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Analyses of Range Enclosure Plots,  
Bow Valley, Banff Park, 1958.  
by Ronald H. Flork

In 1944 four game enclosure plots were constructed in the Bow Valley of Banff Park. The sites for the enclosures were selected by I. McT. Cowan. They were designated range plots 1, 2, 3 and 4. In 1952 a fifth plot was fenced on a site selected by A.W.F. Lanfield. It was designated range plot 5. In 1953 R. Webb made an analysis of the vegetation within and adjacent to each of the five enclosures. That was reported and published in Wildlife Management Bulletin series 1, No. 13, 1957. Webb described the localities of each of the enclosures. Since 1953 vegetation of plot 1 has been so influenced by the development of the Timberline Hotel that it is of no further value. Plot 2 has been destroyed by the Trans Canada highway.

June 27 to July 3, 1958, assisted by G.R. Francis, I analyzed the vegetation on the three plots which remain.

We attempted to follow Webb's procedure so as to provide a valid indication of any changes in plant cover during the five year interval.

All the enclosures are built of page wire on wooden posts. They have prevented any utilization of the plots by ungulates.

Plot 3, mile 10.5

Plot 3 is located in typical aspen winter range of deer and elk 10 1/2 miles west of Banff on the south side of the

old highway. It's dimensions are 60 by 85 feet. Pellets indicate that elk are the almost sole users of this range.

Thirty-seven aspens in the enclosure were tagged and measured by Cowan in 1944. They were measured by Webb again in 1953. It is quite apparent that Webb's data for D.B.H. actually consist of circumference measurements. Therefore in order to correct his data to diameter I have multiplied each of his measurements by 0.32. In table I the D.B.H. measurements for the tagged trees for the years 1944, 1953, and 1958 are presented.

Table 1. Breast Height Diameters of Tagged Aspens, Plot 3.

Tree No.	1944	1953	1958	Tree No.	1944	1953	1958
1	4½	6½	6	20	2½	3½	4
2	2½	3½	3	21	3	4	3½
3	4½	7½	8	22	7½	10	9½
4	3	5	5	23	5	6½	6
5	5	7½	8	24	5	7	7
6	4½	6½	6½	25	5	6½	?
7	5½	8½	9	26	3½	4½	4½
8	2½	4½	4½	27	4	5½	5½
9	4½	7	7	28	5½	6½	6½
10	5	7½	7	29	3½	5	5½
11	4½	6	5½	30	5½	7	7½
12	3½	5	5½	31	2½	3½	3½
13	4½	2	2½	32	4½	6	5½
14	2 1/8	3	3 (dead)	33	10½	12½	11
15	4½	6	6	34	8½	11½	11
16	6½	8½	?	35	5	7½	?
17	3	4½	3½	36	3	4	4
18	4 1/8	5	4½	37	2½	4	4
19	5½	7½	8				

Inspection of the data in table 1 indicates that growth in trunk diameter has been slight. Error of measurement would account for the shrinkage indicated for some trees as the measurement is quite variable.

The condition and scarring of the trees inside the exclosure fence has remained about equal to those of the trees outside. The bark was so badly scarred at the time of the building of the exclosure that little succulent bark remained to be damaged by elk.

The height of each shrub and tree up to eight feet high inside the exclosure was measured and they were tallied as to height class. Similar data were collected from 50 milacre plots outside the exclosure located in the manner described by Webb.

These data are presented in table 2 in terms of average number per acre of each height class of each woody species.

The difference in height classes of aspen inside and outside the plot was striking. Outside the exclosure elk have so suppressed aspen regeneration that there were no aspen in the height classes between one foot and eight feet. The same was true in 1953. The frequency of seedlings and suckers of aspen less than one foot high outside the exclosure has tripled in the five year interval. The apparent slight decline in numbers of aspen over eight feet high could be due to sampling error.

**Table 2.** Frequency of Height Classes of Shrubs and Trees on Range 3. (Average number per acre)

Species	Height Class (feet)	1953		Height Class (feet)	1958		
		Inside Exclosure	Outside Exclosure		Inside Exclosure	Outside Exclosure	
Populus tremuloidea	0-2	1970	3020	1 2	0 } 93 } 93	9480 } 0 } 9480	
	2-4	1620 <sup>2</sup>	0	3 4	127 } 238 } 365	0 0	
	4-6	1050 <sup>1</sup>	0	5 6	331 } 272 } 603 <sup>5</sup>	0 0	
	6-8	440	0	7	382	382	0
	>8+	280	200	>8	1564	1564	180
Salix scouleriana	0-4	3430	5160	1 2 3 4	17 } 399 } 782 } 2184	2480 } 260 } 140 } 2900	
	>4	300	0	5 6 7 >8	671 } 161 } 17 } 883	0 } 0 } 0 } 0	
	0-4	20	520	1 2 3 4	0 } 0 } 0 } 0	180 } 20 } 200	
	>4	80 <sup>247</sup>	0 <sup>1235</sup>	5 6 7 >8	0 } 0 } 8 } 42	0 } 0 } 0 } 0	
	>8				34 }	0 }	
Shepherdia canadensis	0-4	70	0	1 2 3 4	0 } 17 } 51 } 68	0 } 0 } 0 } 0	
	>4	0	0	5	17	17	0

Table 2. Frequency of Height Classes of Shrubs and Trees on Range 3. (Average number per acre)

Species	Height Class (feet)	1953		Height Class (feet)	1958		
		Inside Exclosure	Outside Exclosure		Inside Exclosure	Outside Exclosure	
Picea glauca	>0	0	0	1	0	0	
				2	8		50
				3	8		
				4	0		
				5	17		
				6	0		
				7	17		
				8	0		
Potentilla fruticosa	>0	70	220	1	0	60	
				2	8		140
				3	17		
				4	17		

$\frac{7650}{1000} = 7.65$     23054 Potentilla    22555    15,550    ~~12,800~~ 3868 18/2m

It is evident that willows outside exclosure 3 are being suppressed by browsing. While the 1953 sampling showed 500 willows over 4 ft. in height per acre, the 1958 sample showed none. The willows under 4 feet had declined from 5160 per acre in 1953 to 2900 per acre in 1958.

The appearance of seedlings of white spruce both inside and outside the exclosure is of note. It is the normal course of plant succession in the area for spruce to become established in the shade of an aspen canopy. The greater frequency of spruce outside the exclosure can be attributed to reduced competition from aspen seedlings, the latter being suppressed by browsing. The spruce seedlings are not being browsed.

Plot 4.

Plot 4 is located on the Hillsdale meadows and is considered favorable grassland winter range for elk. Pellet group counts indicated that use of that range was by elk exclusively.

In order to compare the forage production outside the enclosure with that inside, 8 quadrats, 3 feet square were clipped, 4 inside the enclosure, and 4 on the open range adjacent to it.

Forage production values measured in grams of air dry forage are presented along with those of previous years in table 3. We clipped the plots at a height of two inches. The previous workers did not specify the height at which they clipped.

Table 3. Forage production,\* Hillsdale range plot

Year	1946	1950 Oct.	1951		1952		1953 Aug.	1958 June 27
			May	Sept.	April	Oct.		
Enclosure	-	-	244	233	-	337	112	40
Open Range	130	127	38	123	64	164	136	54

\* Grams air-dried forage per three foot square quadrat.

The accumulation of dead herbaceous material inside the enclosure appears to be suppressing the new growth. Thus moderate grazing on the open range, by reducing the rate

of litter accumulation may stimulate production.

Maximum growth of photosynthetic tissue had not been reached when the clipping was done June 27. However, production was probably lower in 1953 than in many previous years. The difference can be attributed to low precipitation.

Four 25 foot transects were laid out inside the exclosure and four on the adjacent grazed range. The density and species composition of the plant cover on the transects were measured by dropping a pointed metal rod at 100 points at 5 inch intervals on a 25 foot steel tape stretched along each transect. If the point struck the crown of a plant, a hit was recorded for that species. Otherwise it was noted whether the point struck bare soil, erosion, pavement, rock, litter, or rock. The results of the analyses are given in table 4.

That technique provided data comparable to the Clarke point sample method used in previous years.

Table 4. Species Composition and Density of Plant Cover, Plot 4, Hillside meadow

Transect No.	Protected Plot				Open Range				Protected Mean	Open Range Mean
	1	2	3	4	1	2	3	4		
<i>Poa</i> sp.	31	19	17	24	25	8	10	10	23	13
<i>Stipa richardsoni</i>	3	2	2	4	16	31	23	21	3	22
<i>Danthonia intermedia</i>	trace									
<i>Agropyron trachycaulum</i> var. <i>unilaterale</i>					3	1		1		1
Total grasses	34	21	19	28	42	40	33	32	26	36
<i>Hieracium</i> sp.							1			1
<i>Sisyrinchium angustifolium</i>		1							1	
<i>Oxytropis splendens</i>					1		2			2
<i>Anemone multifida</i>										
<i>Viola</i> sp.						1		1		1
<i>Dors</i> sp.						1				1
Total forbs	0	1	0	1	1	2	4	1	1	2
Litter	66	63	65	62	54	50	63	67	64	60½
Moist.	0	15	16	9	3				10	2
Plant density index	36	22	19	29	45	42	37	33	26½	30

On inspecting table 4 it is apparent that under grazed conditions richardson needle grass *Stipa richardsoni* has increased, partly at the expense of blue grass, *Poa* sp., which has apparently decreased with grazing. Also, the total grass



cover is greater under grazed conditions than under protected conditions.

In table 5 the forage class composition obtained in plot 4 in 1958 is compared with those determined in previous years.

Table 5. Forage Class Composition, Plot 4, Hilledale meadow

	Protected Plot			Open Range		
	1944	1953	1958	1944	1953	1958
Grasses	40	36	26	39.8	43.5	36
Forbs	12	0.6	0.5	60	3.0	20
Strubs	0	0	0	0	1.0	0
Total	52	36.6	26.5	45.4	47.5	56.0

On inspecting table 5 it is noted that the density of grasses, forbs, and total plant cover both in the protected plot and on the open range are lower this year than they have been in previous years in which they were measured. That can be attributed to climatic factors. The grass cover in the grazed and protected plots was the same in 1944 when the fence was built. Since then the difference between the grass cover between grazed and protected areas has increased, the grazed area having the more dense grass cover. Forbs have decreased in the protected plot to the point where they have almost disappeared. On the grazed area they have decreased also, but less markedly.

Plot 5.

Range plot 5 is located 17 miles west of Lauff on the south side of the old highway. It is a moist area carrying a dense stand of willows with traces of dwarf birch.

Moist group frequency showed that the range in the vicinity of plot 5 was used by both elk and moose, slightly more by the latter.

In plot 5 an Aldous browse dominance survey was made on 52 one-acre quadrats inside the enclosure, and 50 quadrats on the adjacent open range as was done by Webb in 1953. Similarly the frequency of various height classes of browse plants were tallied as was done by Webb.

The average Aldous dominance values for plot 5 in 1958 were 58% in the enclosure and 49% on the open range. These can be compared to values of 51% in the enclosure and 43% on the open range found by Webb in 1953. These values are simply an index to the density of the shrubby cover represented in per cent. They demonstrate that the willow cover is becoming more dense both in the browsed and protected areas. The effect of browsing is slightly reducing the rate at which the willow cover closes on the open range.

The height classes of browse plants tallied in the plot 5 enclosure and on the open range in 1953 and in 1958 are shown in table 6.

Table 6. Height Class Frequencies of Browse Plants,  
Plot 5, 1953 and 1958\*

50  
52 quadrants

Species	Height Class	Frequency			
		1953		1958	
		Enclosure	Open Range	Enclosure	Open Range
Salix sp. Density/m <sup>2</sup>	< 4 ft.	4.0 .9895	6.7 .7051	0.7 .1230	2.4 .5931
	> 4 ft.	2.1 .5199	0.5 .1236	1.1 .2718	0.2 .0494
Betula glandulosa Density/m <sup>2</sup>	< 3 ft.	0	.04 .0099	.03 .0198	0.3 .0741
	> 3 ft.	0	0	0	0

\* No. of plants per hectare plot.

The total numbers of willows tallied both within and without the enclosure in 1958 is much smaller than in 1953. There is no evidence of a heavy mortality of willows in recent years and the density of the willow cover as measured by the Aldous method had increased. Therefore the explanation for the decline in number of plants must be that I tallied as one plant willows which Webb considered to be more than one. That is understandable. When willow stands are young several shoots from one root may appear to be separate plants. As they grow older they merge into one clump. It is apparent that the proportion of the willow population over 4 feet high has increased within the enclosure over the period since 1953. Outside the enclosure the browsing by moose and elk has retarded the upward growth of willows so that the proportion of plants over 4 feet high has not increased since 1953. The willows outside the

exclosure while not as tall as those inside are vigorous and in an equally productive condition. Browse utilization is not excessive in that area.

Summary and Conclusions.

The effect of game use on the plant cover is most marked in the area including plot 3, ten and one half miles west of Banff on the old highway. There, elk are preventing new aspen shoots from exceeding one foot in height. Young aspen is a highly preferred winter forage for elk in Banff park. As short in supply as it is now in the lower Bow Valley, it is possible that even a small wintering elk population would keep it suppressed. It is recommended that elk be controlled at a low level in that area.

The density and production rate of the grass cover on the Hilledale meadows were less in June 1958 than in previous surveys. It is thought that the reduction is due mainly to climatic factors as the measurements are low in the exclosure as well as on the open range. Grass density and production are higher on the open range than within the exclosure. The difference is made up largely of richardson needle grass, Stipa richardsoni which is apparently favoured in that locality by moderate grazing. Poa sp., blue grass is lower in density within the exclosure than without it. Utilization of the Hilledale meadow by elk is not considered excessive.

On the willow flats around plot 5, seventeen miles west of Lauff, browsing by moose and elk has slightly suppressed the upward growth of willows outside the enclosure. The density of browse cover as indicated by the Aldous dominance value is slightly lower in the area adjacent to the enclosure than within the enclosure. That was the case in 1953, although density both within and without the enclosure has increased slightly. It is believed that the productivity of willows outside the enclosure has not been reduced by browsing, and that the current combined use by elk and moose is not excessive.

The elk population wintering in the Bow Valley should not be allowed to increase beyond the 1958 level. It would be preferable to reduce it further in view of conditions in the plot 5 area.

The three range enclosure plots should be analyzed again not later than 1963 in order to follow changes in the plant communities as they occur under conditions of use by elk and moose, and protection from foraging.

The fence posts on all three enclosures should be replaced as soon as possible as they are rotten at ground level.

*Donald R. Flock*  
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 Donald R. Flock

Edmonton, Alta.  
 July 20, 1959.

CWS-8-58 Flook, D. R. Analyses of range enclosure, Bow Valley, Banff Park, 1958.

DATE	ISSUED TO	DATE	ISSUED TO
Aug 31 73	Lee Venable	May 15 78	Trotter
July 15 75	G. Trotter		
12 Jan 77	D. Karasula		
18 May 79	D. Thompson / McCourt management		
22 Nov 93	JUN 22 1978 G. Trotter		