***33***
Melilotus officinalis							0.3	**0.10**	***33***
Tragopogon dubius						0.3		**0.10**	***33***
Verbascum thapsus	0.3		**0.15**	***50***					
TOTAL IA/BF	**0.3**	**1.0**	**0.65**	***100***	**0.0**	**0.3**	**0.9**	**0.40**	***67***
SHRUBS									
Amelanchier alnifolia	2		**1.00**	***50***					
Ribes setosum						0.3		**0.10**	***33***
Rosa acicularis						0.3	0.3	**0.20**	***67***
TOTAL SHRUBS	**2.0**	**0.0**	**1.00**	***50***	**0.0**	**0.6**	**0.3**	**0.30**	***67***
TREES 0.01-acre									
Juniperus scopulorum	4	30	**17.00**	***100***	10	30	38	**26.00**	***100***
Pinus ponderosa							2	**0.67**	***33***
Pseudotsuga menziesii	20	5	**12.50**	***100***	75	80	58	**71.00**	***100***
TOTAL TREES 0.01-acre	**24.0**	**35.0**	**29.50**	***100***	**85.0**	**110.0**	**98.0**	**97.67**	***100***
TREES 0.1-acre									
Juniperus scopulorum	5	34	**19.50**	***100***	7	38	46	**30.33**	***100***
Pinus ponderosa							8	**2.67**	***33***
Pseudotsuga menziesii	14	18	**16.00**	***100***	68	75	54	**65.67**	***100***
TOTAL TREES 0.1-acre	**19.0**	**52.0**	**35.50**	***100***	**75.0**	**113.0**	**108.0**	**98.67**	***100***
TOTAL VEGETATION (Stratified)	**38.5**	**90.2**	**64.35**	***100***	**99.4**	**115.3**	**103.5**	**106.07**	***100***

[1]Footnotes are presented on cover page B-i.

Table B10

Percent Canopy Cover by Class and Species for 12 Sample Sites in the *Pseudotsuga menziesii/Physocarpus malvaceus* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Pseudotsuga menziesii/Physocarpus malvaceus* h.t.**													
	PLOT NUMBER												Mean	***Con-***
	1	3	4	5	6	7	8	9	10	12	14	15	Cover	***stancy***
													n=12	
SITE PARAMETERS*														
Slope (percent)	60	58	5	60	4	3	72	54	8-65	86	88-94	52		
Aspect (degrees mag. north)	068	124	040	318	220	356	290	290	306	044	020	030		
Topography	Mid	Toe	Bottom	Mid	Bottom	Bottom	U-Mid	Lower	Bot-Bank	Mid	Upper	L-Mid		
Configuration	Convex	Und	Concave	Convex	Concave	Concave	Convex	Convex	Concave	Concave	S (Und)	Concave		
Photo # (Digital)	330-331	334-335	336-337	340-341	270-271	328-329	321-323	305-306	301-302	344-345	729-731	346-347		
Photo azimuth	140-320	026-206	214-040	040-220	032-232	356-176	216-036	208-028	136-306	306-126	300-120	282-098		
Investigator	DB/KL	DB/KL	DB/KL	DB/KL	DB/KL	DB/KL	DB/KL	DB/KL	DB/KL	DB/ED	KS/ED	DB/ED		
Date	7/12/13	7/12/13	7/12/13	7/12/13	7/10/13	7/12/13	7/12/13	7/13/13	7/11/13	7/13/13	7/11/13	7/13/13		
GROUND COVER														
Bare Ground	14	5	3	8	18	15	2	4	2	3	0.5	3	**6.46**	***100***
Rock	5	12	0.3	4	5	20	20	6	3	7	2	2	**7.19**	***100***
Litter	61	40	40	30	61	38	20	82	52	30	40	40	**44.50**	***100***
Lichens	2	5	10	5	4	6	5	0.3	2	3	0.3	5	**3.97**	***100***
Moss	16	35	40	50	8	18	50	3	40	55	52	48	**34.58**	***100***
Basal Vegetation	2	3	7	3	4	3	3	5	1	2	5	2	**3.33**	***100***
VEGETATION STRUCTURE (nonstratified cover)														
Total Vegetation	88	77	96	75	75	90	85	89	76	76	93	82	**83.50**	***100***
Perennial Graminoids	1		1	0.3	36	13	0.3	0.3	0.3	0.3	54	7	**9.46**	***92***
Annual Graminoids									0.3			20	**1.69**	***17***
Perennial Forbs and Subshrubs		0.3	32	1	15	20	2	1	2	2	22	2	**8.28**	***92***
Annual/Biennial Forbs					2	1			1	0.3	1	13	**1.53**	***50***
Shrubs	2	4	18	6	15	20	39	1	5	22	23	1	**13.00**	***100***
Trees 0.01-acre	88	76	90	73	40	75	65	89	74	64	64	76	**72.83**	***100***
Trees 0.1-acre	84	71	70	75	55	65	71	80	75	62	56	75	**69.92**	***100***

Table B10

Percent Canopy Cover by Class and Species for 12 Sample Sites in the *Pseudotsuga menziesii/Physocarpus malvaceus* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Pseudotsuga menziesii/Physocarpus malvaceus* h.t.**													
	PLOT NUMBER												Mean	***Con-***
	1	3	4	5	6	7	8	9	10	12	14	15	Cover	***stancy***
													n=12	
CLASS\SPECIES														
NATIVE PERENNIAL GRAMINOIDS														
Agropyron spicatum					8		0.3			0.3	32	3	**3.63**	***42***
Carex rossii					1								**0.08**	***8***
Elymus glaucus						10							**0.83**	***8***
Festuca campestris								0.3	0.3		12		**1.05**	***25***
Festuca idahoensis	0.3		0.3	0.3							18	2	**1.74**	***42***
Koeleria macrantha			0.3					0.3			0.3		**0.08**	***25***
Poa secunda											0.3		**0.03**	***8***
Stipa viridula					15								**1.25**	***8***
TOTAL NPG	**0.3**	**0.0**	**0.6**	**0.3**	**24.0**	**10.0**	**0.3**	**0.6**	**0.3**	**0.3**	**62.6**	**5.0**	**8.69**	***92***
INTRODUCED PERENNIAL GRAMINOIDS														
Agropyron repens												1	**0.08**	***8***
Phleum pratense					1								**0.08**	***8***
Poa pratensis	0.3		1		14	3				0.3	0.3	1	**1.66**	***58***
TOTAL IPG	**0.3**	**0.0**	**1.0**	**0.0**	**15.0**	**3.0**	**0.0**	**0.0**	**0.0**	**0.3**	**0.3**	**2.0**	**1.83**	***58***
INTRODUCED ANNUAL GRAMINOIDS														
Bromus japonicus									0.3			4	**0.36**	***17***
Bromus tectorum												18	**1.50**	***8***
TOTAL IAG	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**	**0.0**	**0.0**	**22.0**	**1.86**	***17***
NATIVE PERENNIAL FORBS AND SUBSHRUBS														
Achillea millefolium					1						2		**0.25**	***17***
Allium cernuum			0.3			0.3		0.3	0.3	0.3			**0.13**	***42***
Anemone patens					1								**0.08**	***8***
Antennaria microphylla					1					0.3			**0.11**	***17***
Antennaria neglecta					4	2							**0.50**	***17***
Antennaria parvifolia			1										**0.08**	***8***
Arnica cordifolia												0.3	**0.03**	***8***
Arnica sororia					2								**0.17**	***8***
Artemisia ludoviciana						3							**0.25**	***8***
Astragalus miser											1		**0.08**	***8***
Balsamorhiza sagittata								0.3					**0.03**	***8***

Table B10

Percent Canopy Cover by Class and Species for 12 Sample Sites in the *Pseudotsuga menziesii/Physocarpus malvaceus* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Pseudotsuga menziesii/Physocarpus malvaceus* h.t.**													
	PLOT NUMBER												Mean	***Con-***
	1	3	4	5	6	7	8	9	10	12	14	15	Cover	***stancy***
													n=12	
Berberis repens			27										**2.25**	***8***
Besseya wyomingensis											0.3		**0.03**	***8***
Campanula rotundifolia					1	1			0.3				**0.19**	***25***
Crepis acuminata											2		**0.17**	***8***
Crepis atribarba											9		**0.75**	***8***
Crepis occidentalis					0.3								**0.03**	***8***
Delphinium bicolor							0.3			0.3	0.3		**0.08**	***25***
Drymocallis arguta					1								**0.08**	***8***
Erigeron corymbosus					0.3			0.3			6		**0.55**	***25***
Erigeron speciosus											1		**0.08**	***8***
Erigeron subtrinervis			0.3		0.3	0.3							**0.08**	***25***
Eurybia conspicua			1										**0.08**	***8***
Geum triflorum				0.3	0.3						0.3	0.3	**0.10**	***33***
Heuchera cylindrica			0.3				0.3			0.3	1		**0.16**	***33***
Heuchera parvifolia												0.3	**0.03**	***8***
Hieracium scouleri			0.3										**0.03**	***8***
Lithospermum ruderale					0.3								**0.03**	***8***
Lomatium triternatum											0.3		**0.03**	***8***
Mertensia oblongifolia												0.3	**0.03**	***8***
Polemonium pulcherrimum			0.3			1			0.3				**0.13**	***25***
Prosartes trachycarpa		0.3	1			4	0.3		0.3	0.3			**0.52**	***50***
Silene drummondii					0.3								**0.03**	***8***
Silene menziesii			1			4							**0.42**	***17***
Smilacina stellata						0.3			0.3				**0.05**	***17***
Solidago missouriensis			1		3								**0.33**	***17***
Symphyotrichum laeve						0.3							**0.03**	***8***
Valeriana dioica				0.3			1						**0.11**	***17***
Vicia americana			0.3		0.3								**0.05**	***17***
TOTAL NPF	**0.0**	**0.3**	**33.8**	**0.6**	**16.1**	**16.2**	**1.9**	**0.9**	**1.5**	**1.5**	**23.2**	**1.2**	**8.10**	***92***
INTRODUCED PERENNIAL FORBS														
Centaurea maculosa					0.3	1							**0.11**	***17***
Tanacetum vulgare						3							**0.25**	***8***
Taraxacum laevigatum					0.3	0.3					0.3	1	**0.16**	***33***
TOTAL IPF	**0.0**	**0.0**	**0.0**	**0.0**	**0.6**	**4.3**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**	**1.0**	**0.52**	***33***

Table B10

Percent Canopy Cover by Class and Species for 12 Sample Sites in the *Pseudotsuga menziesii/Physocarpus malvaceus* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Pseudotsuga menziesii/Physocarpus malvaceus* h.t.**													
	PLOT NUMBER												Mean	***Con-***
	1	3	4	5	6	7	8	9	10	12	14	15	Cover	***stancy***
													n=12	
FERNS AND ALLIES														
Cystopteris fragilis									0.3				**0.03**	***8***
TOTAL FA	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.3**	**0.0**	**0.0**	**0.0**	**0.03**	***8***
NATIVE ANNUAL/BIENNIAL FORBS														
Chenopodium fremontii											0.3	2	**0.19**	***17***
Collinsia parviflora					0.3				0.3	0.3	1	7	**0.74**	***42***
Collomia linearis					0.3							0.3	**0.05**	***17***
Ellisia nyctelea									0.3				**0.03**	***8***
Epilobium brachycarpum					0.3								**0.03**	***8***
Galium aparine									0.3			4	**0.36**	***17***
Microsteris gracilis												0.3	**0.03**	***8***
Parietaria pensylvanica									0.3				**0.03**	***8***
TOTAL NA/BF	**0.0**	**0.0**	**0.0**	**0.0**	**0.9**	**0.0**	**0.0**	**0.0**	**1.2**	**0.3**	**1.3**	**13.6**	**1.44**	***42***
INTRODUCED ANNUAL/BIENNIAL FORBS														
Camelina microcarpa					0.3								**0.03**	***8***
Carduus nutans					1							0.3	**0.11**	***17***
Cynoglossum officinale						1							**0.08**	***8***
Lactuca serriola												0.3	**0.03**	***8***
TOTAL IA/BF	**0.0**	**0.0**	**0.0**	**0.0**	**1.3**	**1.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.6**	**0.24**	***25***
SHRUBS														
Acer glabrum			1		1	3							**0.42**	***25***
Arctostaphylos uva-ursi			0.3										**0.03**	***8***
Artemisia tripartita						0.3							**0.03**	***8***
Clematis occidentalis						2	1						**0.25**	***17***
Philadelphus lewisii									2				**0.17**	***8***
Physocarpus malvaceus	2	4	5	6	1	8	36	1	3	19	22	1	**9.00**	***100***
Prunus virginiana						5							**0.42**	***8***
Purshia tridentata					0.3								**0.03**	***8***
Ribes cereum							3				1		**0.33**	***17***

Table B10

Percent Canopy Cover by Class and Species for 12 Sample Sites in the *Pseudotsuga menziesii/Physocarpus malvaceus* Habitat Type, Montana Limestone Resources Baseline Study Area, 2013.

	***Pseudotsuga menziesii/Physocarpus malvaceus* h.t.**													
	PLOT NUMBER												Mean	***Con-***
	1	3	4	5	6	7	8	9	10	12	14	15	Cover	***stancy***
													n=12	
Ribes inerme										0.3			**0.03**	***8***
Ribes setosum						3							**0.25**	***8***
Shepherdia canadensis			0.3										**0.03**	***8***
Symphoricarpos albus							0.3						**0.03**	***8***
Symphoricarpos occidentalis			14		14					5			**2.75**	***25***
TOTAL SHRUBS	**2.0**	**4.0**	**20.6**	**6.0**	**16.3**	**21.3**	**40.3**	**1.0**	**5.0**	**24.3**	**23.0**	**1.0**	**13.73**	***100***
TREES 0.01-acre														
Juniperus scopulorum	36	6	30	50	20	1	2	20	30	25	16	3	**19.92**	***100***
Pseudotsuga menziesii	70	75	70	40	30	75	65	85	58	48	62	75	**62.75**	***100***
TOTAL TREES 0.01-acre	**106.0**	**81.0**	**100.0**	**90.0**	**50.0**	**76.0**	**67.0**	**105.0**	**88.0**	**73.0**	**78.0**	**78.0**	**82.67**	***100***
TREES 0.1-acre														
Juniperus scopulorum	20	5	18	35	20	2	3	40	35	10	6	4	**16.50**	***100***
Pseudotsuga menziesii	75	70	60	60	45	65	70	70	60	56	54	73	**63.17**	***100***
TOTAL TREES 0.1-acre	**95.0**	**75.0**	**78.0**	**95.0**	**65.0**	**67.0**	**73.0**	**110.0**	**95.0**	**66.0**	**60.0**	**77.0**	**79.67**	***100***
TOTAL VEGETATION (Stratified)	**108.6**	**85.3**	**156.0**	**96.9**	**124.2**	**131.8**	**109.5**	**107.5**	**96.6**	**99.7**	**188.7**	**124.4**	**119.10**	***100***

[1]Footnotes are presented on cover page B-i.

Table B11

Percent Canopy Cover by Class and Species for Six Sample Sites in the *Poa pratensis, Agrostis stolonifera, Bromus inermis,* and *Typha latifolia* Community Types, Montana Limestone Resources Baseline Study Area, 2013.

	***Poa pratensis* c.t.**			***Agrostis stolonifera* c.t.**				***Bromus inermis* c.t.**			***Typha latifolia* c.t.**			
	PLOT NUMBER	**Mean Cover**	***Con-stancy***	**PLOT NUMBER**		**Mean Cover**	***Con-stancy***	**PLOT NUMBER**	**Mean Cover**	***Con-stancy***	**PLOT NUMBER**		**Mean Cover**	***Con-stancy***
	RW 85			RW 95	RW 98			RW 83			RW 89	RW 96		
		n=1				**n=2**			**n=1**				**n=2**	
SITE PARAMETERS*														
Slope (percent)	1-2 (2-6)			5-8	15-55			1-4			0-2	1-4		
Aspect (degrees mag. north)	0			055	324			324			0	130		
Topography	Aban Chan			Bottom	Mid			Terrace			Aban Chan	Toe Seep		
Configuration	Concave			Concave	Und			S (Und)			Concave	Concave		
Photo # (Digital)	157-158-159			794-795	802-803			151-152				800-801		
Photo azimuth	160-340-010			055-235	060-240			324-144			115	080-200		
Investigator	KS/ED/DCs			KS/ED/DCs	KS/ED/DCs			KS/ED			KS/ED/DCs	KS/ED/DCs		
Date	7/2/13			7/18/13	7/18/13			7/2/13			7/3/13	7/18/13		
GROUND COVER														
Bare Ground	3	**3.00**	***100***	78	5	**41.50**	***100***	50	**50.00**	***100***	10	2	**6.00**	***100***
Rock	0.3	**0.30**	***100***	1		**0.50**	***50***	4	**4.00**	***100***				
Litter	89	**89.00**	***100***	13	88	**50.50**	***100***	42	**42.00**	***100***	50	90	**70.00**	***100***
Lichens														
Moss	0.3	**0.30**	***100***	2		**1.00**	***50***				31		**15.50**	***50***
Basal Vegetation	7	**7.00**	***100***	6	7	**6.50**	***100***	4	**4.00**	***100***	9	8	**8.50**	***100***
VEGETATION STRUCTURE (nonstratified cover)														
Total Vegetation	95	**95.00**	***100***	78	96	**87.00**	***100***	64	**64.00**	***100***	88	86	**87.00**	***100***
Perennial Graminoids	94	**94.00**	***100***	60	92	**76.00**	***100***	30	**30.00**	***100***	17	20	**18.50**	***100***
Annual Graminoids				12		**6.00**	***50***	5	**5.00**	***100***	2		**1.00**	***50***
Perennial Forbs and Subshrubs	24	**24.00**	***100***	38	23	**30.50**	***100***	37	**37.00**	***100***	86	85	**85.50**	***100***
Annual/Biennial Forbs	0.3	**0.30**	***100***	5	1	**3.00**	***100***	9	**9.00**	***100***	1		**0.50**	***50***
Shrubs	5	**5.00**	***100***		1	**0.50**	***50***	0.3	**0.30**	***100***	12		**6.00**	***50***
Trees 0.01-acre	5	**5.00**	***100***	8		**4.00**	***50***	1	**1.00**	***100***				
Trees 0.1-acre	5	**5.00**	***100***	8		**4.00**	***50***	0.3	**0.30**	***100***				

Table B11

Percent Canopy Cover by Class and Species for Six Sample Sites in the *Poa pratensis, Agrostis stolonifera, Bromus inermis,* and *Typha latifolia* Community Types, Montana Limestone Resources Baseline Study Area, 2013.

	***Poa pratensis* c.t.**			***Agrostis stolonifera* c.t.**				***Bromus inermis* c.t.**			***Typha latifolia* c.t.**			
	PLOT NUMBER	**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***	**PLOT NUMBER**	**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	RW 85	**Cover**	***stancy***	RW 95	RW 98	**Cover**	***stancy***	RW 83	**Cover**	***stancy***	RW 89	RW 96	**Cover**	***stancy***
		n=1				**n=2**			**n=1**				**n=2**	
CLASS\SPECIES														
NATIVE PERENNIAL GRAMINOIDS														
Agropyron smithii				0.3		**0.15**	***50***							
Alopecurus aequalis											1		**0.50**	***50***
Carex microptera	3	**3.00**	***100***											
Carex nebrascensis				8	15	**11.50**	***100***					0.3	**0.15**	***50***
Carex praegracilis	4	**4.00**	***100***											
Carex utriculata											4		**2.00**	***50***
Eleocharis palustris												2	**1.00**	***50***
Glyceria borealis											0.3		**0.15**	***50***
Glyceria grandis											6		**3.00**	***50***
Hordeum jubatum				16	0.3	**8.15**	***100***							
Juncus balticus				6	36	**21.00**	***100***					0.3	**0.15**	***50***
Poa secunda								1	**1.00**	***100***				
Schoenoplectus tabernaemontani												15	**7.50**	***50***
Sphenopholis obtusata												3	**1.50**	***50***
TOTAL NPG	**7.0**	**7.00**	***100***	**30.3**	**51.3**	**40.80**	***100***	**1.0**	**1.00**	***100***	**11.3**	**20.6**	**15.95**	***100***
INTRODUCED PERENNIAL GRAMINOIDS														
Agrostis stolonifera				28	38	**33.00**	***100***				3	1	**2.00**	***100***
Alopecurus arundinaceus					12	**6.00**	***50***	2	**2.00**	***100***		0.3	**0.15**	***50***
Bromus inermis								22	**22.00**	***100***				
Phleum pratense	10	**10.00**	***100***	1		**0.50**	***50***							
Poa compressa								8	**8.00**	***100***	0.3		**0.15**	***50***
Poa palustris											4		**2.00**	***50***
Poa pratensis	85	**85.00**	***100***	12	44	**28.00**	***100***					0.3	**0.15**	***50***
TOTAL IPG	**95.0**	**95.00**	***100***	**41.0**	**94.0**	**67.50**	***100***	**32.0**	**32.00**	***100***	**7.3**	**1.6**	**4.45**	***100***
NATIVE ANNUAL GRAMINOIDS														
Beckmannia syzigachne											2		**1.00**	***50***
Juncus bufonius				12		**6.00**	***50***							
TOTAL NAG	**0.0**	**0.00**	***0***	**12.0**	**0.0**	**6.00**	***50***	**0.0**	**0.00**	***0***	**2.0**	**0.0**	**1.00**	***50***
INTRODUCED ANNUAL GRAMINOIDS														
Bromus japonicus								2	**2.00**	***100***				
Bromus tectorum								3	**3.00**	***100***				
TOTAL IAG	**0.0**	**0.00**	***0***	**0.0**	**0.0**	**0.00**	***0***	**5.0**	**5.00**	***100***	**0.0**	**0.0**	**0.0**	***0***

Table B11

Percent Canopy Cover by Class and Species for Six Sample Sites in the *Poa pratensis, Agrostis stolonifera, Bromus inermis,* and *Typha latifolia* Community Types, Montana Limestone Resources Baseline Study Area, 2013.

	***Poa pratensis* c.t.**			***Agrostis stolonifera* c.t.**				***Bromus inermis* c.t.**			***Typha latifolia* c.t.**			
	PLOT NUMBER	**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***	**PLOT NUMBER**	**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	RW 85	**Cover**	***stancy***	RW 95	RW 98	**Cover**	***stancy***	RW 83	**Cover**	***stancy***	RW 89	RW 96	**Cover**	***stancy***
		n=1				**n=2**			**n=1**				**n=2**	
NATIVE PERENNIAL FORBS AND SUBSHRUBS														
Achillea millefolium					1	**0.50**	***50***	1	**1.00**	***100***				
Campanula rotundifolia				0.3		**0.15**	***50***							
Epilobium ciliatum				0.3		**0.15**	***50***					5	**2.50**	***50***
Fragaria virginiana	1	**1.00**	***100***											
Galium trifidum											3		**1.50**	***50***
Geum macrophyllum					0.3	**0.15**	***50***							
Glycyrrhiza lepidota								4	**4.00**	***100***				
Iris missouriensis	0.3	**0.30**	***100***											
Mentha arvensis	6	**6.00**	***100***									2	**1.00**	***50***
Mimulus guttatus												5	**2.50**	***50***
Myosotis laxa	0.3	**0.30**	***100***								9		**4.50**	***50***
Potentilla anserina	0.3	**0.30**	***100***		1	**0.50**	***50***					0.3	**0.15**	***50***
Potentilla gracilis				0.3		**0.15**	***50***							
Ranunculus cymbalaria					0.3	**0.15**	***50***					8	**4.00**	***50***
Ranunculus gmelinii											0.3		**0.15**	***50***
Ranunculus macounii	0.3	**0.30**	***100***											
Rumex occidentalis											1		**0.50**	***50***
Rumex salicifolius								0.3	**0.30**	***100***				
Sium suave											2		**1.00**	***50***
Symphyotrichum ascendens	3	**3.00**	***100***	6	6	**6.00**	***100***							
Typha latifolia											82	72	**77.00**	***100***
Veronica americana				2		**1.00**	***50***							
Vicia americana					1	**0.50**	***50***							
TOTAL NPF	**11.2**	**11.20**	***100***	**8.9**	**9.6**	**9.25**	***100***	**5.3**	**5.30**	***100***	**97.3**	**92.3**	**94.80**	***100***
INTRODUCED PERENNIAL FORBS														
Centaurea maculosa				1		**0.50**	***50***							
Cirsium arvense					14	**7.00**	***50***							
Euphorbia esula								36	**36.00**	***100***				
Lepidium latifolium								0.3	**0.30**	***100***				
Linaria dalmatica								0.3	**0.30**	***100***				
Plantago major				14		**7.00**	***50***							
Rumex crispus				1		**0.50**	***50***							
Taraxacum laevigatum	5	**5.00**	***100***		2	**1.00**	***50***							
Taraxacum officinale	8	**8.00**	***100***	1		**0.50**	***50***							
Trifolium pratense	0.3	**0.30**	***100***											
Trifolium repens	0.3	**0.30**	***100***											
Veronica anagallis-aquatica				16		**8.00**	***50***					1	**0.50**	***50***
TOTAL IPF	**13.6**	**13.60**	***100***	**33.0**	**16.0**	**24.50**	***100***	**36.6**	**36.60**	***100***	**0.0**	**1.0**	**0.50**	***50***

Table B11

Percent Canopy Cover by Class and Species for Six Sample Sites in the *Poa pratensis, Agrostis stolonifera, Bromus inermis,* and *Typha latifolia* Community Types, Montana Limestone Resources Baseline Study Area, 2013.

	Poa pratensis c.t.			*Agrostis stolonifera* c.t.				*Bromus inermis* c.t.			*Typha latifolia* c.t.			
	PLOT NUMBER	Mean	*Con-*	PLOT NUMBER		Mean	*Con-*	PLOT NUMBER	Mean	*Con-*	PLOT NUMBER		Mean	*Con-*
	RW 85	Cover	*stancy*	RW 95	RW 98	Cover	*stancy*	RW 83	Cover	*stancy*	RW 89	RW 96	Cover	*stancy*
		n=1				n=2			n=1				n=2	
FERNS AND ALLIES														
Equisetum laevigatum	0.3	0.30	*100*											
TOTAL FA	**0.3**	0.30	*100*	**0.0**	**0.0**	0.00	*0*	**0.0**	0.00	*0*	**0.0**	**0.0**	0.00	*0*
NATIVE ANNUAL/BIENNIAL FORBS														
Collomia linearis								0.3	0.30	*100*				
Epilobium brachycarpum								0.3	0.30	*100*				
Madia glomerata				1		0.50	*50*							
Microsteris gracilis								2	2.00	*100*				
Potentilla biennis	0.3	0.30	*100*											
Ranunculus sceleratus											0.3		0.15	*50*
Rorippa palustris											1		0.50	*50*
TOTAL NA/BF	**0.3**	0.30	*100*	**1.0**	**0.0**	0.50	*50*	**2.6**	2.60	*100*	**1.3**	**0.0**	0.65	*50*
INTRODUCED ANNUAL/BIENNIAL FORBS														
Alyssum alyssoides								1	1.00	*100*				
Camelina microcarpa	0.3	0.30	*100*					0.3	0.30	*100*				
Carduus nutans					0.3	0.15	*50*							
Descurainia sophia								5	5.00	*100*				
Lactuca serriola				3		1.50	*50*							
Melilotus officinalis				0.3	0.3	0.30	*100*							
Polygonum aviculare				0.3		0.15	*50*							
Thlaspi arvense				0.3		0.15	*50*	1	1.00	*100*				
Tragopogon dubius								0.3	0.30	*100*				
TOTAL IA/BF	**0.3**	0.30	*100*	**3.9**	**0.6**	2.25	*100*	**7.6**	7.60	*100*	**0.0**	**0.0**	0.00	*0*
SHRUBS														
Rosa woodsii					1	0.50	*50*							
Salix bebbiana											4		2.00	*50*
Salix boothii											2		1.00	*50*
Salix exigua	5	5.00	*100*					0.3	0.30	*100*	6		3.00	*50*
Salix lasiandra											2		1.00	*50*
TOTAL SHRUBS	**5.0**	5.00	*100*	**0.0**	**1.0**	0.50	*50*	**0.3**	0.30	*100*	**14.0**	**0.0**	7.00	*50*
TREES 0.01-acre														
Populus angustifolia								1	1.00	*100*				
Populus balsamifera	3	3.00	*100*											
Populus tremuloides	2	2.00	*100*											
Pseudotsuga menziesii				8		4.00	*50*							
TOTAL TREES 0.01-acre	**5.0**	5.00	*100*	**8.0**	**0.0**	4.00	*50*	**1.0**	1.00	*100*	**0.0**	**0.0**	0.00	*0*

Table B11

Percent Canopy Cover by Class and Species for Six Sample Sites in the *Poa pratensis, Agrostis stolonifera, Bromus inermis,* and *Typha latifolia* Community Types, Montana Limestone Resources Baseline Study Area, 2013.

	***Poa pratensis* c.t.**			***Agrostis stolonifera* c.t.**				***Bromus inermis* c.t.**			***Typha latifolia* c.t.**			
	PLOT NUMBER	**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***	**PLOT NUMBER**	**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	RW 85	**Cover**	***stancy***	RW 95	RW 98	**Cover**	***stancy***	RW 83	**Cover**	***stancy***	RW 89	RW 96	**Cover**	***stancy***
		n=1				**n=2**			**n=1**				**n=2**	
TREES 0.1-acre														
Populus angustifolia								0.3	**0.30**	***100***				
Populus balsamifera	3	**3.00**	***100***											
Populus tremuloides	2	**2.00**	***100***											
Pseudotsuga menziesii				8		**4.00**	***50***							
TOTAL TREES 0.1-acre	**5.0**	**5.00**	***100***	**8.0**	**0.0**	**4.00**	***50***	**0.3**	**0.30**	***100***	**0.0**	**0.0**	**0.00**	***0***
TOTAL VEGETATION (Stratified)	**137.7**	**137.70**	***100***	**138.1**	**172.5**	**155.30**	***100***	**91.4**	**91.40**	***100***	**133.2**	**115.5**	**124.35**	***100***

[1]Footnotes are presented on cover page B-i.

Table B12

Percent Canopy Cover by Class and Species for Eight Sample Sites in the *Carex nebraskensis* , *Carex pellita* and *Carex utriculata* Habitat Types, Montana Limestone Resources Baseline Study Area, 2013.

	***Carex nebraskensis* c.t.**					***Carex pellita* h.t.**				***Carex utriculata* h.t.**				
	PLOT NUMBER			**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***	**PLOT NUMBER**			**Mean**	***Con-***
	RW 93	RW 94	RW 97	**Cover**	***stancy***	RW 86	RW 92	**Cover**	***stancy***	RW 87	RW 88	RW 91	**Cover**	***stancy***
				n=3				**n=2**					**n=3**	
SITE PARAMETERS*														
Slope (percent)	1-3	2-5	1-4			0-1	0-2			0-2	0-2	0-2		
Aspect (degrees mag. north)	004	120	130			285	0			0	0	0		
Topography	Bottom	Bottom	Toe Seep			Overflow	Overflow			Channel	Channel	Overflow		
Configuration	Concave	Concave	Concave			Concave	Concave			Concave	Concave	Concave		
Photo # (Digital)	790-791	792-793	800-801			156	163			160-161	162	26-28		
Photo azimuth	170-350	120-300	080-200			285	286			300-030	144	238-058		
Investigator	KS/ED/DCs	KS/ED/DCs	KS/ED/DCs			KS/ED/DCs	KS/ED			KS/ED/DCs	KS/ED/DCs	KS/ED/DCs		
Date	7/18/13	7/18/13	7/18/13			7/2/13	7/3/13			7/3/13	7/3/13	7/3/13		
GROUND COVER														
Bare Ground	2	66	0.3	**22.77**	***100***	8	28	**18.00**	***100***	2	3	20	**8.33**	***100***
Rock		16		**5.33**	***33***	0.3		**0.15**	***50***					
Litter	91	14	88	**64.33**	***100***	35	62	**48.50**	***100***	55	50	68	**57.67**	***100***
Lichens														
Moss		0.3	5	**1.77**	***67***		2	**1.00**	***50***	35	39	6	**26.67**	***100***
Water						50		**25.00**	***50***					
Basal Vegetation	7	4	7	**6.00**	***100***	7	8	**7.50**	***100***	8	8	6	**7.33**	***100***
VEGETATION STRUCTURE (nonstratified cover)														
Total Vegetation	98	70	98	**88.67**	***100***	90	97	**93.50**	***100***	92	99	96	**95.67**	***100***
Perennial Graminoids	90	56	90	**78.67**	***100***	45	96	**70.50**	***100***	91	98	92	**93.67**	***100***
Annual Graminoids							11	**5.50**	***50***	0.3	2		**0.77**	***67***
Perennial Forbs and Subshrubs	28	18	36	**27.33**	***100***	57	30	**43.50**	***100***	12	43	9	**21.33**	***100***
Annual/Biennial Forbs	42	2	8	**17.33**	***100***	4	0.3	**2.15**	***100***	0.3	8		**2.77**	***67***
Shrubs						3	5	**4.00**	***100***	8	14	3	**8.33**	***100***
Trees 0.01-acre		10		**3.33**	***33***	10		**5.00**	***50***			10	**3.33**	***33***
Trees 0.1-acre		32		**10.67**	***33***	10		**5.00**	***50***	2		30	**10.67**	***67***

Table B12

Percent Canopy Cover by Class and Species for Eight Sample Sites in the *Carex nebraskensis* , *Carex pellita* and *Carex utriculata* Habitat Types, Montana Limestone Resources Baseline Study Area, 2013.

	***Carex nebraskensis* c.t.**					***Carex pellita* h.t.**				***Carex utriculata* h.t.**				
	PLOT NUMBER			**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***	**PLOT NUMBER**			**Mean**	***Con-***
	RW 93	RW 94	RW 97	**Cover**	***stancy***	RW 86	RW 92	**Cover**	***stancy***	RW 87	RW 88	RW 91	**Cover**	***stancy***
				n=3				**n=2**					**n=3**	
CLASS\SPECIES														
NATIVE PERENNIAL GRAMINOIDS														
Agropyron smithii						0.3		**0.15**	***50***					
Alopecurus aequalis											2		**0.67**	***33***
Carex athrostachya										2			**0.67**	***33***
Carex nebrascensis	28	16	22	**22.00**	***100***									
Carex pellita						38	18	**28.00**	***100***					
Carex praegracilis						1	6	**3.50**	***100***					
Carex sartwellii							16	**8.00**	***50***					
Carex stipata												1	**0.33**	***33***
Carex utriculata										88	84	92	**88.00**	***100***
Eleocharis palustris		8	8	**5.33**	***67***		28	**14.00**	***50***					
Glyceria grandis											16		**5.33**	***33***
Hordeum brachyantherum							8	**4.00**	***50***					
Hordeum jubatum		2		**0.67**	***33***		1	**0.50**	***50***	0.3			**0.10**	***33***
Juncus balticus		10	18	**9.33**	***67***		34	**17.00**	***50***	0.3			**0.10**	***33***
Schoenoplectus tabernaemontani			0.3	**0.10**	***33***		1	**0.50**	***50***					
Scirpus microcarpus							0.3	**0.15**	***50***					
Sphenopholis obtusata			7	**2.33**	***33***									
TOTAL NPG	**28.0**	**36.0**	**55.3**	**39.77**	***100***	**39.3**	**112.3**	**75.80**	***100***	**90.6**	**102.0**	**93.0**	**95.20**	***100***
INTRODUCED PERENNIAL GRAMINOIDS														
Agropyron repens										0.3			**0.10**	***33***
Agrostis stolonifera	10	26	36	**24.00**	***100***	3	4	**3.50**	***100***	3			**1.00**	***33***
Alopecurus arundinaceus	65		3	**22.67**	***67***		20	**10.00**	***50***		1		**0.33**	***33***
Bromus inermis	5			**1.67**	***33***									
Phleum pratense		2		**0.67**	***33***									
Poa compressa						0.3		**0.15**	***50***					
Poa palustris										5	8		**4.33**	***67***
Poa pratensis	18		24	**14.00**	***67***	6	7	**6.50**	***100***	1			**0.33**	***33***
TOTAL IPG	**98.0**	**28.0**	**63.0**	**63.00**	***100***	**9.3**	**31.0**	**20.15**	***100***	**9.3**	**9.0**	**0.0**	**6.10**	***67***
NATIVE ANNUAL GRAMINOIDS														
Beckmannia syzigachne							11	**5.50**	***50***	0.3	2		**0.77**	***67***
TOTAL NAG	**0.0**	**0.0**	**0.0**	**0.00**	***0***	**0.0**	**11.0**	**5.50**	***50***	**0.3**	**2.0**	**0.0**	**0.77**	***67***

Table B12

Percent Canopy Cover by Class and Species for Eight Sample Sites in the *Carex nebraskensis* , *Carex pellita* and *Carex utriculata* Habitat Types, Montana Limestone Resources Baseline Study Area, 2013.

	***Carex nebraskensis* c.t.**					***Carex pellita* h.t.**				***Carex utriculata* h.t.**				
	PLOT NUMBER			**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***	**PLOT NUMBER**			**Mean**	***Con-***
	RW 93	RW 94	RW 97	**Cover**	***stancy***	RW 86	RW 92	**Cover**	***stancy***	RW 87	RW 88	RW 91	**Cover**	***stancy***
				n=3				**n=2**					**n=3**	
NATIVE PERENNIAL FORBS AND SUBSHRUBS														
Arnica chamissonis							0.3	**0.15**	***50***					
Crepis runcinata										0.3			**0.10**	***33***
Epilobium ciliatum	1	0.3	9	**3.43**	***100***	3		**1.50**	***50***		0.3	2	**0.77**	***67***
Erigeron glabellus							2	**1.00**	***50***					
Galium trifidum											2		**0.67**	***33***
Geum macrophyllum										0.3	0.3		**0.20**	***67***
Glycyrrhiza lepidota		2		**0.67**	***33***							0.3	**0.10**	***33***
Helenium autumnale										1			**0.33**	***33***
Mentha arvensis			0.3	**0.10**	***33***	4	3	**3.50**	***100***	1	1	4	**2.00**	***100***
Mimulus guttatus			4	**1.33**	***33***	0.3		**0.15**	***50***					
Moehringia lateriflora										0.3			**0.10**	***33***
Myosotis laxa							3	**1.50**	***50***	6	28	2	**12.00**	***100***
Polygonum amphibium											0.3		**0.10**	***33***
Potentilla anserina	5		4	**3.00**	***67***		12	**6.00**	***50***	2			**0.67**	***33***
Potentilla gracilis			0.3	**0.10**	***33***									
Pyrrocoma integrifolia							0.3	**0.15**	***50***					
Ranunculus aquatilis												1	**0.33**	***33***
Ranunculus cymbalaria		0.3	18	**6.10**	***67***	0.3		**0.15**	***50***					
Ranunculus gmelinii						0.3		**0.15**	***50***					
Ranunculus macounii	0.3			**0.10**	***33***	1		**0.50**	***50***	0.3	0.3		**0.20**	***67***
Rumex occidentalis						2		**1.00**	***50***		3		**1.00**	***33***
Rumex salicifolius							0.3	**0.15**	***50***		1		**0.33**	***33***
Scutellaria galericulata						0.3		**0.15**	***50***					
Sisyrinchium idahoense							0.3	**0.15**	***50***					
Sium suave							5	**2.50**	***50***	0.3	2		**0.77**	***67***
Stachys palustris							3	**1.50**	***50***					
Stellaria longipes						0.3		**0.15**	***50***					
Symphyotrichum ascendens						2		**1.00**	***50***					
Typha latifolia			3	**1.00**	***33***		0.3	**0.15**	***50***		9		**3.00**	***33***
Veronica americana		3		**1.00**	***33***									
Zigadenus venenosus							0.3	**0.15**	***50***					
TOTAL NPF	**6.3**	**5.6**	**38.6**	**16.83**	***100***	**13.5**	**29.8**	**21.65**	***100***	**11.5**	**47.2**	**9.3**	**22.67**	***100***
INTRODUCED PERENNIAL FORBS														
Centaurea maculosa		4		**1.33**	***33***									
Cirsium arvense	1	1	0.3	**0.77**	***100***					0.3	0.3		**0.20**	***67***
Plantago major		9		**3.00**	***33***	0.3		**0.15**	***50***					
Rumex crispus	1			**0.33**	***33***									
Silene vulgaris						0.3		**0.15**	***50***					
Taraxacum officinale	4			**1.33**	***33***									

Table B12

Percent Canopy Cover by Class and Species for Eight Sample Sites in the *Carex nebraskensis* , *Carex pellita* and *Carex utriculata* Habitat Types, Montana Limestone Resources Baseline Study Area, 2013.

	Carex nebraskensis c.t.					*Carex pellita* h.t.				*Carex utriculata* h.t.				
	PLOT NUMBER			Mean	Con-	PLOT NUMBER		Mean	Con-	PLOT NUMBER			Mean	Con-
	RW 93	RW 94	RW 97	Cover	stancy	RW 86	RW 92	Cover	stancy	RW 87	RW 88	RW 91	Cover	stancy
				n=3				n=2					n=3	
Trifolium hybridum	10			3.33	33		2	1.00	50		0.3		0.10	33
Trifolium pratense	7			2.33	33		1	0.50	50					
Veronica anagallis-aquatica	0.3		1	0.43	67	48		24.00	50					
TOTAL IPF	**23.3**	**14.0**	**1.3**	**12.87**	**100**	**48.6**	**3.0**	**25.80**	**100**	**0.3**	**0.6**	**0.0**	**0.30**	**67**
FERNS AND ALLIES														
Equisetum laevigatum			1	0.33	33									
TOTAL FA	**0.0**	**0.0**	**1.0**	**0.33**	**33**	**0.0**	**0.0**	**0.00**	**0**	**0.0**	**0.0**	**0.0**	**0.00**	**0**
NATIVE ANNUAL/BIENNIAL FORBS														
Artemisia biennis		0.3		0.10	33									
Polygonum ramosissimum						0.3	0.3	0.30	100					
Potentilla biennis										0.3	0.3		0.20	67
Potentilla norvegica						1		0.50	50					
Ranunculus sceleratus		0.3		0.10	33									
Rorippa palustris						3		1.50	50	0.3	8		2.77	67
TOTAL NA/BF	**0.0**	**0.6**	**0.0**	**0.20**	**33**	**4.3**	**0.3**	**2.30**	**100**	**0.6**	**8.3**	**0.0**	**2.97**	**67**
INTRODUCED ANNUAL/BIENNIAL FORBS														
Carduus nutans	0.3			0.10	33									
Cirsium vulgare	0.3			0.10	33									
Descurainia sophia	0.3			0.10	33									
Medicago lupulina	4	2	8	4.67	100		0.3	0.15	50					
Melilotus alba	18			6.00	33									
Melilotus officinalis	28	0.3		9.43	67									
Polygonum aviculare		0.3		0.10	33									
Tragopogon dubius	0.3			0.10	33									
TOTAL IA/BF	**51.2**	**2.6**	**8.0**	**20.60**	**100**	**0.0**	**0.3**	**0.15**	**50**	**0.0**	**0.0**	**0.0**	**0.00**	**0**
SHRUBS														
Alnus incana											1		0.33	33
Cornus sericea											1		0.33	33
Rosa woodsii						2		1.00	50					
Salix bebbiana							4	2.00	50	3	5	1	3.00	100
Salix boothii										2	4		2.00	67
Salix eriocephala var. watsonii							1	0.50	50	1			0.33	33
Salix exigua										2	3	2	2.33	100
Salix lasiandra										0.3	2		0.77	67
Symphoricarpos occidentalis						1		0.50	50					
TOTAL SHRUBS	**0.0**	**0.0**	**0.0**	**0.00**	**0**	**3.0**	**5.0**	**4.00**	**100**	**8.3**	**16.0**	**3.0**	**9.10**	**100**

Table B12

Percent Canopy Cover by Class and Species for Eight Sample Sites in the *Carex nebraskensis* , *Carex pellita* and *Carex utriculata* Habitat Types, Montana Limestone Resources Baseline Study Area, 2013.

	***Carex nebraskensis* c.t.**					***Carex pellita* h.t.**				***Carex utriculata* h.t.**				
	PLOT NUMBER			**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***	**PLOT NUMBER**			**Mean**	***Con-***
	RW 93	RW 94	RW 97	**Cover**	***stancy***	RW 86	RW 92	**Cover**	***stancy***	RW 87	RW 88	RW 91	**Cover**	***stancy***
				n=3				**n=2**					**n=3**	
TREES 0.01-acre														
Juniperus scopulorum		2		**0.67**	***33***	8		**4.00**	***50***					
Pinus ponderosa		3		**1.00**	***33***									
Populus balsamifera						6		**3.00**	***50***			10	**3.33**	***33***
Populus tremuloides		5		**1.67**	***33***									
TOTAL TREES 0.01-acre	**0.0**	**10.0**	**0.0**	**3.33**	***33***	**14.0**	**0.0**	**7.00**	***50***	**0.0**	**0.0**	**10.0**	**3.33**	***33***
TREES 0.1-acre														
Juniperus scopulorum		10		**3.33**	***33***	8		**4.00**	***50***					
Pinus ponderosa		12		**4.00**	***33***									
Populus balsamifera						6		**3.00**	***50***	2		30	**10.67**	***67***
Populus tremuloides		15		**5.00**	***33***									
TOTAL TREES 0.1-acre	**0.0**	**37.0**	**0.0**	**12.33**	***33***	**14.0**	**0.0**	**7.00**	***50***	**2.0**	**0.0**	**30.0**	**10.67**	***67***
TOTAL VEGETATION (Stratified)	**206.8**	**96.8**	**167.2**	**156.93**	***100***	**132.0**	**192.7**	**162.35**	***100***	**120.9**	**185.1**	**115.3**	**140.43**	***100***

[1]Footnotes are presented on cover page B-i.

Table B13

Percent Canopy Cover by Class and Species for One Sample Site in the *Symphoricarpos occidentalis* and Two Sample Sites in the *Salix exigua-Cornus sericea* Community Types, Montana Limestone Resources Baseline Study Area, 2013.

	***Symphoricarpos occidentalis* c.t.**			***Salix exigua-Cornus sericea* c.t.**			
	PLOT NUMBER	**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	RW 84	**Cover**	***stancy***	RW 90	RW 103	**Cover**	***stancy***
		n=1				**n=2**	
SITE PARAMETERS*							
Slope (percent)	1-4			0-2	1-4		
Aspect (degrees mag. north)	0			0	0		
Topography	Floodplain			Overflow	Floodplain		
Configuration	S (Und)			Concave	Und		
Photo # (Digital)	153-155				871-872		
Photo azimuth	025-205			096	160-055		
Investigator	KS/ED			KS/ED/DCs	KS/ED		
Date	7/2/13			7/3/13	9/21/13		
GROUND COVER							
Bare Ground	14	**14**	***100***	5		**2.50**	***50***
Rock							
Litter	52	**52**	***100***	58	90	**74.00**	***100***
Lichens							
Moss	28	**28**	***100***	30		**15.00**	***50***
Basal Vegetation	6	**6**	***100***	7	10	**8.50**	***100***
VEGETATION STRUCTURE (nonstratified cover)							
Total Vegetation	96	**96**	***100***	98	99	**98.50**	***100***
Perennial Graminoids	60	**60**	***100***	21	78	**49.50**	***100***
Annual Graminoids	28	**28**	***100***				
Perennial Forbs and Subshrubs	16	**16**	***100***	15	32	**23.50**	***100***
Annual/Biennial Forbs	14	**14**	***100***	3	6	**4.50**	***100***
Shrubs	55	**55**	***100***	94	87	**90.50**	***100***
Trees 0.01-acre				3		**1.50**	***50***
Trees 0.1-acre				0.3	0.3	**0.30**	***100***
CLASS\SPECIES							
NATIVE PERENNIAL GRAMINOIDS							
Agropyron smithii	28	**28**	***100***				
Carex atherodes				6		**3.00**	***50***
Carex pellita				3		**1.50**	***50***
Carex praegracilis	0.3	**0.3**	***100***				
Eleocharis palustris				5		**2.50**	***50***
Juncus balticus	0.3	**0.3**	***100***				
Muhlenbergia richardsonis	1	**1**	***100***				
Stipa comata	2	**2**	***100***				
TOTAL NPG	**31.6**	**31.60**	***100***	**14.0**	**0.0**	**7.00**	***50***

Table B13

Percent Canopy Cover by Class and Species for One Sample Site in the *Symphoricarpos occidentalis* and Two Sample Sites in the *Salix exigua-Cornus sericea* Community Types, Montana Limestone Resources Baseline Study Area, 2013.

	***Symphoricarpos occidentalis* c.t.**			***Salix exigua-Cornus sericea* c.t.**			
	PLOT NUMBER	**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	RW 84	**Cover**	***stancy***	RW 90	RW 103	**Cover**	***stancy***
		n=1				**n=2**	
INTRODUCED PERENNIAL GRAMINOIDS							
Agropyron repens					14	**7.00**	***50***
Agrostis stolonifera				5	18	**11.50**	***100***
Poa compressa	0.3	**0.3**	***100***				
Poa palustris				4		**2.00**	***50***
Poa pratensis	34	**34**	***100***		66	**33.00**	***50***
TOTAL IPG	**34.3**	**34.30**	***100***	**9.0**	**98.0**	**53.50**	***100***
INTRODUCED ANNUAL GRAMINOIDS							
Bromus tectorum	28	**28**	***100***				
TOTAL IAG	**28.0**	**28.00**	***100***	**0.0**	**0.0**	**0.00**	***0***
NATIVE PERENNIAL FORBS AND SUBSHRUBS							
Achillea millefolium	3	**3**	***100***				
Agoseris glauca	2	**2**	***100***				
Antennaria microphylla	1	**1**	***100***				
Artemisia ludoviciana	4	**4**	***100***				
Astragalus agrestis	0.3	**0.3**	***100***				
Erigeron glabellus	3	**3**	***100***				
Geum macrophyllum				2	4	**3.00**	***100***
Helenium autumnale				1		**0.50**	***50***
Heterotheca villosa	1	**1**	***100***				
Mentha arvensis				4	2	**3.00**	***100***
Myosotis laxa				1		**0.50**	***50***
Ranunculus macounii				3		**1.50**	***50***
Schoenocrambe linifolia	0.3	**0.3**	***100***				
Scutellaria galericulata				2		**1.00**	***50***
Sium suave				0.3		**0.15**	***50***
Smilacina stellata	0.3	**0.3**	***100***	0.3		**0.15**	***50***
Thalictrum dasycarpum	1	**1**	***100***		0.3	**0.15**	***50***
Urtica dioica				1	3	**2.00**	***100***
Vicia americana	0.3	**0.3**	***100***				
TOTAL NPF	**16.2**	**16.20**	***100***	**14.6**	**9.3**	**11.95**	***100***
INTRODUCED PERENNIAL FORBS							
Cirsium arvense				0.3	16	**8.15**	***100***
Taraxacum laevigatum	1	**1**	***100***		10	**5.00**	***50***
Taraxacum officinale				0.3		**0.15**	***50***
TOTAL IPF	**1.0**	**1.00**	***100***	**0.6**	**26.0**	**13.30**	***100***
FERNS AND ALLIES							
Equisetum arvense				0.3		**0.15**	***50***
Equisetum laevigatum	0.3	**0.3**	***100***				
TOTAL FA	**0.3**	**0.30**	***100***	**0.3**	**0.0**	**0.15**	***50***

Table B13

Percent Canopy Cover by Class and Species for One Sample Site in the *Symphoricarpos occidentalis* and Two Sample Sites in the *Salix exigua-Cornus sericea* Community Types, Montana Limestone Resources Baseline Study Area, 2013.

	***Symphoricarpos occidentalis* c.t.**			***Salix exigua-Cornus sericea* c.t.**			
	PLOT NUMBER	**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	RW 84	**Cover**	***stancy***	RW 90	RW 103	**Cover**	***stancy***
		n=1				**n=2**	
NATIVE ANNUAL/BIENNIAL FORBS							
Cardamine pensylvanica				0.3		**0.15**	***50***
Cleome serrulata	0.3	**0.3**	***100***				
Collomia linearis	1	**1**	***100***				
Descurainia pinnata	0.3	**0.3**	***100***				
Erysimum cheiranthoides					0.3	**0.15**	***50***
Euphorbia serpyllifolia	0.3	**0.3**	***100***				
Galium aparine				2		**1.00**	***50***
Hackelia deflexa				0.3		**0.15**	***50***
Lepidium densiflorum	0.3	**0.3**	***100***				
Microsteris gracilis	1	**1**	***100***				
Phacelia linearis	2	**2**	***100***				
Polygonum douglasii	0.3	**0.3**	***100***				
Potentilla biennis				0.3		**0.15**	***50***
TOTAL NA/BF	**5.5**	**5.50**	***100***	**2.9**	**0.3**	**1.60**	***100***
INTRODUCED ANNUAL/BIENNIAL FORBS							
Alyssum alyssoides	0.3	**0.3**	***100***				
Camelina microcarpa	1	**1**	***100***				
Cynoglossum officinale					4	**2.00**	***50***
Descurainia sophia	4	**4**	***100***				
Filago arvensis	0.3	**0.3**	***100***				
Thlaspi arvense					2	**1.00**	***50***
Tragopogon dubius	2	**2**	***100***				
Veronica verna	1	**1**	***100***				
TOTAL IA/BF	**8.6**	**8.60**	***100***	**0.0**	**6.0**	**3.00**	***50***
SHRUBS							
Cornus sericea				45	54	**49.50**	***100***
Ericameria nauseosa	1	**1**	***100***				
Ribes americanum				2		**1.00**	***50***
Ribes aureum				12	2	**7.00**	***100***
Ribes setosum				2	8	**5.00**	***100***
Rosa woodsii				22	4	**13.00**	***100***
Rubus idaeus					5	**2.50**	***50***
Salix bebbiana				8	16	**12.00**	***100***
Salix boothii				8	7	**7.50**	***100***
Salix drummondiana					10	**5.00**	***50***
Salix eriocephala var. watsonii					8	**4.00**	***50***
Salix exigua				55	38	**46.50**	***100***
Symphoricarpos occidentalis	54	**54**	***100***	10	3	**6.50**	***100***
TOTAL SHRUBS	**55.0**	**55.00**	***100***	**164.0**	**155.0**	**159.50**	***100***
TREES 0.01-acre							
Juniperus scopulorum				3		**1.50**	***50***
TOTAL TREES 0.01-acre	**0.0**	**0.00**	***0.0***	**3.0**	**0.0**	**1.50**	***50***

Table B13

Percent Canopy Cover by Class and Species for One Sample Site in the *Symphoricarpos occidentalis* and Two Sample Sites in the *Salix exigua-Cornus sericea* Community Types, Montana Limestone Resources Baseline Study Area, 2013.

	***Symphoricarpos occidentalis* c.t.**			***Salix exigua-Cornus sericea* c.t.**			
	PLOT NUMBER	**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	RW 84	**Cover**	***stancy***	RW 90	RW 103	**Cover**	***stancy***
		n=1				**n=2**	
TREES 0.1-acre							
Juniperus scopulorum				0.3	0.3	**0.30**	***100***
TOTAL TREES 0.1-acre	**0.0**	**0.00**	***0.0***	**0.3**	**0.3**	**0.30**	***100***
TOTAL VEGETATION (Stratified)	**180.5**	**180.50**	***100***	**208.4**	**294.6**	**251.50**	***100***

[1]Footnotes are presented on cover page B-i.

Table B14

Percent Canopy Cover by Class and Species for Six Sample Sites in the *Juniperus scopulorum/Cornus sericea, Populus balsamifera/Symphoricarpos occidentalis, Populus balsamifera/Cornus sericea* and *Populus tremuloides/Cornus sericea* Riparian Forest Types, Montana Limestone Resources Baseline Study Area, 2013.

	***JUN SCO/COR SER* h.t.**			***POP BAL/SYM OCC* c.t.**				***POP BAL/COR SER* c.t.**			***POP TRE/COR SER* h.t.**			
	PLOT NUMBER	**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***	**PLOT NUMBER**	**Mean**	***Con-***	**PLOT NUMBER**		**Mean**	***Con-***
	RW 102	**Cover**	***stancy***	RW 82	RW 101	**Cover**	***stancy***	RW 99	**Cover**	***stancy***	RW 100	RW 104	**Cover**	***stancy***
		n=1				**n=2**			**n=1**				**n=2**	
SITE PARAMETERS*														
Slope (percent)	0-3			1-4	0-2			0-2			0	0-1		
Aspect (degrees mag. north)	0			164	0			355			0	0		
Topography	Floodplain			Floodplain	Floodplain			Floodplain			Floodplain	Floodplain		
Configuration	S (V)			S (V)	S (Und)			S (Und)			S (Und)	S		
Photo # (Digital)	869-870			149-150	867-868			864-865			866	873		
Photo azimuth	320-240			164-344	230-190			095-095			325	170		
Investigator	KS/ED			KS/ED/DCs	KS/ED			KS/ED			KS/ED	KS/ED		
Date	9/21/13			7/2/13	9/21/13			9/21/13			9/21/13	9/21/13		
GROUND COVER														
Bare Ground	1	**1.0**	***100***	1		**0.50**	***50***	1	**1.0**	***100***				
Rock	0.3	**0.3**	***100***											
Litter	86	**86.0**	***100***	94	93	**93.50**	***100***	93	**93.0**	***100***	93	92	**92.50**	***100***
Lichens								0.3	**0.3**	***100***				
Moss	8	**8.0**	***100***		0.3	**0.15**	***50***				1	0.3	**0.65**	***100***
Basal Vegetation	5	**5.0**	***100***	5	7	**6.00**	***100***	6	**6.0**	***100***	6	8	**7.00**	***100***
VEGETATION STRUCTURE (nonstratified cover)														
Total Vegetation	97	**97.0**	***100***	98	96	**97.00**	***100***	90	**90.0**	***100***	96	99	**97.50**	***100***
Perennial Graminoids	4	**4.0**	***100***	14	10	**12.00**	***100***	24	**24.0**	***100***	18	88	**53.00**	***100***
Annual Graminoids														
Perennial Forbs and Subshrubs	2	**2.0**	***100***	12	15	**13.50**	***100***	18	**18.0**	***100***	17	43	**30.00**	***100***
Annual/Biennial Forbs	4	**4.0**	***100***	7	0.3	**3.65**	***100***	0.3	**0.3**	***100***	0.3	6	**3.15**	***100***
Shrubs	12	**12.0**	***100***	78	76	**77.00**	***100***	65	**65.0**	***100***	72	46	**59.00**	***100***
Trees 0.01-acre	94	**94.0**	***100***	94	84	**89.00**	***100***	64	**64.0**	***100***	78	78	**78.00**	***100***
Trees 0.1-acre	92	**92.0**	***100***	84	88	**86.00**	***100***	76	**76.0**	***100***	86	74	**80.00**	***100***

Table B14

Percent Canopy Cover by Class and Species for Six Sample Sites in the *Juniperus scopulorum/Cornus sericea, Populus balsamifera/Symphoricarpos occidentalis, Populus balsamifera/Cornus sericea* and *Populus tremuloides/Cornus sericea* Riparian Forest Types, Montana Limestone Resources Baseline Study Area, 2013.

	JUN SCO/COR SER h.t.			*POP BAL/SYM OCC* c.t.				*POP BAL/COR SER* c.t.			*POP TRE/COR SER* h.t.			
	PLOT NUMBER	Mean	Con-	PLOT NUMBER		Mean	Con-	PLOT NUMBER	Mean	Con-	PLOT NUMBER		Mean	Con-
	RW 102	Cover	stancy	RW 82	RW 101	Cover	stancy	RW 99	Cover	stancy	RW 100	RW 104	Cover	stancy
		n=1				n=2			n=1				n=2	
CLASS\SPECIES														
NATIVE PERENNIAL GRAMINOIDS														
Agropyron trachycaulum	0.3	0.3	100								1		0.50	50
Calamagrostis rubescens											4		2.00	50
Carex pellita	0.3	0.3	100	1	0.3	0.65	100	9	9.0	100	1		0.50	50
Carex praticola					1	0.50	50	13	13.0	100				
Juncus balticus								0.3	0.3	100		0.3	0.15	50
TOTAL NPG	**0.6**	**0.6**	**100**	**1.0**	**1.3**	**1.15**	**100**	**22.3**	**22.3**	**100**	**6.0**	**0.3**	**3.15**	**100**
INTRODUCED PERENNIAL GRAMINOIDS														
Agrostis stolonifera								4	4.0	100	3	48	25.50	100
Bromus inermis	1	1.0	100									3	1.50	50
Poa palustris				1		0.50	50							
Poa pratensis	3	3.0	100	12	9	10.50	100				10	65	37.50	100
TOTAL IPG	**4.0**	**4.0**	**100**	**13.0**	**9.0**	**11.00**	**100**	**4.0**	**4.0**	**100**	**13.0**	**116.0**	**64.50**	**100**
NATIVE PERENNIAL FORBS AND SUBSHRUBS														
Achillea millefolium					0.3	0.15	50	2	2.0	100				
Antennaria microphylla	0.3	0.3	100											
Apocynum cannabinum								0.3	0.3	100				
Artemisia ludoviciana	0.3	0.3	100											
Berberis repens											2		1.00	50
Fragaria virginiana					0.3	0.15	50					1	0.50	50
Galium boreale	0.3	0.3	100		5	2.50	50	0.3	0.3	100	3		1.50	50
Geum macrophyllum												4	2.00	50
Glycyrrhiza lepidota												16	8.00	50
Iris missouriensis											1		0.50	50
Lactuca pulchella					0.3	0.15	50							
Prosartes trachycarpa					0.3	0.15	50							
Ranunculus macounii				0.3		0.15	50							
Ranunculus uncinatus				0.3		0.15	50							
Senecio serra												0.3	0.15	50
Silene menziesii				6	2	4.00	100				4		2.00	50
Smilacina stellata				4	1	2.50	100	0.3	0.3	100	1	0.3	0.65	100

Table B14

Percent Canopy Cover by Class and Species for Six Sample Sites in the *Juniperus scopulorum/Cornus sericea, Populus balsamifera/Symphoricarpos occidentalis, Populus balsamifera/Cornus sericea* and *Populus tremuloides/Cornus sericea* Riparian Forest Types, Montana Limestone Resources Baseline Study Area, 2013.

	JUN SCO/COR SER h.t.			*POP BAL/SYM OCC* c.t.				*POP BAL/COR SER* c.t.			*POP TRE/COR SER* h.t.			
	PLOT NUMBER	Mean Cover	Con-stancy	PLOT NUMBER		Mean Cover	Con-stancy	PLOT NUMBER	Mean Cover	Con-stancy	PLOT NUMBER		Mean Cover	Con-stancy
	RW 102			RW 82	RW 101			RW 99			RW 100	RW 104		
		n=1				n=2			n=1				n=2	
Solidago gigantea											0.3	3	1.65	100
Solidago missouriensis					1	0.50	50	14	14.0	100	2		1.00	50
Stellaria longipes					0.3	0.15	50							
Symphyotrichum ascendens					0.3	0.15	50					0.3	0.15	50
Symphyotrichum laeve								0.3	0.3	100				
Thalictrum dasycarpum								2	2.0	100	4	8	6.00	100
Viola adunca	1	1.0	100		4	2.00	50				0.3		0.15	50
TOTAL NPF	**1.9**	**1.9**	**100**	**10.6**	**14.8**	**12.70**	**100**	**19.2**	**19.2**	**100**	**17.6**	**32.9**	**25.25**	**100**
INTRODUCED PERENNIAL FORBS														
Centaurea maculosa								0.3	0.3	100		0.3	0.15	50
Cirsium arvense								0.3	0.3	100		14	7.00	50
Tanacetum vulgare					0.3	0.15	50							
Taraxacum laevigatum				1		0.50	50							
Taraxacum officinale					0.3	0.15	50							
TOTAL IPF	**0.0**	**0.0**	**0**	**1.0**	**0.6**	**0.80**	**100**	**0.6**	**0.6**	**100**	**0.0**	**14.3**	**7.15**	**50**
FERNS AND ALLIES														
Equisetum laevigatum											0.3		0.15	50
TOTAL FA	**0.0**	**0.0**	**0**	**0.0**	**0.0**	**0.00**	**0**	**0.0**	**0.0**	**0**	**0.3**	**0.0**	**0.15**	**50**
NATIVE ANNUAL/BIENNIAL FORBS														
Erysimum cheiranthoides				0.3		0.15	50							
Galium aparine				2		1.00	50					0.3	0.15	50
Polygonum ramosissimum								0.3	0.3	100				
TOTAL NA/BF	**0.0**	**0.0**	**0**	**2.3**	**0.0**	**1.15**	**50**	**0.3**	**0.3**	**100**	**0.0**	**0.3**	**0.15**	**50**
INTRODUCED ANNUAL/BIENNIAL FORBS														
Carduus nutans	1	1.0	100	1		0.50	50					4	2.00	50
Cynoglossum officinale	2	2.0	100	4	0.3	2.15	100				0.3	2	1.15	100
Medicago lupulina								0.3	0.3	100				
Tragopogon dubius				0.3		0.15	50							
Verbascum thapsus	1	1.0	100											
TOTAL IA/BF	**4.0**	**4.0**	**100**	**5.3**	**0.3**	**2.80**	**100**	**0.3**	**0.3**	**100**	**0.3**	**6.0**	**3.15**	**100**

Table B14

Percent Canopy Cover by Class and Species for Six Sample Sites in the *Juniperus scopulorum/Cornus sericea, Populus balsamifera/Symphoricarpos occidentalis, Populus balsamifera/Cornus sericea* and *Populus tremuloides/Cornus sericea* Riparian Forest Types, Montana Limestone Resources Baseline Study Area, 2013.

	JUN SCO/COR SER h.t.			*POP BAL/SYM OCC* c.t.				*POP BAL/COR SER* c.t.			*POP TRE/COR SER* h.t.			
	PLOT NUMBER	Mean	Con-	PLOT NUMBER		Mean	Con-	PLOT NUMBER	Mean	Con-	PLOT NUMBER		Mean	Con-
	RW 102	Cover	*stancy*	RW 82	RW 101	Cover	*stancy*	RW 99	Cover	*stancy*	RW 100	RW 104	Cover	*stancy*
		n=1				n=2			n=1				n=2	
SHRUBS														
Clematis ligusticifolia				5		2.50	50							
Cornus sericea	0.3	0.3	100		0.3	0.15	50	10	10.0	100	1	5	3.00	100
Prunus virginiana				5	1	3.00	100	2	2.0	100	9		4.50	50
Ribes aureum					0.3	0.15	50				0.3		0.15	50
Ribes inerme												0.3	0.15	50
Ribes setosum	2	2.0	100	2	1	1.50	100				2		1.00	50
Rosa woodsii	2	2.0	100	38	56	47.00	100	12	12.0	100	4	3	3.50	100
Rubus idaeus				0.3		0.15	50							
Salix bebbiana												18	9.00	50
Salix eriocephala var. watsonii								3	3.0	100				
Symphoricarpos occidentalis	8	8.0	100	58	30	44.00	100	48	48.0	100	68	28	48.00	100
TOTAL SHRUBS	**12.3**	**12.3**	**100**	**108.3**	**88.6**	**98.45**	**100**	**75.0**	**75.0**	**100**	**84.3**	**54.3**	**69.30**	**100**
TREES 0.01-acre														
Juniperus scopulorum	88	88.0	100	22	34	28.00	100	22	22.0	100	28	2	15.00	100
Populus angustifolia	6	6.0	100		30	15.00	50	0.3	0.3	100				
Populus balsamifera	14	14.0	100	92	56	74.00	100	42	42.0	100				
Populus tremuloides								10	10.0	100	62	78	70.00	100
TOTAL TREES 0.01-acre	**108.0**	**108.0**	**100**	**114.0**	**120.0**	**117.00**	**100**	**74.3**	**74.3**	**100**	**90.0**	**80.0**	**85.00**	**100**
TREES 0.1-acre														
Juniperus scopulorum	86	86.0	100	8	48	28.00	100	42	42.0	100	38	9	23.50	100
Populus angustifolia	2	2.0	100		52	26.00	50	0.3	0.3	100				
Populus balsamifera	6	6.0	100	78	42	60.00	100	44	44.0	100				
Populus tremuloides								16	16.0	100	70	70	70.00	100
Pseudotsuga menziesii	2	2.0	100		0.3	0.15	50							
TOTAL TREES 0.1-acre	**96.0**	**96.0**	**100**	**86.0**	**142.3**	**114.15**	**100**	**102.3**	**102.3**	**100**	**108.0**	**79.0**	**93.50**	**100**
TOTAL VEGETATION (Stratified)	**130.80**	**130.8**	**100**	**255.50**	**234.60**	**245.05**	**100**	**196.00**	**196.0**	**100**	**211.50**	**304.10**	**257.80**	**100**

[1]Footnotes are presented on cover page B-i.

APPENDIX C

Shrub Density (Plants Per Acre) by Plot for Vegetation Types in the Montana Limestone Resources Baseline Study Area, 2013.

PHYSIOGNOMIC TYPE	TABLE	PAGE
GRASSLAND	C1	C-1
TAME PASTURE	C1	C-1
SHRUBLAND	C2	C-7
FOREST AND WOODLAND	C3	C-9
RIPARIAN AND WETLAND	C4	C-15
SUPPLEMENTAL TALL SHRUB-RIPARIAN	C5	C-16

Footnotes for the tables in Appendix C:

[1]In this classification, community types are named according to the following convention:

A slash (/) indicates a separation of species dominating one or more strata, namely the herbaceous, shrub and/or tree layers.

A hyphen (-) indicates species dominating the same stratum (understory, middle story or overstory) either or both of which may be dominant or codominant at a given sample site.

All plot locations are shown on the vegetation type map (Plate 1).

Binomials follow Lesica (2012).

Density counts in each 2 x 20-meter belt transect were converted to shrubs per acre using a conversion factor of 101.18. Supplemental density data were recorded for tall shrubs in the Riparian vegetation type by counting stems and stem clumps by species (tall shrubs) in the circular, 0.1-acre tree density plot at each sample site (Table C5).

Table C1
Shrub Density (Plants Per Acre) by Species for 29 GRASSLAND and 8 TAME PASTURE Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	AGROPYRON SPICATUM/POA SECUNDA h.t.									
	PLOT NUMBER									
	42	48	50	53	54	55	56	59	70	Mean
SHRUB SPECIES/AGE CLASS	Plants Per Acre									n=9
Amelanchier alnifolia										
immature/mature										
decadent										
Total live										
Artemisia tridentata										
immature/mature							304			33.7
decadent										
Total live							304			33.7
Chrysothamnus viscidiflorus										
immature/mature										
decadent										
Total live										
Ericameria nauseosa										
immature/mature										
decadent										
Total live										
Krascheninnikovia lanata										
immature/mature					202					22.5
decadent										
Total live					202					22.5
Prunus virginiana										
immature/mature	202									22.5
decadent										
Total live	202									22.5
Rosa arkansana										
immature/mature									1720	191.1
decadent										
Total live									1720	191.1
Rosa woodsii										
immature/mature	1214	202								157.4
decadent										
Total live	1214	202								157.4

Table C1
Shrub Density (Plants Per Acre) by Species for 29 GRASSLAND and 8 TAME PASTURE Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	AGROPYRON SPICATUM/POA SECUNDA h.t.									
	PLOT NUMBER									
	42	48	50	53	54	55	56	59	70	Mean
SHRUB SPECIES/AGE CLASS	Plants Per Acre									n=9
Tetradymia canescens										
immature/mature						304	1821			**236.1**
decadent										
Total live						304	1821			**236.1**
TOTAL SHRUBS										
IMMATURE/MATURE	1417	202			202	304	2125		1720	**663.3**
DECADENT										
TOTAL LIVE	1417	202			202	304	2125		1720	**663.3**

Table C1
Shrub Density (Plants Per Acre) by Species for 29 GRASSLAND and 8 TAME PASTURE Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	AGROPYRON SPICATUM/AGROPYRON SMITHII h.t.														
	PLOT NUMBER														
	43	44	49	52	57	60	61	62	63	64	65	66	69	71	Mean
SHRUB SPECIES/AGE CLASS	Plants Per Acre														n=14
Amelanchier alnifolia															
immature/mature										2125					151.8
decadent										607					43.4
Total live										2732					195.1
Artemisia tridentata															
immature/mature							101					101			14.5
decadent															
Total live							101					101			14.5
Chrysothamnus viscidiflorus															
immature/mature			101		101										14.5
decadent															
Total live			101		101										14.5
Ericameria nauseosa															
immature/mature	202														14.5
decadent															
Total live	202														14.5
Krascheninnikovia lanata															
immature/mature													304		21.7
decadent															
Total live													304		21.7
Prunus virginiana															
immature/mature															
decadent															
Total live															
Rosa arkansana															
immature/mature															
decadent															
Total live															
Rosa woodsii															
immature/mature										3744	304				289.1
decadent															
Total live										3744	304				289.1

Table C1
Shrub Density (Plants Per Acre) by Species for 29 GRASSLAND and 8 TAME PASTURE Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	AGROPYRON SPICATUM/AGROPYRON SMITHII h.t.														
	PLOT NUMBER														
	43	44	49	52	57	60	61	62	63	64	65	66	69	71	Mean
SHRUB SPECIES/AGE CLASS	Plants Per Acre														n=14
Tetradymia canescens															
immature/mature					304										21.7
decadent															
Total live					304										21.7
TOTAL SHRUBS															
IMMATURE/MATURE	**202**		**101**		**405**		**101**			**5868**	**304**	**101**	**304**		**527.6**
DECADENT										**607**					**43.4**
TOTAL LIVE	**202**		**101**		**405**		**101**			**6476**	**304**	**101**	**304**		**570.9**

Table C1
Shrub Density (Plants Per Acre) by Species for 29 GRASSLAND and 8 TAME PASTURE Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	FES IDA/ AGR SPI h.t.		*FES CAM/AGR SPI* h.t.						TAME PASTURE								
	PLOT NUMBER		PLOT NUMBER						PLOT NUMBER								
	68	Mean	46	47	51	58	67	Mean	73	75	76	77	78	79	80	81	Mean
SHRUB SPECIES/AGE CLASS	**Plants Per Acre**	**n=1**	**Plants Per Acre**					**n=5**	**Plants Per Acre**								**n=8**
Amelanchier alnifolia																	
immature/mature																	
decadent																	
Total live																	
Artemisia tridentata																	
immature/mature			101					**20.2**						202			**25.3**
decadent																	
Total live			101					**20.2**						202			**25.3**
Chrysothamnus viscidiflorus																	
immature/mature	304	**303.5**		202			101	**60.7**									
decadent																	
Total live	304	**303.5**		202			101	**60.7**									
Ericameria nauseosa																	
immature/mature	708	**708.3**		809				**161.9**									
decadent				405				**80.9**									
Total live	708	**708.3**		1214				**242.8**									
Krascheninnikovia lanata																	
immature/mature					1113		304	**283.3**									
decadent																	
Total live					1113		304	**283.3**									
Prunus virginiana																	
immature/mature																	
decadent																	
Total live																	
Rosa arkansana																	
immature/mature														101			**12.6**
decadent																	
Total live														101			**12.6**
Rosa woodsii																	
immature/mature			4351					**870.1**									
decadent																	
Total live			4351					**870.1**									

Table C1
Shrub Density (Plants Per Acre) by Species for 29 GRASSLAND and 8 TAME PASTURE Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	FES IDA/ AGR SPI h.t.		*FES CAM/AGR SPI* h.t.						TAME PASTURE								
	PLOT NUMBER		PLOT NUMBER						PLOT NUMBER								
	68	Mean	46	47	51	58	67	Mean	73	75	76	77	78	79	80	81	Mean
SHRUB SPECIES/AGE CLASS	**Plants Per Acre**	**n=1**	**Plants Per Acre**					**n=5**	**Plants Per Acre**								**n=8**
Tetradymia canescens																	
immature/mature							101	**20.2**									
decadent																	
Total live							101	**20.2**									
TOTAL SHRUBS																	
IMMATURE/MATURE	**1012**	**1011.8**	4452	1012	1113		506	**1416.5**						**304**			**37.9**
DECADENT				405				**80.9**									
TOTAL LIVE	**1012**	**1011.8**	4452	1417	1113		506	**1497.5**						**304**			**37.9**

Table C2
Shrub Density (Plants Per Acre) by Species for 20 SHRUBLAND Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	ART TRI/POA SEC c.t.				*ART TRI/AGR SMI* c.t.			*ART TRI/AGR SPI* h.t.					*ART TRI/FES IDA* h.t.			
	PLOT NUMBER				PLOT NUMBER			PLOT NUMBER					PLOT NUMBER			
	28	30	74	Mean	40	41	Mean	26	31	36	37	Mean	35	39	72	Mean
SHRUB SPECIES/AGE CLASS	Plants Per Acre			n=3	Plants Per Acre		n=2	Plants Per Acre				n=4	Plants Per Acre			n=3
Artemisia tridentata																
immature/mature	21754	13356	9612	14907.2	3440	2428	2934.2	9106	2934	2833	3541	4603.7	4351	4452	11636	6812.8
decadent	607	304	405	438.4	202	202	202.4	506	101	304	708	404.7	607	405	1012	674.5
Total live	22361	13659	10017	15345.6	3642	2631	3136.6	9612	3035	3137	4250	5008.4	4958	4857	12648	7487.3
Artemisia tripartita																
immature/mature																
decadent																
Total live																
Chrysothamnus viscidiflorus																
immature/mature																
decadent																
Total live																
Ericameria nauseosa																
immature/mature		101	202	101.2				101				25.3				
decadent																
Total live		101	202	101.2				101				25.3				
Rosa woodsii																
immature/mature								304				75.9				
decadent																
Total live								304				75.9				
Symphoricarpos occidentalis																
immature/mature																
decadent																
Total live																
TOTAL SHRUBS																
IMMATURE/MATURE	**21754**	**13457**	**9814**	**15008.4**	**3440**	**2428**	**2934.2**	**9511**	**2934**	**2833**	**3541**	**4704.9**	**4351**	**4452**	**11636**	**6812.8**
DECADENT	**607**	**304**	**405**	**438.4**	**202**	**202**	**202.4**	**506**	**101**	**304**	**708**	**404.7**	**607**	**405**	**1012**	**674.5**
TOTAL LIVE	**22361**	**13760**	**10219**	**15446.8**	**3642**	**2631**	**3136.6**	**10017**	**3035**	**3137**	**4250**	**5109.6**	**4958**	**4857**	**12648**	**7487.3**

Table C2

Shrub Density (Plants Per Acre) by Species for 20 SHRUBLAND Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	Artemisia tridentata /Festuca campestris h.t.								*SYM OCC/ POA PRA* c.t.	
	PLOT NUMBER								PLOT NUMBER	
	25	27	29	32	33	34	38	Mean	45	Mean
SHRUB SPECIES/AGE CLASS	Plants Per Acre							n=7	Plants	n=1
Artemisia tridentata										
immature/mature	2327	10320	4452	2226	3642	2024	3845	4119.5		
decadent	1417	1012	2125	1113	405	405	1214	1098.5		
Total live	3744	11332	6577	3339	4047	2428	5059	5218.0		
Artemisia tripartita										
immature/mature				708		1214		274.6		
decadent				202				28.9		
Total live				911		1214		303.5		
Chrysothamnus viscidiflorus										
immature/mature						304		43.4		
decadent										
Total live						304		43.4		
Ericameria nauseosa										
immature/mature	202	101						43.4		
decadent										
Total live	202	101						43.4		
Rosa woodsii										
immature/mature	1012							144.5	2428	2428.3
decadent										
Total live	1012							144.5	2428	2428.3
Symphoricarpos occidentalis										
immature/mature									4351	4350.7
decadent										
Total live									4351	4350.7
TOTAL SHRUBS										
IMMATURE/MATURE	**3541**	**10422**	**4452**	**2934**	**3642**	**3541**	**3845**	**4625.4**	**6779**	**6779.1**
DECADENT	**1417**	**1012**	**2125**	**1315**	**405**	**405**	**1214**	**1127.4**		
TOTAL LIVE	**4958**	**11433**	**6577**	**4250**	**4047**	**3946**	**5059**	**5752.8**	**6779**	**6779.1**

Table C3
Shrub Density (Plants Per Acre) by Species for 24 FOREST AND WOODLAND Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	JUN SCO/AGR SPI c.t.						*PIN PON/AGR SPI* h.t.			*PSE MEN/AGR SPI* h.t.			*PSE MEN/FES CAM* h.t.			
	PLOT NUMBER						PLOT NUMBER			PLOT NUMBER			PLOT NUMBER			
	2	17	20	22	23	Mean	16	21	Mean	11	18	Mean	13	19	24	Mean
SHRUB SPECIES/AGE CLASS	Plants Per Acre					n=5	Plants Per Acre		n=2	Plants Per Acre		n=2	Plants Per Acre			n=3
Acer glabrum																
immature/mature										101		50.6				
decadent																
Total live										101		50.6				
Amelanchier alnifolia																
immature/mature	101					20.2	202		101.2	304		151.8				
decadent		101				20.2										
Total live	101	101				40.5	202		101.2	304		151.8				
Artemisia tridentata																
immature/mature							101		50.6							
decadent																
Total live							101		50.6							
Artemisia tripartita																
immature/mature																
decadent																
Total live																
Cornus sericea																
immature/mature										101		50.6				
decadent																
Total live										101		50.6				
Philadelphus lewisii																
immature/mature																
decadent																
Total live																
Physocarpus malvaceus																
immature/mature																
decadent																
Total live																
Prunus virginiana																
immature/mature														809		269.8
decadent																
Total live														809		269.8

Table C3
Shrub Density (Plants Per Acre) by Species for 24 FOREST AND WOODLAND Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	JUN SCO/AGR SPI c.t.						*PIN PON/AGR SPI* h.t.			*PSE MEN/AGR SPI* h.t.			*PSE MEN/FES CAM* h.t.			
	PLOT NUMBER						PLOT NUMBER			PLOT NUMBER			PLOT NUMBER			
	2	17	20	22	23	Mean	16	21	Mean	11	18	Mean	13	19	24	Mean
SHRUB SPECIES/AGE CLASS	Plants Per Acre					n=5	Plants Per Acre		n=2	Plants Per Acre		n=2	Plants Per Acre			n=3
Purshia tridentata																
immature/mature	101					20.2										
decadent																
Total live	101					20.2										
Ribes cereum																
immature/mature																
decadent																
Total live																
Ribes inerme																
immature/mature										202		101.2				
decadent																
Total live										202		101.2				
Ribes setosum																
immature/mature																
decadent																
Total live																
Rosa acicularis																
immature/mature																
decadent															304	101.2
Total live															304	101.2
Rosa woodsii																
immature/mature							708		354.1							
decadent																
Total live							708		354.1							
Symphoricarpos albus																
immature/mature							809		404.7							
decadent																
Total live							809		404.7							
Symphoricarpos occidentalis																
immature/mature																
decadent																
Total live																

Table C3
Shrub Density (Plants Per Acre) by Species for 24 FOREST AND WOODLAND Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	JUN SCO/AGR SPI c.t.						*PIN PON/AGR SPI* h.t.			*PSE MEN/AGR SPI* h.t.			*PSE MEN/FES CAM* h.t.			
	PLOT NUMBER						PLOT NUMBER			PLOT NUMBER			PLOT NUMBER			
	2	17	20	22	23	Mean	16	21	Mean	11	18	Mean	13	19	24	Mean
SHRUB SPECIES/AGE CLASS	Plants Per Acre					n=5	Plants Per Acre		n=2	Plants Per Acre		n=2	Plants Per Acre			n=3
TOTAL SHRUBS																
IMMATURE/MATURE	202					40.5	1821		910.6	708		354.1		809		269.8
DECADENT		101				20.2									304	101.2
TOTAL LIVE	202	101				60.7	1821		910.6	708		354.1		809	304	371.0

Table C3
Shrub Density (Plants Per Acre) by Species for 24 FOREST AND WOODLAND Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	PSEUDOTSUGA MENZIESII/PHYSOCARPUS MALVACEUS h.t.												
	PLOT NUMBER												
	1	3	4	5	6	7	8	9	10	12	14	15	Mean
SHRUB SPECIES/AGE CLASS	Plants Per Acre												n=12
Acer glabrum													
immature/mature			101		1720	2428			101				**362.6**
decadent													
Total live			101		1720	2428			101				**362.6**
Amelanchier alnifolia													
immature/mature		506					405						**75.9**
decadent													
Total live		506					405						**75.9**
Artemisia tridentata													
immature/mature													
decadent													
Total live													
Artemisia tripartita													
immature/mature						101							**8.4**
decadent													
Total live						101							**8.4**
Cornus sericea													
immature/mature													
decadent													
Total live													
Philadelphus lewisii													
immature/mature		304							304				**50.6**
decadent													
Total live		304							304				**50.6**
Physocarpus malvaceus													
immature/mature	1113	2833	2732	5565	1518	1922	25194	202	607	5464	7487	101	**4561.5**
decadent											506		**42.2**
Total live	1113	2833	2732	5565	1518	1922	25194	202	607	5464	7993	101	**4603.7**
Prunus virginiana													
immature/mature						1113							**92.7**
decadent													
Total live						1113							**92.7**

Table C3
Shrub Density (Plants Per Acre) by Species for 24 FOREST AND WOODLAND Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	PSEUDOTSUGA MENZIESII/PHYSOCARPUS MALVACEUS h.t.												
	PLOT NUMBER												
	1	3	4	5	6	7	8	9	10	12	14	15	Mean
SHRUB SPECIES/AGE CLASS	Plants Per Acre												n=12
Purshia tridentata													
immature/mature													
decadent													
Total live													
Ribes cereum													
immature/mature							304						25.3
decadent													
Total live							304						25.3
Ribes inerme													
immature/mature										405			33.7
decadent													
Total live										405			33.7
Ribes setosum													
immature/mature						405							33.7
decadent													
Total live						405							33.7
Rosa acicularis													
immature/mature													
decadent													
Total live													
Rosa woodsii													
immature/mature													
decadent													
Total live													
Symphoricarpos albus													
immature/mature				202			506						59.0
decadent													
Total live				202			506						59.0
Symphoricarpos occidentalis													
immature/mature			4250		21653	101				1315			2276.6
decadent													
Total live			4250		21653	101				1315			2276.6

Table C3
Shrub Density (Plants Per Acre) by Species for 24 FOREST AND WOODLAND Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	PSEUDOTSUGA MENZIESII/PHYSOCARPUS MALVACEUS h.t.												
	PLOT NUMBER												
	1	3	4	5	6	7	8	9	10	12	14	15	Mean
SHRUB SPECIES/AGE CLASS	Plants Per Acre												n=12
TOTAL SHRUBS													
IMMATURE/MATURE	1113	3642	7083	5767	24890	6071	26408	202	1012	7184	7487	101	7580.1
DECADENT											506		42.2
TOTAL LIVE	1113	3642	7083	5767	24890	6071	26408	202	1012	7184	7993	101	7622.2

Table C4
Shrub Density (Plants Per Acre) by Species for Eight WOODY RIPARIAN Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	SYM OCC c.t.	*SAL EXI-COR SER* c.t.*	*JUN SCO/ COR SER* h.t.	*POP BAL/SYM OCC* c.t.			*POP BAL/ COR SER* c.t.	*POP TRE/COR SER* h.t.		
	PLOT	PLOT	PLOT				PLOT			
	RW 84	RW 103	RW 102	RW 82	RW 101	Mean n=2	RW 99	RW 100	RW 104	Mean n=2
SHRUB SPECIES/AGE CLASS										
Clematis ligusticifolia										
immature/mature				506		253.0				
decadent										
Total live				506		253.0				
Cornus sericea										
immature/mature		2125		202	101	151.8	101		607	303.5
decadent									202	101.2
Total live		2125		202	101	151.8	101		809	404.7
Prunus virginiana										
immature/mature				5767	304	3035.4		607		303.5
decadent				708		354.1				
Total live				6476	304	3389.5		607		303.5
Ribes aureum										
immature/mature					202	101.2		809		404.7
decadent								202		101.2
Total live					202	101.2		1012		505.9
Ribes setosum										
immature/mature		809	1113	304	607	455.3		1417	708	1062.4
decadent								101	101	101.2
Total live		809	1113	304	607	455.3		1518	809	1163.6
Rosa woodsii										
immature/mature		708	304	7791	6273	7032.0	3541	3035	1315	2175.4
decadent		101		708	708	708.3	202	202	202	202.4
Total live		809	304	8499	6981	7740.3	3744	3238	1518	2377.7
Rubus idaeus										
immature/mature		809		506		253.0				
decadent										
Total live		809		506		253.0				
Salix boothii										
immature/mature		708								
decadent										
Total live		708								
Salix exigua										
immature/mature		1113								
decadent										
Total live		1113								
Symphoricarpos occidentalis										
immature/mature	34300	708	2428	17099	7993	12546.3	9814	12648	17201	14924.1
decadent				304	304	303.5	202	708	202	455.3
Total live	34300	708	2428	17403	8297	12849.9	10017	13356	17403	15379.4
TOTAL SHRUBS										
IMMATURE/MATURE	**34300**	**6981**	**3845**	**32175**	**15481**	**23827.9**	**13457**	**18516**	**19831**	**19173.6**
DECADENT		**101**		**1720**	**1012**	**1365.9**	**405**	**1214**	**708**	**961.2**
TOTAL LIVE	**34300**	**7083**	**3845**	**33895**	**16492**	**25193.8**	**13862**	**19730**	**20540**	**20134.8**

* RW 90 = No Woody Plant Density Data

Table C5
Tall Shrub Density (Stems Per Acre/Stem Clumps Per Acre) by Species for Eight WOODY RIPARIAN Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	SYM OCC c.t.	*SAL EXI-COR SER* c.t.*	*JUN SCO/ COR SER* h.t.	*POP BAL/SYM OCC* c.t.			*POP BAL/ COR SER* c.t.	*POP TRE/COR SER* h.t.		
	PLOT	**PLOT**	**PLOT**				**PLOT**			
	RW 84	RW 103	RW 102	RW 82	RW 101	**Mean n=2**	RW 99	RW 100	RW 104	**Mean n=2**
SHRUB SPECIES/AGE CLASS										
Cornus sericea										
immature/mature		1290/220	90/10				100/10	40/10	420/80	**230/45**
decadent										
Total live		1290/220	90/10				100/10	40/10	420/80	**230/45**
Prunus virginiana										
immature/mature			50/10							
decadent										
Total live			50/10							
Salix bebbiana										
immature/mature		340/40							380/70	**190/35**
decadent										
Total live		340/40							380/70	**190/35**
Salix boothii										
immature/mature		1150/200								
decadent										
Total live		1150/200								
Salix drummondiana										
immature/mature		140/30								
decadent										
Total live		140/30								
Salix eriocephala										
immature/mature		210/20					650/30			
decadent										
Total live		210/20					650/30			
Salix exigua										
immature/mature		1060/160	280/30							
decadent										
Total live		1060/160	280/30							
TOTAL SHRUBS										
IMMATURE/MATURE		**4190/670**	**420/50**				**750/40**	**40/10**	**800/150**	**420/80**
DECADENT										
TOTAL LIVE	**0/0**	**4190/670**	**402/50**	**0/0**	**0/0**	**0/0**	**750/40**	**40/10**	**800/150**	**420/80**

* RW 90 = No Woody Plant Density Data

Tall shrub species were considered to be those which commonly attained 8 feet or greater height, thus many *Prunus virginiana* in the study area did not qualify.

APPENDIX D

Live Tree Density (Plants Per Acre) by Plot for Vegetation Types in the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

PHYSIOGNOMIC TYPE	TABLE	PAGE
GRASSLAND	D1	D-1
TAME PASTURE	D1	D-1
SHRUBLAND	D2	D-2
FOREST AND WOODLAND	D3	D-3
RIPARIAN AND WETLAND	D4	D-7

Footnotes for the tables in Appendix D:

All plot locations are shown on the vegetation type map (Plate 1).

Binomials follow Lesica (2012).

Density counts in each 0.1-acre circular plot were converted to trees per acre or *Juniperus scopulorum* stems per acre using a conversion factor of 10.

Table D1

Tree Density (Live Trees or Juniperus scopulorum Stems Per Acre) by Species for 29 GRASSLAND and 8 TAME PASTURE Sample Sites, Montana Limestone Resources Baseline Study Areas, 2013.

	AGR SPI/POA SEC h.t.			*AGR SPI/AGR SMI* h.t.			*FES IDA/ AGR SPI* h.t.	*FES CAM/AGR SPI* h.t.			TAME PASTURE
	PLOT NUMBER			PLOT NUMBER			PLOT	PLOT NUMBER			PLOT
TREE SPECIES	42	70	**Mean**	63	64	**Mean**	**Mean**	47	67	**Mean**	**Mean**
DBH CLASS - LIVE TREES			**n=9**			**n=14**	**n=1**			**n=5**	**n=8**
Juniperus scopulorum											
<1"				130		**9.3**		10	10	**4.0**	
1-4"		10	**1.1**	70	10	**5.7**					
4-8"											
8-12"											
TOTAL LIVE TREES		10	**1.1**	200	10	**15.0**	**0.0**	10	10	**4.0**	**0.0**
Pseudotsuga menziesii											
<1"											
1-4"	20		**2.2**								
4-8"											
8-12"	10		**1.1**								
TOTAL LIVE TREES	30		**3.3**			**0.0**	**0.0**			**0.0**	**0.0**
TOTAL TREE SPECIES - LIVE											
<1"				**130**		**9.3**		**10**	**10**	**4.0**	
1-4"	**20**	**10**	**3.3**	**70**	**10**	**5.7**					
4-8"											
8-12"	**10**		**1.1**								
***TOTAL LIVE TREES**	**30**	**10**	**4.4**	**200**	**10**	**15.0**	**0.0**	**10**	**10**	**4.0**	**0.0**

*Note: Sample Sites (0.1-acre circular plots) in which no trees were recorded are not shown in this table, but are included in the calculation of mean density. No trees were recorded at any of the eight plots sampled in the Tame Pasture vegetation type.

Table D2

Tree Density (Live Trees or Juniperus scopulorum Stems Per Acre) by Species for 20 SHRUBLAND Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	ART TRI/ POA SEC c.t.	*ART TRI/ AGR SMI* c.t.		*ART TRI/AGR SPI* h.t.			*ART TRI/FES IDA* h.t.			*ART TRI/FESCAM* h.t.				*SYM OCC/ POA PRA* c.t.
	PLOT	PLOT NUMBER		PLOT NUMBER			PLOT NUMBER			PLOT NUMBER				PLOT
TREE SPECIES	Mean	41	Mean	26	37	Mean	35	72	Mean	25	34	38	Mean	Mean
DBH CLASS - LIVE TREES	n=3		n=2			n=4			n=3				n=7	n=1
Juniperus scopulorum														
<1"		10	5.0		230	57.5					30	20	7.1	
1-4"					80	20.0								
4-8"														
8-12"														
TOTAL LIVE TREES	0.0	10	5.0		310	77.5			0.0		30	20	7.1	0.0
Pinus ponderosa														
<1"					20	5.0	20		6.7					
1-4"					10	2.5								
4-8"														
8-12"														
TOTAL LIVE TREES	0.0		0.0		30	7.5	20		6.7				0.0	0.0
Pseudotsuga menziesii														
<1"				10		2.5	10		3.3					
1-4"								30	10.0		10		1.4	
4-8"														
8-12"										10			1.4	
TOTAL LIVE TREES	0.0		0.0	10		2.5	10	30	13.3	10	10		2.9	0.0
***TOTAL TREE SPECIES - LIVE**														
<1"		**10**	**5.0**	**10**	**250**	**65.0**	**30**		**10.0**		**30**	**20**	**7.1**	
1-4"					**90**	**22.5**		**30**	**10.0**		**10**		**1.4**	
4-8"														
8-12"										**10**			**1.4**	
TOTAL LIVE TREES	**0.0**	**10**	**5.0**	**10**	**340**	**87.5**	**30**	**30**	**20.0**	**10**	**40**	**20**	**10.0**	**0.0**

*Note: Sample Sites (0.1-acre circular plots) in which no trees were recorded are not shown in this table, but are included in the calculation of mean density.

Table D3

Tree Density (Live Trees or Juniperus scopulorum Stems Per Acre) by Species for 24 FOREST AND WOODLAND Sample Sites, Montana Limestone Resources Baseline Study Areas, 2013.

	JUN SCO/AGR SPI c.t.						*PIN PON/AGR SPI* h.t.			*PSE MEN/AGR SPI* h.t.			*PSE MEN/FES CAM* h.t.			
	PLOT NUMBER						PLOT NUMBER			PLOT NUMBER			PLOT NUMBER			
TREE SPECIES	2	17	20	22	23	**Mean**	16	21	**Mean**	11	18	**Mean**	**13**	**19**	**24**	**Mean**
DBH CLASS - LIVE TREES						**n=5**			**n=2**			**n=2**				**n=3**
Juniperus scopulorum																
<1"	70	150	940	100	130	**278.0**	170	90	**130.0**	50	480	**265.0**	30	190	200	**140.0**
1-4"	70	230	350	300	670	**324.0**	130	770	**450.0**	90	260	**175.0**	40	200	300	**180.0**
4-8"	60		10	90	50	**42.0**	200	40	**120.0**	60		**30.0**		20	80	**33.3**
8-12"	20			10		**6.0**									10	**3.3**
12-16"																
16-20"																
20-24"																
24-28"																
TOTAL LIVE TREES	220	380	1300	500	850	**650.0**	500	900	**700.0**	200	740	**470.0**	70	410	590	**356.7**
Pinus ponderosa																
<1"		20				**4.0**	460	140	**300.0**						10	**3.3**
1-4"		10		10		**4.0**	150	60	**105.0**							
4-8"							20	20	**20.0**						10	**3.3**
8-12"																
12-16"							30		**15.0**						10	**3.3**
16-20"							10		**5.0**							
20-24"								10	**5.0**							
24-28"																
TOTAL LIVE TREES		30		10		**8.0**	670	230	**450.0**			**0.0**			30	**10.0**
Pseudotsuga menziesii																
<1"			10			**2.0**	40		**20.0**	60	20	**40.0**	100		120	**73.3**
1-4"	10		20			**6.0**				70	30	**50.0**	170	40	70	**93.3**
4-8"										40	10	**25.0**	120	90	30	**80.0**
8-12"													40	60	10	**36.7**
12-16"										20	10	**15.0**		20	30	**16.7**
16-20"																
20-24"														10		**3.3**
24-28"																
TOTAL LIVE TREES	10		30			**8.0**	40		**20.0**	190	70	**130.0**	430	220	260	**303.3**

Table D3

Tree Density (Live Trees or Juniperus scopulorum Stems Per Acre) by Species for 24 FOREST AND WOODLAND Sample Sites, Montana Limestone Resources Baseline Study Areas, 2013.

	JUN SCO/AGR SPI c.t.						*PIN PON/AGR SPI* h.t.			*PSE MEN/AGR SPI* h.t.			*PSE MEN/FES CAM* h.t.			
	PLOT NUMBER						PLOT NUMBER			PLOT NUMBER			PLOT NUMBER			
TREE SPECIES	2	17	20	22	23	**Mean**	16	21	**Mean**	11	18	**Mean**	**13**	**19**	**24**	**Mean**
DBH CLASS - LIVE TREES						**n=5**			**n=2**			**n=2**				**n=3**
***TOTAL TREE SPECIES - LIVE**																
<1"	**70**	**170**	**950**	**100**	**130**	**284.0**	**670**	**230**	**450.0**	**110**	**500**	**305.0**	**130**	**190**	**330**	**216.7**
1-4"	**80**	**240**	**370**	**310**	**670**	**334.0**	**280**	**830**	**555.0**	**160**	**290**	**225.0**	**210**	**240**	**370**	**273.3**
4-8"	**60**		**10**	**90**	**50**	**42.0**	**220**	**60**	**140.0**	**100**	**10**	**55.0**	**120**	**110**	**120**	**116.7**
8-12"	**20**			**10**		**6.0**							**40**	**60**	**20**	**40.0**
12-16"							**30**		**15.0**	**20**	**10**	**15.0**		**20**	**40**	**20.0**
16-20"							**10**		**5.0**							
20-24"								**10**	**5.0**					**10**		**3.3**
24-28"																
TOTAL LIVE TREES	**230**	**410**	**1330**	**510**	**850**	**666.0**	**1210**	**1130**	**1170.0**	**390**	**810**	**600.0**	**500**	**630**	**880**	**670.0**

Table D3

Tree Density (Live Trees or Juniperus scopulorum Stems Per Acre) by Species for 24 FOREST AND WOODLAND Sample Sites, Montana Limestone Resources Baseline Study Areas, 2013.

	***PSEUDOTSUGA MENZIESII/PHYSOCARPUS MALVACEUS* h.t.**												
	PLOT NUMBER												
TREE SPECIES	1	3	4	5	6	7	8	9	10	12	14	15	**Mean**
DBH CLASS - LIVE TREES													**n=12**
Juniperus scopulorum													
<1"	280	30	20	280	90	100	20	240	180	130		50	**118.3**
1-4"	140	60	80	140	240	10	50	360	190	130	30	40	**122.5**
4-8"	50	10	80	20	70	10	20	30	30				**26.7**
8-12"			30										**2.5**
12-16"			10										**0.8**
16-20"			10										**0.8**
20-24"													
24-28"													
TOTAL LIVE TREES	470	100	230	440	400	120	90	630	400	260	30	90	**271.7**
Pinus ponderosa													
<1"													
1-4"													
4-8"													
8-12"													
12-16"													
16-20"													
20-24"													
24-28"													
TOTAL LIVE TREES													**0.0**
Pseudotsuga menziesii													
<1"			1030	30	110	70	40	170	20	30			**125.0**
1-4"	60	30	190	180	20	30	170	40	80	160	40	120	**93.3**
4-8"	170	120	10	310		30	140	150	180	210	30	220	**130.8**
8-12"	170	70	10	60		100	80	90	50	20	60	110	**68.3**
12-16"	40	30			20	40		50	20		50	30	**23.3**
16-20"		10	20		10	30	20	40			10		**11.7**
20-24"					10	30							**3.3**
24-28"									10				**0.8**
TOTAL LIVE TREES	440	260	1260	580	170	330	450	540	360	420	190	480	**456.7**

Table D3

Tree Density (Live Trees or Juniperus scopulorum Stems Per Acre) by Species for 24 FOREST AND WOODLAND Sample Sites, Montana Limestone Resources Baseline Study Areas, 2013.

	***PSEUDOTSUGA MENZIESII/PHYSOCARPUS MALVACEUS* h.t.**												
	PLOT NUMBER												
TREE SPECIES	1	3	4	5	6	7	8	9	10	12	14	15	**Mean**
DBH CLASS - LIVE TREES													**n=12**
***TOTAL TREE SPECIES - LIVE**													
<1"	**280**	**30**	**1050**	**310**	**200**	**170**	**60**	**410**	**200**	**160**		**50**	**243.3**
1-4"	**200**	**90**	**270**	**320**	**260**	**40**	**220**	**400**	**270**	**290**	**70**	**160**	**215.8**
4-8"	**220**	**130**	**90**	**330**	**70**	**40**	**160**	**180**	**210**	**210**	**30**	**220**	**157.5**
8-12"	**170**	**70**	**40**	**60**		**100**	**80**	**90**	**50**	**20**	**60**	**110**	**70.8**
12-16"	**40**	**30**	**10**		**20**	**40**		**50**	**20**		**50**	**30**	**24.2**
16-20"		**10**	**30**		**10**	**30**	**20**	**40**			**10**		**12.5**
20-24"					**10**	**30**							**3.3**
24-28"									**10**				**0.8**
TOTAL LIVE TREES	**910**	**360**	**1490**	**1020**	**570**	**450**	**540**	**1170**	**760**	**680**	**220**	**570**	**728.3**

Table D4

Tree Density (Live Trees or Juniperus scopulorum Stems Per Acre) by Species for Eight WOODY RIPARIAN Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	SYM OCC c.t.	*SAL EXI-COR SER* c.t.	*JUN SCO/ COR SER* h.t.	*POP BAL/ SYM OCC* c.t.			*POP BAL/ COR SER* c.t.	*POP TRE/COR SER* h.t.		
	PLOT	**PLOT**	**PLOT**	**PLOT NUMBER**			**PLOT**	**PLOT NUMBER**		
TREE SPECIES	RW 84	RW 103	RW 102	RW 82	RW 101	**Mean**	RW 99	RW 100	RW 104	**Mean**
DBH CLASS - LIVE TREES						**n=2**				**n=2**
Juniperus scopulorum										
<1"			50	60	300	**180.0**	310	150		**75.0**
1-4"		10	200	20	280	**150.0**	290	120	30	**75.0**
4-8"			330	20	50	**35.0**	10	90	10	**50.0**
8-12"			70							
12-16"										
16-20"										
20-24"										
24-28"										
28-32"										
TOTAL LIVE TREES		**10**	**650**	**100**	**630**	**365.0**	**610**	**360**	**40**	**200.0**
Populus angustifolia										
<1"			140				10			
1-4"										
4-8"					10	**5.0**				
8-12"					10	**5.0**				
12-16"					30	**15.0**				
16-20"					20	**10.0**				
20-24"										
24-28"					10	**5.0**				
28-32"										
TOTAL LIVE TREES			**140**		**80**	**40.0**	**10**			
Populus balsamifera										
<1"				30		**15.0**	30			
1-4"										
4-8"					20	**10.0**				
8-12"					10	**5.0**				
12-16"				30		**15.0**				
16-20"				60		**30.0**	10			
20-24"				20	20	**20.0**	10			
24-28"			10	20		**10.0**	10			
28-32"					10	**5.0**				
TOTAL LIVE TREES			**10**	**160**	**60**	**110.0**	**60**			

Table D4

Tree Density (Live Trees or Juniperus scopulorum Stems Per Acre) by Species for Eight WOODY RIPARIAN Sample Sites, Montana Limestone Resources Baseline Study Area, 2013.

	SYM OCC c.t.	*SAL EXI-COR SER* c.t.	*JUN SCO/ COR SER* h.t.	*POP BAL/ SYM OCC* c.t.			*POP BAL/ COR SER* c.t.	*POP TRE/COR SER* h.t.		
	PLOT	**PLOT**	**PLOT**	**PLOT NUMBER**			**PLOT**	**PLOT NUMBER**		
TREE SPECIES	RW 84	RW 103	RW 102	RW 82	RW 101	**Mean**	RW 99	RW 100	RW 104	**Mean**
DBH CLASS - LIVE TREES						**n=2**				**n=2**
Populus tremuloides										
<1"							40	40	50	**45.0**
1-4"							40	230	90	**160.0**
4-8"							40	240	190	**215.0**
8-12"									50	**25.0**
12-16"							10		50	**25.0**
16-20"										
20-24"										
24-28"										
28-32"										
TOTAL LIVE TREES							**130**	**510**	**430**	**470.0**
Pseudotsuga menziesii										
<1"					10	**5.0**				
1-4"										
4-8"										
8-12"										
12-16"										
16-20"										
20-24"										
24-28"										
28-32"										
TOTAL LIVE TREES					**10**	**5.0**				
TOTAL TREE SPECIES - LIVE										
<1"			**190**	**90**	**310**	**200.0**	**390**	**190**	**50**	**120.0**
1-4"		**10**	**200**	**20**	**280**	**150.0**	**330**	**350**	**120**	**235.0**
4-8"			**330**	**20**	**80**	**50.0**	**50**	**330**	**200**	**265.0**
8-12"			**70**		**20**	**10.0**			**50**	**25.0**
12-16"				**30**	**30**	**30.0**	**10**		**50**	**25.0**
16-20"				**60**	**20**	**40.0**	**10**			
20-24"				**20**	**20**	**20.0**	**10**			
24-28"			**10**	**20**	**10**	**15.0**	**10**			
28-32"					**10**	**5.0**				
TOTAL LIVE TREES	**0**	**10**	**800**	**260**	**780**	**520.0**	**810**	**870**	**470**	**670.0**

APPENDIX E

Soil Type and Ecological Site by Plot for Community Types in the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

PHYSIOGNOMIC TYPE	PAGE
GRASSLAND	E-1
TAME PASTURE	E-1
SHRUBLAND	E-2
CONIFER FOREST AND WOODLAND	E-2
RIPARIAN AND WETLAND	E-3

Map Symbol[1]	Soil Mapping Unit[1]
11A	Mccabe-Canarway complex, 0-2%, occasionally flooded
24B	Con loam, 0-4%
25B	Straw silty clay loam, 0-4%
39D	Winspect gravelly loam, 8-15%
49C	Danvers clay loam, 4-8%
52C	Martinsdale loam, 4-8%
52D	Martinsdale loam, 8-15%
58C	Coben clay loam, 4-8%
60C	Quigley loam, 4-8%
65D	Tanna loam, 8-15%
88F	Whitecow gravelly loam, 35-60%
151E	Shawmut cobbly loam, 15-35%
351E	Roy-Shawmut-Danvers complex, 15-35%
442E	Braziel-Tolbert complex, 15-35%
444B	Gregson silt loam, 0-4%, rarely flooded
488F	Whitecow gravelly loam, cool, 35-60%
839E	Windham-Lap-Rock outcrop complex, 15-35%
988F	Whitecow-Rock outcrop complex, 35-60%

[2]Ecological sites were determined using the baseline soils study and descriptions in the Granite County Soil Survey (USDA Natural Resources Conservation Service 2003, 2012).

All plot locations are shown on the vegetation type map (Plate 1).

APPENDIX E
Soil Type and Ecological Site by Plot for Community Types in the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

COMMUNITY TYPE	Vegetation Plot Number	Soil Mapping Unit[1]	Ecological Site[2]
GRASSLAND (n=29)			
Agropyron spicatum/Poa secunda (n=9)	42	88F	Douglas-fir/Snowberry (bluebunch wheatgrass phase)
	56	351E	Silty, 15-19" ppz
	59		
	70		
	48	839E	Silty, 15-19" ppz - Shallow, 15-19" ppz - Rock Outcrop
	50		
	53		
	54		
	55		
Agropyron spicatum/Agropyron smithii (n=14)	64	39D	Silty, 15-19" ppz
	62	49C	
	52	52C	
	57	52D	
	60	58C	Clay Pan, 15-19" ppz
	66	65D	Silty, 10-14" ppz
	43	151E	Silty, 15-19" ppz
	44		
	49		
	69	351E	
	71		
	61	442E	Silty, 15-19" ppz - Shallow, 15-19" ppz
	63	839E	Silty, 15-19" ppz - Shallow, 15-19" ppz - Rock Outcrop
	65		
Festuca idahoensis/Agropyron spicatum (n=1)	68	351E	Silty, 15-19" ppz
Festuca campestris/Agropyron spicatum (n=5)	46	151E	Silty, 15-19" ppz
	58	442E	Silty, 15-19" ppz - Shallow, 5-19" ppz
	47	839E	Silty, 15-19" ppz - Shallow, 15-19" ppz - Rock Outcrop
	51		
	67		
TAME PASTURE (n=8)			
Tame Pasture (n=8)	75	52C	Silty, 15-19" ppz
	76		
	77		
	73	52D	
	79	60C	
	80		
	81		
	78	839E	Silty, 15-19" ppz - Shallow, 15-19" ppz - Rock Outcrop

APPENDIX E
Soil Type and Ecological Site by Plot for Community Types in the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

COMMUNITY TYPE	Vegetation Plot Number	Soil Mapping Unit[1]	Ecological Site[2]
SHRUBLAND (n=20)			
Artemisia tridentata/Poa secunda (n=3)	74	49C	Silty, 15-19" ppz
	30	60C	
	28	151E	
Artemisia tridentata/Agropyron smithii (n=2)	40	351E	Silty, 15-19" ppz
	41	839E	Silty, 15-19" ppz - Shallow, 15-19" ppz - Rock Outcrop
Artemisia tridentata/Agropyron spicatum (n=4)	31	49C	Silty, 15-19" ppz
	37		
	26	151E	
	36	442E	Silty, 15-19" ppz - Shallow, 15-19" ppz
Artemisia tridentata/Festuca idahoensis (n=3)	35	49C	Silty, 15-19" ppz
	39		
	72	52D	
Artemisia tridentata/Festuca campestris (n=7)	25	151E	Silty, 15-19" ppz
	27		
	32		
	33	442E	Silty, 15-19" ppz - Shallow, 15-19" ppz
	34		
	29	839E	Silty, 15-19" ppz - Shallow, 15-19" ppz - Rock Outcrop
	38		
Symphoricarpos occidentalis/Poa pratensis (n=1)	45	151E	Silty, 15-19" ppz
CONIFER FOREST AND WOODLAND (n=24)			
Juniperus scopulorum/Agropyron spicatum (n=5)	2	88F	Douglas-fir/Snowberry (bluebunch wheatgrass phase)
	20	351E	Silty, 15-19" ppz
	17	839E	Silty, 15-19" ppz - Shallow, 15-19" ppz - Rock Outcrop
	23		
	22	988F	Douglas-fir/Snowberry - Rock Outcrop
Pinus ponderosa/Agropyron spicatum (n=2)	16	839E	Silty, 15-19" ppz - Shallow, 15-19" ppz - Rock Outcrop
	21	988F	Douglas-fir/Snowberry - Rock Outcrop
Pseudotsuga menziesii/Agropyron spicatum (n=2)	11	488F	Douglas-fir/Snowberry, Douglas-fir/ Pinegrass
	18	839E	Silty, 15-19" ppz - Shallow, 15-19" ppz - Rock Outcrop
Pseudotsuga menziesii/Festuca campestris (n=3)	19	88F	Douglas-fir/Snowberry (bluebunch wheatgrass phase)
	13	488F	Douglas-fir/Snowberry, Douglas-fir/ Pinegrass
	24	839E	Silty, 15-19" ppz - Shallow, 15-19" ppz - Rock Outcrop
Pseudotsuga menziesii/Physocarpus malvaceus (n=12)	1	88F	Douglas-fir/Snowberry (bluebunch wheatgrass phase)
	3	488F	Douglas-fir/Snowberry, Douglas-fir/ Pinegrass
	4		
	5		
	6		
	7		
	8		
	9		
	10		
	12		
	14		
	15		

APPENDIX E
Soil Type and Ecological Site by Plot for Community Types in the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

COMMUNITY TYPE	Vegetation Plot Number	Soil Mapping Unit[1]	Ecological Site[2]
RIPARIAN AND WETLAND (RW) (n=23)			
Herbaceous RW (n=14)			
Poa pratensis (n=1)	RW85	11A	Subirrigated, 10-14" ppz
Agrostis stolonifera (n=2)	RW95	442E	Silty, 15-19" ppz - Shallow, 15-19" ppz
	RW98	351E	Silty, 15-19" ppz
Bromus inermis (n=1)	RW83	11A	Subirrigated, 10-14" ppz
Typha latifolia (n=2)	RW89	11A	Subirrigated, 10-14" ppz
	RW96	351E	Silty, 15-19" ppz
Carex nebrascensis (n=3)	RW93	24B	Silty, 10-14" ppz
	RW94	839E	Silty, 15-19" ppz - Shallow, 15-19" ppz - Rock Outcrop
	RW97	351E	Silty, 15-19" ppz
Carex pellita (n=2)	RW86	25B	Silty, 15-19" ppz
	RW92	11A	Subirrigated, 10-14" ppz
Carex utriculata (n=3)	RW87	11A	Subirrigated, 10-14" ppz
	RW88		
	RW91		
Woody RW (n=9)			
Symphoricarpos occidentalis (n=1)	RW 84	444B	Subirrigated, 10-14" ppz
Salix exigua-Cornus sericea (n=2)	RW90	11A	Subirrigated, 10-14" ppz
	RW103		
Juniperus scopulorum/Cornus sericea (n=1)	RW102	11A	Subirrigated, 10-14" ppz
Populus balsamifera/Symphoricarpos occidentalis (n=2)	RW82	11A	Subirrigated, 10-14" ppz
	RW101		
Populus balsamifera/Cornus sericea (n=1)	RW99	11A	Subirrigated, 10-14" ppz
Populus tremuloides/Cornus sericea (n=2)	RW100	11A	Subirrigated, 10-14" ppz
	RW104		

APPENDIX F

Summary of Site Parameters for Community Types in the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

SITE PARAMETER	TABLE	PAGE
TOPOGRAPHICAL POSITION	F1	F-1
SLOPE GRADIENT	F2	F-2
ASPECT	F3	F-3

Footnotes for the tables in Appendix F:

Appendix F tables summarize the site parameters given for each sample site in Appendix B.

Table F1

Summary of TOPOGRAPHICAL Categories by Community Type, Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

		TOPOGRAPHY								
COMMUNITY TYPE[1]	n	Bottom/ Bank	Terrace/ Floodplain	Swale	Bench	Toeslope	Lower Slope	Middle Slope	Upper Slope	Ridge/ Shoulder
		Number of Vegetation Sample Sites								
GRASSLAND	**29**									
Agropyron spicatum/Poa secunda habitat type	9						1	5	2	1
Agropyron spicatum/Agropyron smithii habitat type	14				1		5	3	4	1
Festuca idahoensis/Agropyron spicatum habitat type	1							1		
Festuca campestris/Agropyron spicatum habitat type	5						2	2	1	
TAME PASTURE	**8**									
Tame Pasture	8	1		1			2	3	1	
SHRUBLAND	**20**									
Artemisia tridentata/Poa secunda community type	3						1	1	1	
Artemisia tridentata /Agropyron smithii community type	2		1		1					
Artemisia tridentata/Agropyron spicatum habitat type	4							3	1	
Artemisia tridentata/Festuca idahoensis habitat type	3				1		1	1		
Artemisia tridentata/Festuca campestris habitat type	7						1	5	1	
Symphoricarpos occidentalis/Poa pratensis community type	1							1		
FOREST AND WOODLAND	**24**									
Juniperus scopulorum/Agropyron spicatum community type	5							5		
Pinus ponderosa/Agropyron spicatum habitat type	2	1						1		
Pseudotsuga menziesii/Agropyron spicatum habitat type	2							1	1	
Pseudotsuga menziesii/Festuca campestris habitat type	3	2							1	
Pseudotsuga menziesii/Physocarpus malvaceus habitat type	12	4				1	2	3	2	
RIPARIAN AND WETLAND (RW)	**23**									
Herbaceous RW types	**(14)**									
Poa pratensis community type	1		1							
Agrostis stolonifera community type	2	1						1		
Bromus inermis community type	1		1							
Typha latifolia community type	2		1			1				
Carex nebraskensis community type	3	2				1				
Carex pellita habitat type	2		2							
Carex utriculata habitat type	3		3							
Shrub RW types	**(3)**									
Symphoricarpos occidentalis community type	1		1							
Salix exigua-Cornus sericea community type	2		2							
Conifer and Deciduous Forest RW types	**(6)**									
Juniperus scopulorum/Cornus sericea habitat type	1		1							
Populus balsamifera/Symphoricarpos occidentalis community t	2		2							
Populus balsamifera/Cornus sericea community type	1		1							
Populus tremuloides/Cornus sericea habitat type	2		2							
TOTAL	**104**									

Table F2

Summary of SLOPE GRADIENT Categories by Community Type, Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

		SLOPE GRADIENT (percent)													
COMMUNITY TYPE[1]	**n**	**0-5**	**6-10**	**11-15**	**16-20**	**21-25**	**26-30**	**31-40**	**41-50**	**51-60**	**61-70**	**71-80**	**81-90**	**91-100**	**100-110**
		Number of Vegetation Sample Sites													
GRASSLAND	**29**														
Agropyron spicatum/Poa secunda habitat type	9	1		4			1	1	1		1				
Agropyron spicatum/Agropyron smithii habitat type	14	2	6	1	3		1		1						
Festuca idahoensis/Agropyron spicatum habitat type	1							1							
Festuca campestris/Agropyron spicatum habitat type	5		1	1	1	1		1							
TAME PASTURE	**8**														
Tame Pasture	8	3	4	1											
SHRUBLAND	**20**														
Artemisia tridentata/Poa secunda community type	3		2	1											
Artemisia tridentata /Agropyron smithii community type	2	2													
Artemisia tridentata/Agropyron spicatum habitat type	4		1	3											
Artemisia tridentata/Festuca idahoensis habitat type	3		2	1											
Artemisia tridentata/Festuca campestris habitat type	7	1	1	1	2		1	1							
Symphoricarpos occidentalis/Poa pratensis community type	1		1												
FOREST AND WOODLAND	**24**														
Juniperus scopulorum/Agropyron spicatum community type	5							1	2	1	1				
Pinus ponderosa/Agropyron spicatum habitat type	2								1	1					
Pseudotsuga menziesii/Agropyron spicatum habitat type	2									1			1		
Pseudotsuga menziesii/Festuca campestris habitat type	3									1	1	1			
Pseudotsuga menziesii/Physocarpus malvaceus habitat type	12	3							1	4	1	1	1	1	
RIPARIAN AND WETLAND (RW)	**23**														
Herbaceous RW types	**(14)**														
Poa pratensis community type	1	1													
Agrostis stolonifera community type	2		1					1							
Bromus inermis community type	1	1													
Typha latifolia community type	2	2													
Carex nebraskensis community type	3	3													
Carex pellita habitat type	2	2													
Carex utriculata habitat type	3	3													
Shrub RW types	**(3)**														
Symphoricarpos occidentalis community type	1	1													
Salix exigua-Cornus sericea community type	2	2													
Conifer and Deciduous Forest RW types	**(6)**														
Juniperus scopulorum/Cornus sericea habitat type	1	1													
Populus balsamifera/Symphoricarpos occidentalis community t	2	2													
Populus balsamifera/Cornus sericea community type	1	1													
Populus tremuloides/Cornus sericea habitat type	2	2													
TOTAL	**104**														

Table F3

Summary of ASPECT Categories by Community Type, Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

		ASPECT									
COMMUNITY TYPE[1]	**n**	**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**	**None**	**Variable**
		Number of Vegetation Sample Sites									
GRASSLAND	**29**										
Agropyron spicatum/Poa secunda habitat type	9	1		1	4	2	1				
Agropyron spicatum/Agropyron smithii habitat type	14	1	5	1		3	3		1		
Festuca idahoensis/Agropyron spicatum habitat type	1	1									
Festuca campestris/Agropyron spicatum habitat type	5	1	2						2		
TAME PASTURE	**8**										
Tame Pasture	8	2	1	1			2	2			
SHRUBLAND	**20**										
Artemisia tridentata/Poa secunda community type	3	1	1					1			
Artemisia tridentata /Agropyron smithii community type	2		1	1							
Artemisia tridentata/Agropyron spicatum habitat type	4		1	1	1			1			
Artemisia tridentata/Festuca idahoensis habitat type	3		3								
Artemisia tridentata/Festuca campestris habitat type	7		6						1		
Symphoricarpos occidentalis/Poa pratensis community type	1								1		
FOREST AND WOODLAND	**24**										
Juniperus scopulorum/Agropyron spicatum community type	5			2		2	1				
Pinus ponderosa/Agropyron spicatum habitat type	2		1				1				
Pseudotsuga menziesii/Agropyron spicatum habitat type	2		1	1							
Pseudotsuga menziesii/Festuca campestris habitat type	3	2							1		
Pseudotsuga menziesii/Physocarpus malvaceus habitat type	12	2	3	1	1		1	2	2		
RIPARIAN AND WETLAND (RW)	**23**										
Herbaceous RW types	**(14)**										
Poa pratensis community type	1									1	
Agrostis stolonifera community type	2		1						1		
Bromus inermis community type	1								1		
Typha latifolia community type	2				1					1	
Carex nebraskensis community type	3	1			2						
Carex pellita habitat type	2							1		1	
Carex utriculata habitat type	3									3	
Shrub RW types	**(3)**										
Symphoricarpos occidentalis community type	1									1	
Salix exigua-Cornus sericea community type	2									2	
Conifer and Deciduous Forest RW types	**(6)**										
Juniperus scopulorum/Cornus sericea habitat type	1									1	
Populus balsamifera/Symphoricarpos occidentalis community type	2					1				1	
Populus balsamifera/Cornus sericea community type	1	1									
Populus tremuloides/Cornus sericea habitat type	2									2	
TOTAL	**104**										

Table F3

Summary of ASPECT Categories by Community Type, Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

		ASPECT									
COMMUNITY TYPE[1]	**n**	**N**	**NE**	**E**	**SE**	**S**	**SW**	**W**	**NW**	**None**	**Variable**

Aspect Direction	Degree Interval
N	337.5 - 22.5
NE	22.5 - 67.5
E	67.5 - 112.5
SE	112.5 - 157.5
S	157.5 - 202.5
SW	202.5 - 247.5
W	247.5 - 292.5
NW	292.5 - 337.5
None	approx.level

APPENDIX G

Synoptic Literature Review of Community Types Occurring in the Region of the Montana Limestone Resources Baseline Study Area, Granite County, Montana, 2013.

Appendix G

Published and Unpublished Literature Reviewed for the Montana Limestone Resources Vegetation Type Classification, 2013.

STUDY CITATION	STUDY/PROJECT	LOCATION
Allewalt and Scow (2013)	Wetland Mitigation Bank	Madison County, Montana
Beaver and Scow (2011)	Wetland Mitigation Bank	Powell County, Montana
Cooper *et al.* (1991)	Forest Habitat Types	Northern Idaho
Cooper and Scow (1998)	Potter TNC Easement	Missoula County, Montana
Culwell *et al.* (1985)	Loon Lake TNC Easement	Lincoln County, Montana
Culwell and Scow (1982)	Jardine Project Area	Park County, Montana
Culwell and Scow (1993)	Diamond Hill Exploration Area	Broadwater County, Montana
Culwell and Scow (2003)	Beal Mountain Mine	Silver Bow County, Montana
Culwell and Scow (2005)	Montanore Project	Lincoln and Sanders Counties, Montana
Culwell *et al.* (1984)	Montana Tunnels Mine	Jefferson County, Montana
Culwell *et al.* (1998)	Yellowstone Pipeline Project	Missoula, Mineral, Sanders and Lake Counties, Montana; Shoshone County, Idaho
Culwell *et al.* (1990)	Little Rocky Mountains Environmental Study Area	Phillips County, Montana
Culwell *et al.* (1993)	McDonald Project Area Wetlands	Lewis and Clark County, Montana
Culwell *et al.* (1987)	Guide to Natural Vegetation	Montana
Hansen *et al.* (1995)	Classification of Riparian And Wetland Sites	Montana
Hironaka *et al.* (1983)	Sagebrush-Grass Habitat Types	Southern Idaho
Larsen *et al.* (1987)	Lewis and Clark Caverns State Park	Jefferson County, Montana
Mueggler and Stewart (1980)	Grassland and Shrubland Habitat Types	Western Montana
Pfister *et al.* (1977)	Forest Habitat Types	Montana
Roberts (1980)	Forest Habitat Types	Bear's Paw and Little Rocky Mountains, Montana
Roberts *et al.* (1979)	Forest and Woodland Habitat Types	Missouri River Breaks, Montana
Scow (1988)	Yellow Band Project	Beaverhead County, Montana
Scow (1989)	Yellowstone Talc Mine	Madison County, Montana
Scow (1990)	Dancing Prairie TNC Preserve	Lincoln County, Montana
Scow (1995a)	Basin Gulch Project Area	Granite County, Montana
Scow (1995b)	Golden Sunlight Mine	Jefferson County, Montana
Scow (1997)	Norris Gold Project	Madison County, Montana
Scow (2001); Scow (2005b)	Limestone Hills and Fort Harrison	Broadwater and Lewis & Clark Counties, Montana
Scow (2005a); Scow (2006a)	Indian Creek Project	Broadwater County, Montana
Scow (2006b)	Limestone Hills LEIS	Broadwater County, Montana
Scow (2009)	Bull Mountains Mine	Musselshell County, Montana
Scow and Beaver (1999a)	Fort Harrison	Lewis and Clark County, Montana
Scow and Beaver (1999b)	Limestone Hills	Broadwater County, Montana
Scow and Beaver (1999c)	Peters TNC Easement	Beaverhead County, Montana
Scow and Beaver (1999d)	Staudenmeyer TNC Easement	Beaverhead and Madison Counties, Montana
Scow and Culwell (1988)	Beal Project Area	Silverbow County, Montana
Scow and Culwell (1990)	Seven-Up Pete Project	Lewis and Clark County, Montana
Scow and Culwell (1994)	Elkhorn Project Area	Jefferson County, Montana
Scow *et al.* (1993)	McDonald Project Area	Lewis & Clark County, Montana
Scow *et al.* (1986)	Chartam Project Area	Broadwater County, Montana
Scow *et al.* (1987a)	Valley View Hills TNC Easement	Lake County, Montana
Scow *et al.* (1987b)	Rock Creek Project Area	Sanders County, Montana
Scow *et al.* (1989)	Basin Creek Mine	Jefferson and Lewis & Clark Counties, Montana
Scow *et al.* (1992)	New World Project	Park County, Montana
Steele *et al.* (1983)	Forest Habitat Types	Eastern Idaho – Western Wyoming
Steele *et al.* (1981)	Forest Habitat Types	Central Idaho
Thompson and Kuijt (1976)	Montane and Subalpine Plants	Sweetgrass Hills, Montana
Tuhy and Jensen (1982)	Riparian Classification	Upper Salmon/Middle Fork Salmon Rivers, Idaho
WESTECH Environmental Services, Inc. (2009)	Williams Property (Lazy Y 3 Ranch) PPLT Easement	Lewis & Clark County, Montana
WESTECH Environmental Services, Inc. (2010)	Milburn Property PPLT Easement	Lewis & Clark County, Montana
WESTECH Environmental Services, Inc. (2012)	Aspen Trails PPLT Easement	Lewis & Clark County, Montana
Western Technology and Engineering, Inc. (1988)	Kendall Venture Project	Fergus County, Montana
Western Technology and Engineering, Inc. (1991a)	Bar None Ranch (Sixteen Mile Creek) TNC Easement	Broadwater and Gallatin Counties, Montana
Western Technology and Engineering, Inc. (1991b)	Flying D Ranch (Spanish Peaks) TNC Easement	Madison and Gallatin Counties, Montana
Youngblood *et al.* (1985)	Riparian Classification	Eastern Idaho - Western Wyoming

Full citations are given in References Cited Section 4.0.

Appendix H

Representative Photographs of Vegetation Sample Plots,
Montana Limestone Resources Project, July 2013

GRASSLAND

Agropyron spicatum/Poa secunda h.t.

Plot 53 ..... H-1

Plot 56 ..... H-1

Agropyron spicatum/Agropyron smithii h.t.

Plot 44 ..... H-2

Plot 57 ..... H-2

Plot 60 ..... H-3

Plot 65 ..... H-3

Festuca idahoensis/Agropyron spicatum h.t.

Plot 68 ..... H-4

Festuca campestris/Agropyron spicatum h.t.

Plot 51 ..... H-4

Plot 58 ..... H-5

TAME PASTURE

Tame Pasture

Plot 76 ..... H-5

SHRUBLAND

Artemisia tridentata/Poa secunda c.t.

Plot 30 ..... H-6

Artemisia tridentata/Agropyron smithii c.t.

Plot 40 ..... H-6

Artemisia tridentata/Agropyron spicatum h.t.

Plot 36 ..... H-7

Artemisia tridentata/Festuca idahoensis h.t.

Plot 39 ..... H-7

Artemisia tridentata/Festuca campestris h.t.

Plot 29 ..... H-8

Plot 33 ..... H-8

Symphoricarpos occidentalis/Poa pratensis c.t.

Plot 45 ..... H-9

CONIFER FOREST AND WOODLAND

Juniperus scopulorum/Agropyron spicatum c.t.

Plot 17 ..... H-9

Plot 23 ..... H-10

Pinus ponderosa/Agropyron spicatum h.t.

Plot 21 ..... H-10

Pseudotsuga menziesii/Agropyron spicatum h.t.

Plot 11 ..... H-11

Pseudotsuga menziesii/Festuca campestris h.t.

Plot 13 ..... H-11

Pseudotsuga menziesii/Physocarpus malvaceus h.t.

Plot 7 ..... H-12

Plot 8 ..... H-12

Plot 14 ..... H-13

Appendix H

Representative Photographs of Vegetation Sample Plots,
Montana Limestone Resources Project, July 2013

RIPARIAN AND WETLAND (RW)

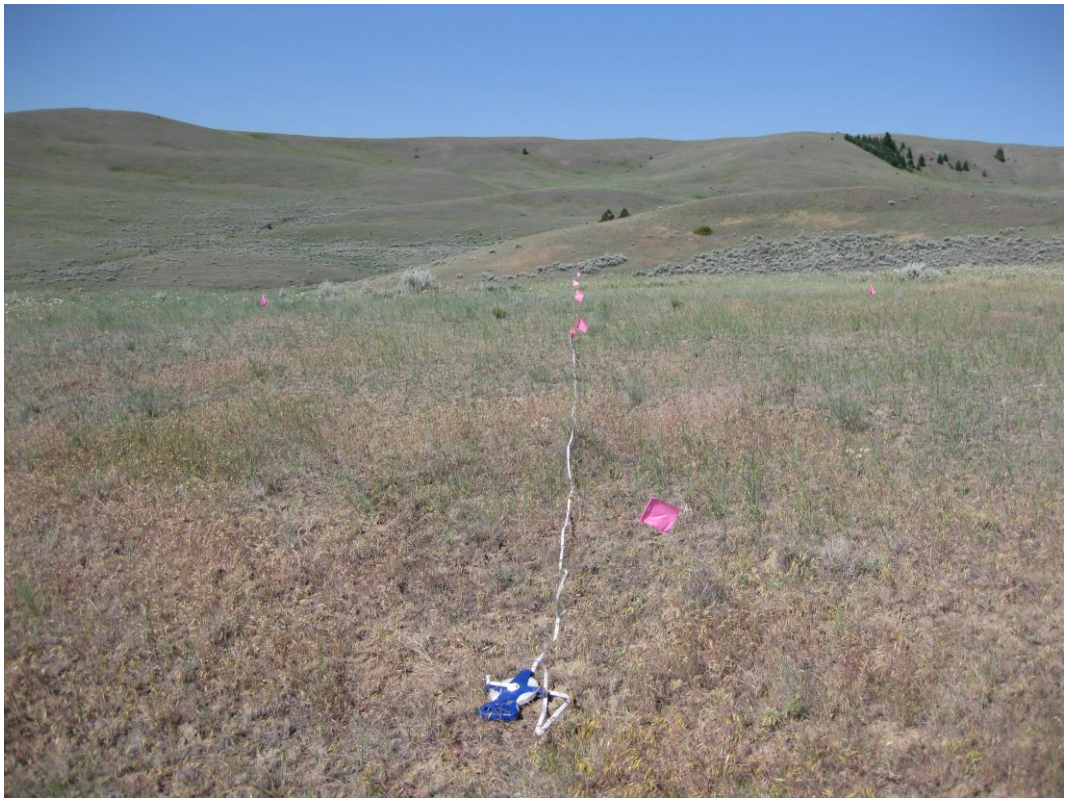
Poa pratensis c.t.
Plot RW 85 ..... H-13
Agrostis stolonifera c.t.
Plot RW 98 ..... H-14
Bromus inermis c.t.
Plot RW 83 ..... H-14
Typha latifolia c.t.
Plot RW 89 ..... H-15
Carex nebraskensis c.t.
Plot RW 97 ..... H-15
Carex pellita h.t.
Plot RW 92 ..... H-16
Carex utriculata h.t.
Plot RW 88 ..... H-16
Symphoricarpos occidentalis c.t.
Plot RW 84 ..... H-17
Salix exigua-Cornus sericea c.t.
Plot RW 90 ..... H-17
Juniperus scopulorum/Cornus sericea h.t.
Plot RW 102 ..... H-18
Populus balsamifera/Symphoricarpos occidentalis c.t.
Plot RW 82 ..... H-18
Populus balsamifera/Cornus sericea c.t.
Plot RW 99 ..... H-19
Populus tremuloides/Cornus sericea h.t.
Plot RW 104 ..... H-19

Appendix H. Representative Photographs of Vegetation Sample Plots,
Montana Limestone Resources Project, July 2013

Agropyron spicatum/*Poa secunda* h.t. Plot 53 at 310° azimuth

Agropyron spicatum/*Poa secunda* h.t. Plot 56 at 131° azimuth

Agropyron spicatum/Agropyron smithii h.t. Plot 44 at 320° azimuth



Agropyron spicatum/Agropyron smithii h.t. Plot 57 at 220° azimuth

Agropyron spicatum/Agropyron smithii h.t. Plot 60 at 065° azimuth

Agropyron spicatum/Agropyron smithii h.t. Plot 65 at 300° azimuth

Festuca idahoensis/Agropyron spicatum h.t. Plot 68 at 360° azimuth

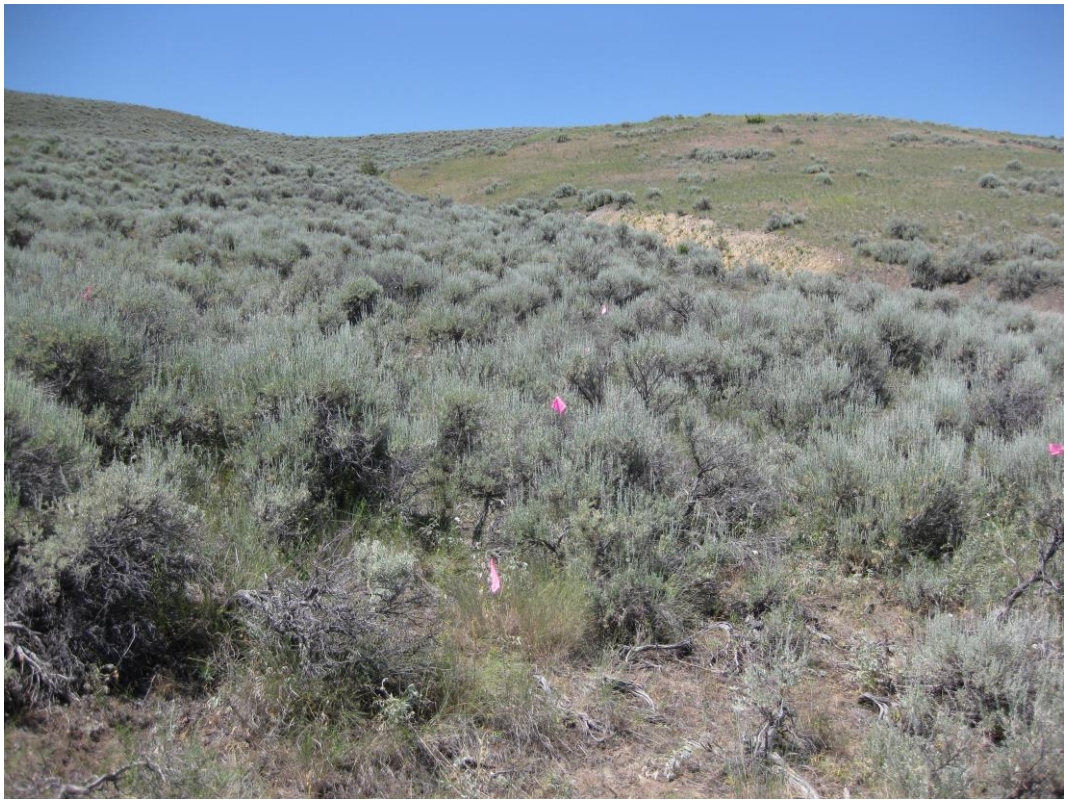
Festuca campestris/Agropyron spicatum h.t. Plot 51 at 036° azimuth

Festuca campestris/Agropyron spicatum h.t. Plot 58 at 038° azimuth

Tame Pasture Plot 76 at 350° azimuth

Artemisia tridentata/Poa secunda c.t. Plot 30 at 026° azimuth

Artemisia tridentata/Agropyron smithii c.t. Plot 40 at 090° azimuth



Artemisia tridentata/Agropyron spicatum h.t. Plot 36 at 310° azimuth

Artemisia tridentata/Festuca idahoensis h.t. Plot 39 at 310° azimuth

Artemisia tridentata/Festuca campestris h.t. Plot 29 at 040° azimuth

Artemisia tridentata/Festuca campestris h.t. Plot 33 at 025° azimuth

Symphoricarpos occidentalis/Poa pratensis c.t. Plot 45 at 056° azimuth

Juniperus scopulorum/Agropyron spicatum c.t. Plot 17 at 140° azimuth

Juniperus scopulorum/Agropyron spicatum c.t. Plot 23 at 025° azimuth

Pinus ponderosa/Agropyron spicatum h.t. Plot 21 at 294° azimuth

Pseudotsuga menziesii/Agropyron spicatum h.t. Plot 11 at 140° azimuth

Pseudotsuga menziesii/Festuca campestris h.t. Plot 13 at 232° azimuth

Pseudotsuga menziesii/Physocarpus malvaceus h.t. Plot 7 at 176° azimuth

Pseudotsuga menziesii/Physocarpus malvaceus h.t. Plot 8 at 216° azimuth

Pseudotsuga menziesii/Physocarpus malvaceus h.t. Plot 14 at 300° azimuth

Poa pratensis c.t. Plot RW 85 @ 010° azimuth

Agrostis stolonifera c.t. Plot RW 98 @ 060° azimuth

Bromus inermis c.t. Plot RW 83 @ 144° azimuth

Typha latifolia c.t. Plot RW 89 Facing East

Carex nebraskensis c.t. Plot RW 97 Facing North

Carex pellita h.t. Plot RW 92 @ 286° azimuth

Carex utriculata h.t. Plot RW 88 @ 144° azimuth

Symphoricarpos occidentalis c.t. Plot RW 84 @ 205° azimuth

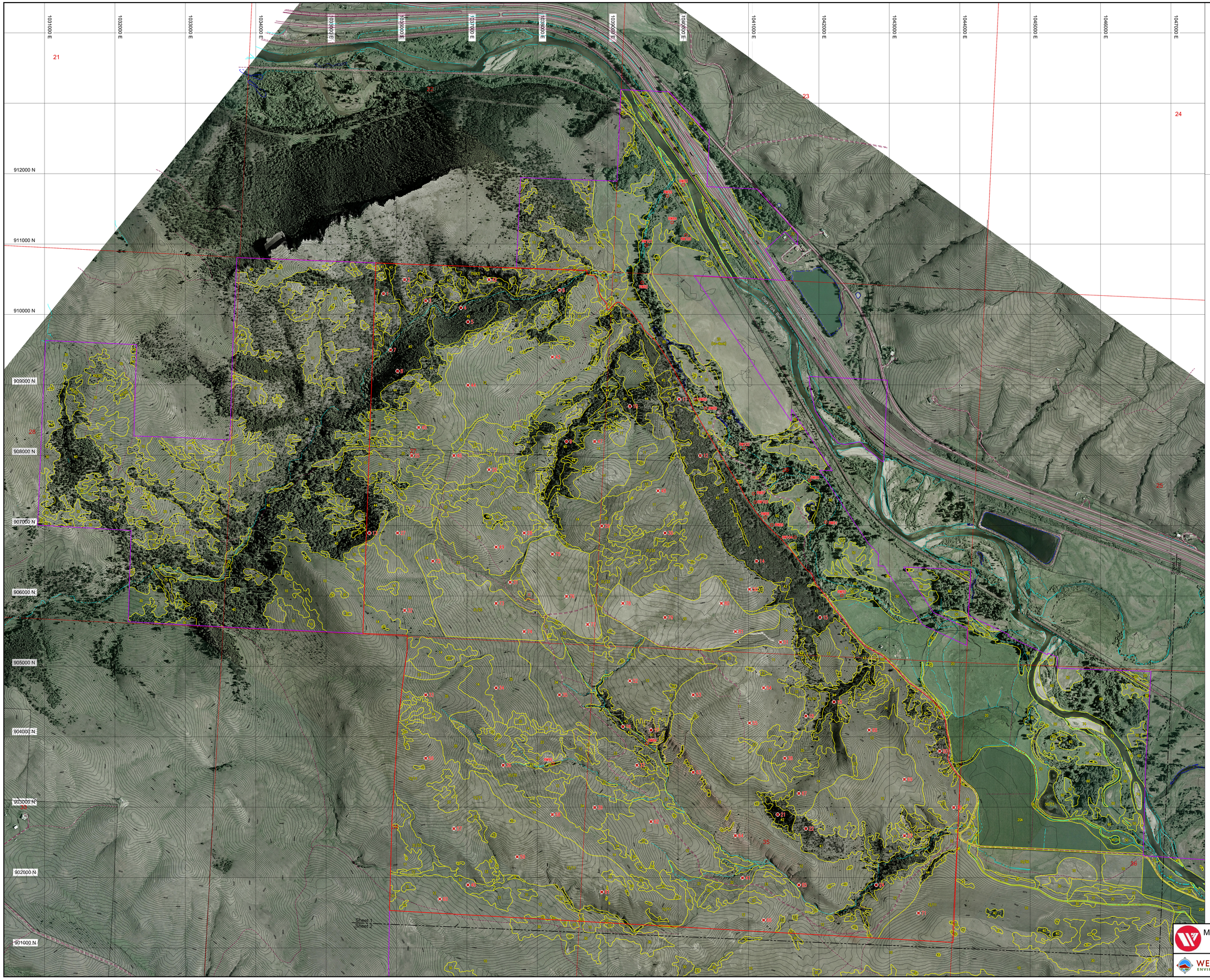
Salix exigua-Cornus sericea c.t. Plot RW 90 Facing Northeast

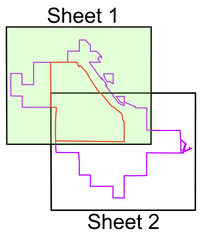
Juniperus scopulorum/Cornus sericea h.t. Plot RW 102 @ 320° azimuth

Populus balsamifera/Symphoricarpos occidentalis c.t. Plot RW 82 @ 344° azimuth

Populus balsamifera/Cornus sericea c.t. Plot RW 99 @ 095° azimuth

Populus tremuloides/Cornus sericea h.t. Plot RW 104 @ 170° azimuth





LEGEND

- Extensive Study Area
- Intensive Study Area
- Vegetation Type Boundary
- 81 Upland Vegetation Sample Site
- RW104 Riparian / Wetland Sample Site

MAP SYMBOL	VEGETATION TYPE
10	**GRASSLAND**
10D	Disturbed Grassland
11	*Agropyron spicatum/Poa secunda* habitat type
12	*Agropyron spicatum/Agropyron smithii* habitat type
13	*Festuca idahoensis/Agropyron spicatum* habitat type
14	*Festuca campestris/Agropyron spicatum* habitat type
20	**TAME PASTURE**
20	Tame Pasture
20A	Alfalfa
30	**SHRUBLAND**
31	*Artemisia tridentata/Poa secunda* community type
32	*Artemisia tridentata /Agropyron smithii* community type
33	*Artemisia tridentata/Agropyron spicatum* habitat type
34	*Artemisia tridentata/Festuca idahoensis* habitat type
35	*Artemisia tridentata/Festuca campestris* habitat type
36	*Symphoricarpos occidentalis/Poa pratensis* community type
37	*Prunus virginiana/Agropyron spicatum* community type
40	**CONIFER FOREST AND WOODLAND**
41	*Juniperus scopulorum/Agropyron spicatum* community type
42	*Pinus ponderosa/Agropyron spicatum* habitat type
43	*Pseudotsuga menziesii/Agropyron spicatum* habitat type
44	*Pseudotsuga menziesii/Festuca campestris* habitat type
45	*Pseudotsuga menziesii/Physocarpus malvaceus* habitat type
50	**HERBACEOUS RIPARIAN AND WETLAND**
51	*Poa pratensis* community type
52	*Agrostis stolonifera* community type
53	*Bromus inermis* community type
54	*Typha latifolia* community type
55	*Carex nebraskensis* community type
56	*Carex pellita* habitat type
57	*Carex utriculata* habitat type
60	**WOODY RIPARIAN AND WETLAND**
61	*Symphoricarpos occidentalis* community type
62	*Salix exigua-Cornus sericea* community type
63	*Juniperus scopulorum/Cornus sericea* habitat type
64	*Populus balsamifera/Symphoricarpos occidentalis* community type
65	*Populus balsamifera/Cornus sericea* community type
66	*Populus tremuloides/Cornus sericea* habitat type
70	**MISCELLANEOUS**
71	Roads, Railroads
72	Residential and Related
73	Water
74	Gravel Bar
75	Rock Outcrop, Scree
NS	Not Surveyed

Note: Acreages for composite map units (mosaic of vegetation types) are generated using the following percentages:

Map Unit	Percent of Acreage
x/y	60/40
x(y)	75(25)

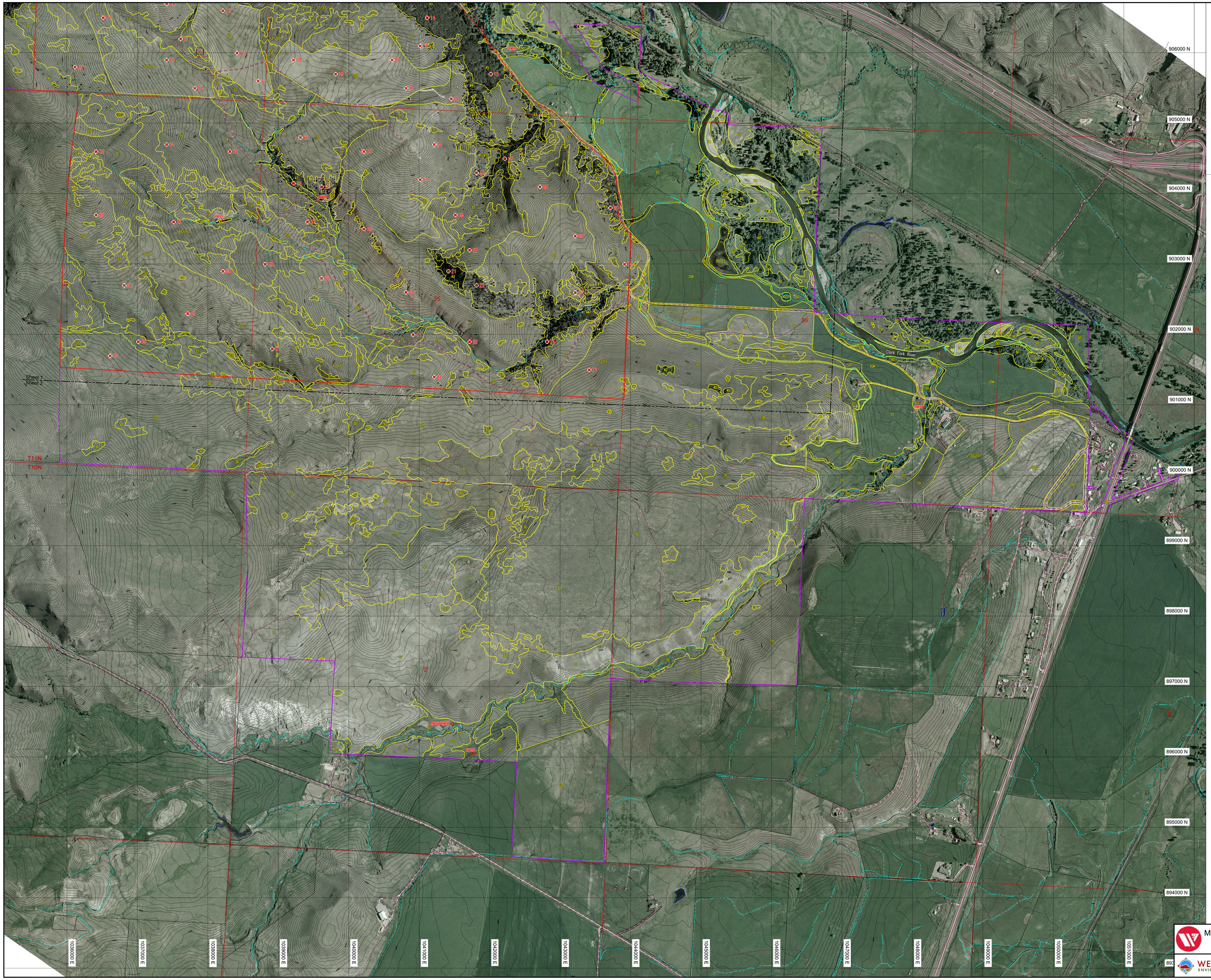
N

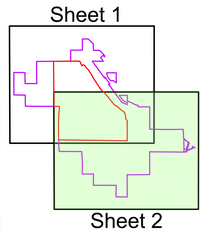
0 200 400 800
Feet

Montana Limestone Resources
Vegetation

WESTECH ENVIRONMENTAL

SCALE: 1"=400'	Plate
DATE: 12/3/14 | Rev 2: 2/16/18	1
DRAWN BY: DC	
CHECKED BY: DC	
FILE: MLR18 Vegetation R2.dwg	SHEET: 1 of 2





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- Intensive Study Area
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- ○ RW104 Riparian / Wetland Sample Site

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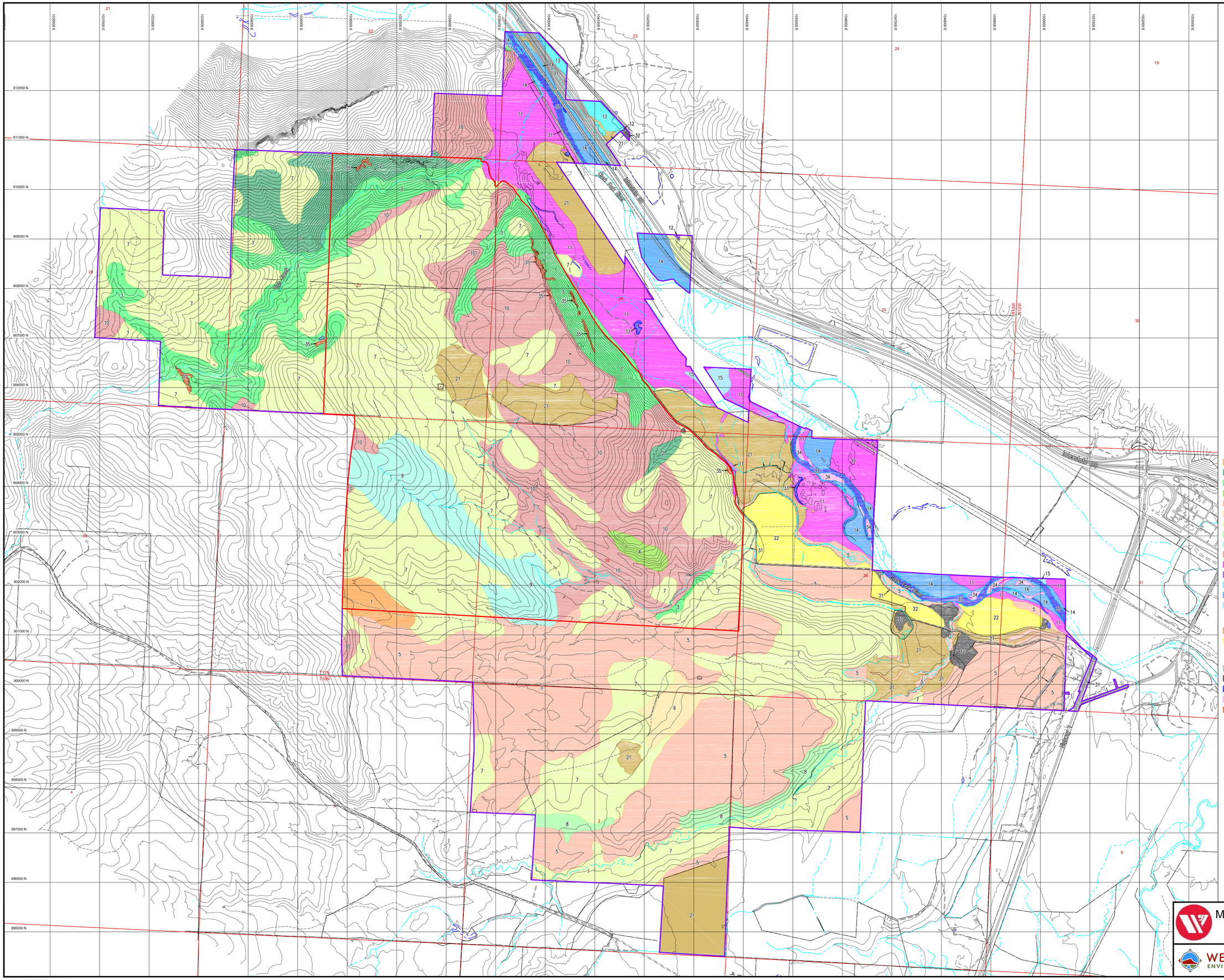
N

0 200 400 800
Feet

Montana Limestone Resources
Vegetation

WESTECH ENVIRONMENTAL

SCALE: 1"=400'	Plate
DATE: 12/3/14 | Rev 2, 2/16/18	1
DRAWN BY: DC	
CHECKED BY: DC	
FILE: MLR18_Vegetation_R2.dwg	SHEET: 2 of 2



LEGEND

Extensive Study Area

Intensive Study Area

Ecological Site

- 1 Claypan, 15-19" ppz
- 2 Douglas-fir/Snowberry
- 3 Douglas-fir/Snowberry - Douglas-fir/ Pinegrass
- 4 Douglas-fir/Snowberry - Rock Outcrop
- 5 Silty, 10-14" ppz
- 6 Silty, 10-14" ppz - Silty Droughty, 10-14" ppz
- 7 Silty, 15-19" ppz
- 8 Silty, 15-19" ppz - Silty Droughty, 10-14" ppz
- 9 Silty, 15-19" ppz - Shallow, 15-19" ppz
- 10 Silty, 15-19" ppz - Shallow, 15-19" ppz - Rock Outcrop
- 11 Subirrigated, 10-14" ppz
- 12 Subirrigated, 15-19" ppz
- 13 Wet Meadow, 10-14" ppz
- 14 Wet Meadow, 10-14" ppz - Subirrigated, 10-14" ppz
- 15 Wet Meadow, 15-19" ppz

Tame Pasture

- 21 Tame Pasture Nonirrigated
- 22 Tame Pasture Irrigated

Miscellaneous

- 31 Roads, Railroads
- 32 Residential and Related
- 33 Water
- 34 Gravel Bar
- 35 Rock Outcrop, Scree

0 400 800 1600
Feet

Montana Limestone Resources
Ecological Sites

WESTECH ENVIRONMENTAL

SCALE: 1"=800'	Plate
DATE: 04/02/14 | Rev. 02/19/18	2
DRAWN BY: DC	
CHECKED BY: KS	
FILE: MLR18_Ecological R2.dwg	SHEET: 1 of 1