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A description of the major plant communities on the Theodore Roosevelt Memorial Ranch

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A DESCRIPTION OF THE MAJOR PLANT COMMUNITIES ON THE THEODORE ROOSEVELT MEMORIAL RANCH

By

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The major plant communities and soil types were described and mapped on the Theodore Roosevelt Memorial Ranch (TRMR), a working cattle ranch purchased in 1986 by the Boone and Crocket Club. The purpose of this research was to establish baseline data needed to aid in the development of future ranch management and research activities. The major plant communities have been floristicly described, mapped, and classified according to the dominant coverage of overstory and understory species. Plant community data collection was done using the Daubenmire method, or a variation thereof. Each community has been correlated with the habitat type, range site and soil types on with they are found. Soils were mapped using aerial photography, classification systems, and nomenclature employed by the Soil Conservation Service. The importance of each plant community is discussed from a livestock and wildlife perspective. A total of 22 plant communities were described and key of these plant communities is included.

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INTRODUCTION

The Theodore Roosevelt Memorial Ranch was purchased by the Boone and Crocket club in 1986 to examine management programs which benefit the while maintaining the integrity of a working cattle operation. The ranch, which is located 9 miles (14 km) west of Dupuyer, Montana, encompasses approximately 6,050 acres (2,448 ha). This area lies in a transition zone where the northern mixed-grass prairie integrates into the Douglas-fir forests. Therefore, the ranch, though relatively small, encompasses many vegetation types and is quite diverse in vegetation and wildlife.

While this area is typically thought of as a cattle ranching and production region, this ranch is also a critical big game winter range for deer and elk. The ranch has historically supported approximately 275 cow-calf pairs and a large number of wintering wild ungulates as well as a smaller year-round resident population of many wildlife species. Although this ranch is certainly an important wildlife and research acquisition, it also is an integral part of a complex needed to provide for the long term future of wildlife on the Rocky Mountain Front in these times of production oriented land uses. This complex currently consists of Glacier National Park, located 40 miles (64 km) to the north, the Blackleaf Wildlife Management Area located 7

miles (11 km)to the south, Pine Butte Swamp Preserve located 25 miles (40 km) to the south and the Sun River Wildlife Management Area located 50 miles (80 km) to the south.

The vegetation is the primary resource of any ranching operation. The degree of diversity within and among various plant communities are an important attribute that must be documented in an effort to understand how the needs of cattle and wildlife can be met while facilitating prediction of vegetative responses to management. Without an adequate knowledge of the current and potential vegetation of the area sound management and research are not possible.

The overall objective of my research project was to initiate the vegetation analysis and monitoring that are needed to aid in ranch management and research activities on the TRMR.
Specifically, I: 1) described and mapped all major plant communities on the TRMR; 2) established permanent transects within the major plant communities to monitor changes in range condition and composition as a response to management or research activities; 3) determined the potential vegetation for each major plant community based on the range site and habitat type concepts; 4) and determined the effect of past management on the plant community composition within the important grazing areas of the ranch.

STUDY AREA DESCRIPTION

The TRMR is located in Teton County, Montana between the towns of Browning and Choteau (Fig.1). The nearest community is Dupuyer, Montana which is approximately 9 miles east (14 km) of the ranch on U.S. highway 89. The ranch, approximately 6,050 acres (2,448 ha), is in Township 27 North, and Ranges 8 and 9 West (for a legal description see appendix C).

This area is in the vegetation and precipitation transition zone associated with the abrupt meeting of the mountains and the plains common to this portion of the Rocky Mountain East Front. The precipitation varies from 15 to 20 plus inches (50 cm) annually. In general, a vegetative gradation from a mixed-grass prairie, through a limber pine, to a Douglas-fir forest occurs within the study area.

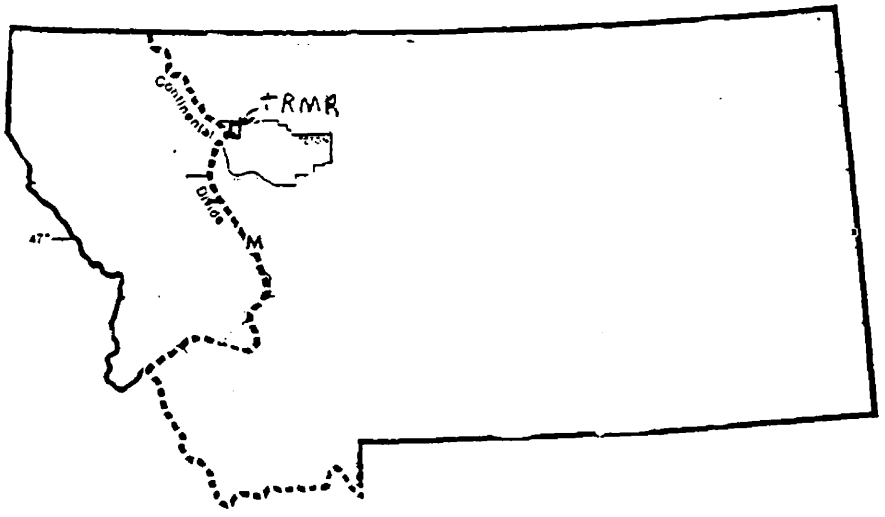

Figure 1. Study area map

METHODS

Field Methods

A reconnaissance of ranch vegetation led to the recognition of prevalent community types (c.t.). Sample stands within each recognized c.t. were selected subjectively without preconceived bias as described by Mueller-Dombois and Ellenberg (1974). All sample stands were chosen as homogeneous representatives of the community being sampled. Sample plots and transect locations within sample plots were chosen objectively. Transect lines were permanently marked at their beginning and ending points with metal posts and wooden stakes. Identifier numbers were stamped into steel washers and attached to each metal post and identifier numbers were stamped directly into the wooden stakes. A photographic record was established for each sample plot. The photographic record, original data collection sheets, and computer data base file have been submitted to Dr. Donald Bedunah, School of Forestry, University of Montana, for future reference.

All areas having an overstory of aspen, Douglas-fir, or limber pine were sampled using the Daubenmire cover class method (Daubenmire 1959). The only variation of this method was that I used the following cover classes: (1) trace to 2.49, (2) 2.5 to 4.99, (3) 5.0 to 9.99, (4) 10.0 to 19.99, (5) 20.0 to 29.99, (6)

30.0 to 49.99, (7) 50.0 to 74.99, (8) 75.0 to 100. All plant communities not within the canopy cover of aspen, Douglas-fir or limber pine were sampled using the following variation of the Daubenmire cover class method: 1) Macroplot size was increased to 50m long and 30m wide. 2) Microplot frame size was increased to 0.44 m^2. 3) Microplots were located at 5 m intervals along the transect lines. 4) Species cover was divided into 8 cover classes as described above. Vegetation data include a complete list of plant species, cover class, constancy, and frequency of occurrence, for each plant species and sample plot. Within selected bunchgrass communities, basal area was recorded for shrubs and bunchgrasses.

Most plants were identified to species during fieldwork. Particularly difficult specimens were collected and identification was corrected or confirmed by Dr. Peter Stickney, USDA Forest Service, Intermountain Research Station, Missoula, Montana. Taxonomic nomenclature, for all species, follows Hitchcock and Cronquist (1973). All common names used in community descriptions correspond to scientific names as presented in USDA Forest Service Master Plant List (1987)(see Appendix B). A complete plant species collection has been placed in the range herbarium at the University of Montana.

Site characteristics and plot composition were recorded at

each transect location. Site data included elevation, aspect, slope, soil profile description, rooting depth, and topography. Soils were described using the new classification system (ABC system) of the Soils Survey Manual (currently in draft status) as reported in Soils Genesis and Morphology syllabus by Nimlos (1988), and by Fanning and Fanning (1989). At each transect site a soil pit was dug and each soil horizon or layer was described separately. Rooting depth was ocularly estimated as the depth above which 90% of the root biomass was found in the soil profile.

Data Analysis

All field data were computer coded to data base files and transferred to the FUZPHY computer program for data manipulation and evaluation. FUZPHY facilitates the creation of coverage and constancy tables, similarity indexes, and association tables of individual and combined sample plots. These indexes and tables were used for the purpose of classification and naming of homogeneous plant communities from environmentally similar habitats, based on their dominant and co-dominant species composition.

lapping

The plant communities were mapped to show their geographic listribution. Infrared and color aerial photography, as well as :opographic quadrate maps, were used to aid in the mapping >rocedure. Any vegetation mapping requires a generalization, ıbstraction, or typification of the real present vegetation >attern. Therefore, community boundaries necessarily include ecotones that occur within, between, and among the recognized vegetative segments.

RESULTS AND DISCUSSION

Riparian Community Types

The riparian communities are those plant communities that are associated with lakes, reservoirs, springs, bogs, wet meadows, and ephemeral, intermittent, or perennial streams (Hansen et al. 1988). Individual communities within this group are usually very dissimilar in species composition, but are often closely associated in distribution. Collectively, these communities are important features for maintaining water quality and providing cover and forage for cattle and many species of wildlife. I have identified five important riparian c.t.

Water sedge/Baltic rush c.t.: The water sedge/ Baltic rush community (Fig. 1) was found in draws and on gently sloping hillsides of the domestic grass-hay regions of the TRMR. They were usually long and narrow following surface or sub-surface water courses. They were floristically simple with as few as 13 species found on a sample site.

Sedges and rushes were the dominant class of vegetation averaging 54% cover. Graminoids were represented by a mean cover of 9%, but on the wettest sites, they may be reduced to less than 1% cover. Forbs averaged 7% cover and shrubs were

Figure 2. Water sedge/Baltic rush c.t.

present on two of four sample sites and averaged 11% cover.

Sedges were dominated by water sedge and beaked sedge which averaged 18% cover respectively (Table 1.). Water sedge was dominant on three sites while beaked sedge dominates the fourth. Baltic rush was the dominant rush on all sample sites and averaged 23% cover. As the proportion of water sedge and beaked sedge increased the cover of baltic rush and grass species appeared to decline.

Three different species of graminoid dominated this vegetative class. These were redtop, seaside arrow-grass, each dominant on one site, and northern reedgrass which was dominant on two sample sites. Northern reedgrass was the only graminoid present on one of these sites and it represented only 1% cover.

Forbs were dominated by a different species on each sample site. Arranging the sites from driest to wettest the dominant forbs were Virginia strawberry, little gray aster, elephanthead, and water hemlock. None of these species had cover values greater than 5%. Water hemlock is a common species along the waterways of the ranch and is very poisonous to humans, cattle, and wild ungulates.

Shrubs were found on only two sample sites within this community. Bebb's willow was the dominant shrub on both sites, averaging 8% cover, and 65% of all shrub cover. Hoary willow, diamond willow, and blueberry willow were also present, but each was limited to only one site.

Because these communities were small, they were considered inclusions on soil maps provided by the Soil Conservation Service. Soil pits dug at each sample site showed that these soils are typically organic material to an average depth of 6.5 inches (16 cm.). Mineral soils of clay loam and clay occur to 25 inches (63 cm.) in the soil profile and set on a compact layer of sandy clay. These soils contain heavy concentrations of carbonates beginning at the soil surface and continuing throughout the soil profile. Ocular estimate of rooting depth averaged 24 inches (61 cm.). The rhizomatous growth habit of the major

Table 1. Coverage (%) and constancy (%) of major plant species, litter, and bareground of the Water sedge / Baltic rush c.t.

Vegetation Class	Constancy	Coverage
Tree/Shrub		
Bebb's willow	100	8
Blueberry willow	25	4
Graminoid		
Redtop	50	8
Northern reedgrass	75	2
Kentucky bluegrass	62	2
Forb		
Water hemlock	50	8
Little gray aster	62	2
Virginia strawberry	50	1
Water mint	88	2
Sedge/Rush		
Water sedge	100	18
Beaked sedge	75	18
Baltic rush	100	23
Litter	100	82
Bareground	25	1

species of these sites forms a dense sod effectively stabilizing soils. The range site classification corresponding to these sites is Subirrigated 15-19.

Bebb's Willow c.t.: The Bebb's willow community (Fig. 2) was common on the TRMR but the size of individual stands was usually less than 5 acres (2 ha). It was best represented on streambanks, overflow channels, and seeps.

Shrubs were the dominant class of vegetation averaging 86% cover. Bebb's willow was the dominant shrub species with an average cover of 65% (Table 2). No other shrub species was observed on all sample sites of this community. Woods rose, snowberry, and ribes were found on three sites with an average 3%, 2%, and 4% cover, respectively. Serviceberry, chokecherry, red osier dogwood, and river birch could also be found, but were infrequent constituents of the Bebb's willow type.

Graminoids averaged 24% cover with variation from 11% to 38%. Timothy and redtop were dominants on different sample sites. Timothy was the co-dominant on one site dominated by redtop, and redtop was the co-dominant on one site dominated by timothy. Kentucky bluegrass was the co-dominant species on the remaining two sites. Across sample stands, redtop, timothy, and

Figure 3. Bebb's willow c.t.

Kentucky bluegrass averaged 7%, 6%, and 4% cover, respectively. Blue rye grass was also represented on all sample sites averaging 5% cover. Other common graminoids were smooth brome, fowl mannagrass, and sedges.

Forbs averaged 32% cover, but variation in species coverage between stands was very high. Forb composition was very dynamic with only a few species i.e., Virginia strawberry, domestic dandelion, American vetch, and common yarrow represented on all sample sites. Common hound's-tongue, Virginia strawberry, domestic dandelion, and field mint were the dominant forbs for a site. These species, and many others represented in this community, are increasers with grazing and indicate that these areas are subjected to frequent disturbance.

Table 2. Coverage (%) and constancy (%) of major plant species, litter, and bareground of the Bebb's willow c.t..

Vegetative Class	Constancy	Coverage
Tree/Shrub		
Bebb's willow	100	65
Shrubby cinquefoil	37	8
Red osier dogwood	37	5
River birch	25	4
Woods rose	75	3
Snowberry	75	2
Graminoid		
Redtop	100	7
Timothy	88	6
Kentucky bluegrass	100	4
Blue wild rye	37	5
Fowl mannagrass	37	3
Forb		
Virginia strawberry	100	3
Domestic dandelion	100	3
Hound's-tongue	25	8
Field mint	75	3
Sedge/Rush		
Baltic rush	37	1
Litter	100	82
Bareground	62	7
Mosses	62	5

Few forbs of this community are good forage value to cattle or wildlife. A noted exception is sticky geranium, which occurred infrequently, but is good forage for wildlife.

The Bebb's willow community was most commonly found on soils of the Ridgelawn-Nesda complex in areas which Ridgelawn soils dominate. These soils are deep and well drained and have alluvium parent material. They are associated with stream terraces and floodplains. Carbonates were observed only at depths of greater than 16 inches (41 cm.) in the soil profile. Ocular estimate of rooting depth averaged 19 inches (48 cm.). The range site classification of this c.t. is subirrigated 15-19 or OV 15-19 (overflow).

Blueberry Willow/Beaked Sedge c.t.: This community was found along the stream coarse of Dupuyer Creek where active and inactive beaver ponds result in siltation (Fig. 3). Sample sites of this community represented a succession of beaver pond vegetation from active sites with standing and running water to old, abandoned sites without standing or running water. This community had an average plant cover of 79% with variation from 60% on the most active sites to 93% on old, abandoned sites.

Shrubs were the dominant class of vegetation, averaging 37% cover with a maximum variation of 10%. The dominant shrub

Figure 4. Blueberry willow/Beaked sedge c.t.

species was blueberry willow, which averaged 26% cover or 77% of all shrub cover (Table 3). Diamond willow was co-dominant averaging 6% cover. These were the only shrub species that occurred on all sample sites of this community. Riverbank willow was found on active or recently abandoned beaver pond sites and was represented on three of four sample sites with an average cover of 1% on sites on which it occurred. Silverberry was found on two sample sites, both of which are old abandoned ponds with little or no surface water present. This species averaged 3% cover on those sites.

Sedges and rushes averaged 28% total cover with beaked sedge the dominant species averaging 17% cover. This species was most dominant on active or recently abandoned beaver ponds, which

Table 3. Coverage (%) and constancy (%) of major species, litter, bareground, and mosses of the Blueberry willow / Beaked sedge c.t.

Vegetative Class	Constancy	Coverage
Tree/Shrub		
Blueberry willow	100	26
Diamond willow	75	6
Woods rose	50	5
Silverberry	50	3
Graminoid		
Redtop	62	2
Kentucky bluegrass	62	2
Timothy	50	4
Basin wild rye	12	8
Forb		
Field horsetail	75	3
Starry solomon-plume	50	3
Sedge/Rush		
Beaked sedge	62	17
Water sedge	50	12
Baltic rush	37	2
Litter	75	81
Mosses	25	4
Bareground	25	1

contained running or standing surface water. Water sedge was co-dominant and averaged 12% cover. Baltic rush was also represented on all sample sites averaging 2% cover. This species appeared to have increased cover where surface water declined and achieved 7% cover on the oldest abandoned pond site.

Graminoids were sparsely represented throughout this c.t. and averaged only 3% cover. Redtop, the most common grass species occurring on three sites, averaged 2% cover. Basin wild rye, timothy, and Kentucky bluegrass were each represented on only one sample site.

Forbs, as a vegetation class, apparently increased in cover as the time since pond abandonment increased. On active sites forb cover was only 2%, while on the oldest sites cover increased to 20%. No one forb was dominant on all sites; however, field horsetail which also apparently increases with the age of the pond site was the dominant species on three sample sites. This species was not found on active sites, but increased to 18% cover on the oldest sites. Other common forb species included fireweed, smooth willow-herb, Canada goldenrod, and starry solomon-plume. All forb species represented in this c.t. are associated with areas which have frequent disturbance by flooding or are submerged for part of the growing season.

Because this community is typically under water or has water very near the surface, soil pits were not dug, and the soils were not described. These soils are classified by the Choteau-Conrad Area Soil Survey as riverwash. Riverwash consists of unstabilized sand and gravelly sediment that is flooded, washed, and reworked frequently. This soils type is represented by the Shallow Gravely 15-19 range site classification.

Cottonwood/Snowberry c.t.: The cottonwood/snowberry c.t. (Fig. 4) was found along all major stream courses on the TRMR. This c.t. provided cattle with feeding, bedding, wintering, and calving areas while serving as a preferred foraging and security area for many wildlife species. It was the largest riparian c.t. on the ranch.

Tree species were dominated by black cottonwood which averaged 56% cover. The cover of this species was highly variable from site to site and appeared dependent on the age of the trees. Very old stands that had frequent disturbance exhibited cover values as low as 30%, while old undisturbed sites had cover values of about 100%. The complexity of the community is related to the fact that nearly any combination of old, young, thick, or thin stands can occur and fade almost impreceptively or abruptly from one state to the next. The nature of riparian

Figure 5. Cottonwood/Snowberry c.t.

areas seems best described as being in a continuous and dynamic state of change, often affecting several layers of vegetation.

Shrubs were the co-dominant class of vegetation averaging 60% cover. They were dominated on all sample sites by snowberry, which averaged 39% cover or approximately 65% of all shrub cover (Table 4). Woods rose was the co-dominant shrub averaging 11% cover and occurring on each sample site. Other common shrub species included serviceberry, chokecherry, river birch, silverberry, and diamond willow. None of these species averaged greater than 5% cover; however, individual site cover was quite variable.

Graminoids averaged 17% cover and were dominated by shade-tolerant species. Timothy, Kentucky bluegrass, and blue wildrye

Table 4. Coverage (%) and constancy (%) of major species, litter, mosses, and bareground of the Cottonwood/Snowberry c.t.

Vegetative Class	Constancy	Coverage
Tree/Shrub		
Eastern cottonwood	100	56
Snowberry	100	39
Woods rose	88	11
Chokecherry	75	3
Serviceberry	37	5
River birch	25	4
Graminoid		
Timothy	88	6
Kentucky bluegrass	100	5
Redtop	100	2
Blue wild rye	75	1
Forb		
Burdock	50	4
Canada violet	75	4
Canada thistle	75	4
Hound's tongue	50	2
Domestic dandelion	100	3
Field horsetail	62	3
Litter	88	87
Bareground	37	1
Mosses	12	1

were represented on all sample sites within this c.t. Timothy and Kentucky bluegrass each dominated two sites and were the co-dominant species on sites dominated by the other. Overall timothy and Kentucky bluegrass averaged 4% and 5% cover, respectively. Other common grass species included redtop, smooth brome, and orchardgrass; however, none of these species averaged greater than 1% cover.

Forb species composition was highly variable. In areas used as cattle wintering grounds species such as burdock, Canada thistle, common hound's tongue, and Canada violet collectively averaged 29% cover or 76% of all forb cover. Though these species were represented on all sample sites, collective cover declined to approximately 1% on less-disturbed sites. The less-disturbed sites were dominated by common dandelion, which is also a disturbance-associated species. The overriding theme of the forb constituent of this community is that early-successional-stage species are dominant and provide little foraging opportunity.

The cottonwood / snowberry community was found exclusively on soils delineated as riverwash. Riverwash consists of unstablilized sandy and gravelly sediment that is flooded, washed, and frequently reworked by rivers or streams. Soil pits dug at each sample site show carbonates may be present throughout

the soil profile or completely absent. All sites exhibit dark soils to a depth of at least 13 inches (33 cm) with a sandy horizon followed by sand and gravel at greater depths. Ocular estimate of rooting depth averages 20 inches (50 cm.), which often places the roots in direct contact with subsurface water. Because this community exhibits greater than 40% overstory cover, no range site classification is associated with it.

Jointed Rush/Tufted Hair-grass c.t.: This community type was found only in the northwest corner of the Lenstra Creek pasture. Because of its limited distribution, only one sample site was selected and inventoried in this community. Unlike other riparian communities, this area supported no shrub or tree species and was composed almost entirely of rushes and grasses.

Jointed rush was the dominant species of this community with an average 40% cover (Table 5). Tufted hair-grass was co-dominant, averaging 20% cover. Together, these species provided 74% of the total plant cover of this site. Pointed broom sedge and baltic rush exhibited 4% and 9% cover, respectively. Missouri iris was the dominant forb species, averaging 3% cover. No other species of this community exceeded 1% cover. This site is associated with soils of the Haploboroll-Argiborall complex. These soils are poorly drained and often sodic and saline.

Table 5. Coverage (%) and constancy (%) of major plant species, litter, mosses and bareground of the Jointed rush/Tufted hair-grass c.t..

Vegetative Class	Constancy	Coverage
Graminoid		
Tufted hair-grass	100	20
Redtop	100	1
Fowl managrass	50	1
Sedge/Rush		
Jointed rush	100	40
Pointed broom sedge	100	4
Baltic rush	100	9
American bulrush	100	1
Forb		
Missouri iris	100	3
False dandelion	100	1
Little gray aster	50	1
Litter	100	68
Bareground	100	8
Mosses	100	20

Parent material is glaciofluvial or alluvial in nature. The danger of erosion by wind and water is slight. Ocular estimates of rooting depth averaged 21 inches (53 cm.). This site is represented by the Clayey 15-19 range site classification.

Introduced Grass and Alfalfa Hay Community Types

Grass Hay c.t.: The introduced grass hay communities (Fig. 5) were the least floristically diverse of all the grasslands found on the TRMR. They appeared to have been established by planting as few as 15 years or as many as 35 years ago.

These areas appear to be very similar but have been separated into three community types based on different dominant species (Table 6). The most prevalent c.t. was dominated by Kentucky bluegrass. The average canopy coverage of this species was 58%. The co-dominant species found in conjunction with the Kentucky bluegrass dominant were timothy, smooth brome, and redtop, each being the main co-dominant species on one of the three sample sites. The mean cover values for these three sites were timothy 19%, smooth brome 14%, and redtop 6%. The three co-dominants appeared to be influenced by a moisture gradient that favored redtop on the wettest sites and smooth brome on the driest sites.

Figure 6. Domestic grass hay c.t.

The other two c.t. that occurred within the introduced hay regions were dominated by smooth brome and timothy. Both of these communities exhibited Kentucky bluegrass as the major co-dominant species with smooth brome a secondary co-dominant in timothy dominated stands and timothy a secondary co-dominant in the smooth brome dominated stands.

All of the communities described within the introduced hay type occurred on soils of the Adel-Bynum-Doby complex or the Kiev-Rounder loams. These soils typically range in depth from 40 to 60 inches (101 to 152 cm) and have dark surface horizons. Parent material is alluvium or residuum and soils are moderate to well drained. Potential rooting depths range from 20 to 40 inches. Ocular estimation of rooting depth from the five sample

Table 6. Coverage (%) and constancy (%) of major plant species, litter, bareground, and mosses of the domestic grass hay community types.

	Kentucky bluegrass c.t.	Timothy c.t.	Smooth brome c.t.
Vegetative Class	Cov(Con)	Cov(Con)	Cov(Con)
Tree/Shrub			
Shrubby cinquefoil	1 (29)	1 (13)	1 (50)
Woods rose	1 (14)	3 (25)	1 (50)
Bebb's willow	0 (0)	3 (38)	0 (0)
Snowberry	0 (0)	1 (13)	0 (0)
Graminoid			
Kentucky bluegrass	58 (100)	16 (100)	4 (100)
Timothy	19 (100)	27 (100)	14 (100)
Smooth brome	14 (86)	7 (63)	33 (100)
Redtop	6 (100)	8 (50)	11 (100)
Tufted hair-grass	3 (71)	4 (25)	6 (100)
Meadow fescue	8 (14)	8 (63)	0 (0)
Forb			
Domestic dandelion	8 (100)	7 (100)	1 (100)
Missouri iris	7 (100)	2 (75)	2 (100)
Western bedstraw	2 (100)	3 (100)	1 (100)
Northwest cinquefoil	5 (100)	2 (100)	8 (100)
Virginia strawberry	5 (86)	3 (88)	11 (100)
American vetch	2 (100)	2 (88)	1 (100)
Litter	88 (100)	85 (100)	88 (100)
Bareground	4 (43)	6 (63)	0 (0)
Mosses	3 (29)	0 (0)	1 (100)

areas averaged 11 inches (28 cm) under the current plant compositions.

The introduced hay c.t. are found primarily on Silty 15-19 inch (38 to 48 cm) precipitation zone range sites with slopes of less than 10%. It comprises approximately 270 acres (110 ha.) on the ranch.

Alfalfa hay c.t.: The irrigated alfalfa hay fields were not sampled. This community was planted to alfalfa and orchardgrass approximately 20 years ago and is presently dominated by these species. Alfalfa appeared to be the major forage producing species, but in many areas this species was beginning to die out and in need of replanting. Orchardgrass is also a major forage producer. This species had its greatest cover in areas where alfalfa was declining due to the age of the stand.

The soils of this community are often stony and shallow or moderately deep. They have a low water holding capacity (2 to 3 inches (5 to 8 cm)) making flood irrigation time consuming and only moderately effective.

Native Shrub and Grassland Community Types

The native shrub and grasslands regions of the ranch are those areas not under the canopy of tree species or associated

with the riparian zone. These areas have been divided into four vegetative series and each series was then further divided into c.t. as needed to represent the current vegetative composition.

Shrubby Cinquefoil Series

The shrubby cinquefoil series was the largest in terms of acreage and most productive of the native grasslands found on the TRMR. It corresponded to the Potentilla fruticosa / Festuca scabrella habitat type described by Mueggler and Stewart (1980). This series has been broken down into three c.t. which were prevalent on the ranch.

Shrubby cinquefoil was the dominant shrub in all areas sampled within this series, having an average cover of 12% and averaged 48% of total shrub cover. Communities within this series were dominated by the graminoids rough fescue, Idaho fescue, and Parry's danthonia. These species alternated dominant and co-dominant roles to form the following communities.

Shrubby cinquefoil / Rough fescue c.t.: The shrubby cinquefoil/rough fescue community (Fig. 7) is represented in each pasture unit of the TRMR. Graminoids were the dominant class of vegetation averaging 48% cover while forbs and shrubs averaged 17% and 31% cover respectively.

The dominant shrub species was shrubby cinquefoil which averaged 11% cover (Table 9). Other shrub species were wild rose, snowberry, kinnikinnick, and horizontal juniper. None of the shrubs, other than shrubby cinquefoil, were recorded on all sample sites within this community.

Graminoids were dominated by rough fescue which averaged 20% cover or 41% of total graminoid cover. Idaho fescue was co-dominant and averaged 7% cover or 17% of total graminoid cover. Other grass species common to this community were Kentucky bluegrass, thickspike wheatgrass, bluebunch wheatgrass, junegrass, Parry's danthonia, timber oatgrass, and timothy. None of these species occurred on all of the sample sites and all had average cover values less than 5%.

The forb component of this community was very diverse. It commonly contained as many as 30 species in a sample site. However, they produced little forage of value with the exception of sticky geranium which averaged 4% cover.

Forbs were dominated by wild strawberry and western bedstraw which averaged 6% cover. Other common forbs were showy lupine, golden rod, chickweed, common yarrow, besseya, and ball anemone. Many of these species were found on all sites in this community.

The shrubby cinquefoil\rough fescue community was typically found on soils of the Bynum-Adel-Fifer complex, Bynum-Fifer-

Figure 7. Shrubby cinquefoil/Rough fescue c.t.

Cheadle complex, and the Shambo-Amor loams. These soils are often calcareous and deep. Ocular estimate of rooting depth averages 15 inches (38 cm.). Range site classifications of these soils are Silty 20+ or Shallow 20+ depending on the constituent parts of the complex with which they are associated.

Shrubby cinquefoil / Parry's Danthonia c.t. The shrubby cinquefoil/Parry's danthonia community (Fig. 8) had an average plant cover of 125%. Graminoids were dominant, averaging 54% cover. Forbs and shrubs averaged 47% and 24% cover respectively.

Parry's danthonia was the dominant grass species with an average cover of 24% (Table 7) or 44% of total graminoid cover

Table 7. Coverage (%) and constancy (%) of the major plant species, litter, rock, bareground, and mosses of the Shrubby cinquefoil/Rough fescue series of communities.

	SC/RF c.t.	SC/PD c.t.	SC/ID c.t.
Vegetative Class	Cov(Con)	Cov(con)	Cov(Con)
Tree/Shrub			
Shrubby cinquefoil	11 (100)	9 (100)	15 (100)
Woods rose	3 (100)	3 (100)	8 (100)
Snowberry	3 (71)	0 (0)	0 (0)
Horizontal juniper	8 (57)	3 (60)	0 (0)
kinnikinnick	1 (14)	8 (40)	0 (0)
Graminoid			
Rough fescue	20 (100)	10 (100)	15 (100)
Idaho fescue	7 (100)	7 (100)	40 (100)
Parry's danthonia	4 (86)	24 (100)	0 (0)
Junegrass	2 (86)	2 (100)	1 (100)
Timothy	7 (71)	1 (20)	1 (100)
Timber oatgrass	1 (57)	1 (100)	0 (0)
Kentucky bluegrass	1 (71)	5 (80)	1 (100)
Forb			
Virginia strawberry	6 (100)	1 (40)	15 (100)
Western bedstraw	6 (100)	2 (100)	4 (100)
Ball anemone	6 (100)	4 (80)	0 (0)
Missouri goldenrod	3 (100)	1 (80)	1 (100)
Sticky geranium	4 (71)	1 (20)	0 (0)
Silky lupine	3 (86)	4 (80)	0 (0)
Old mans whiskers	4 (14)	11 (40)	15 (100)
Tufted fleabane	1 (71)	3 (100)	0 (0)
Common yarrow	1 (100)	1 (100)	4 (100)
Northwest cinquefoil	1 (71)	1 (40)	8 (100)
Litter	78 (100)	88 (100)	88 (100)
Bareground	4 (100)	2 (100)	1 (100)
Mosses	1 (86)	3 (80)	1 (100)
Rock	1 (14)	1 (100)	0 (0)

and 19% of total plant cover. Co-dominant grass species were Idaho fescue and rough fescue which exhibited average cover values of 8% and 10%, respectively. These three species comprised 77% of all graminoid cover. Other minor contributions were made by junegrass, bluebunch wheatgrass, western wheatgrass, green needle grass, mountain muhly, intermediate oatgrass, Kentucky bluegrass, timothy, and carex species all of which had cover values less than 5%.

No one forb was dominant in all areas sampled within the shrubby cinquefoil/Parry's danthonia c.t., although, lupine was often the most conspicuous. Other common forbs were western bedstraw, common yarrow, ball anemone, golden rod, and chickweed.

Shrub cover was dominated by shrubby cinquefoil which averaged 9%. This represented the lowest cover value of this species for the shrubby cinquefoil series. Other shrub species common to this c.t. were horizontal juniper, wild rose, and fringed sage all of which exhibited mean cover values of less than 5%.

This c.t. is mostly associated with soils of the Hanson-Raynesford complex, Babb-Tibson-Adel complex, Adel-Doby-Hanson complex, Adel-Burnett-Bynum loams and the Bynum-Fifer-Cheadle complex. Range site classification varies with soil type and moisture regime. Range sites represented are Silty 15-19, Silty

Figure 8. Shrubby cinquefoil/Parry's danthonia c.t.

20+, Shallow 15-19, Shallow 20+, and Silty Draughty 15-19. Generally these soils are slightly shallower and more draughty than other soils of the shrubby cinquefoil series.

Shrubby cinquefoil/Idaho fescue c.t.: The shrubby cinquefoil/Idaho fescue c.t. (Fig. 9) had the highest plant cover (162%) of all communities within the shrubby cinquefoil series. Shrubs, forbs, and graminoids averaged 24%, 61% and 77% cover respectively.

Shrubs were dominated by shrubby cinquefoil with a mean cover of 15%, or 62% of total shrub cover (Table 7). Woods rose was co-dominant exhibiting 8% cover. None of the shrubs of this community were important browse species; although, they may act

Figure 9. Shrubby cinquefoil/Idaho fescue c.t.

as mechanical barriers and reduce the availability of palatable forbs and grasses.

Forbs were dominated by old man's whiskers and Virginia strawberry, with each averaging 15% cover. Other common forbs were western bedstraw, common yarrow, northwest cinquefoil, pearly everlasting, chickweed, ball anemone, and sticky geranium.

Grass species were dominated by Idaho fescue with a mean cover of 40%. Rough fescue was co-dominant with an average cover

of 15%. Other common grass species were bluebunch wheatgrass, Kentucky bluegrass, green needlegrass, poverty danthonia, mountain brome, and timothy.

The shrubby cinquefoil/Idaho fescue community was found only on the Bynum-Adel-Fifer complex. Soils within this complex are loams, usually with few coarse fragments and deep solums. Ocular estimate of rooting depth was 19 inches (47 cm.). These soils correspond to the Silty 20+ range site classification.

Bluebunch wheatgrass/Fringed sage c.t.: The bluebunch wheatgrass/fringed sage communities (Fig. 10) occurred in the Festuca scabrella/Agropyron spicatum habitat type as described by Mueggler and Stewart (1980). These communities were characterized by high rock and bare soil cover values, and an average slope of 20% with south, southeast, or southwest aspects. Communities were often long and narrow, seldom over 500 feet (150m) wide. Graminoids were the most productive class of vegetation followed by a highly diverse, but much less productive forb constituent. Shrubs were often inconspicuous and are the least productive vegetative class.

Graminoids were dominated by bluebunch wheatgrass which averaged 19% cover or 31% of total graminoid cover (Table 8).

Figure 10. Bluebunch wheatgrass/Fringed sage c.t.

Co-dominant grasses were rough fescue and Parry's danthonia which averaged 8% and 6% cover. Idaho fescue was also an important community constituent averaging 5% cover. Other common grass were junegrass, green needlegrass, thickspike wheatgrass, and threadleaf sedge. None of these species exceeded a 5% mean cover. Forbs were the dominant vegetative class averaging 65% cover. Forbs were dominated by arrowleaf balsamroot with 6% cover. Many forb species were found on all sample sites. These included rose pussytoes, ballhead sandwort, bastard toad-flax, hairy golden aster, tufted fleabane, northern bedstraw, Hood's phlox, alyssum-leafed phlox, dotted blazing star, American vetch, and astragalus species. Though these species provide little forage their ground hugging habit provides soil protection and

Table 8. Coverage (%) and constancy (%) of the major plant species, litter, bareground, mosses, and rock of the Bluebunch wheatgrass/Fringed sage c.t..

Vegetative Class	Constancy	Coverage
Tree/Shrub		
Fringed sage	100	8
Woods rose	88	2
Snowberry	50	3
kinnikinnick	38	3
Shrubby cinquefoil	25	4
Graminoid		
Bluebunch wheatgrass	100	19
Rough fescue	100	8
Parry's danthonia	100	6
Idaho fescue	100	5
Junegrass	100	5
Thickspike wheatgrass	100	4
Timothy	63	1
Forb		
Arrowleaf balsamroot	100	6
Ballhead sandwort	100	2
Tufted fleabane	100	2
Western bedstraw	100	2
Hood's phlox	88	3
Silky lupine	88	4
Rose pussytoes	88	2
Litter	100	45
Bareground	88	16
Rock	100	15
Mosses	38	2

reduces the effect of erosive forces.

Shrubs were dominated by fringed sage, which had an average cover of 8% or 33% of all shrub cover. This low growing shrub was the only member of it's vegetative class that occurred on all sample sites. Other shrub species occurring within this community were snowberry, woods rose, horizontal juniper, serviceberry, and common chokecherry. These species seldom exceeded 2% cover and although some are of good forage value, particularly to deer and elk, they provided little forage biomass.

The bluebunch wheatgrass / fringed sage community occurs on a variety of soil types. The major soil groups represented are the Adel-Doby-Hanson complex, Bynum-Doby-Cheadle complex, Babb-Fifer-Cheadle complex, and the Hanson very cobbly loams. These soils are typically shallow and have a high hazard of erosion by wind and water if excessively disturbed. These soils correspond to the Silty Draughty 20+, Shallow 20+, and Silty 15-19 range sites.

Rough fescue / Idaho fescue Series

All communities of this series are in the Festuca scabrella /Festuca idahoensis habitat type (Mueggler and Stewart 1980). They were similar to communities of the shrubby cinquefoil/rough

fescue series in plant composition, but were differentiated by a reduction of total plant cover and a reduction in shrubby cinquefoil cover to less than 5%.

Communities within the rough fescue/Idaho fescue series were typically found on flat benches or gentle west-facing slopes. Soils are calcareous, cobbly, and shallow or draughty. High carbonate content at shallow depths in the soil profile may reduce the availability of nitrogen and phosphorus needed for improved vegetative production on these sites.

Parry's danthonia / Rough fescue c.t.: The Parry's danthonia /rough fescue c.t. (Fig. 11) was the most productive of the rough fescue/Idaho fescue series. Grasses were dominant averaging 67% cover, forbs and shrubs averaged 56% and 18% cover respectively.

Parry's danthonia was the dominant graminoid with 31% cover or 46% of total graminoid cover (Table 9). Rough fescue was co-dominant and averaged 14% cover or 21% of total graminoid cover. Other common grass species of this community were Idaho fescue, junegrass, and intermediate oatgrass.

The forb component of the Parry's danthonia/Idaho fescue c.t. was diverse with as many as 40 species represented on a

Figure 11. The Parry's danthonia/Rough fescue c.t.

sample site. Forbs were dominated by showy lupine, with 4% cover. Other forb species occurring on all sample sites within this c.t. were tufted fleabane, western bedstraw, ball anemone, ballhead sandwort, rose pussytoes, Missouri goldenrod, common yarrow, allysum-leaved phlox, and bastard toad flax. All of these species are considered poor to fair forage value. Blanket flower is often a conspicuous community constituent but did not occur on all sites.

Shrub species were dominated by horizontal juniper, with a mean cover of 13% or approximately 72% of all shrub cover. Shrubby cinquefoil was dominant on all sample sites within the community. Kinnikinnick and fringed sagewart were also found in this c.t. but each occurred on only one site. All shrub species

Table 9. Coverage (%) and constancy (%) of the major plant species, litter, bareground, and rock of the Rough fescue/Idaho fescue series of communities.

Vegetation Class	PD/RF c.t. Cov(Con)	PD/IF c.t. Cov(Con)	IF/RF c.t. Cov(con)
Tree/Shrub			
Horizontal juniper	13 (100)	8 (50)	2 (100)
Shrubby cinquefoil	2 (100)	1 (100)	1 (100)
Fringed sage	3 (88)	1 (100)	4 (100)
Kinnikinnick	0 (0)	0 (0)	4 (100)
Graminoid			
Parry's danthonia	31 (100)	15 (100)	0 (0)
Rough fescue	14 (100)	2 (100)	8 (100)
Idaho fescue	6 (100)	6 (100)	15 (100)
Junegrass	4 (100)	3 (100)	4 (100)
Timber oatgrass	1 (100)	3 (100)	0 (0)
Threadleaf sedge	2 (80)	1 (100)	1 (100)
Thickspike wheatgrass	1 (60)	1 (100)	0 (0)
Bluebunch wheatgrass	0 (0)	1 (100)	4 (100)
Forb			
Silky lupine	4 (100)	0 (0)	1 (100)
Western bedstraw	3 (100)	1 (100)	4 (100)
Hood's phlox	3 (100)	1 (100)	0 (0)
Tufted fleabane	2 (100)	1 (100)	1 (100)
Missouri goldenrod	2 (100)	1 (100)	1 (100)
Ballhead sandwort	1 (100)	1 (100)	1 (100)
Rose pussytoes	1 (80)	11 (100)	1 (100)
Sulphur hedysarum	1 (100)	1 (100)	0 (0)
Arrowleaf balsamroot	1 (20)	0 (0)	8 (100)
Litter	78 (80)	88 (100)	85 (100)
Bareground	5 (100)	4 (100)	4 (100)
Mosses	5 (100)	4 (100)	2 (100)
Rock	1 (60)	4 (80)	8 (100)

represented are of fair forage value for mule deer; although, they are poor forage species for domestic livestock.

The Parry's danthonia / rough fescue c.t. is usually found on soils of the Hanson-Raynesford complex, Bynum-Doby-Cheadle complex, and the Hanson very cobbly loams. These soils are typically moderate in depth and well drained. Ocular estimates of rooting depth averaged only 10 inches (25 cm.). Rooting depth may be restricted due to heavy carbonate concentrations that appear in the soil profile at approximately 8 inches (20 cm.). Range sites represented in this community are Silty 15-19 and Shallow 20+.

Parry's danthonia / Idaho fescue c.t.: The Parry's danthonia/Idaho fescue c.t. (Fig. 12) is dominated by Parry's danthonia with a mean cover of 15% or approximately 43% of all graminoid cover (Table 9). Idaho fescue was co-dominant with a mean cover of 6%. Rough fescue was averaged only 2% cover but had a 90% frequency of occurrence. Rough fescue plants were small and there was no evidence of the more normal, large, rough fescue plants. Other common grass species were intermediate oatgrass, junegrass, mountain muhly, and bluebunch wheatgrass. Needle and thread was not represented in samples of this community, however, occasional plants of this species could be

found. Threadleaf sedge and Ross's sedge also occurred, but had less than 1% cover.

The forb community was diverse with as many as 40 species occurring on a single sample site. Rose pussytoes was the dominant forb with an average cover of 11%. Forb species with cover of greater than 1% were ballhead sandwort, Hood's phlox, western bedstraw, common blue-eyed grass, cliff anemone, tufted fleabane, Missouri goldenrod, blazing star, sticky locoweed, and sulfur hedysarum. These forbs provide little forage to ungulates due to their relatively low palatability ratings. One exception is sulfur hedysarum, which is rated as good forage for all classes of ungulates (Mueggler and Stewart 1980).

Shrubs of this c.t. were very inconspicuous. All species represented had a low mat-forming growth form and are of poor to fair forage value. Horizontal juniper was dominant with a mean cover of 8%, but occurred with only 15% frequency. Other shrub species represented, although none exceeded an mean cover of 1%, were shrubby cinquefoil, fringed sagewort, prairie sagewort, and broom snakeweed.

The Parry's danthonia/Idaho fescue c.t. was found only on soils of the Judith-Windham complex. These soils are located on terraces with little or no aspect exposure. Parent materials

Figure 12. Parry's danthonia/Idaho fescue c.t.

are derived from limestone, dolomite, and sandstone and are often calcareous.

Ocular estimates of rooting depth was 8.5 inches (22 cm.). Rooting depth appeared to be limited by very heavy concentrations of carbonates in the soil profile at depths greater than 5.5 inches (14 cm.). The Choteau-Conrad Area Soil Survey (1988), proposes that the major limitations of this soil complex is low to moderate available water capacity and high lime content. Carbonates, if present in excess, reduce the availability of nitrogen and phosphors needed for good root development and plant growth. This condition may favor shallow-rooted species. These soils are represented by the Silty Draughty 15-19 range site.

Idaho fescue / Rough fescue c.t.: In the rough fescue/Idaho fescue c.t. (Fig. 13) graminoids were the dominant with a mean cover of 40%. Forbs contributed 45% cover and shrubs only 15% cover.

Idaho fescue was the dominant with a mean cover of 15% (Table 9). Rough fescue and bluebunch wheatgrass were the major co-dominant species with a mean cover of 8%. Intermediate oatgrass, thickspike wheatgrass, junegrass, and threadleaf sedge were also represented in this c.t.: however, none had an average cover value greater than 2.5%.

Rough fescue plants appeared to be larger in basal area than those of the Parry's danthonia / Idaho fescue community. However, they were not as large or robust as those found on adjacent deeper soils or those found on the leeward side of erect shrubs or conifers. This observation implies that available moisture is an important contributing factor limiting rough fescue production within this community.

Forbs were dominated by arrowleaf balsamroot which averaged 8% cover. Western bedstraw was the major co-dominant forb species with 4% cover. Field pussytoes, tufted fleabane, American vetch, ball anemone, silky lupine, and slender locoweed each exhibited greater than 1% cover. All of the major forbs represented in this community are considered poor to very poor

Figure 13. Rough fescue/Idaho fescue c.t.

forage with the exception of American vetch, which is considered good to excellent forage for all classes of ungulates.

As a vegetative class shrubs had reduced to their lowest coverage of the native grassland group. Fringed sagewort and kinnikinnick averaged 4%, and horizontal juniper 2% cover. All other shrub species averaged less than 1% cover.

The Idaho fescue / Rough fescue c.t. is typically associated with soils of the Hanson-Raynesford complex. Parent material is limestone, argillite, and dolomite. Soils are well drained and commonly contain many coarse fragments. The major limitations are low available water capacity and lime content (Choteau-Conrad Area Soil Survey 1988).

Ocular estimates of rooting depth was 9 inches (23 cm.). Heavy concentrations of carbonates were present in the soil profile beginning at 6.5 inches (17 cm.). This factor appears to limit root development lower in the profile and may effect plant community composition and productivity. These soils are represented by the Silty 15-19 range site classification.

Shrub Community Types

The shrub communities as described here, were dominated by shrub species most commonly found adjacent to grasslands or limber pine communities and did not include shrub dominated riparian areas.

These communities were dominated by a combination of snowberry, woods rose, serviceberry, and chockcherry. Snowberry and woods rose were sometimes dominant species in terms of cover, but they are not major browse species. Snowberry is poor or fair forage for all classes of ungulates and the young shoots of Woods rose are fair browse for cattle and good browse for elk and deer (Mueggler and Stewart 1980). However, due to its spiny nature, this species receives limited use and may create a mechanical barrier to foraging ungulates.

Serviceberry is good forage for cattle and excellent browse for wild ungulates (Mueggler and Stewart 1980). Chokecherry is

fair for cattle and good for wildlife browse but can be poisonous to livestock and wildlife (Flemming et al. 1926). This usually occurs when other forage is not available, or after drought or freezing. Because of the importance of serviceberry and chokecherry to ungulates, communities of the shrub type will be delineated by the dominance of these species.

Serviceberry c.t.: Communities dominated by serviceberry (Fig. 14) were typically found on slopes of greater than 20% with south or southeast exposures. Shrubs were dominant with an average 81% cover. Graminoid cover and species dominance was highly variable. This association expressed the highest (68%) and lowest (9%) graminoid cover of the shrub community types (Table 10). Forbs averaged 22% cover but variation from 12% to 31% was observed.

Shrubs were dominated by serviceberry, which averaged 28% cover. Woods rose and snowberry were co-dominant, with 16% and 13% average cover. Chokecherry also was found on all sample sites and averaged 9% cover. Hawthorn was observed on one sample site with 22% cover. This species is a severe mechanical barrier to all ungulates because of its long, sharp spines.

Graminoids were dominated on one site by Kentucky bluegrass with 4% cover and smooth brome on another with 68% cover.

Western wheatgrass was the co-dominant grass species on both sites with 4% cover. The large variation in grass cover was probably the result of variation in shrub height and cover expressed on individual sample sites. Other common species were timothy, rough fescue, basin wild rye, and blue wild rye. None of the species averaged greater than 1% cover in this community.

Forbs, because of the variation of shrub height and cover, varied in species composition and cover. The most consistently present forbs were species such as common hound's tongue and stinging nettles. Stinging nettles were the dominant forb and averaged 4% cover. Common hound's tongue was co-dominant with

Figure 14. Serviceberry c.t.

Table 10. Coverage (%) and constancy (%) of the major plant species, litter, bareground, rock, and mosses of the Shrub community types.

	Serviceberry c.t.	Chokecherry c.t.
Vegetative class	Cov(Con)	Cov(Con)
Tree/Shrub		
Serviceberry	28 (100)	5 (70)
Wood rose	16 (100)	11 (100)
Snowberry	13 (100)	18 (100)
Chokecherry	3 (100)	24 (100)
Hawthorn	22 (50)	0 (0)
Shiny-leaf spiraea	4 (50)	1 (20)
Graminoid		
Timothy	1 (100)	15 (90)
Kentucky bluegrass	4 (75)	8 (90)
Smooth brome	68 (50)	4 (50)
Western wheatgrass	4 (50)	0 (0)
Basin wild rye	4 (50)	1 (10)
Thickspike wheatgrass	8 (25)	1 (10)
Rough fescue	1 (25)	7 (70)
Idaho fescue	0 (0)	2 (60)
Forb		
Stinging nettles	4 (100)	2 (40)
Virginia strawberry	1 (100)	2 (80)
American vetch	1 (100)	1 (50)
Cow parsnip	4 (50)	4 (20)
Hound's tongue	1 (75)	1 (10)
Bristly stickseed	3 (50)	1 (30)
Wild bergamont	1 (75)	2 (80)
Common yarrow	1 (75)	1 (100)
Western bedstraw	1 (50	1 (75)
Litter	88 (100)	86 (100)
Bareground	1 (100)	3 (70)
Rock	4 (50)	8 (40)
Mosses	1 (20)	1 (70)

3% cover. Other common forbs included chickweed, Virginia strawberry, western bedstraw, common yarrow, wild bergamot, bristly stickweed, and burdock. The consistent presence of these disturbance species suggested that this community was subjected to considerable disturbance.

Chokecherry c.t.: The chokecherry c.t. (Fig. 15) was commonly found on slopes with less than 20% slope and northwest or southeast aspects. Shrubs were the dominant class of vegetation averaging 59% cover. Chokecherry was the dominant shrub with an average cover of 24% (Table 14). Snowberry was the major co-dominant, exhibiting an average 18% cover. Woods rose and serviceberry were found on all sample sites of this community and averaged 11% and 2% cover respectively.

Graminoids averaged 42% cover, but like the serviceberry association they showed a large variation in species composition and cover. Timothy was the dominant on three sample sights averaging 20% cover. Basin wild rye, Kentucky bluegrass, and rough fescue were each co-dominant one these sites. Kentucky bluegrass was dominant on one site with 16% cover where basin wild rye was co-dominant. Rough fescue was also dominant on one site with 11% cover where timothy was the co-dominate species. Other common grass species included meadow fescue, Idaho fescue,

Figure 15. Chokecherry c.t.

bearded wheatgrass, smooth brome, mountain brome, cheatgrass brome, and California danthonia.

Forbs averaged 22% cover with a variation of only 5% on all sample sites. Sticky geranium was often the dominant, exhibiting average cover values up to 6%. Species that were co-dominant included Virginia strawberry, western bedstraw,showy aster, and showy fleabane.

Because of the small size of shrub-dominated communities, they were considered inclusions on soils maps provided by the Soil Conservation Service. Soil pits dug at each transect site show shrub-dominated communities were associated with deep, well-drained soils that have little or no carbonate concentrations. These soils are loam or clay loam to a depth of 40 inches (101

cm.) or more and have a high water holding capacity. The serviceberry association commonly has large coarse fragments in the soil profile at depths greater than 20 inches (50 cm.). Chokecherry associations have clay loam with few coarse fragments at depths greater than 20 inches (51 cm.). This suggests that serviceberry was found on dryer sites and chokecherry on the more mesic areas of the TRMR. Ocular estimate of rooting depth averaged 21 inches (53 cm.) for the serviceberry association and 18 inches (45 cm.) on chokecherry association sites. Range site classification of these soils is Silty 20+.

Tree Dominated Community Types

The tree dominated communities were those vegetation associations that occurred under the canopy of coniferous or deciduous tree species other than cottonwood.

Aspen/Snowberry/Timothy c.t.: The aspen communities (Fig. 16) occurred in all pastures. These communities were usually less than 2 acres (1 ha), but could be as large as 30 acres (12 ha). They are probably much more important, in terms of animal use, than the area that they occupy might suggest. They provide forage, shade, and bedding areas for cattle and are used extensively by many species of wildlife.

Ecologically this c.t. was commonly located on north, northwest, or northeast aspects with gently sloping hillsides at all elevations on the ranch. Soils, if not excessively disturbed, typically had organic horizons on the surface and a mineral clay loam soil in the rooting zone. This community is most commonly expressed in areas with a perched water table or in areas where soil moisture is available throughout the growing season.

Aspen as an overstory species appeared to be in a dynamic equilibrium. In each stand sampled a wide variety of age classes were represented with a large number of saplings and a declining number of trees in each age group as age increased. Fire apparently has not played a role in these communities. No fire scars were found on any age class of trees or on dead and down older material and there was no evidence of charcoal was found in the soil profile.

Because the aspen type had little variation in overstory tree or shrub species dominance, and differences in graminoid dominance were found only in small isolated stands, this type will be described as a single c.t. and variations on the type will be noted where appropriate. This type of description seems applicable because of the widespread distribution, but limited area of these communities.

Figure 16. Aspen/Snowberry/Timothy c.t.

Aspen was the dominant tree species and was commonly the only tree species represented in this c.t., although, black cottonwood and other species may occur. Aspen cover averaged 54% (Table 11) with variations from 35% in areas dominated by older trees to 85% in areas with several age classes represented. Increment boring of the five largest living aspens in each sample stand showed that large trees were between 50 and 60 years old. Regeneration of aspen was observed in all sample stands with as many as 258 and as few as 80 saplings under 2 inches (5 cm.) diameter at breast height present in the 15X25 meter macroplot.

Shrubs averaged approximately 31% cover. Snowberry was the dominant shrub (Table 10) averaging 13% cover. Woods rose was co-dominant and also occurred in each sample stand but averaged

Table 11. Coverage (%) and constancy (%)of the major plant species, litter, bareground, mosses and rock of the Aspen/Snowberry/Timothy c.t..

Vegetative class	Constancy	Coverage
Tree/Shrub		
Aspen	100	54
Snowberry	100	13
Woods rose	100	5
Wax current	57	2
Chokecherry	43	1
Graminoid		
Timothy	100	15
Redtop	86	5
Kentucky bluegrass	86	4
Smooth brome	71	2
Blue wild wry	29	3
Forb		
Virginia strawberry	100	3
Starry Solomon-plume	100	3
Sticky geranium	100	3
Domestic dandelion	100	3
Western bedstraw	86	2
Showy aster	86	2
Mountain sweet-root	71	4
Canada violet	71	5
Litter	100	87
Bareground	86	1
Mosses	14	1
Rock	43	1

only 5% cover. Other common shrubs included serviceberry, chokecherry, red-osier dogwood, and Bebb's willow. Bebb's willow was most commonly found near the outer edge of the aspen community type and did not appear to be as shade tolerant as the other shrub species.

Graminoids averaged 38% cover in the aspen community. Timothy was the dominant species in four of six sample stands and was co-dominant in the two stands in which it was not the dominant. It exhibited and average 15% cover. Redtop was the dominant grass of one sample site that was believed to be the most mesic community sampled in aspen c.t. The sample stand believed to be the least disturbed was dominated by blue wild rye. However, it had only 0.8% greater cover than did timothy. Other common grass species were Kentucky bluegrass, meadow fescue, and on the most mesic sites, American managrass.

Forb dominance was highly variable and appeared to be related to the time and intensity of disturbance. For example, in small isolated stands where cover or shade was limited in a pasture, forb species were dominated by Virginia strawberry, Starry solomon-plume, and Canada violet. In pastures with more shade and cover available species such as sticky geranium and mountain sweet-root were dominant. This trend also occurred for

Kentucky bluegrass which occurred most often in isolated stands and decreased in stands with widespread cover or shade.

The largest aspen communities of the TRMR are found on soils of the Babb-Fifer-Cheadle complex. Parent materials are piedmont glacial till, or residuum derived from interbedded shale, mudstone, and sandstone (Choteau-Conrad area soil survey 1989). These soils are moderate in depth. Ocular estimates of rooting depth averaged 18 inches (45 cm.). This complex is represented by the Silty 20+ range site classification. The more isolated aspen stands occur on soils of the Tibson-Cheadle-Fifer complex and the Babb-Tibson-Adel complex.

Douglas-fir/Shiny-leaf Spiraea c.t.: This c.t. was found almost entirely on the mountain slopes along the western edge of the ranch; although a few isolated patches were found on shaded north-facing slopes in other areas. All Douglas-fir stands on the ranch were located on north, northeast, or northwest aspects and occurred only on slopes with greater than 20% (Fig. 17) This c.t. would correspond to the Pseudotsuga menziesii / Spiraea betulifolia habitat type (Pfister et al. 1983).

Douglas-fir was the dominant overstory species with canopy cover variations from 30% to 85%. The average cover for all sample sites was 64% (Table 12). Increment bores of the

Figure 17. Douglas-fir/Shiny-leaf spiraea c.t.

largest trees showed significant age differences between stands. The youngest stands were only about 50 years old while the oldest stands had individuals up to 150 years old. Age of the stand appeared to have little impact on the dominant vegetation, but did effect the amount of cover expressed in the understory.

Evidence of fire found in all stands suggested that fire probably occurred 85 to 90 years ago. Other tree species

Table 12. Coverage (%) and constancy (%) of the major plant species, litter, bareground, and rock of the Douglas-fir c.t.

Vegetative class	Constancy	Coverage
Tree/Shrub		
Douglas-fir	100	64
Shiny-leaf spiraea	100	7
Snowberry	100	2
Woods rose	100	2
Western clematis	80	1
Graminoids		
Pinegrass	80	2
Forb		
Virginia strawberry	100	2
Broadleaf arnica	100	1
Raceme pussytoes	80	1
Showy aster	60	1
Litter	100	88
Bareground	40	
Rock	20	8

found on these sample sites were lodgepole pine, limber pine, and spruce. However, none of these species were common and did not provided greater than 1% cover.

Shrubs as a vegetation class averaged 19% cover. Shiny-leaf spirea was the dominant species on all sample sites and averaged 7% cover (Table 12). Snowberry and woods rose were co-dominant, but averaged only 2% cover. All of these shrub species are poor to fair forage for cattle and wildlife.

Graminoid cover averaged only 3% and was dominated by pinegrass, which averaged only 2% cover. On the three sample sites with tree canopy cover greater than 70%, pinegrass was the only graminoid species recorded. In less restricted canopies, species such as Wheeler's bluegrass, timothy, Idaho fescue, and rough fescue could be found, but only as occasional plants.

Forbs contributed an average cover of 10%. They were dominated by Virginia strawberry and broadleaf arnica. Both species were found on all sample sites and had mean cover values of 2%. Raceme pussytoes was co-dominant averaging 1% cover. Other forb species such as stinging nettles and starry solomon-plume were common, indicating frequent disturbance of this c.t..

The major portion of the Douglas fir/shiny-leaf spirea/ pinegrass communities were found on soils of the Garlet-Loberg-

Starley stony loams. These are well drained soils formed in colluvium, residuum, or alpine till from mixed sources. They typically have organic horizons on the surface made up chiefly of pine needles and wind throw from the conifer overstory. Ocular estimate of rooting depth averaged 31 inches (79 cm.). These soils have conifer cover greater than 40% and therefor are not assigned a range site classification. Other soil types containing smaller portions of this community include the Babb-Fifer-Cheadle complex and the Garlet-Whitore stony loams.

Limber Pine Community Types

The limber pine communities of the TRMR are widespread in their distribution and are found in each current pasture unit. They are usually found on either flat benches or west-and northwest-facing ridges. The common attribute of all limber pine communities is a shallow, rocky soil that is droughty in nature.

Limber pine as an overstory dominant, averaged 37% cover but varied from 15% to 50% cover depending on the site (Table 13). Grasses and forbs had a bimodal distribution, which appears to be based on the ecological position of the stand. Stands located on flat benches averaged 7% graminoid cover and 9% forb cover. Stands located on west or northwest aspects had graminoid cover averaging 23% and forbs averaging 18% cover.

Species dominance varied little between each of these ecological groups, but from a management standpoint, it seems useful to describe the limber pine communities based on the differences in their production of grasses and forbs. High production communities will be called "limber pine moist" and low production sites will be called "limber pine dry". Variation in species dominance within each group will be noted and described where appropriate.

Dry Limber Pine c.t.: Limber pine was the dominant tree species averaging 38% cover (Table 13). Increment boring of the five largest trees in each sample stand showed the average tree age to be 57 years, the youngest being 47 years and the oldest being 87 years old. Regeneration was found on each sample site. Douglas-fir was also represented within this community but averaged less than 1% cover.

Shrubs averaged 32% cover and were dominated by kinnikinnick with 16% cover. Horizontal juniper was the co-dominant shrub species, averaging 6% cover. Other common shrub species included shrubby cinquefoil, Canada buffalo-berry, and Rocky Mountain juniper (Table 13). All shrub species of this community have forage values considered poor or fair for cattle and wildlife.

Graminoids averaged only 7% cover and were dominated by rough fescue, with 4% cover. Idaho fescue and bluebunch wheatgrass were co-dominant species, but both averaged less than 1% cover. Other grass species occurring in this community included junegrass, Parry's danthonia, intermediate oatgrass, and Kentucky bluegrass.

Forbs averaged 9% cover with an average of 26 species per site. None of these species had an average cover greater than 1% and therefore none could be called dominant. Common species included Missouri golden-rod, western bedstraw, chickweed, tufted fleabane, Hood's phlox, blanket flower, and sulphur hedysarum. Of these species, only sulfur hedysarum is considered good forage for cattle and wildlife.

The dry site limber pine communities (Fig. 18) are usually found on soils of the Hanson very cobbly loams or the Adel-Doby Hanson complex. Parent materials are alluvium derived from limestone, dolomite, and argillite or shale bedrock. Surface soils are susceptible to erosion by wind or water if disturbed or vegetation is removed by overgrazing. Ocular estimates of rooting depth averaged 8 inches (20 cm), however, soil pits were very difficult to dig on these sites due to the high rock content and rooting may be deeper than reported here. Heavy carbonates were found at 4 inches (10 cm) and continued throughout the soil

Table 13. Coverage (%) and constancy (%) of the major plant species, litter, bareground, rock, and mosses of the limber pine community types.

	Dry limber pine c.t.	Moist limber pine c.t.
Vegetative class	Cov(Con)	Cov(Con)
Tree/Shrub		
Limber pine	38 (100)	37 (100)
Douglas-fir	1 (100)	1 (100)
Kinnikinnick	16 (100)	9 (100)
Horizontal juniper	6 (100)	5 (67)
Woods rose	4 (100)	2 (100)
Shrubby cinquefoil	1 (100)	11 (100)
Canada buffalo-berry	3 (100)	3 (67)
Shiny-leaf spiraea	1 (100)	4 (50)
Snowberry	1 (100)	3 (100)
Graminoid		
Rough fescue	4 (100)	11 (100)
Idaho fescue	1 (100)	2 (100)
Junegrass	1 (100)	1 (100)
Bluebunch wheatgrass	1 (100)	1 (67)
Kentucky bluegrass	1 (50)	1 (100)
Parry's danthonia	1 (50)	1 (100)
Timothy	1 (50)	3 (67)
Forb		
Missouri goldenrod	1 (100)	1 (100)
Western bedstraw	1 (100)	1 (100)
Tufted fleabane	1 (100)	1 (33)
Hood's phlox	1 (100)	0 (0)
Sulphur hedysarum	1 (100)	1 (100)
Blanket flower	1 (50)	1 (100)
Chickweed	1 (100)	2 (100)
Ball anemone	1 (100)	1 (100)
Litter	88 (100)	88 (100)
Bareground	3 (100)	4 (67)
Rock	3 (100)	1 (33)
Mosses	0 (0)	4 (67)

Figure 18. Dry limber pine c.t.

profile. Range site classifications of these soils are Silty 15-19 and Silty Droughty 15-19.

Moist limber pine c.t. Dominance of limber pine on moist sites (Fig. 19) was often more extensive than that of dry sites. Two samples within this type averaged 48% limber pine cover and an average tree age of 54 years. A third sample had only 15% cover. The third sample was taken to represent the variation of limber pine cover that can be found within this c.t.. All trees on this site were young and too small for increment boring. Understory composition of this sample site is very similar to others of the moist limber pine c.t. and little change is expected as canopy cover increases with age of the trees.

Shrubs averaged 30% cover with shrubby cinquefoil the dominant shrub, averaging 11% cover (Table 13). Kinnikinnick and horizontal juniper were co-dominant, averaging 9% and 5% cover respectively. Other common shrub species included Canada buffaloberry, snowberry, Rocky Mountain juniper, and Ribes species. All of the shrubs represented in this c.t. are rated as poor to fair forage for cattle and wildlife.

Graminoids averaged 23% cover and they were dominated by rough fescue, with 11% cover. Timothy was dominant with 2% more cover than rough fescue on one site, but it did not occur on the other two. This was believed to be the result of early spring grazing in the pasture unit in which this sample was located. Idaho fescue and Kentucky bluegrass were co-dominant species. Both species were found on all sample sites and both averaged 2% cover. Other grass species common to this community were bluebunch wheatgrass, thick-spike wheatgrass, bearded wheatgrass, Parry's danthonia, Wheeler's bluegrass, smooth brome, mountain brome and carex species.

Forbs averaged 18% cover but no one species was dominant on more than one sample site. Therefore, no dominance of this vegetative class was assigned.

Figure 19. Moist limber pine c.t.

All sample sites of this community type were located on soils of the Babb-Fifer-Cheadle complex. These soils were piedmont glacial till or residuum derived from interbedded shale, mudstone, and sandstone. Ocular estimate of rooting depth averaged 10 inches (25 cm). Carbonates are present in the soil at moderate or shallow depths. The hazard of erosion is severe or very severe by water and moderate by wind. The range site classification corresponding to these soils is Shallow 20+.

Aspen/limber pine/Douglas fir c.t.: The aspen/limber pine/Douglas-fir complex (Fig. 20) was found only on the two western-most pasture units of the TRMR. It was found on all aspects but was limited to elevations from 5,000 to 5,600 feet (1,524m to 1,707m). Trees were the major contributors of cover, averaging 65% with variation from 50% on south facing slopes to 94% on north facing slopes. Aspen was the dominant tree species with 59% cover, but varied from 40% to 78% on south facing slopes and north facing slopes respectively. Limber pine averaged 5% cover and Douglas-fir averaged 1% cover (Table 14). These species exhibited little variation in cover with aspect changes. Spruce could also be found in this c.t. but was inconsistent in occurrence and appeared to be limited to very moist micro-sites.

Shrubs averaged 42% cover with a maximum variation of only 9% regardless of aspect. Kinnikinnick was the dominant shrub with 17% cover (Table 14). Shrubby cinquefoil was co-dominant with 5% cover. Snowberry, woods rose, and shiny-leaf spirea were also found on each sample site and averaged greater than 3% cover. Other common shrub species included serviceberry, chokecherry, Canada buffalo berry, horizontal juniper, and Rocky Mountain juniper. Serviceberry and chokecherry are good or very good browse species for deer and elk. None of the other shrub

Figure 20. Aspen/Limber pine/Douglas-fir c.t.

species of this c.t. provide more than fair forage for cattle or wildlife.

Graminoids averaged 15% cover, but on south slopes graminoid cover was less than 5%. Pinegrass was the dominant grass species with 4% cover. Rough fescue and Kentucky bluegrass were co-dominant, averaging 3% and 2% cover. Idaho fescue also occurred on all sample sites, but contributed less than 1% cover. Other common grass species included timothy, Parry's danthonia, poverty danthonia, spike trisetum, bluebunch wheatgrass, bearded wheatgrass, mountain brome, and carex species.

Forbs averaged 27% cover but no species was dominant on all sample sites. Those species found on all sites and averaging greater than 1% cover included Virginia strawberry 2%, showy

Table 14. Coverage (%) and constancy of the major plant species, litter, bareground and rock of the Aspen/Limber pine/Douglas-fir c.t..

Vegetative class	Constancy	Coverage
Tree/Shrub		
Aspen	100	59
Limber pine	100	5
Douglas-fir	100	1
Kinnikinnick	88	17
Shrubby cinquefoil	88	7
Woods rose	88	6
Snowberry	88	4
Shiny-leaf spiraea	88	4
Canada buffalo-berry	75	3
Horizontal juniper	75	3
Serviceberry	75	3
Graminoid		
Rough fescue	100	4
Pinegrass	88	5
Idaho fescue	88	1
Kentucky bluegrass	75	3
Forb		
American vetch	100	1
Western bedstraw	100	2
Virginia strawberry	100	2
Smooth aster	88	2
Cream-flowered peavine	88	2
Showy aster	62	3
Litter	100	79
Bareground	100	7
Rock	62	9

aster 4%, smooth aster 2%, western bedstraw 2%, cream-flowered peavine 2%, and sulfur hedysarum 1% (Table 14). Few forb species of this community provide good forage to domestic or wildlife ungulates with the exception of sulphur hedysarum.

The aspen/limber pine/Douglas-fir complex is best expressed on soils of the Bynum-Adel-Doby complex. Parent materials are residuum from weakly consolidated sedimentary beds or shale bedrock. Soils are moderately deep. Ocular estimate of rooting depth averaged 16 inches (41 cm). No carbonates were noted in any portion the soil profiles. A heavy clay horizon from 8 to 16 inches (20 cm to 41 cm) in the profile appeared to hold moisture near the surface even on south exposures. These soils are represented by the Silty 20+ or Shallow 20+ range site.

MANAGEMENT IMPLICATIONS

This section discusses the management implications and pertinent literature regarding the community types described on the TRMR. Many communities respond similarly to management and therefore have been grouped for discussion.

Riparian Zone Communities

Ames (1977) reported that riparian ecosystems are probably the single most productive type of wildlife habitat, benefiting the greatest number of species. Mosconi and Hutto (1982) found that in western Montana 59% of the upland bird species use riparian habitat for breeding purposes and 36% of those breed only in riparian areas. The influence of riparian ecosystems on wildlife is not limited to those species that are restricted to it. Carothers (1977) found that population densities of upland birds adjacent to the riparian areas were influenced by the presence of the riparian zone.

Riparian areas are also of vital importance to the livestock industry, but proper and sensitive management are critical. Livestock tend to congregate in riparian areas and will utilize vegetation much more intensively than on adjacent upland areas. Davis (1982) suggested that one of the most destructive forces in riparian zones is the long term impact caused by excessive

livestock grazing. For example, Marlow (1985) found that during August and September approximately 80% of the forage used by cattle may come from riparian areas even though these areas may comprise less than 4% of the total acreage in a pasture.

Kauffman and Krueger (1984) found that the effects of excessive use of woody vegetation in a riparian zone can generally be termed negative. Knopf and Cannon (1982) found excessive cattle grazing on willows significantly altered the size, shape, volume, and quantity of live and dead stems and also influenced the spacing of plants. Marcuson (1977) found shrub production to be 13 times greater in an ungrazed area than in a severely overgrazed area, and canopy coverage was 82% greater in the ungrazed area.

Grazing management is often based solely on the production of upland sites, typically incorporating small riparian areas into the overall management plan. Using this approach, maintenance or improvement of the riparian vegetation is usually impossible. If a management objective is to maintain or improve the condition of riparian vegetation, managers must incorporate grazing methods and techniques specifically designed around the species and communities found in the riparian zone (Hanson et al. 1988). Suggested management techniques include:

1. Specialized grazing systems, especially those controlling the season of use.
2. Special-use pastures which base management decisions specifically on the riparian zone.
3. Complete exclusion of livestock.
4. Changes in the kind or class of livestock.
5. Range management practices such as fencing, herding, salting, and alternative water sources.

Water sedge/Baltic rush c.t.: These wet meadow communities have historically been used as hay producing areas on the TRMR, although few domestic species are currently represented. Hermann (1970) reports that water sedge is moderately palatable for cattle and horses and is sometimes used as hay from wet meadows while beaked sedge is only lightly utilized. Pickford and Reid (1943) report that elk may heavily utilize baltic rush during summer but use at other periods is usually low. This species is generally considered palatable early in the growing season when shoots are young and tender but decreases as stems mature.

Domestic livestock do not readily use these communities until the soil surface dries in late summer or early fall. Season-long grazing, especially when soils are saturated, will

damage plants and compact soils. However, late-season use or rest will allow the vegetation to recover quickly.

Bebb's willow c.t.: The Bebb's willow communities are potentially excellent forage producers for cattle and wildlife. The dominant species, Bebb's willow, is however, generally old, decadent, unavailable for forage, and often a mechanical barrier limiting usefulness. This condition may attract cattle to use these areas for shade and bedding, causing frequent disturbance.

Prescribed burning is a commonly used wildlife management tool to rejuvenate decadent communities of this type. Bebb's willow sprouts rapidly following fire. Quick, hot fires maximize sprouting, while slower burns cause more damage to plants Haeussler and Coates (1986). Mechanical manipulation, such as cutting, also results in vigorous sprouting, especially when cut during dormant periods. Individual cut stems produce an abundance of new sprouts.

This community could provide a valuable source of browse and cover for ungulates, especially during periods when herbaceous species are covered with snow. This community provides an excellent opportunity to research the improvement of production for cattle and wildlife in the riparian zones of the TRMR.

Blueberry willow/Beaked sedge c.t.: The dominant species of this community, blueberry willow, is often utilized heavily by ungulates, particularly during winter. Grazing by livestock should be limited due to soil compaction and stream bank destruction, which occurs with overuse. These areas could probably best be used as wildlife habitat and to provide a buffer zone around active stream courses.

Cottonwood/Snowberry c.t.: Because this community stabilizes streambanks, preserves water quality, and is important to fisheries and wildlife resources, it should be protected against excessive use by domestic livestock. Management actions such as fencing and water development may be required to meet this objective. Those areas used as wintering grounds for cattle should be targeted as weedy species seed sources and an aggressive program of weed control enacted.

Jointed rush/Tufted-hair grass c.t.: To maintain vigor and prevent damage to soils and vegetation, grazing should be deferred until soils are dry.

Native Shrub and Grassland Communities

The native grasslands of the TRMR are dominated by rough

fescue, Idaho fescue, bluebunch wheatgrass, and Parry's danthonia. Of these species, rough fescue, Idaho fescue, and bluebunch wheatgrass are considered good to excellent forage for domestic livestock (Mueggler and Stewart 1980). Parry's danthonia is considered only fair forage for all classes of ungulates.

Cattle grazing of these areas should be keyed to rough fescue. Not only is it usually the major forage producer, but it is also highly sensitive to grazing. Johnson (1961) found that light grazing by cattle often favored Parry's danthonia to the detriment of rough fescue. This would seem to support Moss (1955) who suggested that Parry's danthonia behaves as a disclimax species under grazing. Light grazing did, however, resulted in a more varied flora with a greater total basal area than protected areas which appeared to simplify the flora (Johnson 1961). A diverse species cover could be of value to the ecosystem especially during times of climatic stress.

Heavy grazing during the summer severely reduced rough fescue in a similar vegetative type in Canada, and even moderate grazing reduced rough fescue about one-third below that of light grazing (Campbell et al. 1962).

Deferred-rotation and rest-rotation grazing systems may be used to maintain or improve rough fescue grasslands. Mueggler

and Stewart (1980) suggest rest-rotation may be best suited for ranges of this type. However, with adverse topographic conditions, rest rotation may not be as desirable as deferred-rotation for improving the density of rough fescue. Regardless of which grazing system is employed, only 50% of the current year's growth should be budgeted for use. Campbell et al.(1962) recommends leaving 40% to 50% carryover of the current year's growth and 20% of the seed stalks to maintain rough fescue plant vigor. The remainder should be left for the development of litter, which plays an important role in soil-water relations.

Fencing, water development, and salt placement can often be used to obtain better livestock distribution and more uniform use of the available resources.

Shrubby cinquefoil/Rough fescue c.t.: Except for the presence of shrubby cinquefoil, this community should respond similarly to others of the native grassland type. Shrubby cinquefoil may play an important role in this community by reducing snow and litter loss to wind and therefore improving the moisture regime throughout the growing season.

Cattle grazing in this community should be keyed to the response of rough fescue. Species that commonly increase with over-use are shrubby cinquefoil, Idaho fescue, lupine, yarrow,

chickweed, and western bedstraw. All of these species are currently well represented in the community composition. Horizontal juniper is the only shrub that is sought by mule deer as a preferred forage species (Ihsle 1982), all others are of poor or fair forage value.

Shrubby cinquefoil/Parry's danthonia c.t.: This community is primarily located on west, southwest, and gently sloping easterly exposures. This suggests that It will be the first community of the shrubby cinquefoil series to suffer moisture stress due to wind and solar radiation.

Species of this community type that tend to increase with overgrazing are fringed sage, Parry's danthonia, and such forbs as chickweed, common yarrow, and lupine. Because all of these species are currently either dominant or common in their respective vegetation classes, sensitive management will be required to maintain or increase production of more palatable and productive species.

Shrubby cinquefoil/Idaho fescue c.t.: Idaho fescue is typically an increaser species within the shrubby cinquefoil series. The shrubby cinquefoil/Idaho fescue community is probably the result of past grazing practices. The presence of

poverty danthonia, old mans whiskers, and Virginia strawberry at high cover values also are indicators of past overuse of this community. Management of this community, like other of this series should be keyed to the response of rough fescue.

Bluebunch wheatgrass/Fringed sage c.t.: Management of these communities will be somewhat difficult because they are often long, narrow, and surrounded by larger, important grazing communities within the same pastures. Due to the steepness of slope, often 20% or more, distribution of grazing may be difficult to achieve. This community could probably be best utilized as a spring grazing area.

A high frequency of deer and elk pellets found on all sample sites within this community type indicate that it may also be an important wildlife foraging type. All of the dominant and co-dominant grass species are highly palatable for both cattle and wildlife ungulates and are also sensitive to grazing. Management of this community must be sensitive to these species and to the possibility of excessive disturbance causing erosion.

Parry's danthonia/Rough fescue c.t.: Parry's danthonia is reported to be present at climax in the rough fescue/Idaho

fescue habitat type, particularly in this geographic area, but average cover values do not exceed 8% (Looman 1969, Stringer 1973, and Mueggler and Stewart 1980). The dominance of Parry's danthonia is probably the result of past grazing practices. Rough fescue should be the major forage producer on ranges of this type in good condition. Forbs and shrubs of this community will probably decrease in frequency and cover as range condition improves.

Parry's danthonia/Idaho fescue c.t.: Species composition of this community is probably more the result of soil and moisture relations than past grazing practices. The high frequency of rough fescue (90%) and purple prairie clover (40%), both of which are decreasers with grazing, support this contention. I believe that high winds remove litter, facilitate rapid evaporation of water, and reduce infiltration. These factors limit root development in the soil profile and reduce the generally large robust rough fescue plants to very small specimens which, though frequent, provide little cover.

Idaho fescue/Rough fescue c.t.: The vegetative composition of the Idaho fescue/rough fescue community, like that of the

Parry's danthonia/Idaho fescue community, is probably the result of soil relations rather than past grazing practices. It is interesting to note that although the frequency of rough fescue declines from 90%, in the Parry's danthonia / Idaho fescue community, to 80%, the cover of rough fescue increases from 2% to 10%. Because these communities occur within the same pasture, differences in grazing should not account for differences between the communities. This suggest that differences in soils, depth to carbonates, and rooting depth are important factors contributing to the productivity of rough fescue. Management of this community, like others of the native grasslands, should be keyed to the response of rough fescue.

Serviceberry/Chokecherry c.t.: These communities were often small in size i.e., less than 5 acres (2 ha), but were very important components of mule deer winter range. Ihsle (1982) reported 68% of mule deer rumen contents were made up of shrubs. The communities of this type on the TRMR showed signs of heavy use of preferred browse species.

All of the major species of shrubs represented in the shrub types readily resprout following fire or mechanical disturbance. These management actions or disturbances may be used to remove old or decadent material from these communities and provide an

opportunity for resprouting of highly productive and available forage.

Many of the chokecherry-dominated communities appear to be used extensively as browse. Many plants of this species have lateral shoots closely cropped to the main stem, giving the plant a column-like appearance. These communities appear to be the most heavily used of the shrub type.

Some communities of the serviceberry association are decadent and unavailable for wildlife consumption while others with available forage show heavy use. Available plants are often clubbed in appearance and show the affect of repeated browsing.

If burning or other management practices are employed, a rotation should be used to assure that sufficient area is left undisturbed each year to provide winter forage for wildlife. These areas should be monitored to access the amount of use they are receiving in the years following a management practice. This type of practice could cause over use-of some areas resulting in a reduction rather than increase in forage production.

Because chokecherry is poisonous and is represented in all shrub communities on the ranch, cattle use of these areas should be closely monitored. Most authorities suggest that livestock losses from chokecherry can be avoided by proper range management (Fleming et al. 1926). Cattle use of these communities on the

ranch is somewhat reduced because of the steepness of the slopes where this vegetative type is commonly found.

Domestic Grass and Alfalfa Hay Communities

Kentucky bluegrass/Timothy/Smooth brome domestic hay c.t.: The domestic grass hay community types are found on the potentially most productive sites on the ranch. However, many of these sites do not achieve their potential livestock forage production due to their age and species composition.

Kentucky bluegrass, is resistant to grazing and of good forage value, but it is not a very productive species due to its lack of biomass production in relation to cover area occupied. I believe that this species has increased since these areas were planted and is now reducing biomass by competing with the more productive timothy and smooth brome. Fertilization of these communities could be used to improve yields of early spring forage and grass hay production. On very moist sites, species such as Garrison foxtail could be planted to improve site productivity and add diversity to grazing species composition.

There is also an encroachment problem developing with species such as wild Iris, shrubby cinquefoil, and northwest cinquefoil within all of the domestic hay communities. In some cases, controlling these species and reestablishing a more

productive species composition may be desirable. Because these communities have such great potential and flexibility of use patterns, they should be examined closely and appropriate management actions initiated as soon as possible.

Domestic Alfalfa c.t.: This community is of great importance to the ranching operation as it provides the major source of winter forage for cattle, considerable fall grazing, and is heavily used by wildlife. Its management and improvement should be made a priority project to improve the overall productivity of the ranch.

Those areas currently used for the production of alfalfa hay are decadent and should be replanted to an early-producing strain of alfalfa. Most existing irrigation ditches could be removed and irrigation water channeled to existing ponds for impoundment and availability for a sprinkler type irrigation system. A sprinkler irrigation system could be used to maximize water-use efficiency and improve water distribution. Because the soils that are associated with this community have low water holding capacity, flood irrigation is very time consuming and inefficient. Fertilization of these areas should also be considered on a bi-yearly basis.

Tree Dominated Communities

Aspen/Snowberry/Timothy c.t.: Aspen stands provide succulent vegetation in the understory throughout the growing season and are used extensively for shade and cover by both cattle and wildlife. These communities appear to be used far more than their availability might suggest. Areas of overuse will be difficult to avoid.

The surface layer of soils associated with the aspen communities are susceptible to water erosion if disturbed or if the understory is overgrazed. Timely movement of cattle to other areas, even within the same pasture, could reduce adverse soil impacts. Proper placement of salt and development of water in locations removed from aspen stands will improve grazing distribution and reduce impacts of domestic livestock.

Douglas-fir/Shiny-leaf spiraea c.t.: This community type has low potential for timber production. It provides little forage for cattle or wildlife, however, it appears to be used extensively for shade and bedding areas by cattle and may provide thermal protection for wildlife throughout the year. Extensive trail systems crisscross every sample stand within this vegetative type, and the presence of many disturbance species in the understory suggest that animal use exceeded that expected

based on availability alone. These areas of dense overstory should be maintained to provide thermal protection for wintering wildlife. Erosion from water may also result if the surface of steep slopes are disturbed.

From a practical stand point, this community does not cover enough total area to significantly reduce production on the ranch as a whole and should be left to play its natural ecological role and add diversity to the total plant community.

Dry Limber Pine c.t.: These communities are of little value for timber or forage production; however, they do provide hiding and thermal cover for wildlife and shade or wind breaks for livestock. Mule deer and elk appear to use these communities extensively during winter and fawning or calving periods. This observation is, however, based on personal opinion and experience with no data to support it.

Graminiod production is limited by shallow rooting depths and heavy carbonate concentrations is the soil profile. These factors suggest limited moisture infiltration and availability to all species of these very harsh sites and implies that livestock use should be limited in an effort to maintain soil cover and protect against erosion.

The limber pine communities provide an excellent opportunity for research in wildlife habitat selection, use, and structural attributes.

Moist Limber Pine c.t.: The major use of this community is livestock understory grazing and wildlife habitat. Good grazing distribution is important because steepness of slopes limits access by livestock and promotes overgrazing of the less sloping areas. Proper salt placement and timely movement will assist in achieving desired livestock distribution. This community, like those of the native grasslands, could be maintained or improved by implementing a rest or deferred-rotation grazing system targeting rough fescue as the major forage producing species.

Aspen/Limber pine/Douglas-fir c.t.: The major use of this community is understory grazing and wildlife habitat. On north facing slopes, tree and shrub species have become mechanical barriers to grazing. This condition could be controlled by burning or mechanical means but the area would probably regenerate rapidly and require frequent intervention to maintain an open canopy.

APPENDIX A

SOILS MAPPING NUMBER, TYPE AND RANGE SITE CORRELATION

Map #	Soil Type	Range Site
108A	Korchea-Ridglawn loams	Si 15-19
109B	Nesda-Riverwash complex	SwG 15-19
113A	Ridgelawn- Nesda complex	Si & SwG 15-19
168B	Saypo-Truchot clay loam	Sb 15-19
174D	Cabba-Amor loams	Si & Sw 15-19
191F	Whitore-Starley association	
193E	Loberg-Whitore-Garlet stony loams	
194E	Bynum-Adel-Doby complex	Si 20+
195B	Hanson-Raynesford complex	Si & SiD 15-19
196E	Teton-Tibson-Cheadle complex	Si & Sw 20+
197E	Adel-Doby-Hanson complex	Si & SiD 20+
198C	Adel-Gallatin-Shedhorn complex	
219A	Winginaw-tetonview mucky peats	
220B	Judith-Windham complex	Si & Si-Ly 15-19
283D	Amor-Winifred-Werner complex	Si,Sw,& Cy 15-19
291F	Starley-Rock outcrop complex	Sw 20+
293F	Garlet-Whitore stony loams	
294E	Adel-Burnette-Bynum complex	Si 20+
296E	Babb-Tibson-Adel complex	Si & SiD 15-19
384D	Shambo-Amor loams	Si 15-19
390F	Cheadle-Doby-Rock outcrop complex	Sw 20+
393E	Garlet-Loberg-Starley stony loams	
474F	Cabba-Roundor-Windham complex	Sw & Si 15-19
475D	Roundor-Kiev-Windham Complex	TSi 15-19
484D	Shambo-Amor-Windham complex	Si 20+
493E	Garlet-Cheadle-Loberg stony loams	Si 15-19
495B	Hanson very cobbly loams	Si 15-19
500	Riverwash	
590E	Babb-Fifer-Cheadle complex	Si & Sw 20+
684C	Shambo-Amor-Whitore complex	Si 15-19
690E	Bynum-Doby-Cheadle complex	Sw 20+

APPENDIX B

TRMR PLANT LIST

ABBREV.	SCIENTIFIC NAME	COMMON NAME
ACTRUB	Actaea ruba	Baneberry.
ACEGLA	Acer glabrum	Rock mountain maple.
ACHMIL	Achillea millefolium	Yarrow
AGOGLA	Agroseris glauca	False dandelion.
AGRDAS	Agropyron dasytachyum	Thick-spiked wheatgrass
AGRREP	Agropyron repens	Quackgrass
AGRSMI	Agropyron smithii	Western wheatgrass.
AGRSPI	Agropyron spicatum	Bluebunch wheatgrass
AGRSUB	Agropyron subsecundum	Bearded wheatgrass
AGRTRA	Agropyron trachycaulum	Braid-glumed wheatgrass
AGRTRC	Agropyron trichophorum	Pubescent wheatgrass
AGRALB	Agrostis alba	Redtop
AGRSCA	Agrostis scabra	Rough bentgrass-ticklegrass
ALLCER	Allium cernuum	Nodding onion
ALLSCH	Allium schoenoprasum	Chives
ALOGEN	Alopecurus geniculatus	Water foxtail
ALYALY	Alyssum alyssoides	Pale alyssum
AMEALN	Amelanchier alnifolia	Serviceberry
ANDSEP	Androsace septentrionalis	Northern fairy candelabra
ANAMAR	Anaphalis margaritaceaia	Pearly everlasting
ANDOCC	Androsace occidentalis	Western fairy candelabra
ANEMUL	Anemone multifida	Cliff anemone
ANEPAT	Anemone patens	Pasque flower
ANGARG	Angelica arguta	Sharptoothed angelica
ANTRAC	Antennaria racemosa	Raceme pussytoes
ANTROS	Antennaria rosa	Rose pussytoes
APOAND	Apocynum androsaemifolium	Dogbane
AQUFLA	Aquilegia flavescens	Yellow columbine
ARACRU	Arabis crucisetosa	Crosshair rockcress
ARAGLA	Arabis glabra	Tower mustard
ARASPA	Arabis sparsiflora	Hoary rockcress
ARCMIN	Arctium minus	Common burdock
ARCUVA	Arctostaphylos uva-ursi	Kinnikinnick
ARECON	Arenaria congesta	Ballhead sandwort
ARELAT	Arenaria latifolia	Blunt leaf
ARNLAT	Arnica latifolia	Broadleaf arnica

ARTCAM	Artemisia campestris	Pacific sagewort
ARTCAN	Artemisia cana	Silver sage
ARTDRA	Artemisia dracunculus	Tarragon
ART.FRI	Artemisia frigida	Fringed sage
ARTLUD	Artemisia ludoviciana	Prairie sagewort
ARTTRI	Artemisia tridentata	Big sagebrush
ARTTSV	Artemisia tridentata	Big sagebrush (mountain)
ASTCON	Aster conspicuus	Showy aster
ASTFAL	Aster falcatus	Little gray aster
ASTFOL	Aster foliaceus	Leafy aster
ASTHES	Aster hesperius	Siskiyou aster
ASTJUN	Aster junciformis	Rush aster
ASTLAE	Aster laevis	Smooth aster
ASTCAN	Astragalus canadensis	Canada milkvetch
ASTCRA	Astragalus crassicarpus	Groundplum milkvetch
ASTMIC	Astragalus microcystis	Bladdery milkvetch
ASTSTR	Astragalus striatus	Standing milkvetch
ASTVEX	Astragalus vexilliflexus	Bentflowered milkvetch
BALSAG	Balsamorhiza sagittata	Arrowleaf balsam
BESWYO	Besseya wyomingensis	Wyoming kittentail
BETFON	Betula fontinalis	Water birch
BROANO	Bromus anomalus	Nodding brome
BROCAR	Bromus carinatus	Mountain brome
BROINE	Bromus inermis	Smooth brome
BROMAR	Bromus marginatus	Big mountain brome
BROVUL	Bromus vulgaris	Columbia brome
BUPAME	Bupleurum americanum	American thorough-wax
CALINE	Calamagrostis inexpansa	Northern reedgrass
CALPUR	Calamagrostis purpurascens	Purple reedgrass
CALRUB	Calamagrostis rubescens	Pinegrass
CAMROT	Campanula rotundifolia	Creeping bellflower
CARNUT	Carduss nutans	Musk thistle
CARAQU	Carex aquatilis	Water sedge
CARFIL	Carex filifolia	Threadleaf sedge
CARGEY	Carex geyeri	Elk sedge
CAROBT	Carex obtusata	Obtuse sedge
CARPRA	Carex praegracilis	Silver sedge
CARROI	Carex rossii	Ross sedge
CARROS	Carex rostrata	Beaked sedge
CARSCI	Carex scirpoidea	Northern Single-spiked sedge
CARSCO	Carex scopularum	Holm's Rocky Mountain sedge
CENMAC	Centaurea maculosa	Spotted knapweed
CASMIN	Castilleja minata	Scarlet paintbrush
CASNIV	Castilleja nivea	Snow paintbrush
CERARV	Cerastium arvense	Field chickweed

CHRVIL	Chrysopsis villosa	Hairy goldenaster
CICDOU	Cicuta douglasii	Douglas Waterhemlock
CIRARV	Circium arvense	Canada thistle
CIRUND	Circium undulatum	Utah thistle
CIRVUL	Circium vulgare	Bull thistle
CLECOL	Clematis columbiana	Columbia clematis
CLEHIR	Clematis hirsutissima	Vaseflower clematis
CLELIG	Celmatis ligusticifolia	Wester virgins-brower
CLEPSE	Clematis pseudoalpina	Rocky Mountain clematis
COMUMB	Comandra umbellata	Bastard toad-flax
COMARV	Convolvulus arvensis	Field morning-glory
CORSTO	Cornus stolenifera	Red osier dogwood
CREACU	Crepis acuminata	Tapertip hawksbeard
CRETEC	Crepis tectorum	Annual hawksbeard
CRYINT	Cryptantha interrupta	Bristly crytantha
CYNOFF	Cynoglossum officinale	Common hound's tongue
DANCAL	Danthonia californica	Californis danthonia
DANINT	Danthonia intermedia	Timber danthonia
DANPAR	Danthonia parryi	Parry's danthonia
DANSPI	Danthonia spicata	Poverty danthonia
DESCES	Deschampsia cespitosa	Tufted hair-grass
DISTRA	Disporum trachycarpum	Wartberry fairy-bell
DISSPI	Distichlis spicata	Seashore saltgrass
DODECA	Dodecatheon spp.	Shooting star
ELACOM	Elaeagus commutata	Silverberry
ELECAN	Elymus canadensis	Canada wildrye
ELYCIN	Elymus cinereus	Giant wildrye
ELYGLA	Elymus glaucus	Blue wild rye
EPICIL	Epilobium ciliatum	Autumn willow-herb
EPILAT	Epilobium latifolium	Red willow-herb
EQUARV	Equisetum arvense	Field horsetail
ERICES	Erigeron caesoitosus	Tufted fleabane
ERICOU	Erigeron coulteri	Coulter's fleabane
ERISIL	Erigeron filifolius	Threadleaf fleabane
ERIOCH	Erigeron ochroleucus	Buff fleabane
ERICPE	Erigeron speciosus	Showy fleabane
ERIFLA	Eriogonum flavum	Yellow eriogonum
ERYINC	Erysimum inconspicuum	Smallflowered rocket
EUPESU	Euphorbia esula	Leafy spurge
FESIDA	Festuca idahoensis	Idaho fescue
FESPRA	Festuca pratensis	Meadow fescue
FESSCA	Festuca scabrella	Rough fescue
FRAVES	Fragaria vesca	Woods strawberry
FRAVIR	Fragaria virginiana	Virginia strawberry
FRASPE	Frasera speciosa	Giant frasera

GAIARI	Geillardia aristata	Blanket-flower
GALAPA	Galium aparine	Goose-grass
GALBOR	Galium boreala	Northern bedstraw
GAUCOC	Gaura coccinea	Scarlet gaura
GENAFF	Gentiana affinis	Pleated gentian
GENAMR	Gentiana amarella	Northern gentian
GENCAL	Gentiana calycosa	Explorer's gentian
GENAMA	Gentianella amarella	Annual gentian
GENAMA	Gentianella amarella	Annual gentiaium bicknellii
GERBIC	Geranium bicknellii	Bicknell's geranium
GERRIC	Geranium richardsonii	White geranium
GERVIS	Geranium viscosissimum	Sticky geranium
GEUALE	Geum aleppicum	Yellow avens
GEUTRI	Geum triflorum	Old man's whiskers
GLYGRA	Glyceria grandis	American mannagrass
GLYSTR	Glyceria striata	Fowl mannagrass
GOOOBL	Goodyera oblongifolia	Western rattlesnake-plantian
GRISQU	Grindelia squarrosa	Curlycup gumweed
GUTSAR	Guterrizia sarothrae	Broom snakeweed
HABBRA	Habenaria bracteata	Long-bracted Bog-orchid
HABUNA	Habenaria unalascensis	Alaska rein-orchid
HACHIS	Hackelia micrantha	Blue stickseed
HAPLAC	Haplopappus lanceolatus	Lance-leaved goldenweed
HEDBOR	Hedsarum boreale	Northern hedsarum
HEDSUL	Hedysarum sulphurescens	Sulphur hedysarum
HELMAX	Helianthus maximiliani	Maximilan's sunflower
HELNUT	Helianthus nuttallii	Nuttall's sunflower
HESMAT	Hesperis matronalis	Dame's violet
HUECYL	Huechera cylindrica	Roundleaf alumroot
HUEGRO	Huechera grossulariifolia	Gooseberryleaved alumroot
HIEALE	Hieracium albertinum	Western hawkweed
HIEALB	Hieracium albiflorum	White hawkweed
HIEUMB	Hieracium umbellatum	Narrow-leaved hawkweed
HORBRA	Hordeum brachyantherum	Meadow barley
HYMACA	Hymenoxys acaulis	Stemless hymenoxys
IRIMIS	Iris missouriensis	Rocky mountain iris
JUNBAL	Juncus balticus	Baltic rush
JUNBUF	Juncus bufonius	Chestnut rush
JUNEFF	Juncus effusus	Soft rush
JUNNOD	Juncus nodosus	Jointed rush
JUNTEN	Juncus tenuis	Slender rush
JUNTRA	Juncus tracyi	Tracy's rush
JUNHOR	Juniperus horizontalis	Creeping juniper
JUNSCO	Juniperus scopulorum	Rocky mountain juniper
KOECRI	Koeleria cristata	Junegrass
LAPECH	Lappula echinata	Bristly stickseed

LATOCH	Lathyrus ochroleucus	Cream-flowered peavine
LIAPUN	Liatris punctata	Dotted blazing-star
LILPHI	Lilium philadelphicum	Red lily
LITRUD	Lithospermum ruderale	Wayside gromwell
LOMCOU	Lomatium cous	Cous biscuit root
LOMATI	Lomatium spp.	Biscuit root
LOMTRI	Lomatium triternatum	Narrowleaf lamatium
LUPSER	Lupinus sericeus	Silky lupine
LUPINU	Lupinus spp.	lupine
LYNDRU	Lynchnis drummondii	Drummond campion
MEDLUP	Medicago lupulina	Black medic
MELLIN	Melampyrum lineare	Narrow-leaved Cow-wheat
MELSPE	Melica spectabilis	Showy oniongrass
MELOFF	Melilotus officinalis	Yellow sweet-clover
MELILO	Melilotus spp.	Sweetclover
MENARV	Mentha arvensis	Field mint
MENTHA	Mentha spp.	Mint
MONFIS	Monarda fistulosa	Wild bergamot
MUHCUS	Muhlenbergia cuspidata	Plains muhly
MUHRIC	Muhlenbergia richardsonis	Mat muhly
MUHLEN	Muhlenbergia spp.	Muhly
OENOTH	Oenothera spp.	Evening-primrose
OROFAS	Orhtocarpus luteus	Yellow owl clover
OSMCHI	Osmorhiza chilensis	Mountain sweet-root
OSMORH	Osmorhiza spp.	Sweet-root
OXYCAM	Oxytropis campestris	Slender locoweed
OXYSPL	Oxytropis splendens	Showy locoweed
OXYVIS	Oxyrtopis visicida	Sticky locoweed
PARPAL	Parnassia palustris	Norhtern grass-of-parnasssus
PEDBRA	Pedicularis bracteosa	Bracted lousewort
PEDCON	Pedicularis contorta	Coil-beak lousewort
PEDGRO	Pedicularis groenlandica	Elphanthead
PENGLO	Penstemon globosus	Globe penstemon
PENTRI	Penstemon triphyllus	Whorled penstemon
PERGAI	Perideridia gairdneri	Gairder's yampa
PETCAN	Petalostemon candida	White prairie clover
PETPUR	Petalostemon purpurea	Purple prairie clover
PHAARU	Phalaris arundinacea	Reed canarygrass
PHLPRA	Phleum pratense	Timothy
PHLALY	Phlox alyssifolia	Alyssum-leaved phlox
PHLHOO	Phlox hoodii	Hood's phlox
PHLOXX	Phlox spp.	Phlox
PHYDID	Physaria didymocarpa	Common twinpod
PICENG	Picea engelmannii	Engelman spruce
PINCON	Pinus contorta	Lodgepole pine

PINFLE	Pinus flexilis	Limber pine
PLAELO	Plantago elongata	Slender plantain
PLAERI	Plantago eriopoda	Redwool plantain
PLALAN	Plantago lanceolata	Buckhorn plantain
PLANTA	Plantago spp.	Plantain
POACOM	Poa compressa	Canada bluegrass
POANER	Poa nervosa	Wheeler's bluegrass
POAPRA	Poa pratensis	Kentucky bluegrass
POATRI	Poa trivialis	Roughstalk bluegrass
POPANG	Populus angustifolia	Narrowleaf cottonwood
POPDEL	Populus deltoides	Eastern cottenwood
POPTRE	Populus tremuloides	Quaking aspen
POTNAT	Potamogeton natans	Floating-leaved pondweed
POTAMO	Potamageton spp.	Pondweed
POTANS	Potentilla anserina	Common silverweed
POTARG	Potentilla arguta	Tall cinquefoil
POTFRU	Potentilla fruticosa	Shrubby cinquefoil
POTGRA	Potentilla gracilis	Northwest cinquefoil
POTPEN	Potentilla pensylvanica	Prairie cinquefoil
PRUVUL	Pruella vulgaris	Self-heal
PRUVIR	Prunus virginiana	Common chokecherry
PSEMAN	Pseudotsuga menziesii	Douglas fir
PTEAND	Pterospora andromedea	Woodland pinedrops
PYRASA	Pyrola asarifolia	Pind wintergreen
PYRSEC	Pyrola secunda	One-sided wintergreen
RANUNC	Ranunculus spp.	Buttercup
RATCOL	Ratibiba columnifera	Prairie coneflower
RHUSXX	Rhus spp.	Sumac
RIBCER	Ribes cereum	Wax currant
RIBESX	Ribes spp.	Ribes
ROSACI	Rosa acicularis	Prickly rose
ROSWOO	Rosa woodsii	Woods rose
RUBIDA	Rubus idaeus	Red raspberry
RUDLAC	Rudbeckia laciniata	Cutleaf coneflower
RUMSAL	Rumex salicifolius	Willow dock
RUMEXX	Rumex spp.	Dock
SALBEB	Salix bebbiana	Bebb's willow
SALBOO	Salix boothii	Blueberry willow
SALCAN	Salix candida	Hoary willow
SALEXI	Salix exigua	Riverbank willow
SALRIG	Salix rigida	Diamond willow
SANMAR	Sanicula marilandica	Black snake-root
SCRAME	Scirpus americanus	Hardstem bulrush
SEDSTE	Sedum stenopetalum	Wormleaf stonecrop

SENCAN	Senecio canus	Woolly groundsel
SENPAU	Senecio pauperculus	Balsam groundsel
SENPSE	senecio pseudaureus	Golden groundsel
SENTRI	Senecio triangularis	Arrowleaf groundsel
SHECAN	Shepherdia canadensis	Canada buffalo-berry
SILCUC	Silene cucubalus	Bladder campion
SISANG	Sisyrinchium amgustifolium	Common blue-eyed grass
SMIRAC	Smilaciana racemosa	False spikenard
SMISTE	Smilaciana stellata	Starry solomon-plume
SOLCAN	Solidago canadensis	Canada goldenrod
SOLGIG	Solidago gigantea	Giant goldenrod
SOLMIS	Solidago missouriensis	Missouri goldenrod
SOLSPA	Solidago spathulata	Coast goldenrod
SONARV	Sonchus arvensis	Field sowthistle
SPIBET	Spiraea betulifolia	Shiny-leaf spirea
SPIROM	Spiranthes romanzoffiana	Hooded ladies-tresses
STAPAL	Stachts palustris	Swamp hedge-nettle
STECAL	Stellaria calycantha	Starwort
STICOM	Stipa comata	Needle-and-thread
STIOCC	Stipa occidentalis	Western needlegrass
STIVIR	Stipa viridula	Green needlegrass
SYMALB	Symphoricarpos albus	Common snowberry
TAROFF	Taraxacum officinale	Common dandelion
THAAFF	Thalictrum occidentale	Wersern meadowrue
THERHO	Thermopsis rhombifolia	Round-leaved thermopsis
TRADUB	Tragopogon dubius	Yellow salsify
TRIFOL	Trifolium spp.	Clover
TRIMAR	Triglochin maritimum	Seaside-Arrow-grass
TRIOVA	Trillium ovatum	White wake-robin
TRISPI	Trisetum spicatum	Spike trisetum
TYPLAT	Typha latiifolia	Common cattail
URTDIO	Urtica dioica	Stinging nettle
VALDIO	Valeriana dioica	Northern valerian
VERBLA	Veratrum viride	Green false hellebore
VERPES	Veronica persica	Birdseye speedwell
VICAME	Vicia americana	American vetch
VIOADU	Viola audunca	Hook violet
VIOCAN	Viola canadensis	Canada violet

APPENDIX C

Study area legal description

TOWNSHIP 27 NORTH RANGE 8 WEST

1. S.1/2 of sec. 5 excluding the N.W. 1/4 of S.W. 1/2
2. S. 1/2 of sec. 6
3. All of sec. 7
4. N. 1/2 of N. 1/2, S.W. 1/4 of N.W. 1/4, S.E. 1/4 of N.E. 1/4, N.W. 1/4 of S.W. 1/4 of sec. 8
5. S. 3/4 of sec. 17
6. All of sec. 18 excluding the S.W. 1/4 of S.W. 1/4
7. E. 1/2 of N.E. 1/4, N.E. 1/2 of N.W. 1/4 of sec. 19
8. N. 1/2 of sec. 20
9. N. 1/2, S.E. 1/4 of sec. 21
10. N.W. 1/4 of S.W. 1/4 of sec. 22
11. N.E. 1/4 of N.E. 1/4 of sec. 28

TOWNSHIP 27 NORTH RANGE 9 WEST

1. S. 1/2 of sec. 12
2. All of sec. 13 excluding S.E. 1/4 of S.E. 1/4
3. S. 1/2 of S.E. 1/4 of sec. 14
4. All of sec. 23 excluding W. 1/2 of S.W. 1/4
5. All of sec. 26 excluding N.W. 1/4 of N.W. 1/4
6. N. 1/2 of sec. 35

APPENDIX D

Summary of plant communities coverage (%), by vegetation class and total cover values.

Community Type	(%) Cover					
	Total	Trees	Shrubs	Grasses	Forbs	Segdes & Rushes
Water sedge/ Baltic rush	75	0	5	8	6	54
Bebb's willow	142	0	86	24	33	0
Blue. willow/ beaked sedge	79	0	37	3	11	28
Cottonwood/ Snowberry	163	59	60	16	28	0
Jointed rush/ Tufted-hairgrass	71	0	0	21	3	47
Kentucky blue/ grass hay	128	0	t	88	36	4
Timothy/ grass hay	120	0	t	85	33	2
Smooth brome/ grass hay	95	0	t	67	23	5
Shrubby cinq/ Rough fescue	119	0	24	48	47	t
Shrubby cinq/ Parry's dan.	114	0	14	52	47	t
Shrubby cinq/ Idaho fescue	142	0	26	59	57	t

Summary of plant communities coverage (%), by vegetation class and total cover values.

Community Type	(%) Cover					
	Total	Trees	Shrubs	Grasses	Forbs	Segdes & Rushes
Blue.wheatgrass/ Fringed sage	92	0	12	52	28	t
Parry's dan/ Rough fescue	101	0	20	55	26	t
Parry's dan/ Idaho fescue	82	0	14	33	35	t
Idaho fescue/ Rough fescue	87	0	5	41	32	t
Serviceberry	141	0	81	38	22	t
Chokecherry	123	0	59	42	22	t
Aspen / Snowberry	146	69	20	25	32	t
Douglas-fir/ Spiraea	87	64	10	3	10	t
Limber pine/ dry	87	37	32	8	10	t
Limber pine/ moist	118	47	30	23	18	t
Aspen/Limber pine/Doug-fir	151	67	42	15	27	t

APPENDIX E

Suggested Research

1. The effect of rest-rotation vs. deferred-rotation grazing systems on rough fescue and Parry's danthonia production.

2. The effect of fire vs. mechanical disturbance on production within the serviceberry, chokecherry, and Bebb's willow community types.

3. Improving rough fescue production by reducing shrubby cinquefoil through herbicide application.

4. The role of limber pine communities in mule deer and elk habitat selection and use (with emphasis on wintering and fawning or calving periods).

5. The effect of cattle use and movement patterns on elk habitat selection and use.

6. Grazing systems which permit use of riparian zones while minimizing impacts.

7. Methods of minimizing depredation by wintering ungulate wildlife populations.

APPENDIX F

Summary of TRMR acerage by plant community

Community type	Plant community map symbol	Approximate tolal acers
Water sedge/ Baltic rush	R4	33
Bebb's willow	R2	167
Blueberry willow/ beaked sedge	R3	38
Cottonwood/ snowberry	R1	241
Jointed rush/ Tufted-hairgrass	R5	38
Domestic alfalfa	DA	188
Domestic grass & hay meadows	DM	539
Shrubby cinquefoil/ Rough fescue	PF	2,045
Shrubby cinquefoil/ Parry's danthonia	PD	388
Shrubby cinquefoil/ Idaho fescue	PI	28
Bluebunch wheatgrass/ Fringed sage	AA	205
Parry's danthonia/ Rough fescue	DF	345
Parry's danthonia/ Idaho fescue	DI	246

Summary of TRMR acerage by plant community

Community Type	Plant community map symbol	Approximate total acers
Idaho fescue/ Rough fescue	FD	286
Serviceberry	SA	10
Chokecherry	PA	53
Aspen / Snowberry	PS	227
Douglas-fir/ Spiraea	PB	192
Limber pine/ dry	PX	356
Limber pine/ moist	PM	277
Aspen/Limber pine/Doug-fir	PC	156

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