Variation in Defecation Rates of Pronghorns Relative to Habitat and Activity Level

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Abstract

During June through September, 1977, pronghorn antelope *(Antilocapra americana)* were observed in the National Bison Range, Moiese, Montana, to determine if defecation rates were constant in different habitat types and at different levels of activity. Individuals and groups that were active 50% or more of observation periods were found to have defecation rates approximately 10 times greater than groups or individuals that were active less than 50% of observation periods. Habitat type was much less tightly related to defecation frequency than was activity level.

The use of pellet-group counts as indices of ungulate numbers and habitat use was reviewed by Neff (1968). In this review, he stated that deer are assumed to deposit pellet-groups most frequently in areas where they spend the most time. Other authors, including White (1960), Bowden et al. (1969), McCaffery and Creed (1969), Gill et al. (1975), and Kearney and Gilbert (1976), have made the same assumption for deer and other ungulates. If this assumption is not true, the pellet-group count is one of the most economical approaches available to a land manager concerned with assessing wild ungulate use of specific blocks of land. If the assumption is not true, use of this technique could provide biased information that would lead to poor management decisions. This study was designed to gather quantitative information on pronghorn defecation rates in selected habitat types to determine if frequency of defecation were independent of habitat type and activity level of observed animals.

The National Bison Range, located in the Flathead Valley approximately 50 km north of Missoula, Montana, was selected as a study site because resident pronghorns were easy to observe and were well habituated to moving and standing vehicles. The terrain of this 7,700 ha refuge is characterized by rugged hills in the southern and central sections and rolling plains in the northern sections. Dominant grasses include bluebunch wheatgrass *(Agropyron spicatum),* Idaho fescue *(Festuca idahoensis)*, and rough fescue *(F. scabrella). Bromus* spp., *Poa* spp., and *Aristida* spp. are common on disturbed sites (Morris and Schwartz 1957). Only the higher hills are forested. Douglas fir *(Pseudostuga menziesii)* is dominant on northern exposures, and ponderosa pine *(Pinus ponderosa)* is dominant on southern exposures. Common shrubs include snowberry *(Symphoricarpus occidentalis)* in swales, chokecherry *(Prunus demiss),* serviceberry *(Amelanchier alnifolia),* and mockorange *(Philadelphus lewisii)* on scree and rock outcrops, and ninebark *(Physocarpus malvaceus)* on the margins of Douglas fir stands (Morris and Schwartz 1957, Kitchen 1974).

Methods

Individuals and groups of antelope were observed at ranges of 25–400 m using 7x binoculars or a 20-45x spotting scope. Observations were made during all daylight hours. To minimize observer fatigue, observation periods were broken into 10-minute segments, 6 minutes of observation followed by a 4-minute rest. The 6-minute observation segments were often truncated because observed animals moved into different habitat types or moved into positions where defecation could not be seen. The activity of observed animals, the number of defecations, the physiognomy of vegetation, and the terrain physiography were recorded for each observation. Habitat types were defined as a combination of growth form of dominant vegetation (grassland, grass-shrubland, tree-shrubland), presence or absence of slope, and aspect (cool slopes—N, NW, E, NE; warm slopes—W, SW, S, SE). All observations within 10 m of a pronounced change in vegetation or terrain configuration were considered ecotonal and were designated as the habitat type "ecotone."

In order to avoid splintering the sample, activity classes were pooled. "Active" animals were defined as those involved in feeding, moving, or social interactions. "Inactive" animals were defined as those lying or standing. In most observation periods, several individuals were observed together. The total animal-minutes recorded during each period were categorized as "high activity" (50% or more of the animal-minutes recorded as active observations) or "low activity" (less than 50% of the animal-minutes recorded as active observations). Male and female pronghorns were treated as separate sampling strata because of the territorial marking behavior of males (Kitchen 1974). Fawns were included with the female stratum. Data were analyzed using one-celled Chi-square analysis (Steele and Torrie 1960) and analysis of variance in the randomized block design (Steele and Torrie 1960).

Results and Discussion

During June through September 1977, 600 or more animal-minutes were recorded in each of four habitat types utilized by male and female pronghorns (Table 1). This sample was small but was considered minimally adequate for the tests conducted.

One-cell Chi-square analysis (Table 2) indicated no significant deviations from expected defecation frequency for any of the habitat types when all animal-minutes were considered. A breakdown of observations into "high activity" and "low activity" subsamples revealed that defecation occurred significantly more often

Table 1. Animal-minutes and observed defecation for pronghorns in four habitat types and two activity classes in the National Bison, Range, June–September 1977.

	0–49% Active		50–100% Active	
Habitat	Minutes	Defecation	Minutes	Defecation
Males				
Grassland, cool sopes	406	0	195	5
Grassland, flats	401	0	205	3
Grass-shrubland, flats	402	0	200	3
Ecotones	377	3	299	6
Females and Fawns				
Grassland, cool slopes	472	0	618	6
Grassland, flats	484	0	152	6
Grass-shrubland, flats	382	0	356	6
Ecotones	402	2	293	5

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Table 2. One-celled Chi-square analysis of defecation in "habitat × activity" cells for pronghorns in the National Bison Range, June–September, 1977.

Habitat	0–49% active				50–100% active				Overall			
	Obs[1]	Exp[2]	Dev[3]	Chi-sq[4]	Obs	Exp	Dev	Chi-sq	Obs	Exp	Dev	Chi-sq
Pronghorn males												
Grassland, cool slopes	0	3.27	−3.27	2.35	5	1.57	+3.43	5.47[5]	5	4.83	0.17	0.02
Grassland, flats	0	3.23	−3.23	2.31	3	1.65	+1.35	0.44	3	4.88	−1.88	0.39
Grass-shrubland, flats	0	3.23	−3.23	2.31	3	1.61	+1.39	0.49	3	4.85	1.85	0.38
Ecotones	3	3.03	−0.03	0.07	6	2.41	+3.59	3.96[5]	9	5.44	+3.56	1.72
Totals	3	12.76	−9.76	6.72[5]	17	7.24	+9.76	11.84[5]				
Pronghorn females												
Grassland, cool slopes	0	3.73	−3.73	2.79	6	4.89	+1.11	0.08	6	8.63	−2.63	0.53
Grassland, flats	0	3.83	−3.83	2.90	6	1.20	+4.80	15.41[5]	6	5.03	+0.97	0.04
Grass-shrubland, flats	0	3.02	−3.02	2.10	6	2.82	+3.18	2.55	6	5.84	+0.16	0.02
Ecotones	2	3.18	−1.18	0.15	5	2.32	+2.68	2.05	7	5.50	+1.50	0.18
Totals	2	13.77	−11.77	9.22[5]	23	11.23	+11.77	11.31[5]				

[1]Observed defecations.

[2]Expected defecations = $\frac{\text{(Observation min. in Habitat} \times \text{Activity class) Total defecations}}{\text{Total observation min. in all Habitat} \times \text{Activity classes}}$

[3]Deviations from expected: + = > expected, − = < expected.

[4]Chi-square = $\frac{(\text{Obs} - \text{Exp} - 0.5)^2}{\text{Exp}}$

[5]Significant ($p < 0.05$).

than expected for individuals or groups engaged in high levels of activity and significantly less often than expected for individuals or groups at lower activity levels. Three of the eight "habitat type × high activity level" cells created by the breakdown contained significantly higher numbers of defecations than would be expected for the number of animal-minutes represented in the cells (Table 2). Because these cells consisted of less than 300 animal-minutes, a two-way analysis of variance was used as a check on the validity of "habitat type" as a variable with significant impact on defecation rate (Table 3). The effect of high activity versus low activity was significant (Males: $F = 33.3, p<0.01$; females: $F = 7.93, p<0.10$), but the effect of habitat type was not.

Table 3. Analysis of variance for defecation rates in selected habitat types at two activity levels for pronghorns.

Source	AOV[a] Degrees of freedom	Sum of squares	square	F
Pronghorn males				
Blocks (activity level)	1	2.000	2.000	33.333**
Treatments (habitat)	3	0.255	0.085	1.417
Error	3	0.180	0.060	
Total	7	2.435		
Pronghorn females				
Blocks	1	2.760	2.760	7.93*
Treatments	3	0.894	0.298	0.86
Error	3	1.045	0.348	
Total	7	4.699		

[a]Model: $X = \mu + T_i B_j + e_{ij}$ (Where: X = defecations/hr; B_j = activity levels T_i = habitat classes; e_{ij} = unexplained variation)

* Significant ($p<0.10$).

**Significant ($p<0.01$).

The information obtained from the analyses indicates that pellet-counts could be an adequate index of time spent in a specific area if animals utilize the same habitats while resting as they do while active. If animals feed in one habitat type (80% of recorded activity for Bison Range pronghorns consisted of feeding) and rest in another, pellet-counts would presumably be biased towards the areas where the animals fed. Pronghorns in the Bison Range apparently did feed and rest in similar habitats. Pronghorns associated with other habitat conditions or with different patterns of human disturbance might behave differently.

Literature Cited

Bowden, D.C., A.E. Anderson, and D.E. Medin. 1969. Frequency distributions of mule deer fecal group counts. J. Wildl. Manage. 33:895-905.

Gill, J.D., J.W. Thomas, W.M. Healy, J.C. Pack, and H.R. Sanderson. 1975. Comparison of seven forest type for game in West Virginia. J. Wildl. Manage. 39:762-768.

Kearney, S.R., and F.F. Gilbert. 1976. Habitat use by white-tailed deer and moose on sympatric range. J. Wildl. Manage. 40:645-657.

Kitchen, D.W. 1974. Social behavior and ecology of the pronghorn. Wildl. Monogr. 38. 96 p.

McCaffery, K.R., and W.A. Creed. 1969. Significance of forest openings to deer in northern Wisconsin. Wisconsin Dep. Nat. Resource Tech. Bull. 44. 104 p.

Morris, M.S., and J.E. Schwartz. 1957. Mule deer and elk food habits on the National Bison Range. J. Wildl. Manage. 21:189-193.

Neff, D.J. 1968. The pellet-group count technique for big game trend, census and distribution: a review. J. Wildl. Manage. 32:597-614.

Steele, R.G.D., and J.H. Torrie. 1960. Principles and Procedures of Statistics.. McGraw-Hill Book Co., New York. 481 p.

White, K.L. 1960. Differential range use by mule deer in the spruce-fir zone. Northwest Sci. 34:118-126.