RANGELAND REFERENCE AREAS

SPECIES COMPOSITION CHANGES IN THE PRESENCE AND ABSENCE OF GRAZING AND FIRE ON THE *ROUGH FESCUE-HAIRY WILDRYE* DOMINATED COMMUNITY TYPES OF THE UPPER FOOTHILLS SUBREGION

Alberta
ENVIRONMENT

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prepared by

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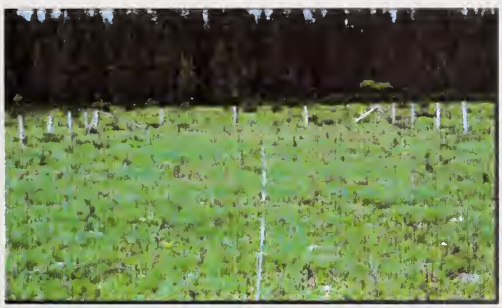
McCue Creek Rangeland Reference Area

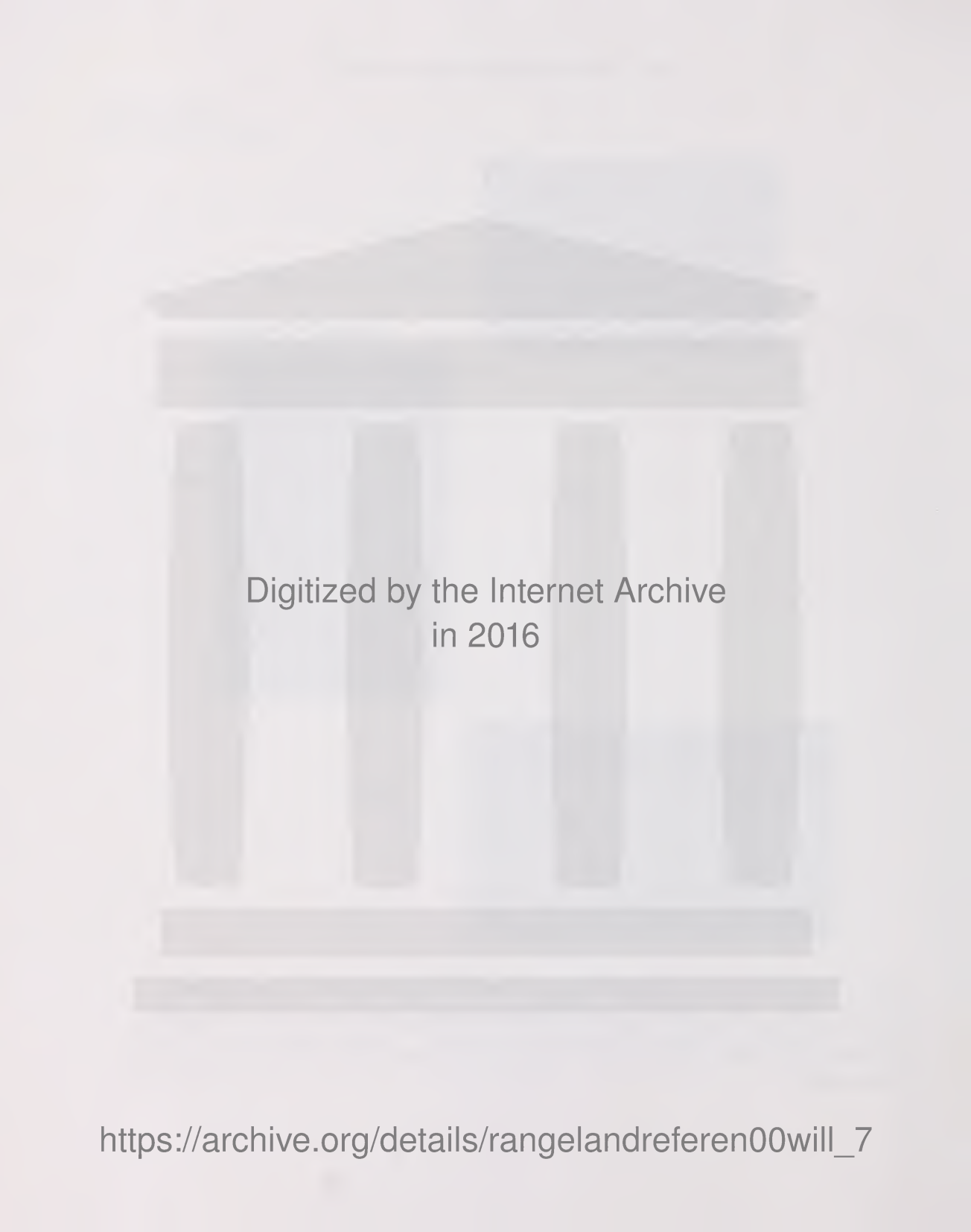
1963

1997



2000

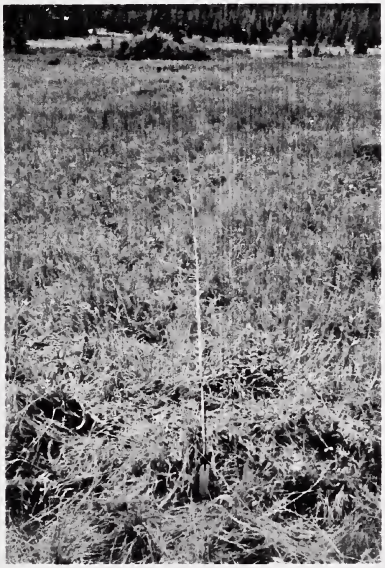
Plate 1. The McCue Creek reference area was extensively utilized prior to protection from grazing in 1963. After 30 years of no grazing pressure rough fescue cover had increased and there was an extensive buildup of litter inside the exclosure. Two years of grazing in 1998 and 1999 reduced the litter buildup, lowered rough fescue cover and increased species diversity on the inside transect.



Yara Creek Rangeland Reference Area

1963 **1991**

Plate 2. In 1963 the ungrazed transect at Yara Creek was dominated by rough fescue and hairy wildrye. After 20 years of no grazing and fire the transect has become dominated by willow and there has been a shift in the dominance of the understory away from grasses to forb species (fireweed and star flowered solomon seal).



1963

2000

Plate 3. Trees have slowly started to invade the ungrazed inside transect at the Upper James River exclosure.

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ABSTRACT

The Rangeland Reference Area program administered by the Land and Forest Service was established by the Eastern Rockies Forest Conservation Board to assess range condition and monitor trend on rangelands within the boundaries of the Rocky Mountain Forest Reserve (RMFR). Forty-five fenced exclosures have been established in the Forest Reserve. These exclosures include permanently marked grazed and ungrazed transects. Species composition data has been recorded on these transects since 1953 when many of the sites were established. Recently, the data of these sites has been analyzed in order to determine the successional pathways in the presence and absence of grazing. This long-term data used in conjunction with a detailed ecological classification of the range community types will help to determine the health of the forested rangelands in the province.

This report evaluates and discusses the range condition and trend of the McCue Creek, Yara Creek and Upper James River Rangeland Reference Areas. These reference areas were established in 1963 on glacialfluvial terraces and a colluvial slope adjacent to the Red Deer and Upper James River. Willoughby and Smith (1999), classified these reference areas as belonging to the Rough fescue-Hairy wildrye community type and placed them in the grassland/shrubland ecosite of the Upper Foothills subregion.

INTRODUCTION

In the late 1800's livestock grazing was unregulated along the eastern slopes of the Rocky Mountains in Alberta. In an effort to protect the Saskatchewan River basin watershed the Rocky Mountain Forest Reserve was established in 1910. At this time grazing by domestic animals was prohibited. However, by 1913 grazing by livestock was recognized as a useful tool to reduce forage accumulation and assist in preventing a potential fire hazard. Due to inadequate management policies and funding, water quality continued to deteriorate because of fire and localized overgrazing. As a result, the Rangeland Reference Area Program of the Alberta Forest Service was established in 1949 to assess range condition and monitor range trend on grasslands within the boundaries of the Rocky Mountain Forest Reserve (Hanson 1975). Forty-five reference areas have been established in the Reserve. Many of these sites have been monitored since 1953.

This report discusses and evaluates the range condition and trend of the McCue Creek, Yara Creek and Upper James River Rangeland Reference Areas. These reference areas were established in 1963 on fluvial and colluvial terraces adjacent to the Red Deer River and Upper James River on sites which had been overgrazed and were thought to be in poor range condition. Willoughby and Smith (1999), classified the undisturbed transects of these reference areas as belonging to the Rough fescue-Hairy wildrye dominated community type. This paper will examine the successional relationships of these reference areas in the presence and absence of grazing and fire.

SITE DESCRIPTION

These Reference Areas are part of the primary rangelands in the Upper Foothills subregion of Alberta (Dept. of Environmental Protection 1994). This subregion is found elevationally below the subalpine and above the Lower Foothills subregions. It ranges in elevation from 1200-1500m at lower latitudes and from 1000-1250 m at higher latitudes. It is dominated by closed canopy lodgepole pine forests with the potential climax species on reference sites being white spruce and black spruce. This subregion can be distinguished from the Subalpine subregion by the lack of engelmann spruce and from the Lower Foothills by the lack of aspen.

This subregion has a boreal climate which is modified by the Rocky Mountains. The average annual precipitation is 538 mm with over half the precipitation received in the summer months (340 mm). The temperature averages 11.5 ^{0}C in the summer and -6.0 ^{0}C in the winter (Strong 1992). These temperatures are milder and not nearly as extreme as the other subregions within the Boreal forest and Foothills natural regions. The native grass and shrubland community types are found in the valley bottoms, adjacent to streams and rivers and on south facing slopes throughout the Upper Foothills subregion. Deep snow accumulations and/or cold air drainage prevent trees from growing in these valley bottoms (Daubenmire 1978). Historically, these grass and shrublands burned frequently, further preventing tree encroachment.

Soils and physiographic information are available for each reference area (Appendix 1). Both the McCue Creek and Upper James reference areas are located on terraces overlooking the

Red Deer and Upper James Rivers, repectively. Both sites have Orthic Eutric Brunisol soils. The Yara Creek reference area is located on a south facing slope above the Red Deer River. The soil at this site is a Orthic Humic Regosol.

METHODS

Reference sites were selected from within range allotments on areas that represented primary range. Originally sites thought to be in poor range condition were selected. These sites were usually represented by open grasslands on south-facing slopes, benchlands and terraces. The reference sites were not located near salt or within 100-ft. (30-m) of a fence. The preferred distance from a water source was greater than 1000-ft. (300-m) but less than 1-mi. (1.6-km).

Each reference site consisted of a fenced exclosure and a 100-ft (33-m) transect inside and outside the exclosure. The outside transect was situated 25-ft (8-m) or greater from the edge of the exclosure. At 3-in. (7-cm) intervals, the basal frequency of the plant species were recorded using Parker's loop (Parker 1954). In 1982, the canopy cover of the plant species was also recorded (at 6-ft. (2-m) intervals) using a 20x50 cm Daubenmire frame. Presently, the transects are being recorded every three years. All the basal frequency data prior to 1982 was converted to canopy cover using regression analysis. The regression equation for the McCue Creek reference area is (COVER)=1.1+1.2(FREQ), R^2=59, p>.0001. The equation for the Yara Creek reference area is (COVER)=1.63+1.2(FREQ), R^2=41, p>.0001 and the equation for the Upper James River reference area is (COVER)=1.2+1.2(FREQ), R^2=52, p>.0001.

The McCue Creek reference area is located in the McCue Creek allotment, the Yara Creek reference area is located in the Upper Red Deer allotment and the Upper James reference area is located in the Upper James allotment. The McCue Creek exclosure was opened to grazing by livestock in the summers of 1998 and 1999 in an effort to reduce the litter build up and try and increase species diversity on the transect.

A combination of of both ordination (DECORANA) (Gauch 1982) and cluster analysis (SAS) were used to group the inside and outside transects of different years for each reference area. These techniques combined the sites based on the similarity of species composition. The groupings from cluster analysis were overlain on the site ordination. The number refers to the year the transect was recorded, the (i) refers to inside (ungrazed), the (o) to the outside (grazed).

Mean grazing pressure for each year was assessed by comparing annual utilization to the rated carrying capacity of the lease. Total yearly AUM (Animal Unit Months) useage from the inception of the lease was divided by the calculated carrying capacity (AUM) and multiplied by 100. For example a number of 100 would indicate proper utilization.

Species diversity was assessed using the Shannon-Wiener index of diversity (Krebs 1978).

RESULTS

Historic grazing pressure

Range use for the McCue Creek, Upper Red Deer, and Upper James allotments is

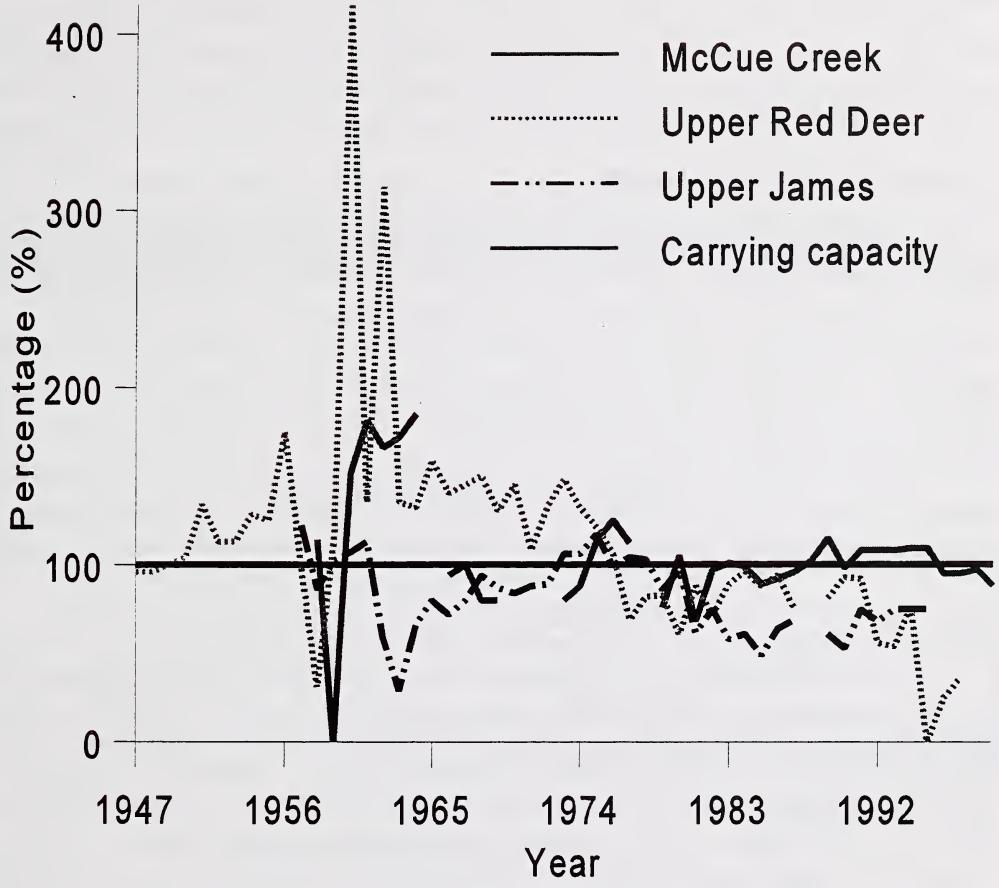

Figure 1. Percentage use of calculated carrying capacity for the McCue Creek, Upper Red Deer and Upper James allotment.

outlined in Figure 1. Range use on the Upper Red Deer (Yara Creek) allotment was the highest averaging over 139% of calculated carrying capacity from 1947 to 1976. Since 1976 use has been light averaging below carrying capacity at 70%. The McCue Creek allotment also had very heavy grazing pressure from 1958 to 1964 averaging over 138% of calculated carrying capacity. However, since 1964 use has only been moderate averaging 97% of carrying capacity. The Upper James allotment has only been lightly to moderately used since 1957 averaging 81% of calculated carrying capacity. Generally these allotments have historically been used for grazing cows and calves and the grazing season has been from the middle of June to the end of October.

Vegetation changes

McCue Creek Reference Area

The ordination of the McCue Rangeland Reference Area with years grouped by cluster analysis is outlined in Figure 2. The first two axes in the ordination accounted for 37% and 11%

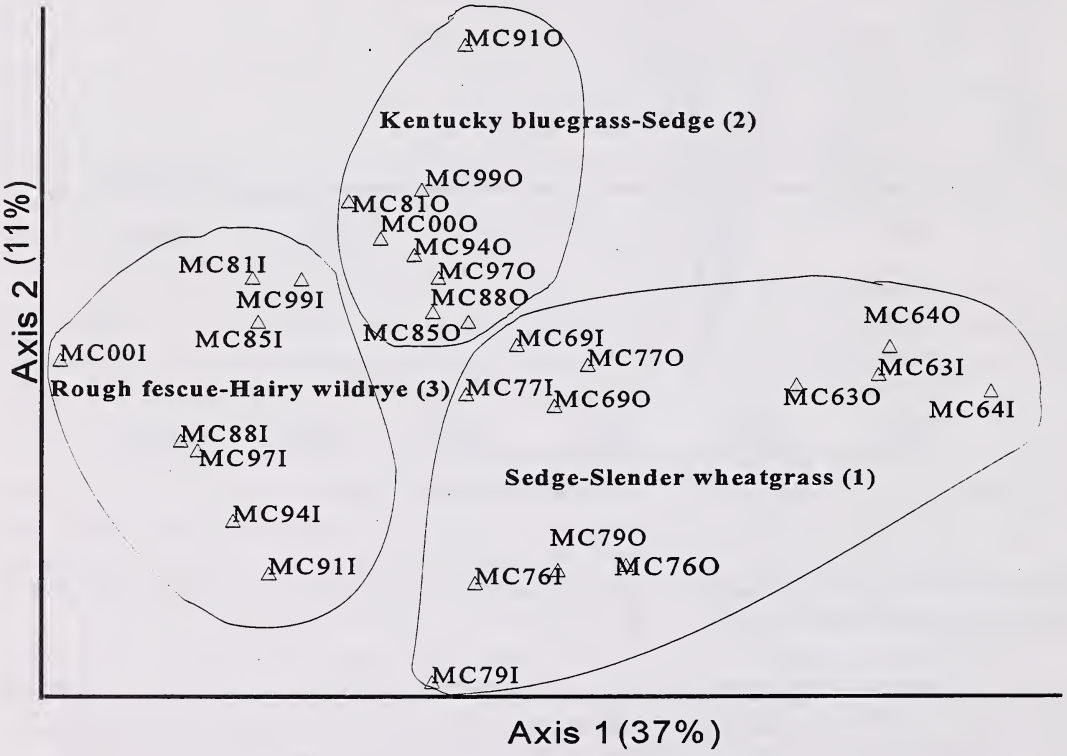

Figure 2. Ordination and cluster analysis of the inside (i) and outside (o) transects at the McCue Creek Rangeland reference area from 1963 to 2000.

of the variation in the species stand table, respectively. There is a distinct grouping of the inside and outside transects from 1963 to 1979 (Group 1), the outside transects from 1981 to 2000 (Group 2) and the inside transects from 1981 to 2000 (Group 3).

The inside transects in 1981,1985,1999 and 2000 grouped very closely with the outside transects from 1981 to 2000 likely because of the low cover of rough fescue. The drought conditions in the 1980's and the grazing treatment applied to the inside of the exclosure in 1998 and 1999 severely reduced the cover of rough fescue. However, these sites were stilled grouped in group 3 because the cover of rough fescue was still higher than any of the other transects in the other groups.

The low cover of Kentucky bluegrass and the high cover of sedge species made the 1985 and 1988 outside transects very similar to the ungrazed and grazed transects from 1963 to 1979 (Group 1), but the cluster analysis indicated these transects were mathematically more similar to the transects in Group 2.

Grazing pressure prior to the establishment of the exclosure in 1963 caused rough fescue cover to decline and allowed sedge, slender wheatgrass and old man's whiskers to increase in cover to form the Sedge-Slender wheatgrass dominated community type (Table 1). This plant community continued to dominate the site on both the inside and outside transects until 1979 (Group 1). However, after seventeen years (1981) of protection from grazing rough fescue cover had increased and the community had succeeded back to a Rough fescue-Hairy wildrye[1] dominated community type (Group 3). In contrast, the continued grazing pressure outside the exclosure favoured the growth of grazing resistant species Kentucky bluegrass and dandelion to form a Kentucky bluegrass-Sedge dominated community type (Group 2).

Table 2 outlines the change in canopy cover of the dominant species on the inside and outside transects from 1963 to 2000. In 1963 when the exclosure was established the transects were dominated by sedge, Idaho fescue, slender wheatgrass both inside and outside the exclosure. Kentucky bluegrass was present on both transects, but did not dominate the site. Protection from grazing allowed rough fescue to recover and it continued to dominate the inside ungrazed transect until 1998 (Appendix 1) when the exclosure was again opened for grazing. The grazing pressure in 1998 and 1999 caused rough fescue cover to decline and allowed other species like old man's whiskers, yarrow, graceful cinquefoil, sedge, fringed brome and slender wheatgrass to increase. Species diversity and richness increased from an average of 2.0 and 25 in 1991,1994 and 1997 to an average of 3.1 and 32 in 1999 and 2000, respectively.

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[1]Note hairy wildrye at this site has characteristics of both slender wheatgrass and hairy wildrye. Packer J.G. has recognized a hybrid of *Agropryon trachycaulumXElymus innovatus* as *Agroelymus hirtiflorus* in the Upper Foothills subregion (Moss 1994). The hairy wildrye identified here is likely a cross between these two species.

Table 1. Canopy cover (%) of the dominant species for Groups 1,2 and 3 as outlined in Figure 2 at the McCue Creek Rangeland Reference area.

Species	In&Out(1) 1960s-70s	Out(2) 1980&90s	In(3) 1980&90s
Shrubs			
SHRUBBY CINQUEFOIL (*Potentilla fruticosa*)	2	3	2
Forbs			
DANDELION (*Taraxacum officinale*)	3	15	1
NORTHERN BEDSTRAW (*Galium boreale*)	3	2	2
OLD MAN'S WHISKERS (*Geum triflorum*)	9	22	18
YARROW (*Achillea millefolium*)	2	7	4
GRACEFUL CINQUEFOIL (*Potentilla gracilis*)	2	6	3
VEINY MEADOW RUE (*Thalictrum venulosum*)	1	5	2
TALL LARKSPUR (*Delphinium glaucum*)	1	2	5
Grasses			
IDAHO FESCUE (*Festuca idhaoensis*)	6	1	T
SEDGE SPP (*Carex obtusata, C.siccata, C.praegracilis*)	17	18	14
KENTUCKY BLUEGRASS (*Poa pratensis*)	5	17	1
SLENDER WHEATGRASS (*Agropyron trachycaulum*)	10	5	9
ROUGH FESCUE (*Festuca scabrella*)	5	4	21
FRINGED BROME (*Bromus ciliatus*)	1	1	3
JUNEGRASS (*Koeleria macrantha*)	3	1	2
SPECIES RICHNESS	44	64	51

Table 2. Change in canopy cover (%) of selected species on the grazed (Out) and ungrazed (In) transects from 1963 to 2000 at the McCue Creek rangeland reference area.

	In					Out				
Species	1963	1979	1988	1999	2000	1963	1979	1988	1999	2000
Shrubs										
SHRUBBY CINQUEFOIL	1	1	1	3	1	1	-	3	2	3
Forbs										
DANDELION	2	1	1	1	2	4	3	16	13	13
NORTHERN BEDSTRAW	2	2	2	1	4	2	5	2	1	2
OLD MAN'S WHISKERS	3	8	34	10	22	5	14	40	18	16
YARROW	1	1	5	4	9	1	2	7	5	7
GRACEFUL CINQUEFOIL	1	-	5	1	8	3	2	5	6	7
VEINY MEADOW RUE	-	1	2	1	2	-	2	3	9	5
TALL LARKSPUR	-	1	8	5	10	-	1	1	4	1
Grasses										
IDAHO FESCUE	15	-	-	-	-	10	1	2	1	-
SEDGE SPP	12	31	16	19	32	11	29	29	23	21
KENTUCKY BLUEGRASS	5	-	-	-	-	7	4	10	14	31
SLENDER WHEATGRASS	9	8	1	10	18	6	5	1	10	9
ROUGH FESCUE	2	9	37	7	9	2	4	7	1	1
FRINGED BROME	-	-	3	-	13	-	-	2	-	2
JUNEGRASS	-	12	1	3	7	1	8	3	1	3
Species richness	**18**	**22**	**28**	**29**	**34**	**22**	**25**	**36**	**35**	**37**

Yara Creek Reference Area

The ordination of the Yara Rangeland Reference Area with years grouped by cluster analysis is outlined in Figure 3. The first two axes in the ordination accounted for 39% and 7%

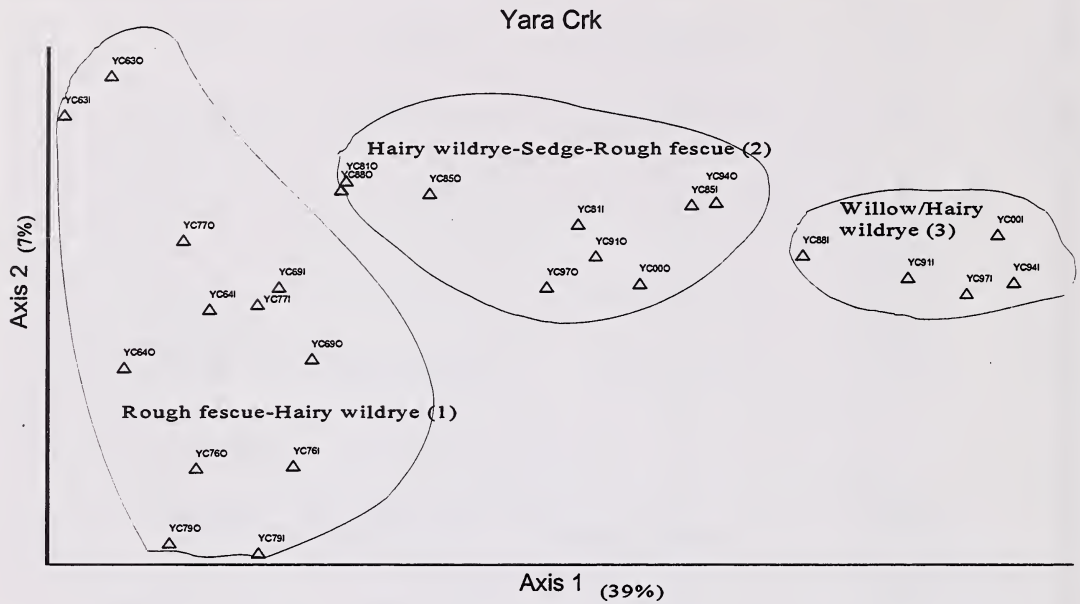

Figure 3. Ordination and cluster analysis of the inside (i) and outside (o) transects at the Yara Creek Rangeland Reference Area from 1963 to 2000.

of the variation in the species stand table, respectively. There is a distinct grouping of the inside and outside transects from 1963 to 1979 (Group 1), the inside transects in 1981 and 1985 and the outside transects from 1981 to 2000 (Group 2) and the inside transects from 1988 to 2000 (Group 3). The canopy cover of the dominant plant species within each group of the ordination is outlined in Table 3. When the site was established in 1963 it was dominated by rough fescue, hairy wildrye and sedge species. The inside and outside transects continued to be dominated by these species until 1979 and formed the Rough fescue-Hairy wildrye[2] community type (Group 1)(Figure 3).

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[2]Note hairy wildrye at this site has characteristics of both slender wheatgrass and hairy wildrye. Packer J.G. has recognized a hybrid of *Agropryon trachycaulumXElymus innovatus* as *Agroelymus hirtiflorus* in the Upper Foothills subregion (Moss 1994). The hairy wildrye identified here is likely a cross between these two species.

Table 3. Canopy cover (%) of the dominant species for Groups 1,2 and 3 as outlined in Figure 3 at the Yara Creek Rangeland Reference area.

Species	In&Out(1) 1960s-70s	In 1980's(2) Out 80-90s	In(3) 1990s
Shrubs			
SHRUBBY CINQUEFOIL (*Potentilla fruticosa*)	3	4	7
BEBB'S WILLOW (*Salix bebbiana*)	-	T	10
Forbs			
DANDELION (*Taraxacum officinale*)	1	5	1
FIREWEED (*Epilobium angustifolium*)	1	8	20
OLD MAN'S WHISKERS (*Geum triflorum*)	7	13	4
STAR FLOWERED SOLOMON SEAL (*Achillea millefolium*)	-	5	23
GRACEFUL CINQUEFOIL (*Potentilla gracilis*)	3	4	1
STRAWBERRY (*Fragaria virginiana*)	3	7	-
SMOOTH ASTER (*Aster laevis*)	2	2	2
Grasses			
HAIRY WILDRYE (*Elymus innovatus*)	1	9	17
SEDGE SPP (*Carex obtusata, C. prairea*)	13	9	5
KENTUCKY BLUEGRASS (*Poa pratensis*)	3	3	2
SLENDER WHEATGRASS (*Agropyron trachycaulum*)	13	4	2
ROUGH FESCUE (*Festuca scabrella*)	13	8	10
FRINGED BROME (*Bromus ciliatus*)	1	2	6
JUNEGRASS (*Koeleria macrantha*)	2	1	-
SPECIES RICHNESS	47	65	40

After 1979 there was a shift away from a rough fescue dominated community to a community that was dominated by hairy wildrye, sedge, old man's whiskers and rough fescue on both the inside (ungrazed 1981,1985) and outside (grazed) transects to form a Sedge-Hairy wildrye-Rough fescue dominated community type (Group 2)(Figure 3). However, since 1985 the inside ungrazed transect has been invaded by willow to form the Willow/Hairy wildrye-Rough fescue dominated community (Group 3)(Figure 3).

Table 4 outlines the change in canopy cover of the dominant species on the inside and outside transects from 1963 to 2000. In 1963 when the exclosure was established the transects were dominated by rough fescue, sedge and slender wheatgrass both inside and outside the exclosure. In the absence of disturbance (grazing and fire) there has been an invasion of willow and a shift in understory species from a site that was dominated by grass species in the 1960's and 70's to a site that has become dominated by forbs (fireweed, star flowered solomon seal). Slender wheatgrass and hairy wildrye continue to dominate the grass layer on the inside transect, but there has been a drop in sedge and rough fescue cover.

In contrast on the grazed outside transect there has also been a drop in rough fescue cover and an increase in the cover of hairy wildrye. There has only been a slight increase in the cover of willow, fireweed and star flowered solomon seal. It is interesting to note that old man's whiskers has declined in cover from a high of 27% in 1988 to 11% in 2000 and during this time period there has been a large increase in the cover of fireweed and star-flowered solomon seal. There has also been an increase in grazing resistant species of dandelion and Kentucky bluegrass on the grazed outside transect (Table 4).

Table 4. Change in canopy cover (%) of selected species on the grazed (Out) and ungrazed (In) transects from 1963 to 2000 at the Yara Creek rangeland reference area.

	In					Out				
Species	1963	1979	1988	1994	2000	1963	1979	1988	1994	2000
Shrubs										
SHRUBBY CINQUEFOIL	-	3	11	2	12	2	3	4	2	10
BEBB'S WILLOW	-	-	3	13	8	-	-	-	1	1
Forbs										
DANDELION	-	-	1	1	1	-	2	1	13	10
FIREWEED	-	2	29	15	12	-	-	4	6	4
OLD MAN'S WHISKERS	4	6	8	2	1	7	9	27	15	11
STAR FLOWERED SOLOMON SEAL	-	4	14	29	23	-	2	1	6	9
GRACEFUL CINQUEFOIL	4	3	2	1	1	2	3	6	3	3
STRAWBERRY	-	2	3	1	-	2	7	11	7	3
SMOOTH ASTER	-	-	3	2	-	1	4	2	3	1
Grasses										
HAIRY WILDRYE	3	-	17	17	24	5	-	4	14	20
SEDGE SPP	10	11	6	5	5	9	24	18	13	10
KENTUCKY BLUEGRASS	2	-	1	-	-	3	2	2	4	4
SLENDER WHEATGRASS	7	14	1	2	1	3	11	4	2	2
ROUGH FESCUE	25	17	15	10	6	6	15	6	6	6
FRINGED BROME	3	-	1	9	10	-	-	1	8	1
JUNEGRASS	2	7	-	-	-	1	6	4	-	1
Species richness	**20**	**19**	**25**	**26**	**31**	**21**	**25**	**33**	**35**	**29**

Upper James River Reference Area

The ordination of the Upper James Rangeland Reference Area with years grouped by cluster analysis is outlined in Figure 4. The first two axes in the ordination accounted for 34% and 15% of the variation in the species stand table, respectively. There is a distinct grouping of the inside and outside transects from 1963 to 1979 (Group 1), the inside transects in 1981 to 2000 (Group 3) and the outside transects from 1981 to 2000 (Group 2).

The canopy cover of the dominant plant species within each group of the ordination is outlined in Table 5. When the site was established in 1963 it was dominated by slender wheatgrass[3], sedge, rough fescue and hairy wildrye species. The inside and outside transects continued to be dominated by these species until 1979 and formed the Hairy wildrye-Sedge-Rough fescue community type (Group 1)(Figure 4). After 1979 on the ungrazed inside transects there was a shift away from a hairy wildrye dominated community to a community that was dominated by rough fescue to form a Rough fescue-Hairy wildrye dominated community type (Group 3)(Figure 4). In contrast on the grazed outside transect rough fescue cover has continued to decline and there has been an increase in grazing resistant species (Kentucky bluegrass and dandelion) to form the Kentucky bluegrass-Sedge-Hairy wildrye dominated community type (Group 2).

Table 4 outlines the change in canopy cover of the dominant species on the inside and outside transects from 1963 to 2000. In 1963 when the exclosure was established the inside and outside transects were dominated by sedge, rough fescue, slender wheatgrass and hairy wildrye. Protection from grazing allowed rough fescue to recover and after 18 years of protection from livestock grazing the site was again dominated by rough fescue. During this time there was a corresponding drop in sedge cover and an increase in the cover of the hairy wildrye and slender wheatgrass hybrid.

In contrast on the grazed outside transect rough fescue cover continued to decline from 1963 and there was a corresponding increase in grazing resistant species of Kentucky bluegrass, dandelion, graceful cinquefoil and yarrow. Sedge and hairy wildrye cover continues to remain high on the grazed outside transect. Since 1988 Kentucky bluegrass cover appears to be declining and there has been a slight increase in cover of sedge and hairy wildrye. This may indicate the grazed transect is undergoing succession back to a community dominated by native species. Hopefully, future data collection will confirm these results.

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[3]Note hairy wildrye at this site has characteristics of both slender wheatgrass and hairy wildrye. Packer J.G. has recognized a hybrid of *Agropryon trachycaulumXElymus innovatus* as *Agroelymus hirtiflorus* in the Upper Foothills subregion (Moss 1994). The hairy wildrye identified here is likely a cross between these two species.

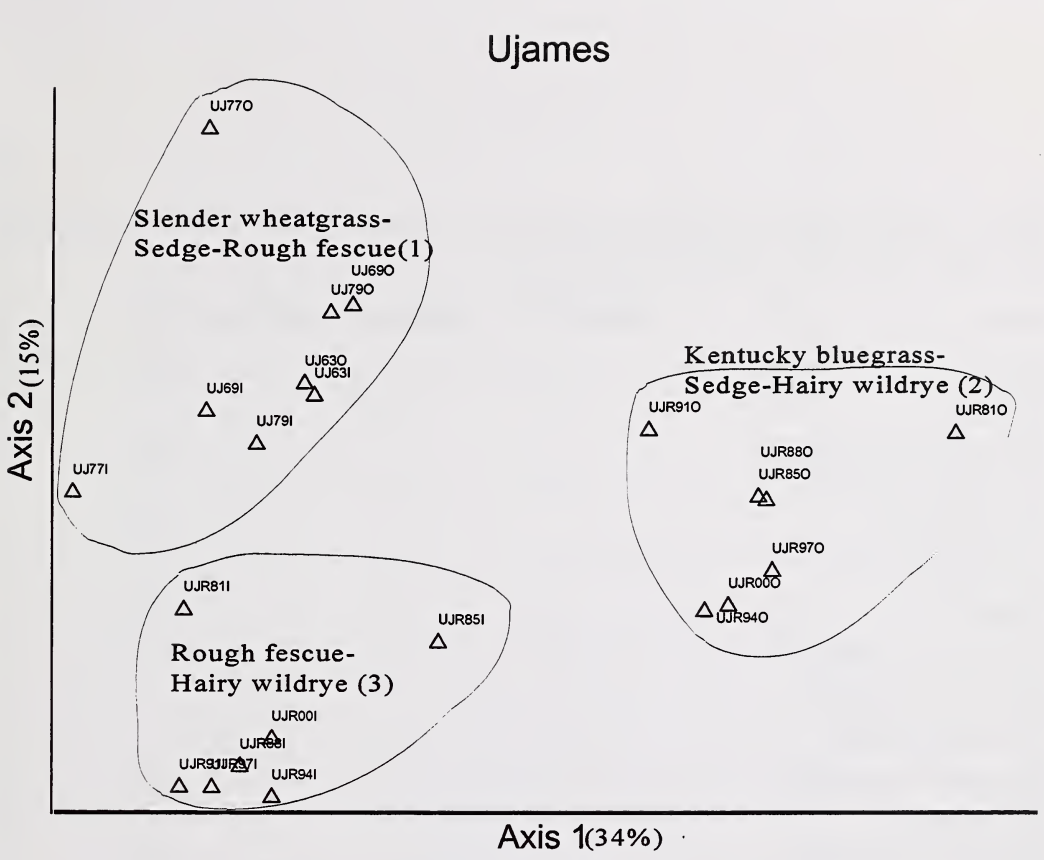

Figure 4. Ordination and cluster analysis of the inside (i) and outside (o) transects at the Upper James River Rangeland Reference Area from 1963 to 2000

Table 5. Canopy cover (%) of the dominant species for Groups 1,2 and 3 as outlined in Figure 4 at the Upper James River Rangeland Reference area.

Species	In&Out(1) 1960s-70s	Out(2) 1980&90s	In(3) 1980&90s
Forbs			
DANDELION (*Taraxacum officinale*)	1	23	1
NORTHERN BEDSTRAW (*Galium boreale*)	3	2	5
OLD MAN'S WHISKERS (*Geum triflorum*)	5	1	3
YARROW (*Achillea millefolium*)	3	6	4
GRACEFUL CINQUEFOIL (*Potentilla gracilis*)	3	14	4
VEINY MEADOW RUE (*Thalictrum venulosum*)	1	6	4
TALL LARKSPUR (*Delphinium glaucum*)	-	T	3
Grasses			
HAIRY WILDRYE (*Elymus innovatus*)	1	9	9
SEDGE SPP (*Carex obtusata, C.atrosquama, C.praegracilis*)	12	13	6
KENTUCKY BLUEGRASS (*Poa pratensis*)	5	17	1
SLENDER WHEATGRASS (*Agropyron trachycaulum*)	14	6	7
ROUGH FESCUE (*Festuca scabrella*)	11	1	28
FRINGED BROME (*Bromus ciliatus*)	1	1	2
JUNEGRASS (*Koeleria macrantha*)	2	1	1
SPECIES RICHNESS	39	62	58

Table 6. Change in canopy cover (%) of selected species on the grazed (Out) and ungrazed (In) transects from 1963 to 2000 at the Upper James River rangeland reference area.

	In					Out				
Species	1963	1979	1988	1994	2000	1963	1979	1988	1994	2000
Forbs										
DANDELION	1	1	2	1	1	1	1	38	13	21
NORTHERN BEDSTRAW	2	3	5	5	3	2	3	2	1	1
OLD MAN'S WHISKERS	1	3	7	3	3	1	3	1	1	4
YARROW	2	2	3	6	4	1	2	5	4	8
GRACEFUL CINQUEFOIL	3	2	9	1	2	1	2	32	6	4
VEINY MEADOW RUE	-	3	7	3	2	-	3	11	5	5
TALL LARKSPUR	-	-	4	2	5	-	-	2	-	-
Grasses										
HAIRY WILDRYE	1	-	14	12	11	2	-	13	10	14
SEDGE SPP	18	7	4	2	6	13	19	19	12	16
KENTUCKY BLUEGRASS	4	1	1	1	2	3	10	19	12	8
SLENDER WHEATGRASS	5	16	2	3	4	2	23	2	5	2
ROUGH FESCUE	7	15	42	22	20	6	4	1	1	-
FRINGED BROME	-	-	-	4	8	-	-	-	5	1
JUNEGRASS	2	2	-	4	8	1	3	2	5	2
Species richness	**21**	**26**	**33**	**26**	**27**	**21**	**26**	**33**	**30**	**24**

DISCUSSION

Community ecology

Both the Upper James and McCue Creek Reference Areas have been represented by 3 community types since they were established in 1963 (Figure 2 and 4). When these sites were first established the inside and outside transects were represented by a Sedge-Slender wheatgrass dominated community type. After 20 years of protection from grazing both sites succeeded to a rough fescue dominated community type. Moss and Campbell (1947), Looman (1969) and Willoughby (1992) found that rough fescue grows almost to the exclusion of other plants in the absence of disturbance. Looman (1969) also found that rough fescue declined and sedge increased with increased grazing pressure indicating that the Sedge-Slender wheatgrass community type which dominated the two sites in 1963, to be a grazing disclimax community.

In contrast the grazing pressure at the Yara Creek exclosure prior to the establishment of the exclosure does not appear to have been as heavy as the Upper James and McCue Creek sites. When the exclosure was established in 1963 the site was dominated by rough fescue indicating lighter grazing pressure which favored rough fescue growth. However, continued protection from grazing at the Yara Creek site has allowed willows to invade and there has been a shift in dominance of the understory from grasses to forbs (Plate 2). In the absence of grazing trees have also started to invade the inside ungrazed transect at the Upper James site (Plate 3). Indeed, Looman (1969) felt that the hairy wildrye subassociation of the rough fescue grasslands formed a preclimax to coniferous forest. It would appear that if left undisturbed these rough fescue, hairy wildrye dominated grasslands will eventually become dominated by coniferous forest.

Continued heavy grazing pressure at the McCue Creek and Upper James reference areas from 1963 to 1981, has allowed Kentucky bluegrass to become dominant on the outside grazed transects to form a Kentucky bluegrass-Sedge dominated community type. Moss and Campbell (1947), Looman (1969) and Willms et al. (1985), all found that long-term heavy grazing pressure leads to a decline in rough fescue and an increase in Kentucky bluegrass. Grazing pressure at the Yara Creek site has caused rough fescue cover to decline and allowed sedge and hairy wildrye to increase. The outside grazed transect at Yara Creek is now very similar to the 1963 transects at the McCue Creek and Upper James sites.

The successional sequences for the Rough fescue-Hairy wildrye dominated community type in the Upper Foothills subregion is outlined in Figure 5. Protection on the Sedge-Hairy wildrye-Rough fescue community type in 1963 allowed rough fescue to recover, to form the Rough fescue-Hairy wildrye dominated community type after 20 years. However, continued protection from grazing and lack of fire allows these rough fescue dominated grasslands to be invaded by willow on the moister sites, and eventually conifer forests. Continued grazing pressure leads to the further decline in native species and there is an increase in Kentucky bluegrass. In southern Alberta Willoughby and Alexander (2000) have found that rough fescue cover can recover in these Kentucky bluegrass dominated communities. It is likely that protection from grazing on the Kentucky bluegrass-Sedge dominated community type may

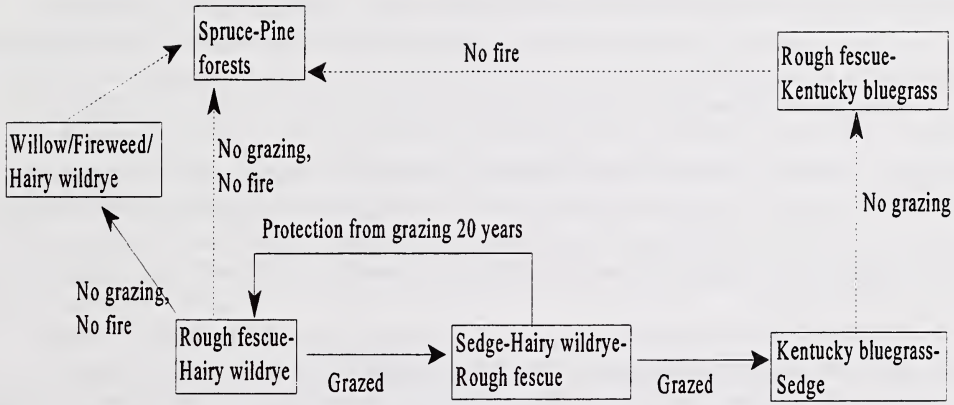

Figure 5. Successional changes in the presence and absence of grazing and fire disturbance for the Rough fescue - Hairy wildrye dominated community type in the Upper Foothills subregion.

eventually lead to a Rough fescue-Kentucky bluegrass dominated community. In the absence of disturbance these community types will likely succeed to conifer forest.

Range condition

Traditionally, range condition has been defined by comparing species present with species of the climax community (Dyksterhuis 1949, Wroe et al. 1988). This climax range

condition model suggests that vegetation will be directional, predictable and revert back to the original rough fescue dominated predisturbance plant community in time. It would appear that this model of rangeland succession would appropriately describe the successional changes at the McCue Creek, Upper James River and Yara Creek rangeland reference areas up to the point in time before Kentucky bluegrass, willow or conifer trees invade the site. Heavy grazing pressure caused rough fescue to decline and allowed sedge, slender wheatgrass and hairy wildrye to increase in cover. Protection from grazing pressure allowed the plant community to succeed back to a rough fescue dominated community type. However, continued protection from disturbance (grazing, fire) allows these rough fescue dominated communities to succeed to willow on moister sites and eventually to conifer forest. It would appear that the climax community in the absence of disturbance on these sites will be a forested community type.

In contrast, continued grazing pressure has kept shrub and tree invasion to a minimum, but it has allowed Kentucky bluegrass to invade onto the grazed outside transect at the McCue and Upper James sites. Willoughby and Alexander (2000), have found in Southern Alberta that once Kentucky bluegrass invades the community the traditional range condition model does not apply and the vegetation dynamics closely follow the state and threshold model. This model implies that the grassland species composition moves to the point of stabilization with plant species that have invaded rather than succeed back to the original vegetation. It appears once Kentucky bluegrass becomes established it continues to remain co-dominant with rough fescue in the absence of disturbance.

These problems with the climax range condition model have led the range scientific community to define rangeland health on a broader list of functions, not just plant species integrity (Alberta Rangeland Health Task Group 1999). The term Proper Functioning Condition (PFC) is now applied to rangeland health. New rangeland health protocols have been developed for Alberta rangelands which include measures of plant community integrity, site stability, hydrologic function, nutrient cycling and energy flow, community structure and noxious weeds (Adams et al 2000). Ratings are based on a percentage of possible scores for each category. The total possible score is 60 and rangelands are rated as Healthy=75-100%, Healthy with problems=50-75% and Unhealthy<50%. The health rating for the McCue Creek rangeland reference area is 100% for the inside transect and 60% for the outside grazed transect. The rating for the Upper James rangeland reference area is 83% for the inside ungrazed transect and 72% for the grazed outside transect.

Clearly, the desired plant community of the vegetation has to be defined before a range health score can be determined for the ungrazed transect at the Yara Creek reference area. If the primary resource of the vegetation is for wildlife and livestock production, then continued grazing by wildlife and livestock and periodic burning are required to maintain the most productive community. If there is some other resource that is valued that requires succession to a willow dominated shrubland or conifer forest then this site should be left undisturbed. Historically, these grassland communities in the foothills of West-Central Alberta have been burned and grazed by wild and domestic ungulates. Currently, the resource value for these rangelands is recreation, wildlife and livestock production. Once society decides upon the desired community range health ratings can then be determined.

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APPENDIX ONE

SOILS AND PHYSIOGRAPHIC FEATURES FOR EACH RANGELAND REFERENCE AREA

McCue Creek Rangeland Reference Area

Soil classification:	Orthic Eutric Brunisol
Parent Material:	Silt loamy fluvial material
Landform:	Fluvial terrace
Topography:	Nearly level (2% slope)
Drainage:	Well to Moderately well
Elevation:	1470 m
Aspect:	Southwest (112°)

SOIL PROFILE DESCRIPTION

0	4-0 cm. Very dark brown (10YR2/2, moist) organic mat consisting of slightly to moderately decomposed leaves, grasses, and roots. 3.0-5.0 cm thick.
Ah	0-3.0cm. Very dark brown (10YR2/2, moist) silt loam. Moderate medium granular, friable, non-sticky, slightly plastic, abundant fine oblique inped and exped roots, clear wavy boundary, neutral, 2-8cm thick.
Bm	3-9cm. Dark brown. (7.5YR3/2, moist) silt loam, strong medium platy, plentiful fine oblique inped and exped roots, gradual wavy boundary, moderately alkaline, 3-9 cm thick.
Ck1	9-24 cm. Dark brown, (10YR3/3, moist) silt loam, with pockets of sandy material, friable, non-sticky, slightly plastic, plentiful fine oblique roots, clear smooth boundary, strongly effervescent.
Ahb	24-26 cm. Ver dark greyish brown (10YR3/2,moist) silt loam, moderate fine subangular blocky, firm non-sticky, slightly plastic, clear broken boundary.
C	26-30 cm. Brown to dark brown. (10YR4/3) sandy loam, weak fine platy, friable, non-sticky, non-plastic, plentiful fine oblique inped and exped roots, clear wavy boundary. strongly effervescent.
Ck2	30-41 cm. Dark greyish brown. (10YR4/2) sand, single grained, firm, non-sticky, non-plastic, plentiful fine oblique roots, clear wavy boundary, strongly effervescent.
Ck3	41-70 cm. Dark greyish brown. (10YR4/2) loam, weak medium subangular block, firm, slightly sticky, slightly plastic, plentiful fine oblique roots, clear wavy boundary, strongly effervescent.

Yara Creek Rangeland Reference Area

Soil classification:	Orthic Humic Regosol
Parent Material:	Colluvium
Landform:	Colluvial apron
Topography:	Strongly sloping (22%)
Drainage:	Well drained
Elevation:	1500 m
Aspect:	Southwest (220°)

SOIL PROFILE DESCRIPTION

FH	5-0 cm. Very dark brown (10YR2/2, moist) organic mat consisting of slightly to moderately decomposed leaves, grasses, and roots. 3-6 cm thick.
Ah	0-10 cm. Black (10YR2/1, moist) loam, 5% shaly fragments, moderate fine granular, friable, slightly sticky, slightly plastic, abundant fine oblique roots, clear wavy boundary, medium acid, 9-12 cm thick.
C1	10-25 cm. Very dark greyish brown (10YR3/2) clay loam, 15% angular gravelly fragments, weak coarse granular, friable, sticky, plastic, abundant fine and very fine oblique exped roots, clear wavy boundary, neutral. 12-18 cm thick.
C2	25-50 cm. Very dark greyish brown (10YR3/2) clay loam, 20% angular gravelly slaty fragments, moderate medium granular, abundant fine oblique inped roots, friable, sticky, plastic, clear wavy boundary, strongly acid. 25 cm thick.
C3	50-62 cm. Dark brown (7.5YR3/2, moist) clay loam, 25% shaly fragments, weak to moderate medium granular, abundant fine oblique exped roots, firm sticky, plastic, clear wavy boundary, slightly acid. 9-14cm thick.
C4	62-70+ cm. dark brown (10YR3/3) clay, 50% shaly fragments, moderate fine subangular blocky, abundant fine oblique inped exped roots, very firm, sticky, plastic, slightly acid.

Upper James River Rangeland Reference Area

Soil classification:	Orthic Eutric Brunisol
Parent Material:	Aeolian over glaciofluvial
Landform:	Aeolian veneer over glaciofluvial blanket
Topography:	Gently slope (8%)
Drainage:	Well
Elevation:	1500 m
Aspect:	Southeast (150°)

SOIL PROFILE DESCRIPTION

FH	4-0 cm. Very dark brown organic mat consisting of slightly to moderately decomposed leaves, grasses, and roots, Rhizomull humus.
Ah	0-4 cm. Very dark brown (10YR2/2) silt loam, medium fine platy, friable non-sticky, plastic, abundant fine roots, clear smooth boundary , slightly acid, 3-6 cm thick.
Bm1	4-11 cm. Dark brown (7.5YR3/2, moist) silt loam, weak fine platy, friable, slightly sticky, plastic, plentiful fine oblique roots, clear wavy boundary, slightly acid, 6-10cm thick.
Ahb	11-15 cm. Dark brown (7.5YR3/2) silt loam, massive, friable, slightly sticky, plastic, plentiful fine oblique roots, clear wavy boundary, slightly acid, clear wavy boundary, 2-6 cm thick.
Bm2	15-28 cm. Dark reddish brown (5YR3/2) loamy sand with 70% gravelly cobbly and stony fragments, single-grained, loose, very friable, non-sticky, slightly plastic, plentiful fine oblique roots, clear wavy boundary, slightly acidic, 9-16 cm thick.
C1	28-70 cm. Dark brown (7.5YR3/2) sand with 70% gravel, cobbly and stony fragments, single grained, very friable, non-sticky, non-plastic, plentiful fine oblique roots, clear wavy boundary, slightly acidic, 42 cm thick.
C2	70+ cm. Dark greyish brown (10YR3/2) silty clay loam 10% gravelly fragments, single grained, massive, friable, sticky, plastic, plentiful fine oblique roots, clear wavy boundary, mildly alkaline.

APPENDIX TWO

SPECIES COMPOSITION OF THE INSIDE AND OUTSIDE CLUSTER GROUPS OUTLINED IN FIGURES 2, 3 AND 4

MCCUE CREEK RANGELAND REFERENCE AREA

Group name: McCue Group 1

			Avg	Avg	Plots																					
					MC63I		MC630		MC64I		MC640		MC69I		MC690		MC76I		MC760		MC77I		MC770		MC79I		MC790	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																								
5	1	POTEFRU	75.0	01.5	01		01				02		03		02		01				02		01		01			
	2	SALISPP	08.3	00.1																			01			
6	3	GEUMTRI	91.7	08.7	03		05		07		08		20				08		10		08		07		08		14	
	4	TARAOFF	91.7	03.1	02		04		04		06		05		02				02		01		03		01		03	
	5	ACHIMIL	91.7	02.3	01		01		01		01		03		01		01				04		02		04		02	
	6	VICIAME	83.3	03.0					16		04		01		02		01		01		02		02		01		01	
	7	GALIBOR	66.7	02.9	02		02						04		13						01		02		02		05	
	8	POTEGRA	66.7	02.0	01		03		01		03		07						02				01				02	
	9	THALVEN	66.7	01.4							02		02		01		01				02		01		01		02	
	10	OXYTMON	58.3	01.7			01		01		03								04		01		05				02	
	11	ASTELAE	50.0	01.7	02		07				01		04												01		03	
	12	ANTEPAR	41.7	03.9					19		21								01				02				02	
	13	ASTRALP	33.3	01.6	10		04						02												01			
	14	STELLON	33.3	00.8									01						02						02		02	
	15	CERAARV	25.0	00.6									01								02		04					
	16	AGOSGLA	25.0	00.6											01										02		02	
	17	GERAVIS	25.0	00.4									01						01						02			
	18	ZIZIAPT	25.0	00.4					01														01		02			
	19	VIOLADU	16.7	00.8																					06		03	
	20	SOLIMIS	16.7	00.5	04		01																					
	21	ARNIFUL	16.7	00.3	02		01																					
	22	DELPGLA	16.7	00.3													01				01							
	23	DODECON	16.7	00.3																					01		01	
	24	CAMPROT	16.7	00.3																	01		01					
	25	GEUMALE	16.7	00.3																	01		01					
	26	LINULEW	08.3	00.1																					01			
	27	PLANMAJ	08.3	00.1																							01	
	28	HEDYALP	08.3	00.1			01																					
	29	FRAGVIR	08.3	00.1					01																			
7	30	CAREOBT	0100	17.4	12		11		08		08		11		11		14		24		20		24		31		29	
	31	AGROTRA	0100	10.2	09		06		10		14		07		14		10		14		11		08		08		05	
	32	FESTSCA	0100	04.5	02		02		02		02		01		02		05		03		11		05		09		04	
	33	POA PRA	75.0	05.0	05		07		02		02				03				05		13		16				04	
	34	FESTIDA	50.0	05.6	15		10		25		12		01														01	
	35	KOELMAC	50.0	02.6			01										04		03		01				12		08	
	36	DANTPAR	50.0	01.3	03		02		01		01												02				03	
	37	DANTCAL	41.7	00.9	01		01										03		02								01	
	38	FESTSAX	33.3	00.8															02				03		01		01	
	39	MUHLRIC	16.7	00.5															02								03	
	40	BROMINE	16.7	00.5	02		03																					

(CONTINUED)

Group name: McCue Group 1

			Avg	Avg	Plots																					
					MC63I		MC630		MC64I		MC640		MC69I		MC690		MC76I		MC760		MC77I		MC770		MC79I		MC790	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																										
7	41	ELYMINN	08.3	00.1							01																	
	42	HIERODO	08.3	00.1													01											
	43	JUNCBAL	08.3	00.1																					01			
	44	DESCCES	08.3	00.1			01																					

Group name: McCue Group 2

			Avg	Avg	Plots															
					MC810		MC850		MC880		MC910		MC940		MC970		MC990		MC000	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																		
5	1	POTEFRU	87.5	02.5	02		01		03		03				03		02		03	
6	2	GALIBOR	0113	02.2	04		00		02		03		01		01		01		02	
	3	GEUMTRI	0100	21.7	28		13		40		18		19		19		18		16	
	4	TARAOFF	0100	14.5	19		03		16		27		15		07		13		13	
	5	ACHIMIL	0100	06.9	10		01		07		14		05		04		05		07	
	6	POTEGRA	0100	05.6	07		01		05		06		03		06		06		07	
	7	THALVEN	0100	04.8	06		00		03		03		03		06		09		05	
	8	AGOSGLA	0100	01.3	01		00		00		02		01		01		01		00	
	9	CERAARV	0100	00.8	00		00		00		00		01		00		00		02	
	10	DELPGLA	87.5	01.5	01		00		00		01				02		04		01	
	11	ZIZIAPT	87.5	00.6	01		00		00				00		00		00		01	
	12	CAMPROT	87.5	00.4	00		00		00				00		00		00		00	
	13	RUMEACE	87.5	00.4	00		00		00				00		00		00		00	
	14	ASTELAE	75.0	01.3			00		01		01		01		01		04			
	15	ASTRALP	75.0	01.1			00		00		04				00		01		00	
	16	TRIFREP	75.0	01.0			00		01				01		00		03		01	
	17	DODECON	62.5	01.3							01		02		03		02		02	
	18	VICIAME	62.5	00.7	03		00		01				00						00	
	19	STELLON	62.5	00.3							00		00		00		00		00	
	20	ANEMMUL	62.5	00.2			00		00		00						00		00	
	21	ANTEPAR	37.5	00.4			00		01		02									
	22	POTEDIV	37.5	00.3							00				00		01			
	23	FRAGVIR	37.5	00.1			00										00		01	
	24	SOLIMIS	37.5	00.1					00								00		00	
	25	GENTAMA	37.5	00.1					00		00								00	
	26	SONCARV	25.0	00.5			00		03											
	27	OXYTMON	25.0	00.3			01		01											
	28	HIERUMB	25.0	00.2											01				00	
	29	GERARIC	25.0	00.0	00								00							
	30	ASTECIL	12.5	00.4															02	
	31	ASTECON	12.5	00.3	02															
	32	SENEPAU	12.5	00.1	00															
	33	POLEPUL	12.5	00.1					00											
	34	HEDYALP	12.5	00.0							00									
	35	POTEHIP	12.5	00.0													00			
	36	ERIGPER	12.5	00.0					00											
	37	LATHOCH	12.5	00.0			00													
	38	LINULEW	12.5	00.0							00									
	39	VIOLADU	12.5	00.0					00											
	40	PENSPRO	12.5	00.0					00											

(CONTINUED)

Group name: McCue Group 2

			Avg	Avg	Plots													
					MC810		MC850		MC880		MC910		MC940		MC970		MC990		MC000	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																		
6	41	SISYMON	12.5	00.0									00							
7	42	POA PRA	0100	15.8	12		01		10		21		17		16		14		31	
	43	AGROTRA	0100	05.4	04		01		01		09		04		02		10		09	
	44	FESTSCA	0100	04.0	15		01		07		02		02		00		00		00	
	45	CAREOBT	87.5	14.4			07		29		04		21		21		17		14	
	46	BROMCIL	62.5	01.4			00		02				05		00				02	
	47	KOELMAC	62.5	01.1			00		03		00						01		03	
	48	JUNCBAL	50.0	00.4									00		00		00		02	
	49	FESTIDA	50.0	00.4			01		02				00				00			
	50	ELYMINN	50.0	00.2	00						00				00				00	
	51	POA ALP	37.5	00.2									00				01		00	
	52	CARESIC	25.0	02.3							12						06			
	53	MUHLRIC	25.0	00.1													00		00	
	54	AGROSCA	25.0	00.0			00		00											
	55	CAREPRE	12.5	00.9															07	
	56	POA COM	12.5	00.8									06							
	57	CAREPRA	12.5	00.4							03									
	58	FESTSAX	12.5	00.2															01	
	59	DANTCAL	12.5	00.1											00					
	60	BROMPUM	12.5	00.1													00			
	61	HELIHOO	12.5	00.1															00	
	62	HIERODO	12.5	00.0													00			
	63	CALARUB	12.5	00.0											00					
	64	DANTPAR	12.5	00.0					00											

Group name: McCue Group 3

			Avg	Avg	Plots													
					MC81I		MC85I		MC88I		MC91I		MC94I		MC97I		MC99I		MC00I	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																		
5	1	POTEFRU	0100	01.7	01		01		00		01		02		01		03		01	
6	2	GEUMTRI	0100	17.7	30		12		34		07		08		14		10		22	
	3	DELPGLA	0100	04.6	02		01		08		01		02		04		05		10	
	4	ACHIMIL	0100	04.3	07		02		05		02		02		01		04		09	
	5	GALIBOR	0100	02.1	04		01		02		01		00		00		01		04	
	6	THALVEN	0100	02.0	06		01		02		01		01		00		00		02	
	7	LINULEW	0100	01.4	00		02		00		00		04		01		00		01	
	8	VICIAME	0100	00.6	00		00		00		00		00		00		00		00	
	9	ZIZIAPT	0100	00.4	00		00		00		00		00		00		00		00	
	10	POTEGRA	87.5	03.1	05		02		05		00		01				01		08	
	11	TARAOFF	87.5	01.3	01		01		01				00		01		01		02	
	12	AGOSGLA	87.5	00.8	00				00		00		01		00		01		02	
	13	CERAARV	87.5	00.7			00		00		00		01		00		00		01	
	14	DODECON	75.0	00.3					00		00		00		00		00		00	
	15	CAMPROT	75.0	00.2			00		00				00		00		00		00	
	16	ASTELAE	62.5	00.6			00		00				00		01		01			
	17	RUMEACE	62.5	00.4					00				00		00		01		00	
	18	ASTRALP	62.5	00.4			00				00		00				00		01	
	19	VIOLADU	62.5	00.2			00		01		00				00				00	
	20	ANEMMUL	37.5	00.3	01		00		00											
	21	GENTAMA	37.5	00.2					00				00						01	
	22	FRAGVIR	37.5	00.1	00		00		00											
	23	STELLON	37.5	00.1									00		00		00			
	24	BOTRLUN	37.5	00.0											00		00		00	
	25	PENSPRO	25.0	00.1	00						00									
	26	ARABHIR	25.0	00.1													00		00	
	27	ASTECIL	12.5	00.5															03	
	28	HIERUMB	12.5	00.1															00	
	29	ASTECON	12.5	00.0	00															
	30	POLEPUL	12.5	00.0					00											
	31	RANUCAR	12.5	00.0									00							
	32	OXYTSPL	12.5	00.0															00	
	33	OXYTMON	12.5	00.0			00													
	34	PENSCON	12.5	00.0									00							
	35	POTEARG	12.5	00.0							00									
7	36	FESTSCA	0100	20.7	15		05		37		47		29		14		07		09	
	37	AGROTRA	0100	08.5	04		01		01		15		13		04		10		18	
	38	CAREOBT	87.5	08.6			02		16		18		09		06		10		05	
	39	BROMCIL	62.5	03.3					03		00		04		04				13	
	40	POA PRA	50.0	00.4	02		00						00		00					

(CONTINUED)

Group name: McCue Group 3

			Avg	Avg	Plots															
					MC81I		MC85I		MC88I		MC91I		MC94I		MC97I		MC99I		MC00I	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																		
7	41	KOELMAC	37.5	01.5					01								03		07	
	42	JUNCBAL	37.5	00.4					00								00		01	
	43	BROMPUM	25.0	00.8													04		01	
	44	FESTSAX	25.0	00.1									00		00					
	45	FESTIDA	25.0	00.0			00										00			
	46	CAREPRE	12.5	03.5															27	
	47	CARESIC	12.5	01.2													09			
	48	CAREFIL	12.5	00.3															02	
	49	BROMINE	12.5	00.1			01													
	50	ELYMINN	12.5	00.1							01									
	51	HELIHOO	12.5	00.0															00	

YARA CREEK RANGELAND REFERENCE AREA

Group name: Yara Crk Group 1

					Plots																					
			Avg	Avg	YC63I		YC630		YC64I		YC640		YC69I		YC690		YC76I		YC760		YC77I		YC770		YC79I		YC790	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																										
5	1	POTEFRU	91.7	02.5			02		02		02		02		03		02		02		02		02		03		03	
	2	ROSAACI	50.0	01.0	01				01						02		02				02				02			
6	3	GEUMTRI	0100	06.9	04		07		05		11		13		05		04		06		05		05		06		09	
	4	FRAGVIR	91.7	03.3			02		03		02		03		02		02		04		02		06		02		07	
	5	POTEGRA	75.0	02.6	04		02		04		03						02				03		02		03		03	
	6	GALIBOR	66.7	02.2	03		01		04		03		02		06						02		02					
	7	ACHIMIL	66.7	01.8			01						02		02		02				03		03		03		03	
	8	VICIAME	66.7	01.7	01		02		03		03		02								02		02		02			
	9	ANTEPAR	50.0	02.3					03		10		05						02				03				04	
	10	OXYTMON	50.0	01.6					04		04								02		02		03				02	
	11	THALVEN	50.0	01.4	01				04		03		02		02												02	
	12	ARTELUD	50.0	01.3					03		02		02				02				02		02					
	13	SMILSTE	50.0	01.3									02		02		02		02						04		02	
	14	ARTEFRI	50.0	01.1	02		01				01				02				02								02	
	15	ASTELAE	41.7	01.7			01		04		06		04														04	
	16	TARAOFF	41.7	01.2					04		03				02						02						02	
	17	AGOSGLA	33.3	00.8			01																02		02		03	
	18	ZIGAELE	33.3	00.8					02		02						02		02									
	19	EPILANG	33.3	00.8					02						02						02				02			
	20	ANEMMUL	25.0	00.7	03		03		02																			
	21	CAMPROT	25.0	00.7											02						02		03					
	22	ASTRALP	16.7	00.7	04		04																					
	23	STELLON	16.7	00.5																					02		03	
	24	SOLIMIS	16.7	00.4	03																		02					
	25	GERARIC	16.7	00.4																					02		02	
	26	ALLICER	16.7	00.3																					02		02	
	27	VIOLADU	16.7	00.3																					02		02	
	28	HEDYBOR	16.7	00.3	01				01																			
	29	DODECON	08.3	00.3																							03	
	30	CERAARV	08.3	00.2																			02					
	31	GEUMALE	08.3	00.2																	02							
	32	PLANMAJ	08.3	00.2																							02	
7	33	FESTSCA	0100	12.7	05		06		15		16		08		14		12		11		17		11		17		15	
	34	AGROTRA	0100	12.6	07		03		21		19		11		16		11		09		13		11		14		11	
	35	CAREOBT	0100	12.6	10		09		07		09		07		07		08		20		12		22		11		24	
	36	POA PRA	75.0	02.7	02		03						03		05		02		02		06		03				02	
	37	KOELMAC	66.7	02.4	02		01		02		03								03		02				07		06	
	38	DANTPAR	58.3	03.0	09		09		03		04		02								02		04					
	39	ELYMINN	41.7	01.3	03		05		02		01		02															
	40	DANTCAL	25.0	00.8													03		02								02	

(CONTINUED)

Group name: Yara Crk Group 1

			Avg	Avg	Plots																					
					YC63I		YC63O		YC64I		YC64O		YC69I		YC69O		YC76I		YC76O		YC77I		YC77O		YC79I		YC79O	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																										
7	41	STIPRIC	25.0	00.6	01		02																03					
	42	BROMCIL	25.0	00.6	03														02				02					
	43	HELIHOO	16.7	00.3													02		02									
	44	JUNCBAL	16.7	00.3													02								02			
	45	CALAPUR	08.3	00.2							02																	
	46	FESTIDA	08.3	00.2			02																					
	47	AGROSCA	08.3	00.2																	02							

RESOURCE INVENTORY, EDMONTON ALBERTA

Group name: Yara Crk Group 2

			Avg	Avg	Plots															
					YC81I		YC810		YC85I		YC850		YC880		YC910		YC940		YC970		YC000	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																				
5	1	POTEFRU	0100	04.1	05		05		01		01		04		01		02		03		10	
	2	SALIBEB	33.3	00.3													00		01		00	
	3	ROSAACI	11.1	00.1											01							
6	4	GEUMTRI	0100	13.2	12		14		04		06		27		14		15		11		11	
	5	EPILANG	0100	07.8	16		02		08		02		04		24		06		02		04	
	6	TARAOFF	0100	04.6	00		04		00		01		01		03		13		06		10	
	7	VICIAME	0100	04.1	09		16		01		01		00		00		01		02		02	
	8	POTEGRA	0100	04.1	04		08		01		01		06		03		03		05		03	
	9	ACHIMIL	0100	03.7	05		01		01		01		07		01		05		04		05	
	10	GALIBOR	0100	02.8	04		05		02		01		04		02		02		00		00	
	11	AGOSGLA	0100	01.9	00		03		00		00		01		03		01		03		02	
	12	CAMPROT	0100	01.1	00		00		00		00		01		00		01		03		01	
	13	FRAGVIR	88.9	06.5			18		01		04		11		09		07		02		03	
	14	SMILSTE	88.9	04.7	07		00		03				01		06		06		06		09	
	15	ASTELAE	88.9	01.5	01		02		01		01		02		00		03				01	
	16	THALVEN	88.9	01.0			01		00		00		01		02		00		02		01	
	17	LATHOCH	77.8	00.8			01				00		00		01		02		01		01	
	18	HEUCRIC	77.8	00.6			01		00		00		00				02		00		00	
	19	ALLICER	77.8	00.3	00		00		00		00		00						01		00	
	20	ASTRALP	55.6	01.3			03		00		00		06		00							
	21	DODECON	44.4	00.7											01		02		00		02	
	22	CERAARV	44.4	00.5							00		00				04		00			
	23	DELPGLA	44.4	00.5	02		00		02						00							
	24	ARTELUD	33.3	00.7	04				01						00							
	25	OXYTMON	33.3	00.5			02				01						00					
	26	ANEMMUL	22.2	00.2			01						00									
	27	ANTEPAR	22.2	00.1			00				00											
	28	GENTAMA	22.2	00.1									00		01							
	29	GAILARI	22.2	00.1									00								00	
	30	HEDYBOR	22.2	00.1			00						00									
	31	RANURHO	22.2	00.1															00		00	
	32	ARTEFRI	22.2	00.1	00														00			
	33	MYOSALP	22.2	00.1													00		00			
	34	OXYTSPL	22.2	00.1													00		00			
	35	ZIGAELE	11.1	00.6															05			
	36	CREPRUN	11.1	00.3													02					
	37	HIERUMB	11.1	00.3															02			
	38	PENSPRO	11.1	00.2											02							
	39	TRIFPRA	11.1	00.2													02					
	40	POTEDIV	11.1	00.1															01			

(CONTINUED)

Group name: Yara Crk Group 2

			Avg	Avg	Plots															
					YC81I		YC810		YC85I		YC85O		YC88O		YC91O		YC94O		YC97O		YC000	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																				
6	41	RANUCAR	11.1	00.1													00					
	42	SONCARV	11.1	00.1			00															
	43	ASTECIL	11.1	00.1															00			
	44	SOLIMUL	11.1	00.0															00			
	45	BOTRLUN	11.1	00.0															00			
	46	RUMEACE	11.1	00.0					00													
	47	ZIZIAPT	11.1	00.0			00															
7	48	FESTSCA	0100	08.4	12		19		01		02		06		11		06		09		06	
	49	AGROTRA	0100	04.1	08		10		01		01		04		04		02		03		02	
	50	BROMCIL	0100	02.1	00		01		01		00		00		01		08		05		00	
	51	CAREOBT	88.9	08.1	00				02		02		18		24		03		11		10	
	52	ELYMINN	77.8	08.5					02		04		04		17		14		14		20	
	53	POA PRA	66.7	02.5			01						02		05		04		04		04	
	54	KOELMAC	55.6	00.7	00				00				04						01		00	
	55	HIERODO	33.3	00.4									01		00		00					
	56	DANTCAL	22.2	00.4			00												03			
	57	DANTPAR	22.2	00.2									00						01			
	58	JUNCBAL	22.2	00.1					00								00					
	59	CAREPRA	11.1	01.2													10					
	60	STIPRIC	11.1	00.2									01									
	61	HELIHOO	11.1	00.1																	01	
	62	POA COM	11.1	00.1													01					
	63	POA INT	11.1	00.0											00							
	64	BROMPUM	11.1	00.0					00													
	65	PHLEPRA	11.1	00.0											00							

RESOURCE INVENTORY, EDMONTON ALBERTA

Group name: Yara Crk Group 3

			Avg	Avg	Plots									
					YC88I		YC91I		YC94I		YC97I		YC00I	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES												
5	1	SALIBEB	0100	10.1	03		13		13		11		08	
	2	POTEFRU	0100	07.2	11		04		02		05		12	
	3	ROSAACI	0100	01.6	00		00		01		02		03	
	4	RIBEAME	20.0	00.0									00	
6	5	VICIAME	0120	01.7	00		00		00		00		05	
	6	SMILSTE	0100	22.8	14		27		29		19		23	
	7	EPILANG	0100	20.2	29		30		15		14		12	
	8	GEUMTRI	0100	03.5	08		06		02		00		00	
	9	ACHIMIL	0100	01.7	02		01		01		01		02	
	10	DELPGLA	0100	01.5	02		01		00		01		03	
	11	GALIBOR	0100	01.5	03		02		01		00		00	
	12	TARAOFF	0100	01.3	00		03		01		00		01	
	13	POTEGRA	0100	01.2	02		01		01		00		00	
	14	THALVEN	0100	01.1	00		01		02		00		01	
	15	ASTELAE	80.0	01.6	03		00		02		01			
	16	ARTELUD	80.0	01.2	01				01		01		02	
	17	AGOSGLA	80.0	00.8	00		02				00		01	
	18	FRAGVIR	60.0	01.4	03		02		01					
	19	LATHOCH	60.0	00.4			00		00				01	
	20	CAMPROT	60.0	00.4			00		00		00			
	21	GENTAMA	40.0	00.2			00		00					
	22	HEUCRIC	40.0	00.1	00				00					
	23	CERAARV	40.0	00.0							00		00	
	24	ASTECIL	20.0	00.7									03	
	25	ALLICER	20.0	00.1									00	
	26	RANURHO	20.0	00.0									00	
	27	BOTRLUN	20.0	00.0									00	
	28	GERAVIS	20.0	00.0							00			
	29	VIOLADU	20.0	00.0									00	
7	30	ELYMINN	0100	17.1	17		13		17		13		24	
	31	FESTSCA	0100	10.4	15		13		10		06		06	
	32	BROMCIL	0100	06.3	00		04		09		05		10	
	33	AGROTRA	0100	01.6	01		01		02		02		00	
	34	JUNCBAL	0100	00.6	00		00		00		00		01	
	35	POA PRA	80.0	02.4	00		04				02		04	
	36	CAREOBT	60.0	03.1	06		06				02			
	37	CAREPRA	40.0	02.1					05				05	
	38	HIERODO	40.0	00.2			00						00	
	39	POA INT	20.0	00.1			00							
	40	DANTCAL	20.0	00.0							00			

UPPER JAMES RIVER RANGELAND REFERENCE AREA

RESOURCE INVENTORY, EDMONTON ALBERTA

Group name: Ujames Group 1

			Avg	Avg	Plots													
					UJ63I		UJ630		UJ69I		UJ690		UJ77I		UJ770		UJ79I		UJ790	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																		
5	1	SALIMYR	25.0	00.3									01		01					
	2	VACCMYR	25.0	00.3									01		01					
6	3	GEUMTRI	0100	04.5	01		01		11		01		06		06		03		03	
	4	GALIBOR	0100	03.1	02		02		03		05		01		02		03		03	
	5	ACHIMIL	0100	02.7	02		01		02		05		01		02		02		02	
	6	VICIAME	0100	01.4	01		01		01		01		01		01		01		01	
	7	POTEGRA	75.0	02.5	03		01		03		05						02		02	
	8	TARAOFF	75.0	01.3	01		01						01		03		01		01	
	9	ASTEALP	75.0	01.1	01		02						01		01		01		01	
	10	AGOSGLA	75.0	01.0	01		01						01		01		01		01	
	11	THALVEN	50.0	01.4					01		02						03		03	
	12	ANTELAN	50.0	00.7					01		01						01		01	
	13	FRAGVIR	50.0	00.7					01		01						01		01	
	14	SOLIMUL	25.0	00.8	03		02													
	15	DODECON	25.0	00.5													02		02	
	16	HIERCYN	25.0	00.5													02		02	
	17	TRIFREP	25.0	00.5									01		03					
	18	SMILSTE	25.0	00.4													01		01	
	19	STELLON	25.0	00.4													01		01	
	20	VIOLCAN	25.0	00.3					01		01									
	21	ZIZIAPT	25.0	00.3									01		01					
	22	ARNICHA	25.0	00.3	01		01													
	23	MERTPAN	25.0	00.3													01		01	
7	24	AGROTRA	0100	13.5	05		02		09		18		13		19		16		23	
	25	CAREPRE	0100	11.7	18		13		07		13		03		09		07		19	
	26	FESTSCA	0100	10.9	07		06		13		03		32		05		15		04	
	27	POAPRAT	0100	05.3	04		03		03		10		01		06		01		10	
	28	JUNCBAL	0100	04.5	05		03		03		03		05		04		04		06	
	29	KOELMAC	75.0	01.6	02		01		01		01						02		03	
	30	FESTIDA	75.0	01.4	01		01		01		01						01		03	
	31	ELYMINN	50.0	01.0	01		02		02		01									
	32	DESCCES	50.0	00.8	01		01										01		01	
	33	DANTCAL	50.0	00.7					01		01						01		01	
	34	FESTOVI	25.0	02.1									01		15					
	35	BROMCIL	25.0	00.5									02		01					
	36	BROMINE	25.0	00.5	02		01													
	37	PHLEPRA	25.0	00.4									01		01					
	38	AGROSTO	25.0	00.3													01		01	
	39	DANTPAR	25.0	00.3	01		01													

Group name: Ujames Group 2

			Avg	Avg	Plots											
					UJR810		UJR850		UJR880		UJR910		UJR940		UJR970		UJR000	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																
5	1	POTEGRA	28.6	00.0	00				00									
6	2	TARAOFF	0100	22.5	24		10		38		28		13		21		21	
	3	ACHIMIL	0100	06.0	03		04		05		05		04		10		08	
	4	MERTPAN	0100	04.8	00		01		08		02		04		12		05	
	5	VICIAME	0100	04.6	09		01		01		06		04		05		01	
	6	GALIBOR	0100	01.9	02		01		02		02		00		02		01	
	7	AGOSGLA	0100	01.3	00		00		01		01		00		01		02	
	8	GEUMTRI	0100	01.2	00		00		00		01		00		01		04	
	9	CERAARV	0100	01.1	00		01		01		01		00		00		01	
	10	POTEGRA	85.7	13.8	40		08		32				06		04		04	
	11	THALVEN	85.7	05.8	01		01		11				05		14		05	
	12	TRIFREP	85.7	01.1	04		00		00		02		00		00			
	13	FRAGVIR	71.4	01.2	01		00		05		00		00					
	14	CAMPROT	71.4	00.5			00				00		00		01		00	
	15	DODECON	57.1	00.9							02		01		00		01	
	16	RUMEACE	57.1	00.8							01		01		00		02	
	17	ASTEALP	57.1	00.7	02		00		01		00							
	18	ZIZIAPT	57.1	00.2	00				01				00		00			
	19	STELLON	42.9	01.2									04		03		00	
	20	RUMEOCC	42.9	00.4	00		00		02									
	21	DELPGLA	42.9	00.4	00		00		02									
	22	ASTELAE	28.6	00.3									00				01	
	23	ANTELAN	28.6	00.2									00		00			
	24	LATHOCH	28.6	00.1	00										00			
	25	ARNICHA	28.6	00.1					00								00	
	26	RANUCAR	28.6	00.1							00		00					
	27	ASTRALP	28.6	00.0					00								00	
	28	GEUMALE	28.6	00.0	00		00											
	29	JUNCBAL	14.3	00.7									05					
	30	RHINMIN	14.3	00.3	02													
	31	PHLEPRA	14.3	00.2									01					
	32	GENTAMA	14.3	00.1					00									
	33	PENSPRO	14.3	00.1							00							
	34	POLEACU	14.3	00.1	00													
	35	MONAFIS	14.3	00.0											00			
	36	EPILANG	14.3	00.0	00													
	37	HEDYSUL	14.3	00.0							00							
	38	POTEDIV	14.3	00.0											00			
	39	ASTECON	14.3	00.0	00													
	40	GENTCAL	14.3	00.0	00													

(CONTINUED)

RESOURCE INVENTORY, EDMONTON ALBERTA

Group name: Ujames Group 2

					Plots													
			Avg	Avg	UJR810		UJR850		UJR880		UJR910		UJR940		UJR970		UJR000	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																
6	41	GEUMMAC	14.3	00.0					00									
	42	LINULEW	14.3	00.0	00													
	43	SMILSTE	14.3	00.0					00									
	44	SOLIMUL	14.3	00.0			00											
7	45	POAPRAT	0100	16.8	19		05		19		41		12		12		08	
	46	ELYMINN	0100	08.7	02		04		13		08		10		06		14	
	47	AGROTRA	0100	06.1	03		02		02		17		05		08		02	
	48	JUNCBAL	85.7	02.6	01		01		01		03				06		04	
	49	FESTSCA	85.7	00.4	00		00		01		00		00		00			
	50	PHLEPRA	71.4	00.7	02		01		00		00						00	
	51	CAREPRE	57.1	03.6	00		03		19						02			
	52	CAREOBT	42.9	05.7							14		09				16	
	53	BROMCIL	42.9	01.3									05		01		01	
	54	KOELMAC	42.9	00.6	00		00		03									
	55	DESCCES	28.6	00.9	05		00											
	56	CAREATR	28.6	00.5									03		00			
	57	HIERODO	28.6	00.5							02		00					
	58	CAREPRA	14.3	02.7											18			
	59	AGROSTO	14.3	00.1					00									
	60	BROMINE	14.3	00.1					00									
	61	CALARUB	14.3	00.0											00			
	62	AGROELY	14.3	00.0					00									

Group name: Ujames Group 3

			Avg	Avg	Plots													
					UJR81I		UJR85I		UJR88I		UJR91I		UJR94I		UJR97I		UJR00I	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																
5	1	POTEGRA	28.6	00.0	00				00									
6	2	MERTPAN	0100	07.6	00		00		05		06		11		14		15	
	3	GALIBOR	0100	05.3	06		08		05		05		05		03		03	
	4	ACHIMIL	0100	04.0	02		05		03		02		06		02		04	
	5	POTEGRA	0100	03.6	07		03		09		00		00		01		02	
	6	THALVEN	0100	03.6	01		06		07		02		03		01		02	
	7	DELPGLA	0100	02.9	01		01		04		03		02		02		05	
	8	VICIAME	0100	02.0	01		00		00		02		04		02		02	
	9	AGOSGLA	0100	01.5	00		00		00		01		01		03		03	
	10	TARAOFF	0100	01.4	00		00		02		02		01		01		01	
	11	GEUMTRI	85.7	02.8	02		02		07				03		01		03	
	12	CERAARV	85.7	00.4	00		00		00				01		00		00	
	13	CAMPROT	71.4	00.3			00				00		01		01		00	
	14	DODECON	42.9	00.4							01				00		00	
	15	RUMEOCC	42.9	00.3	00		00		00									
	16	ASTEALP	42.9	00.3	00		00		01									
	17	FRAGVIR	42.9	00.2	00		00		00									
	18	STELLON	42.9	00.2									00		00		00	
	19	TRIFREP	42.9	00.1	00		00		00									
	20	SMILSTE	42.9	00.0					00				00		00			
	21	ZIZIAPT	42.9	00.0	00				00		00							
	22	RUMEACE	28.6	00.3									00				01	
	23	SOLIMUL	28.6	00.1			00								00			
	24	ASTECIL	28.6	00.0											00		00	
	25	GEUMALE	28.6	00.0	00		00											
	26	HIERCYN	14.3	00.1													00	
	27	ANTELAN	14.3	00.1									00					
	28	POTEFRU	14.3	00.0													00	
	29	ANAPMAR	14.3	00.0													00	
	30	ASTELAE	14.3	00.0									00					
	31	GENTCAL	14.3	00.0	00													
	32	ARNICHA	14.3	00.0					00									
	33	ASTECON	14.3	00.0	00													
	34	ASTRALP	14.3	00.0					00									
	35	EPILANG	14.3	00.0	00													
	36	GENTAMA	14.3	00.0					00									
	37	GEUMMAC	14.3	00.0					00									
	38	LATHOCH	14.3	00.0	00													
	39	LINULEW	14.3	00.0	00													
	40	POLEACU	14.3	00.0	00													

(CONTINUED)

RESOURCE INVENTORY, EDMONTON ALBERTA

Group name: Ujames Group 3

			Avg	Avg	Plots											
					UJR81I		UJR85I		UJR88I		UJR91I		UJR94I		UJR97I		UJR00I	
			% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg
LAYER	N	SPECIES																
6	41	RHINMIN	14.3	00.0	00													
7	42	FESTSCA	0100	27.7	23		04		42		58		22		21		20	
	43	ELYMINN	0100	08.9	02		05		14		09		12		07		11	
	44	AGROTRA	0100	06.6	16		01		02		12		03		06		04	
	45	JUNCBAL	0100	02.8	00		00		01		06		03		03		03	
	46	POAPRAT	0100	00.8	00		00		00		02		00		00		02	
	47	CAREPRE	85.7	03.3	00		01		04				02		07		06	
	48	BROMCIL	57.1	02.2							00		04		02		08	
	49	KOELMAC	57.1	00.7	00		00		00						05			
	50	CAREATR	42.9	01.0									01		05		00	
	51	PHLEPRA	42.9	00.0	00		00		00									
	52	HIERODO	28.6	00.6							03		00					
	53	DESCCES	28.6	00.0	00		00											
	54	CAREOBT	14.3	01.8							12							
	55	FESTSAX	14.3	00.7											05			
	56	AGROELY	14.3	00.2					01									
	57	BROMINE	14.3	00.0					00									
	58	AGROSTO	14.3	00.0					00									