Pronghorn range use and relation to livestock in southeastern Montana
by James Samuel Freeman

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree of
MASTER OF SCIENCE in Fish and Wildlife Management
Montana State University

Abstract:
A study of pronghorn range use and relation to livestock was conducted in Carter County, Montana during the fall of 1969, and winter of 1970. A total of 1,014 observations of pronghorns during fall indicated a population composition of 26, 45, and 29 percent males, females, and fawns, respectively. Respective densities of 2.6 and 2.1 per square mile before and after the hunting season, together with an increase in the ratio of females per 100 males from 188 to 230 for the same periods, indicated a decrease in the population during the hunting season weighing heavier on males. None of four female fawns examined were pregnant but all four females older than fawns carried twins. Fat content of femur marrows, kidney fat indexes, and ratios of hog-dressed to whole weights for 12 animals examined from October to March indicated animals were in best condition during mid-winter. A Chi-square goodness of fit test was applied to a total of 4,478 observations of pronghorns, evaluated on the basis of habitat types used, indicated distribution was dependent on habitat types. Percent use of the Agropyron-Artemisia habitat type by pronghorns in relation to other habitat types increased from 75 in early fall to 100 by winter. Pronghorns used areas of progressively denser sagebrush from early fall through winter. Group size of pronghorns increased progressively from 6 to 55 for these seasons. Home range sizes determined for 11 individual pronghorns showed female home ranges were significantly larger than those of males. Fence types, classified according to penetrability by pronghorns, did not appear to hamper pronghorn distribution. A total of 39, 19, and 17 feeding sites of pronghorns, cattle, and sheep, respectively were examined and 19 rumen samples from pronghorns were analyzed to obtain food habits data. Browse was the major component of the diet of pronghorns, with forbs and grasses of little importance in fall and winter. Grass was the most important item in the diet of cattle and sheep, with browse a distant second. Artemisia tridentata and A. cana were important items in the browse component of the diets of all three species. Food habits data indicated forage competition between pronghorns and either sheep or cattle was minor, but use of pastures indicated an incompatability between pronghorns and sheep that could result in notable land use competition. Data suggested that pronghorns and cattle were compatible, and that joint use of range by these species in this area could possibly result in better overall forage use than use by either species alone.

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Signature James Samuel Freeman

Date July 8, 1971

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by

JAMES SAMUEL FREEMAN

A thesis submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree

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ABSTRACT

A study of pronghorn range use and relation to livestock was conducted in Carter County, Montana during the fall of 1969, and winter of 1970. A total of 1,014 observations of pronghorns during fall indicated a population composition of 26, 45, and 29 percent males, females, and fawns, respectively. Respective densities of 2.6 and 2.1 per square mile before and after the hunting season, together with an increase in the ratio of females per 100 males from 188 to 230 for the same periods, indicated a decrease in the population during the hunting season weighing heavier on males. None of four female fawns examined were pregnant but all four females older than fawns carried twins. Fat content of femur marrows, kidney fat indexes, and ratios of hog-dressed to whole weights for 12 animals examined from October to March indicated animals were in best condition during mid-winter. A Chi-square goodness of fit test was applied to a total of 4,478 observations of pronghorns, evaluated on the basis of habitat types used, indicated distribution was dependent on habitat types. Percent use of the *Agropyron-Artemisia* habitat type by pronghorns in relation to other habitat types increased from 75 in early fall to 100 by winter. Pronghorns used areas of progressively denser sagebrush from early fall through winter. Group size of pronghorns increased progressively from 6 to 55 for these seasons. Home range sizes determined for 11 individual pronghorns showed female home ranges were significantly larger than those of males. Fence types, classified according to penetrability by pronghorns, did not appear to hamper pronghorn distribution. A total of 39, 19, and 17 feeding sites of pronghorns, cattle, and sheep, respectively were examined and 19 rumen samples from pronghorns were analyzed to obtain food habits data. Browse was the major component of the diet of pronghorns, with forbs and grasses of little importance in fall and winter. Grass was the most important item in the diet of cattle and sheep, with browse a distant second. *Artemisia tridentata* and *A. cana* were important items in the browse component of the diets of all three species. Food habits data indicated forage competition between pronghorns and either sheep or cattle was minor, but use of pastures indicated an incompatability between pronghorns and sheep that could result in notable land use competition. Data suggested that pronghorns and cattle were compatable, and that joint use of range by these species in this area could possibly result in better overall forage use than use by either species alone.

INTRODUCTION

Southeastern Montana is very important for the production of pronghorn antelope (*Antilocapra americana*). Beer (1944) listed Carter, Powder River, Custer, and Fallon Counties of this area as maintaining nearly one-third of the total population in Montana, with Carter County supporting the highest resident population in the State. More recent figures verify the importance of Carter County for pronghorns; e.g. Campbell (1970) reported densities as great as three per square mile in summer. Southeastern Montana is primarily a livestock producing area. It has been extensively fenced, often with sheep-tight fences. Stock ponds for watering livestock have been constructed. These activities and others for the benefit of livestock had not been critically evaluated from the standpoint of their effects on the ecology of pronghorns.

Despite an early study by Buck (1947) which suggested little competition betwen pronghorns and livestock in this part of the State, and several studies concerning various phases of the ecology of the pronghorn in this and other parts of the State, little was known about pronghorn-livestock relations. The studies of Couey (1946), Cole (1956), Martinka (1967), Wentland (1968), and Bayless (1969) conducted in various parts of the State indicated a clearcut relationship between pronghorns and Sagebrush-Grassland vegetation types but data on interspecific relations of pronghorns and livestock were generally lacking.

With game management becoming more critical, the shortage of infor-

mation on pronghorn-livestock relationships in this important area of Montana's pronghorn production lead to a year-long study. Food habits and range use were recorded for pronghorns, cattle (*Bos taurus*), and sheep (*Ovis aries*) on a common use range. Use of range by pronghorns was related to livestock use as well as characteristics of fences and vegetation types of pastures. Bruce Campbell and I worked on this project together, but he concentrated on the spring and summer seasons and reported his findings separately (Campbell 1970). I concentrated on fall and winter, spending full time in the field from October, 1969 through mid-March, 1970. The results of my studies are presented here.

DESCRIPTION OF STUDY AREA

The study area, including the vegetation, has been described in detail by Campbell (1970). A brief resumé is presented here for reference in this paper. The area consisting of approximately 96,000 acres, of which 57 percent is privately owned, is in extreme southeastern Montana (Figure 1). The economy is agricultural, primarily livestock oriented.

Physiographic features center around broad sloping plains sporadically dissected by coulees. The north and west sides of the area are bordered by shale hills and buttes. Exposed rock formations are sedimentary in origin ranging in age from Jurassic to present. Little crustal disturbance is indicated by the rock formations which dip very gently if at all.

Soils are primarily shallow and poorly developed. Most are fairly heavy resulting from the underlying shale formations. The exceptions are soils of flood plains of major drainages where some fairly deep soils are quite well developed, and where sandstone outcrops in the extreme northeastern part of the area have produced the only sandy or loamy soils present. Clay pan spots are scattered through the flats. Around the bases of hills and buttes on the west and north edges of the area are numerous solonchaks or puff spots resulting from soluble salt percolation in poorly drained silty clay loam soil.

The vegetation was classified according to six habitat types: *Agropyron-Artemisia; Agropyron*-Leguminosae-*Gutierrezia, Agropyron-*

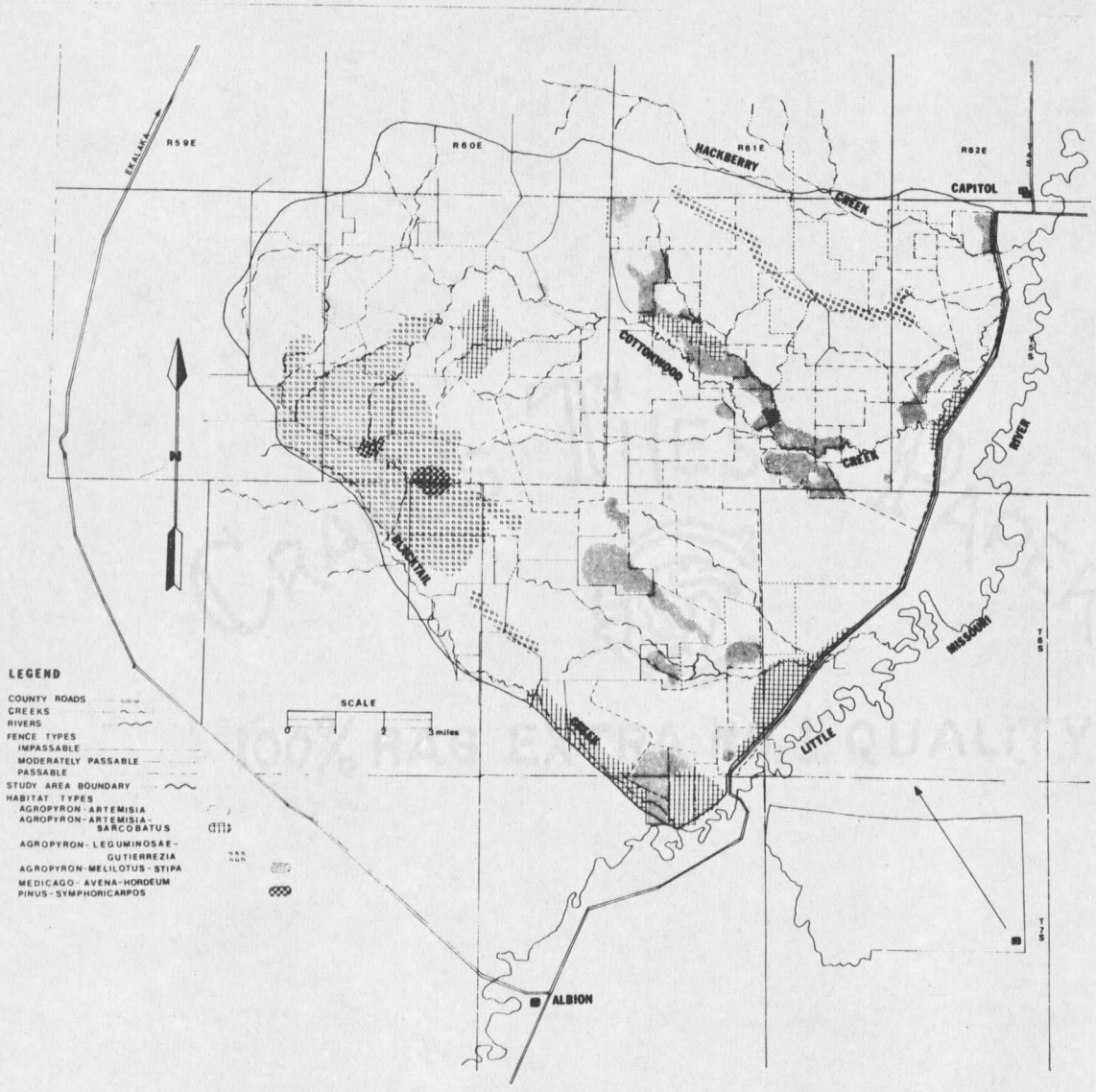

Figure 1. Map of study area showing types of fences and distribution of habitat types.

Melilotus-Stipa, Agropyron-Artemisia-Sarcobatus, Pinus-Symphoricarpos, and *Medicago-Avena-Hordeum*. The first type was further sub-divided according to density aspect of woody sagebrush (*Artemisia* spp.) as determined by crown intercept along 100-foot lines. Less than 1, 1-5, 6-20, and 20+ percent line intercept were considered rare, scattered, common, and dense, respectively.

The *Agropyron-Artemisia* type is by far the most important type, covering approximately 79 percent of the area (Figure 1), primarily the broad flatlands. *Agropyron smithii* is the most characteristic grass. Others are *Schedonnardus paniculatus, Koeleria cristata, Poa* spp., and *Stipa viridula*. Important forbs include: *Achillea millefolium, Artemisia-frigida, Aster falcatus, Iva axillaris, Lomatium foeniculaceum, L. macrocarpum, Phlox hoodii, Sphaeralcea coccinea, Taraxacum officinale,* and *Vicia americana*. The dominant shrub is *Artemisia tridentata* followed in importance by *Gutierrezia sarothrae* and *Atriplex nuttallii*. *Artemisia tridentata* displays a wide variety of growth forms, apparently related to past grazing history, soils, and topography. Its association with forbs and grasses changes considerably within short distances, probably related in part to sagebrush density. Fewer grass species are present in the dense sagebrush aspect as compared to other aspects. The greatest number of forb species is present in the scattered aspect. Total canopy coverage and frequency for shrubs increase as the sagebrush becomes progressively denser. Sheep use on this type reduces the number of forbs by species, frequency of occurrence, and canopy coverage.

The *Agropyron*-Leguminosae-*Gutierrezia* habitat type covers approximately 9.4 percent of the area, occurring in places of greatest relief with accompanying solonchak spots, shale outcrops, and impermeable soils. *Agropyron smithii* is the dominant grass followed in importance by *Buchloe dactyloides* and *Muhlenbergia cuspidata*. The dominant shrub is *Gutierrezia sarothrae*, with *Artemisia tridentata* and *Atriplex nuttallii* secondary. Among important forbs are many species of legumes including *Melilotus officinalis*, *Petalostemon candidum*, and *P. purpureus* in the more mesic sites. Other important forbs include *Artemisia frigida* and *Iva axillaris*.

The *Agropyron-Melilotus-Stipa* type covers 6.6 percent of the area, primarily areas of past cultivation seeded to *Agropyron smithii*. It is found mainly along major drainages and other areas of increased moisture. Dominant grasses are *Agropyron smithii*, *Stipa viridula*, and *Poa* spp.. Important forbs are *Melilotus officinalis*, *Iva axillaris*, and *Polygonum ramosissimum*. Along the edges, *Artemisia tridentata* and *Atriplex nuttallii* are invading.

The *Agropyron-Artemisia-Sarcobatus* type covers 3.6 percent of the area, occurring primarily on dense, heavy soils. The dominant grass is *Agropyron smithii*. Primary shrubs are *Sarcobatus vermiculatus* and *Artemisia tridentata*. Most frequent forbs are *Artemisia frigida*, *Phlox hoodii*, *Achillea millefolium*, and *Haplopappus multicaulis*. Grasses and forbs have the lowest canopy coverage in this type as compared to

other types, while shrubs and cactus have the highest.

6 The *Pinus-Symphoricarpos* type occurring on rugged hill tops in the western part of the area and the *Medicago-Avena-Hordeum* type occurring on small harvested plots in the northern part of the area, together account for only 1.3 percent of the area.

Monthly climatological data for the months of my study were obtained by averaging the records from the United States Department of Commerce Weather Stations at Albion, 5 miles south of the area, and Ridgeway, about 8 miles northwest of the area (Table 15, Appendix). The average temperature during the fall, October, November, and December, was 31.0 F which was 2.8 percent below the 1960-70 average. The average temperature in winter, January, February, and March, was 20.5 F, which was 7 percent below the average. Precipitation in fall and winter was 1.61 and 1.62 inches, respectively. This was 13.5 and 49 percent above the average, respectively. Summers are hot and dry. Winters are severe with long cold spells and infrequent blizzards.

METHODS

Habitat Analysis

An analysis of the vegetation by forage classes in each habitat type used by pronghorns was made in the fall of 1969 by a method similar to that of Daubenmire (1959) to determine changes in availability of green forage as compared to spring and summer (Campbell 1970). A 2 x 5 dm plot frame was placed at 10-foot intervals along two, 50-foot lines, one of which extended north, and the other south from a central point at each of several feeding sites. In each plot, the canopy coverage of each taxon was visually estimated according to one of six classes. Canopy coverages for the forage classes, grasses, forbs, and shrubs, were estimated independent of individual species. Percent coverages for litter, rocks, bare ground, and lichens were likewise estimated. Classes I to VI represented coverages of 0-5, 5-25, 25-50, 50-75, 75-95, and 95-100 percent, respectively. Mid-points of the cover classes were used in data analyses.

At each feeding site of pronghorns, sagebrush density, as indicated by crown coverage, was estimated along a straight line of 100 paces. Less than 1, 1-5, 6-20, and over 20 percent line coverage were recognized as rare, scattered, common, and dense, respectively.

Plant nomenclature followed Booth (1950) and Booth and Wright (1966).

Distribution and Movements

Forty pronghorns were individually marked with neck bands and/or ear tags prior to the beginning of my observations.

An 111-mile vehicle route which traversed all parts of the study area was traveled at slow speeds approximately every 2 weeks from late September through November. After this date many of the roads became impassable to vehicle travel, but I was able to visit each portion of the area approximately every 2 weeks via the roads remaining open. For each pronghorn observed, group associates, locations to quarter section, sex, whether fawn or adult, habitat type, including sagebrush density occupied, whether marked, and its occurrence with livestock were recorded. Observations were aided by the use of a 6 x 30 binocular and a variable power 15-60X spotting scope.

Fall and winter home ranges were calculated by a method similar to that described by Hayne (1949) for individuals observed a minimum of five times.

Pasture occupancy by livestock was recorded.

Food Habits Analysis

Food habits were determined for both pronghorns and livestock by feeding site examinations supplemented by analysis of the contents of at least two rumen samples per month from pronghorns and one from a steer butchered in December. Both procedures of analysis followed methods similar to Cole (1956) as well as several others. The aggregate percentage method of Martin *et al.* (1946) was used in tabulating monthly and seasonal food habits for both methods.

Physical Characteristics

Twelve pronghorns were collected at the rate of two per month from October, 1969 through March, 1970. Physical characteristics such as standard measurements, whole and hog-dressed weights were taken. Uteri were examined for embryos. A gross examination was conducted for the presence of internal and external parasites. The age class was determined by dentition (Dow and Wright 1962). Femur marrow compression (Greer 1968), and kidney fat index (Ransom 1965), were calculated as indicators of physical condition.

RESULTS AND DISCUSSION

Pronghorn Population Characteristics

From late September, 1969 through mid-March, 1970, a total of 2,150 observations of individual pronghorns were classified according to sex and age (Table 1). The highest individual count for any period was 386 in early October giving a density of 2.6 per square mile. In late fall and winter, following the mid-October to mid-November hunting season, the density was found to be 2.1 per square mile which compared favorably with the spring density reported by Campbell (1970). The 64 fawns per 100 females in the fall was very close to that found for early fall by Campbell (1970). By November fawns were no longer classifiable with accuracy during field observations. All animals were then classed as adults. Early fall showed a ratio of 188 females to 100 males. In late fall, following the hunting season, this ratio increased to 230 females per 100 males. This possibly shows a greater vulnerability of males to hunting pressure which may be due to selectivity of the hunters.

Of eight females collected during fall and winter, four were fawns and four were 2 years old or older. Although female fawns have been known to breed (Wright and Dow 1962) and (O'Gara 1968), none of the fawns was pregnant. All of the older females were carrying twins.

Fawn males are apparently infertile, at least during the regular breeding season in September and October (Wright and Dow 1962). No direct evidence was found to the contrary. However, during the second

TABLE 1. SEX, AGE, FEMALES PER 100 MALES, AND FAWNS PER 100 FEMALES FOR PRONGHORNS AS DETERMINED FROM OBSERVATION COUNTS.

Date	ADULTS				Number Fawns	Percent	Total Classified	Fawns Per 100 Females	Females Per 100 Males
	Number Males	Percent	Number Females	Percent					
EARLY FALL:									
September (late)	100[1]	33[2]	133	43	72	24	305	54	133
October (early)	107	28	168	43	111	29	386	67	157
October (late)	57	18	155	48	111	34	323	72	274
Total or Average	264	26	456	45	294	29	1,014	64	188
LATE FALL:									
November (early)	87	27	235	73			322		270
November (late)	44	29	106	71			150		241
December	19	36	34	64			53		179
Total or Average	150	31	375	69			525		230
WINTER:									
January	120	39	189	61			309		157
February	30	28	76	72			106		254
March	61	31	135	69			196		222
Total or Average	211	33	400	67			611		211

[1] Number of observations of individuals for each time period in each category. (In September and October fawns were classified separately, but in subsequent months they were included as adults.)

[2] Percent of the total number of observations of individuals for each period in each category.

and third weeks in October many female-fawn groups were observed in which all of the fawns were females, while several male fawns were observed alone, apart from any group. On October 9, one male fawn was observed being chased away by an older male. This could indicate the coming of sexual maturity to the male fawns albeit after most of the rutting activity of the population was over.

Pronghorn Physical Characteristics

Kidney fat indexes for 12 pronghorns of both sexes and various ages including fawns tended to be highest December through February (Table 2). Femur marrow compression tended to show the same trend. There was no compression during mid-winter, but two animals showed very low compression values in fall. One male fawn showed the highest compression found when killed in mid-February. The compression value of 12 percent would indicate a femur fat value in the range of 50 percent (Greer 1968) but the kidney fat index was well above the critical level of 30 percent. Ransom (1965) determined that kidney fat decreased to an index of 30 without appreciable changes in fat content of femur marrow. The ratios of hog-dressed weights to whole weights did not indicate poor condition. This ratio for males tended to be lower than in spring and summer as found by Campbell (1970). Female fawns, all of which were non-pregnant, tended to have a higher ratio than the older females, all of which were pregnant. The highest ratio of 75.5 was found in a fe-