Winter-Range Utilization by Elk and Mule Deer in Southeastern Washington

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THE objective of this study was to determine the utilization of winter-range forage by elk, *Cervus canadensis nelsoni* and mule deer, *Odocoileus hemionus hemionus*, at different levels of population density. Some indication of the carrying capacity of grassland communities grazed by elk and deer alone is evident from the data presented here, and may be useful for comparison with ranges open to livestock grazing.

Method of Procedure

Two areas were selected for comparisons on the William T. Wooten Game Range, a 12,000-acre tract owned by the State of Washington Department of Game, where livestock had been excluded for 5 to 6 years. One area, designated as the "Elk Range," contained almost three times as many elk and about half as many deer as the other which was designated as the "Mule-Deer Range." On each area, clip plots (4 by 0.25 meters) were established in adjacent pairs to determine productivity and utilization of forage plants on grassy, southward-facing slopes. Open slopes covered mainly by herbaceous forage were considered the "key" areas most important for elk, the principal big-game animal in the Blue Mountains of southeastern Washington. Five 200-meter transects with five pairs of clip plots each were placed on the Elk Range; six on the Mule-Deer Range. Plots were clipped in September and October, 1949, and adjacent plots were clipped in early April, 1950.

Population densities of elk and mule deer were determined by direct observations made at intervals during the winter and early spring. These observations are recorded in Table 1. Admittedly, the population densities were not nearly as precise as those obtainable under controlled conditions in fenced pastures. The animals wandered freely into or out of the study areas, but their home ranges were sufficiently well established that ingress and egress were probably insignificant, as indicated by the relative uniformity of the census figures, particularly for the Elk Range. The elk first appeared on the areas sometime during the first two weeks in December and remained until the second week in May. Clipping to determine winter utilization was made April 5 to 7, immediately prior to renewed growth of the important herbs. Forage use and grazing months were, therefore, calculated for the four-month period, December to April.

The so-called "production" of bluebunch wheatgrass (*Agropyron spicatum*) actually represents only the amount of forage available at the time of clipping. Intermittent growth of this plant throughout the winter under favorable conditions precludes the determination of true production data. For management purposes this minor error is of little significance. Likewise, so-called "utilization," which represents the amount of forage removed during the time interval, results from several factors in addition to elk and deer consumption and is also not an

accurate term. Forage removal of bunchgrass resulting from factors other than big game were insignificant, but for cheatgrass (*Bromus tectorum*) and most forbs the removal from other causes was of major importance.

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The adequacy of the sample was tested by group comparisons, independent of pairing, of the fall and spring clippings

TABLE 1

Census and population density of elk and deer in study areas

DATE	ELK RANGE (1400 ACRES)				MULE-DEER RANGE (451 ACRES)			
	Elk		Mule Deer		Elk		Mule Deer	
	Number	*Days*	*Number*	*Days*	*Number*	*Days*	*Number*	*Days*
1949 Dec. 15	37		21		2		6	
		1,668*		357		230		311
1950 Jan. 6–7	108		10		18		21	
		3,888		1,512		666		594
Feb. 11–12	108		74		19		12	
		2,744		1,400		660		908
Mar. 12	88		26		—		—	
		2,633		662				
Apr. 8	107		23		5		21	
Apr. 15–16	69		43		5		19	
Apr. 23	81		33		—		—	
May 6	89		15	—	—		—	
May 14	0		7		—		—	
Dec. 15–Apr. 8:								
Total grazing days	10,933		3,931		1,556		1,813	
Acres per month	4		11		9		7	
Average number of animals per square mile	41		14		16		21	

* $\frac{37 + 108}{2}$ elk × 23 days = 1,668 elk-days.

Pairing plots appeared to increase the efficiency of sampling only slightly. For total forage on the Elk Range, 1.2 times as many plots would have been required if the data were not paired. In this case pairing was scarcely worthwhile. For wheatgrass on the Mule-Deer Range, about 1.5 times as many plots would have been required if they were not paired. Since the efficiency gained by pairing with the small number of plots involved was not appreciably great, the procedure can be recommended only where the additional effort and expense of securing paired data are not important limiting considerations.

The adequacy of the sample was tested by group comparisons, independent of pairing, of the fall and spring clippings for wheatgrass on each range. Setting "t" at the five-percent level of significance in the formula, $n = 2s^2t^2/\bar{x}$ (p. 80 in Snedecor, 1946), for the Elk Range, 7 plots would have been required in fall and in spring to sample adequately for the 78 percent reduction that occurred. On the Mule-Deer Range, 20 plots would have been required each season to sample adequately for the 49 percent reduction that occurred. Actually 24 usable plots were established each season on the former and 30 on the latter.

Results and Discussion

Production and Utilization

The productivity of the two areas was approximately the same (Table 2), as analysis of variance showed that the differences in total forage (299 and 283 lb./ac.) and bluebunch wheatgrass (209 and 206 lb./ac.) were not significant. On

TABLE 2

Forage production and utilization

SPECIES	ELK RANGE		MULE-DEER RANGE	
	Production	Utilization	Production	Utilization
	Lbs. per acre	*Percent*	*Lbs. per acre*	*Percent*
Grasses:				
Agropyron spicatum....	209	78	206	49
Festuca idahoensis.....	6	50	13	85
Bromus tectorum.....	53	85	25	92
Forbs, total:.....	28	86	27	89
All herbs, total:.....	299	82	283	60

the Elk Range, 82 percent of all herbs and 78 percent of the wheatgrass by air-dry weight were removed from the range between fall and spring. In contrast, 60 percent of all herbs and 49 percent of the wheatgrass were removed from the Mule-Deer Range. For spring clippings, the differences between areas were highly significant for both total forage (54 and 113 lb./ac.) and wheatgrass (46 and 105 lb./ac.), indicating that the reductions were much greater on the Elk Range than on the Mule-Deer Range. Since the fall productivity of the two ranges was essentially the same, the greater reduction in all forage and particularly in wheatgrass can be attributed only to the higher population density of elk on the Elk Range. On this area, as shown in Table 1, only four acres were available per elk-month.

Idaho fescue (*Festuca idahoensis*) was approximately twice as abundant on the Mule-Deer Range as on the Elk Range (Table 2). According to the Range Plant Handbook (1937), Idaho fescue is a choice forage plant relished by all classes of livestock. Presumably, it also ranks high for elk and mule deer. It appeared to be more palatable than bluebunch wheatgrass in the present study, since it was found utilized in greater amounts than wheatgrass where both occurred together in abundance. The higher utilization (85 compared to 50 percent) of Idaho fescue was correlated with the area of higher production (13 compared to 6 lb./ac.), and apparently reflected the influence of availability upon utilization.

It is noteworthy that 85 percent of the cheatgrass on the Elk Range, and 92 percent on the Mule-Deer Range, was removed between fall and spring. This reduction represents primarily a loss in weight resulting from curing, trampling, packing by snow, leaching, washing during run-offs, and bacterial decomposition, rather than animal utilization. The plant does not appear to be utilized in a cured state, but elk were observed feeding avidly on cheatgrass in early May when the forage was green and fairly abundant in patches on benches and ridges.

The reduction in forb forage likewise resulted, at least in part, from factors other than grazing, although perhaps greater winter utilization may be expected on this group of plants than on cheatgrass.

Influence of Game Reserve

The Elk Range was located adjacent to a game reserve, approximately 35 square miles in area, from which elk migrated to obtain winter forage. This reserve was closed during the period 1932–1940 and open to elk hunting in 1945, 1946, 1947, and 1950. A significant reduction in the elk population occurred only in 1950 when the reserve was open for the first time to

all hunters for elk of either sex and any age. Previous seasons were primarily for bulls, although during some years a few cow permits were issued. The reserve served as a reservoir, providing large numbers of elk for a limited winter range. Elk also migrated from areas surrounding the reserve to winter in the vicinity of the study area on Abel Ridge, one of the most important wintering areas in the Blue Mountains. The population density on this area was particularly high during the severe winters of 1948–49 and 1949–50, two of the coldest winters on record. Early snowfalls drove the elk to lower elevations and persistent snow throughout the winters held them there. In the spring of 1950 the elk did not depart for the summer range until sometime between May 6 and 14 (Table 1).

Carrying Capacity

Blaisdell and Pechanec (1949) have shown that clumps of bluebunch wheatgrass clipped to ground level on October 30 produced as much herbage the following year as unclipped clumps. The greatest reduction in the following year's herbage resulted from clippings made in late May and early June, and the effect of late-fall clipping was slight. Further evidence that wheatgrass may withstand high utilization during the period of dormancy is presented by Daubenmire (1940) who observed that a fence-corner relic remained in fair condition despite ground-level grazing by livestock in the fall. Based on this evidence, the 78 percent utilization of wheatgrass on the Elk Range during the winter season did not appear to exceed the physiological limits of the plant. Yet it seems risky to base carrying capacity only on utilization of the key forage plant. Continued soil loss through washes, slips, and surface run-off, early spring trampling in water-saturated soil, packed trails that accelerated erosion, low density of the vegetation, scarcity of litter, and persistence of cheatgrass on the drier exposures and overused benches, and other factors indicated that the range was not in good condition. It appears doubtful that the range would recover to the desired stage of development under a grazing pressure of 4 acres per elk-month and 11 acres per deer-month. Furthermore, utilization of wheatgrass extended into the growing season in 1950. Probably this is a common phenomenon following severe winters and late forage production on the summer range. However, despite heavy use of elk during periodic severe winters, the vegetation on the Wooten Game Range improved considerably in composition and productive capacity during the 5 to 6 years after the removal of livestock. Elimination of cattle grazing during the summer undoubtedly made possible the recovery of the vegetation that has occurred.

In comparing the two study areas, it was apparent that the vegetation on the Mule-Deer Range was in a healthy, satisfactory condition, while that on the Elk Range was seriously abused by both previous and current overuse. The data presented here indicate that the grassland vegetation can be maintained in good condition when not over 50 percent of the wheatgrass is utilized, and that 9 acres per elk-month and 7 acres per deer-month reflected approximately proper population densities over the period of time when the range was used.

Summary and Conclusions

Comparison of two areas, one of which contained approximately three times as many elk and half as many deer as the other, showed no significant difference in fall productivity of herbaceous forage. In the spring, the difference between the areas in remaining forage was highly significant as a result of much higher utili-

zation by elk on one area. At a population density of 41 elk and 14 deer per square mile, or 4 acres per elk-month and 11 acres per deer-month, 78 per cent of bluebunch wheatgrass was removed, whereas only 49 percent was removed at a population density of 16 elk and 21 deer per square mile, or 9 acres per elk-month and 7 acres per deer-month. Despite rather heavy winter use, the vegetation on the Wooten Game Range as a whole has shown considerable improvement since summer grazing by cattle was eliminated. Recovery of the grassland vegetation was seriously retarded where elk were most numerous. To maintain the vegetation in vigorous condition, it is recommended that winter use not exceed 50 percent of bluebunch wheatgrass.

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LITERATURE CITED

BLAISDELL, JAMES P., AND JOSEPH F. PECHANEC. 1949. Effects of herbage removal at various dates on vigor of bluebunch wheatgrass and arrowleaf balsamroot. Ecol. 30: 298-305.

DAUBENMIRE, REXFORD F. 1940. Plant succession due to overgrazing in the Agropyron bunchgrass prairie of southeastern Washington. Ecol. 21: 55-64.

DAYTON, W. A., *et al.* 1937. Range plant handbook. U. S. Govt. Printing Off., Washington, D. C. See p. G58.

SNEDECOR, GEORGE W. 1946. Statistical methods. Iowa State Col. Press, Ames, Iowa. xvi + 485 pp.

THE PUBLICATION OF RESEARCH—2

The purpose of writing is not only to *express* ideas, but to *communicate* them to others. Science is not inherently dull, heavy, and hard to comprehend; it is essentially fascinating, understandable, and full of charm. It is simple, after it has been worked out, and is capable of being stated in concise terms easily understood.—*E. W. Allen.*