

Population Characteristics of Elk, *Cervus elaphus*, in Spruce Woods, Southwestern Manitoba

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Spruce Woods was censused by aerial survey during three winters (1976-79) in order to determine the size, distribution and structure of the Elk population. Results indicate Elk have increased since the early 1960's when only a few individuals were believed to be present in the area. By 1978-79, the Elk population had increased to about 651 animals, the majority of which were in the Forest Reserve. The density of Elk in the Reserve was 0.60 per km² in 1976-77 and 0.91 per km² in 1978-79. During the same period, the density of Elk in the adjoining Provincial Park ranged from 0.10 per km² to 0.40 per km². The male: antlerless ratio averaged 17:100 during the three years of study. Mixed-sex and female (antlerless) aggregations of Elk were larger in the Reserve than in the Park. Male Elk tended to be solitary or to form small groups in both areas. Further increases of Elk are anticipated and the herd is expected to follow the typical eruptive pattern of ungulate growth.

Key Words: Elk, Wapiti, *Cervus elaphus*, population density, sex ratio, and aggregation size.

Early records indicate that Elk (*Cervus elaphus*) were indigenous to Spruce Woods but disappeared from the district by early settlement, about 1887 (Criddle 1929). There is no record of Elk in the area for approximately the next forty years: "... except for occasional strays from the north" (Soper 1946, p. 150.).

Elk were not recorded with regularity in Spruce Woods until the early 1960's when a population was re-established. Wrigley (1974) presented the following numbers suggesting that Elk reinvaded Spruce Woods as follows: 1958, 2; 1959, 0; 1960, 15; 1961, 35; 1962, 58; 1963, 63. There were at least 145 Elk in the area by 1969 (Ransom 1969).

Prior to this investigation, therefore, Spruce Woods Elk received only cursory scientific study; there being no systematic attempt to document the herd's status. My study was initiated in January 1977 with field work continuing through July 1978. In addition, a third winter of aerial survey counts (1978-79) was provided (G. Meseman, personal communication). Results pertaining to population size, structure, and distribution, and aggregation size are presented. Observed variations between the two adjoining land jurisdictions; namely, Spruce Woods Forest Reserve and Spruce Woods Provincial Park, are explained in terms of historical and present land uses.

The Study Area

Spruce Woods is a district in southwestern Manitoba (49°55'N, 99°37'W) with a total area of approximately 930 km². Included within this area are Spruce Woods Forest Reserve (599 km²) and the adjoining Spruce Woods Provincial Park (265 km²) [Figure 1].

The surrounding area is a mixture of private and crown land.

Spruce Woods occurs within the eastern Aspen-Oak and mixed-wood section of the Aspen Parkland (Bird 1961). The Parkland, a transition zone, is characterized by a mosaic of Aspen (*Populus tremuloides*), White Spruce (*Picea glauca*) and grassland. Aspen is the most prevalent species, invading the grasslands as small groves or occurring as irregularly-shaped stands. The mixed-wood section is distinguished by the presence of Spruce and Tamarack (*Larix laricina*).

The topography is rolling to hummocky as a result of the stabilized sand dune formations (Ehrlich et al. 1957). The climate is classified as a humid continental, cool-summer (Critchfield 1974). Distinguishing features of the climate are seasonal temperature extremes and annual variability of precipitation. Snowfall is typically 25 to 40 cm.

Spruce Woods Forest Reserve has been leased to the Canadian Department of National Defense since 1932, and public access to the Reserve has been restricted since that time. Wildfires have occurred frequently and have created a habitat with interspersions of grassland, shrubland, and seral Aspen communities. Grasslands and Aspen communities less than 15 years old comprise approximately 74% of the vegetation mosaic (Kerr et al. 1978).

Spruce Woods Provincial Park was established in 1970 and has a history of settlement and agricultural use. The Park has no recorded history of wildfire and since about 1970, all-season, multiple-use recreational developments have been present. During the years of this study, approximately 18 000 visitors used the

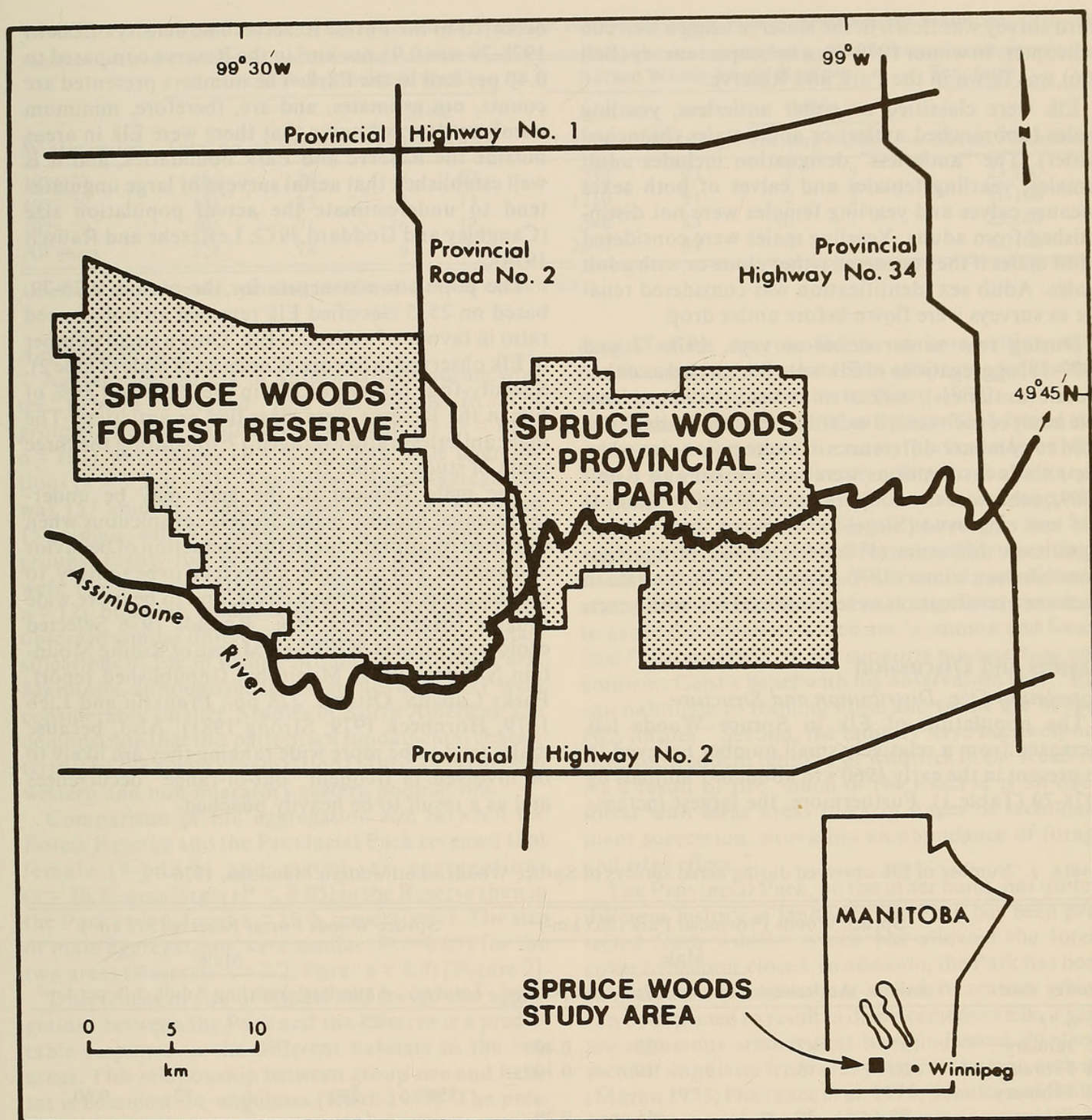


FIGURE 1. Map of Spruce Woods, southwestern Manitoba, showing names and places of importance.

Park annually. The Park is characterized by contiguous stands of Aspen and Aspen-Spruce forest. Grasslands and stabilized openings comprise about 5% of the vegetation cover (Hornbeck 1979).

During the study, the Elk herd was not legally hunted and the area has few, if any, large predators such as Wolves (*Canis lupus*) or Black Bears (*Ursus americanus*).

Methods

The data were collected during three winters (1976-79) of aerial surveys using parallel north-south linear strips covering at least 80% of the study area (Hornbeck 1979). Six fixed-wing aircraft surveys were flown during winter 1976-77; five in the Park and one in the Reserve. During winter 1977-78, two fixed-wing aircraft surveys were flown in the Park and Reserve and a

third survey was flown in the Reserve using a Bell 206 helicopter. In winter 1978-79, a helicopter survey (Bell 206) was flown in the Park and Reserve.

Elk were classified as either antlerless, yearling males (unbranched antler) or adult males (branched antler). The "antlerless" designation includes adult females, yearling females and calves of both sexes because calves and yearling females were not distinguished from adults. Yearling males were considered adult males if they occurred either alone or with adult males. Adult sex identification was considered reliable as surveys were flown before antler drop.

During two winter aerial surveys, 1976-77 and 1977-78, aggregations of Elk were designated as either female (antlerless), male or mixed-sex (having at least one adult of each sex). Student's *t* test (two-tailed) was used to compare differences in aggregation size when the *t* test's assumptions were met (Sokal and Rohlf 1969), otherwise the nonparametric Mann-Whitney U test was employed (Siegel 1956). Since there was no significant difference ($P > 0.05$) in size of aggregations between winters 1976-77 and 1977-78, the data in each sex classification were combined for both years.

Results and Discussion

Population Size, Distribution and Structure

The population of Elk in Spruce Woods has increased from a relatively small number believed to be present in the early 1960's to about 651 animals by 1978-79 (Table 1). Furthermore, the largest increase

occurred in the Forest Reserve. The density of Elk in 1978-79 was 0.91 per km² in the Reserve compared to 0.40 per km² in the Park. The numbers presented are counts, not estimates, and are, therefore, minimum numbers. It was known that there were Elk in areas outside the Reserve and Park boundaries, and it is well established that aerial surveys of large ungulates tend to underestimate the actual population size (Caughley and Goddard 1972; LeResche and Rausch 1974).

The population structure for the period 1976-79, based on 2535 classified Elk revealed an unbalanced ratio in favour of antlerless Elk. Only a small number of Elk observed in Spruce Woods were male (Table 2). Seventy-four percent of Elk in the Park and 89% of Elk in the Reserve were classified as antlerless. The male:antlerless ratio averaged 17:100 during the three years of study (Table 2).

The male segment of the herd may be under-represented because males are less conspicuous when censused by aircraft due to the interaction of behavior and habitat. For example, males tend to be solitary, to inhabit areas of extensive cover, and to be more wide ranging (Moran 1973; R.C. Rounds 1976 Selected ecological aspects of Elk and Moose of Riding Mountain National Park, Manitoba. Unpublished report, Parks Canada, Ottawa. 278 pp.; Franklin and Lieb 1979; Hornbeck 1979; Strong 1981). Also, because males tend to be more wide ranging they are likely to be involved in frequent "out-of-range" occurrences and as a result to be heavily poached.

TABLE 1. Number of Elk observed during aerial surveys of Spruce Woods, southwestern Manitoba, 1976-79.

Survey date	Spruce Woods Provincial Park (265 km ²)					Spruce Woods Forest Reserve (599 km ²)				
	Total no.	Antlerless ¹	Male		Elk per km ²	Total no.	Antlerless ¹	Male		Elk per km ²
			Yearling	Adult				Yearling	Adult	
<i>1976-77</i>										
17 January	107	82		25	0.40					
4 February	26	5	2	19	0.10					
12 February						358 ²	240	6	12	0.60
15 February	54	38		16	0.20					
28 February	60	46	5	9	0.23					
31 March	38	29	2	7	0.14					
Total/ Mean	285	40	2	15	0.22	358	240	6	12	0.60
<i>1977-78</i>										
4 January	64	55	2	7	0.24	370	341	6	23	0.62
20 January						420	350	19	51	0.70
28 February	67	54	6	7	0.25	420	406	1	13	0.70
Total/ Mean	131	54	4	7	0.25	1210	366	9	29	0.67
<i>1978-79</i>										
22 January	105	75	17	13	0.40	546	454	56	36	0.91

¹Includes adult females, yearling females and calves of both sexes.

²Includes a group of 100 unclassified Elk observed outside the Forest Reserve boundary.

TABLE 2. Percent classification of Elk observed during aerial surveys of Spruce Woods, southwestern Manitoba, 1976-79.

Winter period	Spruce Woods Provincial Park				Spruce Woods Forest Reserve				Sex ratio
	Total no.	Antlerless ¹	Male		Total no.	Antlerless ¹	Male		Males: Antlerless ¹
			Yearling	Adult			Yearling	Adult	
1976-77	285	70	3	27	258	93	2	5	23:100
1977-78	131	83	6	11	1210	91	2	7	11:100
1978-79	105	71	16	12	546	83	10	7	23:100
All years	521	74	6	20	2014	89	4	7	17:100

¹Includes adult females, yearling females and calves of both sexes.

Aggregation Size

Aggregations of Elk in Spruce Woods during winter 1976-78 averaged 10.8 individuals ($n = 174$ groups). Female (antlerless) aggregations ($\bar{x} = 14.0$, $n = 101$) were larger ($P < 0.01$) than male aggregations ($\bar{x} = 3.3$, $n = 61$). The largest single aggregation was 157 animals. Male aggregations never exceeded 15 animals, with a predominance of singles and small groups. Eighty-five percent of males groups ($n = 52$) were five or less. Mixed-sex aggregations ($\bar{x} = 22.7$, $n = 12$), however, tended to be largest. Rounds (1980) observed similar differences among identical sex classifications of Elk in Riding Mountain National Park, Manitoba, although the size of groups in RMNP were considerably smaller. Studies of North American Elk demonstrate that this pattern is a fundamental characteristic of Elk social organization (Murie 1979) in both western and non-migratory eastern populations.

Comparison of Elk aggregation size between the Forest Reserve and the Provincial Park revealed that female ($\bar{x} = 18.5$) and mixed-sex aggregations ($\bar{x} = 26.7$) were larger ($P < 0.05$) in the Reserve than in the Park ($\bar{x} = 6.4$ and $\bar{x} = 17.0$, respectively). The size of male aggregations were similar ($P > 0.05$) for the two areas (Reserve: $\bar{x} = 3.2$; Park: $\bar{x} = 3.3$) [Figure 2].

Differences in size of female and mixed-sex aggregations between the Park and the Reserve is a predictable response to the different habitats in the two areas. This relationship between group size and habitat is common for ungulates (Hirth 1977). The presence of extensive cover, as found in the Park, make it difficult for animals to remain in contact (Schaller 1967) and promotes opportunistic searching for forage by small groups (Geist 1982). On open ranges, as found in the Reserve, large aggregations afford individuals several advantages; less time spent watching for predators (Bergerud 1974) and less time spent finding forage by watching others (Clutton-Brock 1974). Thus aggregation size reflects an anti-predator strategy as much as a feeding strategy (Geist 1982). Male Elk do not exhibit the same response to changes in habitat. Presumably, there is no evolutionary benefit to male Elk in banding together on open

ranges where they would be in competition with females and possibly their own offspring. A dispersal strategy has evolved in males (Geist 1982).

Re-establishment of Elk in Spruce Woods and the subsequent period of increase, particularly in the Forest Reserve, can be directly related to the military's presence. First, by virtue of the military zone, the Reserve has been an effective sanctuary for Elk against direct human disturbance; military activities result, on most occasions, only in indirect disturbance. Geist (1971) theorized that ungulates can learn to avoid disturbances which are "common and localized." Strong (1982, p. 92) supports my assertion and confirms Geist's belief with his observation that: "Elk can habituate to training noise and to the use of specific locales." Second, the military have been responsible for frequent ignition of wildfires in the Reserve. As a result of fire, much of the Reserve is an open forest with large areas in early stages of secondary plant succession, providing an abundance of forage and edge effect.

The Provincial Park, on the other hand, has quite a different history of land use. The Park has been protected from wildfire which has allowed the forest cover to become closed. In addition, the Park has been subjected to intensive year-round recreation which can be expected to result in displacement of Elk. There are numerous studies that have indicated displacement of ungulates from areas of direct human activity (Moran 1973; Dorrance et al. 1975; Schultz and Bailey 1978; Rost and Bailey 1979; Ferguson and Keith 1982).

I believe the military's presence in the Forest Reserve has allowed re-establishment of Elk in that area and, in the absence of large predators or a legal hunting season, has promoted the subsequent increase. I also believe that the lack of seral vegetation and the presence of direct human disturbance have combined to limit the number of Elk in the Provincial Park.

The growth of the Spruce Woods Elk herd can be expected to follow Caughley's (1976) theory of the typical pattern of ungulate growth. According to

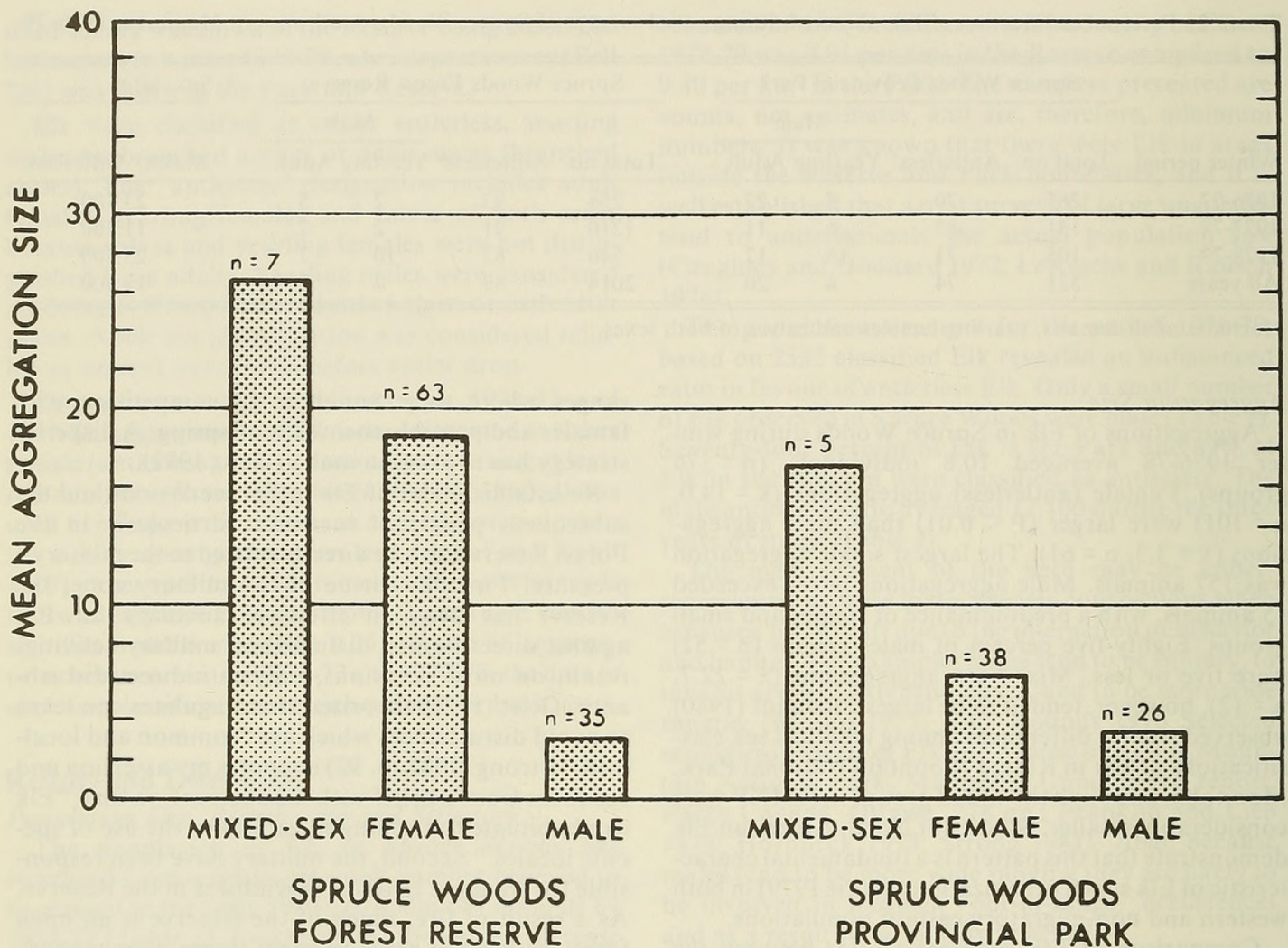


FIGURE 2. Comparison of aggregation size for mixed-sex (at least one adult of each sex), female (adult female, yearling female, and calves of both sexes), and male groups of Elk in Spruce Woods, southwestern Manitoba, winters 1976-78.

Caughley (1976, p. 198): "Whenever an ungulate population is faced with a standing crop of vegetation in excess of that needed for maintenance and replacement of animals, an eruption and crash is the inevitable consequence." Although the Spruce Woods Elk are not "undisturbed", that is, there is some poaching and a limited harvest was instituted in fall 1979, I believe the possibility of an eruption is realistic.

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Literature Cited

- Bergerud, A. T.** 1974. The role of the environment in the aggregation, movement and disturbance behavior of caribou. Pp. 552-584 in *The behavior of ungulates and its relation to management*. Volume 2. Edited by V. Geist and F. Walther. IUCN New Series Publication number 24. Morges, Switzerland.
- Bird, R. D.** 1961. Ecology of the aspen parkland of western Canada. Canada Department of Agriculture, Research Station Contribution 27. 155 pp.
- Caughley, G.** 1976. Wildlife management and the dynamics of ungulate populations. Pp. 183-246 in *Applied Biology*. Volume I. Edited by T. H. Coaker. Academic Press, London.
- Caughley, G., and J. Goddard.** 1972. Improving the esti-

- mates from inaccurate censuses. *Journal of Wildlife Management* 36(1): 135-140.
- Clutton-Brock, T. H.** 1974. Why do animals live in groups? *New Scientist* 63(905): 72-74.
- Criddle, S.** 1929. An annotated list of the mammals of Aweme, Manitoba. *Canadian Field-Naturalist* 43(7): 155-159.
- Critchfield, H. J.** 1974. General climatology, third edition. Prentice-Hall Inc., Englewood Cliffs, New Jersey. 446 pp.
- Dorrance, M. J., P. J. Savage, and D. E. Huff.** 1975. Effects of snowmobiles on White-tailed Deer. *Journal of Wildlife Management* 39(3): 563-569.
- Ehrlich, W. A., E. A. Poyser, and L. E. Pratt.** 1957. Report of reconnaissance soil survey of Carberry map sheet area. Canada Department of Agriculture, Soils Report 7. 93 pp.
- Ferguson, M. A. S., and L. B. Keith.** 1982. Influence of nordic skiing on distribution of Moose and Elk in Elk Island National Park, Alberta. *Canadian Field-Naturalist* 96(1): 69-78.
- Franklin, W. L., and J. W. Lieb.** 1979. The social organization of a sedentary population of North American Elk: a model for understanding other populations. Pp. 185-198 in *North American Elk: ecology, behavior and management*. Edited by M. S. Boyce and L. D. Hayden-Wing. The University of Wyoming.
- Geist, V.** 1971. A behavioral approach to the management of wild ungulates. Pp. 413-424 in *The scientific management of animal and plant communities for conservation*. Edited by E. Duffey and A. S. Watt. Eleventh Symposium of the British Ecological Society. Blackwell Scientific Publications, Oxford.
- Geist, V.** 1982. Adaptive behavioral strategies. Pp. 219-277 in *Elk of North America: ecology and management*. Edited by J. W. Thomas and D. E. Toweill. Stackpole Books, Harrisburg, Pennsylvania.
- Hirth, D. H.** 1977. Social behavior of White-tailed Deer in relation to habitat. *Wildlife Monograph* Number 53. 55 pp.
- Hornbeck, G. E.** 1979. Winter distribution, seasonal movements and cover type relationships of Elk in southwestern Manitoba. M.S. thesis, Colorado State University, Fort Collins. 151 pp.
- Kerr, G. D., R. C. Rounds, and J. W. Welsted.** 1978. Classification and measurement of attendant vegetation at Canadian Forces Base Shilo, Manitoba. *Transactions of the Fifth Canadian Symposium on Remote Sensing*. Victoria, British Columbia, pp. 408-414.
- Le Resche, R. E., and R. A. Rausch.** 1974. Accuracy and precision of aerial moose censusing. *Journal of Wildlife Management* 38(2): 175-182.
- Moran, R. J.** 1973. The Rocky Mountain Elk in Michigan. Michigan Department of Natural Resources, Wildlife Division, Research and Development Report Number 267. 93 pp.
- Murie, O. J.** 1979. The Elk of North America. Teton Bookshop, Jackson, Wyoming. 376 pp. [First published in 1951].
- Ransom, A. B.** 1969. Preliminary wildlife management studies of the Spruce Woods Provincial Park. Manitoba Department of Natural Resources, Parks Branch, Brandon. 38 pp.
- Rost, G. R., and J. A. Bailey.** 1979. Distribution of Mule Deer and Elk in relation to roads. *Journal of Wildlife Management* 43(3): 634-641.
- Rounds, R. C.** 1980. Aggregation behavior of Wapiti (*Cervus elaphus*) in Riding Mountain National Park, Manitoba. *Canadian Field-Naturalist* 94(2): 148-153.
- Schaller, G. B.** 1967. The Deer and the Tiger: a study of wildlife in India. The University of Chicago Press, Chicago. 370 pp.
- Schultz, R. D., and J. A. Bailey.** 1978. Responses of National Park Elk to human activity. *Journal of Wildlife Management* 42(1): 91-100.
- Siegel, S.** 1956. Nonparametric statistics for the behavioral sciences. McGraw-Hill Book Company, Toronto. 312 pp.
- Sokal, R. R., and F. J. Rohlf.** 1969. Biometry, the principles and practice of statistics in biological research. W. H. Freeman and Company, San Francisco. 776 pp.
- Soper, J. D.** 1946. Mammals of the northern Great Plains along the international boundary in Canada. *Journal of Mammalogy* 27(2): 127-153.
- Strong, J. T.** 1981. Distribution, range use and movements of Elk on the Shilo military reserve. Master of Natural Resource Management thesis, University of Manitoba, Winnipeg. 121 pp.
- Wrigley, R. E.** 1974. Mammals of the sandhills of southwestern Manitoba. *Canadian Field-Naturalist* 88(1): 21-39.

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