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Livestock and Deer Ratios
for
Texas Range Lands

August 1957

TEXAS AGRICULTURAL EXPERIMENT STATION

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SUMMARY

On ranges where mixed classes of livestock and deer are grazed, ranchmen and range specialists are faced with the problem of determining the proper numbers and ratios for best management of grazing lands. Information from recent grazing experiments in Texas has indicated that the animal unit standards now used may need to be altered.

Conclusions reported in this publication are based on long-time effects of livestock and deer on the basic forage and soil resources, and not necessarily on the results of feeding studies, thermal or nutritional requirements or body weight comparisons.

The following recommendations are based on information obtained from studies and field surveys:

1. Where the vegetation is suitable, mixed classes of livestock should be grazed for the most desirable utilization of range forage. Pastures stocked at moderate rates with combinations of livestock show more uniform utilization of the area and better use of a wider variety of forage species.

2. The following equivalent values are proposed as animal unit standards for planning and management of grazing lands:

CATTLE

Weaned calves to yearlings.....	0.6	animal unit
Steers and heifers (1 to 2 years).....	1.0	animal unit
Mature cows with or without unweaned calves at side.....	1.0	animal unit
Bulls (2 years and over).....	1.3	animal units

SHEEP

5 weaned lambs to yearlings.....	0.6	animal unit
5 muttons or ewes (1 to 2 years).....	1.0	animal unit
5 mature ewes with or without unweaned lambs at side.....	1.0	animal unit
5 rams.....	1.3	animal units

GOATS AND DEER

6 weaned kids to yearlings.....	0.6	animal unit
6 muttons or does (1 to 2 years).....	1.0	animal unit
6 does with or without kids at side.....	1.0	animal unit
6 bucks or muttons over 2 years.....	1.3	animal units
6 deer.....	1.0	animal unit

3. Variations in range site and range condition classes often will result in varying degrees of competition between kinds of livestock and deer. These variations should be considered in the planning and management of range lands. However, the major differences between range sites and range condition classes will be in total carrying capacities rather than in ratios among the various kinds of livestock and deer.

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Livestock and Deer Ratios for Texas Range Lands

ON TEXAS RANGE LANDS, there is a need for better understanding and agreement among ranchmen and range and wildlife specialists on the numbers of sheep, goats, cattle or deer which should constitute an "animal unit." This problem is especially apparent in areas where mixed classes of livestock and deer are, or could be, grazed in various combinations.

Exchange ratios for the various kinds of grazing animals have been studied in the western part of the United States for many years. Most of the published research has been concerned with "sheep to cattle" ratios. Very little information is available on "goat to cattle" ratios, or on combinations of cattle, sheep, goats and deer.

Grazing experiments concerned with livestock and deer ratios are being conducted at the Ranch Experiment Station between Rocksprings and Sonora, the Texas Range Station near Barnhart, the Kerr Wildlife Management area at Hunt and at other locations in Texas. These studies have yielded valuable information in setting up standards for livestock and deer ratios for the most desirable utilization of range forage.

A committee composed of representatives from several agricultural organizations was formed to review available research data on livestock-deer ratios, make extensive field surveys on lands where mixed classes of livestock and deer are grazed and compile information obtained from agencies working with ranchmen. This publication summarizes the work of this group and presents recommendations for livestock and deer ratios.

Recommendations presented in this publication were based on long-time effects of livestock and deer on the basic forage and soil resource, and, not necessarily on the results of feeding studies, thermal or nutritional requirements or body-weight comparisons.

ON THE SONORA STATION

Substation No. 14 of the Texas Agricultural Experiment Station, commonly called the Ranch Experiment Station, is located on the Edwards Plateau between Rocksprings and Sonora. The soils are rocky and of limestone origin. The vegetation is mixed, with a grass-forb understory composed primarily of curlymesquite, sideoats grama, the bluestems and other species. The overstory is liveoak and shinoak mixed with numerous other browse species.

The station has carried on detailed range management studies since 1949, one of the aims of which was to determine the proper stocking ratio

among sheep, goats, cattle and deer for best range use. Because of the small size of the pastures under study, steers, mutton sheep and mutton goats, from yearlings past to 2-year-olds past, have been used. Pastures have been stocked at three different grazing intensities—with sheep alone, cattle alone, a combination of cattle, sheep and goats, a combination of cattle and goats, and, during the past 2 years, with goats alone. Deferred-rotation grazing also has been studied with a combination of sheep, goats and cattle. Deer activities and grazing habits have been observed in the experimental pastures and deer and livestock enclosures have been established as an aid in interpreting grazing effects.

ON THE BARNHART STATION

The Texas Range Station near Barnhart has been used for grazing experiments since 1938. The station is operated by the Texas Agricultural Experiment Station under a cooperative agreement with the University of Texas. Soils are clay types, moderately deep and underlain with limestone or caliche. The vegetation is predominantly tobosa, buffalo and curlymesquite grasses, with an overstory of mesquite trees.

The 16 pastures of the station have been subjected to yearlong and deferred-rotation grazing with different rates of stocking and various combinations of sheep and cattle during the past 19 years. No deer or goats have been in any of the pastures. Detailed measurements of the vegetation and livestock response furnish valuable information in establishing "cattle to sheep" ratios.

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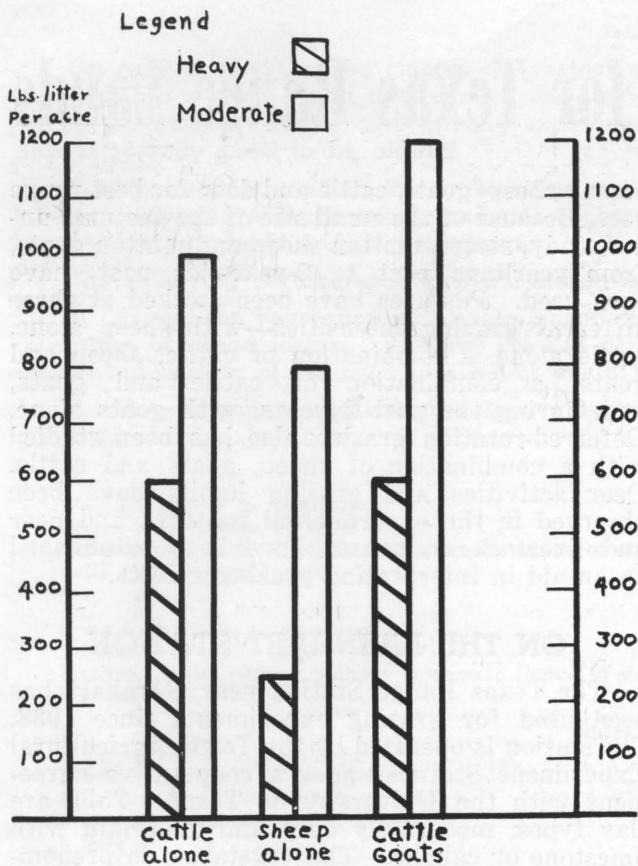


Figure 1. Accumulated litter in pounds per acre on experimental pastures of the Ranch Experiment Station under heavy and moderate rates of grazing with different kinds of livestock.

ON THE KERR WILDLIFE MANAGEMENT AREA

Grazing studies and livestock-deer observations have been made on the Kerr Wildlife Management area near Hunt for many years as a part of a cooperative study by the Texas Game

TABLE 1. PASTURE CONDITIONS AND PRESENT CARRYING CAPACITY OF HEAVILY AND MODERATELY GRAZED PASTURES STOCKED WITH DIFFERENT KINDS OF LIVESTOCK¹

Item	Heavy, at 48 animal units			Moderate, at 32 animal units		
	Cattle alone	Sheep alone	Cattle and goats	Cattle alone	Sheep alone	Cattle and goats
Accumulated litter, pounds per acre	600	250	600	1000	800	1200
Plant vigor	Poor to fair	Very poor	Poor to fair	Fair	Poor to fair	Fair to good
Browse utilization	Moderate	Moderate to heavy	Very heavy	Light	Moderate	Moderate
Range trend	Down	Severely down	Down	Relatively steady	Down	Steady
Range condition	High poor	Poor	High poor	Fair	Low fair	Fair
Present carrying capacity	22	20	22	30	25 to 30	32

¹Data are from experimental pastures on the Ranch Experiment Station as measured in January 1957.

and Fish Commission and the Texas Agricultural Experiment Station. Soils of the area are mainly rough, stony, clay types, ranging in depth from a thin cover over limestone bedrock to more than 20 inches. The vegetation consists of an overstory of oaks and cedar and an understory of mixed grasses such as curlymesquite, Texas wintergrass, sideoats grama, little bluestem and many others.

Grazing experiments on the Kerr area were designed to study three different rates of stocking with combinations of sheep, goats, cattle and deer. The effects of deer alone at "managed" and "unmanaged" rates also are studied in relation to livestock grazing and brush control practices. Data from these experiments have aided materially in making recommendations on livestock and deer ratios.

OTHER STUDIES AND OBSERVATIONS

Other research studies relating to livestock and deer ratios were reviewed by members of the joint committee. The experience and recommendations of agencies associated with grazing land problems, such as the Soil Conservation Service, Texas Agricultural Extension Service, Texas Game and Fish Commission and vocational agriculture groups, also were considered.

SHEEP AND CATTLE RATIOS

Standardizing conversion ratios from cattle to sheep, or computing the stocking rates when these two classes of livestock are grazed in combination, is a nationwide problem. When weight is used as a basis for a sheep-to-cattle conversion ratio, the yearlong average relationship is about 6.0 sheep to 1.0 cow (Stoddart & Smith, 1955). If the conversion is based on feeding tests, the ratio may run as high as 6.66 sheep to 1.0 cow. The ratio commonly used of 5.0 sheep to 1.0 cow has been adopted by most federal range agencies.

Stocking rates for the grazing experiments on the Ranch Experiment Station were set up on a basis of 6 sheep, 6 goats or 1 steer as 1 animal unit. Pastures were stocked with sheep, goats and cattle, and various combinations of these animals, at 48, 32 and 16 animal units per section.

All pastures on the Ranch Experiment Station were observed in this study, but most of the information was obtained from heavily and moderately grazed areas, and especially those stocked with only one kind of livestock. Determinations were made on each pasture of the amount of accumulated litter (number of pounds per acre), plant vigor (very poor, poor, fair or good), browse use (light, moderate or heavy), range trend (down, steady or up), present pasture condition (very poor to good) and present carrying capacity (animal units per section).

Table 1 shows that the pastures grazed with sheep alone were rated lower than those stocked with cattle, or with cattle and goats. Figure 1 shows that in the heavily-grazed pastures with sheep alone there were only approximately 250 pounds of litter per acre remaining on the ground to prevent raindrop splash and facilitate water intake into the ground. This is somewhat lower than the 600 pounds of litter per acre on pastures stocked with other kinds of livestock. Plant vigor was very poor in the heavily-stocked sheep pastures and poor to fair in pastures stocked heavily with cattle and with cattle and goats. Browse utilization was moderate in the cattle pasture, moderate to heavy in the sheep pastures and very heavy in the cattle and goat areas. With cattle and goat grazing, the range trend was down, but it was down severely where sheep were grazed alone.

The only heavily-grazed pasture placed in very poor condition was that stocked with sheep only (Figure 2). The pastures stocked heavily with cattle, and with cattle and goats, were placed in high poor condition (Figures 3 and 4). Figure 5 shows that the heavily-grazed sheep pasture was capable of carrying 20 or fewer animal units of livestock per section for expected improvement, while the straight cattle and the cattle and goat pastures were capable of carrying 22 or more animal units per section. The pasture grazed with sheep alone probably will need at least a year's complete rest for desirable recovery. It appears from these data that a stocking ratio of 6 sheep to 1 cow will place undue pressure on the forage and soil resources.

The moderately-grazed pastures at Sonora showed variations similar to those grazed heavily. However, the pasture stocked with sheep alone (considering 6 sheep as 1 animal unit) was the only one in the moderate group in which the range had deteriorated sharply during the severe drought. Intensive spot grazing was evident in the sheep pasture. Some areas were completely bare, others had an ungrazed cover of curlymes-



Figure 2. An experimental pasture on the Ranch Experiment Station stocked heavily with sheep alone. There has been a sharp decline in range condition during the 7 years of drouth.

quitegrass. The pastures stocked moderately with other kinds and combinations of animals showed no range deterioration (Figure 6).

Summarizing the results in both heavily and moderately-grazed pastures on the Ranch Experiment Station, it was evident that 5 sheep to 1 cow would be a more desirable ratio than 6 sheep to 1 cow.

Results from grazing studies on the Texas Range Station near Barnhart also indicate that, from the standpoint of conservation, a sheep-to-cow ratio of 5 to 1 is most desirable. Figure 7 shows a utilization survey made on the Texas Range Station in the heavily-stocked sheep and cow pastures in February 1956. It is apparent from this survey that there is a much more uniform utilization pattern in the cattle pasture than in the sheep pasture where 6 sheep were



Figure 3. An experimental pasture on the Ranch Experiment Station grazed heavily with cattle alone. The range condition of this pasture has deteriorated during the 7 years of drouth. This photo, taken in January 1957, shows a little more ground cover than the sheep pasture stocked at 6 sheep to 1 cow.

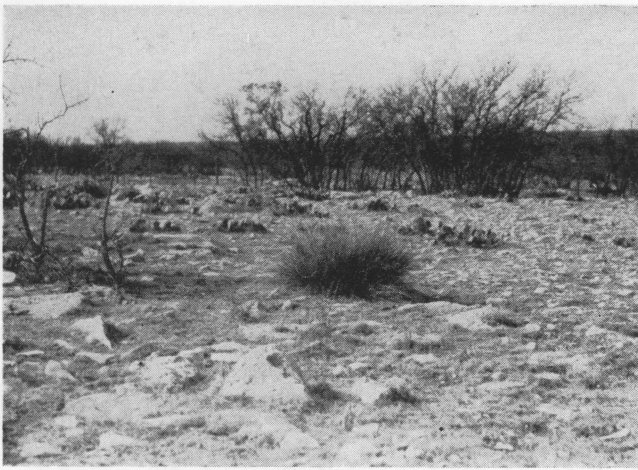


Figure 4. An experimental pasture on the Ranch Experiment Station grazed heavily with cattle and goats. The range condition of the pasture also has deteriorated during 7 years of drouth, but is slightly higher than pastures stocked with sheep only or with cattle only. The browse has been utilized heavily by the goats which replaced an animal unit of cattle.

considered as 1 animal unit. Sheep characteristically "spot graze" in certain locations, depending on wind and soil conditions. This spot grazing leads to serious reductions in ground cover

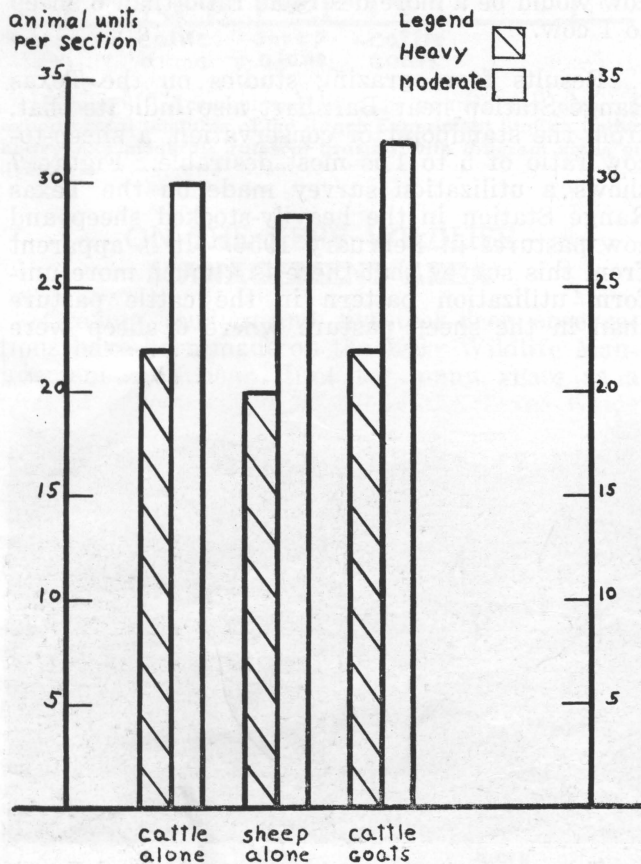


Figure 5. Carrying capacity in animal units per section on experimental pastures of the Ranch Experiment Station stocked at heavy and moderate rates of grazing with different kinds of livestock. Measurements were made in January 1957 after 7 years of grazing treatment.

and may create an erosion hazard. Pastures stocked at moderate rates with combinations of sheep and cattle show more desirable utilization of the area and a better use of a wider variety of forage species (Figure 8). Although some bitterweed poisoning of sheep occurred on all pastures during certain years, in general, less sheep poisoning has been recorded on pastures stocked moderately with combinations of sheep and cattle.

The results obtained at the Sonora and Barnhart stations confirm experimentally what agricultural agency technicians have observed on many ranches in Texas — that sheep ranches using more than a 5 to 1 ratio generally are more closely grazed than goat or cattle ranches. Apparently, this is because sheep eat more grass than goats, yet are able to graze the grass closer than cattle. Also, since sheep can subsist on closely-grazed ranches, the owners do not make adjustments in sheep numbers as readily when drouth hits.

It is agreed generally that to produce the maximum amount of forage, enough cover must remain on the soil surface to protect the soil and absorb rains. Sheep are able to subsist on grasses that are closely cropped, and on annual, lower-producing weeds that invade severely-abused ranges. They are able to survive long after forage shortage necessitates the removal or supplementary feeding of cattle. This is a special problem during times of drouth when the sheep are left on the land and continue to remove the needed vegetative cover. When rains do come, much of the needed moisture is wasted as runoff or evaporation from the land.

The Soil Conservation Service, working with soil conservation districts in Texas, has considered 5 sheep as 1 animal unit in developing ranch conservation plans. This ratio was selected from observations and experience throughout the West-



Figure 6. An experimental pasture on the Ranch Experiment Station stocked moderately with cattle, sheep and goats. The pasture has shown no decline in range condition in spite of the series of extremely dry years since 1949. Photo taken in January 1957.

ern States (S.C.S. Range Handbook, 1956), and has worked well in getting conservation on Texas ranches.

It is apparent from both experimental studies and other observations, that sheep, when stocked in balance with the forage produced and adjusted as rainfall and other conditions necessitate, are no more harmful to a range than any other class of livestock. It also is evident from these studies that, from the standpoint of range conservation, 5 mature sheep should be considered as 1 animal unit or equivalent.

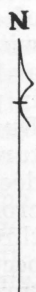
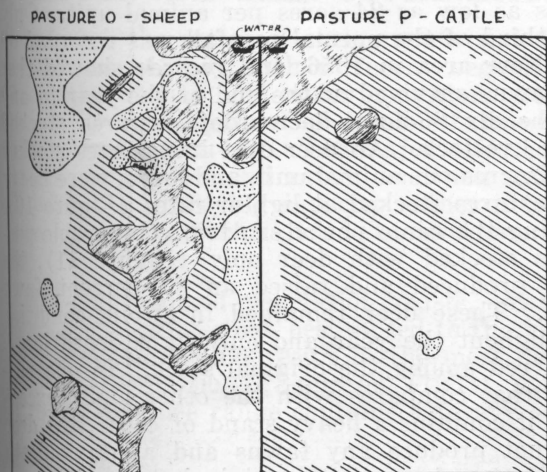
GOAT RATIOS

Grazing experiments at the Ranch Experiment Station have yielded considerable information on the effects of goats alone and goats in combination with sheep and cattle on the basic forage and soil resources. The practice of grazing goats alone has been in effect on the station for only 2 years. However, considerable information on the relation of goats to other kinds of livestock was obtained from the pastures stocked with cattle and goats, and combinations of sheep, cattle and goats.

Table 1 and Figures 1 and 5 show that, at the heavy rate of grazing, there is little difference between the pasture stocked with cattle and that stocked with cattle and goats. In the moderate-to-grazed pastures, the area grazed with cattle and goats was in somewhat better condition than

FORAGE UTILIZATION PATTERN

TEXAS RANGE STATION



— LEGEND —

- SEVERE USE
- HEAVY USE
- MODERATE USE
- LIGHT USE

Figure 7. Forage utilization pattern in pastures O and P of the Texas Range Station. These two adjacent 320-acre pastures have been stocked continuously at a heavy rate since 1944 with the kinds of livestock shown (6 sheep were used for 1 cow). There is a much more uniform utilization pattern in the cow pasture than in the variable-use pattern in the sheep pasture. Water is located in the northeast corner of pasture O and the northwest corner of pasture P.

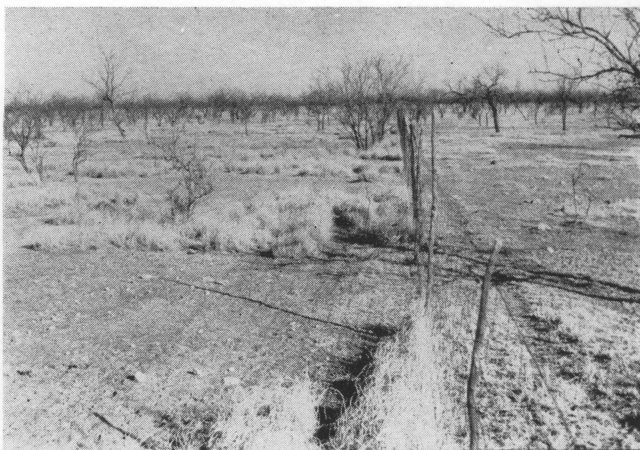


Figure 8. This photo was taken on the Texas Range Station along the fence separating the heavily-stocked sheep pasture (pasture O) on the left from the heavily-stocked cow pasture (pasture P) on the right. Note the difference in utilization of tobosa grass. There is less total forage remaining on the cow pasture, but the area is more uniformly grazed.

that grazed with cattle alone. Browse had been utilized more heavily in all pastures where goats were present (Figure 9). This was true on both the Sonora station and the Kerr Wildlife Management area.

Observations made by Soil Conservation Service technicians working in mixed vegetation areas of Texas indicate that pastures stocked with female goats make faster vegetative recovery than pastures stocked with an equal number of ewes. Large mutton goats, 2 years old or over, apparently are about equal to ewes in their overall grazing effect on the range.

Tieken and McNeely (1956) reported that more than 95 percent of the goat producers in Texas have other livestock on the same range. Studies have shown that goats normally use large quantities of browse and that competition between goats and other classes of livestock is more



Figure 9. An experimental pasture on the Ranch Experiment Station that has been heavily grazed by goats. Goat grazing in this pasture has resulted in heavy browse utilization of many species, including cedar.

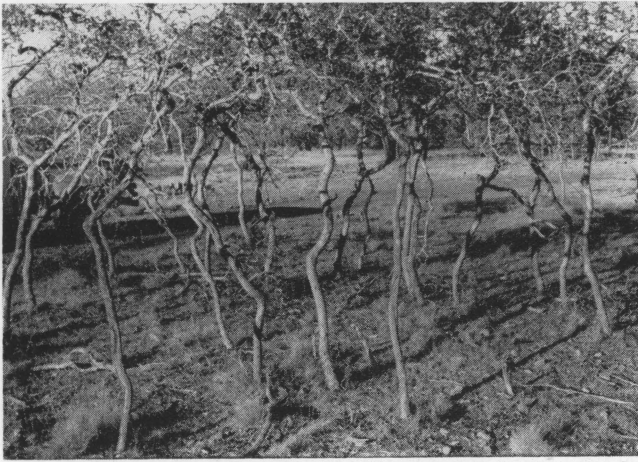


Figure 10. A 96-acre pasture on the Kerr Wildlife Management area stocked with 7 deer, and a light rate of livestock consisting of 7 goats, 8 sheep and 1 cow. Shinoak sprouts have been consumed completely and old growth is "sky-lined."

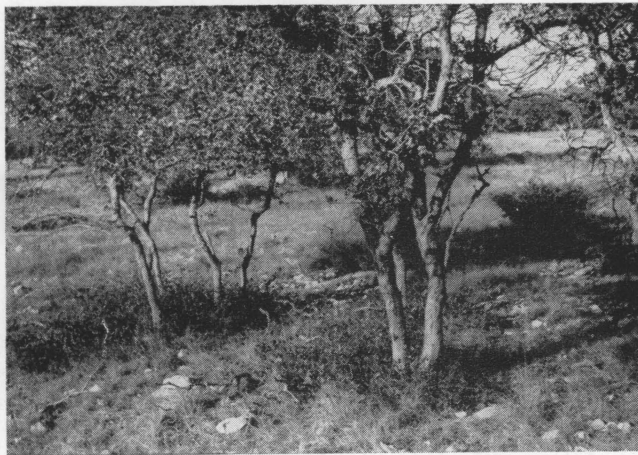


Figure 11. A 96-acre pasture on the Kerr area stocked with deer only. The deer in this pasture had an abundance of browse and other forage and produced an 87 percent fawn crop in 1956.



Figure 12. This 96-acre pasture on the Kerr area is protected completely from both livestock and deer grazing. Note the abundance of shinoak sprouts and other forage. Enclosures such as this compared with grazed areas, yield valuable information on grazing preferences and livestock-deer competition.

severe when browse species are scarce. Hahn (1945), working with the Texas Game and Fish Commission, found that heavy forage competition existed between goats and deer.

After careful consideration of conditions on experimental pastures and on other range areas where palatable browse species are available, it is apparent that a ratio of 6 goats to 1 cow is a comparable proportion. Variations between range sites and range conditions may have some effect on this ratio. Competition among goats, other classes of livestock and deer is influenced directly by the availability and quality of browse and other forage.

DEER RATIOS

The effects of deer grazing on pastures were somewhat more difficult to determine than the effects of cattle, sheep and goat grazing. Records were kept on the approximate number of deer found on all the livestock pastures of the Ranch Experiment Station. The pasture grazed lightly with cattle alone normally supports enough deer units to make a grazing rate comparable with moderate grazing. This pasture is in a condition comparable with or slightly better than the pasture grazed moderately with cattle and goats, which indicates a similarity between deer and goat units. At the heavy rates of grazing, where either sheep or goats were present, the deer had abandoned the pastures.

Results on the Kerr Wildlife Management area indicate that deer suffer from livestock competition during drouth years with stocking rates as low as 24 acres per animal unit. Only one-third of the normal rainfall was recorded on the Kerr area in 1956, and records showed that no fawns survived at the end of the year in any of the six 96-acre, deer-proof pastures stocked with livestock. All deer died in pastures stocked at 12 acres per animal unit, and losses were heavy in pastures stocked at lighter rates (Figure 10). During the same period, in two comparable pastures stocked with deer only (Figure 11), the deer produced and raised an 87 percent fawn crop. These deer remained in strong condition throughout the year and only light death losses occurred among the original stock. In one pasture that compares with the other eight, except that it contains a heavy stand of cedar, the deer did not produce any fawns and a heavy death loss occurred among the original stock. The condition of shinoak browse with neither deer nor livestock grazing is shown in Figure 12.

Results of the studies on the Kerr area indicate a high degree of competition between deer and the three classes of livestock. It is much more intense during drouth. The effect of the heavy stand and growth of cedar on the quantity and the quality of forage available was the apparent cause of the poor deer production in the heavy cedar pasture.

Dahlberg and Guettinger, 1956, found that deer require good quality forage during most of the year. When forced to take poor quality forage, the quantity required will increase. They also found that deer required a greater variety of forage when they were forced to eat less palatable foods.

Davis (1952) found that 12.7 deer were equal to one 1,000-pound steer in South Texas liveoak-mesquite type grazing. His work was based on the weight of the rumen content of deer and steers. The greatest competition was during the winter when they were on "starvation" diets, and in the spring when the annuals began to "green up."

Taylor and Buchner (1943) reported that 2.35 pounds of airdry forage were required per day for 100 pounds live weight of deer, and that 5,591 pounds of air-dry forage were required by a 750-pound cow in 1 year. Using these figures and an average weight of 109 pounds for Kerr county deer, it was calculated that 6 deer were equivalent to 1 cow.

The kind and amount of forage consumed by deer varies greatly, depending on what is available. There also are varying degrees of competition between deer and livestock, depending on the kind of forage available and the class of livestock grazing with deer. After considering these factors, and that in most cases three classes of livestock are grazed with deer in this area, 6 adult deer should be considered equal to 1 cow.

LIVESTOCK AND DEER COMBINATIONS

Although the ratios of sheep, goats and deer to cattle might vary with different vegetation, these ratios should hold under conditions where any of the combinations of kinds of livestock could be used effectively. The major differences between range sites and range condition classes will be in total carrying capacity rather than in ratios among the various kinds of livestock and deer.

When any mixed vegetation exists, grazing combinations of livestock best suited to the vegetation available should result in the most desirable range utilization. Sampson (1952) points out that a dual-use range contains a forage com-

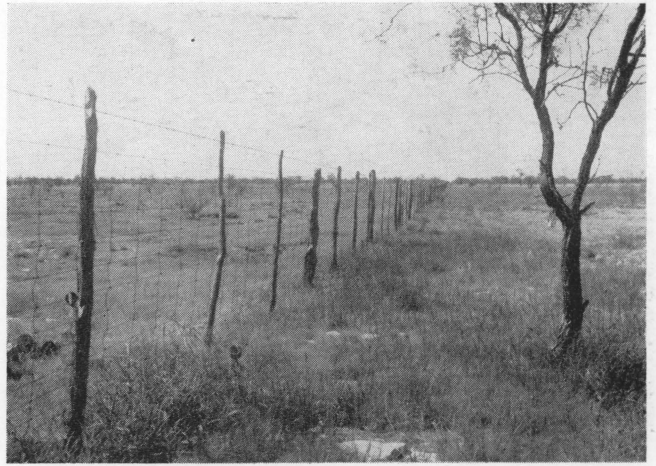


Figure 13. A fence-line contrast on the Texas Range Station between a heavily-stocked sheep pasture on the left and a pasture moderately-stocked with a combination of sheep and cattle on the right. Where the vegetation is suitable, combinations of livestock show more uniform utilization of the area, more opportunities for good growth of a wider variety of forage species and better conservation of the soil and forage resources.

bination of grass, forbs and browse which enables two or more kinds of livestock to graze the area to advantage, either at the same time or separately at different times. This should achieve more complete grazing of the forage as a whole without overgrazing any major plant community. The number of animal units should be increased little, if any, to carry on dual use where single classes have been grazed previously, especially if ranges are in need of improvement. Cook (1954), working on summer ranges of Utah, also found that common use by cattle and sheep resulted in more uniform range utilization than was obtained by grazing single kinds.

Research on the Ranch Experiment Station (Merrill and Young, 1954) and the Texas Range Station (Thomas and Young, 1954) shows that much greater uniformity of grazing can be obtained, both between plant species and within plant species, by grazing mixed kinds of livestock than by grazing a single kind alone. This results in better range use and greater economic returns (Figure 13).

Under good management, deer can be produced effectively and profitably on areas in Texas grazed by livestock.