



Final Report 2010

GLACIER NATIONAL PARK: EASTSIDE GRASSLANDS ECOLOGY PROJECT



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I. Introduction

Glacier National Park's grasslands and closely associated communities are extremely important contributors to the character and ecology of the park. Many wildlife species utilize these grasslands; elk, bighorn sheep, white-tailed and mule deer regularly forage there. Federally listed grizzly bears and species of concern gray wolves and bald eagles feed on these ungulates or on carrion. Both grizzly and black bears utilize the meadows for vegetative components of their diets. Numerous smaller mammals such as coyotes, Columbian ground squirrels, deer mice, and voles are commonly observed there.

A number of previous studies have evaluated different aspects of the grassland communities, but no comprehensive project has been undertaken to establish an overall understanding of the correlations between the condition and integrity of the grasslands and overall biological diversity for both plant and animal species. Prior to this report, no comprehensive plant species lists have ever been compiled for the various eastside meadows. No analysis of eastside meadow composition or of specific community groups has been made. Exotic plants, particularly noxious weeds, are known to constitute a major concern due to the susceptibility of many grassland communities (Tyser and Worley 1992, Weaver and Woods 1985, Tyser and Key 1988). Although infestations have been documented for much of the park (Lange 1991, 1998), investigation has been concentrated along roadways. A much more complete analysis of grasslands is needed to determine current infestations and to evaluate the risk such weeds represent to native plant and animal communities. A dramatic loss in diversity of plant communities where exotics are present in large number (Tyser 1991, Tyser and Worley 1992) suggests cause for concern about these areas as habitat for mammals, birds, and other wildlife species.

Historical use of park grasslands includes the planting of timothy and harvesting of hay, and park, concessioner, and trespass livestock use. Until about 1980, it was common practice to seed roadsides after construction projects with such exotics as timothy, Kentucky bluegrass, and various clovers (Tyser 1991, 1992). Ongoing livestock trespass and the construction of roads and various other facilities remain the primary causes of weed encroachment. Densities of non-natives decrease with distance away from primary roads, but their steady advance over the past 70 years is a definite threat to these formerly native plant communities. The last work on elk utilization dates to the early 1960s (Wasem 1963, 1964), and current use of these meadows may be increasing as elk winter range is lost outside the park due to competition from livestock and deteriorating conditions of nearby grasslands (Gniadek 1998). Fire exclusion has likely caused a shift in structure from grassland to coniferous forest (Barrett 1993, 1997). Historically fires have been an important contributor to wildlife range, particularly that of bighorn sheep (Riggs 1977, Peek et al. 1985). The scope and severity of change in cover, just over the last 100 years, is unknown.

The Glacier National Park Eastside Grasslands Ecology Project was initiated in 1999 as a three-year study. The goals of this study are:

1. To determine plant species composition in each of the numerous meadow systems and to classify the grassland communities on the east side of the park.
2. To monitor the presence and status of exotic plant species within east side grasslands.
3. To establish permanent vegetation plots, which may be used again in the future for comparative analysis.
4. To document wildlife utilization of grasslands to establish a baseline for determining relationships with vegetative conditions, comparison with historical records, and future monitoring. This assessment will focus on bighorn sheep, neotropical migratory birds, and small mammals.
5. To determine the initial extent of undisturbed grasslands, identify what changes (if any) have occurred over the last 100 years, and clarify the rate and direction of change to help forecast expected future conditions.
6. To create a management matrix that ranks the health of each grassland area based on current ecological values, severity of current stressors to ecological integrity, and potential threats to each of the sites.

The 1999 season saw the beginning of the three-year meadow vegetation surveys. Additional projects during the 2000 and 2001 seasons included a prairie bird survey, a small mammal study, the continuation of a graduate-level bighorn sheep study, and comparative past and present photography. Twenty-one sites on bighorn sheep range were sampled to provide vegetative information for the graduate study.

II. Study Area

Numerous meadows and prairies are present east of the Continental Divide in Glacier. They have likely been present for thousands of years, as the gravelly well-drained soils and south and westerly exposures favor the formation and maintenance of grassland conditions. In a few instances, these Bunchgrass-Prairie Life Zones are small continuous extensions from the drier short-grass Great Plains to the east, though plant composition differs because of abrupt increases in elevation and precipitation in the park (Lesica 2002). Principal areas of investigation (from north to south) include the Belly River valley, Otatso and Kennedy Creeks, Swiftcurrent valley and Ridge, Boulder Creek and Ridge, St. Mary valley, Red Eagle Creek, Milk River Ridge, Cut Bank Creek and Ridge, Two Medicine valley and Ridge, and the Railroad Creek-Lubec-Three Bears Lake areas. Emphasis was placed on fescue-grassland communities between about 4,500 and 6,500 feet in elevation, including weedy sites that likely used to be fescue grassland. These areas generally correspond to the Landsat types (DN) 5-9 (approximately 28,000 acres). Priority has been given to sites that are known to be severely degraded, that are known to be of particular importance to wildlife, that represent the original native prairie conditions for comparisons, or that are otherwise of concern to management.

Underlying soils are typically gravelly, sandy alluvial fans or high river terraces, and rocky colluvial soils of glacial origin (Dutton 1997). Most samples were of gravelly sandy loam, with variable clay content. Thus, most of the meadows are on well-drained, relatively dry, flat to moderate slopes, with a west or southerly exposure. These were originally rough fescue-Idaho fescue habitat types with associated forbs and shrubs, being modified to various degrees by such factors as slope, aspect, elevation, moisture, fire and grazing histories, and the invasion of exotic plant species.

Common native grasses include bluebunch wheatgrass (*Pseudoroegneria spicata*), bearded wheatgrass (*Elymus trachycaulus* ssp. *subsecundus*), Idaho fescue (*Festuca idahoensis*), rough fescue (*Festuca campestris*), timber oatgrass (*Danthonia intermedia*), Columbia needlegrass (*Stipa nelsonii*), and prairie junegrass (*Koeleria macrantha*). Rough fescue is an indicator of moister sites in bunchgrass habitats, while bluebunch wheatgrass is indicative of the driest sites such as south-facing open ridgetops. Idaho fescue is intermediate in terms of moisture requirements (Mueggler and Stewart 1980). Less abundant native grasses include tickle-grass (*Agrostis scabra*), California brome (*Bromus carinatus*), pinegrass (*Calamagrostis rubescens*), spike-oat (*Helictotrichon hookeri*), mat muhly (*Muhlenbergia richardsonii*), Richardson's needlegrass (*Stipa richardsonii*), and spike trisetum (*Trisetum spicatum*). Several native sedges (*Carex* spp.) are present, and exotic grasses, especially timothy (*Phleum pratense*) and Kentucky bluegrass (*Poa pratensis*), are also common. Typical shrubs include serviceberry (*Amelanchier alnifolia*), rose (*Rosa* spp.), and shrubby cinquefoil (*Pentaptylloides floribunda*) in the lower and mid-elevations, and kinnikinnick (*Arctostaphylos uva-ursi*) and dryad (*Dryas octopetala*) in the higher zones. Groves of aspens (*Populus tremuloides*), black cottonwoods (*Populus balsamifera* ssp. *trichocarpa*), lodgepole pines (*Pinus contorta*), and subalpine fir (*Abies lasiocarpa*) are also often adjacent to or actually within these meadows. The general trend toward higher elevations (above 6000 feet) is for fewer exotics, and for more Idaho fescue, sedges, and subalpine species such as spike trisetum (*Trisetum spicatum*) and spiked woodrush (*Luzula spicata*). Appendix A contains a complete list of all plant species found in and immediately adjacent to all sampled meadows.

The average annual precipitation (1951 – 1980) at Chief Mountain Customs is 38-inches, 46-inches at Many Glacier Ranger Station, 26-inches at St. Mary Ranger Station, and 31-inches at East Glacier. St. Mary averaged 162-inches and East Glacier 194-inches of snow during the same time period. Total annual precipitation drops off sharply on the prairies just to the east of the park. Totals for Babb are only 19-inches, 16-inches at Browning, and 23-inches at the Sherburne Lake dam (Finklin 1986). Glacier's eastside climatic conditions include frequent westerly and southwesterly winds which are exceptionally strong and often warm (chinooks) during the winter. Desiccating winds and eastside geology and landforms result in more bare ridgetops, limiting the extent and continuity of forested areas and resulting in smaller and less fuel (Finklin 1986).

The historic mean fire interval for the Hudson Bay drainage was nine years, while the mean fire interval for the Missouri drainage was only four years. Native Americans ignited many pre-1900 fires in the prairies and adjacent forests to stimulate forage, drive game, maintain grasslands, and for communication and entertainment. An Indian-caused fire in 1885 burned the ridge along the north side of St. Mary Lake all the way from Rising Sun to the foot of the lake. Several other Indian-caused fires were noted from Marias Pass to the East Glacier area and a 1919 burn in the Two Medicine-Spot Mountain area (Ayres 1900). Other early eastside fires included an extensive burn in the lower Belly River valley before 1874 and the Heaven's Peak fire which crossed the divide into the Many Glacier valley in 1936 (Finklin 1986). Since the mid-1900's, the intervals have become much longer because of more efficient fire suppression, especially of early season smaller events which could formerly have spread (Barrett 1997). Grassland-aspen grove ecosystems have been among the most seriously impacted by years of fire exclusion (Barrett 1997). Lower elevation conifer stands are invading several grassland communities on the east side of the park.

III. Historic Use

The western Great Plains were grazed by millions of bison for thousands of years, as well as by lesser numbers of deer, elk, pronghorns, and other ungulates. In 1815, Hugh Monroe saw mountain bison along upper St. Mary Lake (Schultz 1918). Biologist Vernon Bailey in 1885 described the remains of many old buffalo trails in the Belly River country leading from the higher river terraces down to the river bottoms that “showed where buffalo had at one time occupied this valley in great numbers.” He also noted skeletal remains from all the eastside valleys (Bailey 1918). Apparently all park bison were gone by about 1850, as chronicles of hunting and surveying trips after this time make no mention of them (DeSanto 1971). Bison bones and Native American bison kill sites are still regularly unearthed, sometimes far up the drainages (Reeves 1995).

Nearly all lower elevation eastside meadows have a long history of grazing by domestic livestock, including sheep, cattle, and horses. This includes grazing by the old Glacier Park Saddle Horse Company concessioner, by National Park Service horses and mules, and illegal stock trespass from adjacent private lands and tribal leases.

A. Concessioner Use

W. N. Noffsinger's Saddle Horse Company operated from all hotels and backcountry chalets starting about 1915 and by 1925, had over 1,000 head of horses parkwide (Buchholtz 1976). Although grazing was prohibited in the early 1940s by all concessioners, horses frequently grazed in the park after this time and records show that the concessioner actually seeded some park grasslands with timothy for better horse pasture during the 1930s (Potter 1999), including the Red Eagle and Belly River meadows and areas in Goat Haunt. The Cut Bank valley, Belly River valley, Two Medicine Valley, and Two Dog Flats, Rising Sun, Red Eagle valley, and Many Glacier valley (Cracker, Windy, and Apikuni Flats) were all grazed by concession horses.

Development of chalets by the Great Northern Railway was also constructed in certain east side grassland meadows. Out of nine constructed chalets, three were built in fescue grasslands including Cut Bank, Two Medicine, and St. Mary Chalets along with associated outbuildings and access roads. Removal of the Cut Bank and St. Mary Chalets in the mid-1940s ended concessioner use in these areas. There was also a horse concession barn and associated corrals just east of the parking lot at Two Medicine Lake that have also been removed. Overall historic concessioner use in these areas disturbed many of these fescue grasslands, introducing exotic plants, particularly non-native grasses that displaced native vegetation.

B. Glacier National Park Use

In addition to concessioner use, the Park Service had several pastures that were used for horse grazing and haying. These included pastures in the Red Eagle valley, St. Mary Flats, Two Dog Flats, Rising Sun, and areas near the Belly River Ranger Station, Many Glacier Hotel and Road, old Cut Bank Chalet, old Two Medicine Ranger Station, and old Lubec Ranger Station. Some areas, like the Red Eagle meadows, still had horses being wintered into the mid-

1960s (Wasem 1964). In addition, meadows at Red Eagle, St. Mary Flats, Rising Sun, and Two Dog Flats were hayed for many years. The park still maintains a pasture in Belly River.

The National Park Service also developed several buildings and roads in certain grassland areas. Some of these buildings include the Belly River Ranger Station, old Cut Bank Chalet, old Two Medicine Ranger Station, old Lubec Ranger Station, Slide Lake patrol cabin, and Red Eagle Lookout. In addition, the small mining town of Altyn existed on Cracker Flats in the Many Glacier valley. Roads that ran through east side meadows were often associated with these developments. Examples include a road that ran throughout the Red Eagle meadows up to the former Red Eagle Lookout site and a road and extensive campground on the south end of St. Mary Flats that were still in use in the early 1960s. In addition, there was also a road that was constructed to the east of Oatso Lakes where virtually the entire valley was taken up by claims associated with the Van Pelt Mines. Finally, the Lubec Lake area was the site of several former homesteads and later of a small railroad town. Homesteader G. C. Smiley had a large ranch with at least seven buildings, including two houses and a barn around the south end of the Lake in the 1920's. One small log cabin still stands.

C. Stock Trespass

Trespass grazing by adjacent landowners and leaseholders has been going on for many years and is still a major problem. In the 1950s and 1960s, domestic sheep were regularly summered in the Chief Mountain/Otatso Creek with periodic sheep trespass in the Kennedy Creek and Cut Bank areas. Horses were also often wintered near Boulder Ridge. Cattle and horse trespass still continues as trespass regularly occurs along the east slopes of the park. Historic and current cattle and horse trespass has been documented in the Lubec, Railroad Creek, Two Medicine, Lake Creek, Spot Mountain, Kennedy Creek, Cut Bank Ridge and Racine Basin, Milk River Ridge, White Calf Mountain, Mad Wolf Mountain, Swiftcurrent Ridge, Boulder Ridge, Otatso Creek, and Chief Mountain Road areas. In the 1960s, the local Blackfeet were shooting the numerous semi-wild horses in the Lee Creek area and selling the carcasses to canners (Wasem 1963).

These years of livestock use have been detrimental to the native grasslands, causing soil degradation and the introduction of exotics, particularly noxious weeds and non-native grasses timothy and Kentucky bluegrass.

IV. Study Methods

Fifty-seven vegetative sampling plots were established in thirty eastside grasslands (also referred to as meadows) from 22 June to 23 September 1999. Forty-eight more were placed in thirty-nine grasslands from 15 June to 16 September 2000. Fifty-five more plots in forty grasslands were sampled in 2001 from 11 June to 31 August, for a three-year total of 155 plots in 99 discreet grasslands (Figures 1-7; Appendix B). Plots were located between 4,490 and 6,844 feet elevation, with approximately half of all sites between 4,500 and 5,000 feet. Vegetation maps were made of several meadows by surveying and mapping according to vegetation types. Representative sites were then selected in these different types in each meadow, such as on drier ridges, lower moister swales, and disturbed areas.

Permanent plots measuring 20m x 5m were randomly established in each grassland with one to many plots established depending on the number of different associations that were present. Often, if the grassland was large, multiple plots were established, even within the same association, to document the condition of the entire grassland area. Each plot was marked with eight-inch spikes placed in the lower right and upper left corners. Each spike has an aluminum tag with the plot number. Within this 100 square meters, fourteen 50cm x 50cm microplots were randomly located. Percent cover of all species located in each microplot was recorded, as was percent cover of bare soil, rock, gravel, lichen, moss, wood, animal droppings, and litter. Ocular cover estimates were made for other species in the 100 square-meter macroplot that were not captured in the microplots. In addition, a walk-through survey was made of each meadow in which the plots were located. This was preferably done more than once at different times of the season in an effort to record all plant species present in each of the various meadow systems. Plot and meadow photographs were also taken, and general site characteristics, such as aspect, slope, and soil texture, were documented.

Based on the evaluation of six plots at the beginning of the study, it was determined to read 14 microplots in each macroplot. Species curves for each plot (Figure 10) illustrated that 14 microplots captured 90% to 100% of all species in each plot. In addition, a comparison of 12, 14, 15, 16, and 18 microplots (Appendix E) revealed that mean canopy cover estimates using 14 microplots were not significantly different from estimates using 16 or 18 microplots.

During May 1999, and again in May 2001, 11 transects established during the mid-1960s by Wildlife Management Ranger C. Robert Wasem were also monitored (Appendix F). Wasem used a modified Parker Method, beginning each transect at a permanent stake and noting ground cover with a ¾-inch diameter loop at 100 random step stations. In every case, the 1999 and 2001 results showed equal or better ground cover than was present at the same time 35 years ago and all transects were in excellent browse condition based on standards outlined in Wasem (1963, 1964). Some of these transects have been disturbed and stakes removed, but on most transects at least one red angle-iron stake remains.

V. Results

A. Vegetation

A master list of all plant species encountered during the three field seasons was compiled with notations for edge and exotic species (Appendix A). Species lists for each individual meadow were also made. A total of 342 species (241 forbs, 62 grasses and sedges, 31 shrubs, and 8 trees) were found in and immediately adjacent to the meadows. Included in these totals are 25 exotic forbs and 8 exotic grasses. Few plots were exotic-free; frequency of non-native plants decreased with elevation and distance from disturbed areas.

In 2003, plot data was analyzed by NatureServe as part of the vegetation mapping program. Data analysis classified the following 11 grassland and dwarf-shrub association types following *International classification of ecological communities: terrestrial vegetation of the United States* (Grossman et al. 1998) (Appendix B):

1. *Festuca campestris*-*Festuca idahoensis*/*Geranium viscosissimum* association

a. Environmental Description

Fifty-three plots (34% of sampled areas) were classified into the *Festuca campestris*-*Festuca idahoensis*/*Geranium viscosissimum* association. It is by far the most common grassland association found on the east side of Glacier NP. This mesic to subxeric type occurs mostly on flat to gently sloping basin floors, toeslopes, and lowslopes with variable aspects at elevations between 1,370m (4,490 feet) and 1,900m (6,240 feet), although it can occur on slightly steeper midslopes. Soils are typically moderately well to well drained sandy loams, but soil texture may also be sandy clay loam or loamy sand. These soils are moderately well developed, moderately acidic to moderately alkaline and formed on course-textured glaciofluvial, morainal, and sometimes colluvial landforms that generally contain argillite. Litter comprises 40-95% of the ground surface with *Selaginella* spp. and moss having secondary ground cover.

b. Vegetation Description

A high diversity of native grasses and forbs dominate this herbaceous grassland community. Overall herbaceous cover ranges from 30-85% (50% mean cover) with native forb cover generally being higher than native grass cover. Overall native grass cover ranges from 10-40% (20% mean cover) and is often clearly dominated by indicator species *Festuca campestris* with 1-25% cover (8% mean cover) and *Festuca idahoensis* with 1-10% cover (4% mean cover). Other high constancy grasses present are indicator species *Carex petasata* with trace-6% cover (1% mean cover), *Danthonia intermedia* with 1-6% cover (2% mean cover), *Carex obtusata* with trace-15% cover (2% mean cover), *Koeleria macrantha* with trace-2% cover (0.5% mean cover), and *Elymus trachycaulus* ssp. *subsecundus* with trace-2% cover (0.5% mean cover). In general, *Carex petasata* has higher cover and constancy within this association than within the other native grass or dwarf-shrub associations and *Danthonia intermedia* and *Elymus trachycaulus* ssp. *subsecundus* have the highest constancy within this type. Grasses that are present on a little more than half the plots and often have conspicuous cover also include *Pseudoroegneria spicata* (trace-8% cover) and *Stipa nelsonii* (trace-13% cover). Although *Stipa richardsonii* has only 25% constancy, this is the only native grassland type that this species occurs in. Other lower

constancy grasses, such as *Bromus carinatus*, *Bromus pumpellianus*, *Calamagrostis rubescens*, *Juncus balticus*, *Carex filifolia*, *Carex geyeri*, and *Carex rossii*, may have conspicuous cover in certain areas. *Bromus carinatus*, *Calamagrostis rubescens*, *Juncus balticus*, *Carex geyeri*, and *Carex rossii* are not present within the drier *Festuca campestris*/*Festuca idahoensis* association. *Elymus innovatus*, a G5/S1 species, is also present in one plot within this association.

Overall native forb cover ranges from 10-60% (27% mean cover), dominated by forb species that are typical to other association types. These high constancy forbs include *Lupinus sericeus* (trace-21% cover; 4% mean cover), *Achillea millefolium* (1-10% cover; 3% mean cover), *Galium boreale* (trace-4% cover; 2% mean cover), *Agoseris glauca* (trace-5% cover; 1% mean cover), *Anemone multifida* (trace-4% cover; 1% mean cover), *Cerastium arvense* (trace-4% cover; 1% mean cover), *Potentilla gracilis* (trace-5% cover; 1% mean cover), and *Campanula rotundifolia* (trace-1% cover; 0.5% mean cover). However, this type tends to support higher cover and more diversity of mesic forbs than other associations, especially the *Festuca campestris*/*Festuca idahoensis* association. *Geranium viscosissimum*, a mesic species and indicator species for this type, has higher cover and constancy on this type than any other association (trace-8% cover; 1% mean cover). Cover of *Potentilla gracilis*, a second indicator species for this type, is greater on this type than any other association. Other high constancy forbs, including *Penstemon confertus* (trace-12% cover; 3% mean cover), *Fragaria virginiana* (1-11% cover; 2% mean cover), *Lomatium triternatum* (trace-4% cover; 1% mean cover), *Solidago* spp. (both *S. missouriensis* and *S. multiradiata*; trace-5% cover; 1% mean cover), and *Dodecatheon conjugens* (trace-4% cover; 0.5% mean cover), tend to occur in more mesic environments and tend to have higher cover and constancy on this type than within the *Festuca campestris*/*Festuca idahoensis* association. Other species that are present on approximately half of the plots include *Selaginella densa* with trace-20% cover (4% mean cover), *Aster laevis*, *Eriogonum umbellatum*, *Antennaria anaphaloides*, and *Heuchera cylindrica* with trace-8% cover (1% mean cover) and *Antennaria rosea*, *Antennaria umbellatum*, *Arabis nuttallii*, *Gaillardia aristata*, *Lithospermum ruderales*, *Oxytropis campestris*, and *Potentilla hippiana* with trace-3% cover (0.5% mean cover). *Balsamorhiza sagittata* and *Vicia americana* have low constancy but may have high cover in certain areas.

Shrubs are present on almost all plots. Shrub cover is less than or equal to 5% on 75% of the sampled areas, however, shrub cover may reach 15% in certain locations. Shrubs with the highest constancy are only present on approximately 50% of the plots and include *Amelanchier alnifolia* with trace-5% cover (1% mean cover), *Dasiphora floribunda* with trace-5% cover (2% mean cover), and *Rosa* spp. (both *R. acicularis* and *R. woodsii*; trace-9% cover; 2% mean cover). *Arctostaphylos uva-ursi*, *Mahonia repens*, *Symphoricarpos albus*, and *Vaccinium caespitosum* have low constancy but may have high cover in certain areas.

Diversity and cover of non-native species is quite low; only three species have high constancy. *Phleum pratense* has the highest cover of any non-native species, ranging from trace-5% (2% mean cover). *Poa pratensis* and *Taraxacum officinale* are commonly observed with trace-3% cover (0.5% mean cover). Cover of noxious weeds was also found to be low (see description of noxious weeds in *Overall Condition* section below).

c. Element Distribution

This association is the most common grassland type found on the east side of Glacier NP. It was observed in all east-side subdistricts from basin floors to midslopes, although it occurs most regularly on toeslopes and lowslopes. In the St. Mary subdistrict, this type dominates Two Dog Flats, the 1913 Ranger Station meadow, and various meadows along the Red Eagle Trail, as well as areas near Rising Sun, St. Mary Flats, and the St. Mary Visitor Center. In the Many Glacier subdistrict, it dominates Swiftcurrent Ridge, Cracker Flats, and meadows north and south of Poia Lake and can be found along Windy Creek, in Apikuni Flats, along Lake Sherburne, along Slide Lake, along Kennedy Creek, along Boulder Creek, and on Mt. Henkel and Yellow Mt. In the Two Medicine subdistrict, it was observed near Two Medicine Lake, near the Moose Ponds, along the Oldman Lake Trail, near the Ranger Station corral, and in various meadows along Highway 2 including two miles east of the Summit, near Autumn Creek, along the Firebrand Pass trail, and in grasslands across from Lucke's. In the Belly River subdistrict, it dominates the meadows west of the Belly River, the old 3-Mile Campground meadow, and small grasslands near Cosley Lake. Finally, in the Cut Bank drainage, this type dominated meadows near the Cut Bank Campground and Ranger Station and was observed on Cut Bank Ridge, along the Cut Bank boundary, and along Lake Creek.

d. Overall Condition

Despite the widespread distribution of this association and current disturbances that continue to impact this association, the overall condition of this type is relatively good. Although 85% of sampled areas have an exotic forb component and 92% of the plots have an exotic grass component, overall exotic cover is surprisingly low ranging from 0-7% (2% mean cover). Thirty-eight % of the plots have less than 1% exotic cover, 43% of the plots have 1-4% exotic cover, and only 19% of the plots have 4-7% exotic cover. The 10 plots with the highest exotic cover include SM-99-030 (St. Mary Flats), SM-00-001 (Two Dog Meadow 1B), SM-00-010 (1913 Ranger Station), MG-99-055 (Cracker Flats), MG-00-004 (Apikuni Flats), MG-01-009 (Kennedy Creek), BR-99-020 (west of Belly River), BR-99-021 (3-Mile along trail), TM-99-049 (2 miles east of Summit), and CB-00-036 (Cut Bank Ridge).

As stated above, diversity and cover of non-native species is quite low; only three species have high constancy. *Phleum pratense* has the highest cover of any non-native species, ranging from trace-5% (2% mean cover). *Poa pratensis* and *Taraxacum officinale* are commonly observed with trace-3% cover (0.5% mean cover). Sampling plots detected *Centaurea maculosa* and *Cirsium arvense* as the only noxious weeds found within this association. *C. maculosa* was found on 9 plots (17%) with trace-2% cover (0.6% mean cover), while *C. arvense* was documented in 1 plot (2%). These sites include Two Dog Flats 1, St. Mary Flats, St. Mary Visitor Center, Rising Sun and the picnic area, Sleepy Lagoon, old Cut Bank chalet meadow, and east of Cut Bank Ranger Station. GNP weed surveys, however, have documented noxious weeds in 10 additional east-side meadows for a total of 19 meadows (36%) that are currently infested with low cover of noxious weeds (see table below). Weed surveys have documented *C. maculosa* in 7 additional meadows (total 16 meadows or 30%) and *Cirsium arvense* in four additional meadows (total 5 meadows or 9%), as well as documented the presence of *Linaria vulgaris* in two (4%) meadows and *Chrysanthemum leucanthemum* in one (2%) meadow. Weed surveys indicate that some noxious weeds may have higher cover in the meadows than are documented from plot data. Plots near Rising Sun and Sleepy Lagoon in the St. Mary subdistrict had the highest cover of *C. maculosa*, although it was also noted that *C. maculosa* was also spreading near to plots from the Going-To-The-Sun Road near Two Dog and St. Mary Flats and near plots off the Many Glacier Road. Finally, it should be noted that 17 additional meadows (32%) have noxious weeds within 500m of the meadow boundary. *C. maculosa* and *C. arvense* are most commonly nearby; however, *L. vulgaris*, *C. leucanthemum*, *Hypericum perforatum*, *Hieracium aurantiacum*, *Hieracium caespitosum*, *Potentilla recta*, *Cynoglossum officinale*, and *Euphorbia esula* are all present near grasslands within this association. In the end, that only leaves 17 meadows (32%) within this association with no noxious weed threats.

Invasion of woody material is harder to assess from plot data since plots were not often set at the edges of meadows where trees and shrubs commonly get established. Plot data indicates that invasion of tree species is extremely low within this type. Only 4 plots (8% of sampled areas) had trace cover of trees; these trees are generally seedlings no more than a few inches tall. One plot, TM-01-010 along Lower Two Medicine Lake, had greater than 1% cover of *Populus tremuloides*. Plot comments, however, and assessment of aerial photographs indicate that trees, specifically *Pinus contorta* and *P. tremuloides*, are moving into at least 29 additional meadows (33 total meadows or 62%) within this type at the locations listed in the table below. Generally, tree invasion remains low, however, scattered trees are present in these meadows.

Low shrub cover appears to be a characteristic feature of this association, particularly cover from *Arctostaphylos uva-ursi*, *Dasiphora floribunda*, and *Mahonia repens*. Four plots (8% of sampled areas), however, had shrub cover greater than 10%, including cover from species that are rhizomatous and can spread more quickly. Grasslands that had noticeably higher cover of species such as *Symphoricarpos albus*, *Rosa* spp., *Amelanchier alnifolia*, and *Spiraea betulifolia* are listed in the table below.

Overall the most important management concerns for this association are weed invasion by noxious weeds and non-native grasses, as well as woody plant invasion, particularly by trees and rhizomatous shrubs. Lack of fire in these grassland systems are likely causing the increase in woody material, while livestock trespass and grazing is the main concern for continued presence or increase of exotic species. Below is a summary table of the historic and current disturbances to this association. Overall, it appears that grasslands within the Many Glacier, along the Cut Bank and Two Medicine boundary, and southern Two Medicine subdistrict are highest at risk for continued disturbance.

Table 1. Historic and Current Disturbances to *Festuca campestris*-*Festuca idahoensis*/*Geranium viscosissimum* plots.

Historic disturbance	# / % of plots impacted	Grassland locations	Current disturbance	# / % of plots impacted	Grassland locations
Historic grazing	26 + 16 current / 79%	N of Belly River RS, BR 3-mile, Cosley Lake, Apikuni Flats, Two Dog Flats 1 (2), Two Dog Flats 1A, Two Dog Flats 1B, Two Dog Flats 2, Two Dog Flats 3 (3), Two Dog Flats 4, Rising Sun, St. Mary Flats, 1913 RS, Red Eagle LO, Red Eagle frog ponds, SM Sleepy Lagoon, CB Ridge, W of CB CG, CB Old Chalet, TM RS corral, Two Med Lk Moose Ponds, 2 mi E Summit, Autumn Ck Tr	Current trespass and grazing by livestock	16 / 30%	Slide Lake, Swiftcurrent Ridge (2), Poia above, Poia below, Yellow Mt. base, Kennedy Creek, Cracker Flats, Lake Sherburne, Boulder Creek, CB boundary, CB Lake Creek, Lower Two Med Lake, W of Firebrand TH, Lucke's, Hwy 2 Old Bison Siding
Historic development (see below)	17		Road nearby	9 / 17%	Windy Creek, Lake Sherburne, Two Dog Flats 1 (2), Two Dog Flats 4, St. Mary VC, SM Sleepy Lagoon, CB E of RS, CB boundary
Road	8 / 15%	N of Belly River RS (2), BR 3-mile, Boulder Creek, Red Eagle LO, Red Eagle frog ponds, CB Old Chalet, CB Ridge	Trail through meadow	14 / 26%	BR 3-mile, Cosley Lake, Slide Lake, Poia above, Apikuni Flats, Cracker Flats (2), Mt. Henkel base, 1913 RS (2), Red Eagle N, Red Eagle frog ponds, CB Ridge, Two Med Lk Moose Ponds
Camp/structure	6 / 11%	Cosley Lake, Apikuni Flats, Boulder Creek, SM Sleepy Lagoon, Lower Two Med Lake, TM RS corral,	Railroad nearby	1 / 2%	Hwy 2 Old Bison Siding
Trail	4 / 8%	N of Belly River RS, Poia below, Cracker Flats, CB Lake Creek	Present development nearby	1 / 2%	St. Mary VC
Buried powerline	8 / 15%	Windy Creek, Two Dog Flats 1 (2), Two Dog Flats 1A, Two Dog Flats 2, Two Dog Flats 3, Two Dog Flats 4, Rising Sun	Tree invasion	33 / 62%	N of Belly River RS (2), BR 3-mile, Cosley Lake, Slide Lake, Swiftcurrent Ridge (2), Poia below, Apikuni Flats, Cracker Flats (2), Windy Creek, Two Dog Flats 1B, Two Dog Flats 4, Rising Sun, Rising Sun Picnic, St. Mary VC, 1913 RS (2), Red Eagle frog ponds, Red Eagle LO, SM Sleepy Lagoon, Red Eagle N, CB Ridge, W of CB CG, CB E of RS, CB Old Chalet, Oldman Tr, Lower Two Med Lake, Hwy 2 Old Bison Siding, W of Firebrand TH, 2 mi E Summit, Autumn Ck Tr
			Shrub invasion	4 / 8%	Mt. Henkel base, Two Dog Flats 3, Rising Sun, Lower Two Med Lake
			Noxious weed invasion	19 / 36%	Slide Lake, Swiftcurrent Ridge, Apikuni Flats, Lake Sherburne, Two Dog Flats 1, Two Dog Flats 1A, Two Dog Flats 4, Rising Sun, Rising Sun Picnic, St. Mary VC, St. Mary Flats, 1913 RS (2), SM Sleepy Lagoon, Red Eagle frog ponds, CB E of RS, CB Old Chalet, CB Ridge, Hwy 2 Old Bison Siding

2. *Festuca campestris*/*Festuca idahoensis* association

a. Environmental Description

Seven plots (5% of sampled areas) were classified into the *Festuca campestris*/*Festuca idahoensis* association. This montane to lower subalpine type occurs on mostly flat to gentle toeslopes at elevations between 1,370m (4,500 feet) and 1,570m (5,150 feet) at various aspects. Soils are moderately well drained sandy loams. Plots at higher elevations tend to be on steeper south-facing slopes that have well-drained soils. Parent material is coarse, quartzite and argillite developed on morainal and glaciofluvial landforms. Litter dominates the ground surface with 70% mean cover, however, cover of *Selaginella* spp., averaging 12%, is three to five times as high on this type in comparison to all other grass and dwarf-shrub associations.

b. Vegetation Description

Although dominant species are quite similar between this association and the *Festuca campestris*-*Festuca idahoensis*/*Geranium viscosissimum* association, this mesic to subxeric type tends to be drier and less diverse than with slightly less overall cover. Overall herbaceous cover ranges from 38-55% (48% mean cover) with native forb cover again generally being higher than native grass cover. Overall native grass cover ranges from 12-30% (18% mean cover) and is also often clearly dominated by indicator species *Festuca campestris* with 1-27% cover (8% mean cover) and *Festuca idahoensis* with 1-8% cover (4% mean cover). Other high constancy grasses present are *Carex obtusata*, *Stipa nelsonii*, and *Pseudoroegneria spicata* each with trace-4% cover (1.5% mean cover) and *Koeleria macrantha* with trace-2% cover (1% mean cover). These four grasses have a higher constancy on this type than any other native grass or dwarf-shrub associations. In contrast, *Danthonia intermedia* is present on a little more than half the plots, the lowest constancy of any association, with trace-4% cover (1.5% mean cover). *Carex filifolia* is the only low constancy grass than can have conspicuous cover in certain areas. As stated above, *Bromus carinatus*, *Calamagrostis rubescens*, *Juncus balticus*, *Carex geyeri*, *Carex raynoldsii*, *Stipa richardsonii*, and *Elymus trachycaulus* ssp. *trachycaulus* are not present within this drier type as they are in others. This type also has the lowest mean cover of *Carex petasata* and the lowest constancy of *Elymus trachycaulus* ssp. *subsecundus*.

Overall native forb cover ranges from 15-40% (29% mean cover), also dominated by forb species that are typical to other association types. These high constancy forbs include *Lupinus sericeus* (1-8% cover; 5% mean cover), *Achillea millefolium* (trace-3% cover; 1.5% mean cover), *Cerastium arvense* (trace-2% cover; 1% mean cover), *Galium boreale* (trace-2% cover; 0.5% mean cover), *Anemone multifida*, *Potentilla gracilis*, and *Campanula rotundifolia* (each with trace mean cover). Other high constancy forbs tend to be drier species than the common species on other associations. These include *Selaginella densa* (6-28% cover; 13% mean cover), *Lithospermum ruderales* (trace-9% cover; 2% mean cover), *Antennaria umbrinella* (trace-2% cover; 1% mean cover), *Solidago spathulata* or *multiradiata*, *Gaillardia aristata* (each with trace-1% cover; 0.5% mean cover), *Allium cernuum*, and *Sedum lanceolatum* (each with trace mean cover). *Selaginella densa* and *Lithospermum ruderales* have the highest cover and constancy on this association than on any other type, while *Antennaria umbrinella*, *Allium cernuum*, *Gaillardia aristata*, and *Sedum lanceolatum* have higher constancy on this type than most others. Species present on approximately 50% of the plots also tend to be drier species and have higher constancy within the *Festuca campestris*/*Festuca idahoensis* association than on any other type. *Geum triflorum*, *Arnica sororia* (each with trace-6% cover; 2% mean cover), and *Comandra umbellata* (1% mean cover) have the highest mean cover and constancy on this type, while *Erigeron caespitosus*, *Erigeron compositus*, *Heterotheca villosa*, *Heuchera parvifolia*, *Lomatium macrocarpum*, *Orthocarpus tenuifolius*, *Oxytropis splendens*, and *Potentilla hippiana* (each with trace cover) also have the highest constancy on this type than on any other association. Other species with trace cover that are present on half of the plots are *Pyrocoma carthamoides* and *Senecio canus* that have higher constancy on this type than on the *Festuca campestris*-*Festuca idahoensis*/*Geranium viscosissimum* association, as well as *Agoseris glauca* and *Eriogonum umbellatum*. Finally, this association has little or more often no cover of *Geranium viscosissimum*, *Antennaria anaphaloides*, *Antennaria rosea*, *Calochortus apiculatus*, *Castilleja sulphurea*, *Delphinium bicolor*, *Erigeron subtrinervis*, *Erigeron speciosus*, *Potentilla glandulosa*, *Senecio streptanthifolius*, *Solidago missouriensis*, *Thalictrum occidentale*, *Valeriana sitchensis*, or *Vicia americana* that are generally found within other types. In addition, this type has the lowest constancy of *Penstemon confertus*, *Oxytropis campestris*, *Dodecatheon conjugens*, and *Arabis nuttallii* than any other type. *Penstemon confertus* may, however, have conspicuous cover (trace-5%; 2% mean cover) in certain areas.

Shrub cover is also the lowest within this association than any other native grassland or dwarf-shrub type. Shrub cover ranges from 0-5% (2% mean cover) with only consistent cover from *Dasiphora floribunda* and *Rosa woodsii* (each with trace-2% cover; 0.5% mean cover). *Amelanchier alnifolia* (trace-2% cover; 1% mean cover) and *Arctostaphylos uva-ursi* (trace cover) are present on approximately half of the plots. No trees were observed on any plots within this association.

Diversity and cover of non-native species is very low; only three species have moderate to high constancy. *Centaurea maculosa* has the highest cover of any non-native species, ranging from trace-5% (2% mean cover) and is present on 57% of the plots, the highest constancy of any association. *Phleum pratense* and *Poa pratensis* are commonly present in many meadows but only have trace cover. *Taraxacum officinale* is present on less than half of the plots with trace cover.

c. Element Distribution

This association is relatively uncommon on the east side of Glacier NP (much less common than originally thought) and mainly present within the Saint Mary and Many Glacier subdistricts, although one plot occurred in the southern Two Medicine subdistrict. It tends to be at the tops of convex meadows where soils are well-drained or on hotter, steeper slopes. In the Saint Mary subdistrict, this type is common in Saint Mary Flats and near Rising Sun. In the Many Glacier subdistrict, it was observed in Cracker Flats and near Windy Creek. This type was also present east of Marias Pass north of Highway 2 in the Two Medicine subdistrict.

d. Overall Condition

The overall condition of this association type is good to very good. Although 70% of sampled areas have an exotic forb and exotic grass component, overall exotic cover is very low ranging from trace-5% (1% mean cover). Four of the plots (57%) have less than 1% exotic cover, 2 of the plots (29%) have 1-2% exotic cover, and only 1 plot (14%) has greater than 4% cover. The only plot with relatively high exotic cover is TM-00-032 (east of Marias Pass).

As stated above, diversity and cover of non-native species is very low. *Centaurea maculosa*, however, has the highest cover of any non-native species, ranging from trace-5% (2% mean cover). It is also present on four (57%) of the plots, the highest constancy of any association. Plot TM-00-032 east of Marias Pass has the highest cover of *C. maculosa* at 4.3%, while plot SM-99-023 in Rising Sun and plot SM-99-027 at St. Mary Flats each have 1% cover. GNP weed records indicate that *C. maculosa*, *Euphorbia esula*, and *Linaria vulgaris* are also present within the Windy Creek meadow, resulting in the presence of noxious weeds in 5 (71%) total grasslands within this association. Weed surveys also indicate the presence of *L. vulgaris*, *Hypericum perforatum*, *Cirsium arvense*, *Chrysanthemum leucanthemum*, and *Potentilla recta* within 500m of several of the meadows within this type. Finally, *Phleum pratense* and *Poa pratensis* are commonly present in many meadows but only have trace cover.

Invasion of tree species is very low within this association and does not appear to be an important management concern. There were no trees recorded in any plots and plot comments indicate that only a few trees, specifically *Pinus contorta* and *Populus tremuloides*, were invading the edges of grasslands at Windy Creek, Rising Sun, Cracker Flats, and east of Marias Pass.

Low shrub cover also appears to be a characteristic feature of this association, particularly low cover from *Arctostaphylos uva-ursi* and *Dasiphora floribunda*. No plots had 10% cover of are rhizomatous and can spread more quickly. Plots that had noticeably higher cover of species such as *Rosa woodsii*, *Amelanchier alnifolia*, *Spiraea betulifolia*, and *Prunus virginiana* occur in Rising Sun (SM-99-025) and east of Marias Pass (TM-00-032).

Overall the most important management concerns for this association are weed invasion by spotted knapweed and non-native grasses. There are few current threats to this type with current livestock trespass and grazing only impacting two areas, Cracker Flats and east of Marias Pass. Below is a summary table of the historic and current disturbances to this association. Overall, it appears that the grassland east of Marias Pass and possibly the grassland in Cracker Flats are at the highest risk for continued disturbance.

Table 2. Historic and Current Disturbances to *Festuca campestris*/*Festuca idahoensis* plots.

Historic disturbance	# / % of plots impacted	Plot #s	Current disturbance	# / % of plots impacted	Plot #s
Historic grazing	4 + 2 current / 86%	Rising Sun (2), St. Mary Flats (2)	Current trespass and grazing by livestock	2 / 29%	Cracker Flats, E of Marias Pass
Historic development (see below)	2		Road nearby	2 / 29%	Windy Creek, Rising Sun
Road	1 / 14%	St. Mary Flats	Concession trail nearby	1 / 14%	Cracker Flats
Camp/structure	2 / 29%	St. Mary Flats (2)	Railroad nearby	1 / 14%	E of Marias Pass
Ditches	2 / 29%	St. Mary Flats (2)	Tree invasion	5 / 71%	Windy Creek, Rising Sun (2), Cracker Flats, E of Marias Pass
Buried powerline	1 / 14%	Rising Sun	Noxious weed invasion	5 / 71%	Windy Creek, Rising Sun (2), St. Mary Flats, E of Marias Pass

3. *Festuca idahoensis*-(*Festuca campestris*)/*Potentilla diversifolia* association

a. Environmental Description

Thirteen plots (8% of sampled areas) were classified into the *Festuca idahoensis*-(*Festuca campestris*)/*Potentilla diversifolia* association. This type is highly variable in both vegetation and environment, being found from the lower subalpine at 1,575m (5,170 feet) to the alpine at 2,090m (6,850 feet). It can occur as high as 7,640 feet. This type occurs primarily on east-facing through southerly exposures on gentle low slopes to moderately steep high slopes. It can occur on north-facing slopes but west-facing slopes are conspicuously unrepresented. The standard presumption that the prevailing winds are westerly to southwesterly would place many of the inventoried sites in lee slope positions with augmented snow accumulations; this community also occurs in the lee of wind-barriers such as convex relief-forms, krummholz patches, and bedrock terraces. Parent materials include red and green argillite from glaciofluvial and sedimentary sources. Soil texture tends to be a moderately well to well drained sandy loam. The amount of exposed rock and frost-structured rubble is highly variable, with rock ranging from 0-15% and rubble ranging from 0-63%. Litter cover ranges from 17-92% cover (78% mean cover), while cover of *Selaginella densa* ranges from 0-22%.

b. Vegetation Description

Overall herbaceous cover for this mesic, high-diversity type ranges from 30-60% (44% mean cover) with native forbs providing the highest cover. Native forb cover ranges from 15-37% (27% mean cover) and is very species rich. Dominant species that are common to most associations include *Lupinus sericeus* (trace-5% cover), *Achillea millefolium*, *Agoseris glauca*, *Anemone multifida*, *Galium boreale* (each with trace-3% cover), *Campanula rotundifolia*, *Cerastium arvense*, *Penstemon confertus*, and *Potentilla gracilis* (each with trace-2% cover). Other dominant species that are more unique to this type include indicator species *Antennaria umbrinella*, *Dodecatheon conjugens* (each with trace-5% cover), *Selaginella densa* (trace-22% cover), *Bupleurum americanum*, *Solidago spathulata* (each with trace-3% cover), *Besseyia nyomingensis*, *Silene parryi* (each with trace-2% cover), *Sedum lanceolatum*, and *Arabis nuttallii* (each with trace-1% cover). In addition, species present on at least half of the plots include *Anemone patens*, *Antennaria anaphaloides*, *Eriogonum umbellatum*, *Hedysarum sulphurescens*, *Lomatium triternatum*, and *Oxytropis campestris*, each with trace-3% cover. Of all these species, *Anemone patens*, *Arabis nuttallii*, *Hedysarum sulphurescens*, and *Silene parryi* have higher constancy on this type than on other grassland associations and *Besseyia nyomingensis* and *Bupleurum americanum* have higher constancy and cover than most other associations. Indicator species *Arenaria capillaris*, *Eriogonum flavum*, and *Potentilla diversifolia* also have higher constancy and cover on this type than others and *Linum lewisii*, *Minuartia rubella*, *Pedicularis contorta*, and *Polygonum bistortoides* have higher constancy than other types. Finally, *Antennaria rosea*, *Arenaria capillaris*, *Aster laevis*, *Erigeron caespitosus*, *Eriogonum flavum* (indicator species), *Fragaria virginiana*, *Gaillardia aristata*, *Hieracium albertinum*, and *Minuartia obtusiloba* (indicator species) have low constancy but may have high cover in certain areas.

Overall native grass cover is lower, ranging from 8-25% (17% mean cover). Dominant grasses include *Festuca campestris* with trace-13% cover (5% mean cover) and *Festuca idahoensis* with 2-15% cover (5% mean cover). Cover of *F. campestris* is slightly lower on this type than on other associations. Other common grasses include *Danthonia intermedia*, *Carex obtusata* (each with trace-6% cover), *Muhlenbergia richardsonis*, *Bromus pumpellianus*, *Luzula spicata*, and *Koeleria macrantha* (each with trace-3% cover). *Carex geyeri*, *Pseudoroegneria spicata*, and *Elymus smithii* have low constancy but may have high cover in certain areas. Of all these species, *Muhlenbergia richardsonis*, *Bromus pumpellianus*, *Luzula spicata*, and *Carex geyeri* have higher constancy on this type than on any other association.

Shrub cover is relatively low with trace-10% cover (5% mean cover). *Dasiphora floribunda* is the only dwarf-shrub consistently present with trace-7% cover. *Amelanchier alnifolia*, *Arctostaphylos uva-ursi*, *Rosa acicularis*, and *Spiraea betulifolia* have low constancy but may have high cover in certain areas.

There are no noxious weeds found on any plot and GNP weed surveys indicate that there are no noxious weeds in any of the meadows within this type. Overall exotic cover is very low, ranging from 0-1%. *Taraxacum officinale* is only present on approximately half of the plots with very low cover. All other non-native species have very low constancy and cover.

Lastly, as expected with a higher elevation association, many more high elevation species are present within this type than on the other grassland associations. These generally have low constancy and cover but can include *Androsace chamsejasme*, *Arnica rydbergii*, *Artemisia campestris*, *Douglasia montana*, *Eriogonum ovalifolium*, *Minuartia obtusiloba* (indicator species), *Oxytropis borealis*, *Phacelia hastata*, *Phacelia sericea*, *Potentilla ovina*, *Saxifraga bronchialis*, *Silene acaulis*, *Poa alpina*, *Trisetum spicatum*, *Trisetum wolfii*, and *Juncus communis*. These species are generally not present in the lower elevation grassland associations and more indicative of this type. Other high elevation species that were observed in vegetation mapping plots also include *Carex phaeocephala*, *Calamagrostis purpurescens*, *Poa cusickii*, and *Carex rupestris*.

c. Element Distribution

This association is very common in the southeastern portion of Glacier NP at moderate to high elevations, as well as in certain areas of the Many Glacier subdistrict and near Red Gap Pass to the north. This type was most commonly observed in the Two Medicine subdistrict and Cut Bank drainage. In Two Medicine, it was observed on Spot Mountain, Red Mountain, near Pray Lake, along the Dry Fork trail, and in the Looking Glass meadow. In Cut Bank, it was observed on Mad Wolf Mountain, Cut Bank Ridge, Milk River Ridge, Kupunkamint Ridge, and Lake Creek Ridge. Finally, this type was also documented in the Many Glacier subdistrict on Apikuni Mountain and Boulder Ridge.

d. Overall Condition

The overall condition of this association is very good to excellent. Overall exotic cover is extremely low ranging from 0-1%. *Taraxacum officinale* is the most common non-native species and it currently has very low cover. There are very few non-native species on any plot and 5 plots (38%) have no exotic species cover. No noxious weeds were documented on any plot or grassland, however, GNP weed surveys indicate that *Cirsium arvense* is near the Dry Fork meadow and *Centaurea maculosa* and *Linaria vulgaris* are within 500m of the Pray Lake grassland.

While the level of tree invasion within these grasslands is relatively low, invasion of tree species is moderate within this association and should be addressed. While tree seedlings were only recorded in one plot, plot comments indicate that a few trees, specifically *Pinus contorta*, were invading the edges of grasslands at both lower and higher elevations. Overall, 54% of plots had low invasion of trees.

Low shrub cover also appears to be a characteristic feature of this association, particularly low cover from *Arctostaphylos uva-ursi* and *Dasiphora floribunda*. Only 3 plots (23% of sampled areas) had somewhat higher shrub cover, including cover from species that are rhizomatous and can spread more quickly. Plots that had noticeably higher cover of species such as *Rosa woodsii*, *Amelanchier alnifolia*, *Spiraea betulifolia*, and *Prunus virginiana* occur in Rising Sun (SM-99-025) and east of Marias Pass (TM-00-032).

Currently these grasslands have few management concerns; however, threats from livestock trespass and grazing still exist. Many areas that are currently grazed have been historically grazed as well but impacts have been low and grazing has been minimal. Below is a summary table of the historic and current disturbances to this association. Overall, it appears that the grasslands along Cut Bank Ridge, Mad Wolf Mountain, Boulder Ridge, Looking Glass, and Milk River Ridge suffer the highest and most consistent amount of livestock trespass and are at the highest risk for future disturbance.

Table 3. Historic and Current Disturbances to *Festuca idahoensis*-(*Festuca campestris*)/*Potentilla diversifolia* plots.

Historic disturbance	# / % of plots impacted	Plot #s	Current disturbance	# / % of plots impacted	Plot #s
Historic grazing	1 + 7 current / 62%	Pray Lake	Current trespass and grazing by livestock	7 / 54%	Boulder Ridge, Milk River Ridge, Cut Bank Ridge, Mad Wolf, Looking Glass, Lake Creek (CB), Spot Mt
Historic trail	2 / 15%	Mad Wolf, Dry Fork	Tree invasion	7 / 54%	Boulder Ridge, Pray Lake, Kupunkamint Ridge, Milk River Ridge, Mad Wolf, Looking Glass, Dry Fork
Historic campground	1 / 8%	Pray Lake	Trail nearby	1 / 8%	Looking Glass
			Driving on meadow	1 / 8%	Cut Bank Ridge

4. *Arctostaphylos uva-ursi*/*Festuca campestris*-*Festuca idahoensis* association

a. Environmental Description

Thirty-one plots (20% of sampled areas) were classified into the *Arctostaphylos uva-ursi*/*Festuca campestris*-*Festuca idahoensis* association. This small patch type exhibits a relatively broad elevation range from 1,330 to 1,980 m (4,375 to 6,500 feet), although it has also been known to occur at elevations as low as 3,500 feet and at elevations as high as 7,150 feet. It is closely associated with xeric environments such as upper ridge slopes, slope shoulders and the convex uppermost portions of ridgelines. It has been documented from all but north-facing slopes but the higher elevation stands are by far most commonly associated with southeast through west-facing slopes of moderate to steep inclinations; lower elevation stands (mostly below 5,500 feet) occur on more gradual slopes and even in exceptional cases on well-drained flats. All sites are hypothesized to be swept snow-free by prevailing westerlies. This community occurs primarily on colluvial slopes composed of sedimentary rock, predominantly argillite and limestone, but is also found on glacial drift, till and fluvial materials. Soils are rocky, shallow, and moderately well- to mostly well-drained with sandy loam being by far the most common texture of sampled stands. Between high litter cover (generally over 80%) and ground appressed *A. uva-ursi*, there is little exposed ground surface.

b. Vegetation Description

Total vascular plant cover ranges from approximately 50-100% (67% mean cover) with more than half of the stands having in excess of 70% cover. In this type's modal expression, the dark green mats of *Arctostaphylos uva-ursi* provide the dominant aspect, comprising 5-70% cover (28% mean cover) of the 10-75% overall shrub cover (35% mean cover). Other high constancy shrubs that have 1-4% mean cover (trace-13% plot cover) include *Dasiphora floribunda*, *Rosa acicularis*, and *Amelanchier alnifolia*. *Juniperus communis* occurs on almost half of the plots with 2% cover, the highest constancy and cover of any association. *Juniperus horizontalis* and *Vaccinium caespitosum* have low constancy but can have high cover in certain areas. Four of the 31 plots (13%) have a trace of tree cover.

On the most favorable sites, usually those of lower elevations, total bunchgrass cover can approach 35% (sometimes even 60%) but it often ranges between 10-20% (15% mean cover). Grass cover is dominated by indicator species *Festuca campestris* (trace-23% cover; 9% mean cover) and *Festuca idahoensis* (trace-7% cover; 3% mean cover) that can contend for dominance. Other common species include indicator species *Danthonia intermedia*, *Koeleria macrantha*, and *Carex obtusata* that have trace-3% cover. *Pseudoroegneria spicata* and *Elymus trachycaulus* ssp. *subsecundus* are present on approximately half of the plots with trace-3% cover. *Bromus pumpehianus*, *Calamagrostis rubescens*, and *Carex geyeri* generally have low constancy but may have conspicuous cover in certain areas.

Native forb diversity is very high with slightly higher overall cover, ranging from 9-31% (20% mean cover). Highly constant species that are typical of most grass and dwarf-shrub associations include *Lupinus sericeus* (trace-8% cover), *Penstemon confertus*, *Fragaria virginiana* (each with trace-6% cover), *Achillea millefolium*, *Potentilla gracilis*, *Galium boreale* (each with trace-4% cover), *Agoseris glauca*, *Anemone multifida*, *Campanula rotundifolia*, and *Cerastium arvense* (each with trace-2% cover). Other dominant species that are more unique to this type include *Hedysarum sulphurescens* (trace-4% cover), *Gaillardia aristata* (trace-6% cover), *Dodecatheon conjugens*, and *Sedum lanceolatum* (each with trace-1% cover). In addition, species present on at least half of the plots include *Selaginella densa*, *Aster laevis*, *Antennaria umbrinella*, *Eriogonum umbellatum*, *Senecio canus*, *Lithospermum ruderae*, *Oxytropis campestris*, *Bupleurum americanum*, *Solidago spathulata*, *Allium cernuum*, and *Arabis nuttallii*, each with trace-5% cover. Of all these species, only *Hedysarum sulphurescens* and *Senecio canus* have higher constancy on this type than on any other association. Finally, *Antennaria anaphaloides*, *Antennaria rosea*, *Aster conspicuus*, *Astragalus tenellus*, *Balsamorhiza sagittata*, *Heuchera cylindrica*, *Hieracium albertinum*, *Lomatium triternatum*, *Phlox boodii*, and *Solidago missouriensis* have low constancy but may have high cover in certain areas.

Seventeen of the 31 plots (55%) have no exotic species present on them at all. 10 of the remaining 14 plots have less than 1% exotic cover. Only four plots have somewhat higher exotic cover between 1-3%. *Phleum pratense* is the most common exotic grass with trace-3% cover, although it is present on only 39% of the plots. *Poa pratensis* is also present on about a third of the plots but only has trace cover. All other non-native species have very low constancy and cover. Sampling detected that *Centaurea maculosa* is present on one plot at Rising Sun with trace cover, however, GNP weed surveys identified *C. maculosa*, *Linaria vulgaris*, and *Cirsium arvense* in a meadow north of Lubeck

Lake and *Hieracium aurantiacum* and *H. caespitosum* in a grassland near the Belly River suspension. Weed surveys have also detected that noxious weeds are within 500m of nine additional meadows.

Like the *Festuca idahoensis*-(*Festuca campestris*)/*Potentilla diversifolia* association described above, many more high elevation species are present within this broader range type than on the other associations. These generally have low constancy and cover but can include *Androsace chamsejasma*, *Antennaria alpina*, *Aquilegia flavescens*, *Arnica alpina*, *Artemisia campestris*, *Besseyia nyomingensis*, *Douglasia montana*, *Eriogonum ovalifolium*, *Hedysarum alpinum*, *Minuartia obtusiloba*, *Oxytropis borealis*, *Pedicularis contorta*, *Phacelia sericea*, *Saxifraga bronchialis*, *Poa alpina*, *Trisetum spicatum*, *Trisetum wolffii*, *Carex scirpoidea* (indicator species), and *Oryzopsis exigua*. These species are generally not present in the lower elevation grassland associations and are more indicative of this type.

c. Element Distribution

This is a common small patch type encountered in both Glacier and Waterton Lakes National Parks, virtually restricted to lands east of the Continental Divide. It was sampled in all subdistricts on the east side of Glacier NP. Within the St. Mary subdistrict, it was observed in Rising Sun, Baring Basin, at the base of Otokomi Mt., and on Goat Mt. Within the Many Glacier subdistrict, it is located on Apikuni Mt., in Apikuni Flats, on Mt. Henkel, west of Poia Lake, and at lower Slide Lake. In the Cut Bank drainage, this type can be found on Mad Wolf Mt. and on White Calf Mt. Within the Belly River subdistrict, it can be observed near Cosley Lake, in the “Veldt” north of the Ranger Station, at Custom Hill, and near the suspension bridge. Finally in the Two Medicine subdistrict, this type can be found east of Scenic Point, on Spot Mt., on eastern Red Mt., along the Dry Fork Trail, and in the southern part of the subdistrict near Lubec Lake and Ranger Station, near Railroad Creek, on Dancing Lady, and west of the Firebrand Pass trailhead.

d. Overall Condition

Overall, plots within this association are in very good to excellent condition. Overall, there is very low cover of exotic species. Exotic grass cover averages 0.30% (1-3% range) with *Phleum pratense* and *Poa pratensis* occurring on less than 40% of the plots in low amounts. Exotic forb cover is even lower with an average of 0.06% cover (0-0.71% range). Seventeen of the 31 plots (55%) are in pristine condition with no exotic species present. Ten additional plots have less than 1% exotic cover. Only 4 plots have 1-3% cover of exotic species: BR-99-015 east of the Belly River Ranger Station, TM-99-057 north of Lubec Lake, MG-00-044 on Apikuni Mt., and BR-01-031 on Custom Hill. As stated above, sampling detected that *Centaurea maculosa* is present on one plot at Rising Sun with trace cover, however, GNP weed surveys identified *C. maculosa*, *Linaria vulgaris*, and *Cirsium arvense* in a meadow north of Lubec Lake and *Hieracium aurantiacum* and *H. caespitosum* in a grassland near the Belly River suspension bridge (10% of surveyed grasslands within this type). In addition, nine additional grasslands (29% of surveyed grasslands) have one to several species of noxious weeds within 500m of the grassland.

While there is little tree invasion in the plots themselves (0.06% mean cover; 0-0.68% range), 52% of the grasslands were observed to have tree invasion at least at the edges of the grassland. In addition, rhizomatous shrubs have begun to invade 23% of the plots within this association. As with other areas, lack of fire has allowed woody plants to become established at the edges of these meadows.

Disturbance to this association is mostly due to past and current grazing. Generally, these dwarf-shrublands have few management concerns, however, threats from livestock trespass and grazing still exist. Like other higher elevation associations, grazing is periodic with low overall impact. Below is a summary table of the historic and current disturbances to this association. Overall, it appears that the meadows in the southern Two Medicine subdistrict, within the Many Glacier subdistrict, and along the eastern boundary suffer the highest and most consistent amount of livestock trespass and are at the highest risk for future disturbance.

Table 4. Historic and Current Disturbances to *Arctostaphylos uva-ursi*/*Festuca campestris*-*Festuca idahoensis* plots.

Historic disturbance	# / % of plots impacted	Plot #s	Current disturbance	# / % of plots impacted	Plot #s
Historic grazing	4 + 15 current / 61%	Veldt, Apikuni Mt, Rising Sun, W Poia Lk	Current trespass and grazing by livestock	15 / 48%	Apikuni Flats (2), S Lubec RS, N Lubec Lk, S Railroad Ck, lower Slide Lk, White Calf Mt, SE Spot Mt (2), Mad Wolf Mt, Apikuni Mt, Cosley Lk, W Firebrand TH, BR Custom Hill, Dry Fork Tr
Historic trail	3 / 10%	SE Spot Mt, Baring Basin, Dry Fork Tr	Tree invasion	16 / 52%	Veldt, N Lubec Lk, S Railroad Ck, E Red Mt, lower Slide Lk, White Calf Mt, BR suspension bridge, Apikuni Mt, Rising Sun, Cosley Lk, W Firebrand TH, BR Custom Hill, Apikuni Flats (2), W Poia Lk, Dry Fork Tr
Historic road	1 / 3%	Apikuni Flats	Shrub invasion	7 / 23%	N Lubec Lk, base of Mt Henkel (2), E Red Mt, BR suspension bridge, W Firebrand TH, Dry Fork Tr
			Noxious weed invasion	3 / 10%	N Lubec Lk, BR suspension bridge, Rising Sun
			Trail nearby	8 / 26%	Veldt, SE Scenic Pt, BR suspension bridge, Apikuni Mt, Cosley Lk, BR Custom Hill, base of Mt Henkel, W Poia Lk
			Road nearby	2 / 6%	Rising Sun, Apikuni Flats

5. *Dasiphora floribunda*/*Festuca campestris* association

a. Environmental Description

Four plots (3% of sampled areas) have been classified into the *Dasiphora floribunda*/*Festuca campestris* association. This association occurs on gentle slopes (2 to 5 degrees) from 1,370m (4,500 feet) to 1,600m (5,250 feet) although it has also been known to occur on somewhat steep slopes at elevations as high as 6,600 feet. These types tend to be found on south-facing low and midslopes but can occur at all aspects and are sometimes found within the basin floor. Soil texture of most plots was characterized as a sandy loam, but certain soils may occur as sandy clay loams. All soils are moderately well-drained and mostly derived from glacial-fluvial or sedimentary deposits. Argillite and limestone rock and gravel are common in the soil profile. Litter dominates the ground surface with 80-90% cover.

b. Vegetation Description

This association is a montane to subalpine, mesic dwarf-shrub steppe dominated by *Dasiphora floribunda* in the shrub layer and *Festuca campestris* in the herbaceous layer. Overall shrub cover ranges from 10-25% (17% mean cover) with *Dasiphora floribunda* comprising 7-20% cover (13% mean cover). Other shrubs present on at least half of the plots with trace to 3% cover include *Amelanchier alnifolia*, *Arctostaphylos uva-ursi*, *Rosa acicularis*, and *Rosa woodsii*. *Mahonia repens* has low constancy but may have high cover where it occurs. In general, the higher elevation plots tend to have less overall vegetative cover, including shrub cover.

Herbaceous cover ranges from 50-65% cover with high species diversity. Overall native grass cover ranges from 8-41% (23% mean cover) and is consistently dominated by *Festuca campestris* with 3-11% cover (7% mean cover), *Danthonia intermedia* with trace-24% cover (7% mean cover), and *Festuca idahoensis* with 2-7% cover (4% mean cover). Other common grasses include *Koeleria macrantha* (trace-1% cover), *Carex* spp. (including *C. petasata* and *C. rossii* with 1-3% total cover), *Elymus trachycaulus* ssp. *subsecundus* (trace-3% cover), and *Stipa nelsonii* (1-4% cover). *Bromus carinatus* and *Helictotrichon bookeri* are present on half of the plots with trace cover.

Overall native forb cover ranges from 22-34% (26% mean cover) and is dominated by forb species that are typical of most grassland and dwarf-shrubland associations. High constancy forbs include *Fragaria virginiana* (2-6% cover), *Galium boreale* (1-6% cover), *Achillea millefolium* (1-5% cover), *Lupinus sericeus* (2-3% cover), *Potentilla gracilis* (1-3% cover), *Penstemon confertus* (trace-3% cover), *Agoseris glauca* (trace-2% cover), *Anemone multifida* (trace-2% cover), *Cerastium arvense* (trace-2% cover), *Campanula rotundifolia* (trace-1% cover), and *Gaillardia aristata* and *Lomatium triternatum* (each with trace cover). Other high constancy forbs that are also present include *Antennaria rosea*, *Arnica sororia*, *Eriogonum umbellatum*, *Potentilla hippiana*, *Sisyrinchium montanum*, and *Solidago missouriensis*, each with trace to 1% cover. Species that are present on half of the sampled areas include *Allium cernuum*, *Aster laevis*, *Bupleurum americanum*, *Calochortus apiculatus*, *Camassia quamash*, *Dodecatheon conjugens*, *Geranium viscosissimum*, *Lithospermum ruderales*, *Microsteris gracilis*, *Polygonum bistortoides*, *Potentilla glandulosa*, *Sedum lanceolatum*, and *Vicia americana*. Most of these species have trace-2% cover, except for *A. laevis* which has 5-8% cover and *L. ruderales* which has 4-9% cover. A number of additional forb species contributing minimal cover are present within this association.

Overall cover of exotic species is variable, ranging from 1-12%. Exotic forb cover is generally low, often with only trace cover. *Taraxacum officinale* and *Tragopogon dubius* are consistently present with low cover. *Centaurea maculosa* occurs on only one plot with trace cover, however, GNP weed surveys indicate that *C. maculosa* is present in one additional meadow. Exotic grass cover is higher, ranging from 1-11%. *Phleum pratense* is present on all plots with 1-3% cover, while *Poa pratensis* is present on most plots with 3-8% cover.

c. Element Distribution

This association is relatively uncommon on the east side of Glacier NP. It is present at moderate elevations on open lowslopes and midslopes with rocky sandy loam soil. These plots are located in the St. Mary subdistrict along the Red Eagle trail and near the Rising Sun boat dock and in the southern Two Medicine subdistrict east of Marias Pass. It has also been documented along the Firebrand Pass Trail, near the Cut Bank Ranger Station, above St. Mary Lake near Dead Horse Point, and near Slide Lake by the vegetation mapping survey.

d. Overall Condition

This association is in moderately good to fair condition. Like other native grassland associations, diversity and cover of non-native species is still relatively low. All plots, however, have an exotic species component with 75% of the plots having greater or equal to 5% exotic grass cover. Plot SM-00-007 (at the south beaver ponds along the Red Eagle Trail) has greater than 10% exotic grass cover, an estimate that is higher than both the overall shrub cover and the overall native grass cover for this plot.

Exotic grass cover is variable, ranging from 1-11%. *Phleum pratense* is present on all plots with 1-3% cover, while *Poa pratensis* is present on most plots with 3-8% cover. Exotic forb cover is generally low, often with only trace cover. *Taraxacum officinale* and *Tragopogon dubius* are consistently present with low cover. While *Centaurea maculosa* was only documented in a plot at Rising Sun with trace cover, weed surveys indicate that *C. maculosa* is also present in a meadow east of Marias Pass. In addition, *C. maculosa* and *Cirsium arvense* have been documented nearby to a second Red Eagle meadow and *C. arvense*, *Chrysanthemum leucanthemum*, *Cynoglossum officinale*, and *Linaria vulgaris* have been documented near the Rising Sun meadow.

Invasion of tree species is low within this association; however, it is occurring within three of the four meadows. While trees were only observed in one plot, field comments indicate that *Pinus contorta* and *Pseudotsuga menziesii* are invading the meadows at the old Red Eagle lookout and east of Marias Pass and *Populus tremuloides* is colonizing the edges of the Rising Sun boat dock meadow where there are also dead and dying *Pinus flexilis*, *Pinus contorta* and *Pseudotsuga menziesii* trees.

Invasion of shrubs other than *Dasiphora floribunda* appears to be less of a management issue, except for on plot SM-01-027 (Rising Sun boat dock) where there is high shrub cover (18%) from species *Mahonia repens*, *Rosa woodsii*, and *Prunus virginiana*.

Overall the most important management concerns for this association are continued persistence and possible increase of exotic grasses (introduced from historic grazing and development) and possibly invasion of woody plant material. There are few current threats to this type with current livestock trespass and grazing only impacting one area. Below is a summary table of the historic and current disturbances to this association. Overall, it appears that the grasslands east of Marias Pass and near the Rising Sun boat dock are at the highest risk for continued disturbance, while the grasslands along the Red Eagle Trail should be managed to reduce populations of exotic grasses.

Table 5. Historic and Current Disturbances to *Dasiphora floribunda*/*Festuca campestris* plots.

Historic disturbance	# / % of plots impacted	Plot #s	Current disturbance	# / % of plots impacted	Plot #s
Historic grazing	2 + 1 current / 75%	Red Eagle, Red Eagle beaver pond S	Current trespass and grazing by livestock	1 / 25%	E Marias Pass
Historic road	1 / 25%	Red Eagle	Tree invasion	3 / 75%	Rising Sun, Red Eagle, E Marias Pass
			Shrub invasion	1 / 25%	Rising Sun
			Road nearby	1 / 25%	Rising Sun
			Noxious weed invasion	2 / 50%	Rising Sun, E Marias Pass

6. *Dryas octopetala*/*Polygonum viviparum* association

a. Environmental Description

Only two plots (1% of sampled areas) were classified as *Dryas octopetala*/*Polygonum viviparum* associations. This type occurs exclusively within alpine environments, usually well above treeline. Elevations for these plots range from 2,010m (6,600 feet) to 2,060m (6750 feet), although this type can occur as high as 8,660 feet. These plots are located on gentle midslopes or ridges with cooler aspects, however, this type can also occur on steep slopes. It is speculated that the more mesic conditions found in this type may be attributable to exposures with less solar insulation, placements in the landscape receiving less wind and greater snow deposition and duration. Parent materials include a wide range of sedimentary rock with limestone and siltstone (argillite) predominating. Soil texture tends to be a moderately well drained sandy loam. Litter dominates the ground surface, although patches of exposed rock and gravel are evident.

b. Vegetation Description

This is a small patch dwarf-shrubland type with mats of *Dryas octopetala* or *Arctostaphylos uva-ursi* (can also be *Salix nivalis* or *Salix arctica*, as observed from GNP's vegetation map study) providing the dominant aspect. Shrub cover ranges from 40-65% with *Dryas octopetala* ranging from 8-32% (20% mean cover) and *Arctostaphylos uva-ursi* ranging from 3-62% cover (33% mean cover). *Dasiphora floribunda* is often present with approximately 5% cover. A few *Abies lasiocarpa* and *Pinus contorta* seedlings were observed on one plot.

Native grass cover is low, rarely exceeding 10%. Species characteristically present include *Carex scirpoidea* (an indicator species for this type), *Bromus pumpellianus*, *Poa alpina*, and *Trisetum spicatum*, each with trace to 2% cover. *Danthonia intermedia*, *Festuca campestris*, *Festuca idahoensis*, and *Carex obtusata* have lower constancy but may have conspicuous cover ranging between 1-3%. Other common species present from the vegetation mapping survey also include *Carex rupestris*, *Carex albonigra*, *Carex phaeocephala*, *Festuca brachyphylla*, *Luzula spicata*, and sometimes *Kobresia simpliciuscula* and *K. myosuroides* in the most mesic sites. There were no exotic grasses observed on the plots.

The forb component is highly diverse with overall cover ranging from 13-20% (17% mean cover). Forbs that are typically present include *Polygonum bistortoides*, *Polygonum viviparum*, *Zigadenus elegans* (all three are indicators for this type), *Hedysarum sulphurescens*, *Minuartia rubella*, *Oxytropis splendens*, *Solidago missouriensis*, and *Androsace chamaejasme*, as well as species that are more typical to all associations including *Achillea millefolium*, *Agoseris glauca*, *Antennaria umbrinella*, *Galium boreale*, and *Gaillardia aristata*. Most of these species have trace to 1% cover, however, *H. sulphurescens* and *S. missouriensis* may have 2-3% cover. Other common species from the vegetation mapping survey also include *Minuartia obtusiloba*, *Silene acaulis*, *Besseyia nyomingensis*, *Potentilla diversifolia*, *Oxytropis campestris*, *Smelowskia calycina*, *Solidago multiradiata*,

and *Selaginella densa*, many of which are present on at least one of these sampled plots as well. There were no exotic grasses observed on the plots.

c. Element Distribution

This association is common throughout the alpine zone of Glacier NP and is likely present in most subdistricts. The two plots sampled in this survey are on Mad Wolf Mountain in the Cut Bank drainage and on Lee Ridge in the Belly River subdistrict.

d. Overall Condition

The two plots sampled within this association are in pristine condition with no invasion by exotic species and little invasion by tree species. The plot on Lee Ridge has more *Pinus contorta* and *Abies lasiocarpa* seedlings within the meadow but faces few threats with only the little-used Lee Ridge Trail nearby. Despite the pristine condition of vegetation within the plot, the Mad Wolf Mountain area faces greater threats with current grazing by horses and cattle. Livestock has been grazing in this area for the last 35 years and there were 30 horses grazing at the time of sampling. Horse and cattle trails criss-cross the meadow. These disturbances may impact the quality of this dwarf-shrubland in the future.

7. *Phleum pratense*-*Poa pratensis*-*Bromus inermis* association

a. Environmental Description

Thirty-nine plots (25% of sampled areas) were classified into the *Phleum pratense*-*Poa pratensis*-*Bromus inermis* association. This association is located mostly on disturbed flat to gentle toeslopes and lowslopes at variable aspects, although it can occur on moderately steep midslopes and flat basin floors. Elevations typically range from 1,340m (4,400 feet) to 1,770m (5,800 feet). Soil texture varies and can include moderately well- to well-drained sandy and silt loam or poorly drained clay or sandy clay loam. Generally, these are weakly to well developed, medium to coarse textured soils that have developed on glaciofluvial and morainal landforms that contain quartzite and argillite. Litter comprises 75-95% of the ground cover.

b. Vegetation Description

This mesic to dry association is dominated by both non-native grasses and native forbs. The dominance of exotic grasses within this type is a result of historic and current disturbance, including light to intense grazing and development of out buildings, corrals, and other park housing. Herbaceous cover ranges from 16-95% (55% mean cover) with exotic species contributing 8-44% cover (21% mean cover). Exotic grass cover ranges between 7-40% (19% mean cover), clearly dominated by *Phleum pratense* with trace-40% cover (13% mean cover) and *Poa pratensis* with trace-20% cover (5% mean cover). *Bromus inermis*, *Elymus repens*, and *Poa compressa* have lower constancy but can have high cover in certain areas. Exotic forb cover is lower, ranging from 0-16% (3% mean cover). *Taraxacum officinale* comprises most of this cover with trace-16% cover (3% mean cover), however, *Trifolium repens* and *Tragopogon dubius* can have conspicuous cover in certain areas.

Overall native forb cover ranges from 4-57% (26% mean cover) and despite being fairly diverse, is dominated by forb species that are typical to most grassland associations. These high constancy forbs include *Fragaria virginiana* (trace-15% cover), *Aster laevis* (trace-13% cover), *Penstemon confertus* (trace-12% cover), *Potentilla gracilis* (trace-10% cover), *Achillea millefolium* (1-8% cover), *Galium boreale* (trace-6% cover), *Agoseris glauca*, *Lomatium triternatum* (each with trace-5% cover), *Lupinus sericeus*, *Cerastium arvense*, and *Campanula rotundifolia* (each with trace-3% cover). Other common species include *Geranium viscosissimum* (trace-8% cover), *Solidago* spp. (both *S. missouriensis* and *S. multiradiata*, trace-5% cover), and *Vicia americana* (trace-4% cover). Species present on approximately half the plots include *Cirsium bookerianum*, *Heuchera cylindrica*, *Gaillardia aristata*, *Lithospermum ruderale*, and *Potentilla glandulosa*, each with trace-4% cover. *Aster conspicuus*, *Antennaria anaphaloides*, *Anemone patens*, *Arnica sororia*, *Erigeron speciosus*, *Eriogonum umbellatum*, and *Thalictrum occidentale* have low constancy but may have high cover in certain areas.

Native grass cover is the lowest of all grassland associations with cover ranging from trace-37% (8% mean cover). Cover remains dominated by *Festuca campestris* (trace-28% cover; 5% mean cover) and *Festuca idahoensis* (trace-

9% cover; 1% mean cover), but both species have much lower cover than other associations. Other common native grasses include *Stipa nelsonii* (trace-11% cover), *Bromus carinatus* (trace-5% cover), *Carex petasata* (trace-4% cover), and *Elymus trachycaulus ssp. subsecundus* (trace-2% cover). *Elymus trachycaulus ssp. trachycaulus*, *Carex obtusata*, *Koeleria macrantha*, *Elymus smithii*, and *Bromus pumpellianus* have low constancy but may have high cover in certain locations.

Finally, shrub cover is low within this type, ranging from 0-14% (3% mean cover). *Dasiphora floribunda*, *Amelanchier alnifolia*, and *Rosa spp* (*R. woodsii* and *R. acicularis*) are the most common shrubs, each with trace-9% cover. Only 2 of the 39 plots (5%) have a trace of tree cover.

Based on indicator species present, it is interesting to note that 37 of the 39 plots (95%) would have fallen into *Festuca campestris-Festuca idahoensis*/*Geranium viscosissimum* association had they not had such high exotic grass cover. In comparison to this type, the invasion of weeds has caused several species changes. Many native species in the *Phleum pratense-Poa pratensis-Bromus inermis* association have lower constancy and cover than the native grassland type: *Anemone multifida*, *Antennaria anaphaloides*, *Antennaria umbrinella*, *Arabis nuttallii*, *Arenaria capillaris*, *Balsamorhiza sagittata*, *Comandra umbellatum*, *Hedysarum sulphureum*, *Hieracium albertinum*, *Lupinus sericeus*, *Oxytropis campestris*, *Oxytropis splendens*, *Potentilla hippiana*, *Selaginella densa*, *Arctostaphylos uva-ursi*, *Festuca campestris*, *Festuca idahoensis*, *Koeleria macrantha*, *Danthonia intermedia*, *Carex obtusata*, *Carex filifolia*, *Carex geyeri*, *Stipa richardsonii*, *Helictotrichon hookeri*, and *Pseudoroegneria spicata*. Constancy of *Allium cernuum*, *Antennaria rosea*, *Dodecatheon conjugens*, *Eriogonum umbellatum*, and *Sedum lanceolatum* is also lower on the weedy type. As expected, many non-native species, such as *Phleum pratense*, *Poa pratensis*, *Poa compressa*, *Bromus inermis*, *Elymus repens*, *Centaurea maculosa*, *Linaria vulgaris*, *Taraxacum officinale*, *Tragopogon dubius*, and *Trifolium repens*, have higher constancy and cover in the *Phleum pratense-Poa pratensis-Bromus inermis* association. A few opportunistic native species also have higher cover and constancy on the weedy type as well: *Aster laevis*, *Cirsium hookerianum*, *Fragaria virginiana*, *Geranium viscosissimum*, *Lathyrus ochroleucus*, *Polygonum douglasii*, *Thalictrum occidentale*, *Vicia americana*, and *Bromus carinatus*.

c. Element Distribution

This association is very common in historically disturbed areas on the east side of Glacier NP. It is present less frequently on the west side of the park. Sampled stands in the St. Mary subdistrict occur predominantly in Two Dog Flats and along the Red Eagle Trail but are also found in St. Mary Flats, near the St. Mary campground, and in the Rising Sun picnic area. Within the Two Medicine subdistrict, this type occurs mostly in the southern portion in Ashline meadow, east of Marias Pass, near Lubec Lake, near the old Lubec Ranger Station, and west of the Firebrand Pass trailhead. It also occurs in the old Two Medicine Ranger Station corral area. Within the Many Glacier subdistrict, sampled stands occur along Swiftcurrent Ridge, on Apikuni Mt., at the Apikuni corral, and at Cassidy Curve along the Many Glacier road. Within the Belly River subdistrict, this association was observed along the Belly River Trail, near Jule's Creek, near the Belly River and Mokowanis Lake Trail junctions, and near the Belly River Ranger Station. Finally, in the Cut Bank drainage, this type occurs near the old chalet site.

4. Overall Condition

This association is typically in poor condition. From historic grazing, historic cultivation (seeding), and past development, these plots have high invasion from exotic species, particularly exotic grasses. The plots in the best condition have only 8-10% exotic cover. Seven out of 39 plots (18%) fall into this category and include areas at St. Mary Campground, Lubec Lake, Apikuni Mt., Apikuni corral, Red Eagle beaver ponds, Ashline meadow, and at the old Cut Bank chalet. Just over half of the plots have moderately high exotic cover: 13 of 39 plots (33%) have 12-18% exotic cover and 9 of 39 plots (23%) have 20-28% exotic cover. These include many areas within Two Dog Flats, St. Mary Flats, Swiftcurrent Ridge, along the Red Eagle trail, along the Belly River Trail, near Jule's Creek, at the Two Medicine corral, part of the Belly River Ranger Station pasture, and east of Marias Pass. The remaining 10 plots have very high exotic cover, ranging between 31-44%. These areas tend to have little native cover. These plots occur in the Rising Sun picnic area, western Two Dog Flats, along parts of the Belly River Trail, in Ashline meadow, at Lubec Ranger Station, on Red Eagle hill, in part of the Belly River Ranger Station pasture, and at Cassidy Curve on the Many Glacier Road. These areas may need severe reclamation to recover their native component.

In addition, 4 species of noxious weeds were observed within this type: *Centaurea maculosa* occurs on 11 plots (including Two Dog Flats 1, 2, and 3, St. Mary Flats, St. Mary CG, Rising Sun Picnic Area, Apikuni corral, Lubec Lake, and west of the Firebrand TH), *Linaria vulgaris* occurs on 2 plots (including Lubec Lake and Apikuni Corral), and *Cirsium arvense* occurs on 3 plots. GNP weed surveys have documented noxious weed infestations in five additional meadows and have documented that noxious weeds are present within 500m of 11 additional meadows.

Tree invasion is occurring on 22 of the 39 plots (56%). Aspens are beginning to colonize the edges of several of the meadows, while lodgepole pine is establishing in the other grasslands. This is occurring in Two Dog Flats, in the grasslands along the Belly River Trail, in the Rising Sun Picnic Area, in the grasslands along the Red Eagle Trail, in Ashline meadow, and in grasslands near Marias Pass.

Finally, current trespass by livestock and subsequent grazing still occurs on 13 plots (33%). These areas include Swiftcurrent Ridge, the Belly River Ranger Station pasture, the Apikuni corral, near St. Mary Campground, near Jule's Creek, at the Lubec Ranger Station, and west of the Firebrand Pass trailhead. These areas will likely be at continued risk for further disturbance as long as grazing continues.

Overall management concerns for these areas are the high cover of exotic species, particularly exotic grasses that are difficult to control, and any further spread of noxious weeds. Even without continued disturbance, few of the meadows will likely improve in their quality without intensive weed control and restoration efforts. Below is a summary table of the historic and current disturbances to this association. It appears that the grasslands along the Belly River Trail and any grassland along the eastern boundary of the park are at the highest risk for continued disturbance due to continued grazing, tree invasion, and nearby trails. Based on the persistence and aggressive nature of exotic grasses, all grasslands within this type will likely continue to be dominated by exotic species without management intervention.

Table 6. Historic and Current Disturbances to *Pheum pratense*-*Poa pratensis*-*Bromus inermis* plots.

Historic disturbance	# / % of plots impacted	Plot #s	Current disturbance	# / % of plots impacted	Plot #s
Historic grazing	24 + 13 current / 95%	BR-1 mile, BR-3 mile, Veldt (2), Belly/Mokowanis Jct, Apikuni Mt, Rising Sun Picnic, Two Dog 1 (3), Two Dog 2 (2), Two Dog 3, St Mary CG, St Mary Flats (2), Red Eagle Hill, Red Eagle Jct, Red Eagle LO (2), Red Eagle S of LO, Red Eagle 2 mile, Old CB Chalet, Two Med RS corral	Current trespass and grazing by livestock	13 / 33%	Jule's Ck, Belly River RS (2), Swiftcurrent Ridge(2), Cassidy Curve, Apikuni corral, Lubec RS, Lubec Lk, E of Marias Pass, Ashline (2), W Firebrand TH
Historic road	11 / 28%	BR-1 mile, BR-3 mile, Veldt, Belly /Mokowanis Jct, Ashline (2), Apikuni corral, St Mary Flats, Red Eagle LO (2), Old CB Chalet	Road nearby	9 / 23%	Apikuni Mt, Apikuni corral, Two Dog 1 (3), Two Dog 2 (2), Two Dog 3, W Firebrand TH
Historic structure	7 / 18%	St Mary Flats, Old CB Chalet, Two Med RS corral, Lubec Lk, Lubec RS, Ashline (2)	Tree invasion	22 / 56%	BR-1 mile, BR-3 mile, Veldt (2), Apikuni corral, Rising Sun Picnic, Two Dog 1, Two Dog 2, St Mary Flats (2), Red Eagle Hill, Red Eagle LO (2), Red Eagle S of LO, Red Eagle 2 mile, Old CB Chalet, Two Med RS corral, E of Marias Pass, Lubec Lk, Ashline (2), W Firebrand TH
Historic vehicle use	1 / 3%	Belly River RS	Shrub invasion	5 / 13%	Rising Sun Picnic, Two Dog 1, Two Dog 2, Two Dog 3, St Mary Flats
Buried powerline	2 / 5%	Two Dog 1(2)	Trail nearby	4 / 10%	Apikuni Mt, Red Eagle Hill, Red Eagle Jct, Red Eagle S of LO
			Noxious weed invasion	17 / 44%	BR-1 mile, Belly/Mokowanis Jct, Apikuni corral, Rising Sun Picnic, Two Dog 1(3), Two Dog 2, Two Dog 3, St Mary CG, St Mary Flats(2), Red Eagle Hill, Lubec RS, Lubec Lk, E of Marias Pass, W Firebrand TH

8. *Elymus repens*/*Taraxacum officinale* association

1. Environmental Description

Three plots (2% of sampled areas) were classified into the *Elymus repens*/*Taraxacum officinale* association. This uncommon association is located on disturbed, flat to gently sloping low or toeslopes at elevations between 1,450m (4,750 feet) and 1,555m (5,100 feet) at various aspects. Soils are derived from glacial-fluvial deposits but vary in soil texture. They range from moderately well drained sandy loams to poorly drained gravel and rock. Litter dominates the ground surface with 85-90% cover.

2. Vegetation Description

This montane, mesic to subhygric, herbaceous association has low overall species diversity due to the dominance of *Elymus repens*, an exotic grass. Overall herbaceous cover ranges from 25-50% with *E. repens* clearly dominating this association with 5-40% cover (20% mean cover). Overall exotic grass cover ranges from 7-40% (24% mean cover) and includes cover from other high constancy non-native grasses: *Phleum pratense* (trace-8% cover), *Poa pratensis* (1-3% cover), and *Poa compressa* (trace cover).

Overall exotic forb cover ranges from trace-14% (6% mean cover) with *Taraxacum officinale* (trace-3% cover) most commonly present. Other exotic forbs that have low constancy (present on only one plot) but can have high cover in certain areas include *Centaurea maculosa* (3% cover) and *Cirsium arvense* (10% cover). These two species, in addition to *Linaria vulgaris* and *Tanacetum vulgare* that are also present with low cover on one plot, are Category 1 noxious weeds for the state.

Native grass cover is very low, likely outcompeted by the invasion of exotic species. Overall native grass cover ranges from 0-4% with no high constancy or common grass species. *Carex microptera* and *Poa palustris* were found to have 1-2% cover on one plot.

Native forb cover is higher, ranging from trace-17% (10% mean cover). Dominant native forbs include those typical to most grassland associations: *Achillea millefolium* (2-5% cover), *Aster laevis* (2-6% cover), *Cerastium arvense*, *Penstemon confertus*, *Potentilla gracilis* (each with trace-2% cover), *Campanula rotundifolia*, *Fragaria virginiana*, and *Galium boreale* (each with trace cover). Other common species include *Eriogonum umbellatum*, *Potentilla hippiana*, and *Solidago multiradiata* with trace-1% cover. Native forb diversity is otherwise very low with only a few other species offering trace cover.

3. Element Distribution

This association occurs on disturbed, low elevation sites on the east side of Glacier NP but is uncommon. Disturbance usually consists of historic grazing or flooding. These plots are located in the Many Glacier subdistrict below the high water mark along Lake Sherburne and in the southern Two Medicine subdistrict in the Ashline meadow and near Lubec Lake and cabin.

4. Overall Condition

The overall condition of this association is poor. From past development, historic overgrazing, and in one instance shoreline flooding, these plots are dominated by exotic grasses with cover that is often so high that native grass is almost non-existent. *Elymus repens* is the most dominant exotic grass but the presence of *Phleum pratense*, *Poa pratensis*, and *Poa compressa* presents additional management concerns. Exotic forb cover is also relatively high with fairly consistent cover from two Category 1 noxious weeds, *Centaurea maculosa* and *Cirsium arvense*. *Linaria vulgaris* and *Tanacetum vulgare*, also Category 1 noxious weeds, are also present with low cover in the grassland near Lubec Lake, while *Linaria dalmatica* is present with low cover in the Ashline meadow. Overall tree and shrub cover is very low and not a management concern here.

The high cover of exotic species, as well as current livestock trespass on all three plots and annual flooding on plot MG-01-012, likely mean these plots will remain in poor condition without drastic management approaches. These are clearly areas that could only be repaired with intensive weed control and restoration efforts.

9. *Vaccinium caespitosum* association

a. Environmental Description

Only one plot was classified into the *Vaccinium caespitosum* association. This uncommon type is located within a flat, low level, lake plain at an elevation near 1,495m (4,900 feet). Soils are derived from glacial-fluvial deposits and are characterized as somewhat poorly drained sandy loams. Litter dominates the ground surface but basal vegetation, bare soil, moss, and gravel cover are clearly evident.

b. Vegetation Description

Overall vegetative cover is high within this mesic to subhygric association, approaching 100%. Shrub cover is nearly 25%, thus the classification as a dwarf-shrubland type. It is dominated exclusively by *Vaccinium caespitosum* with no other shrubs present. No trees were observed within the plot but *Abies lasiocarpa* seedlings and saplings are present within the meadow.

Despite being classified as a dwarf-shrubland type, herbaceous species dominate the plot with 90% cover. Overall native grass cover is nearly 50%, clearly dominated by *Calamagrostis canadensis* with 20% cover, *Festuca saximontana* with 12% cover, and *Juncus balticus* with nearly 10% cover. Other conspicuous grasses and sedges include *Danthonia intermedia* with 4% cover, *Carex microptera* with 3% cover, *Festuca idahoensis* with 2% cover, and *Carex rossii* with 1% cover.

Overall native forb cover is estimated to be 43% and is dominated by species that are common to most other associations. These include *Fragaria virginiana* with 19% cover, *Penstemon confertus* with 7% cover, *Achillea millefolium* with 5% cover, and *Potentilla gracilis* with 4% cover. Other species with high cover include *Aster laevis* with 6% cover, *Valeriana sitchensis* with 3% cover, and *Erigeron speciosus* with 1% cover.

Cover of exotic species is moderate at 6%, dominated mostly by exotic grasses. *Poa pratensis* is common with 4% cover and *Phleum pratense* is present with 1% cover. Exotic forbs have only trace cover with low cover from *Taraxacum officinale* and *Trifolium repens*.

c. Element Distribution

This association is rare on the east side of Glacier NP. This plot is located within the lake plain at the head of Elizabeth Lake in the Belly River subdistrict.

d. Overall Condition

This association is in moderately good condition with only a few trees invading the meadow and no invasion by noxious weeds. As a mesic community, vegetation cover is very high with moderately low species diversity. The main threat to this stand is the evident cover of *Poa pratensis* and *Phleum pratense*. These exotic grasses were likely introduced to the area from historic horse grazing. They are likely to persist or increase in the area due to moderately used public trails that flank this meadow to the south and west. These trails are also used by park stock.

10. *Calamagrostis rubescens* association

a. Environmental Description

Only one plot was classified into the *Calamagrostis rubescens* association. This minor type, which is more typically found at lower elevations following stand-replacing fires (usually west of the Continental Divide), was observed at 1,700m (5,570 feet) on a relatively flat, east-facing bench along the midslope. Soil texture is a moderately well-drained sandy loam formed by glacial-fluvial deposits. Litter dominates the ground surface with 80% cover.

b. Vegetation Description

This association is a mesic, herbaceous type that is dominated by native forbs. Overall native forb cover is 60% and is dominated by *Fragaria virginiana* with 19% cover, *Chamerion angustifolium* with 10% cover, *Senecio pseud aureus* with 9% cover, and *Aster conspicuus* with 4% cover. Other forb species with 1-3% cover include *Achillea millefolium*,

Agoseris glauca, *Galium boreale*, *Lupinus sericeus*, and *Penstemon confertus* that are common to other grassland types, as well as more mesic forbs *Aster laevis*, *Equisetum arvense*, *Erigeron speciosus*, and *Lathyrus ochroleucus*.

Overall native grass cover is 33% and is dominated by *Calamagrostis rubescens* with 12% cover. Other grasses with cover ranging from 2-6% include *Bromus carinatus*, *Calamagrostis purpurescens*, *Carex* spp. (includes *C. hoodii* and *C. rossii*), *Elymus trachycaulus* ssp. *subsecundus*, and *Festuca idahoensis*. *Phleum pratense* and *Poa pratensis*, both exotic grasses, add an additional 7% cover.

Although this stand shares similar herbaceous vegetation to west side stands, this type differs from west side vegetation in that there are no shrubs and few trees and it is not maintained by fire. In addition, *C. rubescens* clearly dominates west-side stands where this stand is dominated by several forb and grass species.

c. Element Distribution

This type is very uncommon on both the east and west sides of Glacier NP. This plot is located along the Firebrand Pass Trail in the southern Two Medicine subdistrict.

d. Overall Condition

This association appears to be in moderately good to fair condition. Although there are a few scattered *Pinus contorta* trees in the meadow, tree and shrub invasion is extremely low and there is no invasion by noxious weeds. As a more mesic community, vegetation cover is very high with moderate species diversity. The main threat to this stand is the presence of *Phleum pratense*, *Poa pratensis*, and *Taraxacum officinale* with cover approaching 10%. These exotic species are likely to persist or increase due to two management concerns in the area: (1) it continues to be occasionally grazed by cattle and horses that trespass the area; and (2) it is flanked to the south and east by moderately used public trails that are also used by park stock.

11. *Carex geyeri* association

a. Environmental Description

Only one plot was classified into the *Carex geyeri* association. This small patch vegetation type was found in the subalpine zone at 1,660m (5,460 feet), however, it can occur well into lower alpine areas at 2,190m (7,190 feet). This plot occurs on a gentle low slope with a southeast aspect; other sampled areas from the vegetation map survey found that this type more typically is found on moderate to mostly steep slopes on similar southerly exposures. They also found that this association often occurs in protected gully slopes near stream headwaters where deeply incised streambeds fill and hold snow late into the growing season, assuring ample soil moisture. Soil texture on this plot is a moderately well drained sandy clay loam, supporting this trend. This association can occur on colluvial slopes or glaciofluvial landforms, comprised of red and green argillite and quartzite and bedrock. Although talus and bedrock can sometimes dominate the ground surface of this type, litter comprised almost 90% of the surface on this plot.

b. Vegetation Description

Overall vegetation cover of this association is moderate on this plot, estimated at approximately 50%. It is dominated by native forbs with 25% overall cover that are typical to many other associations, including *Fragaria virginiana* and *Penstemon confertus* with 4% cover, *Achillea millefolium* and *Galium boreale* with 3% cover, and *Potentilla gracilis*, *Campanula rotundifolia*, and *Cerastium arvense* with 1 to 1.5% cover. Other species that may have conspicuous cover include *Antennaria rosea*, *Arenaria capillaris*, *Erigeron speciosus*, *Hieracium scouleri* var. *albertinum*, and *Vicia americana*, each with approximately 1% cover. Species that were noted in other plots for the vegetation map survey, particularly at the higher elevations, also include *Senecio megacephala*, *Arnica rydbergii*, *Lomatium dissectum*, *Aquilegia flavescens*, *Potentilla diversifolia*, *Cirsium bookerianum*, *Aster foliaceus*, *Eriogonum flavum*, and *Sedum stenopetalum*.

Native grass cover is approximately 20% and is clearly dominated by *Carex geyeri* with 10% cover. Other common grasses include *Calamagrostis rubescens* with 4% cover, *Calamagrostis purpurescens* and *Danthonia intermedia* with 2-3% cover, and *Bromus carinatus* with 1% cover. Common species that were noted in other plots for the vegetation map survey also include *Poa cusickii*, *Pseudoroegneria spicata*, and *Festuca idahoensis*.

Shrub cover is low with no more than 5% cover on this or other surveyed plots. *Amelanchier alnifolia* has the most conspicuous cover, however, *Dasiphora floribunda*, *Shepherdia canadensis*, *Spiraea betulifolia*, and *Rubus parviflorus* may also be present. No trees were noted in the plot but there are scattered *Pinus contorta* invading this meadow.

Cover of exotic species is also very low with very few non-native species present. Exotic grass cover is approximately 1%, comprised of *Phleum pratense*. There is only a trace of exotic forb cover, due to the presence of *Prunella vulgaris* and *Taraxacum officinale*.

c. Element Distribution

This type is uncommon and found only on the east side of Glacier NP in valleys not far removed from the adjacent prairie foothills. This plot is located in the southern portion of the Two Medicine subdistrict along the Autumn Creek Trail just northeast of Three Bears Lake.

d. Overall Condition

This plot is in good condition. Although there are a few scattered *Pinus contorta* trees in the meadow, tree and shrub invasion is low and there is no invasion by noxious weeds. Vegetation cover is moderately high despite low species diversity. A minor threat to this stand is the presence of *Phleum pratense* that currently has low cover. This grass could persist or increase due to two management concerns in the area: (1) it continues to be occasionally grazed by cattle and horses that trespass the area; and (2) a moderately used public trail (Autumn Creek Trail) cuts through the middle of the meadow. Wildlife use, as evidenced by several deer and elk trails, is also high here.

B. Wildlife

Fescue grasslands are home to a number of wildlife species, many of which are only found within these grassland communities. Grasslands provide year-round range for a number of grazers including elk, deer (mostly white-tail), moose, and mountain sheep in the higher elevations. Grasslands provide habitat for a number of small mammals, whose presence attracts grizzly and black bear, weasels, striped skunks, mink, pine marten, badgers, wolverines, coyotes, red fox, and wolves. Finally, many bird species are wholly or partially dependent for survival on meadow and adjacent brush and woodland habitats. Some bird species, such as Savannah, Clay-colored, Vesper, LeConte's, and Brewer's Sparrows, Western Meadowlarks and Horned Larks, are very closely associated with prairie-type habitats.

As part of this grassland assessment, three wildlife studies were conducted in areas that overlapped with vegetation surveys. Bird surveys were conducted at seven sites, a small mammal study occurred at six sites, and bighorn sheep were surveyed in twenty-one areas where grassland plots were established.

1. Birds

An eastside grasslands bird study was conducted during June and July 2000 and again in 2001 (Bate 2001) to provide baseline data on bird species present, diversity, and abundance in and near these habitats. Thirty-five point count stations were randomly established at seven sites: Rising Sun, Two Dog Flats, St. Mary Flats, Many Glacier, Belly River, Dry Fork, and Two Medicine (Figure 8). As outlined in the USFS Northern Region Landbird Monitoring Program, all species recorded by sight or sound during a ten-minute period at each station were recorded. Using a slightly modified protocol, birds detected more than 100m away were also recorded. Fifty-five total visits to the 35 stations were made and a total of 96 bird species were recorded in and adjacent to the grasslands (Table 7). Habitat variables that may influence the presence of various species were also measured. These variables include grass and forb cover and height, litter depth, ground cover, and bush and tree heights and proximity.

Savannah Sparrows were by far the most abundant grassland species detected, followed by clay-colored and Vesper Sparrows and Western Meadowlarks. Interestingly, Savannah Sparrows were frequently found in sites

dominated by timothy, as in Belly River. Much litter is present in these dense stands, important to savannah sparrows in nest construction. Clay-colored and Vesper Sparrows prefer sites with some cover of low-growing shrubs for both perching and concealment (Bate 2001). These bird species, which are heavily dependent on grasslands, have likely evolved with the natural disturbance of regular fires. Other vegetative components of the grassland ecosystem include the adjacent woodlands, patches of aspens and conifers, and brush in wetter depressions and draws. These habitats are home to a host of neotropical migrants such as warblers, swallows, vireos, thrushes, flycatchers, hummingbirds, and wrens. In fact, grasslands near riparian areas had the highest diversity of birds. Year-round residents include jays, magpies, chickadees, woodpeckers, grouse, and various raptors. The scattered snags provide feeding, nesting, roosting, perching, and hunting sites for numerous bird species.

2. Small Mammals

A study of small mammals in Glacier's eastside fescue grasslands was conducted during June of each year from 2000 to 2003 (Pearson and Ruggerio 2004) to survey small mammal species present, their relative abundance, and their relations to different vegetation types. Transects in six sites were surveyed, including Windy Flats, Two Dog Flats, St. Mary Flats, Two Medicine, and two locations in Belly River (Figure 9), using Sherman folding live-traps for captures. A total of 10,400 trap nights produced 297 captures of 202 individuals representing six species of small mammals (Table 8). Deer mice (*Peromyscus maniculatus*) (171 captures) were by far the most abundant species, followed by western jumping mice (*Zapus princeps*) (14 captures), meadow voles (*Microtus pennsylvanicus*) (5 captures), montane heather voles (*Phenacomys intermedius*) (3 captures), yellow pine chipmunks (*Eutamias amoenus*) (2 captures), and one long-tailed vole (*Microtus longicaudus*). Shrews were not captured in this study but have been documented previously and are likely present in low densities. Habitat selection analysis was not possible except for deer mice due to low overall capture success. Deer mice tended to select microsites with less exotic grass cover and with slightly more bare ground and rocks. This suggests that deer mice may be negatively impacted by the invasion of exotic species since they tend to avoid areas of dense cover.

Variables recorded included native grass and forb cover, exotic grass and forb cover, and presence of woody shrubs, bare ground, and rocks. Rough fescue was the dominant native bunchgrass on all sampling sites. Ocular estimate surveys of sign of northern pocket gophers and Columbian ground squirrels were also made, giving a rough estimate of relative abundance of these species, as well as a percentage of disturbed soil which may facilitate exotic plant invasions. The study showed significant positive relationships between pocket gophers and exotic forbs, but not for exotic grasses for either gophers or ground squirrels.

This study confirmed that Glacier's eastside grasslands are relatively species-poor in small mammals with deer mice being the dominant species. Although this is generally similar to other bunchgrass habitats in the northern Rockies, this study did find that the vole population was more diverse in these park grasslands than in similar habitats in the state (Pearson and Ruggerio 2004). Meadow voles and heather voles are more common in the park while montane voles are more common outside the park. This study also found that overall densities of small mammals were lower, however. Deer mice could be avoiding the heavier ground cover typically found in the park or low densities could be explained by greater predator diversity and numbers (Pearson and Ruggerio 2004). Finally, this study outlined both obvious and subtle negative impacts of non-native plants on native animal and plant diversity, with unknown long-term influences on the entire ecosystem (Pearson and Ruggerio 2004).

3. Bighorn Sheep

Twenty-one vegetation plots were established on areas of good bighorn sheep range, primarily in the Many Glacier and Two Medicine drainages. These provided site-specific data for a Habitat Model Evaluation for Bighorn Sheep Winter Range Study (Dicus 2001) on some higher elevation eastside grasslands. This study identified current and potential sheep ranges to ensure the perpetuation of sustainable populations, by potential habitat improvements or possible reintroductions. Habitat was evaluated by extensive surveys and by such parameters as slope, aspect, elevation, escape terrain, vegetation type, snowpack, and human influences (Dicus 2001). Overall, the *Arctostaphylos uva-ursi*/*Festuca campestris*-*Festuca idahoensis* association was identified as important bighorn sheep winter range.

C. Comparative Historic Photography

The park archives in West Glacier were searched by Carl Key and Dave Shea for old photographs which could potentially be used for historic vegetation comparative photography. Approximately 60 photos were chosen, varying in dates from 1890 to 1977. Fifty-four of the photo sites were relocated on the ground in 2000 and 2001 and the view of the original photos were duplicated as closely as possible in slide format.

Preliminary analysis confirms the permanent nature and locations of these grassland habitats. Also generally confirmed is significant encroachment by brush, aspens, and conifers in several areas, probably due mainly to fire exclusion. This phase of the project was initiated during the fall of 1999 and was continued over the next two seasons. Comparative photo sets are printed in a separate publication (Shea and Key 2006).

VI. Discussion and Recommendations

Overall, this baseline study has documented that a diverse assemblage of native plants and animals thrive in the fescue grasslands on the east side of Glacier National Park. Fescue bunchgrasses dominate most of the meadows and, relatively speaking, most park grasslands are still in good condition. Several pristine meadow systems still exist, tucked away in the backcountry of the park and far from human disturbances.

These fragile ecosystems, however, are easily disturbed by human actions, particularly through domestic livestock trespass, construction activities that have over the years brought the invasion of weed species, and years of fire exclusion. To effectively manage these grassland communities, the surveyed areas have been assessed in regards to their ecological features, their stressors, and their threats to attempt to give park managers a template to prioritize management of these grassland systems. This “Fescue Grassland Management Matrix” (Appendix B) is a list of the surveyed areas, by plot, by meadow, and by association, with a point system that tallies their assigned points for ecological features, their stressors, and their threats. The lower the number, the higher the ecological value and the lower the stressors and the threats.

Ecological values were devised based on three measurable components:

- (1) **Rareness of the Association:** Rare in park and region = 0 points; Rare in park but not region = 1 point; Rare in region but not park = 1 point; Not rare in park or region = 2 points.
- (2) **Relative Richness** (# species present in plot/highest # of species found in total plots): Very High (0.89 - 1.0) = 0 points; High (0.78 - 0.88) = 1 point; Medium-High (0.67 - 0.77) = 2 points; Medium (0.56 - 0.66) = 3 points; Low (0.40 - 0.55) = 4 points; Very Low (< 0.39) = 5 points
- (3) **% Exotic species (% cover exotic species/total % cover):**
 - Associations that were characterized by native species were analyzed with the following point system:
More pristine: None = 0 points; Low (0.01 - 1.0% of total vegetation) = 1 point; Medium (1.01 - 5% of total veg) = 2 points; Medium-High (5.01 - 10% of total veg) = 3 points; High (>10% of total veg) = 4 points
 - Since all of the associations that were characterized by non-native species (timothy, Kentucky bluegrass, smooth brome, or quackgrass) had exotic species cover >10% of the total vegetation, these weed associations were analyzed separately to break down the extent of weed invasion within these types. These less pristine associated were analyzed with the following point system:
Less pristine: Low (14 - 20% of total vegetation) = 0 points; Medium (21 - 30% of total vegetation) = 1 point; Medium-High (31 - 45% of total vegetation) = 2 points; High (46 - 65% of total vegetation) = 3 points; Very High (> 66% of total vegetation) = 4 points

Stressor values were devised based on three measurable stresses to grasslands:

- (1) **Noxious Weed Populations present in meadow:** High cover (10% or <) = 4 points; Medium cover (5-9%) = 3 points; Low cover (1-4%) = 2 points; trace cover = 1 point; No noxious weeds = 0 points

- (2) **Livestock Trespass (determined by notes):** High = 3 points; Medium = 2 points; Low = 1 point; None = 0 points
- (3) **Other direct stressors:** High = 3 points; Medium = 2 points; Low = 1 point

Threat values were devised based on four measurable threats to grasslands:

- (1) **Tree encroachment (determined by plot data and investigation of aerial photos):** Moderate = 2 points; Low = 1 point; None = 0 points
- (2) **Shrub encroachment:** Moderate/High (>10% SYMALB, ROSWOO, AMELAN, PRUVIR) = 1 point; Low/None = 0 points
- (3) **Distance to noxious weed populations if not in meadow already (determined using weed maps):** 3 or more noxious weeds within 0-500m = 2 points; 2 or fewer noxious weeds within 0-500m = 1 point; no noxious weeds within 500m = 0 points

All plots were given points based on the system above and ranked within the matrix from “most pristine with few threats or stressors” to “less pristine with more threats or stressors”. As stated above, areas that were characterized in associations dominated by non-native grasses were kept in a separate list as those areas may not be Glacier’s top priority. The matrix keeps the overall ecological, stressor, and threat tallies separate as well to highlight where the majority of the points are coming from.

In addition, the matrix highlights the action items that the plot or meadow requires to reduce the amount of stressors or threats to that area (Appendices C and D). As we have not tested herbicides to reduce non-native grasses or perfected ways to restore these meadows, these action items focus on noxious weed control, eliminating cattle trespass, and reducing woody tree and shrub invasion. In addition to the management action items listed for each plot or meadow in the matrix, below is a discussion of the recommended management actions for all grassland areas.

It should be noted that more pristine areas, those generally dominated by native species, were summarized separately from less pristine areas, those dominated by non-native species. The summary was done this way because grasslands dominated by non-native species will already be a lower management priority due to their low ecological value and difficulty in restoring these areas.

A. Livestock Trespass

Pacific Northwest grasslands developed in a unique post-glacial environment of minimal grazing. Small bison herds apparently roamed in the region, but the grasslands historically did not experience the same prolonged, widespread, and intense bison grazing that was such a dominant feature of prairie grasslands. Other wild ungulates made use of grasslands to varying degrees—elk, mountain sheep, deer, and mountain goats—but these animals were subject to intense predation and aboriginal hunting pressure, and their populations were kept quite low. Consequently, this set of historical factors combined to produce grassland species that show little resistance to continuous growing season grazing when compared to Great Plains and Eurasian grasses (Mack and Thompson 1982). Typical of this grazing-intolerant group are bluebunch wheatgrass and rough fescue, two keystones of the grassland community in the Pacific Northwest.

As domestic livestock grazing has increased over the past 100 years in the west, vegetation trampling and overgrazing have adversely impacted many native grassland areas. First, studies have shown that animal impact has resulted in a reduction of range condition as evidenced by loss of increaser species. These trends were associated with less soil moisture and increased soil bulk densities indicating reduced infiltration rates. Similarly, soil quality, as determined by percent nitrogen and enzyme activity, was also reduced. Such impact resulted in retrogression of the grasslands in as little as five years (Dormaar et al. 1959, Dormaar et al. 1989). Naeth et al. (1990) also reported the decline in water infiltration rates with heavy stocking rates due to excess removal of plant cover and soil compaction. As grazing intensity increased, water intake and water holding capacity declined. The consequence was more runoff. Once a threshold value of 10 to 15% soil exposure was exceeded, soil erosion processes increased such that they

contributed to loss of more than 5 cm of Ah horizon under the heavy grazing treatment. In very recent studies (Chanasyk et al. 2003, Mapfumo et al. 2002), runoff rates were higher on heavy to very heavily grazed fescue grassland during larger summer storm events and during spring runoff from snow melt.

Second, studies have shown that moderate to intense grazing can reduce or eliminate key fescue grassland species. Rough fescue, in particular, is unable to recover from intense grazing, as it is sensitive to defoliation and its competitiveness declines when grazed during the growing season. Light, season-long grazing reduces rough fescue basal area and it is largely eliminated under heavy grazing (Rangeland Ecosystems and Plants 2009). An increase in stocking rate from light to moderate adversely affects rough fescue basal diameter on range sites with a lengthy grazing history, suggesting that rough fescue plants are susceptible to long-term grazing (Willms et al. 1985). Research has shown that it takes from 20-40 years for overgrazed grassland to recover to "excellent" condition in open coniferous and higher elevation rough fescue grasslands (BC Grasslands 2009).

Similarly, Idaho fescue is a decreaser under heavy grazing by livestock and wildlife. Several studies have reported Idaho fescue as less abundant on areas grazed by livestock compared to ungrazed areas (FEIS 2009). Idaho fescue is a poor competitor with repeated grazing severely reducing the competitive ability of Idaho fescue. Vigor and growth of Idaho fescue are negatively affected by a single, heavy defoliation, and plant production is reduced for several years (Rangeland Ecosystems and Plants 2009). Light to heavy use (<25% to >25% use) reduces leaf height, basal area, and plant weights (Rangeland Ecosystems and Plants 2009).

Other studies suggest that long-term, heavy winter-spring grazing reduced plant vigor of bluebunch wheatgrass, as well as Idaho fescue and rough fescue on foothill rangeland (Brewer et al. 2002). Brewer (2002) concluded that clipping bluebunch wheatgrass plants once per year in April and May had no adverse effects on plant yield or vigor; however clipping moderately and heavily in May for 2-3 consecutive years reduced plant yield and vigor in the summer. Other studies have shown that if severely grazed, bluebunch wheatgrass may need 8 to 10 years of rest to recover (Rangeland Ecosystems and Plants 2009).

Finally, tree seeds are not able to germinate and grow in areas where a healthy cryptogamic crust (layers comprised of spikemosses and other non-vascular plants are a prevalent feature of western bunchgrass habitats) covers the ground and where there are many grass and other plants competing for moisture. If the crust, dominated by grassland mosses, lichens, and *Selaginella* spp., is broken or the plants reduced, the chance of tree seeds growing into trees is increased. Livestock grazing is one way in which the crust is broken or destroyed and the amount of plant cover is reduced.

ACTION ITEM: Reduce, or preferably, eliminate livestock trespass along the eastern boundary of the park. Fence key boundary areas to prevent livestock trespass but allow wildlife passage.

B. Weeds

Through modern transportation and agricultural systems alien plant species have spread throughout North America, including fescue grasslands. Exotic species affect grassland succession in numerous ways. They occupy growing space, displacing native species and making late seral or climax states more difficult to achieve. Certain alien species also have the ability to "hijack" succession, and hold it at an intermediate state for long periods of time.

Invasive plants, especially nonnative perennial grasses, pose one of the most critical threats to prairies in the Pacific Northwest (Stanley et al. 2008). For example, once smooth brome is established, it can displace native species, converting the area into an alien-dominated grassland of low diversity. Fire is not effective in controlling smooth brome but fire suppression is not an acceptable alternative, since unburned fescue prairie is also invaded by smooth brome.

Similarly, Moss and Campbell (1947), Looman (1969), Willms et al. (1985) and Willoughby and Alexander (2000), all found that long-term heavy grazing pressure eventually leads to a decline in rough fescue and an increase in

Kentucky bluegrass. It appears once Kentucky bluegrass becomes established it continues to remain co-dominant with rough fescue even in the absence of disturbance. Kentucky bluegrass cover also seems to increase in the absence of disturbance during years with increased moisture.

Finally, several species of noxious weeds have invaded fescue grasslands. The presence of livestock has added to the spread of weeds as weed seeds attach themselves to livestock, as well as spread through their manure. The most destructive invader may be spotted knapweed which has been spreading rapidly in Idaho fescue, rough fescue, and bluebunch wheatgrass dominated rangeland throughout the western United States and Canada. Some studies have shown that a rough fescue climax community – in the absence of disturbance – appeared to be fairly resistant to spotted knapweed invasion (Lacey et al. 1990). But disturbances, particularly intense disturbance (e.g. prolonged drought, overgrazing) that deplete multiple plant groups, is a prerequisite for spotted knapweed invasion (Rinella et al. 2007). Another study has shown that a single Idaho fescue defoliation at 30% and 90% increased spotted knapweed weight and numbers per plot respectively, over those plots with undefoliated plants (Jacobs and Sheley 1997). As defoliation level and frequency increased, soil water content increased resulting in a corresponding increase in spotted knapweed emergence and growth. Once spotted knapweed is established, literature suggests that spotted knapweed displaces indigenous species and/or invades areas of reduced indigenous plant cover, low diversity, or low species richness (Kedzie-Webb et al. 2001). Other studies have shown that the invasion of spotted knapweed also increased erosion by 56% and sediment yield by 192% when compared with *Pseudoroegneria spicata*–dominated rangeland under simulated rain events (Lacey et al. 1990). While less research has been done on other species of noxious weeds, it is likely that the invasion of other noxious weeds in fescue grassland communities have similar negative results.

While studies have shown that positive strides can be made to restore fescue grasslands with aggressive control of noxious weeds, experiments are just beginning to address the control of exotic perennial grasses in these communities. Experimental treatments began in 2005 show that grass-specific herbicide sethoxydim applications effectively reduce exotic perennial grasses. Combining sethoxydim with other treatments had added benefits: fall burning reduced thatch and moss cover, additional spraying of glyphosate application 1 to 2 weeks after burning reduced broadleaf weeds and seed addition increased native diversity (Stanley et al. 2008).

ACTION ITEMS: (1) Continue persistent and aggressive control of all noxious weeds within and near fescue grasslands; (2) Investigate strategies to remove/control exotic perennial grasses within fescue grasslands and restore the areas with native species; (3) as stated above, fence key boundary areas to prevent livestock trespass that often results in weed invasion and establishment; (4) monitor more pristine grassland areas to assess that they remain weed free.

C. Fire

Overall, fire provides many benefits for grassland communities:

- Increased grass nutrient availability
- Enhanced flowering and seed production
- Removal of dead plant matter
- Creation of suitable seedbeds
- Reduces hazardous fuel build up
- Topkill of shrubs and trees
- Suppression of some undesirable, introduced grasses and forbs
- Increased control of insect pests

Most North American grasslands have an inherent tendency to become dominated by woody plants; that is, they succeed from grassland to either shrubland or forest. Opposing this tendency is fire, which generally favors herbs over shrubs and trees. Low-elevation grasslands historically experienced frequent, low-intensity fire. This frequent fire

regime performed a number of ecological functions, but its primary impact was to control the density of young tree seedlings and woody shrubs. Typically, there was a 5 to 10 year fire interval for rough fescue communities and a 25 year fire interval for dry mixed grass prairie (Rangeland Ecosystems and Plants 2009). These historic fire patterns generally ended near the turn of the century with the development of the west, increased grazing of livestock, and conversion of grassland to agriculture.

The enduring paradox of fire is that the less often it occurs, the more destructive an individual fire event becomes. While there is no arguing the benefits of fire within grassland systems, the effect of skewed fire intervals on control of woody plants, on biodiversity, and on certain native grass species within grasslands is extremely important.

In Antos et al. (1983), experiments showed that large bunches of rough fescue were more seriously damaged than small ones, indicating long intervals between fires are detrimental to this grass species when fire does return. Three years after a burn, four overall trends were evident: (1) Idaho fescue had recovered completely; (2) rough fescue had increased but was still well below unburned levels; (3) lichen cover was reduced; and (4) species composition was greatly altered. While it is still recommended to burn rough fescue grasslands to reduce invasion of woody species and to remove litter accumulations, burning too far outside of the fire interval can decrease yield and delay growth of rough fescue for 1-3 years (Rangeland Ecosystems and Plants 2009). Reduction in primary production is due to injury to the plant and decreased soil water potentials on burned sites.

In terms of tree encroachment, grasslands change to forests along a boundary that is not a clean line but a mix of grasslands with a few trees to forests with fingers of grasslands or grassland patches. Studies in British Columbia have noted that trees seem to have been growing out into the grasslands more rapidly in recent years (BC Grasslands 2009). Studies have shown increased invasion of Douglas fir and ponderosa pine in southern interior British Columbia grasslands (Yuguang et al. 2000). In addition, fescue grasslands are also being lost to invasion of quaking aspen and lodgepole pine (Henderson et al. 2002). By reducing the amount of light and moisture reaching the understory layer of herbs and shrubs, forest ingrowth and encroachment have had a profound negative effect on grassland composition. This creates an impoverished grass and forb community and reductions in plant diversity, forage production, and forage nutritive value. Forest ingrowth and encroachment progressively displaces both wild and domestic grazing animals from the ingrown areas and concentrates them on the remaining open grasslands, thus creating a cycle of overgrazing and subsequent weed invasion.

Western snowberry is one of the few woody plants that can successfully invade grasslands by means of rhizomes that produce aerial stems in quantities sufficient to shade out grasses and permit expansion of the colonies (Pelton 1953). The invasion of western snowberry colonies into grassland habitat may have been facilitated by the widespread practice of suppressing grassland wildfires over the past several decades (Manske 2006).

Once weed and woody species become established, season of fire and consistency of fire are critical components of returning fire to the landscape. Manske (2006) found that prescribed fires during August that occur on an every-other-year schedule over 14 years often resulted in the best scenarios for fescue grasslands. This fire schedule generally: 1) causes the least damage to native cool- and warm-season grasses and perennial forbs; 2) removes all or most of the top growth of western snowberry and results in fewer sucker shoots the following year than a spring burn; 3) results in greater declines of Kentucky bluegrass that increased during earlier burns; and 4) results in greater declines of weedy forbs that also increased greatly following spring burns. A minimum of four burns conducted every other year were required to significantly reduce introduced grasses, early succession and weedy forbs, and shrubs from a mixed grass prairie habitat. Unlike other studies, Manske also found that shoot frequency of both smooth brome and quackgrass was reduced most after early spring burns.

Quaking aspen is intolerant of fire but is well adapted to colonizing sites after fire. Root systems of top-killed aspen trees send up a profusion of sprouts for several years after a fire and fire exposed mineral soil provides an excellent seedbed for aspen. Repeated burning has been thought to promote suckering and result in dense stands, but eventually the aspen roots run out of resources. In many cases, spring is the only practical time to burn when fires are

controlled. Studies have found that repeated spring burns will eventually cause a significant reduction in sucker density (Veenstra and McLennan 2002). However, repeated fall burns at 1-2 year intervals to allow fuel build-up, have been found successful in reducing aspen and other woody plant cover (Veenstra and McLennan 2002). It also may be that fire alone is insufficient to control the invasion of quaking aspen. Some studies have had success with spraying sprouts with herbicide. Herbicides 2,4-D or fosamine (trade name Krenite) have shown to be effective for small saplings and root suckers when applied as a foliar spray (Veenstra and McLennan 2002). Fosamine kills only woody species and is non-volatile. Cutting aspen suckers is not recommended as an aspen control method due to the fact that suckers need to be slashed for 6 to 8 years to exhaust root carbohydrates. Girdling aspen is effective for mature trees but is not a recommended method for removing sprouts from a grassland system. It may be that prescribed burning, if possible to return to the landscape, in combination with herbicide control on suckers may offer the most effective approach for aspen control in fescue grasslands.

In contrast, other studies have shown that fire has little effect on spotted knapweed (Rangeland Ecosystems and Plants 2009). Depending on the heat of the fire, spotted knapweed will return to original populations or increase. Spring burning before native plants emerge may weaken spotted knapweed enough to increase the efficacy of herbicides. Spring burning is also better to control Canada bluegrass.

ACTION ITEMS: (1) Investigate returning prescribed fire to certain east side grasslands on a small-scale and monitor results. If fire is returned to certain problem areas, commitment for every-other-year fires should be considered for effective control of woody plants and weeds; (2) Investigate manual methods of removing woody material, both trees and shrubs, in certain grassland areas

D. Restoration

As more current studies are showing, multiple strategies are likely necessary to effectively manage fescue grassland systems, particularly those with past and current disturbance. As stated above, experimental treatments began in 2005 (Stanley et al. 2008) are beginning to document the benefits of combining several methods to restore a disturbed grassland. To date, combining sethoxydim, a grass-specific herbicide, with fall burning, a broadleaf herbicide, and finally the addition of a native seed mix, is showing the most dramatic results. The seeding of native species, once non-native species are controlled, is a critical step to restoring these grassland areas.

In the past two years at GNP, we have started a pilot project in a fescue grassland near the St. Mary Campground that could serve as a model for how to incorporate weed control and native plant restoration in these grassland systems. This area had very high cover of spotted knapweed but has been carefully sprayed in fall 2008 and spring 2009 and will be sprayed in fall 2009 before being seeded with a native seed mix of grassland species that have been effective in other restoration projects. Monitoring data includes pre-spraying and post-spraying and will follow the success of seeding this area once the spotted knapweed has been controlled. Many grassland species can be hand seeded effectively reducing the overall cost of using restoration as a management tool.

ACTION ITEMS: (1) Continue to investigate the combination of weed control, fire, and subsequent seeding of native grassland species to restore grasslands throughout the park; (2) investigate the use of grass-specific herbicides to control non-native grasses and follow with seeding of native grassland mix.

E. Monitoring

Finally, any areas that have a management action occurring should continue to be monitored. Management actions include weed control, woody plant control, the use of fire, removing cattle trespass, restoration, movement of a structure or development, addition of a structure or development, or other action that could impact the integrity of a nearby grassland. Weed surveys should continue in the grassland areas with high frequency. For each management action, objectives should be identified along with measurements to indicate when success is achieved.

The park may also want to consider a systematic way of resurveying these grassland areas over the years to determine their ongoing health status and any vegetation trends. Approximately 20 grassland areas could be monitored each year to continue to collect trend data on these sensitive habitats.

ACTION ITEMS: (1) Monitor any grassland area that has a new management action implemented to determine if management action is effective; (2) make fescue grassland areas a high priority for weed surveys and control; (3) consider systematic monitoring of the same grassland areas sampled in this study over time to document current status and trend.

Together the Fescue Grassland Management Matrix and the above recommendations should provide park staff with specific actions to focus on to protect Glacier's unique and sensitive grassland system.

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Table 7. Bird Species Recorded in Glacier National Park Eastside Grassland Bird Assessment (Bate 2000; Figure 8)

Pine Siskin	Northern Flicker
Savannah Sparrow	Red-breasted Nuthatch
White-crowned Sparrow	Red-winged Blackbird
Brown-headed Cowbird	Song Sparrow
American Robin	Clay-colored Sparrow
Ruby-crowned Kinglet	Chipping Sparrow
Yellow Warbler	Wilson's Warbler
Tree Swallow	Yellow-rumped Warbler
Warbling Vireo	Bank Swallow
Lincoln's Sparrow	Canada Goose
Swainson's Thrush	Cedar Waxwing
Common Snipe	Great Blue Heron
Fox Sparrow	Hairy Woodpecker
Willow Flycatcher	Lazuli Bunting
Dusky Flycatcher	LeConte's Sparrow
Least Flycatcher	Black-capped Chickadee
Olive-sided Flycatcher	Belted Kingfisher
MacGillivray's Warbler	Cordilleran Flycatcher
Red-naped Sapsucker	Common Loon
Northern Waterthrush	Common Merganser
Common Raven	Common Yellowthroat
Gray Jay	House Wren
Ruffed Grouse	Black-headed Grosbeak
Varied Thrush	Bald Eagle
Dark-eyed Junco	Western Wood Pewee
Steller's Jay	Barrow's Goldeneye
Western Tanager	Common Nighthawk
Mountain Bluebird	Golden-crowned Kinglet
Killdeer	Townsend's Warbler
Eastern Kingbird	Clark's Nutcracker
Golden Eagle	Orange-crowned Warbler
Spotted Sandpiper	Prairie Falcon
Barn Swallow	Red Crossbill
Violet-green Swallow	American Kestrel
Cliff Swallow	Brewer's Sparrow
Mountain Chickadee	Townsend's Solitaire
Vesper Sparrow	Blue Grouse
American Goldfinch	Hermit Thrush
Veery	Western Meadowlark
Yellow-headed Blackbird	Red-tailed Hawk
Black-billed Magpie	
Mallard	
Northern Harrier	

Table 8. Small mammals Recorded in Small Mammal Communities in Glacier National Park's Fescue Grasslands Assessment (Pearson 2004; Figure 9).

Yellow pine chipmunk	<i>Eutamias amoenus</i>
Long-tailed vole	<i>Microtus longicaudus</i>
Meadow vole	<i>Microtus pennsylvanicus</i>
Deer mouse	<i>Peromyscus maniculatus</i>
Montane heather vole	<i>Phenacomys intermedius</i>
Columbian ground squirrel	<i>Spermophilus columbianus</i>
Northern pocket gopher	<i>Thomomys talpoides</i>
Western jumping mouse	<i>Zapus princeps</i>

Figure 1. Map of Grassland Plot Locations Parkwide

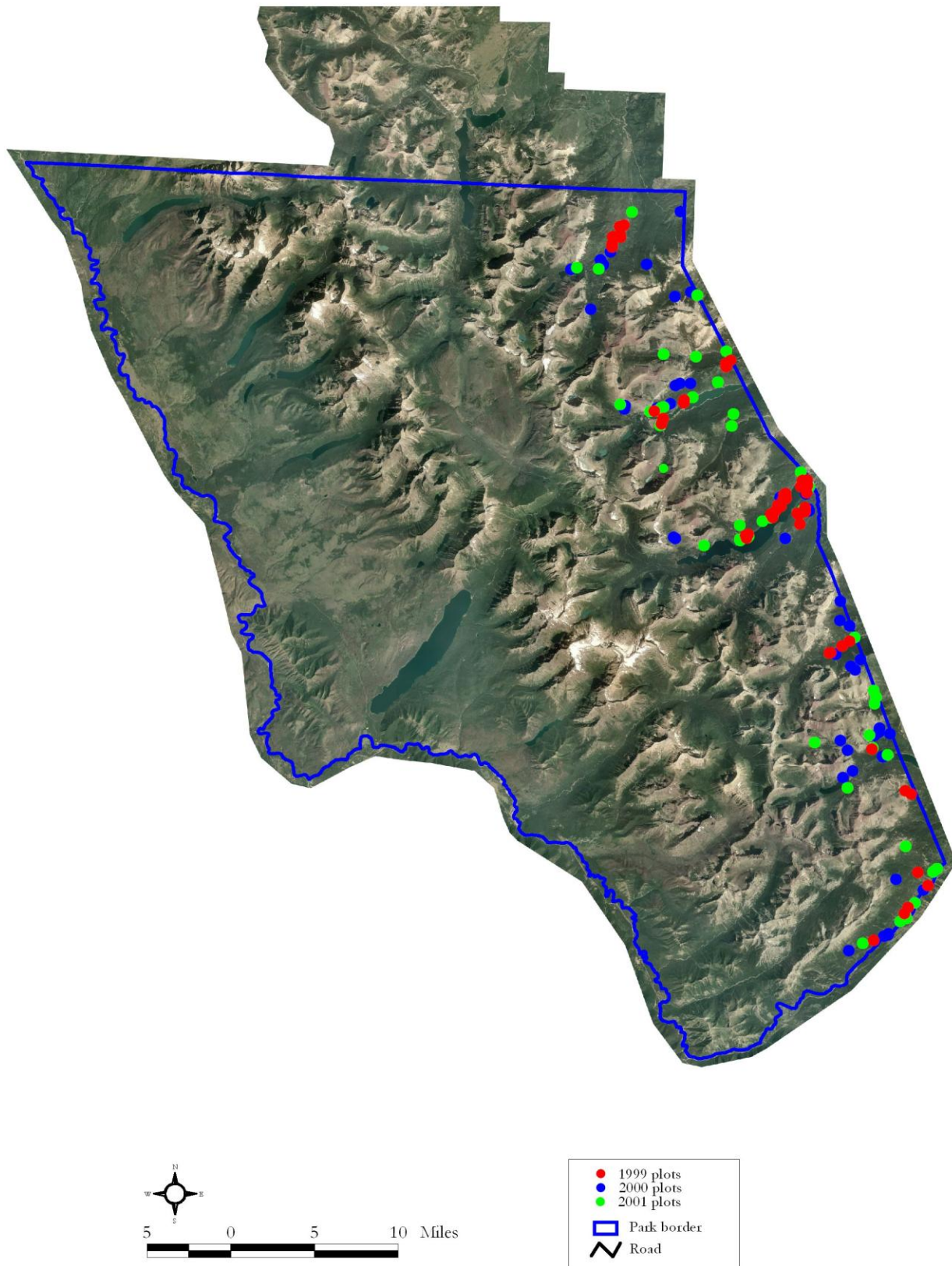


Figure 2. Map of Grassland Plot Locations in the Belly River Subdistrict

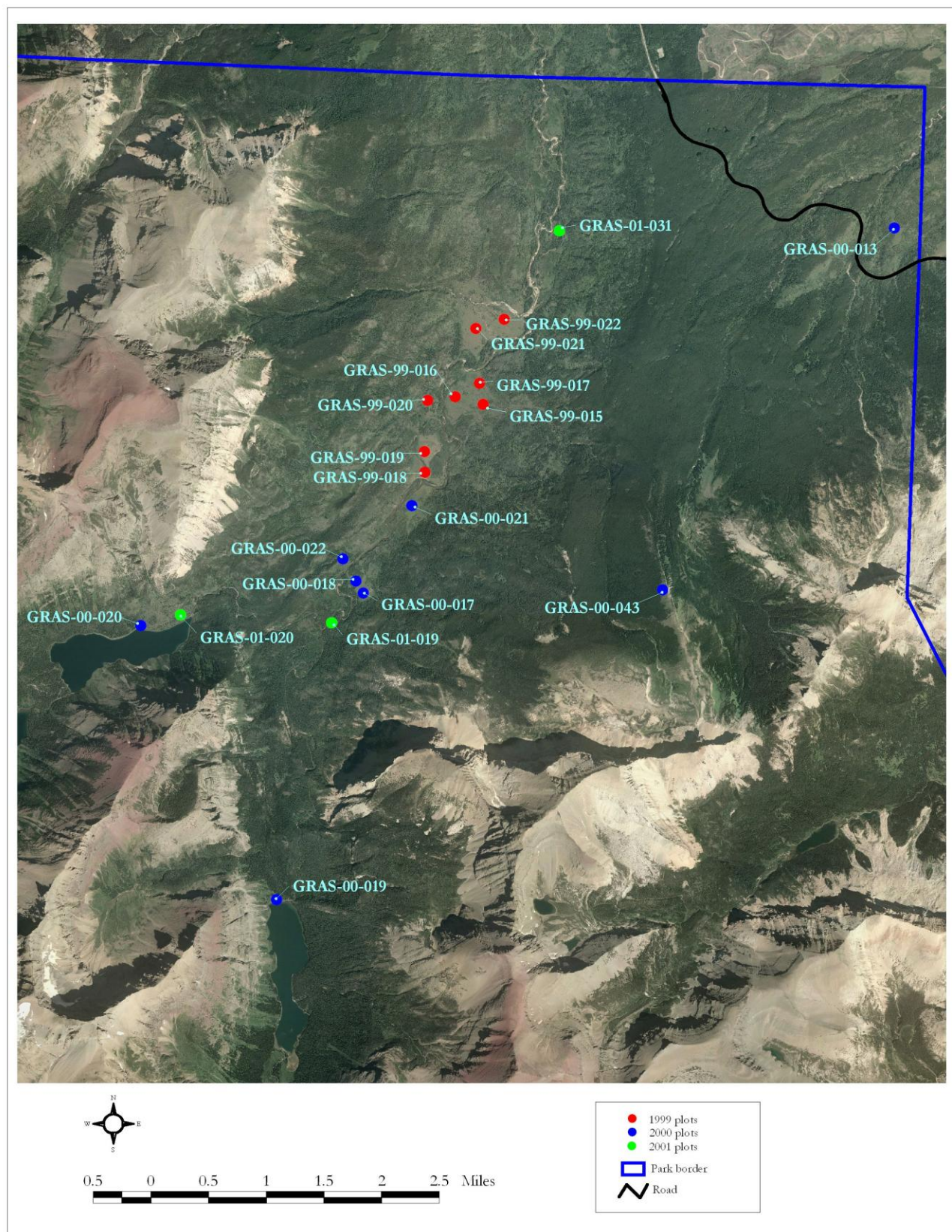
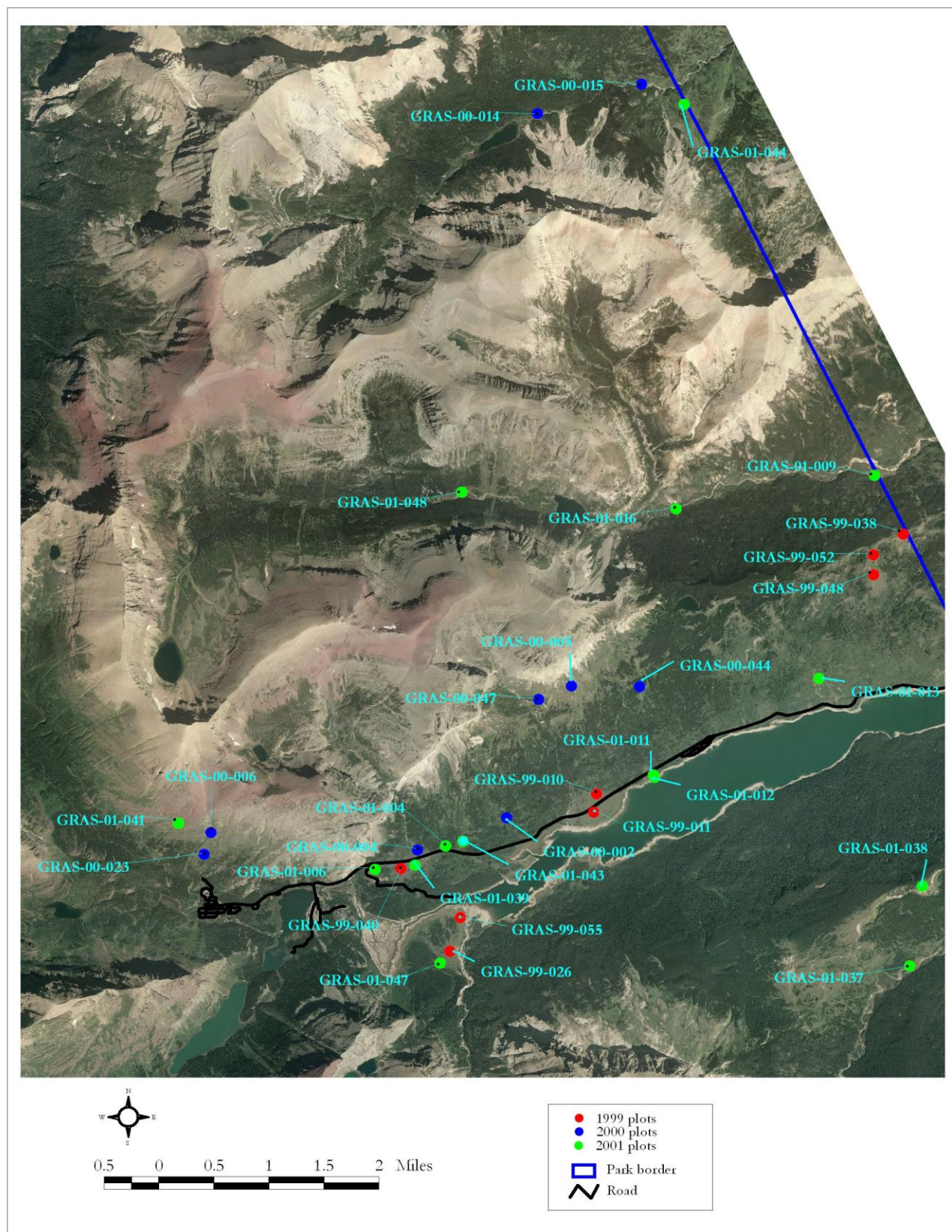


Figure 3. Map of Grassland Plot Locations in the Many Glacier Subdistrict



[illegible]

Figure 5. Map of Grassland Plot Locations in the Cut Bank Subdistrict

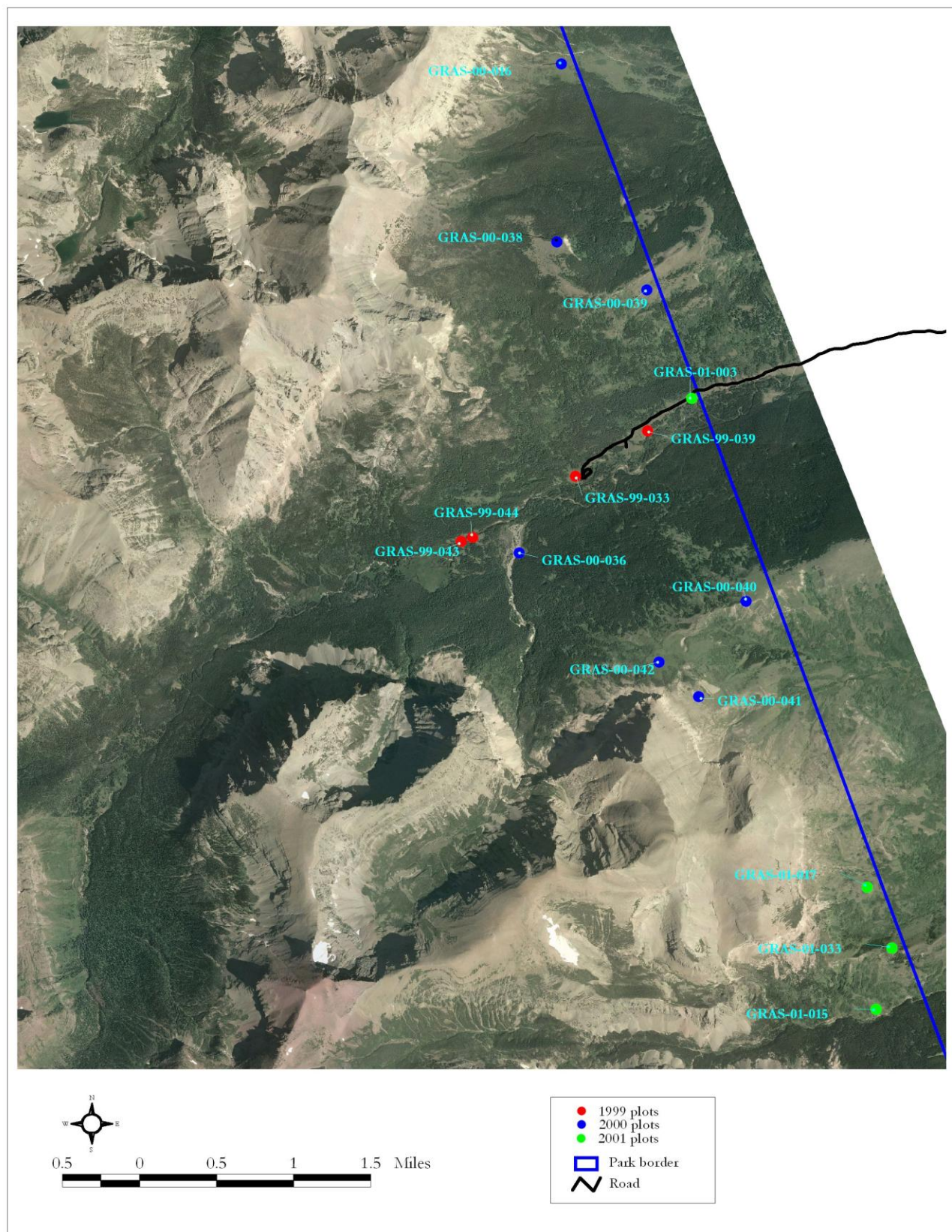


Figure 6. Map of Grassland Plot Locations in the Two Medicine Subdistrict

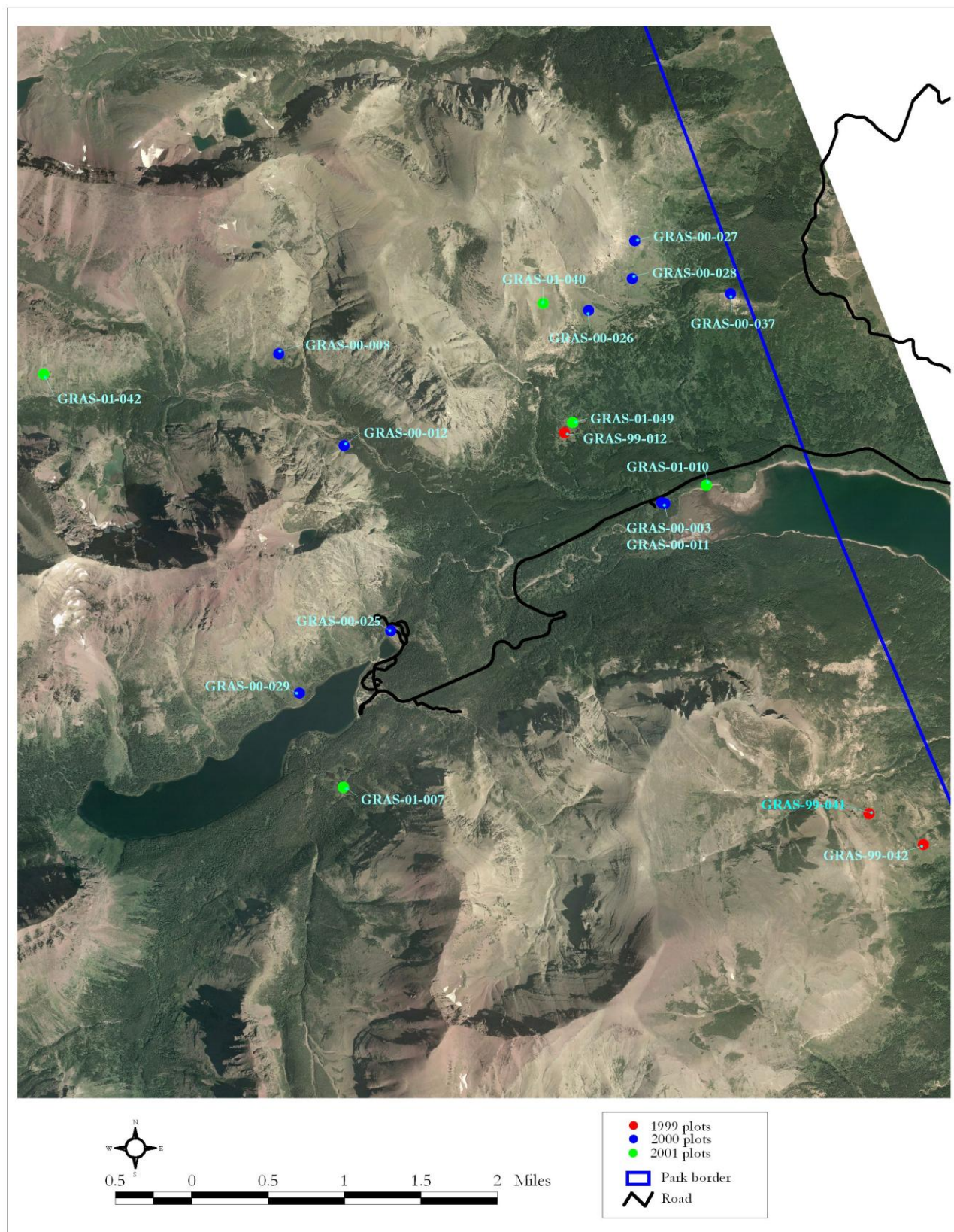


Figure 7. Map of Grassland Plot Locations in the Two Medicine/Highway 2 Area

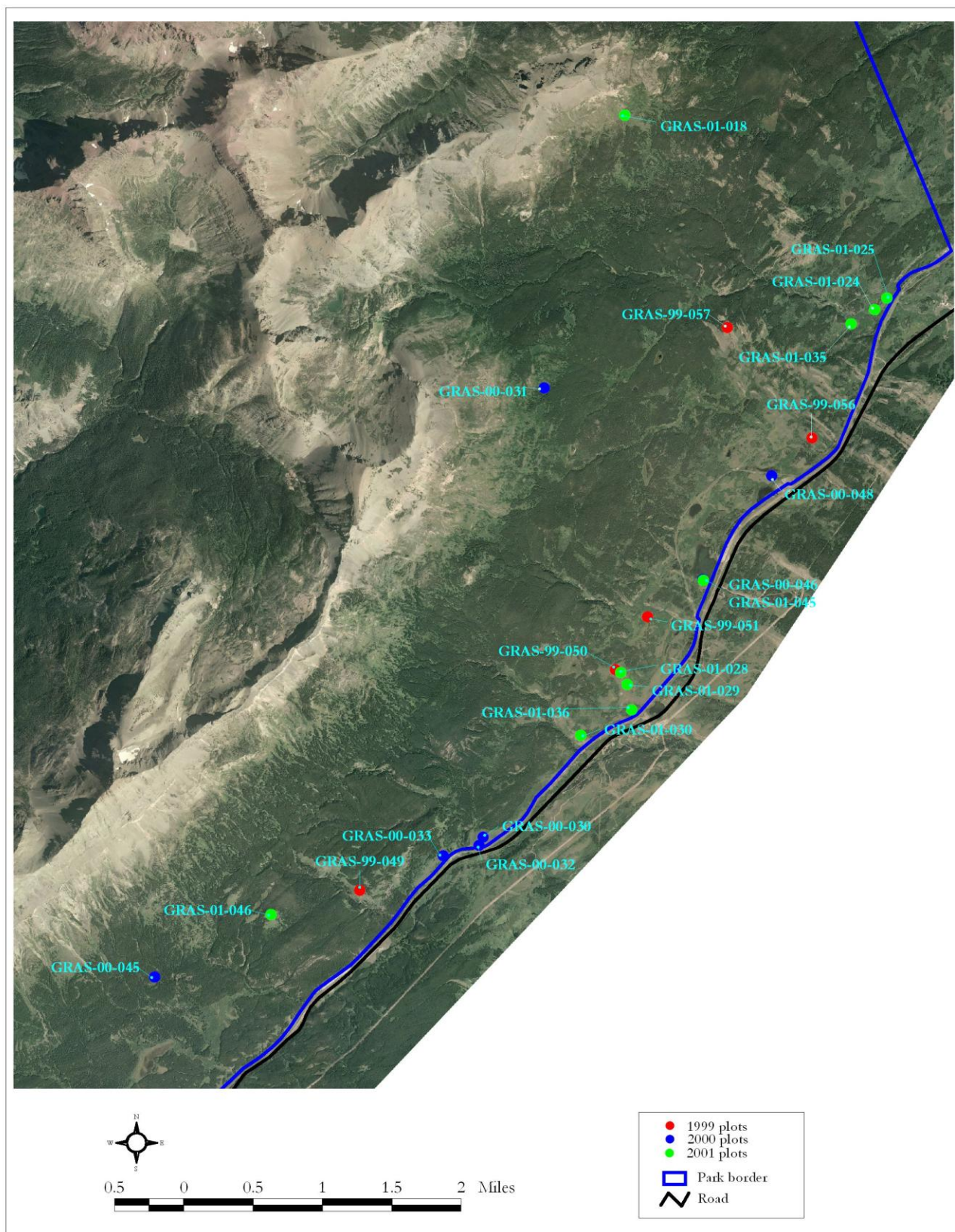


Figure 8. Map of Bird Point Count Site

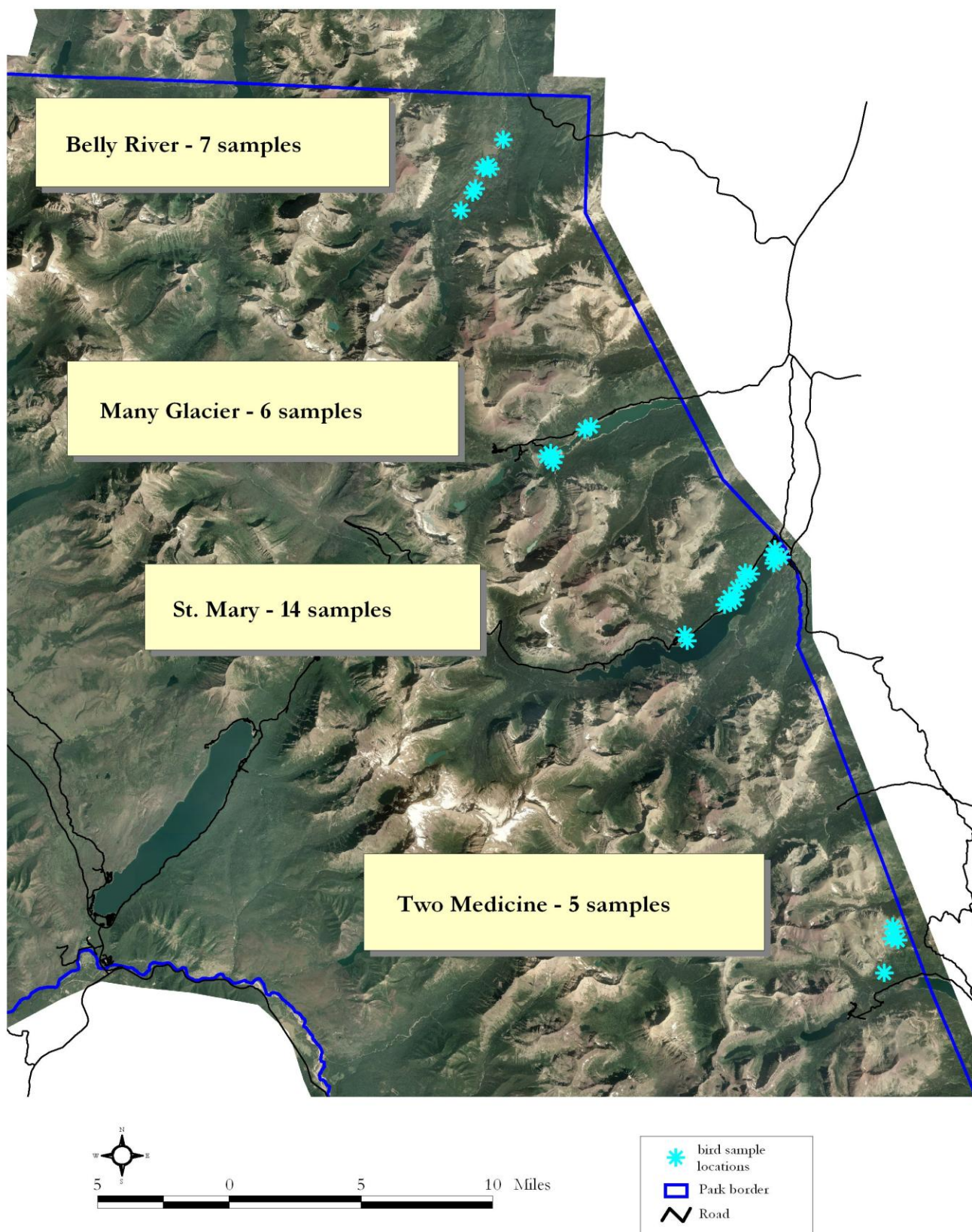


Figure 9. Map of Small Mammal Sampling Sites

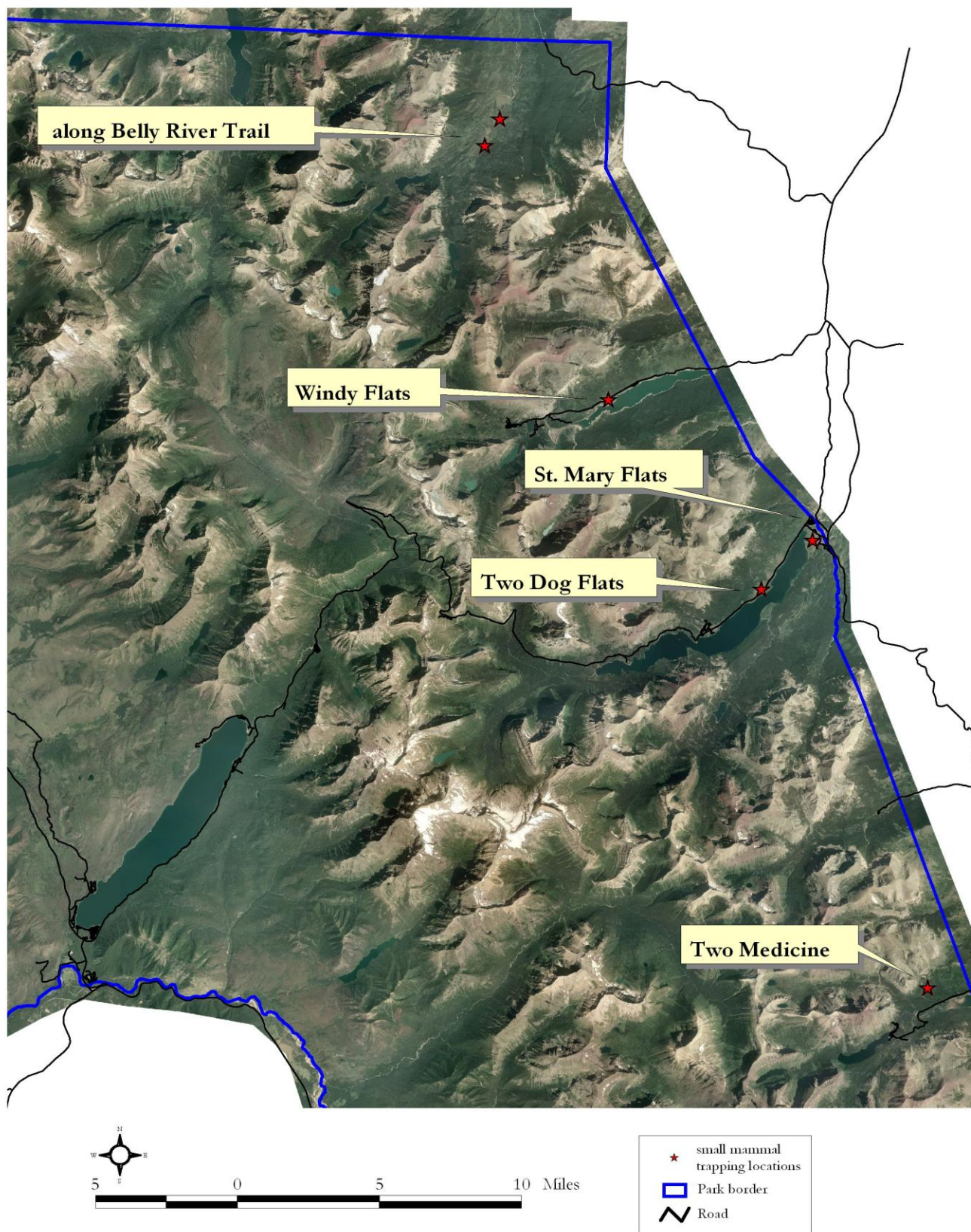
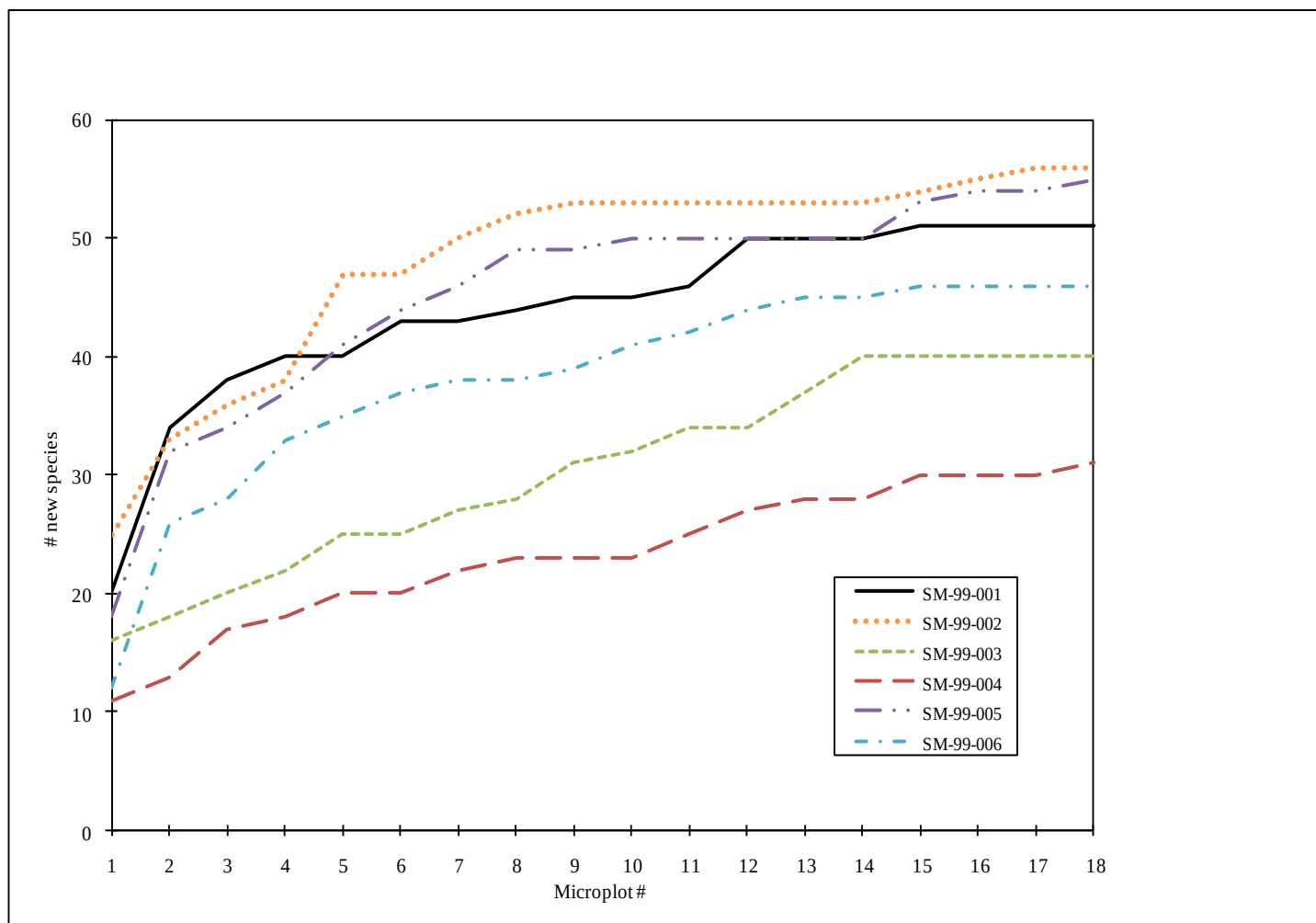


Figure 10. Species Area Curve Used to Determine Number of Monitoring Plots



Appendix A. Grassland Ecology Project: Master Species List, 1999-2001 (* = edge species)

Forbs

<i>Achillea millefolium</i>	<i>Balsamorhiza sagittata</i>	<i>Eriogonum ovalifolium</i>
<i>Agoseris aurantiaca</i>	<i>Besseyia wyomingensis</i>	<i>Eriogonum umbellatum</i>
<i>Agoseris glauca</i>	<i>Botrychium hesperium</i>	<i>Erysimum inconspicuum</i>
<i>Allium cernuum</i>	<i>Botrychium lunaria</i>	<i>Erythronium grandiflorum</i> *
<i>Allium schoenoprasum</i>	<i>Bupleurum americanum</i>	<i>Fragaria virginiana</i>
<i>Allium textile</i>	<i>Calochortus apiculatus</i>	<i>Gaillardia aristata</i>
<i>Anaphalis margaritacea</i>	<i>Camassia quamash</i>	<i>Galium boreale</i>
<i>Androsace lehmanniana</i>	<i>Campanula rotundifolia</i>	<i>Gentiana affinis</i>
<i>Androsace septentrionalis</i>	<i>Castilleja cusickii</i>	<i>Gentiana amarella</i>
<i>Anemone multifida</i>	<i>Castilleja hispida</i>	<i>Geranium richardsonii</i>
<i>Anemone patens (A. nuttalliana)</i>	<i>Castilleja lutescens</i>	<i>Geranium viscosissimum</i>
<i>Angelica arguta</i> *	<i>Castilleja miniata</i>	<i>Geum aleppicum</i>
<i>Angelica dawsonii</i> *	<i>Castilleja occidentalis</i>	<i>Geum macrophyllum</i>
<i>Antennaria alpina</i>	<i>Castilleja sulphurea</i>	<i>Geum rivale</i>
<i>Antennaria anaphaloides</i>	<i>Cerastium arvense</i>	<i>Geum triflorum</i>
<i>Antennaria racemosa</i>	<i>Chamerion angustifolium</i>	<i>Hackelia floribunda</i>
<i>Antennaria rosea (A. microphylla)</i>	<i>(Epilobium angustifolium)</i>	<i>Hackelia micrantha</i>
<i>Antennaria umbrinella</i>	<i>Cirsium hookerianum</i>	<i>Hedysarum alpinum</i>
<i>Apocynum androsaemifolium</i>	<i>Clematis columbiana</i>	<i>Hedysarum boreale</i>
<i>Aquilegia flavescens</i>	<i>Coeloglossum viride (Habenaria viridis)</i>	<i>Hedysarum sulphurea</i>
<i>Aquilegia jonesii</i>	<i>Collinsia parviflora</i>	<i>Heracleum spondylium (H. lanatum)</i> *
<i>Arabis divaricarpa</i>	<i>Collomia linearis</i>	<i>Heterotheca villosa (Chrysopsis villosa)</i>
<i>Arabis drummondii</i>	<i>Comandra umbellata</i>	<i>Heuchera cylindrica</i>
<i>Arabis glabra</i>	<i>Cornus canadensis</i> *	<i>Heuchera parvifolia</i>
<i>Arabis hirsuta</i>	<i>Crepis elegans</i>	<i>Hieracium albertinum</i>
<i>Arabis holboellii</i>	<i>Crepis intermedia</i>	<i>Hieracium albiflorum</i>
<i>Arabis nuttallii</i>	<i>Cryptantha celosoides</i>	<i>Hieracium umbellatum</i>
<i>Arenaria capillaris</i>	<i>Delphinium bicolor</i>	<i>Hydrophyllum capitatum</i> *
<i>Arnica alpina</i>	<i>Dodecatheon conjugens</i>	<i>Iliamna rivularis</i> *
<i>Arnica chamissonis</i>	<i>Douglasia montana</i>	<i>Iris missouriensis</i>
<i>Arnica parryi</i> *	<i>Draba albertina</i>	<i>Lathyrus ochroleucus</i>
<i>Arnica rydbergii</i>	<i>Draba aurea</i>	<i>Linum lewisii</i>
<i>Arnica sororia</i>	<i>Draba nemorosa</i>	<i>Lithophragma parviflora</i>
<i>Artemisia frigida</i>	<i>Draba oligosperma</i>	<i>Lithospermum ruderae</i>
<i>Artemisia ludoviciana</i>	<i>Dryas octopetala</i>	<i>Lomatium dissectum</i>
<i>Aster conspicuus</i> *	<i>Epilobium brachycarpum</i>	<i>Lomatium macrocarpum</i>
<i>Aster engelmannii</i> *	<i>Epilobium halleianum</i>	<i>Lomatium triternatum</i>
<i>Aster laevis</i>	<i>Equisetum arvense</i>	<i>Lupinus sericeus</i>
<i>Astragalus adsurgens</i>	<i>Equisetum hyemale</i>	<i>Maianthemum racemosa (Smilacina racemosa)</i> *
<i>Astragalus agrestis</i>	<i>Equisetum laevigatum</i>	<i>Maianthemum stellata (Smilacina stellata)</i>
<i>Astragalus alpinus</i>	<i>Erigeron caespitosus</i>	<i>Microseris nutans</i>
<i>Astragalus australis</i>	<i>Erigeron compositus</i>	<i>Microsteris gracilis</i>
<i>Astragalus bourgovii</i>	<i>Erigeron speciosus</i>	<i>Minuartia nuttallii (Arenaria nuttallii)</i>
<i>Astragalus crassicaulus</i>	<i>Erigeron subtrinervis</i>	<i>Minuartia obtusiloba (Arenaria obtusiloba)</i>
<i>Astragalus tenellus</i>	<i>Eriogonum flavum</i>	<i>Minuartia rubella (Arenaria rubella)</i>

Appendix A con'd. Grassland Ecology Project: Master Species List, 1999-2001 (* = edge species)

Forbs, con'd

<i>Moebria lateriflora</i>	<i>Senecio canus</i>
(<i>Arenaria lateriflora</i>)	<i>Senecio integerrimus*</i>
<i>Monarda fistulosa</i>	<i>Senecio pauperculus</i>
<i>Myosotis sylvatica</i>	<i>Senecio pseudoreus</i>
<i>Nemophila breviflora</i>	<i>Senecio streptanthifolius</i>
<i>Orthocarpus luteus</i>	<i>Senecio triangularis*</i>
<i>Orthocarpus tenuifolius</i>	<i>Silene acaulis</i>
<i>Osmorhiza chilensis*</i>	<i>Silene parryi</i>
<i>Oxytropis borealis</i>	<i>Sisyrinchium montanum</i>
<i>Oxytropis campestris</i>	<i>Smelowskia calycina</i>
<i>Oxytropis splendens</i>	<i>Solidago canadensis*</i>
<i>Pedicularis bracteosa*</i>	<i>Solidago missouriensis</i>
<i>Pedicularis contorta</i>	<i>Solidago multiradiata</i>
<i>Pedicularis groenlandica</i>	<i>Solidago spatulata</i>
<i>Penstemon albertinus*</i>	<i>Spiranthes romanoffiana</i>
<i>Penstemon confertus</i>	<i>Stellaria americana</i>
<i>Penstemon nitidus</i>	<i>Stellaria borealis</i>
<i>Penstemon procerus</i>	<i>Stellaria longipes</i>
<i>Perideridia gairdneri</i>	<i>Thalictrum occidentale</i>
<i>Phacelia hastata</i>	<i>Townsendia parryi</i>
<i>Phacelia sericea</i>	<i>Urtica dioica*</i>
<i>Phlox abyssifolia</i>	<i>Valeriana dioica</i>
<i>Phlox hoodii</i>	<i>Valeriana sitchensis</i>
<i>Polemonium pulcherrimum</i>	<i>Veratrum viride*</i>
<i>Polygonum bistortoides</i>	<i>Veronica serpyllifolia*</i>
<i>Polygonum douglasii</i>	<i>Veronica wormskeoldii</i>
<i>Polygonum viviparum</i>	<i>Vicia americana</i>
<i>Potentilla glandulosa</i>	<i>Viola adunca</i>
<i>Potentilla gracilis</i>	<i>Viola canadensis*</i>
<i>Potentilla hippiana</i>	<i>Viola glabella*</i>
<i>Potentilla ovina</i>	<i>Viola nuttallii</i>
<i>Potentilla pensylvanica</i>	<i>Viola orbiculata*</i>
<i>Prunella vulgaris</i>	<i>Xerophyllum tenax*</i>
<i>Pyrrocoma carthamoides</i>	<i>Zigadenus elegans</i>
(<i>Haplopappus carthamoides</i>)	<i>Zigadenus venenosus</i>
<i>Ranunculus abortivus</i>	<i>Zizia aptera</i>
<i>Ranunculus flammula</i>	
<i>Ranunculus glaberrimus</i>	Grasses
<i>Rhinanthus crista-galli</i>	<i>Agrostis scabra</i>
<i>Rumex acetosa</i>	<i>Alopecurus aequalis</i>
<i>Saxifraga bronchialis</i>	<i>Alopecurus alpinus</i>
<i>Saxifraga rhomboidea</i>	<i>Bromus carinatus</i>
<i>Saxifraga subapetala</i>	<i>Bromus pumpellianus</i>
<i>Sedum lanceolatum</i>	<i>Calamagrostis canadensis</i>
<i>Sedum stenopetalum</i>	<i>Calamagrostis purpurescens</i>
<i>Selaginella densa</i>	<i>Calamagrostis rubescens</i>
<i>Selaginella scopulorum</i>	<i>Carex aurea</i>
<i>Selaginella standleyi</i>	<i>Carex concinnoides</i>

Grasses, con'd

<i>Carex filifolia</i>
<i>Carex geyeri</i>
<i>Carex hoodii</i>
<i>Carex microptera</i>
<i>Carex obtusata</i>
<i>Carex petasata</i>
<i>Carex raynoldsii</i>
<i>Carex rossii</i>
<i>Carex scirpoidea</i>
<i>Danthonia intermedia</i>
<i>Danthonia parryi</i>
<i>Deschampsia cespitosa</i>
<i>Elymus elymoides</i>
<i>Elymus glaucus*</i>
<i>Elymus innovatus</i>
<i>Elymus lanceolatus</i>
<i>Elymus smithii</i>
<i>Elymus spicatus</i>
<i>Elymus trachycaulus v. subsecundus</i>
(<i>Agropyron caninum v. majus</i>)
<i>Elymus trachycaulus v. trachycaulus</i>
(<i>Agropyron caninum v. unilaterale</i>)
<i>Festuca campestris</i>
<i>Festuca idahoensis</i>
<i>Festuca occidentalis</i>
<i>Festuca saximontana (Festuca ovina)</i>
<i>Helictotrichon hookeri</i>
<i>Juncus balticus</i>
<i>Koeleria montanum (K. cristata)</i>
<i>Luzula campestris</i>
<i>Luzula spicata</i>
<i>Melica spectabilis</i>
<i>Melica subulata*</i>
<i>Muhlenbergia richardsonis</i>
<i>Oryzopsis exigua</i>
<i>Phalaris arundinacea*</i>
<i>Phleum alpinum</i>
<i>Poa alpina</i>
<i>Poa nervosa</i>
<i>Poa palustris*</i>
<i>Poa secunda</i>
<i>Stipa nelsonii (Stipa occidentalis)</i>
<i>Stipa richardsonii</i>
<i>Trisetum canescens</i>
<i>Trisetum cernuum*</i>
<i>Trisetum spicatum</i>
<i>Trisetum wolfii</i>

Appendix A con'd. Grassland Ecology Project: Master Species List, 1999-2001 (* = edge species)

Shrubs

Amelanchier alnifolia
Arctostaphylos uva-ursi
Artemisia campestris
Artemisia frigida
Artemisia michauxiana
Ceanothus velutinus
*Cornus stolonifera**
*Crataegus douglasii**
Dasiphora floribunda
(Potentilla fruticosa)
*Elaeagnus commutata**
Juniperus communis
Juniperus horizontalis
*Lonicera involucrata**
*Lonicera utabensis**
Mahonia repens
*Pachistima myrsinites**
Prunus virginiana
*Rhamnus alnifolia**
*Ribes lacustre**
*Ribes viscosissimum**
Rosa acicularis
Rosa gymnocarpa
Rosa woodsii
Rubus idaeus
*Rubus parviflorus**
*Shepherdia canadensis**
Sorbus spp.
Spiraea betulifolia
*Symphoricarpos albus**
Vaccinium caespitosum
*Vaccinium membranaceum**

Trees

Abies lasiocarpa
*Acer glabrum**
*Betula occidentalis**
*Pinus contorta**
Populus tremuloides
*Populus trichocarpa**
*Pseudotsuga menziesii**
*Salix spp.**

Mosses and Lichens

Peltigera spp.
Polytrichum juniperinum
Thamnochloa vermicularis
Tortula ruralis

Exotic grasses

*Agrostis alba**
Bromus inermis
Bromus tectorum
Dactylis glomerata
Elymus repens
Phleum pratense
Poa compressa
Poa pratensis

Exotic forbs

Alyssum alyssoides
Capsella bursa-pastoris
Centaurea maculosa
Chrysanthemum leucanthemum
Cirsium arvense
Descurainia sophia
Dianthus barbatus
Erysimum cheiranthoides
Euphorbia esula
Linaria vulgaris
Lycnis alba
Medicago lupulina
Melilotus officinalis
Ranunculus acris
Rumex acetosella
Rumex crispus
Tanacetum vulgare
Taraxacum officinale
Thlaspi arvense
Tragopogon dubius
Trifolium agrarium
Trifolium hybridum
Trifolium pratense
Trifolium repens
Verbascum thapsus

Appendix B. Codes used in Appendices B, C, and D

4-letter code	6-letter code	Scientific name	Common name
Trees			
ABLA	ABILAS	<i>Abies lasiocarpa</i>	subalpine fir
PIEN	PICENG	<i>Picea engelmannii</i>	Engelmann spruce
PIAL	PINALB	<i>Pinus albicaulis</i>	whitebark pine
PICO	PINCON	<i>Pinus contorta</i>	lodgepole pine
PIFL	PINFLE	<i>Pinus flexilis</i>	limber pine
POTR	POPTRE	<i>Populus tremuloides</i>	quaking aspen
POTRI	POPTRI	<i>Populus trichocarpa</i>	black cottonwood
PSME	PSEMEN	<i>Pseudotsuga menziesii</i>	Douglas fir
Shrubs			
AMAL	AMEALN	<i>Amelanchier alnifolia</i>	western serviceberry
ARUV	ARCUVA	<i>Arctostaphylos uva-ursi</i>	kinnikinnick
DAFL	DASFLO	<i>Dasiphora floribunda</i>	shrubby cinquefoil
DROC	DRYOCT	<i>Dryas octopetala</i>	white mountain avens
MARE	MAHREP	<i>Mahonia repens</i>	Oregon grape
PRVI	PRUVIR	<i>Prunus virginiana</i>	common chokecherry
ROSE	ROSA	<i>Rosa spp.</i>	rose
ROAC	ROSACI	<i>Rosa acicularis</i>	prickly rose
ROWO	ROSWOO	<i>Rosa woodsii</i>	Wood's rose
SPBE	SPIBET	<i>Spiraea betulifolia</i>	birch-leaved spiraea
SYAL	SYMALB	<i>Symphoricarpos albus</i>	snowberry
VACA	VACCAE	<i>Vaccinium caespitosum</i>	dwarf huckleberry
Weeds			
CEMA	CENMAC	<i>Centaurea maculosa</i>	spotted knapweed
CHLE	CHRLEU	<i>Chrysanthemum leucanthemum</i>	oxeye daisy
CIAR	CIRARV	<i>Cirsium arvense</i>	Canada thistle
CYOF	CYNOFF	<i>Cynoglossum officinale</i>	houndstongue
EUES	EUPESU	<i>Euphorbia esula</i>	leafy spurge
HIAU	HIEAUR	<i>Hieracium aurantiacum</i>	orange hawkweed
HIPR	HIEPRA	<i>Hieracium pratense</i>	meadow hawkweed
HYPE	HYPPER	<i>Hypericum perforatum</i>	St. Johnswort
LIDA	LINDAL	<i>Linaria dalmatica</i>	dalmatian toadflax
LIVU	LINVUL	<i>Linaria vulgaris</i>	yellow toadflax
PORE	POTREC	<i>Potentilla recta</i>	sulfur cinquefoil
RAAC	RANACR	<i>Ranunculus acris</i>	tall buttercup

Insert Appendix B. Fescue Grassland Management Matrix

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Appendix C-1. Management Action Items for more pristine grassland areas.

Plot	Association	Location	Ecological Total	Stressor Total	Threat Total	Total	action 1	action 2	action 3	action 4
00-005	fesida-fescam-potdiv	Apikuni Mt.	1	0	0	1	monitor			
01-018	arcuva-fescam-fesida	Dancing Lady	2	0	0	2	monitor			
99-041	arcuva-fescam-fesida	SE Scenic Pt	3	0	0	3	monitor			
01-040	fesida-fescam-potdiv	Spot Mt	3	0	0	3	monitor			
00-034	arcuva-fescam-fesida	Baring Basin	4	0	0	4	monitor			
00-047	arcuva-fescam-fesida	Apikuni Mt	4	0	0	4	monitor			
01-032	arcuva-fescam-fesida	Otokomi	4	0	0	4	monitor			
01-042	fesida-fescam-potdiv	Red Mt W	4	0	0	4	monitor			
99-042	arcuva-fescam-fesida	SE Scenic Pt	5	0	0	5	monitor			
00-007	dasflo-fescam	Red E beaver S	5	0	0	5	monitor			
00-035	arcuva-fescam-fesida	Baring Basin	5	0	0	5	monitor			
00-043	dryoct/polviv	Lee Ridge	5	0	0	5	monitor			
00-029	arcuva-fescam-fesida	TM Aval chute	7	0	0	7	monitor			
99-018	fesida-fescam-gervis	N of Belly R RS	8	0	0	8	monitor			
00-028	arcuva-fescam-fesida	SE Spot	2	1	0	3	remove livestock trespass			
00-026	arcuva-fescam-fesida	SE Spot	3	1	0	4	remove livestock trespass			
00-027	fesida-fescam-potdiv	Spot Mt	3	1	0	4	remove livestock trespass			
00-041	dryoct/polviv	Mad Wolf	2	3	0	5	remove livestock trespass			
99-032	fesida-fescam-gervis	2 Dog 3	3	0	2	5	remove nearby CEMA, CIAR, LIVU			
00-008	arcuva-fescam-fesida	E Red Mt	3	0	2	5	deal with tree encroachment	deal with AMAL encroachment		
01-038	fesida-fescam-potdiv	Boulder R	3	1	1	5	remove livestock trespass	deal with tree encroachment		
00-037	fesida-fescam-potdiv	Looking Glass	3	1	1	5	remove livestock trespass	deal with tree encroachment		
00-039	fesida-fescam-potdiv	Milk R Ridge	3	1	1	5	remove livestock trespass	deal with tree encroachment		
01-033	fesida-fescam-potdiv	CB Lake Ck	3	2	0	5	remove livestock trespass			
00-006	arcuva-fescam-fesida	Henkel base	4	0	1	5	deal with high cover of AMAL, SPBE, VACA			
99-026	fescam-fesida	Cracker Flats	4	0	1	5	deal with tree encroachment			
99-057	arcuva-fescam-fesida	S RR Ck	3	2	1	6	remove livestock trespass	deal with tree encroachment		
00-016	arcuva-fescam-fesida	White Calf	3	2	1	6	remove livestock trespass	deal with tree encroachment		
00-022	arcuva-fescam-fesida	Belly River susp brdg	3	0	3	6	remove nearby HIAU, HIPR	deal with tree encroachment	deal with AMAL, ROAC encroachment	
00-030	dasflo-fescam	E Marias P	3	1	2	6	remove livestock trespass	remove CEMA in grassland	deal with tree encroachment	
00-042	arcuva-fescam-fesida	Mad Wolf	3	3	0	6	remove livestock trespass			
99-005	fesida-fescam-gervis	2 Dog 1A	4	1	1	6	remove CEMA in grassland	remove nearby CIAR		
99-008	fesida-fescam-gervis	2 Dog 2	4	0	2	6	remove nearby CEMA, CIAR, HYPE, HIAU			
00-014	arcuva-fescam-fesida	L Slide Lk	4	1	1	6	remove periodic livestock trespass	deal with tree encroachment		

Appendix C-1 con'd. Management Action Items for more pristine grassland areas.

Plot	Association	Location	Ecological Total	Stressor Total	Threat Total	Total	action 1	action 2	action 3	action 4
00-044	arcuva-fescam-fesida	Apikuni Mt	4	1	1	6	remove periodic livestock trespass	deal with tree encroachment		
99-035	fesida-fescam-gervis	Red Eagle LO	4	0	2	6	remove nearby CEMA, CIAR	deal with tree encroachment		
00-023	fesida-fescam-gervis	Henkel base	4	0	2	6	remove nearby CEMA, LIVU	deal with SPBE, SYAL, VACA, AMAL encroachment		
00-038	fesida-fescam-potdiv	Kup Rdg	4	0	2	6	deal with tree encroachment			
01-041	arcuva-fescam-fesida	Henkel base	4	0	2	6	remove LIVU downslope	deal with high cover of AMAL, SPBE		
99-002	fesida-fescam-gervis	2 Dog 1	5	0	1	6	remove nearby CEMA, CIAR			
01-044	fesida-fescam-gervis	Yellow Mt	5	1	0	6	remove livestock trespass			
99-025	fescam-fesida	Rising Sun	3	1	3	7	remove CEMA in grassland	remove nearby LIVU, HYPE, CIAR, CHLE, PORE	deal with tree encroachment	
01-017	fesida-fescam-potdiv	Mad Wolf	3	3	1	7	remove livestock trespass	deal with tree encroachment		
99-012	fesida-fescam-potdiv	Dry Fork	4	0	3	7	remove nearby CIAR	deal with tree encroachment		
99-013	fesida-fescam-gervis	2 Dog 3	4	0	3	7	remove nearby CEMA, LIVU, CIAR, HIAU	deal with high cover of ROWO, AMAL, DAFL, PRVI		
01-039	arcuva-fescam-fesida	Apikuni Flats	4	0	3	7	remove nearby CEMA, LIVU, CIAR	deal with tree encroachment		
99-050	arcuva-fescam-fesida	S Lubec RS	4	2	1	7	remove livestock trespass	remove nearby CEMA, CIAR		
99-052	fesida-fescam-gervis	Swiftc. Ridge	4	1	2	7	remove livestock trespass	remove CEMA in grassland	deal with tree encroachment	
01-028	fesida-fescam-gervis	W Firebr TH	4	1	2	7	remove livestock trespass	remove nearby CEMA, CIAR	deal with tree encroachment	
01-043	arcuva-fescam-fesida	Poia Lk W	4	1	2	7	deal with nearby CEMA, LIVU	deal with tree encroachment	monitor impact of human /horse trail through meadow	
99-001	fesida-fescam-gervis	2 Dog 1	5	1	1	7	remove CEMA in grassland	remove nearby CIAR		
99-031	fesida-fescam-gervis	1913 RS	5	0	2	7	remove CEMA in grassland	deal with tree encroachment		
00-010	fesida-fescam-gervis	1913 RS	5	0	2	7	remove CEMA in grassland	deal with tree encroachment		
01-005	fesida-fescam-gervis	2 Dog 4	5	0	2	7	remove CEMA in grassland	deal with tree encroachment		
01-011	fesida-fescam-gervis	Sherburne	5	1	1	7	remove livestock trespass	remove CEMA in grassland		
01-021	fesida-fescam-gervis	2 Dog 3	5	0	2	7	remove nearby CEMA, CIAR, LIVU			
00-020	fesida-fescam-gervis	Cosley Lk	6	0	1	7	deal with tree encroachment			
01-046	fesida-fescam-gervis	Autumn Ck	6	0	1	7	deal with tree encroachment			
99-027	fescam-fesida	St. Mary Flats	4	2	2	8	remove CEMA in grassland	remove nearby LIVU, HYPE, CIAR, CHLE		
00-040	fesida-fescam-potdiv	Cut Bank Ridge	4	4	0	8	remove livestock trespass	remove ability for ranchers to drive on meadow		

Appendix C-1 con'd. Management Action Items for more pristine grassland areas.

Plot	Association	Location	Ecological Total	Stressor Total	Threat Total	Total	action 1	action 2	action 3	action 4
01-016	fesida-fescam-gervis	Poia below	4	2	2	8	remove livestock trespass	remove nearby CIAR, CYOF	deal with tree encroachment	
99-011	fescam-fesida	Windy Creek	5	0	3	8	remove CEMA, EUES, LIVU in grassland	deal with tree encroachment		
99-015	arcuva-fescam-fesida	Veldt	5	0	3	8	remove nearby CIAR, CHLE	deal with tree encroachment		
01-010	fesida-fescam-gervis	Lower 2 Med Lk	5	1	2	8	remove livestock trespass	deal with tree encroachment	deal with ROSE, AMAL, SYAL, PRVI encroachment	
01-030	fesida-fescam-gervis	Lucke's	5	2	1	8	remove livestock trespass	remove nearby CEMA		
99-019	fesida-fescam-gervis	N of Belly River RS	6	0	2	8	remove nearby CIAR	deal with tree encroachment		
99-021	fesida-fescam-gervis	BR 3-mile	6	0	2	8	deal with tree encroachment			
00-001	fesida-fescam-gervis	2 Dog 1B	6	0	2	8	remove nearby CEMA, CIAR	deal with tree encroachment		
01-003	fesida-fescam-gervis	Cut Bank boundary	6	1	1	8	remove livestock trespass	remove nearby CEMA, CIAR		
01-047	fesida-fescam-gervis	Cracker Flats	6	1	1	8	remove concessioner horse grazing	deal with tree encroachment		
01-050	arcuva-fescam-fesida	Goat Mt	6	0	2	8	remove nearby CEMA, CHLE, CIAR, HYPE			
01-037	fesida-fescam-gervis	Boulder Ck	7	1	0	8	remove periodic livestock trespass			
99-053	fescam-fesida	St. Mary Flats	7	0	1	8	remove nearby CEMA, CIAR			
00-012	fesida-fescam-gervis	Oldman Tr	7	0	1	8	deal with tree encroachment			
01-029	arcuva-fescam-fesida	W Firebrand TH	4	1	4	9	remove livestock trespass	remove nearby CEMA, CIAR, CYOF	deal with tree encroachment	deal with AMAL, ROAC encroachment
01-049	arcuva-fescam-fesida	Dry Fork Tr	4	1	4	9	remove livestock trespass	remove nearby CIAR	deal with tree encroachment	deal with ROAC, SPBE, AMAL, SYAL encroachment
99-010	fesida-fescam-gervis	Windy Creek	6	0	3	9	remove nearby CEMA, CIAR, LIVU, EUES	deal with tree encroachment		
99-046	fesida-fescam-gervis	Red Eagle N	6	0	3	9	remove nearby CEMA, CIAR, CHLE	deal with tree encroachment		
00-004	fesida-fescam-gervis	Apikuni Flats	6	0	3	9	remove LIVU, CEMA, CIAR in grassland	deal with tree encroachment		
00-015	fesida-fescam-gervis	Slide Lake	6	1	2	9	remove livestock trespass	remove CIAR in grassland	deal with tree encroachment	
01-020	arcuva-fescam-fesida	Cosley Lake	6	1	2	9	remove park stock grazing	remove nearby RAAC, CIAR	deal with tree encroachment	
01-034	fesida-fescam-gervis	Red Eagle frog ponds	6	0	3	9	remove CEMA, CHLE, CIAR in grassland	deal with tree encroachment		
99-020	fesida-fescam-gervis	N of Belly R RS	7	0	2	9	deal with tree encroachment			
99-034	dasflo-fescam	Red Eagle	7	0	2	9	remove nearby CEMA, CIAR	deal with tree encroachment		

Appendix C-1 con'd. Management Action Items for more pristine grassland areas.

Plot	Association	Location	Ecological Total	Stressor Total	Threat Total	Total	action 1	action 2	action 3	action 4
00-025	fesida-fescam-potdiv	Pray Lake	7	0	2	9	remove nearby CEMA, LIVU	deal with tree encroachment		
01-015	fesida-fescam-gervis	CB Lake Ck	7	2	0	9	remove livestock trespass			
99-055	fesida-fescam-gervis	Cracker Flats	8	0	1	9	deal with tree encroachment			
01-007	fesida-fescam-gervis	2 Med Lk Moose Ponds	8	0	1	9	deal with tree encroachment			
01-048	fesida-fescam-gervis	Poia above	8	1	0	9	remove livestock trespass			
99-023	fescam-fesida	Rising Sun	4	2	4	10	remove CEMA in grassland	remove nearby LIVU, HYPE, CIAR, CHLE	deal with tree encroachment	
99-038	fesida-fescam-gervis	Swiftc. Ridge	6	3	1	10	remove livestock trespass	deal with tree encroachment		
99-040	arcuva-fescam-fesida	Apikuni Flats	6	1	3	10	remove light concessioner grazing	remove nearby CEMA, LIVU, CIAR, LIDA	deal with tree encroachment	
99-044	fesida-fescam-gervis	Old CB Chalet	7	1	2	10	remove CIAR in grassland	deal with tree encroachment		
01-009	fesida-fescam-gervis	Kennedy Ck	7	3	0	10	remove livestock trespass			
01-031	arcuva-fescam-fesida	BR Custom Hill	7	1	2	10	remove park stock grazing	remove nearby CIAR	deal with tree encroachment	
99-030	fesida-fescam-gervis	St. Mary Flats	8	1	1	10	remove CEMA in grassland	remove nearby CIAR		
99-049	fesida-fescam-gervis	2 mi E Sumt	9	0	1	10	deal with tree encroachment			
01-023	fesida-fescam-gervis	Rising Sun Picnic	6	2	3	11	remove CEMA in grassland	remove nearby CIAR, HYPE, LIVU, CHLE, PORE	deal with tree encroachment	
99-039	fesida-fescam-gervis	Cut Bank E of RS	7	1	3	11	remove CEMA in grassland	remove nearby CIAR, HYPE, CHLE, EUES	deal with tree encroachment	
01-002	arcuva-fescam-fesida	Rising Sun	7	1	3	11	remove CEMA in grassland	remove nearby RAAC, PORE, LIVU, HYPE, EUES, CHLE, CYOF, CIAR	deal with tree encroachment	
99-033	fesida-fescam-gervis	W of CB CG	8	0	3	11	remove nearby CEMA, CIAR, CHLE	deal with tree encroachment		
00-003	fesida-fescam-gervis	Two Medicine RS corral	8	0	3	11	remove nearby LIVU, CEMA, LIVU, CHLE, CIAR, HIAU, HIPR, HYPE, PORE	deal with tree encroachment		
00-036	fesida-fescam-gervis	Cut Bank Ridge	9	0	2	11	remove CIAR in grassland	deal with tree encroachment		
99-024	fesida-fescam-gervis	Rising Sun	6	2	4	12	remove CEMA in grassland	remove nearby LIVU, HYPE, CIAR, CHLE	deal with tree encroachment	deal with ROWO, PRVI encroachment
99-056	arcuva-fescam-fesida	N Lubec Lake	6	2	4	12	remove livestock trespass	remove CEMA, CIAR, LIVU in grassland	deal with tree encroachment	deal with AMAL encroachment
01-014	fesida-fescam-gervis	SM Sleepy Lagoon	7	2	3	12	remove CEMA in grassland	remove nearby HYPE, LIVU, CHLE, CYOF, CIAR	deal with tree encroachment	
01-027	dasflo-fescam	Rising Sun	7	1	4	12	remove CEMA in grassland	remove nearby CIAR, CHLE, CYOF, LIVU	deal with tree encroachment	deal with ROWO, PRVI encroachment
99-029	fesida-fescam-gervis	St. Mary VC	8	1	3	12	remove CEMA in grassland	remove nearby LIVU, CIAR	deal with tree encroachment	
00-032	fescam-fesida	E Marias Pass	7	4	2	13	remove high CEMA in grassland	remove livestock trespass	deal with tree encroachment	
00-048	fesida-fescam-gervis	Hwy 2 Old Bison Siding	9	3	2	14	remove livestock trespass	remove LIVU from grassland	remove nearby CIAR	deal with tree encroachment

Appendix C-2. Management Action Items for less pristine grassland areas.

Plot	Association	Location	Ecological Total	Stressor Total	Threat Total	Total	action 1	action 2	action 3	action 4
00-024	phlpra-poapra-broine	Red Eag beaver	2	0	0	2	monitor			
00-002	phlpra-poapra-broine	Swift. Rdge	4	1	0	5	remove livestock trespass			
99-036	phlpra-poapra-broine	Red Eagle LO	4	0	2	6	remove nearby CEMA, CIAR	deal with tree encroachment		
99-043	phlpra-poapra-broine	Old CB Chalet	4	0	2	6	remove nearby CIAR	deal with tree encroachment		
00-013	phlpra-poapra-broine	Jule's Ck	4	3	0	7	remove livestock trespass			
99-017	phlpra-poapra-broine	Veldt	5	0	2	7	remove nearby CIAR, CHLE	deal with tree encroachment		
01-019	phlpra-poapra-broine	Belly/Moko Jct	6	0	1	7	remove CIAR in grassland			
99-006	phlpra-poapra-broine	2 Dog 1	5	1	2	8	remove CEMA in grassland	remove nearby CIAR	deal with ROWO, AMAL encroachment	
99-009	phlpra-poapra-broine	2 Dog 2	5	1	2	8	remove CEMA in grassland	remove nearby CIAR, HIAU, HYPE		
99-054	phlpra-poapra-broine	St. Mary Flats	5	1	2	8	remove CIAR in grassland	deal with tree encroachment	remove nearby CEMA	
00-033	phlpra-poapra-broine	E Marias Pass	5	1	2	8	remove livestock trespass	remove CEMA in grassland	deal with tree encroachment	
01-001	phlpra-poapra-broine	St. Mary CG	5	1	2	8	remove CEMA in grassland	remove nearby LIVU, CIAR		
01-004	phlpra-poapra-broine	Apikuni Mt	5	1	2	8	remove park stock grazing	remove nearby CEMA, CIAR, LIVU		
01-025	phlpra-poapra-broine	Ashline	5	1	2	8	remove livestock trespass	remove nearby CEMA	deal with tree encroachment	
99-045	phlpra-poapra-broine	Red Eagle Jct	7	0	1	8	remove nearby CEMA, CHLE			
01-006	phlpra-poapra-broine	Apikuni corral	4	2	3	9	remove park stock grazing	remove LIVU, CEMA in grassland	remove nearby CIAR, LIDA	deal with tree encroachment
99-014	phlpra-poapra-broine	2 Dog 3	7	1	1	9	remove CEMA in grassland	remove nearby CIAR		
99-022	phlpra-poapra-broine	3 mile	7	0	2	9	deal with tree encroachment			
99-037	phlpra-poapra-broine	Red Eagle LO	7	0	2	9	remove nearby CEMA, CIAR	deal with tree encroachment		
00-021	phlpra-poapra-broine	BR 1-mile	7	0	2	9	remove CIAR in grassland	deal with tree encroachment		
99-007	phlpra-poapra-broine	2 Dog 2	6	0	4	10	remove nearby CEMA, HIAU, CIAR, HYPE	deal with tree encroachment	deal with ROWO, AMAL encroachment	
00-009	phlpra-poapra-broine	Red Eagle 2 mile	7	0	3	10	remove nearby CEMA, CHLE, CIAR	deal with tree encroachment		
01-013	phlpra-poapra-broine	Cassidy Curve	7	3	0	10	remove livestock trespass			
99-003	phlpra-poapra-broine	2 Dog 1	8	0	2	10	remove CEMA, CIAR in grassland	deal with tree encroachment		
99-016	phlpra-poapra-broine	Veldt	8	0	2	10	remove nearby CIAR, CHLE	deal with tree encroachment		
99-048	phlpra-poapra-broine	up Swift. Rdge	7	3	1	11	remove livestock trespass	remove nearby CEMA, CIAR		
00-011	phlpra-poapra-broine	Two Medicine RS corral	8	0	3	11	remove nearby LIVU, CEMA, CHLE, CIAR, HIAU, HIPR, HYPE, PORE	deal with tree encroachment		
00-018	phlpra-poapra-broine	Belly River RS	8	1	2	11	remove park stock grazing	remove nearby LIVU, HIAU, CIAR, PORE, RAAC, CHLE		
01-026	phlpra-poapra-broine	2 Dog 3	8	0	3	11	remove nearby CEMA, CIAR, HYPE, LIVU	deal with ROSE encroachment		
99-004	phlpra-poapra-broine	2 Dog 1	9	1	1	11	remove CEMA in grassland	remove nearby CIAR		
99-047	phlpra-poapra-broine	Red Eagle S LO	9	0	2	11	remove nearby CEMA	deal with tree encroachment		

Appendix C-2 con'd. Management Action Items for less pristine grassland areas.

Plot	Association	Location	Ecological Total	Stressor Total	Threat Total	Total	action 1	action 2	action 3	action 4
01-045	elyrep/taroff	Lubec Lk	8	2	2	12	remove livestock trespass	remove LIVU, CEMA, CIAR in grassland		
01-024	phlpra-poapra-broine	Ashline	9	1	2	12	remove livestock trespass	remove nearby CEMA	deal with tree encroachment	
01-036	phlpra-poapra-broine	W Firebrand TH	7	3	3	13	remove livestock trespass	remove CEMA in grassland	remove nearby CIAR, LIVU, EUES	deal with tree encroachment
01-022	phlpra-poapra-broine	Rising Sun Picnic	8	1	4	13	remove CEMA in grassland	remove nearby CIAR, CHLE, LIVU, HYPE	deal with tree encroachment	deal with ROSE, PRVI encroachment
01-008	phlpra-poapra-broine	Red Eagle Hill	10	0	3	13	remove CEMA, CHLE, CIAR in grassland	deal with tree encroachment		
99-028	phlpra-poapra-broine	St. Mary Flats	8	2	4	14	remove CEMA in grassland	remove nearby CHLE, CIAR, LIVU	deal with tree encroachment	deal with ROWO, SYAL encroachment
00-046	phlpra-poapra-broine	Lubec Lake	9	2	3	14	remove livestock trespass	remove LIVU, CEMA, CIAR in grassland	deal with tree encroachment	
00-017	phlpra-poapra-broine	Belly River RS	10	3	2	15	remove park stock grazing	remove nearby LIVU, HIAU, CIAR, PORE, RAAC, CHLE		
01-012	elyrep/taroff	Sherburne	11	3	1	15	remove livestock trespass	remove CEMA in grassland	remove dam	
99-051	phlpra-poapra-broine	Lubec RS	11	3	2	16	remove livestock trespass	remove CIAR, CEMA, CHLE in grassland		
01-035	elyrep/taroff	Ashline	11	5	2	18	remove livestock trespass	remove high cover of CEMA, CIAR, LIDA in grassland		

Appendix D. Management Action Items by Subdistrict and Meadow.

Association	Location	Ecological Range	Stressor Range	Threat Range	Total Range	action 1	action 2	action 3	action 4
SAINT MARY									
arcuva-fescam-fesida	Otokomi	4	0	0	4	monitor			
arcuva-fescam-fesida	Baring Basin	4-5	0	0	4-5	monitor			
dasflo-fescam	Red E beaver S	5	0	0	5	monitor			
fesida-fescam-gervis	2 Dog 3	3-5	0	2-3	5-7	remove nearby CEMA, CIAR, LIVU, HIAU	deal with high cover of ROWO, AMAL, DAFL, PRVI		
fesida-fescam-gervis	2 Dog 2	4	0	2	6	remove nearby CEMA, CIAR, HYPE, HIAU			
fesida-fescam-gervis	2 Dog 1A	4	1	1	6	remove CEMA in grassland	remove nearby CIAR		
fesida-fescam-gervis	2 Dog 1	5	0-1	1	6-7	remove CEMA in grassland	remove nearby CEMA, CIAR		
fesida-fescam-gervis	Red Eagle LO	4-7	0	2	6-9	deal with tree encroachment	remove nearby CEMA, CIAR		
fesida-fescam-gervis	1913 RS	5	0	2	7	remove CEMA in grassland	deal with tree encroachment		
fesida-fescam-gervis	2 Dog 4	5	0	2	7	remove CEMA in grassland	deal with tree encroachment		
arcuva-fescam-fesida	Goat Mt	6	0	2	8	remove nearby CEMA, CHLE, CIAR, HYPE			
fesida-fescam-gervis	2 Dog 1B	6	0	2	8	remove nearby CEMA, CIAR	deal with tree encroachment		
fescam-fesida	Rising Sun	3-6	1-2	3-4	7-12	remove CEMA in grassland	remove nearby LIVU, HYPE, CIAR, CHLE, PORE	deal with tree encroachment	deal with ROWO, PRVI encroachment
fesida-fescam-gervis						remove CEMA in grassland	remove nearby LIVU, HYPE, CIAR, CHLE		
fescam-fesida-gervis	St. Mary Flats	4-8	0-2	1-2	8-10	remove CEMA in grassland	remove CEMA, CHLE, CIAR in grassland		
fescam-fesida						remove CEMA, CHLE, CIAR in grassland	deal with tree encroachment		
fesida-fescam-gervis	Red Eagle frog ponds	6	0	3	9	remove CEMA, CHLE, CIAR in grassland	remove nearby RAAC, PORE, LIVU, HYPE, EUES, CHLE, CYOF, CIAR	deal with tree encroachment	deal with ROWO, PRVI encroachment
arcuva-fescam-fesida	Rising Sun boat dock	7	1	3-4	11-12	remove CEMA in grassland	remove nearby HYPE, LIVU, CHLE, CYOF, CIAR	deal with tree encroachment	
dasflo-fescam						remove CEMA in grassland	remove nearby LIVU, CIAR	deal with tree encroachment	
fesida-fescam-gervis	SM Sleepy Lagoon	7	2	3	12	remove CEMA in grassland	remove nearby LIVU, CIAR	deal with tree encroachment	
fesida-fescam-gervis	St. Mary VC	8	1	3	12	remove CEMA in grassland	remove nearby LIVU, CIAR	deal with tree encroachment	
phlpra-poapra-broine	Red Eag beaver	2	0	0	2	monitor			
phlpra-poapra-broine	Red Eagle LO	4-7	0	2	6-9	deal with tree encroachment	remove nearby CEMA, CIAR		
phlpra-poapra-broine	St. Mary CG	5	1	2	8	remove CEMA in grassland	remove nearby LIVU, CIAR		
phlpra-poapra-broine	2 Dog 2	5-6	0-1	2-4	8-10	remove CEMA in grassland	remove nearby CIAR, HIAU, HYPE	deal with tree encroachment	deal with ROWO, AMAL encroachment
phlpra-poapra-broine	2 Dog 1	5-9	0-1	1-2	8-11	remove CEMA, CIAR in grassland	deal with tree encroachment	deal with ROWO, AMAL encroachment	
phlpra-poapra-broine	Red Eagle Jct/Hill	7-10	0-1	1-3	8-13	remove CEMA, CHLE, CIAR in grassland	deal with tree encroachment		
phlpra-poapra-broine	St. Mary Flats	5-8	1-2	2-4	8-14	remove CEMA, CIAR in grassland	remove nearby CHLE, LIVU	deal with tree encroachment	deal with ROWO, SYAL encroachment
phlpra-poapra-broine	2 Dog 3	7-8	0-1	1-3	9-11	remove CEMA in grassland	remove nearby CEMA, CIAR, HYPE, LIVU	deal with ROSE encroachment	
phlpra-poapra-broine	Red Eagle 2 mile	7	0	3	10	deal with tree encroachment	remove nearby CEMA, CHLE, CIAR		

Appendix D con'd. Management Action Items by Subdistrict and Meadow.

Association	Location	Ecological Range	Stressor Range	Threat Range	Total Range	action 1	action 2	action 3	action 4
phlptra-poaptra-broine	Red Eagle S LO	9	0	2	11	deal with tree encroachment	remove nearby CEMA		
phlptra-poaptra-broine	Rising Sun	8	1	4	13	remove CEMA in grassland	deal with tree encroachment	deal with ROSE, PRVI encroachment	remove nearby CIAR, CHLE, LIVU, HYPE
TWO MEDICINE									
fesida-fescam-potdiv	Spot Mt	3	0-1	0	3-4	remove livestock trespass			
arcuva-fescam-fesida	SE Spot	2-3	1	0	3-4	remove livestock trespass			
arcuva-fescam-fesida	SE Scenic Pt	3-5	0	0	3-5	monitor			
fesida-fescam-potdiv	Red Mt W	4	0	0	4	monitor			
fesida-fescam-potdiv	Looking Glass	3	1	1	5	remove livestock trespass	deal with tree encroachment		
arcuva-fescam-fesida	E Red Mt	3	0	2	5	deal with tree encroachment	deal with AMAL encroachment		
arcuva-fescam-fesida	TM Aval chute	7	0	0	7	monitor			
fesida-fescam-potdiv	Dry Fork Tr	4	0-1	3-4	7-9	remove livestock trespass	remove nearby CIAR	deal with tree encroachment	deal with ROAC, SPBE, AMAL, SYAL encroachment
arcuva-fescam-fesida									
fesida-fescam-gervis	Lower 2 Med Lk	5	1	2	8	remove livestock trespass	deal with tree encroachment	deal with ROSE, AMAL, SYAL, PRVI encroachment	
fesida-fescam-gervis	Oldman Tr	7	0	1	8	deal with tree encroachment			
fesida-fescam-potdiv	Pray Lake	7	0	2	9	remove nearby CEMA, LIVU	deal with tree encroachment		
fesida-fescam-gervis	2 Med Lk	8	0	1	9	deal with tree encroachment			
fesida-fescam-gervis	Moose Ponds					remove nearby LIVU, CEMA, LIVU, CHLE, CIAR, HIAU, HIPR, HYPE, PORE	deal with tree encroachment		
fesida-fescam-gervis	Two Medicine RS corral	8	0	3	11	remove nearby LIVU, CEMA, CHLE, CIAR, HIAU, HIPR, HYPE, PORE	deal with tree encroachment		
phlptra-poaptra-broine	Two Medicine RS corral	8	0	3	11	remove nearby LIVU, CEMA, CHLE, CIAR, HIAU, HIPR, HYPE, PORE	deal with tree encroachment		
TWO MEDICINE/HIGHWAY 2									
arcuva-fescam-fesida	Dancing Lady	2	0	0	2	monitor			
arcuva-fescam-fesida	S RR Ck	3	2	1	6	remove livestock trespass	deal with tree encroachment		
fescam-fesida	E Marias Pass	3-7	1-4	2	6-13	remove livestock trespass	remove high CEMA in grassland	deal with tree encroachment	
dasflo-fescam									
fesida-fescam-gervis	Autumn Ck	6	0	1	7	deal with tree encroachment			
arcuva-fescam-fesida	W Firebrand	4	1-2	1-4	7-9	remove livestock trespass	remove nearby CEMA, CIAR, CYOF	deal with tree encroachment	deal with AMAL, ROAC encroachment
fesida-fescam-gervis	TH								
fesida-fescam-gervis	Lucke's	5	2	1	8	remove livestock trespass	remove nearby CEMA		
fesida-fescam-gervis	2 mi E Sumt	9	0	1	10	deal with tree encroachment			
arcuva-fescam-fesida	N Lubec Lake	6	2	4	12	remove livestock trespass	remove CEMA, CIAR, LIVU in grassland	deal with tree encroachment	deal with AMAL encroachment
fesida-fescam-gervis	Hwy 2 Old Bison Siding	9	3	2	14	remove livestock trespass	remove LIVU from grassland	remove nearby CIAR	deal with tree encroachment
phlptra-poaptra-broine	E Marias Pass	5	1	2	8	remove livestock trespass	remove CEMA in grassland	deal with tree encroachment	
phlptra-poaptra-broine	Ashline	5-11	1-5	2	8-18	remove livestock trespass	remove high cover of CEMA, CIAR, LIDA in grassland	deal with tree encroachment	

Appendix D con'd. Management Action Items by Subdistrict and Meadow.

Association	Location	Ecological Range	Stressor Range	Threat Range	Total Range	action 1	action 2	action 3	action 4
phlpra-poapra-broine	Lubec Lake	8-9	2	2-3	12-14	remove livestock trespass	remove LIVU, CEMA, CIAR in grassland	deal with tree encroachment	
phlpra-poapra-broine	W Firebrand TH	7	3	3	13	remove livestock trespass	remove CEMA in grassland	remove nearby CIAR, LIVU, EUES	deal with tree encroachment
phlpra-poapra-broine	Lubec RS	11	3	2	16	remove livestock trespass	remove CIAR, CEMA, CHLE		
BELLY RIVER									
dryoct/polviv	Lee Ridge	5	0	0	5	monitor			
arcuva-fescam-fesida	susp brdg	3	0	3	6	remove nearby HIAU, HIPR	deal with tree encroachment	deal with AMAL, ROAC	
arcuva-fescam-fesida	Cosley Lake	6	0-1	1-2	7-9	remove park stock grazing	deal with tree encroachment	remove nearby RAAC, CIAR	
arcuva-fescam-fesida	Veldt	5	0	3	8	deal with tree encroachment	remove nearby CIAR, CHLE		
fesida-fescam-gervis	BR 3-mile	6	0	2	8	deal with tree encroachment			
fesida-fescam-gervis	N of Belly R RS	6-8	0	0-2	8	deal with tree encroachment	remove nearby CIAR		
fesida-fescam-gervis	N of Belly R RS	7	0	2	9	deal with tree encroachment			
arcuva-fescam-fesida	BR Custom Hill	7	1	2	10	remove park stock grazing	remove nearby CIAR	deal with tree encroachment	
phlpra-poapra-broine	Jule's Ck	4	3	0	7	remove livestock trespass			
phlpra-poapra-broine	Belly/Moko Jct	6	0	1	7	remove CIAR in grassland			
phlpra-poapra-broine	Veldt	5-8	0	2	7-10	deal with tree encroachment	remove nearby CIAR, CHLE		
phlpra-poapra-broine	BR 1-mile	7	0	2	9	remove CIAR in grassland	deal with tree encroachment		
phlpra-poapra-broine	BR 3-mile	7	0	2	9	deal with tree encroachment			
phlpra-poapra-broine	Belly River RS	8-10	1-3	2	11-15	remove park stock grazing	remove nearby LIVU, HIAU, CIAR, PORE, RAAC, CHLE		
MANY GLACIER									
fesida-fescam-potdiv									
arcuva-fescam-fesida	Apikuni Mt	1-4	0	0-1	1-6	deal with tree encroachment			
fesida-fescam-potdiv	Boulder Ridge	3	1	1	5	remove livestock trespass	deal with tree encroachment		
arcuva-fescam-fesida	Henkel base	4	0	1-2	5-6	deal with SPBE, SYAL, VACA, AMAL encroachment	remove nearby CEMA, LIVU		
arcuva-fescam-fesida	L Slide Lk	4	1	1	6	remove periodic livestock trespass	deal with tree encroachment		
fesida-fescam-gervis	Yellow Mt	5	1	0	6	remove livestock trespass			
fescam-fesida	Cracker Flats	4-8	0	1	6-9	deal with tree encroachment			
arcuva-fescam-fesida	Poia Lk W	4	1	2	7	deal with tree encroachment	deal with nearby CEMA, LIVU	monitor impact of human /horse trail through meadow	
fesida-fescam-gervis	Sherburne	5	1	1	7	remove livestock trespass	remove CEMA in grassland		
fesida-fescam-gervis	Swiftc. Ridge	4-6	1-3	1-2	7-10	remove livestock trespass	remove CEMA in grassland	deal with tree encroachment	
fesida-fescam-gervis	Poia below	4	2	2	8	remove livestock trespass	deal with tree encroachment	remove nearby CIAR, CYOF	
fesida-fescam-gervis	Boulder Ck	7	1	0	8	remove periodic livestock trespass			
fesida-fescam-gervis						remove CEMA, EUES, LIVU in grassland	remove nearby CIAR	deal with tree encroachment	
fescam-fesida						remove horse concessioner grazing		remove nearby CEMA, LIVU, CIAR, LIDA	
arcuva-fescam-fesida	Apikuni Flats	4-6	0-1	3	8-10	remove LIVU, CEMA, CIAR in grassland	deal with tree encroachment		
fesida-fescam-gervis	Apikuni Flats	6	0	3	9		deal with tree encroachment		

Appendix D con'd. Management Action Items by Subdistrict and Meadow.

Association	Location	Ecological Range	Stressor Range	Threat Range	Total Range	action 1	action 2	action 3	action 4
fesida-fescam-gervis	Slide Lake	6	1	2	9	remove livestock trespass	remove CIAR in grassland	deal with tree encroachment	
fesida-fescam-gervis	Poia above	8	1	0	9	remove livestock trespass			
fesida-fescam-gervis	Kennedy Ck	7	3	0	10	remove livestock trespass			
phlpra-poapra-broine	Swift. Rdge	4	1	0	5	remove livestock trespass			
phlpra-poapra-broine	Apikuni Mt	5	1	2	8	remove park stock grazing	remove nearby CEMA, CIAR, LIVU		
phlpra-poapra-broine	Apikuni corral	4	2	3	9	remove park stock grazing	remove LIVU, CEMA in grassland	deal with tree encroachment	remove nearby CIAR, LIDA
phlpra-poapra-broine	Cassidy Curve	7	3	0	10	remove livestock trespass			
phlpra-poapra-broine	up Swift. Rdge	7	3	1	11	remove livestock trespass	remove nearby CEMA, CIAR		
elyrep/taroff	Sherburne	11	3	1	15	remove livestock trespass	remove CEMA in grassland	remove dam	
CUT BANK									
fesida-fescam-potdiv	CB Lake Ck	3	2	0	5	remove livestock trespass			
fesida-fescam-potdiv	Milk R Ridge	3	1	1	5	remove livestock trespass	deal with tree encroachment		
arcuva-fescam-fesida	Mad Wolf	2-3	3	0	5-6	remove livestock trespass			
arcuva-fescam-fesida	White Calf	3	2	1	6	remove livestock trespass	deal with tree encroachment		
fesida-fescam-potdiv	Kup Rdg	4	0	2	6	deal with tree encroachment			
fesida-fescam-potdiv	Mad Wolf	3	3	1	7	remove livestock trespass	deal with tree encroachment		
fesida-fescam-potdiv	Cut Bank Ridge	4	4	0	8	remove livestock trespass	remove ability for ranchers to drive on meadow		
fesida-fescam-gervis	CB boundary	6	1	1	8	remove livestock trespass	remove nearby CEMA, CIAR		
fesida-fescam-gervis	CB Lake Ck	7	2	0	9	remove livestock trespass			
fesida-fescam-gervis	Old CB Chalet	7	1	2	10	remove CIAR in grassland	deal with tree encroachment		
fesida-fescam-gervis	Cut Bank E of RS	7	1	3	11	remove CEMA in grassland	remove nearby CIAR, HYPE, CHLE, EUES	deal with tree encroachment	
fesida-fescam-gervis	W of CB CG	8	0	3	11	remove nearby CEMA, CIAR, CHLE	deal with tree encroachment		
fesida-fescam-gervis	Cut Bank Ridge Tr	9	0	2	11	remove CIAR in grassland	deal with tree encroachment		
phlpra-poapra-broine	Old CB Chalet	4	0	2	6	remove nearby CIAR	deal with tree encroachment		

Appendix E. Comparison of canopy cover estimates for 12, 14, 15, 16, and 18 microplots on six grassland plots.

	SM-99-001					SM-99-002					SM-99-003					SM-99-004					SM-99-005					SM-99-006				
	12	14	15	16	18	12	14	15	16	18	12	14	15	16	18	12	14	15	16	18	12	14	15	16	18	12	14	15	16	18
bare soil	0.1	0.1	0.1	0.1	0.1	0.6	0.5	0.5	0.5	0.7	9.9	8.5	7.9	8.4	7.4	8.0	7.0	6.6	6.2	5.5	0.1	0.1	0.1	0.1	0.1	0.3	0.5	0.5	2.9	2.9
wood											0.04	0.04	0.1	0.1	0.1											0.1	0.1	0.1	0.1	0.1
rock (> 3 cm)	0.8	0.9	0.9	0.8	0.7	1.8	1.6	1.5	1.4	1.3	0.7	0.6	0.5	0.5	0.4	0.1	0.1	0.1	0.1	0.1	0.8	0.7	0.7	0.6	1.1	0.00	0.00	0.00	0.00	0.06
gravel						0.04	0.04	0.03	0.03	0.03	0.5	0.4	0.4	0.4	0.4	0.2	0.2	0.2	0.2	0.2						0	0.1	0.1	0.1	0.2
moss	27.8	28.9	30.3	29.0	28.6	34.8	36.3	34.2	32.7	33.5	0.00	0.04	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.03	32.7	29.1	27.5	30.5	32.4	0.7	0.6	0.6	0.6	0.5
lichen	0	0.04	0.2	0.2	0.1																0.6	0.6	0.6	0.6	0.6					
litter	59.2	57.5	55.7	57.2	57.5	52.9	51.8	54.0	55.3	54.2	79.8	80.6	81.1	80.6	81.9	81.8	82.3	82.8	83.3	84.1	55.0	58.8	60.4	57.9	56.1	89.6	89.7	89.5	87.3	87.3
basal vegetation	8.3	8.2	8.0	8.1	8.6	8.8	8.4	8.5	8.6	8.5	8.7	8.9	9.1	9.1	8.9	10.0	10.5	10.5	10.4	10.3	7.1	7.4	7.7	7.5	7.3	9.5	9.2	9.4	9.2	9.1
other	1.2	2.0	2.0	1.8	1.9	1.0	1.0	1.0	1.3	1.4	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.2	0.2	4.1	3.6	3.4	3.2	2.9					
SHRUB	1.6	1.5	1.4	1.4	1.3	3.8	3.3	3.2	3.0	2.9	0.6	1.2	1.2	1.1	1.0	0.6	0.8	0.7	0.7	0.7	1.3	1.3	1.9	1.8	1.6	5.3	4.6	4.9	4.6	6.4
<i>Amelanchier alnifolia</i>	0.3	0.2	0.2	0.2	0.2	0.6	0.5	0.5	0.4	0.4	0.2	0.5	0.6	0.5	0.5						0.2	0.1	0.1	0.1	0.1	4.6	3.9	4.3	4.1	5.0
<i>Arctostaphylos uva-ursi</i>											0	0.1	0.1	0.1	0.1															
<i>Mahonia repens</i>	0.8	0.9	0.8	0.8	0.7						0.1	0.1	0.1	0.1	0.1															
<i>Rosa acicularis</i>	0.5	0.4	0.4	0.4	0.4	3.1	2.7	2.7	2.5	2.5	0.3	0.5	0.5	0.5	0.4	0.5	0.8	0.7	0.7	0.7	1.2	1.1	1.1	1.0	0.9	0.8	0.6	0.6	0.6	1.4
<i>Symphoricarpos albus</i>																0.04	0.04	0.03	0.03	0.03	0.0	0.0	0.7	0.6	0.6					
NATIVE GRASS	18.7	18.5	18.3	19.0	18.6	18.8	18.9	19.0	19.1	19.2	11.5	10.2	10.0	9.6	9.0	7.3	9.3	9.1	8.9	10.2	15.4	15.7	17.1	16.3	15.7	6.6	6.9	7.5	8.1	8.2
<i>Bromus carinatus</i>											0.7	0.6	0.7	0.7	0.6	1.2	1.2	1.5	1.4	1.3	0.1	0.1	0.1	0.1	0.1	0.04	0.04	0.03	0.03	0.03
<i>Calamagrostis sp.</i>											6.4	5.5	5.2	5.0	4.4															
<i>Carex aurea</i>	2.0	1.8	1.7	1.6	1.4	1.8	1.9	1.9	2.4	2.1																				
<i>Carex concinoides</i>	0	0	0	0	0.03																									
<i>Carex filifolia</i>	0.04	0.04	0.03	0.1	0.1																0.1	0.1	0.1	0.1	0.1					
<i>Carex obtusata</i>	0.9	1.2	1.3	1.4	1.6	0.3	0.3	0.3	0.3	0.3																0	0.1	0.1	0.1	0.1
<i>Carex petasata</i>	0.0	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.3	0.5	0.9	0.9	1.0	1.0	1.1	0.5	0.5	0.5	0.5	0.5						0.3	0.2	0.2	0.2	0.2
<i>Carex raynoldsii</i>											0.04	0.1	0.1	0.1	0.2															
<i>Carex species</i>	0.1	0.1	0.1	0.1	0.1	1.8	1.7	1.6	1.5	1.6	0.1	0.1	0.1	0.1	0.1						3.8	3.8	3.9	3.6	3.6					
<i>Danthonia intermedia</i>	0.6	0.6	0.6	0.6	0.8	2.9	2.9	2.9	2.8	3.1											3.1	3.4	3.2	3.0	2.9	0.1	0.1	0.1	0.1	0.1
<i>Elymus spicatus</i>	0.04	0.04	0.1	0.1	0.1	0.4	0.4	0.7	0.7	0.6						0	0	0	0	0.03	0.1	0.1	0.1	0.1	0.1					
<i>Elymus trachycaulus</i>	2.3	2.1	2.0	2.2	1.9	0.4	0.5	0.5	0.4	0.5	0	0.04	0.03	0.03	0.03	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<i>Festuca campestris</i>	1.2	1.2	1.3	1.4	1.4	2.5	2.4	2.3	2.4	2.3	1.4	1.3	1.3	1.3	1.3	0.04	0.04	0.03	0.1	0.1	1.1	1.2	1.1	1.1	1.1	2.9	2.9	3.1	3.5	3.9
<i>Festuca idahoensis</i>	4.2	4.3	4.2	4.1	4.0	2.1	2.0	2.0	1.9	1.7						0.04	0.04	0.03	0.03	0.03	1.3	1.4	1.4	1.4	1.4	1.8	2.1	2.2	2.4	2.2
<i>Helictotrichon hookeri</i>	0.5	0.5	0.5	0.5	0.5	0.4	0.5	0.4	0.4	0.4	0	0.04	0.03	0.03	0.03						0.2	0.1	0.1	0.1	0.1					
<i>Koeleria macrantha</i>	1.1	1.0	1.0	1.1	1.0	1.3	1.3	1.3	1.2	1.2	0.04	0.04	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.03	0.5	0.5	0.4	0.4	0.4	0.7	0.6	0.6	0.6	0.5
<i>Poa secunda</i>	0.04	0.1	0.1	0.1	0.1																									
<i>Poa sp.</i>											0.2	0.2	0.2	0.2	0.1															
<i>Stipa nelsonii</i>	4.9	4.4	4.2	4.2	3.9	3.0	3.1	3.3	3.4	3.1	0.4	0.4	0.3	0.3	0.3	5.5	7.6	7.2	7.0	8.5	5.3	5.3	6.9	6.5	6.0	1.1	1.1	1.5	1.5	1.3
<i>Stipa richardsonii</i>						0.5	0.5	0.4	0.4	0.8																				
NATIVE FORB	18.8	18.9	19.0	19.4	18.3	23.3	22.9	22.3	21.9	21.4	16.2	16.5	16.4	16.1	16.0	14.3	15.1	15.5	15.9	14.9	21.5	22.1	21.5	22.0	22.3	21.7	20.3	21.3	20.2	19.4
<i>Achillea millefolium</i>	1.7	1.7	1.8	1.8	1.9	2.3	2.4	2.4	2.4	2.2	2.1	2.1	2.2	2.2	2.3	1.2	1.5	1.6	1.6	1.5	2.6	2.8	2.8	2.7	2.7	2.7	3.0	3.2	3.0	2.7
<i>Agoseris glauca</i>	0.04	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2											1.2	1.1	1.0	0.9	0.9	0.3	0.3	0.3	0.3	0.3
<i>Agoseris sp.</i>																										0.04	0.04	0.03	15.4	15.3
<i>Anaphalis margaritacea</i>											0.1	0.1	0.1	0.1	0.1															
<i>Androsace septentrionalis</i>						0.1	0.1	0.1	0.1	0.1											0.0	0.1	0.1	0.1	0.1					

Appendix E con'd. Comparison of canopy cover estimates for 12, 14, 15, 16, and 18 microplots on six grassland plots.

	SM-99-001					SM-99-002					SM-99-003					SM-99-004					SM-99-005					SM-99-006				
	12	14	15	16	18	12	14	15	16	18	12	14	15	16	18	12	14	15	16	18	12	14	15	16	18	12	14	15	16	18
<i>Anemone multifida</i>						0.2	0.1	0.1	0.1	0.1											0.5	0.7	0.8	0.8	0.8	0.8	0.7	0.9	0.9	0.8
<i>Anemone nuttalliana</i>	0.6	0.6	0.6	0.8	0.7	0.3	0.5	0.5	0.4	0.4																				
<i>Antennaria alpina</i>						0.2	0.2	0.2	0.2	0.3																				
<i>Antennaria anaphaloides</i>																										1.7	1.5	1.4		
<i>Antennaria microphylla</i>						0.3	0.3	0.2	0.2	0.2																				
<i>Antennaria species</i>	0.3	0.2	0.3	0.3	0.3																									
<i>Antennaria umbrinella</i>	0.2	0.3	0.3	0.3	0.3																0.7	0.7	0.6	0.6	0.9	0	0	0.3	0.3	0.3
<i>Arabis nuttallii</i>	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3											0.1	0.1	0.1	0.2	0.2					
<i>Arnica sororia</i>	0.6	0.5	0.5	0.5	0.4	1.0	1.0	1.0	1.0	1.0	1.6	1.4	1.4	1.4	1.6	0.04	0.04	0.03	0.03	0.1	0.8	0.9	0.9	1.0	0.9	0.04	0.2	0.2	0.2	0.1
<i>Aster conspicuus</i>											0.0	0.4	0.4	0.4	0.4															
<i>Aster laevis</i>	0	0	0	0	0.03						1.4	1.2	1.2	1.1	1.0						0.04	0.04	0.03	0.03	0.03	0.2	0.1	0.1	0.1	0.1
<i>Balsamorhiza sagittata</i>																					0.8	1.0	0.9	1.8	1.6					
<i>Besseyia wyomingensis</i>																					0.3	0.2	0.2	0.2	0.2					
<i>Borage</i>	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1						0.3	0.3	0.3	0.3	0.2				0.3	0.2
<i>Botrychium</i>						0	0	0	0	0.03																	0	0	16.3	16.1
<i>Campanula rotundifolia</i>	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.4	0.2	0.3	0.3	0.3	0.3	0.5	0.4	0.4	0.4	0.4
<i>Castilleja species</i>	0.1	0.1	0.1	0.1	0.1																									
<i>Castilleja sulphurea</i>	0.4	0.4	0.4	0.5	0.4	0.1	0.1	0.1	0.1	0.1											0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2
<i>Cerastium arvense</i>	0.4	0.4	0.4	0.4	0.4	0.7	0.7	0.7	0.7	0.6	0.3	0.4	0.4	0.3	0.3	0.04	0.1	0.1	0.1	0.1	0.8	0.9	0.8	0.8	0.8	0.3	0.3	0.3	0.3	0.3
<i>Cirsium species</i>																2.0	1.8	1.7	1.8	1.6										
<i>Collinsia parviflora</i>																					0	0	0.1	0.1	0.1					
<i>Comandra umbellata</i>						0.2	0.2	0.2	0.2	0.3											0.3	0.4	0.3	0.3	0.3				0.1	0.1
<i>Cordate hairy leaves</i>																										0.3	0.3	0.3		
<i>Crepis sp.</i>																										0.1	0.1	0.1		
<i>Delphinium bicolor</i>	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1											0	0	0.1	0.1	0.1	0.04	0.04	0.1	0.1	0.1
<i>Dodecatheon conjugens</i>	1.1	0.9	0.9	0.9	0.9	0.7	0.8	0.8	0.8	0.8	0	0.04	0.03	0.03	0.03						0.1	0.2	0.3	0.3	0.3	0.7	0.7	0.7	0.7	0.6
<i>Draba nemorosa</i>						0.1	0.1	0.1	0.1	0.1																				
<i>Equisetum</i>																0.3	0.5	0.6	0.6	0.6										
<i>Erigeron compositus</i>	0.4	0.4	0.3	0.3	0.3																									
<i>Erigeron species</i>						0.1	0.1	0.1	0.1	0.1																				
<i>Fragaria virginiana</i>	0.6	0.5	0.5	0.4	0.4						3.0	3.2	3.2	3.2	3.3	4.2	4.3	4.0	3.8	3.3						0.8	1.1	1.0	0.9	0.9
<i>Gaillardia aristata</i>	1.9	1.9	1.8	1.8	1.8	0.3	0.3	0.2	0.2	0.4											0.6	0.7	0.6	0.7	0.7	0.3	0.3	0.5	0.5	0.4
<i>Galium boreale</i>	0.7	0.7	0.8	0.8	0.8	0.7	0.6	0.6	0.6	0.6	0.6	0.5	0.6	0.7	0.7	0.4	0.3	0.4	0.3	0.4	1.3	1.2	1.3	1.2	1.3	1.4	1.2	1.4	1.3	1.3
<i>Geranium viscosissimum</i>											0.3	0.3	0.2	0.2	0.2	0.3	0.5	0.5	0.5	0.4	0.1	0.1	0.1	0.1	0.1	1.0	0.9	0.8	0.8	0.7
<i>Geum triflorum</i>																					0.2	0.2	0.2	0.2	0.1					
<i>Heuchera cylindrica</i>											0.6	0.8	0.7	0.8	0.7	0.3	0.2	0.5	0.5	0.4						0.04	0.04	0.03	0.03	0.03
<i>Heuchera parviflora</i>																														
<i>Hieracium species</i>	0	0	0.1	0.1	0.1						0.7	0.6	0.5	0.5	0.4														0.03	0.03
<i>Lathyrus ochroleucus</i>						0.2	0.1	0.1	0.1	0.1																				

Appendix E con'd. Comparison of canopy cover estimates for 12, 14, 15, 16, and 18 microplots on six grassland plots.

	SM-99-001					SM-99-002					SM-99-003					SM-99-004					SM-99-005					SM-99-006				
	12	14	15	16	18	12	14	15	16	18	12	14	15	16	18	12	14	15	16	18	12	14	15	16	18	12	14	15	16	18
<i>Lithospermum ruderales</i>	1.5	2.0	1.9	1.8	1.6	1.7	2.2	2.0	1.9	1.8											0.3	0.3	0.2	0.2	0.2	2.3	1.9	1.8	1.7	2.1
<i>Lomatium dissectum</i>																														
<i>Lomatium macrocarpum</i>	1.3	1.4	1.4	1.3	1.3	1.2	1.3	1.3	1.3	1.3																				
<i>Lomatium triternatum</i>	0.2	0.2	0.2	0.3	0.3	1.3	1.3	1.2	1.2	1.3	0.1	0.1	0.1	0.1	0.1						0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.2
<i>Lupinus sericeus</i>	3.3	3.0	2.9	3.0	3.0	7.2	6.9	7.1	7.0	6.6											3.7	3.6	3.4	3.2	2.9	2.0	1.7	1.9	1.8	1.6
<i>Monarda fistulosa</i>						0.8	0.8	0.7	0.7	0.6	1.2	1.0	0.9	0.9	0.8						0.7	0.6	0.5	0.5	0.4				1.4	1.8
<i>Oxytropis campestris</i>	0.1	0.2	0.2	0.2	0.2	0.6	0.5	0.5	0.4	0.4																				
<i>Penstemon confertus</i>						0.7	0.6	0.5	0.5	0.4	0.9	0.8	0.7	0.7	0.6	0.1	0.1	0.1	0.1	0.1						0.4	0.4	0.4	0.3	0.3
<i>Phlox hoodii</i>																					0.1	0.1	0.1	0.1	0.3					
<i>Potentilla glandulosa</i>											1.5	1.3	1.2	1.1	1.1	0.04	0.04	0.03	0.03	0.03	0.1	0.1	0.1	0.1	0.1					
<i>Potentilla gracilis</i>	1.1	1.0	1.1	1.0	1.2	1.2	1.3	1.2	1.2	1.1	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.5	0.6	0.6	0.9	1.3	1.3	1.3	1.4	0.3	0.3	0.2	0.2	0.2
<i>Potentilla hippiana</i>	1.4	1.4	1.3	1.8	1.7	0	0	0	0.1	0.1											0	0	0	0	0.1					
<i>Potentilla species</i>	0.04	0.1	0.1	0.1	0.1																									
<i>Prunella vulgaris</i>																0.2	0.1	0.1	0.1	0.1										
<i>Rhinanthus crista-galli</i>						0.04	0.04	0.03	0.03	0.03	0.04	0.04	0.03	0.03	0.03						0.04	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
<i>Saxifraga rhomboidea</i>																					0	0	0	0.03	0.03					
<i>Selaginella densa</i>	2.5	2.3	2.8	2.7	2.4	0.4	0.3	0.3	0.3	0.3											2.1	1.8	1.7	1.8	1.8	0.04	0.04	0.03	0.03	0.03
<i>Sisyrinchium angustifolium</i>	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.04	0.04	0.03	0.03	0.03	0	0	0.03	0.03	0.03	0.3	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.1
<i>Smilacina stellata</i>											0.9	0.8	0.7	0.7	0.6											0	0.2	0.2	0.2	0.2
<i>Solidago missouriensis</i>	2.2	2.1	2.1	2.2	2.0						1.7	2.4	2.3	2.2	2.1	5.0	5.3	5.2	5.7	5.5	0.9	1.0	1.0	0.9	0.9	3.8	3.5	3.5	3.4	3.1
<i>spatulate rosette</i>	0.04	0.04	0.03	0.03	0.03	0.1	0.1	0.1	0.1	0.1																				
<i>Valeriana sitchensis</i>																0.04	0.04	0.03	0.03	0.03										
<i>Zigadenus elegans</i>						0	0	0.03	0.03	0.03																				
<i>Zigadenus venulosum</i>	0.5	0.5	0.5	0.4	0.4	0.7	0.6	0.6	0.6	0.6											0.2	0.3	0.3	0.3	0.3	0.04	0.04	0.03	0.03	0.03
EXOTIC GRASS	2.3	1.9	1.8	1.8	1.6	1.3	1.4	1.3	1.9	1.8	14.4	14.5	14.9	17.1	17.7	18.9	18.0	17.5	16.7	18.2	0.7	0.7	0.8	0.8	0.7	16.7	16.8	16.1	16.1	16.1
<i>Bromus inermis</i>																														
<i>Bromus tectorum</i>																										0	0	0	9.3	9.5
<i>Dactylis glomerata</i>																														
<i>Phleum pratense</i>	2.3	1.9	1.8	1.8	1.6	1.3	1.4	1.3	1.9	1.8	14.4	14.5	14.9	17.1	17.7	8.1	8.7	8.8	8.6	8.2	0.7	0.7	0.8	0.8	0.7	15.8	16.1	15.4	1.0	0.9
<i>Poa pratensis</i>																10.9	9.4	8.7	8.3	10.1	0.04	0.04	0.03	0.03	0.03	1.0	0.8	0.8	0.5	0.5
EXOTIC FORB	0.5	0.5	0.5	0.5	0.5	0.5	0.4	0.4	0.4	0.4						0.04	0.04	0.1	0.1	0.1	0.3	0.3	0.3	0.3	0.3	0.8	0.7	0.7	0.7	0.6
<i>Centaurea maculosa</i>	0.1	0.1	0.1	0.1	0.1											0	0	0.03	0.03	0.03						0.6	0.5	0.6	0.2	0.2
<i>Descurainia sophia</i>																										0.04	0.04	0.03	0.00	0.00
<i>Taraxacum officinale</i>	0.4	0.5	0.4	0.4	0.4	0.5	0.4	0.4	0.4	0.4						0.04	0.04	0.03	0.03	0.03	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.0	0.0

Appendix F. 1999 C. R. Wasem Transect Data in comparison to data collected in 1964-1965.

	Percent (= number of hits)																			
	Windy Flat 30-GT-1		Red Eagle LO 33-GT-6		Rising Sun 33-GT-3		St. Mary Flat 33-GT-5		2 Dog #2 33-GT-2		2 Dog #1 33-GT-1		BR Veldt 28-GT-4		BR West 28-GT-3		BR West 28-GT-2		BR West 28-GT-1	
	1964	1999	1965	1999	1965	1999	1964	1999	1964	1999	1964	1999	1964	1999	1964	1999	1964	1999	1964	1999
Bare ground	7	0	10	3	6	2	7	5	5	0	2	1	8	3	1	3	4	5	2	3
Rock > 2 cm	6	2	0	1	12	1	0	0	0	2	0	1	0	0	0	0	0	0	0	0
Litter	63	6	38	9	23	9	58	10	54	7	50	9	54	8	71	7	49	0	40	3
Grass/Carex (Total)	9	53	19	51	10	54	20	47	19	60	16	58	13	59	13	75	18	87	16	91
<i>Carex concinnoides</i>								1		1		1								
<i>Festuca campestris</i>		9												5		16		13		36
<i>Festuca idahoensis</i>		16		9		16		11		10		14		5				5		6
<i>Phleum pratense</i>				15								4		11		7		30		17
Forb/Shrub (Total)	5	33	6	21	4	11	5	21	6	22	4	16	7	29	4	15	6	7	2	3
<i>Achillea millefolium</i>		1		3		2		2		9		3		1				1		1
<i>Anemone nuttalliana</i>				2						2		1								
<i>Antennaria alpina</i>				2																
<i>Antennaria</i> sp.												3								
<i>Arabis nuttallii</i>				3																
<i>Dodecatheon conjugens</i>		8				3				3		4		2		4				
<i>Fragaria virginiana</i>						1								4		3		3		
<i>Geum triflorum</i>								15												
<i>Hieracium</i> sp.				2																
<i>Heuchera parviflora</i>		2								1				1				1		
<i>Lithospermum ruderale</i>		1								2										
<i>Lomatium macrocarpum</i>				2								1								
<i>Lupinus sericeus</i>		3		1		1														
<i>Polemonium pulcherrimum</i>				1																
<i>Potentilla glandulosa</i>										1										
<i>Potentilla gracilis</i>		2		3		1		1						1				1		
<i>Potentilla hippiana</i>												1								
<i>Arctostaphylos uva-ursi</i>		4						2						20		7		1		2
<i>Mahonia repens</i>		1																		
Moss and lichen	13	6	27	15	45	23	10	17	16	9	28	15	18	1	11	0	23	1	40	0

APPENDIX B. FESCUE GRASSLAND MANAGEMENT MATRIX

Native Associations

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare- ness Value	Richness		Exotic cover							Noxious weeds		Livestock trespass Value	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist. Comments	Ecolog. Total	Stressor Total	Threat Total	Total		
				#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value	Comments		Value	Value	Comments	Value	Comments	T	Value	Comments	S	Value						Comments	
01-018	arcuva-fescam-fesida	Dancing Lady	2	0	53	0.95	0	33.79	22.29	27.50	0.00	0.00	0.00%	0		0	0		0	-	0	0	mostly ARUV	33.79	0	-	on climbing route to Dancing Lady	2	0	0	2	
00-028	arcuva-fescam-fesida	SE Spot	2	0	52	0.93	0	30.43	13.43	26.79	0.00	0.00	0.00%	0		1	0		0	natural amt of dead PIAL	0	0	mostly ARUV but some AMAL, ROWO	30.43	0	-	-	2	1	0	3	
99-041	arcuva-fescam-fesida	SE Scenic Pt	2	1	48	0.86	0	51.14	9.43	17.86	0.00	0.00	0.00%	0		0	0		0	some PIFL, ABLA nearby; could expand	0	0	mostly ARUV	51.14	0	-	near Scenic Pt trail	3	0	0	3	
00-026	arcuva-fescam-fesida	SE Spot	2	1	49	0.88	0	12.43	20.21	24.64	0.00	0.00	0.00%	0		1	0		0	natural amt of ABLA, PIFL	0	0	mostly ARUV, but high cover of ROWO to watch	12.43	0	-	-	3	1	0	4	
00-034	arcuva-fescam-fesida	Baring Basin	2	2	42	0.75	0	73.14	33.93	10.57	0.00	0.00	0.00%	0		0	0		0	natural krummholz trees	0	0	mostly ARUV, DAFL	73.14	0	-	Baring Basin Tr nearby	4	0	0	4	
00-047	arcuva-fescam-fesida	Apikuni Mt	2	2	42	0.75	0	56.29	16.86	14.50	0.00	0.00	0.00%	0		0	0		0	near treeline	0	0	mostly ARUV, DAFL	56.29	0	-	-	4	0	0	4	
01-032	arcuva-fescam-fesida	Otokomi	2	2	40	0.71	0	32.14	9.86	11.93	0.00	0.00	0.00%	0		0	0		0	perhaps some conifer encr but generally low	0	0	mostly ARUV, DAFL; some ROSE	32.14	0	-	-	4	0	0	4	
00-008	arcuva-fescam-fesida	E Red Mt	2	1	49	0.88	0	34.75	7.57	12.79	0.00	0.00	0.00%	0		0	0		1	scattered PICO, ABLA, POTR, PIFL	0	1	mostly ARUV, but high cover of AMAL	34.75	0	-	-	3	0	2	5	
00-006	arcuva-fescam-fesida	Henkel base	2	1	46	0.82	1	54.29	11.43	8.29	0.00	0.29	0.38%	0		0	0		0		0	1	mostly ARUV, but fairly high cover of AMAL, SPBE, VACA	54.29	0	-	some hiker/climber trails present	4	0	1	5	

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare-ness	Richness			Exotic cover					Noxious weeds		Livestock trespass	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.	Ecolog.	Stressor	Threat				
			Value	Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value	Comments	Value	Value	Comments	Value	Comments	T	Value	Comments	S	Value	Comments	Comments	Total	Total	Total	Total	
99-042	arcuva-fescam-fesida	SE Scenic Pt	2	3	36	0.64	0	60.93	14.86	14.29	0.00	0.00	0.00%	0		0	0		0	some PIFL, ABLA nearby; could expand	0	0	mostly ARUV	60.93	0	-	near Scenic Pt trail	5	0	0	5	
00-035	arcuva-fescam-fesida	Baring Basin	2	3	33	0.59	0	49.57	5.50	17.50	0.00	0.00	0.00%	0		0	0		0	natural krummholz trees	0	0	mostly ARUV, DAFL, DRYOCT	49.57	0	-	Baring Basin Tr nearby	5	0	0	5	
00-022	arcuva-fescam-fesida	Belly River susp bridge	2	0	55	0.98	1	28.50	18.93	28.71	0.00	0.43	0.56%	0		0	0		1	POTR and conifer encr	0	1	mostly ARUV, but high AMAL, ROAC	28.50	1	HIAU, HIPR in meadow	Cosley Lk Tr neaby	3	0	3	6	
99-057	arcuva-fescam-fesida	S RR Ck	2	0	50	0.89	1	14.07	16.64	20.50	0.07	0.00	0.14%	0		2	0		1	POTR	0	0	ARUV, DAFL, some AMAL	14.07	0		-	3	2	1	6	
00-016	arcuva-fescam-fesida	White Calf	2	1	49	0.88	0	14.14	28.00	28.07	0.00	0.00	0.00%	0		2	0		1	some POTR, PIFL, ABLA moving in	0	0	mostly DAFL, ARUV	14.14	0	-	400' from park boundary	3	2	1	6	
00-042	arcuva-fescam-fesida	Mad Wolf	2	0	55	0.98	1	19.57	18.07	30.71	0.14	0.00	0.20%	0		3	0		0	a few ABLA but not really invading yet	0	0	mostly DAFL, ARUV	19.57	0	-	near park boundary	3	3	0	6	
01-041	arcuva-fescam-fesida	Henkel base	2	2	43	0.77	0	25.93	6.43	18.71	0.00	0.00	0.00%	0		0	0		0		0	1	although high ARUV, also high AMAL, SPBE here	25.93	1	LIVU downslope	park trail 0.2 miles S of plot	4	0	2	6	
00-014	arcuva-fescam-fesida	L Slide Lake	2	2	40	0.71	0	47.57	15.93	16.43	0.00	0.00	0.00%	0		1	0		1	some POTR in plot; conifers moving in	0.68	0	mostly ARUV, JUHO, DAFL	47.57	0	CIAR just beyond 500m	human foot trail through meadow	4	1	1	6	
00-044	arcuva-fescam-fesida	Apikuni Mt	2	0	50	0.89	2	16.86	16.07	19.71	1.32	0.00	2.45%	0		1	0		1	appears from photo to have conifers moving in	0	0	mostly ARUV, DAFL	16.86	0	-	Poia Lk Tr nearby	4	1	1	6	
01-039	arcuva-fescam-fesida	Apikuni Flats	2	1	49	0.88	1	10.61	24.29	24.21	0.07	0.21	0.48%	0		0	0		1	some POTR, PICO	0	0	mostly ARUV, DAFL	10.61	2	CEMA, LIVU, CIAR nearby	horse trail to S; MG Rd.to N	4	0	3	7	

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare- ness Value	Richness		Exotic cover							Noxious weeds		Livestock trespass Value	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.	Ecolog. Total	Stressor Total	Threat Total	Total		
				Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value		Comments	Value	Comments	Value	Comments	T	Value	Comments	S	Value	Comments					Comments	
01-043	arcuva-fescam-fesida	Poia Lk W	2	1	44	0.79	1	36.43	8.93	18.57	0.29	0.00	0.44%	0		0	1	trail runs through meadow with heavy foot and horse traffic	1	POTR, PICO encr	0	0	mostly ARUV, DAFL	36.43	1	CEMA, LIVU nearby	trail runs through meadow, near MG Rd	4	1	2	7	
99-050	arcuva-fescam-fesida	S Lubec RS	2	2	42	0.75	0	69.50	8.64	18.50	0.00	0.00	0.00%	0		2	0		0		0	0	mostly ARUV	69.50	1	CEMA, CIAR nearby		4	2	1	7	
00-029	arcuva-fescam-fesida	TM Aval chute	2	4	30	0.54	1	33.36	24.71	13.14	0.04	0.00	0.06%	0		0	0		0	a few POTR, ABLA	0	0	mostly ARUV but area being invaded by AMAL	33.36	0	-	Dawson Pass Tr 50' to S	7	0	0	7	
99-015	arcuva-fescam-fesida	Veldt	2	1	47	0.84	2	21.57	10.36	18.86	1.86	0.00	3.53%	0		0	0		2	POTR	0.71	0	DAFL, ARUV; getting too high?	21.57	1	CIAR, CHLE nearby	Belly River Tr nearby	5	0	3	8	
01-050	arcuva-fescam-fesida	Goat Mt	2	4	31	0.55	0	51.93	11.29	19.14	0.00	0.00	0.00%	0		0	0		0		0	0	mostly ARUV; some AMAL, ROSE	51.93	2	CEMA, CHLE, CIAR, HYPE nearby	-	6	0	2	8	
01-029	arcuva-fescam-fesida	W Fire-brand TH	2	1	47	0.84	1	56.00	13.00	17.29	0.43	0.00	0.49%	0		1	0		1	small conifers and POTR encr	0.11	1	although mostly ARUV, lots of AMAL, ROAC here	56.00	2	CEMA, CIAR, CYOF nearby	-	4	1	4	9	
01-049	arcuva-fescam-fesida	Dry Fork Trail	2	2	43	0.77	0	10.50	15.57	26.00	0.00	0.00	0.00%	0		1	0		2	PICO, PSME encr	0	1	fair amount of ROAC, SPBE, AMAL, SYAL	10.50	1	CIAR nearby	-	4	1	4	9	
01-020	arcuva-fescam-fesida	Cosley Lake	2	3	36	0.64	1	15.86	14.07	18.64	0.10	0.00	0.21%	0		0	1	perhaps some park stock grazing	1	small meadow - hard to say	0	0	mostly ARUV	15.86	1	RAAC, CIAR nearby	Stoney Ind Pass TR through meadow	6	1	2	9	
99-040	arcuva-fescam-fesida	Apikuni Flats	2	3	36	0.64	1	29.25	17.00	19.71	0.04	0.00	0.05%	0		0	1	light horse concessioner grazing	1	some POTR	0	0	mostly ARUV	29.25	2	CEMA, LIVU, CIAR, LIDA nearby	horse trail 100' to S	6	1	3	10	

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare-ness	Richness			Exotic cover					Noxious weeds		Livestock trespass	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.	Ecolog.	Stressor	Threat				
			Value	Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value	Comments	Value	Value	Comments	Value	Comments	T	Value	Comments	S	Value	Comments	Comments	Total	Total	Total	Total	
01-031	arcuva-fescam-fesida	BR Custom Hill	2	2	39	0.70	3	12.29	5.50	30.50	3.00	0.18	6.18%	0		0	1	perhaps some park stock grazing	1	ABLA, POTR encr	0	0	mostly ARUV, DAFL, but notable SYAL here	12.29	1	CIAR nearby	BR TR cuts through meadow	7	1	2	10	
01-002	arcuva-fescam-fesida	Rising Sun	2	3	33	0.59	2	27.75	13.64	9.36	0.21	0.71	1.80%	1	0.43%	0	0	near RS CG, GTSR, conessions	1	PICO, PSME have moved into this meadow	0	0	mostly ARUV, but some ROSE, AMAL, SYAL	27.75	2	CEMA present, RAAC, PORE, LIVU, HYPE, EUES, CHLE, CYOF, CIAR nearby	-	7	1	3	11	
99-056	arcuva-fescam-fesida	N Lubec Lake	2	2	40	0.71	2	56.86	8.00	8.79	1.93	0.00	2.55%	0		2	0		1	PICO	0.21	1	mostly ARUV, lots of AMAL here	56.86	2	CEMA, CIAR, LIVU in meadow		6	2	4	12	
00-007	dasflo-fescam	Red Eagle beaver S	1	0	55	0.98	4	10.75	8.32	33.57	11.00	0.68	18.16%	0		0	0		0		0.04	0	mostly DAFL	10.75	0	-	upslope from Red Eagle Tr	5	0	0	5	
00-030	dasflo-fescam	E Marias Pass	1	1	44	0.79	1	21.36	41.14	23.00	0.79	0.00	0.91%	0		1	0		1	some PICO, PSME	0	0	mostly DAFL, but AMAL, ROWO are patchy	21.36	1	CEMA in meadow	not far from RR or Hwy 2	3	1	2	6	
99-034	dasflo-fescam	Red Eagle	1	2	41	0.73	4	13.93	19.29	22.79	6.29	0.25	10.45%	0		0	0		1	PSME in meadow	0	0	DAFL	13.93	1	CEMA, CIAR nearby	-	7	0	2	9	
01-027	dasflo-fescam	Rising Sun	1	3	37	0.66	3	22.86	24.21	22.57	4.89	0.21	6.83%	1	0.21%	0	0	very near GTSR and development	1	PICO, PSME, POTR,PIFL scattered in meadow	0	1	although mostly DAFL, MARE, lots of ROWO, PRVI here	22.86	2	CEMA present, CIAR, CHLE, CYOF, LIVU nearby	-	7	1	4	12	
00-041	dryoct/polviv	Mad Wolf	1	1	45	0.80	0	40.86	9.14	20.50	0.00	0.00	0.00%	0		3	0		0	a few ABLA but not really invading yet	0	0	mostly DAFL, ARUV	40.86	0	-	near park boundary	2	3	0	5	
00-043	dryoct/polviv	Lee Ridge	1	4	31	0.55	0	65.50	4.43	13.43	0.00	0.00	0.00%	0		0	0		0	mostly ABLA	0.07	0	ARUV, DAFL	65.50	0	-	light use hiker trail nearby	5	0	0	5	

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats									TOTALS			
			Rare-ness	Richness			Exotic cover							Noxious weeds		Livestock trespass	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.	Ecolog.	Stressor	Threat	Total
			Value	Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value	Comments	Value	Value	Comments	Value	Comments	T	Value	Comments	S	Value	Comments	Comments	Total	Total	Total	
99-026	fescam-fesida	Cracker Flats	1	2	39	0.70	1	1.86	12.79	36.07	0.29	0.14	0.84%	0		0	1	concessioner horse grazing	1	PICO, POTR; more in meadow	0	0	MARE, DAFL	1.86	0	-	horse trail used in meadow	4	1	1	6
99-025	fescam-fesida	Rising Sun	1	1	47	0.84	1	3.00	13.57	40.79	0.00	0.07	0.12%	1	0.07%	0	0	very near GTSR and development	1	PICO, POTR	0	0	ROWO, AMEL	3.00	2	CEMA present, LIVU, HYPE, CIAR, CHLE, PORE nearby		3	1	3	7
99-027	fescam-fesida	St. Mary Flats	1	1	44	0.79	2	0.46	14.64	22.79	0.18	0.86	2.66%	2	0.90%	0	0		0		0	0	ARUV, DAFL	0.46	2	CEMA present, LIVU, HYPE, CIAR, CHLE nearby	GTSR near	4	2	2	8
99-011	fescam-fesida	Windy Creek	1	3	34	0.61	1	1.04	16.79	33.71	0.50	0.00	0.96%	0		0	0		1	PICO, POTR, POTRI, PSME in meadow	0	0	ROS, MARE	1.04	2	CEMA, EUES, LIVU in meadow	MG RD - road weeds	5	0	3	8
99-053	fescam-fesida	St. Mary Flats	1	4	31	0.55	2	0.00	20.21	26.14	0.57	0.00	1.22%	0		0	0		0		0	0		0.00	1	CEMA, CIAR nearby		7	0	1	8
99-023	fescam-fesida	Rising Sun	1	1	45	0.80	2	3.14	18.71	24.57	0.50	1.04	3.20%	2	1%	0	0	very near GTSR and development	2	PICO, POTR	0	0	ROWO, AMAL, ARUV, DAFL	3.14	2	CEMA present, LIVU, HYPE, CIAR, CHLE nearby		4	2	4	10
00-032	fescam-fesida	E Marias Pass	1	3	35	0.63	3	4.43	29.21	15.14	0.00	4.36	8.20%	3	4.30%	1	0		1	some PICO, PSME	0	0	patchy AMAL, PRVI, ROWO, SHCA	4.43	1	CEMA present	not far from RR or Hwy 2	7	4	2	13
99-032	fesida-fescam-gervis	2 Dog 3	2	0	54	0.96	1	2.96	18.57	45.14	0.14	0.04	0.27%	0		0	0		0		0	0	some SYAL, ROSE, AMAL	2.96	2	CEMA, CIAR, LIVU nearby	GTSR near	3	0	2	5

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare- ness Value	Richness			Exotic cover					Noxious weeds		Livestock trespass Value	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.	Ecolog.	Stressor	Threat	Total			
				Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX		Value	Comments	Value	Comments	Value	Comments	T	Value	Comments	S	Value	Comments	Comments	Total		Total	Total	
99-008	fesida-fescam-gervis	2 Dog 2	2	1	44	0.79	1	3.17	17.58	47.67	0.04	0.21	0.36%	0		0	0		0		0	0	AMAL, ROWO	3.17	2	CEMA, CIAR, HYPE, HIAU nearby	GTSR near	4	0	2	6	
99-035	fesida-fescam-gervis	Red Eagle LO	2	1	46	0.82	1	0.04	17.00	30.21	0.39	0.00	0.82%	0		0	0		1	conifers encr in this meadow	0	0	AMAL	0.04	1	CEMA, CIAR nearby	-	4	0	2	6	
00-023	fesida-fescam-gervis	Henkel base	2	1	45	0.80	1	17.43	35.64	32.00	0.00	0.04	0.04%	0		0	0		0		0	1	fairly high cover of SPBE, SYAL, VACA, AMAL	17.43	1	CEMA, LIVU nearby	some hiker/climber trails present	4	0	2	6	
99-005	fesida-fescam-gervis	2 Dog 1A	2	0	56	1.00	2	0.71	14.14	22.14	0.50	0.14	1.71%	1	0.10%	0	0		0		0	0	perhaps shrub encr at edges	0.71	1	CEMA present, CIAR nearby	GTSR near	4	1	1	6	
99-002	fesida-fescam-gervis	2 Dog 1	2	0	51	0.91	3	2.96	18.57	21.79	2.00	0.39	5.23%	0		0	0		0	POTR only at edges	0	0	ROSW, AMEL	2.96	1	CEMA, CIAR nearby	GTSR near	5	0	1	6	
01-044	fesida-fescam-gervis	Yellow Mt	2	3	36	0.64	0	7.29	27.36	22.71	0.00	0.00	0.00%	0		1	0		0	perhaps some conifer encr but generally low	0	0	DAFL, ROSE	7.29	0	-	-	5	1	0	6	
99-013	fesida-fescam-gervis	2 Dog 3	2	1	48	0.86	1	7.50	19.14	22.86	0.29	0.07	0.72%	0		0	0		0		0	1	photo indicates higher shrub cover here: ROWO, AMAL, DAFL, PRVI	7.50	2	CEMA, LIVU, CIAR, HIAU nearby	GTSR near	4	0	3	7	
99-052	fesida-fescam-gervis	Swiftc. Ridge	2	0	51	0.91	2	7.14	19.36	25.71	0.71	0.00	1.35%	0		1	0		1	a few in meadow	0	0		7.14	1	CEMA in meadow	0.5 mile W of bdary	4	1	2	7	
01-028	fesida-fescam-gervis	W of Firebrnd TH	2	0	52	0.93	2	5.07	29.29	38.21	3.29	0.11	4.47%	0		1	0		1	PICO and POTR encr	0.1	0	mostly DAFL, ROAC	5.07	1	CEMA, CIAR nearby		4	1	2	7	
99-031	fesida-fescam-gervis	1913 RS	2	2	43	0.77	1	2.14	13.43	23.79	0.04	0.36	0.99%	0		0	0		1	scattered POTR, PSME	0	0	DAFL	2.14	1	CEMA in meadow	park trail runs through meadow	5	0	2	7	

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare- ness Value	Richness			Exotic cover					Noxious weeds		Livestock trespass Value	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist. Comments	Ecolog. Total	Stressor Total	Threat Total	Total			
				Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX		Value	Comments	Value	Comments	Value	Comments	T	Value	Comments	S						Value	Comments	
00-010	fesida-fescam-gervis	1913 RS	2	0	50	0.89	3	1.46	18.71	30.43	2.71	1.64	7.93%	0		0	0		1	scattered POTR, PSME	0	0	DAFL, ROWO	1.46	1	CEMA in meadow	park trail runs through meadow	5	0	2	7	
01-005	fesida-fescam-gervis	2 Dog 4	2	1	49	0.88	2	7.04	14.71	43.93	0.71	2.11	4.12%	0		0	0		1	ABLA, PICO, POTR moving into meadow	0	0	WATCH: fairly high cover of AMAL, ROSE	7.04	1	CEMA in meadow	near GTSR	5	0	2	7	
01-021	fesida-fescam-gervis	2 Dog 3	2	1	47	0.84	2	4.29	29.07	28.57	0.79	0.07	1.37%	0		0	0	very near GTSR	0	perhaps some POTR at edges	0	0	some ROWO, AMAL, DAFL	4.29	2	CEMA, CIAR, LIVU nearby	-	5	0	2	7	
99-001	fesida-fescam-gervis	2 Dog 1	2	0	50	0.89	3	0.39	18.14	17.86	1.96	0.46	6.26%	1	0.11%	0	0		0	POTR only at edges	0	0	ROAC + others in meadow	0.39	1	CEMA present, CIAR nearby	GTSR near	5	1	1	7	
01-011	fesida-fescam-gervis	Lake Sher- burne	2	1	45	0.80	2	3.00	14.64	37.00	0.96	0.75	3.04%	0		1	0		0	may have some POTR encr?	0	0	mostly ROSE	3.00	1	CEMA in meadow	near MG Rd	5	1	1	7	
00-020	fesida-fescam-gervis	Cosley Lk	2	3	35	0.63	1	1.36	22.00	25.71	0.39	0.07	0.94%	0		0	0		1	a few conifers, POTR	0	0	ROAC, AMAL + others	1.36	0	-	Cosley Lk Tr runs through meadow	6	0	1	7	
01-046	fesida-fescam-gervis	Autumn Creek	2	2	42	0.75	2	6.75	22.86	22.64	0.57	0.00	1.08%	0		0	0		1	appears from photo to have conifers moving in	0	0	mostly ARUV, DAFL	6.75	0	-	-	6	0	1	7	
01-047	fesida-fescam-gervis	Cracker Flats	2	2	40	0.71	2	1.71	13.36	19.43	1.57	0.07	4.55%	0		0	0		1	some PICO, POTR, POTRI	0	0	AMAL	1.71	0	-	horse trail runs to the W in meadow	6	0	1	7	
01-016	fesida-fescam-gervis	Poia below	2	0	55	0.98	2	2.00	20.71	33.93	0.50	1.07	2.70%	0		2	0		1	some POTR, appears in photo to have conifer encr	0.1	0	mostly ROSE, DAFL	2.00	1	CIAR, CYOF nearby	1.8 miles W of park boundary	4	2	2	8	

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare- ness Value	Richness		Exotic cover							Noxious weeds		Livestock trespass Value	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist. Comments	Ecolog. Total	Stressor Total	Threat Total	Total		
				Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value		Comments	Value	Comments	Value	Comments	T	Value	Comments	S	Value						Comments	
01-010	fesida-fescam-gervis	Lower 2 Med Lk	2	1	46	0.82	2	9.00	20.93	25.36	1.82	0.43	3.91%	0		1	0	not far from TM Road	1	POTR, conifers encr	1.21	1	ARUV, MARE, but some ROSE, AMAL, SYAL, PRVI	9.00	0	-	0.6 miles from park boundary	5	1	2	8	
01-030	fesida-fescam-gervis	Lucke's	2	2	39	0.70	1	5.36	39.79	30.43	0.00	0.04	0.05%	0		2	0		0	some conifers and POTR may be encr edges	0	0		5.36	1	CEMA nearby	near RR tracks	5	2	1	8	
99-019	fesida-fescam-gervis	N of Belly River RS	2	2	39	0.70	2	3.68	31.07	12.07	0.68	0.04	1.50%	0		0	0		1	several patches of PICO	0	0	DAFL, ROSE	3.68	1	CIAR nearby	-	6	0	2	8	
99-021	fesida-fescam-gervis	BR 3-mile	2	1	45	0.80	3	1.00	33.07	19.43	2.68	2.14	8.27%	0		0	0		2	PICO, POTR, ABLA common in meadow	0	0	low for now but some large patches of PRVI in meadow	1.00	0	-	-	6	0	2	8	
00-001	fesida-fescam-gervis	2 Dog 1B	2	1	48	0.86	3	2.36	18.50	60.21	5.04	1.86	7.84%	0		0	0		1	PICO, PSME, POTR scattered in meadow	0	0	AMAL, ROAC	2.36	1	CEMA, CIAR nearby	-	6	0	2	8	
01-003	fesida-fescam-gervis	Cut Bank boundry	2	2	40	0.71	2	3.21	13.64	23.50	0.50	0.14	1.57%	0		1	0	park road cuts through meadow	0	some PICO on edges	0	0	ARUV, DAFL	3.21	1	CEMA, CIAR nearby	-	6	1	1	8	
00-012	fesida-fescam-gervis	Oldman Trail	2	4	28	0.50	1	0.00	30.00	32.64	0.21	0.00	0.34%	0		0	0		1	small meadow but some ABLA & PIEN moving in	0	0		0.00	0	-	Pitamakan Pass Tr runs through meadow	7	0	1	8	
01-037	fesida-fescam-gervis	Boulder Creek	2	3	35	0.63	2	2.86	17.36	10.50	0.64	0.00	2.05%	0		1	0		0		0	0	mostly DAFL	2.86	0	-	old disturbance: past grazing, road, cabins	7	1	0	8	
99-018	fesida-fescam-gervis	N of Belly River RS	2	3	32	0.57	3	3.43	13.64	20.36	3.68	0.11	9.19%	0		0	0		0	a few PICO but not bad yet	0	0	DAFL, ROSE	3.43	0	-	-	8	0	0	8	

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare-ness	Richness			Exotic cover					Noxious weeds		Livestock trespass	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.	Ecolog.	Stressor	Threat				
			Value	Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value	Comments	Value	Value	Comments	Value	Comments	T	Value	Comments	S	Value	Comments	Comments	Total	Total	Total	Total	
99-010	fesida-fescam-gervis	Windy Creek	2	2	39	0.70	2	5.33	12.67	42.67	2.58	0.00	4.08%	0		0	0		1	PICO present; PICO, POTR, POTRI, PSME in meadow	0	0	PRVI, ROS, MARE	5.33	2	CEMA, CIAR, LIVU, EUES nearby	MG RD - road weeds	6	0	3	9	
99-046	fesida-fescam-gervis	Red Eagle N	2	1	47	0.84	3	6.00	16.43	14.57	2.00	0.14	5.47%	0		0	0		1	PICO + scattered in meadow	0	0	mostly DAFL, but some AMAL, ROSE	6.00	2	CEMA, CIAR, CHLE nearby	trail runs through meadow	6	0	3	9	
00-004	fesida-fescam-gervis	Apikuni Flats	2	1	46	0.82	3	4.68	16.29	38.21	4.57	0.25	7.53%	0		0	0	Apikuni Falls TR goes through meadow	1	some PICO; POTR, POTRI at edges	0	0	some SYAL, ROAC, AMAL, SHCA	4.68	2	LIVU, CEMA, CIAR in meadow		6	0	3	9	
01-034	fesida-fescam-gervis	Red Eagle frog ponds	2	2	40	0.71	2	1.36	11.07	22.79	1.00	0.11	3.05%	0		0	0		1	POTR and conifer encr	0	0	some ROSE	1.36	2	CEMA, CHLE, CIAR in meadow	Red Eagle TR runs through meadow	6	0	3	9	
00-015	fesida-fescam-gervis	Slide Lk	2	2	43	0.77	2	1.61	28.14	40.29	0.25	0.54	1.11%	0		1	0		1	some POTR in meadow; conifers spreading	0.5	0	mostly ROAC	1.61	1	CIAR in meadow	human foot trail through meadow	6	1	2	9	
99-020	fesida-fescam-gervis	N of Belly River RS	2	2	38	0.68	3	1.82	17.43	32.29	4.04	0.68	8.38%	0		0	0		2	PICO invading meadow	0	0	DAFL	1.82	0	-	-	7	0	2	9	
01-015	fesida-fescam-gervis	CB Lake Creek	2	3	37	0.66	2	1.50	20.64	39.00	0.43	0.50	1.50%	0		2	0		0	-	0	0	ROSE, DAFL, AMAL	1.50	0	-	0.25 miles from park boundary	7	2	0	9	
99-055	fesida-fescam-gervis	Cracker Flats	2	2	43	0.77	4	7.11	16.43	16.36	4.50	0.43	11.00%	0		0	0		1	POTR; others in meadow	0.1	0	DAFL, ROWO, MARE	7.11	0	-	heavy used conc. horse trail nearby	8	0	1	9	
01-007	fesida-fescam-gervis	2 Med Lk Moose Ponds	2	4	26	0.46	2	0.10	15.86	27.93	0.10	0.43	1.19%	0		0	0	park trail cuts through meadow	1	PSME encr and scattered	0	0		0.10	0	-	-	8	0	1	9	
01-048	fesida-fescam-gervis	Poia above	2	4	30	0.54	2	2.39	23.43	17.79	1.11	0.00	2.48%	0		1	0		0	possible PICO encr but appears low	0	0	mostly DAFL	2.39	0	-	park trail 75' to N	8	1	0	9	
99-038	fesida-fescam-gervis	Swiftc. Ridge	2	1	46	0.82	3	6.89	15.36	19.86	2.50	0.71	7.09%	0		3	0		1	a few in meadow	0	0	ROS, ARUV, DAFL	6.89	0	-	120' W of boundary	6	3	1	10	

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare-ness	Richness			Exotic cover					Noxious weeds		Livestock trespass	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.							
			Value	Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value	Comments	Value	Value	Comments	Value	Comments	T	Value	Comments	S	Value	Comments	Comments	Ecolog. Total	Stressor Total	Threat Total	Total	
99-044	fesida-fescam-gervis	Old Cut Bank Chalet	2	2	38	0.68	3	0.36	17.79	22.79	2.82	0.64	7.80%	1	0.32%	0	0		1	small meadow but some PIEN moving in	0	0	DAFL, SYAL	0.36	1	CIAR present	Triple Divide Tr nearby	7	1	2	10	
01-009	fesida-fescam-gervis	Kennedy Ck	2	1	47	0.84	4	3.93	15.50	28.43	2.50	2.82	10.01%	0		3	0		0	may be some POTR encr	0	0	mostly ARUV	3.93	0	-	120 ft from park boundary	7	3	0	10	
99-030	fesida-fescam-gervis	St. Mary Flats	2	2	39	0.70	4	1.43	12.50	16.71	3.71	0.64	12.45%	1	0.61%	0	0		0		0	0	ROWO	1.43	1	CEMA present, CIAR nearby	GTSR/VC near	8	1	1	10	
99-049	fesida-fescam-gervis	2 mi E Summit	2	3	37	0.66	4	1.61	17.43	24.07	5.04	0.14	10.72%	0		0	0		1	a few POTR	0	0	ROWO	1.61	0			9	0	1	10	
01-023	fesida-fescam-gervis	Rising Sun Picnic Area	2	2	40	0.71	2	7.36	14.86	18.07	0.00	0.96	2.34%	2	0.93%	0	0	very near to GTSR and development	1	some POTR, PSME moving into meadow	0	0	WATCH: ROSE and higher shrub cover to east	7.36	2	CEMA present, CIAR, HYPE, LIVU, CHLE, PORE nearby	-	6	2	3	11	
99-039	fesida-fescam-gervis	Cut Bank E of RS	2	3	34	0.61	2	2.43	23.29	18.29	1.54	0.07	3.52%	1	0.10%	0	0	near CB Rd and development	1	a few PICO, POTR	0	0	mostly DAFL, ARUV	2.43	2	CEMA present, CIAR, HYPE, CHLE, EUES nearby	-	7	1	3	11	
99-033	fesida-fescam-gervis	W of CB CG	2	3	37	0.66	3	0.36	12.14	23.00	2.14	0.18	6.14%	0		0	0		1	PICO, POTR	0	0	ROWO + others	0.36	2	CEMA, CIAR, CHLE nearby	trail runs through meadow	8	0	3	11	
00-003	fesida-fescam-gervis	TM RS corral	2	4	27	0.48	2	0.00	18.71	26.00	1.61	0.21	3.91%	0		0	0		1	some PICO, POTR at edges	0	0	6 shrub species in meadow	0.00	2	CEMA, LIVU, CHLE, CIAR, HIAU, HIPR, HYPE, PORE nearby	TM Rd nearby	8	0	3	11	
00-036	fesida-fescam-gervis	Cut Bank Ridge	2	3	37	0.66	4	2.18	20.00	29.36	5.50	0.07	9.75%	0		0	0		1	POTR at edges	0	0	mostly DAFL	2.18	1	CIAR in meadow	seldom used hiker trail nearby	9	0	2	11	

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare- ness Value	Richness		Exotic cover							Noxious weeds		Livestock trespass Value	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist. Comments	Ecolog. Total	Stressor Total	Threat Total	Total		
				Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value		Comments	Value	Comments	Value	Comments	T	Value	Comments	S	Value						Comments	
99-024	fesida-fescam-gervis	Rising Sun	2	2	41	0.73	2	13.07	14.36	28.57	2.14	0.86	5.08%	2	0.90%	0	0	very near GTSR and development	1	PICO, POTR	0	1	ROWO, PRVI, MARE	13.07	2	CEMA present, LIVU, HYPE, CIAR, CHLE nearby		6	2	4	12	
01-014	fesida-fescam-gervis	SM Sleepy Lagoon	2	3	36	0.64	2	1.71	19.57	15.00	0.07	1.82	4.96%	2	1.82%	0	0	very near road and development	1	conifers encr in this meadow	0	0		1.71	2	CEMA present, HYPE, LIVU, CHLE, CYOF, CIAR nearby	-	7	2	3	12	
99-029	fesida-fescam-gervis	St. Mary VC	2	4	29	0.52	2	0.00	17.14	16.93	1.00	0.04	2.95%	1	0.04%	0	0		1	PICO, POTR, POTRI, PSME in meadow	0	0		0.00	2	CEMA present, LIVU, CIAR nearby	GTSR/VC near	8	1	3	12	
00-048	fesida-fescam-gervis	Hwy 2 Old Bison Siding	2	5	21	0.38	2	3.79	34.57	18.00	1.68	0.10	3.06%	0		3	0		1	PICO, POTR scattered	0	0	mostly DAFL, some AMAL, ROSE	3.79	1	LIVU in meadow, CIAR nearby	RR tracks nearby	9	3	2	14	
00-005	fesida-fescam-potdiv	Apikuni Mt.	1	0	56	1.00	0	2.64	21.64	35.57	0.00	0.00	0.00%	0		0	0		0		0	0	mostly DAFL, some ROAC	2.64	0	-	-	1	0	0	1	
01-040	fesida-fescam-potdiv	Spot Mt	1	2	43	0.77	0	6.43	7.71	35.86	0.00	0.00	0.00%	0		0	0		0	-	0	0	DAFL	6.43	0	-	-	3	0	0	3	
00-027	fesida-fescam-potdiv	Spot Mt	1	1	49	0.88	1	1.04	8.14	22.07	0.00	0.14	0.45%	0		1	0		0	natural amt of ABLA, PIFL	0	0	mostly AMAL	1.04	0	-	-	3	1	0	4	
01-042	fesida-fescam-potdiv	Red Mt W	1	3	37	0.66	0	6.29	12.36	24.14	0.00	0.00	0.00%	0		0	0	more PHPR near trail	0	scattered trees here - not really encr	0.1	0	mostly SPBE	6.29	0	-	200m above Pitamakan P TR	4	0	0	4	
00-037	fesida-fescam-potdiv	Looking Glass	1	1	48	0.86	1	1.07	18.21	30.36	0.07	0.07	0.29%	0		1	0		1	some POTR patches at edge	0.5	0	DAFL	1.07	0	-	600' W of park boundary	3	1	1	5	
00-039	fesida-fescam-potdiv	Milk R Ridge	1	0	53	0.95	2	1.57	23.57	22.21	0.50	0.00	1.04%	0		1	0		1	PSME, POTR, PIAL scattered in meadow	0	0	mostly ROWO	1.57	0	-	0.15 miles from park boundary	3	1	1	5	

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare-ness	Richness			Exotic cover					Noxious weeds		Livestock trespass	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.							
			Value	Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value	Comments	Value	Value	Comments	Value	Comments	T	Value	Comments	S	Value	Comments	Comments	Ecolog. Total	Stressor Total	Threat Total	Total	
01-038	fesida-fescam-potdiv	Boulder Ridge	1	1	46	0.82	1	9.75	13.00	31.07	0.00	0.14	0.26%	0		1	0		1	photo shows conifer encr	0	0	WATCH: ARUV here but fair amount of ROSE	9.75	0	-	old disturbance: past grazing	3	1	1	5	
01-033	fesida-fescam-potdiv	CB Lake Creek	1	2	38	0.68	0	6.29	16.50	21.14	0.00	0.00	0.00%	0		2	0		0		0	0	mostly DAFL, ARUV	6.29	0	-	435 ft from park boundary	3	2	0	5	
00-038	fesida-fescam-potdiv	Kup Rdg	1	3	37	0.66	0	5.57	20.07	14.93	0.00	0.00	0.00%	0		0	0		2	ABLA scattered in meadow - very evident on photo	0	0	mostly DAFL	5.57	0	-	-	4	0	2	6	
01-017	fesida-fescam-potdiv	Mad Wolf	1	1	47	0.84	1	7.07	18.50	29.07	0.00	0.07	0.13%	0		3	0		1	appears from photo to have conifers, POTR moving in	0	0	mostly DAFL, ARUV, but notable ROSE	7.07	0	-	0.2 miles from park boundary	3	3	1	7	
99-012	fesida-fescam-potdiv	Dry Fork	1	2	42	0.75	1	7.14	16.21	22.07	0.00	0.04	0.08%	0		0	0		2	PICO, PSME	0	0	half ARUV, half AMAL + others	7.14	1	CIAR nearby	-	4	0	3	7	
00-040	fesida-fescam-potdiv	Cut Bank Ridge	1	2	41	0.73	1	1.61	24.21	29.21	0.00	0.07	0.13%	0		3	1	ranchers sometimes drive here	0	a few ABLA but not really invading yet	0	0	DAFL, ROSE, SHCA	1.61	0	-	0.2 miles from park boundary	4	4	0	8	
00-025	fesida-fescam-potdiv	Pray Lake	1	5	20	0.36	1	0.00	13.50	36.79	0.10	0.21	0.61%	0		0	0	very close to CG road and development	1	some PICO encr	0	0		0.00	1	CEMA, LIVU nearby	-	7	0	2	9	

Rareness: Rare in park and region = 0; Rare in park but not region = 1; Rare in region but not park = 1; Not rare in park or region = 2
Relative Richness (comments field lists # species present in plot/highest # of species found in total plots): Very High (0.89 - 1.0) = 0; High (0.78 - 0.88) = 1; Medium-High (0.67 - 0.77) = 2; Medium (0.56 - 0.66) = 3; Low (0.40 - 0.55); Very Low (< 0.39)

% Exotic species (% cover exotic species/total % cover):
More pristine = None = 0; Low (0.01 - 1.0% of total vegetation) = 1; Medium (1.01 - 5% of total veg) = 2; Medium-High (5.01 - 10% of total veg) = 3; High (>10% of total veg) = 4
Less pristine = Low (14 - 20% of total vegetation) = 0; Medium (21 - 30% of total vegetation) = 1; Medium-High (31 - 45% of total vegetation) = 2;
High (46 - 65% of total vegetation) = 3; Very High (> 66% of total vegetation) = 4

Noxious Weed Populations present in meadow: High cover (10% or <) = 4; Medium cover (5-9%) = 3; Low cover (1-4%) = 2; trace cover = 1; No noxious weeds = 0

Livestock Trespass (determined by notes): High = 3; Medium = 2; Low = 1; None = 0

Other direct stressors: High = 3; Medium = 2; Low = 1

Tree encroachment: Moderate = 2; Low = 1;None =0

Shrub encroachment: Moderate/High (>10% SYMALB, ROSWOO, AMELAN, PRUVIR) = 1; Low/None = 0

Distance to noxious weed populations if not in meadow already (determined using weed maps):
3 or more noxious weeds within 0-500m = 2; 2 or fewer noxious weeds within 0-500m = 1; no noxious weeds within 500m = 0

Weedy Associations

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats									TOTALS			
			Rare-ness	Richness			Exotic cover					Noxious weeds		Livestock trespass	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.	Ecolog.	Stressor	Threat	Total		
			Value	Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value	Comments	Value	Value	Comments	Value	Comments	T	Value	Comments	S	Value	Comments	Comments	Total		Total	Total
99-003	phlpra-poapra-broine	2 Dog 1	2	3	36	0.64	3	0.68	5.96	15.43	19.64	0.00	47.09%	0		0	0		1	PSME, POTR	0	0	ROWO, AMAL	0.68	1	CEMA, CIAR in meadow	GTSR near	8	0	2	10
99-004	phlpra-poapra-broine	2 Dog 1	2	4	30	0.54	3	0.39	11.86	11.57	20.57	0.04	46.38%	1	0.04%	0	0		0		0	0	ROWO, AMAL, SYAL	0.39	1	CEMA present, CIAR nearby	GTSR near	9	1	1	11
99-006	phlpra-poapra-broine	2 Dog 1	2	1	44	0.79	2	7.86	8.86	20.43	17.50	0.68	32.86%	1	0.54%	0	0		0		0	1	notes indicate more ROWO, AMAL here	7.86	1	CEMA present, CIAR nearby	GTSR near	5	1	2	8
99-007	phlpra-poapra-broine	2 Dog 2	2	1	45	0.80	3	8.00	6.63	22.25	32.08	0.13	46.62%	0		0	0		1	small POTR	0	1	notes indicate more ROWO, AMAL here	8.00	2	CEMA, HIAU, CIAR, HYPE nearby	GTSR near	6	0	4	10
99-009	phlpra-poapra-broine	2 Dog 2	2	1	45	0.80	2	3.08	6.33	16.17	12.33	0.33	33.12%	1	0.17%	0	0		0		0	0	ROWO, AMAL, MARE	3.08	2	CEMA present, CIAR, HIAU, HYPE nearby	GTSR near	5	1	2	8
99-014	phlpra-poapra-broine	2 Dog 3	2	3	32	0.57	2	4.86	2.71	19.57	19.93	1.21	43.79%	1	0.10%	0	0		0		0	0	some AMAL, ROWO, MARE	4.86	1	CEMA present, CIAR nearby	GTSR near	7	1	1	9
99-016	phlpra-poapra-broine	Veldt	2	3	32	0.57	3	0.93	16.04	12.79	27.71	4.43	51.93%	0		0	0		1	POTR in meadow	0	0	DAFL, ROWO	0.93	1	CIAR, CHLE nearby	Belly River Tr nearby	8	0	2	10
99-017	phlpra-poapra-broine	Veldt	2	2	40	0.71	1	3.18	19.25	23.29	13.64	2.50	26.10%	0		0	0		1	POTR in meadow	0	0	DAFL, ROWO, AMAL, PRVI	3.18	1	CIAR, CHLE nearby	Belly River Tr nearby	5	0	2	7
99-022	phlpra-poapra-broine	BR 3-mile	2	3	36	0.64	2	1.11	7.21	23.71	11.64	2.71	30.95%	0		0	0		2	patches of POTR, PICO in meadow	0	0	DAFL, ROWO	1.11	0	-	-	7	0	2	9
99-028	phlpra-poapra-broine	St. Mary Flats	2	4	27	0.48	2	13.79	0.11	3.64	10.86	1.93	42.17%	2	1.75%	0	0		1	PICO, POTR, POTRI, PSME in meadow	0	1	11% ROWO, SYAL	13.79	2	CEMA present, CHLE, CIAR, LIVU nearby	GTSR near	8	2	4	14

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare-ness	Richness			Exotic cover							Noxious weeds		Livestock trespass	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.	Ecolog.	Stressor	Threat		
				Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value	Comments		Value	Value	Comments	Value	Comments	T	Value	Comments	S	Value	Comments					Comments
99-036	phlptra-poaptra-broine	Red Eagle LO	2	1	44	0.79	1	1.79	8.61	26.29	11.71	0.39	24.82%	0		0	0		1	a few conifers encr	0	0	AMAL, ROSE, SYAL	1.79	1	CEMA, CIAR nearby	-	4	0	2	6	
99-037	phlptra-poaptra-broine	Red Eagle LO	2	4	30	0.54	1	5.25	4.68	28.21	10.68	2.21	25.26%	0		0	0		1	a few conifers encr	0	0	WATCH -all ROSE	5.25	1	CEMA, CIAR nearby	-	7	0	2	9	
99-043	phlptra-poaptra-broine	Old Cut Bank Chalet	2	2	40	0.71	0	0.21	2.68	40.64	7.07	0.36	14.58%	0		0	0		1	small meadow but some BEPA moving in	0	0	AMAL +others	0.21	1	CIAR nearby	Triple Divide Tr nearby	4	0	2	6	
99-045	phlptra-poaptra-broine	Red Eagle Jct	2	3	34	0.61	2	0.00	5.11	19.29	16.86	0.00	40.87%	0		0	0		0	maybe a few conifers but not bad	0	0	low AMAL, DAFL, SYAL	0.00	1	CEMA, CHLE nearby	trail through meadow; much hist. disturbance	7	0	1	8	
99-047	phlptra-poaptra-broine	Red Eagle S of LO	2	4	31	0.55	3	1.79	3.11	14.29	22.07	0.89	54.49%	0		0	0		1	a few conifers encr	0	0	DAFL, ROSE	1.79	1	CEMA nearby	trail through meadow; much hist. disturbance	9	0	2	11	
99-048	phlptra-poaptra-broine	upper SC Ridge	2	3	34	0.61	2	0.75	9.25	14.07	16.29	1.89	43.03%	0		3	0		0		0	0	ROWO	0.75	1	CEMA, CIAR nearby	0.5 mile W of boundary	7	3	1	11	
99-051	phlptra-poaptra-broine	Lubec RS	2	5	20	0.36	4	0.14	0.21	17.29	31.93	11.57	71.14%	0		3	0	trail cuts through meadow	0		0	0	ROWO, DAFL	0.14	2	CIAR, CEMA, CHLE in meadow	none	11	3	2	16	
99-054	phlptra-poaptra-broine	St. Mary Flats	2	2	39	0.70	1	3.96	11.14	22.79	15.86	0.11	29.64%	1	0.10%	0	0		1	PICO, POTR, POTRI, PSME in meadow	0	0	ROWO	3.96	1	CIAR present, CEMA nearby	access road/trail near	5	1	2	8	
00-002	phlptra-poaptra-broine	SC Ridge	2	2	43	0.77	0	7.25	6.64	46.86	11.43	2.25	18.38%	0		1	0		0	some POTRI at edges	0	0	getting higher; mostly DAFL but some ROWO, SYAL, SPBE	7.25	0	-	Poia TR nearby	4	1	0	5	
00-009	phlptra-poaptra-broine	RE 2 mile	2	3	32	0.57	2	0.79	3.50	29.36	18.07	8.07	43.73%	0		0	0		1	some POTR, POTRI, PSME encr on edges	0	0	a little of 5 species	0.79	2	CEMA, CHLE, CIAR nearby	-	7	0	3	10	

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats									TOTALS			
			Rare-ness	Richness			Exotic cover							Noxious weeds		Livestock trespass	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.	Ecolog.	Stressor	Threat	
			Value	Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value	Comments	Value	Value	Comments	Value	Comments	T	Value	Comments	S	Value	Comments	Comments	Total	Total	Total	Total
00-011	phlpra-poapra-broine	Two Med RS corral	2	4	29	0.52	2	0.00	3.71	18.00	11.57	2.86	39.92%	0		0	0		1	PICO, POTR on edges	0	0	a little ROSE	0.00	2	LIVU, CEMA, CHLE, CIAR, HIAU, HIPR, HYPE, PORE nearby	TM Road nearby	8	0	3	11
00-013	phlpra-poapra-broine	Jule's Ck	2	1	44	0.79	1	5.46	8.93	46.93	18.21	5.64	28.01%	0		3	0		0	only a few POTR on edges	0	0	DAFL, ROWO	5.46	0	-	near Chief Mt Road and park boundary	4	3	0	7
00-017	phlpra-poapra-broine	Belly River RS	2	5	19	0.34	3	2.50	1.36	27.57	18.79	7.93	45.95%	0		0	3	Belly River pasture	0		0	0	ROAC, DAFL, AMAL	2.50	2	LIVU, HIAU, CIAR, PORE, RAAC, CHLE nearby	trails go through pasture	10	3	2	15
00-018	phlpra-poapra-broine	Belly River RS	2	4	24	0.43	2	0.04	4.79	47.50	30.71	10.00	43.76%	0		0	1	part of BR pasture - not used as often	0		0	0		0.04	2	LIVU, HIAU, CIAR, PORE, RAAC, CHLE nearby	trails go through pasture	8	1	2	11
00-021	phlpra-poapra-broine	BR 1-mile	2	3	36	0.64	2	0.00	16.57	56.43	20.29	15.57	32.94%	0		0	0		1	POTR clumps prevalent	0	0		0.00	1	CIAR in meadow	BR RS trail nearby	7	0	2	9
00-024	phlpra-poapra-broine	Red Eagle beaver	2	0	50	0.89	0	4.93	7.21	29.43	8.07	0.36	16.86%	0		0	0		0	some POTR on edges	0	0	mostly DAFL but some AMAL + others to watch	4.93	0	-	upslope from Red Eagle Tr	2	0	0	2
00-033	phlpra-poapra-broine	E Marias Pass	2	2	39	0.70	1	2.29	26.86	45.93	27.14	0.21	26.70%	0		1	0		1	surrounded by POTR that seem to be encr	0	0	DAFL	2.29	1	CEMA in meadow	near to RR and Hwy 2	5	1	2	8
00-046	phlpra-poapra-broine	Lubec Lake	2	5	21	0.38	2	0.04	2.32	14.00	8.79	0.32	35.77%	1	0.29%	1	0		1	PICO, POTR scattered in meadow	0	0	DAFL, ROAC	0.04	2	LIVU, CEMA, CIAR in meadow	near to RR and Hwy 2	9	2	3	14

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats										TOTALS			
			Rare-ness	Richness				Exotic cover							Noxious weeds		Livestock trespass	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.	Ecolog.	Stressor	Threat	
				Value	Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value	Comments		Value	Value	Comments	Value	Comments	T	Value	Comments	S	Value		Comments	Comments	Total	
01-001	phlpra-poapra-broine	St. Mary CG	2	3	35	0.63	0	1.79	9.00	30.57	7.21	1.61	17.58%	1	0.10%	0	0	very close to SM CG	0	may be some POTR encr	0	0	ARUV, DAFL, ROAC	1.79	2	CEMA present, LIVU, CIAR nearby	-	5	1	2	8	
01-004	phlpra-poapra-broine	Apikuni Mt	2	3	34	0.61	0	1.14	11.50	33.14	6.86	1.36	15.21%	0		0	1	some stock grazing, near MG Rd, trail cuts through	0	some PICO, POTR but very small meadow	0.1	0	DAFL	1.14	2	CEMA, CIAR, LIVU nearby	-	5	1	2	8	
01-006	phlpra-poapra-broine	Apikuni corral	2	1	45	0.80	1	3.00	3.86	16.00	8.57	0.61	28.65%	1	0.10%	0	1	some stock grazing, near MG Rd, horse trail cuts through	1	appears to have POTR moving in from photo?	0	0	mostly ROSE	3.00	2	LIVU, CEMA present, CIAR, LIDA nearby	-	4	2	3	9	
01-008	phlpra-poapra-broine	Red Eagle Hill	2	5	22	0.39	3	1.54	0.10	19.71	34.93	2.79	63.85%	0		0	0	park trail (allows stock) cuts through meadow	1	PICO, POTR appear to be encr	0	0	mostly ROSE	1.54	2	CEMA, CHLE, CIAR in meadow	-	10	0	3	13	
01-012	elyrep/taroff	Lake Sherburne	2	5	6	0.11	4	0.00	3.46	0.14	38.93	3.54	92.17%	0		1	2	annually inundated shoreline	0	may be some POTR encr	0	0		0.00	1	CEMA in meadow	near MG Rd	11	3	1	15	
01-013	phlpra-poapra-broine	Cassidy Curve	2	2	38	0.68	3	1.93	2.82	37.43	39.29	3.29	50.23%	0		3	0		0		0	0	ROSE, SYAL	1.93	0	-	1.4 miles W of park boundary	7	3	0	10	
01-019	phlpra-poapra-broine	Belly / Moko Jct	2	3	34	0.61	1	0.00	4.64	32.86	9.93	5.46	29.10%	0		0	0		0		0	0		0.00	1	CIAR in meadow	-	6	0	1	7	
01-022	phlpra-poapra-broine	Rising Sun Picnic	2	4	29	0.52	2	8.36	36.29	19.14	30.64	0.43	32.76%	1	0.53%	0	0	very near GTSR and development	1	PICO, PSME moving into meadow	0	1	although not quite 10% cover, cover of ROSE high and even higher to east with PRVI	8.36	2	CEMA present, CIAR, CHLE, LIVU, HYPE nearby	-	8	1	4	13	
01-024	phlpra-poapra-broine	Ashline	2	4	28	0.50	3	0.39	0.43	18.36	33.00	0.36	63.49%	0		1	0		1	PICO encr	0	0		0.39	1	CEMA nearby	-	9	1	2	12	
01-025	phlpra-poapra-broine	Ashline	2	3	32	0.57	0	1.79	1.21	39.64	8.64	1.18	18.72%	0		1	0		1	PICO encr	0	0		1.79	1	CEMA nearby	-	5	1	2	8	

Plot	Association Type	Location	Ecological Features/Value											Stressors					Threats									TOTALS			
			Rare-ness	Richness			Exotic cover					Noxious weeds		Livestock trespass	Other direct stress		Tree encroachment			Shrub encroachment			Distance to noxious weeds		Distance to pot. dist.	Ecolog.	Stressor	Threat			
			Value	Value	#N	#N/56	Value	S	NG	NF	EG	EF	% EX	Value	Comments	Value	Value	Comments	Value	Comments	T	Value	Comments	S	Value	Comments	Comments	Total	Total	Total	Total
01-026	phlpra-poapra-broine	2 Dog 3	2	4	26	0.46	2	8.57	8.21	31.50	31.00	0.57	39.53%	0		0	0	very near GTSR	0	hard to say how POTR is invading here	0	1	although not quite 10% cover, cover of ROSE high and even higher to east	8.57	2	CEMA, CIAR, HYPE, LIVU nearby	-	8	0	3	11
01-035	elyrep/taroff	Ashline	2	5	19	0.34	4	0.10	0.00	11.79	25.36	13.29	76.48%	4	13.30%	1	0		0		0	0	0.10	2	CEMA, CIAR, LIDA present	near RR tracks	11	5	2	18	
01-036	phlpra-poapra-broine	W Fire-brand TH	2	3	33	0.59	2	7.14	12.93	23.43	16.86	4.04	32.45%	2	4.04%	1	0		1	POTR seedlings	0	0	all DAFL although lg patches of AMAL	7.14	2	CEMA present, CIAR, LIVU, EUES nearby	near RR tracks	7	3	3	13
01-045	elyrep/taroff	Lubec Lake	2	5	22	0.39	1	0.1	0.21	16.43	6.64	0.32	29.38%	1	0.32%	1	0		0		0	0	0.1	2	LIVU present, CEMA, CIAR in meadow	near RR tracks	8	2	2	12	

Rareness: Rare in park and region = 0; Rare in park but not region = 1; Rare in region but not park = 1; Not rare in park or region = 2

Relative Richness (comments field lists # species present in plot/highest # of species found in total plots): Very High (0.89 - 1.0) = 0; High (0.78 - 0.88) = 1; Medium-High (0.67 - 0.77) = 2; Medium (0.56 - 0.66) = 3; Low (0.40 - 0.55); Very Low (< 0.39)

% Exotic species (% cover exotic species/total % cover):

More pristine = None = 0; Low (0.01 - 1.0% of total vegetation) = 1; Medium (1.01 - 5% of total veg) = 2; Medium-High (5.01 - 10% of total veg) = 3; High (>10% of total veg) = 4

Less pristine = Low (14 - 20% of total vegetation) = 0; Medium (21 - 30% of total vegetation) = 1; Medium-High (31 - 45% of total vegetation) = 2;

High (46 - 65% of total vegetation) = 3; Very High (> 66% of total vegetation) = 4

Noxious Weed Populations present in meadow: High cover (10% or <) = 4; Medium cover (5-9%) = 3; Low cover (1-4%) = 2; trace cover = 1; No noxious weeds = 0

Livestock Trespass (determined by notes): High = 3; Medium = 2; Low = 1; None = 0

Other direct stressors: High = 3; Medium = 2; Low = 1

Tree encroachment: Moderate = 2; Low = 1;None =0

Shrub encroachment: Moderate/High (>10% SYMALB, ROSWOO, AMELAN, PRUVIR) = 1; Low/None = 0

Distance to noxious weed populations if not in meadow already (determined using weed maps):

 3 or more noxious weeds within 0-500m = 2; 2 or fewer noxious weeds within 0-500m = 1; no noxious weeds within 500m = 0