Elk winter food habits and forage quality along the Eastern Slopes of Alberta: A review.

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Abstract: A review of the limited number of studies on elk winter food habits along the Eastern Slopes of Alberta shows that elk prefer grasses and grasslike plants over shrubs. When available, rough fescue (Festuca scabrella) can contribute up to 86% of the elk winter diet. In the absence of rough fescue or fescue species (Festuca spp.), elk prefer sedges (Carex spp.) over tufted hairgrass (Deschampsia caespitosa), wheat grass (Agropyron spp.) and wild rye (Elymus innovatus). The nutritional content of elk forage on winter ranges is below maintenance requirements. The selection for grasses and sedges has been related to their digestible energy content which is higher than in shrubs (65% vs. 48%). However, the nutritional value for elk of individual grass and sedge species is not known. Hence, the determining factors that shape elk diet preferences among the numerous grass and grasslike plants cannot be assessed.

INTRODUCTION

Forage selection of elk in North America has been extensively studied by numerous authors (for a review see: Kufeld 1973 and Nelson and Leege 1982). However, our understanding of diet selection of free-ranging elk in Alberta is limited. In 1947, Cowan studied range competition between deer, bighorn sheep and elk in Jasper National Park and estimated elk diet composition through direct observation of grazing animals. A similar study to assess interactions between moose, bison and elk was conducted by Holsworth (1960) in Elk Island National Park.

More recently, Cairns (1976) determined elk food habits in Elk Island National Park through fecal fragment analysis. Fecal fragment analysis was also used by Morgantini and Olsen (1983) in studying feeding behavior of free-ranging elk in the boreal forests of west-central Alberta. But, since 1947, elk diets along the Eastern Slopes were only studied by Berg (1983), while assessing wildlife-livestock interactions in south-western Alberta, and by Morgantini north of the Bow river (Morgantini and Hudson 1983; Morgantini and Russell 1983; Morgantini and Bruns 1984; Morgantini and Hudson 1985; Morgantini 1987).

This limited amount of information is most unfortunate since elk are a widely adaptable species able to shift its foraging behavior depending on local forage availability and

environmental conditions. Furthermore, knowledge of site-specific elk feeding habits is necessary if and when one of the objectives of reclamation is to provide elk habitats.

The aim of this paper is to summarize and review our knowledge of food habits of free-ranging elk along the Eastern Slopes of north-western Alberta and to relate diet selection to forage quality and availability.

STUDY AREAS

The studies which are summarized in this paper were conducted in four distinct elk winter ranges located just inside the East Front Ranges of the Rocky Mountains.

One winter range, the Ya Ha Tinda Ranch, is found along the Red Deer River. It is used by approximately 400-800 elk. The area consists of a rolling, native rough fescue grassland with widely dispersed patches of willow (Salix spp.) and dwarf birch (Betula glandulosa) (Morgantini and Hudson 1985).

A second winter range is situated along the Clearwater river, approximately 25 km. north of the Red Deer river. This range is less extensive than the first. It is still characterized by the presence of rough fescue. However, the area supports also significant extensions of tufted hairgrass and sedge communities (Morgantini and Russell 1983). This range is used by some 300 animals.

The third study area along Ribbon creek is characterized by very poor drainage conditions. Sedge communities and willow

thickets cover 60 to 70% of the range. Dry grasslands communities are restricted to the edges of the area and on rolling knobs. Rough fescue is present (Morgantini and Russell 1983).

The fourth winter range is located along George creek, a tributary to the Blackstone river, approximately 150 km north of the three previous ranges. The area is largely represented by dwarf birch-willow thickets growing on a periodically flooded alluvial meadow. Grasslands communities are restricted to small open slopes and higher plateaus. Following a moisture gradient, in the transition zone between the shrub thickets and dry grassland communities, sedge species are replaced by tufted hairgrass (Morgantini and Russell 1983). Rough fescue is not present. The area supports a very small elk population.

METHODS

Elk monthly food habits were determined by identification of plant cuticular fragments in the feces (Hansen et al. 1973, Dearden et al 1975). Analyses were carried out by the Composition Analysis Laboratory, Colorado State University.

Forage crude protein was assessed using the macro-Kjeldahl method (AOAC 1965).

Forage digestibility was determined through in vitro digestion trials using elk rumen inoculum.

A more detailed description of the methods used in studying

food habits of elk along the Eastern Slopes of Alberta can be found in Morgantini and Russell (1983) and Morgantini and Hudson (1985).

RESULTS AND DISCUSSION

Food habits

Winter diets of elk are summarized in Table 1. For comparison, elk winter diets from the Elk river region outside the Eastern Slopes have been included.

Along the Eastern Slopes, grasses are the major component of the winter diets. Their contribution ranged from 88% along the Red Deer river to 75% along the Clearwater river, 61% on Ribbon Creek and 39% along George creek. These variations parallel the different availability of dry grasslands communities on each winter range. Dry grassland communities represent 55% of the winter range along the Red Deer river, but only 37% along the Clearwater river and 20% on Ribbon creek. On the winter range along George creek, dry grassland communities cover only 4% of the area. Sedge communities are also limited (6% cover of the area). The limited availability of grasses and grasslike species is reflected in the higher contribution of browsing.

Environmental conditions are quite different in the Elk river region. In this area the presence of grasses is mostly restricted to reclaimed right-of-ways and wellsites. Muskegs represent the dominant vegetational feature of the region and

Table 1. Winter diets of elk along the Eastern Slopes and in the Elk river region. December-April. Percentages.

	Grasses	Sedges	Shrubs	Forbs
Eastern Slopes:				
Red Deer river*	88.2	4.2	3.7	2.2
Clearwater river**	75.2	14.2	7.1	1.1
Ribbon creek**	61.1	20.6	11.2	3.2
George creek**	39.2	20.4	23.8	3.8
Boreal forest environment:				
Elk river:				
1980-81***	9.9	42.7	17.1	6.7
1981-82***	14.3	35.5	28.1	1.3

Sources: * Morgantini and Hudson 1983
** Morgantini and Russel 1983
*** Morgantini and Olsen 1983

sedge species are abundant. This abundance is shown by the composition of winter diets, where sedges made up from 35 to 42% of the diet, while grasses only contributed between 9 and 14%.

Species composition of winter diets is summarized in Tables 2 and 3.

Rough fescue constituted the bulk of the diet along the Red Deer and Clearwater rivers, and on Ribbon creek (Table 2). The diffence among the three ranges parallels the availability of fescue communities, and hence rough fescue biomass, in the three study areas.

A smaller contribution of rough fescue to the diet corresponded to a higher contribution of sedges. Even though other grasses species (wild rye, wheat grass, june grass (Koeleria cristata), tufted hairgrass) are abundant in the study areas, their contribution to the diet did not significantly change.

Rough fescue is not present in the Blackstone region. Nonetheless, fescue species, mostly sheep fescue (Festuca ovina), made up 34% of the diet in December (Table 3). Their contribution dropped to 5% in March. In this area, the availability of sedge species is limited. With a decrease in the availability of fescue, due to early winter grazing, elk grazed on any grass or grasslike plant available. The animals shifted from the apparently preferred fescue species to the least preferred wild rye and tufted hairgrass.

Table 2. Percentage contribution of grass and grasslike species to the diet of elk on three winter ranges along the Eastern Slopes. December-April.

	Red Deer river	Clearwater river	Ribbon creek
Fescue spp.	86.9	69.5	54.8
Wild rye	0.8	2.7	2.9
June grass	1.1	2.0	0.0
Tufted hairgrass	0.0	1.2	1.6
Sedge spp.	3.5	13.7	20.1

Sources: Morgantini and Hudson 1983;
Morgantini and Russell 1983

Table 3. Percentage contribution of grass and grasslike species to the diet of elk on the George creek winter range. December and March 1982-83. (Morgantini and Russell 1983).

	December	March
Fescue spp.	34.9	5.7
Wild rye	0.0	12.3
June grass	0.0	2.8
Tufted hairgrass	5.2	11.2
Sedge spp.	13.4	24.9

Diet composition for the winters of 1980-81 and 1981-82 outside the Eastern Slopes is summarized in Table 4.

As previously indicated sedge species make up the bulk of the grass and grasslike component of the diet. Blue grass (Poa spp.) and fescue (Festuca spp.) are the two preferred grass species.

Forage quality

Nutritional values of elk forage species in winter are summarized in Table 5.

In winter, along the Eastern Slopes of western Alberta, all the major elk forage species, with the exception of willow twigs, contained levels of crude protein well below maintenance requirements (5.5-6.0% for elk; 5.9% for beef cattle; Nelson and Leege 1982, NRC 1976). The preference for grass and grasslike species, in spite of their sub-maintenance crude protein content, has been attributed to their higher digestible energy content (65% in grasses, 48% in willow: Morgantini and Hudson 1985). It has been suggested that in winter elk select for high energy forage and that submaintenance protein intake may not be as critical as low energy intake (Morgantini and Russell 1983). The importance of providing high energy forage on elk winter ranges has been underlined also by Nelson and Leege (1982). Nonetheless, to the present day there is no sufficient data to compare grass and grasslike species on the basis of their winter nutritional value for elk. Plant species-specific data available from the

Table 4. Percentage contribution of grass and grasslike species to the winter diet of elk in the Elk River region. December-April 1980-81 and 1981-82. (Morgantini and Olsen 1983).

	1980-81	1981-82
Agropyron spp.	0.0	0.4
Agrostis spp.	0.1	0.3
Bromus spp.	0.4	0.2
Calamagrostis spp.	0.7	0.3
Carex spp.	40.5	33.3
Elymus innovatus	0.3	0.1
Festuca spp	3.3	6.0
Juncus spp.	0.6	2.2
Koeleria cristata	0.1	0.1
Luzula spp.	0.1	0.0
Oryzopsis (type)	0.7	0.0
Poa spp.	6.2	6.1
Schizachne	0.4	0.0

Table 5. Elk forage quality in winter along the Eastern Slopes and from the rough fescue association.

	Protein* (%)	(from Bezeau and Johnston 1962) Dig.Prot. (%)	Cellulose (%)	Dig.coeff. (%)	N.V.I.
Rough fescue	2.3-3.2	1.0	39.5	24.0	23.7
Wild rye	3.1-3.2	0.5	47.4	18.3	16.2
Wheat grass	3.1-3.3	0.4	46.1	21.2	20.2
June grass	2.5-3.3	-	-	-	-
Blue grass	2.4-2.6	-	-	-	-
Tufted hairgrass	3.6-3.9	0.3	34.2	6.2	0.3
Carex spp.	4.5-6.6	0.6	34.4	11.7	7.6
Northern brome		1.9	43.1	43.7	49.6
Red fescue		1.0	29.6	11.7	7.6

Sources: * Morgantini and Russell 1983 and Morgantini and Hudson 1985

Eastern Slopes is limited to crude protein content (Table 5) and phosphorus, calcium, selenium and ADF contents (Morgantini and Russell 1983). In the 60's, Johnston and Bezeau (1962), Bezeau and Johnston (1962) and Johnston *et al* (1968) determined chemical composition and digestibility of forage plants from alpine tundra and rough fescue association. Their digestibility values were based on the digestibility of cellulose. As shown in Table 5, these values, and the Nutritional Value Index (N.V.I.) derived from them, do not explain elk winter diet preference. For instance, the nutritional value index of wild rye and wheat grass species is significantly higher than that of sedge species, but the latter are preferred by elk over wild rye and wheat grass (Tables 2 and 3). Further, based on the Nutritional Value Index northern brome (*Bromus pumpellianus*) is almost 7 times as nutritional as red fescue (*Festuca rubra*) and sedge species (Table 4). But, even though northern brome is widely present on disturbed or reclaimed sites in the Elk river region, elk preferred sedge, blue grass and fescue species (Table 4).

CONCLUSIONS

In view of the variability of elk feeding behavior, it is most unfortunate that no other comparable study on elk winter diets has been conducted along the Eastern Slopes of central and north central Alberta. The available studies indicate the following:

1. Elk prefer grass and grasslike plants to shrubs;

2. Rough fescue is the most important winter forage for elk along the Eastern Slopes. This is also indicated by Berg (1983) in south-western Alberta;

3. In the absence of rough fescue or other fescue species, elk will prefer sedges to tufted hairgrass, wheat grass and wild rye species;

4. Availability of preferred plants, or their accessibility, will determine diet composition.

Little is known on the plant factors that will determine forage selection. There are indications that elk will select for plants with a high digestible energy. Digestibility has been used as a index of palatability (Nowlin 1974). The ongoing study by Pat Fargey and Alex Hawley near Hinton may provide a better understanding of the factors affecting elk selection among cultivated grass species. Where one of the objectives of land reclamation is to provide elk habitats, this knowledge may be used to develop an ideal seed mixture. However, it must be recognized that the utilization by elk of a reclaimed site will be ultimately determined by site specific environmental conditions, animal traditional behaviour and the presence of human activities.

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