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RANGELAND REFERENCE AREAS

CASTLE RIVER

RANGE CONDITION AND TREND FROM

1953-1995

Alberta
ENVIRONMENTAL PROTECTION

RANGELAND REFERENCE AREAS

CASTLE RIVER

RANGE CONDITION AND TREND FROM 1953-1995

prepared by

Michael G. Willoughby

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For copies of this report contact:

Michael Willoughby
9920 108th St.
Edmonton, Alta
T5K2M4
(403) 422-4598

E-mail: mwilloug@env.gov.ab.ca

Figure 1 Overview of the Castle River Watershed Watershed Area

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Photo 1. Overview of the Castle River Rangeland Reference Area.

Table of contents

	Page
Introduction	1
Site description	1
Methods	2
Results	3
Historic grazing pressure	3
Vegetation	3
Discussion	8
Plant community ecology	8
Range condition	10
Summary	11
Literature cited	11
Appendix 1. Species composition of the inside and outside cluster groups outlined in Figure one.	13
Appendix 2. Range use in the Castle River allotment-Lower Castle Distribution Unit (D.U.)	21

List of Figures

Figure 1. Percentage use of calculated carrying capacity	4
Figure 2. Ordination of Castle River Rangeland Reference Area	5
Figure 3. Successional changes in the presence and absence of grazing for the Castle River Rangeland Reference Area	9

Table 1. Summary

1	Introduction
2	Background
3	Methods
4	Results
5	Discussion
6	Conclusion
7	References
8	Appendix
9	Figure 1: Comparison of the two methods
10	Figure 2: Comparison of the two methods
11	Figure 3: Comparison of the two methods
12	Figure 4: Comparison of the two methods
13	Figure 5: Comparison of the two methods
14	Figure 6: Comparison of the two methods
15	Figure 7: Comparison of the two methods
16	Figure 8: Comparison of the two methods
17	Figure 9: Comparison of the two methods
18	Figure 10: Comparison of the two methods
19	Figure 11: Comparison of the two methods
20	Figure 12: Comparison of the two methods
21	Figure 13: Comparison of the two methods
22	Figure 14: Comparison of the two methods
23	Figure 15: Comparison of the two methods
24	Figure 16: Comparison of the two methods
25	Figure 17: Comparison of the two methods
26	Figure 18: Comparison of the two methods
27	Figure 19: Comparison of the two methods
28	Figure 20: Comparison of the two methods
29	Figure 21: Comparison of the two methods
30	Figure 22: Comparison of the two methods
31	Figure 23: Comparison of the two methods
32	Figure 24: Comparison of the two methods
33	Figure 25: Comparison of the two methods
34	Figure 26: Comparison of the two methods
35	Figure 27: Comparison of the two methods
36	Figure 28: Comparison of the two methods
37	Figure 29: Comparison of the two methods
38	Figure 30: Comparison of the two methods
39	Figure 31: Comparison of the two methods
40	Figure 32: Comparison of the two methods
41	Figure 33: Comparison of the two methods
42	Figure 34: Comparison of the two methods
43	Figure 35: Comparison of the two methods
44	Figure 36: Comparison of the two methods
45	Figure 37: Comparison of the two methods
46	Figure 38: Comparison of the two methods
47	Figure 39: Comparison of the two methods
48	Figure 40: Comparison of the two methods
49	Figure 41: Comparison of the two methods
50	Figure 42: Comparison of the two methods
51	Figure 43: Comparison of the two methods
52	Figure 44: Comparison of the two methods
53	Figure 45: Comparison of the two methods
54	Figure 46: Comparison of the two methods
55	Figure 47: Comparison of the two methods
56	Figure 48: Comparison of the two methods
57	Figure 49: Comparison of the two methods
58	Figure 50: Comparison of the two methods
59	Figure 51: Comparison of the two methods
60	Figure 52: Comparison of the two methods
61	Figure 53: Comparison of the two methods
62	Figure 54: Comparison of the two methods
63	Figure 55: Comparison of the two methods
64	Figure 56: Comparison of the two methods
65	Figure 57: Comparison of the two methods
66	Figure 58: Comparison of the two methods
67	Figure 59: Comparison of the two methods
68	Figure 60: Comparison of the two methods
69	Figure 61: Comparison of the two methods
70	Figure 62: Comparison of the two methods
71	Figure 63: Comparison of the two methods
72	Figure 64: Comparison of the two methods
73	Figure 65: Comparison of the two methods
74	Figure 66: Comparison of the two methods
75	Figure 67: Comparison of the two methods
76	Figure 68: Comparison of the two methods
77	Figure 69: Comparison of the two methods
78	Figure 70: Comparison of the two methods
79	Figure 71: Comparison of the two methods
80	Figure 72: Comparison of the two methods
81	Figure 73: Comparison of the two methods
82	Figure 74: Comparison of the two methods
83	Figure 75: Comparison of the two methods
84	Figure 76: Comparison of the two methods
85	Figure 77: Comparison of the two methods
86	Figure 78: Comparison of the two methods
87	Figure 79: Comparison of the two methods
88	Figure 80: Comparison of the two methods
89	Figure 81: Comparison of the two methods
90	Figure 82: Comparison of the two methods
91	Figure 83: Comparison of the two methods
92	Figure 84: Comparison of the two methods
93	Figure 85: Comparison of the two methods
94	Figure 86: Comparison of the two methods
95	Figure 87: Comparison of the two methods
96	Figure 88: Comparison of the two methods
97	Figure 89: Comparison of the two methods
98	Figure 90: Comparison of the two methods
99	Figure 91: Comparison of the two methods
100	Figure 92: Comparison of the two methods

List of Tables

Table 1. Canopy cover (%) of dominant plant species for Groups 1, 2 and 3 outlined in Figure 2	6
Table 2. Change in canopy cover (%) of selected species on the grazed and ungrazed transects from 1953 to 1995.	7

List of Photos

Photo 1. Overview of the Castle River Rangeland Reference Area	Cover
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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 Castle River Rangeland Reference Area. This reference area was established in 1953 on a glacialfluvial terrace adjacent to the Castle River. It is located within the Montane subregion and is part of the group of community types represented by the rough fescue ecosite (Willoughby et al. 1997).

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 Castle River Rangeland Reference Area. This reference area was established in 1953 on a glaciofluvial terrace adjacent to the Castle River. The area had been heavily grazed and was thought to be in poor range condition. In 1962 an enclosure was constructed to exclude livestock grazing. In 1986 the enclosure was reconstructed and the area inside was divided to form a third phase to exclude wildlife.

SITE DESCRIPTION

The Castle River Reference Area is part of the primary rangelands in the Montane subregion of Alberta (Dept. of Environmental Protection 1994). The Montane subregion composes only 0.9% of the province and is found in an area south of Chain Lakes to the Montana border, portions of the Bow and Athabasca river valleys and isolated areas near Ya Ha Tinda and Grande Cache. The Montane is distinguished from the other subregions by the presence of Douglas fir (*Pseudotsuga menziesii*), limber pine (*Pinus flexilis*) and lodgepole pine (*Pinus contorta*). Elevationally the Montane occurs below the Subalpine in the mountains and above the Foothills Fescue and Foothills Parkland subregions in southern Alberta.

Yearly precipitation ranges 308 mm to 1279 mm with two precipitation peaks occurring in May-June and again in August-September (Strong 1992). Summer monthly temperatures average 11.9°C and are 2°C warmer than the Subalpine and 2°C colder than the Foothills Fescue subregions. The Montane has the warmest winter temperatures of any forested subregion in Alberta. This is due to the montane's association with the major east-west mountain valleys. The valleys are warm during winter as they channel warm modified Pacific air into Alberta and often escape outbreaks of cold arctic air from the north (Strong 1992).

In the Montane the modal grassland vegetation occurs on terraces and southerly facing slopes. The dominant grass species include rough fescue (*Festuca scabrella*), Parry oatgrass (*Danthonia parryi*), Richardson needlegrass (*Stipa richardsonii*), Idaho fescue (*Festuca idahoensis*), upland sedge species and bluebunch wheatgrass (*Agropyron spicatum*). Moss and Campbell (1947) believed the rich flora of this subregion could be explained in terms of the

continuity with the Palouse prairie through mountain passes from the Northwestern United States. Many species characteristic of the Palouse prairie are found in southwestern Alberta: Idaho fescue, bluebunch wheatgrass, sticky purple geranium (*Geranium viscosissimum*), woolly gromwell (*Lithospermum ruderae*), and balsamroot (*Balsamorhiza sagittata*). The Castle River rangeland reference area appears to represent a disturbed rough fescue community type on glaciofluvial terraces (Willoughby et al. 1997).

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 enclosure and a 100-ft (33-m) transect inside and outside the enclosure. The outside transect was situated 25-ft (8-m) or greater from the edge of the enclosure. 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. (1.8-m) intervals) using a 20x50 cm Daubenmire frame. Presently, the transects are being recorded every three years. All the basal frequency data prior to 1980 was converted to canopy cover using regression analysis. The regression equation for the Castle River reference area is $(COVER)=1.12+0.68 (FREQUENCY) R^2=.62 p>0.0001$.

This reference area was established in 1953 on a glaciofluvial terrace adjacent to the Castle River that had been overgrazed and was thought to be in poor range condition. The reference area is located in the Lower Castle distribution unit (D.U.) of the Castle River allotment. In 1962 a enclosure was constructed to exclude livestock grazing. In 1986 the enclosure was reconstructed and the area inside was divided to form a third phase to exclude wildlife.

A combination of both ordination (DECORANA) (Gauch 1982) and cluster analysis (SAS) were used to group the inside and outside transects of different years. 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) and (w) inside ungrazed wildlife enclosure.

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

RESULTS

Historic grazing pressure

Range use on the Castle River allotment and Lower Castle distribution unit has averaged over 154% of calculated carrying capacity since 1947 when records were first kept (Figure 1, Appendix 2). Range use around the reference area has averaged 175% of calculated carrying capacity through the 1940's, 50's, 60's and 70's. Use declined somewhat during the 1980's averaging 127% of calculated carrying capacity. Since 1990 use has declined to 67% of calculated carrying capacity. Season of use in the Lower Castle D.U. has generally been from June to October from 1947 to 1975. After 1975, the D.U. was only grazed in September and October to promote range recovery. However, since 1986 full season use has resumed.

Vegetation

The ordination of the Castle River Rangeland Reference Area with years grouped by cluster analysis is outlined in Figure 2. The first two axes in the ordination account for 28% and 10% of the variation in the species stand table, respectively. There is a distinct grouping of the inside and wildlife transects from 1976 to 1995 (Group 3), the outside transects from 1980 to 1995 (Group 2) and outside transects from 1953 to 1979 (Group 1). The inside transect in 1962 was more ecologically similar to the outside transects in Group 1.

The transects in group 2 were mathematically more similar to group 1 transects than group 3 transects according to cluster analysis. Group 1 clustered with group 2 at a semipartial R^2 of 0.18. In contrast group 3 clustered with group 1 and 2 at a semipartial R^2 of 0.32.

It should be noted that two years in group 3 (1979i and 1983i) clustered with transects in group 1. The transect in 1983 was recorded in a very dry year and cover of all species was very low and the transect in 1979 had only 13 species recorded. The low species cover and low number of species are typical of the early readings at this rangeland reference area. These transects were added to group 3 and not group 1 because they were dominated by rough fescue. An attribute which was shared by all the transects in group 3.

The inside and wildlife transects from 1976-1995 represent a plant community that has been protected from grazing for more than 14 years. These transects represent a community type that is dominated by rough fescue, Kentucky bluegrass, and Richardson needlegrass (Table 1). There is little forb cover in this community type.

In contrast the outside grazed transects from 1953 to 1979 and inside transect in 1962 were dominated by Idaho fescue, sedge and California oatgrass and represent an Idaho fescue-California oatgrass community type (Group 1)(Table 1). From 1980 to the present the outside transects (Group 2) have been dominated by Kentucky bluegrass, rough fescue, Idaho fescue and various forb species (silky lupine, yarrow, mountain shooting star, old man's whiskers). These transects represent a Kentucky bluegrass-Rough fescue community type.

Table 2 outlines the change in canopy cover of the dominant species on the inside and outside transects from 1962 to 1995. Idaho fescue, sedge, California oatgrass, forb cover have

Figure 1. Percentage use of calculated carrying capacity for the Castle River allotment-Lower Castle distribution unit (D.U.).

Figure 2. Ordination of Castle River rangeland reference area, with years grouped by cluster analysis (i=inside, o=outside, w=wildlife).

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

Species	In&Out(1) 1950s-70s	Outside(2) 1980-90s	Inside(3) 1980-90s
Shrubs			
PRAIRIE ROSE (<i>Rosa arkansana</i>)	0A	TA	TA
Forbs			
NORTHERN BEDSTRAW (<i>Galium boreale</i>)	3A	4A	2A
OLD MAN'S WHISKERS (<i>Geum triflorum</i>)	2B	5A	3B
YARROW (<i>Achillea millefolium</i>)	2B	5A	3B
SILKY LUPINE (<i>Lupinus sericeus</i>)	1B	12A	5AB
CUT LEAVED ANEMONE (<i>Anemone multifida</i>)	1A	TB	TB
MOUNTAIN SHOOTING STAR (<i>Dodecatheon conjugens</i>)	TB	5A	2B
WOOLLY EVERLASTING (<i>Antennaria lanata</i>)	TB	5A	2AB
YELLOW BEARDTONGUE (<i>Penstemon procerus</i>)	1A	1A	2A
DANDELION (<i>Taraxacum officinale</i>)	1A	1AB	TA
Grasses			
IDAHO FESCUE (<i>Festuca idahoensis</i>)	7A	6A	2B
BLUNT SEDGE (<i>Carex obtusata</i>)	6A	2B	1C
KENTUCKY BLUEGRASS (<i>Poa pratensis</i>)	5B	21A	8B
RICHARDSON NEEDLEGRASS (<i>Stipa richardsonii</i>)	5A	1A	6A
ROUGH FESCUE (<i>Festuca scabrella</i>)	4B	9AB	25A
CALIFORNIA OATGRASS (<i>Danthonia californica</i>)	7A	4A	1B

*Means with the same letter indicate a significant difference at the $p=0.05$ level according to an Lsmeans test.

Table 2. Change in canopy cover (%) of selected species on the grazed (Out) and ungrazed (In) transects from 1962 to 1995 at the Castle River rangeland reference area.

Species	In						Out					
	1962	1979	1986	1989	1992	1995	1962	1979	1986	1989	1992	1995
Forbs												
NORTHERN BEDSTRAW	2	3	1	T	2	1	3	5	4	2	4	5
OLD MAN'S WHISKERS	2	1	1	2	3	4	2	2	6	5	5	7
YARROW	2	1	2	2	4	6	2	3	3	7	8	8
SILKY LUPINE	2	-	12	7	4	1	2	-	19	14	5	5
CUT LEAVED ANEMONE	-	-	-	-	-	-	1	1	-	-	T	T
MOUNTAIN SHOOTING STAR	-	-	1	2	5	1	-	-	T	11	3	5
WOOLLY EVERLASTING	-	-	1	1	1	1	-	-	2	1	3	1
YELLOW BEARDTONGUE	3	-	T	2	4	2	3	-	-	T	2	2
DANDELION	2	1	T	T	-	T	2	2	1	1	T	2
Grasses												
IDAHO FESCUE	8	2	2	2	3	3	6	8	2	2	12	14
BLUNT SEDGE	8	1	1	T	2	3	7	1	2	2	4	2
KENTUCKY BLUEGRASS	7	6	2	1*	14	15	5	9	23	24	30	30
RICHARDSON NEEDLEGRASS	5	7	-	2	20	3	4	8	-	1	2	2
ROUGH FESCUE	3	14	17	39	28	25	4	4	4	13	24	10
CALIFORNIA OATGRASS	9	3	1	T	3	T	5	5	5	6	4	5
PARRY OATGRASS	-	4	-	T	-	-	-	4	1	-	-	-
Species number	17	13	24	22	24	24	19	18	25	31	23	32
Species diversity	2.59	2.2	2.1	1.7	2.3	2.37	2.55	2.62	2.4	2.56	2.4	2.7

*cover of Kentucky bluegrass was 14% inside the wildlife enclosure

declined, whereas, rough fescue and Kentucky bluegrass have increased in the absence of grazing. In contrast the cover of the majority of forb and grass species have increased or remained constant on the grazed outside transects. The cover of Kentucky bluegrass and rough fescue have shown the largest increase in cover on the grazed transect from 1962 to 1995 and the cover of these two species has remained relatively constant since 1989 on both transects.

The transect that was protected from wildlife grazing in 1986 continues to group closely with the transect in the ungrazed cattle enclosure (i). The species composition of the transect in the wildlife enclosure continues to be the same as the ungrazed transect in the cattle enclosure (Appendix 1).

DISCUSSION

Plant community ecology

The Castle River rangeland reference area has been represented by 3 community types since it was established in 1953. When the site was first established the inside and outside transects were represented by the Idaho fescue-California oatgrass community type. When the site was protected from grazing for 24 (1986) years it succeeded to a rough fescue dominated community type. Moss and Campbell (1947) and Willoughby (1992) found that rough fescue grows almost to the exclusion of other plants in the absence of disturbance and that rough fescue declined and Parry oatgrass and Idaho fescue increased with increased grazing pressure. As a result, Moss and Campbell (1947) felt that the Idaho fescue-California oatgrass dominated community type which dominated the site in 1962, to be a grazing disclimax community. Since 1989, the undisturbed inside transects at the Castle River reference area have been invaded by Kentucky bluegrass from outside the enclosure and the transect appears to be undergoing succession to a Rough fescue-Kentucky bluegrass dominated community type.

The continued heavy grazing pressure at the reference area from 1953 to 1990, has allowed Kentucky bluegrass to become dominant on the outside grazed transect to form a Kentucky bluegrass-Idaho fescue-Rough fescue community. 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. Since 1990 the grazing pressure has declined to about half of the calculated carrying capacity. During this time rough fescue has increased in cover and the transect appears to be succeeding to a Kentucky bluegrass-Rough fescue dominated community type.

The successional sequences for the Castle River Rangeland Reference Area are outlined in Figure 3. Protection from grazing on the Idaho fescue-California oatgrass community type in 1962 allowed rough fescue to increase, to form the rough fescue community type in 1986. Invasion by Kentucky bluegrass since 1989 appears to be causing the inside transects to succeed to a Rough fescue-Kentucky bluegrass dominated community type. Continued grazing pressure on the outside transect has allowed Kentucky bluegrass to dominate the site and the reduction in grazing pressure in the 1990's appears to be allowing rough fescue to increase. The outside transect now appears to be succeeding to a Kentucky bluegrass-Rough fescue dominated

Figure 3. Successional changes in the presence and absence of grazing disturbance at the Castle River rangeland reference area.

community type.

There appears to be a threshold when invasion by Kentucky bluegrass becomes so severe that succession back to a rough fescue dominated community maybe unlikely in the absence of disturbance. Observations from other rangeland reference areas have shown that rough fescue and Kentucky bluegrass continue to dominate the site after 30 years of protection (Willoughby 1995).

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. This concept appears to be applicable to the Castle River reference area up to the point in time before Kentucky bluegrass becomes a significant component of the community. When a Idaho fescue-California oatgrass community type is protected from grazing it appears to succeed back to a rough fescue dominated grassland. Consequently, the inside grazed transect would have been in good to excellent condition in 1986.

However, 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 (Laycock 1991). 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 codominant with rough fescue in the absence of disturbance. It seems that both models apply to the vegetation dynamics of this site.

The current dilemma on which system best describes range condition has led the Task Group on Unity in Concepts and Terminology (1995) to propose that ecological site and desired plant community concepts be used to assess the status of rangelands. Ecological site is defined as "a kind of land with specific physical characteristics which differs from other kinds of land in its ability to produce distinctive kinds and amounts of vegetation and in its response to management". The undisturbed transect at the Castle reference area has succeeded to a community that is dominated by rough fescue and Kentucky bluegrass. This community type has been quite stable for the last 6 years (Table 2) and it seems unlikely the site will return to a community that is dominated solely by native plant species.

The desired plant community is defined as "of the several plant communities that may occupy a site, the one that has been identified through a management plan to best meet the plan's objectives for the site". Historically, the desired plant community of these rangelands was one that maximized beef production. Invaders such as timothy and Kentucky bluegrass were desirable. Today society desires the preservation of native grasslands and the desired plant community for the Castle River rangeland reference area is a Rough fescue-Idaho fescue-Parry oatgrass dominated community type. Plants considered non-native (Kentucky bluegrass, timothy and dandelion) are no longer desired. Unfortunately it appears that the past management practices have altered the community structure so that the desired plant community is now

unlikely and range condition assessments will have to be done based on the current species composition of the inside ungrazed transect. The present range condition of the grazed rangeland at the Castle River rangeland reference area would therefore be rated as fair and the trend for the site would be improving.

SUMMARY

1.) The ungrazed inside transects appear to be succeeding to a Rough fescue-Kentucky bluegrass dominated community type.

2.) The grazed outside transect appears to be succeeding to a Kentucky bluegrass-Rough fescue dominated community type.

3.) The desired plant community for the Castle River rangeland reference area is a Rough fescue-Idaho fescue-Parry oatgrass dominated community type, but it seems unlikely that the site will return to a community that is dominated by native species because of the invasion of Kentucky bluegrass. As a result, range condition assessments will now have to be done based upon current species composition.

4.) The present range condition of the grazed rangeland at the Castle River rangeland reference area would be rated as fair and the trend for the site would be improving.

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APPENDIX ONE

**SPECIES COMPOSITION OF THE INSIDE AND OUTSIDE
CLUSTER GROUPS OUTLINED IN
FIGURE TWO.**

RESOURCE INVENTORY, EDMONTON ALBERTA

Plot Number		Average		CR530	CR570	CR590	CR620	CR621	CR760	CR790							
Layer	Species	Value	% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	
6	galibor	0100	02.9	03	-	04	-	02	-	03	-	02	-	02	-	05	-
	geumtri	0100	02.0	03	-	02	-	02	-	02	-	02	-	02	-	02	-
	achimil	0100	01.8	02	-	02	-	02	-	02	-	02	-	02	-	03	-
	taraoff	85.7	01.3	01	-	-	-	02	-	02	-	02	-	02	-	02	-
	lupiser	71.4	01.4	-	-	02	-	02	-	03	-	02	-	02	-	-	-
	anemul	42.9	00.5	-	-	-	-	01	-	01	-	-	-	-	-	01	-
	pensun	28.6	00.8	-	-	-	-	-	-	03	-	-	-	-	-	-	-
	potepen	28.6	00.4	-	-	-	-	-	-	01	-	02	-	-	-	-	-
	antelan	28.6	00.3	01	-	01	-	-	-	-	-	-	-	-	-	-	-
	dodecon	14.3	00.3	-	-	-	-	-	-	-	-	02	-	-	-	-	-
	stellon	14.3	00.3	-	-	-	-	-	-	-	-	02	-	-	-	-	-
	allicer	14.3	00.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	astelae	14.3	00.2	-	-	-	-	02	-	-	-	-	-	-	-	-	-
	erigger	14.3	00.2	-	-	02	-	-	-	-	-	-	-	-	-	-	-
	solimis	14.3	00.2	02	-	-	-	-	-	-	-	-	-	-	-	-	-
agosgla	14.3	00.2	-	-	01	-	-	-	-	-	01	-	-	-	-	-	
penspro	14.3	00.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
planmaj	14.3	00.2	-	-	-	-	-	-	-	-	-	-	-	-	01	-	
potegra	14.3	00.2	-	-	01	-	-	-	-	-	-	-	-	-	-	-	
tragdub	14.3	00.2	-	-	-	-	-	-	-	-	-	-	-	-	01	-	
viciame	14.3	00.2	-	-	-	-	-	-	-	-	-	-	-	-	01	-	
7	festida	0100	07.0	04	-	05	-	07	-	06	-	08	-	11	-	08	-
	careobt	0100	06.4	10	-	08	-	07	-	07	-	08	-	03	-	01	-
	poa pra	0100	05.2	02	-	03	-	04	-	05	-	07	-	07	-	09	-
	stipric	0100	04.8	07	-	04	-	03	-	04	-	05	-	04	-	08	-
	festesca	0100	03.9	02	-	03	-	02	-	04	-	03	-	09	-	04	-
	dantcal	85.7	06.7	08	-	07	-	13	-	05	-	09	-	-	-	05	-
	koelmac	85.7	02.4	02	-	02	-	02	-	05	-	04	-	03	-	-	-
	juncbal	85.7	01.3	02	-	-	-	02	-	02	-	02	-	02	-	02	-

RESOURCE INVENTORY, EDMONTON ALBERTA

Plot Number	Average	CR530	CR570	CR590	CR620	CR621	CR760	CR790
Layer	Value							
Species	% P	MC	Cv	Vg	Cv	Vg	Cv	Vg
agrotro	85.7	01.3	02	.	01	.	01	02
dantpar	28.6	01.7					08	04
fest sax	14.3	00.2						02
bronicil	14.3	00.2				01	.	

RESOURCE INVENTORY, EDMONTON ALBERTA

Plot Number	Average	CR800	CR830	CR860	CR890	CR920	CR950
Layer	% P	Cv	Vg	Cv	Vg	Cv	Vg
Species	Value	Cv	Vg	Cv	Vg	Cv	Vg
[5] rosaark	33.3 00.1		01 -				
rosaaci	16.7 00.0				00 .		
[6] lupiser	0100 11.9	17	-	19	. 14 -	05 .	00 .
achimil	0100 05.4	02	-	03 -	07 -	08 -	05 -
geumtri	0100 05.2	04	-	06 -	05 .	05 .	08 -
dodecon	0100 04.6	01	-	07 +	00 -	11 .	05 .
galibor	0100 03.6	04	-	03 -	04 -	02 .	05 .
agosglä	0100 01.5	01	-	02 -	01 -	01 .	02 .
taraoff	0100 01.4	02	-	02 -	01 -	01 .	02 .
viciame	0100 01.1	01	.	02 -	01 -	01 .	02 .
antelan	83.3 01.8		04 -	02 -	01 -	03 -	01 -
ceraarv	83.3 00.8		00 -	01 -	02 .	00 .	01 -
penscon	83.3 00.7	00	.	00 -	00 .	02 .	02 .
potegra	66.7 00.4		00 -	01 -	02 .	00 .	00 .
camprot	66.7 00.3		00 -	00 -	00 .	00 .	01 -
caloapi	66.7 00.2			00	01 -	01 .	00 .
lomatri	50.0 01.1				02 .	03 .	01 .
anemmul	50.0 00.1		00 -		00 .	00 .	00 .
arniful	33.3 00.9				02 .	04 .	04 .
solinis	33.3 00.4			01	02 -		
lomadis	33.3 00.2		01 -	01 -	00 .	00 .	00 .
deipbic	33.3 00.0				00 .		
potearg	16.7 00.7	04	.			00 .	00 .
potediv	16.7 00.3					02 .	02 .
penspro	16.7 00.1		01 -				
seladen	16.7 00.1				01	.	.
astetae	16.7 00.1			01	.		
ziziapt	16.7 00.1					01 .	01 .
fragvir	16.7 00.0					00 .	00 .

RESOURCE INVENTORY, EDMONTON ALBERTA

Plot Number	Average	CR800	CR830	CR860	CR890	CR920	CR950												
Layer	Species	% P	Value	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	
7	astecil	16.7	00.0																
	poa pra	0100	20.6	11		06		23		24		30		30					
	festuca	0100	09.2	00		05		04		13		24		10					
	festida	0100	06.2	03		03		02		02		12		14					
	juncbal	0100	00.6	00		00		01		00		00		03					
	dantcal	83.3	04.0			04		05		06		04		05					
	agrotra	83.3	01.3	02				00		00		03		02					
	careobt	66.7	01.7					02		02		04		02					
	stipric	66.7	01.0	01						01		02		02					
	koelmac	33.3	00.1					01		00									
	phlepra	16.7	00.5											03					
	caresp	16.7	00.3											02					
	dantpar	16.7	00.2					01											
	stipcom	16.7	00.1					01											
	poa cus	16.7	00.0					00											
	poa com	16.7	00.0							00									

RESOURCE INVENTORY, EDMONTON ALBERTA

Plot Number	Average	CR761	CR791	CR801	CR831	CR861	CR891	CRW89	CR921	CRW92	CR951
Layer	Value										
Species	% P	MC	Cv	Vg	Cv	Vg	Cv	Vg	Cv	Vg	Cv
5	rosaaci	08.3	00.0								00 .
	rosaark	08.3	00.0								
6	geumtri	0100	02.5	02 .	01 .	03 .		02 .	00 .	01 .	04 .
	galibor	0100	02.0	02 .	03 .	00 .		02 .	02 .	03 .	01 .
	achimil	91.7	03.0		01 .	02 .		02 .	04 .	05 .	06 .
	dodecon	91.7	01.8	02 .	01 .	05 .		02 .	01 .	01 .	01 .
	lupiser	83.3	04.5	01 .	07 .	06 .		05 .	04 .	03 .	01 .
	antelan	83.3	00.7		00 .	02 .		01 .	01 .	02 .	01 .
	agosgla	83.3	00.6		00 .	00 .		01 .	01 .	02 .	00 .
	penscon	75.0	01.5		01 .	00 .		02 .	04 .	01 .	02 .
	taraoff	66.7	00.4	01 .	01 .	00 .		00 .			00 .
	ceraarv	58.3	00.2		00 .	00 .		00 .		01 .	00 .
	lomatri	50.0	00.3			00 .			01 .	00 .	01 .
	viciame	50.0	00.1		00 .	00 .					00 .
	solimis	41.7	00.5		01 .	00 .		02 .			
	geravis	33.3	00.3		00 .	01 .					
	camprot	33.3	00.0					00 .	00 .		00 .
	delphic	25.0	00.1		00 .	00 .					01 .
	thalven	25.0	00.1					00 .		00 .	
	potegra	25.0	00.0		00 .	00 .					
	geraric	16.7	00.3						02 .		
	arniful	16.7	00.2			00 .					
	anemmul	16.7	00.0			00 .			00 .		
	lomadis	16.7	00.0		00 .	00 .					
	caloapi	16.7	00.0								00 .
	acondel	08.3	00.1						01 .		
	astelae	08.3	00.0						01 .		
	cirsund	08.3	00.0							00 .	
	penspro	08.3	00.0			00 .					

RESOURCE INVENTORY, EDMONTON ALBERTA

[illegible]

[illegible]

Appendix 2. Range use in the Castle River Allotment-Lower Castle distribution unit (D.U.).

Year	AUMs	Percentage Use of Carrying Capacity	Season of Use
1947	N/A	248*	June 1-Oct 15
1948	"	239*	"
1949	"	194*	"
1950	"	201*	"
1951	"	199*	"
1952	"	201*	"
1953	"	176*	"
1954	"	159*	"
1955	"	159*	"
1956	"	134*	"
1957	"	137*	"
1958	"	127*	"
1959	"	123*	"
1960	"	131*	"
1961	"	131*	"
1962	"	124*	"
1963	"	135*	"
1964	"	139*	"
1965	"	120*	"
1967	610	338	Autumn
1966	344	191	Season long
1968	466	258	Season long
1969	408	226	Season long
1970	386	214	Season long
1971	517	287	Season long
1972	382	212	Season long
1973	443	246	Season long
1974	267	148	Season long
1975	210	116	Autumn
1976	334	185	Autumn
1977	135	75	Autumn
1978	124	68	Autumn
1979	253	141	Autumn
1980	110	61	Autumn
1981	N/A	95*	N/A
1982	"	97*	"
1983	"	91*	"

1984	"	97*	"
1985	117	65	Autumn
1986	164	91	Season long
1987	204	113	Season long
1988	565	313	83% Autumn grazed, 17% season long grazed
1989	444	246	77% Autumn grazed, 23% season long grazed
1990	95	52	Season long
1991	96	54	Season long
1992	99	54	Season long
1993	N/A	97*	N/A
1994	143	79	Season long

Average 154

Carrying capacity for the Castle River allotment (2330 AUMs (1987)) and for the Lower Castle D.U. (180 AUMs (1975)) based on 50% of grass production.

*Indicates percentage use was calculated from the total AUMs utilizing the allotment.

Note - Percentage use of carrying capacity is determined by dividing actual use by calculated carrying capacity

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