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MEEKER, JO ORAN
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University of Nevada

Reno

Interactions Between Pronghorn Antelope and Feral Horses in Northwestern Nevada

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Wildlife Management

by

Jo O. Meeker

May 1979

The thesis of Jo Oran Meeker is approved:

Donald A. Klebenow

Thesis Advisor

Donald A. Klebenow

Department Chairman

John E. Nellor

Dean, Graduate School

University of Nevada

Reno

May 1979

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ABSTRACT

A study of interactions between pronghorn antelope *(Antilocapra americana)* and feral horses *(Equus caballus)* was conducted during two summers at the Sheldon Antelope Range in northwestern Nevada. Visual observations were used to determine watering and foraging interactions and fecal analysis was performed to determine diet overlap. A total of 142 measurable instances of watering were recorded and analyzed to determine if the juxtaposition of horses affected antelope drinking and loafing times. Numerous grazing and meeting situations between the two species were observed to determine if either interfered with the activities of the other. Results indicated a lack of interference competition between antelope and horses at water or under grazing or moving situations. No acts of aggression were observed between the species. There was some evidence of a degree of symbiotic relationship existing between them. Fecal analysis indicated dietary overlap of approximately 12.8 percent, with phlox *(Phlox hoodii)*, the second most abundant forb in the study area, being the only plant species to contribute over five percent to each species' diet.

TABLE OF CONTENTS

INTRODUCTION

The ever-increasing human population of the United States has, without doubt, had a detrimental effect on wildlife populations. Humans have appropriated for their own use that land which they desired. These actions have resulted in decreased quantity and quality of natural habitat for wildlife, especially the larger or less human-tolerant species.

The pronghorn antelope *(Antilocapra americana)* is one species whose population has been greatly affected by human expansion. Nelson (1925) estimated that there were 35 million pronghorn in North America in 1805. During the next century, this population decreased to some 13,000 (Hoover et al. 1959). From that low point, the population increased to an estimated 385,500 by 1964 (Yoakum 1972).

Proper management of this remnant herd of a once enormous population is necessary if the antelope is to remain an important large game animal. The resource manager must have all available information concerning the ecology of the pronghorn, including its interactions with other ungulates, in order to accomplish this required management. It is the intent of this paper to report the results of a study of interactions between pronghorn antelope and feral horses *(Equus caballus)* during the summer months in a sagebrush-bunchgrass community in northwestern Nevada.

The term "feral" is used in preference to the term "wild" because the wild horse became extinct in North America by the end of the Pleistocene epoch and did not appear again until reintroduced by early Spanish colonists (Hickman and Hickman 1972). From this reintroduction, the population of feral horses has grown to numbers in excess of 60,000, primarily in the western United States (Monroe 1977). This growing population of horses is a factor that must be considered by western rangeland managers (Cook 1975).

It is, therefore, my desire that this study will contribute to our knowledge of both pronghorn and horses and their interactions. Should this be the case, it will serve as a management tool for those resource managers operating in the intermountain sagebrush-bunchgrass biome.

LITERATURE REVIEW

The food habits of pronghorn have been well documented for the sagebrush-bunchgrass vegetative community. Ferrel and Leach (1950 and 1952) analyzed stomach contents of 83 antelope taken in California during spring, fall, and winter. They reported that browse, principally big sagebrush *(Artemisia tridentata)*, made up the bulk of the spring and winter diet, while forbs comprised over half of the fall diet. Mason (1952), in studying the Hart Mountain, Oregon antelope, found the most important year-round food source to be sagebrush with forbs contributing heavily to the diet during the summer months. In their study of food preference of penned antelope in Wyoming's Red Desert, Severson and May (1967) found the most important summer foods to be Douglas rabbitbrush *(Chrysothamnus viscidiflorus)* and big sagebrush. Olsen and Hansen (1977) found that sagebrush was the most important food source for pronghorn and that diet diversity increased during the summer. The Olsen and Hansen study provides the only available reference to diet overlap between antelope and feral horses in the sagebrush-bunchgrass community. They reported an extremely small similarity (4 ± 4%) in the diets of these two species. This observation is supported by a study in the cold desert region of eastern Nevada, where the Bureau of Land Management found the summer diet of feral horses was composed of 92 percent grasses, while the pronghorn's diet was 95 percent shrubs and forbs (G. W. Cropper, pers. comm.). It appears that little overlap of diets is to be expected in areas with plentiful resources, but in areas with a limited food supply, this overlap might be considerable. Hansen (1976) reported that the most important food plant for feral horses in southern New Mexico was

Russian thistle *(Salsala kali)*. This testifies to the survivability of the feral horse. His New Mexico study also showed the lowest percentage (50%) of grasses and grass-like plants that he had observed in horse diets from six states. On the other hand, only two studies could be located which reported grasses in excess of five percent of an antelope's diet (Hjersman and Yoakum 1959, Mitchell and Smoliak 1971). This, too, would indicate a lack of serious diet overlap under conditions of forage plentitude. Daily forage requirements for antelope and horses have been reported as 3.1 and 2.5 percent of total body weight respectively (Stoddard and Smith 1955, Thomas 1974). Average weights were estimated at 410 kg for horses (G. Cropper, pers. comm.) and 45 kg for antelope (Pyshora 1977). Based on these estimates, the daily forage requirements were 10.25 kg for horses and 1.395 kg for antelope.

Little has been reported on water requirements of either antelope or feral horses. Beale and Smith (1970) found that the pronghorn of western Utah did not use free water when the moisture content of abundant forbs exceeded 75 percent. However, during the hot, dry summer, the daily requirements averaged 2.8 liters per animal. In a similar study in Wyoming, Sundstrom (1968) reported daily water requirements varied from 0.3 liters per day in May to 4.5 liters per day in August. However, neither study reported on drinking frequency. Water requirements of a domestic 454 kg horse vary from 15 to 57 liters per day depending on ambient temperature, activity, and reproductive condition (Evans et al. 1977). It was also recommended that horses be watered frequently during the day. Pellegrini (1971) reported that feral horses in Mineral County, Nevada watered every other night and remained at the water hole all night.

However, the U.S. Forest Service was able to inventory feral horses in eastern Nevada by time-lapse photography of water holes during the day (Baxter 1977). This was an indication that these animals also water during daylight hours. A thorough literature search failed to reveal any information on interactions between antelope and feral horses in either grazing or watering situations.

The primary aim of this paper is to report any competition that exists between antelope and feral horses in the Charles Sheldon Antelope Range. The definition of interspecific competition preferred by this author is that used by Miller (1967:6): "Biological competition is the active demand by members of two or more species at the same trophic level for a common resource or requirement that is actually or potentially limiting." This definition has been expanded to include, in part, that of Krebs (1972:211) who stated that ". . . if the resources are not in short supply, competition occurs when the organisms seeking the resource nevertheless harm one or other in the process." Competition which exists for a limited resource is termed exploitation competition, and an interference component exists when organisms harm one another in seeking a needed resource, regardless of its availability (Krebs 1972).

The exploitation component of competition for food resources can be determined, with reservations, by comparing dietary overlap of sympatric species to the availability of the relevant foodstuffs. Hansen and Ueckert (1970:640) stated, "The contribution of individual plant species to the diets of sympatric herbivores and the availability of these plants are essential criteria for determining if dietary competition exists." Cody (1974) stated that the mere analysis of stomach contents can give an extremely biased picture of the ecological overlap between species. This could be true were stomach contents used for analyzing the overlap of diets between two species with different feeding habits or areas. This would mean that each was obtaining food not available to the other and, regardless of the degree of overlap, competition would not exist. This should not be the case where the two species under consideration were large terrestrial herbivores feeding in the same general area, and where samples used were composited from 15 or more fecal subsamples.

Several methods are available for collecting data for determination of an herbivore's diet: direct observation, fistulation of either esophagus or stomach, stomach removal, and feces collection. When dealing with a free-roaming large herbivore population, fecal analysis may be the most feasible method.

Direct observation would require the ability to observe from extremely close ranges, or an estimation of how much of a certain plant was removed by an animal and which animal took it, should more than one species be present. Fistulation would require excessive handling of wild animals to the point that the animal would be tame rather than wild. Analysis of stomach contents would be destructive sampling that would require the sacrifice of animals. These drawbacks would be eliminated through the use of fecal analysis, a method that requires nothing more than that material the animal no longer needs.

A microscopic technique for identifying plants eaten by herbivores was developed by Baumgartner and Martin (1939). This technique has been refined and used to study food habits of domestic sheep (Croker 1969), quokkas (Storr 1960), ground squirrels, crickets and grasshoppers

(Hansen and Ueckert 1970), bighorn sheep (Todd and Hansen 1973), meadow voles (Neal et al. 1973), deer (Anthony and Smith 1974), free-roaming horses (Hansen 1976), free-roaming horses, cattle, elk, sheep and pronghorns (Olsen and Hansen 1977), and snowshoe hares (Wolff 1978). Numerous verification studies of the accuracy of fecal analysis have been performed (Sparks and Malechek 1968, Free et al. 1970, Anthony and Smith 1974, Dearden et. al. 1975, Vavra et al. 1978, Havstad and Donart 1978). These studies have reported that the microscopic analysis of feces provides an accurate representation of herbivore diet. Westoby et al. (1976) reported on three problems identified in their study of the accuracy of quantifying artificially compounded mixtures of vegetative material. These problems were: (1) wrong name applied to all fragments of one material, (2) attempt and failure to name material which was not reliably identifiable, (3) miss material altogether. These problems cannot be eliminated but their effect could be reduced. Collecting reference material during the same time period that fecal samples were collected would reduce errors due to phenological stage. Constant referral to photomicrographs and reference slides would reduce misidentification. Rare plants may be missed during analysis, but this should not negate the results since their contribution to either diet would be negligible.

Schroder and Rosenzweig (1975:16) stated, "The only necessary and sufficient means of demonstrating the existence of competition between two species is to observe the numerical responses of the presumed competitiors to perturbation of one or both species." Although perturbation analysis should show competition, it is felt that the inclusion of the word *only* is excessively restrictive. The interference component could be ascertained, although possibly not quantified, by observation of the interaction between two species for a limited resource, i.e., food or water. Dietary overlap for a limited food item should indicate the exploitation component of competition. Additionally, perturbation analysis would be difficult, if not impossible, for studying competition between large, long-lived mammals existing on public domain.

STUDY AREA

The Charles Sheldon Antelope Range (Fig. 1) was established in 1939 for the purpose of preserving, studying and managing pronghorn antelope and other wildlife species (U.S. Dept. of the Interior 1969). This range contains over one-half million acres and supports a stable pronghorn population of approximately 800 animals (B. Wiseman, pers. comm.).

The study area was located in the northwestern portion of the Sheldon Antelope Range, approximately 270 km north of Reno, Nevada. There were an estimated 100 antelope and 115 horses in this area during 1977. The 1978 populations were estimated at 85 antelope and 195 horses. The study area consisted of approximately 40 square kilometers of North Rock Springs Table, known as Horse Heaven (Fig. 1). It was rolling country broken by an occasional valley. Elevations ranged from 1,890 m in the northwest to 2,010 m at the summit of a north-south ridge which bisected the area.

Average temperatures during the summer months of 1977 and 1978 (Table 1) were characterized by high daytime and low nighttime readings.

Table 1. Average temperatures (C) in the study area.

	1977		1978	
	High	Low	High	Low
June	25.1	4.0	21.6	-0.3
July	27.2	3.4	27.4	2.9
August	26.1	3.4	25.8	2.3

The differential between highs and lows exceeded 20 C for each of the six summer months monitored. The average annual precipitation for the past

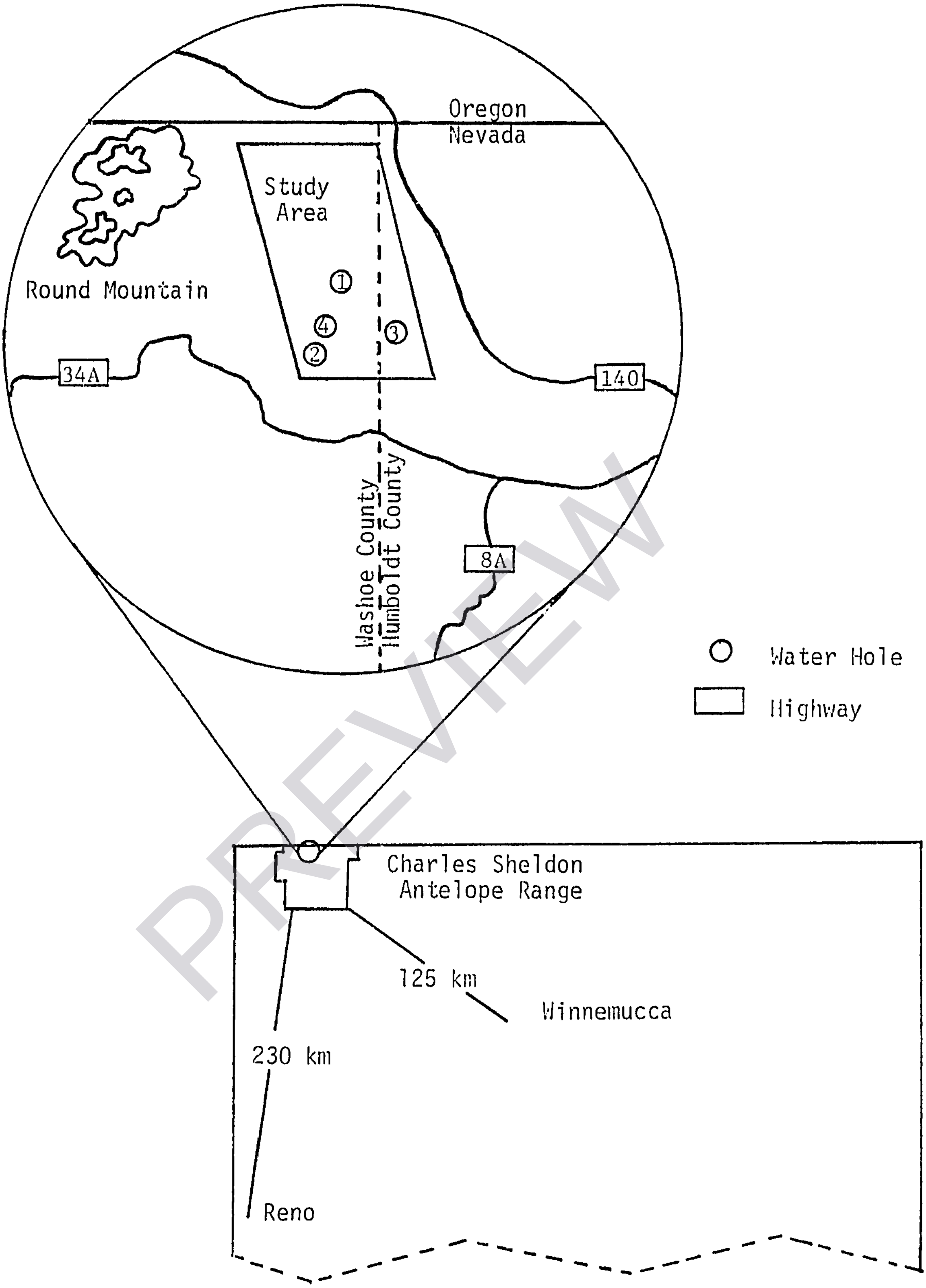

Fig. 1. Location of study area.

ten years has been 19.5 cm, varying from 14.3 to 30.9 cm per year. Total precipitation was 15.9 cm during 1977 and 27.6 cm for 1978.

The study area was located within the sagebrush and bunchgrass major plant community of North America (Kuchler 1964). Yoakum (1972) estimated that 27 percent of North America's pronghorn antelope occupy this vegetative type. The dominant vegetation consisted of low sagebrush *(Artemisia arbuscula)* and Sandberg bluegrass *(Poa sandbergii)*. Numerous patches of big sagebrush occurred throughout the study area. Forbs were plentiful but tended to be patchy in distribution and some species failed to set seed during the summer of 1977.

The soil of the study area was of the order Aridisols, suborder argids. The parent material was predominantly basalt residuum with some admixture of tuffaceous alluvium (Soil Conservation Service 1970). Scattered throughout Horse Heaven were small areas of mollisols. Recent deposits of rhyolite or basalt were laid over old lake sediments. The surface was rock covered and water runoff was rapid.

The water situation in the study area was adequate to provide for the needs of the resident wildlife population. All water was collected from runoff in either natural or man-improved cachments. Fig. 1 portrays the relative location of the four watering places that existed during a good water year. Water hole number 1 was the preferred water hole and received heavy use by both feral horses and antelope until it dried up (July 6, 1977 and August 1, 1978). This was a natural cachment and was the most distant from roads and human activity. Water hole number 2 consisted of one man-improved and two natural cachments. These water holes received little antelope and no horse activity until water hole number 1 dried up and the horses moved to the west in late summer. These water holes dried up in mid-July, 1977, and contained water all summer, 1978. Water hole number 3 was a man-improved cachment and received little activity before number 2 dried up, but the bulk of horse and antelope activity, after this. This water hole held sufficient water to meet the needs throughout both summers. Water hole number 4 was a small natural cachment that contained no water in 1977 but had water until mid-July 1978. Some antelope used this water, but no evidence of horse use could be found.

Other ungulates that used this area were mule deer *(Odocoileus hemionus)* and domestic cattle *(Bos taurus)*. Deer used the area frequently for water and less so for browsing along the bluff edges. Suitable deer habitat, but with less water, existed to the east and south of the study area. Livestock grazing was not permitted during 1977, but approximately 250 cattle were in the study area during portions of the summer of 1978.

METHODS AND MATERIALS

Based on available information on location of feral horse and antelope usage, six agronomy cages were positioned on May 29 and 30, 1977. Four cages were located on Round Mountain and two in Horse Heaven. These cages, each 2.5 by 4 m, were used in an attempt to predict forage production within the study area. At the end of the growing season for each forage type, ground cover was determined for each plant which was totally within the exclosure and current year's growth was removed. Plant diameter was determined by measuring the longest and shortest diameter of the plant and averaging these values. Crown diameter was determined for shrub and forb species and basal diameter for grasses. Vegetative clippings were placed in paper bags and allowed to air dry for a minimum of two months prior to weighing. Current year's growth was weighed to the nearest one-tenth gram. Covariance and regression analysis were used to determine whether plant diameters could be used to predict production. This type of analysis was deemed appropriate because the parameter measured was affected little by grazing activity.

Vegetative data for the study area was obtained from 50 systematically located 0.5 by 20 m strip transects during July 1977. Transects were located without regard to vegetative type. The only areas excluded from sampling were bluff faces. In the two cases where this affected sampling, the plot was displaced to the nearest location that eliminated the obstacle. All plants whose measured component fell totally or partially within a transect were included in the survey. Crown diameter and the estimated percentage of the crown within the plot were recorded for all shrubs and forbs by species. Basal diameter and the percentage within the plot were recorded for all grass species. A computer program, SHELM1, was written and used to obtain percent cover and density for all species of vegetation within each study plot.

Fecal samples for diet comparison were collected during the latter phases of vegetative sampling. These samples were collected in the vicinity of the only water hole within the study area that still contained water. Antelope feces were collected from animals observed defecating, to preclude the possibility of including feces from mule deer that frequented the area. Subsamples weighing about 4 g each were collected from separate fecal groups until 20 subsamples were obtained for each species. The subsamples were then combined by species to form the sample for analysis. Anthony and Smith (1974) reported that subsamples from 15 pellet groups were adequate to describe deer diets in Arizona. Samples were placed in airtight plastic bags and kept frozen until final preparation for analysis.

Specimens of all known plant species in the study area were collected for identification and preparation of reference slides. Plants were identified by the use of Munz (1968) and Hitchcock et al. (1955-69) and verified, where possible, by comparison with known specimens in the Nevada Agricultural Experiment Station Herbarium. Detailed instructions for reference slide preparation are outlined in Appendix A. These reference slides were studied in detail for approximately two weeks and black-and-white photomicrographs were made of diagnostic characteristics. This detailed study was followed by the preparation of a dichotomous key based on characteristics of the leaf portion of the plants (Appendix B). The leaves of grasses were found by Davies (1959) to have the greatest diagnostic value, due to leaf cell structure not being greatly affected by phenological stage of the plant. The lack of a key for all plant parts did require additional effort when analyzing feces, but the time spent was less than that required for the preparation of additional keys.

The next step in the learning process was the quantification of unknown mixtures of plants from the study area. A fellow graduate student prepared these mixtures in quantity. Continued work with test mixtures increased the writer's knowledge of the plants involved until test mixtures were repeatedly analyzed within five percent accuracy. This accuracy is considered sufficient by the Colorado State University Composition Analysis Laboratory (R. M. Hansen, pers. comm.).

Microscope slides of fecal material were prepared as outlined in Appendix A. Fecal analysis was performed by noting species occurrence in 20 systematically located fields on each of five slides for a total of 100 fields. One hundred fields have been reported as adequate to describe an herbivore's diet (Martin 1955, Sparks and Malechek 1968, Free et al. 1970, Todd and Hansen 1973). The contribution of each plant species to an herbivore's diet was determined using the frequency conversion technique developed by Sparks and Malechek (1968). In this technique, the presence of a species in a microscope field is noted, but the number of such fragments is disregarded. This frequency is then converted to relative density using the tables developed by Fracker and Brischle (1944). Sparks and Malechek (1968) reported no loss in accuracy using this method, as compared with counting all fragments of all species appearing in each field.

Correction factors for any over- or under-estimation of species contained in hand-compounded mixtures have been developed (Dearden et al. (1975). Such correction factors were not applied in this study because Hansen (R. M. Hansen, pers. comm.) stated that the increased work load does not justify the slight increase in accuracy.

Data concerning antelope-horse interaction at water holes was collected by observation through a 15X-45X spotting scope. Each observation of antelope watering was recorded by time of day, number of antelope, drinking time, loafing time, number of horses and their distance from the water. Antelope were identified as male, female, or kid. Drinking time was determined by timing, with a 0.1-second stop watch, the amount of time that an antelope remained in a drinking posture at the water. Drinking posture was defined as head over the water and body perpendicular to the water's edge. Small periods of surveillance by the animal were not deducted from drinking time. Loafing time consisted of all time the antelope remained in the vicinity of the water, less drinking time, prior to obvious departure behavior. When actually departing the vicinity of the water hole, an antelope usually acted as though it had a destination in mind, that is, it moved off without hesitation or loitering. This procedure was modified for a period during the summer of 1978 to include cattle when they were present in the study area. This data was analyzed using analysis of covariance and regression to determine if horse proximity had an effect on antelope use of water.

A second method of data collection on water hole interactions was attempted. This method entailed the use of a Minolta movie camera with time-lapse capability, similar to that used by the U.S. Forest Service in