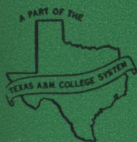


**Economic Analysis of
Year-long Grazing Rate Studies
On Substation No. 14,
Near Sonora**

30.72
T35m
#484



THE AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS
TEXAS AGRICULTURAL EXPERIMENT STATION
R. D. LEWIS, DIRECTOR, COLLEGE STATION, TEXAS

Summary and Recommendations

A study is being conducted on Substation No. 14, near Sonora, Texas, to determine the effects of combination grazing as contrasted to grazing of single classes of livestock at different rates of stocking. This report covers the results of research for the first 7 years, 1949-50 through 1955-56.

This study reveals that pastures were more productive when stocked with a combination than when stocked with only one kind of livestock. Different stocking rates showed significant differences in their effects on range condition. Relating these items, an adjusted gross return per acre, taking into consideration changes in range condition, for each pasture was computed. After this adjustment, significant differences remained between kinds and combinations of livestock grazed, Table 10. Pastures stocked with cattle, sheep and goats remained the most productive, followed by cattle and goats, sheep, and cattle, respectively.

There was little difference in production of animal products between pastures stocked at the heavy and moderate rates, with the exception of the pastures stocked with cattle alone. Pastures stocked with cattle alone had higher adjusted gross returns under moderate than under heavy stocking. All of the pastures stocked at the lightest rate yielded adjusted gross returns per acre significantly lower than the moderate or heaviest rates.

Costs such as labor, interest on investment and veterinary costs influence management decisions. Under the price relationships prevailing at the time of this study, the investment per animal unit of cattle was considerably greater than the investment per animal unit of goats. Consideration of these factors would have made the moderately stocked pastures appear even more favorable in this comparison.

In order to maximize production per acre on rangelands, ranchmen should consider stocking the

types of livestock which are best adapted to the type of vegetation present. For example, pure grasslands are best adapted to cattle production; cattle and sheep do well where weeds are present; and cattle, sheep and goats are adapted where grass, weeds and palatable browse are present.

On rangelands similar to those on the Sonora station, ranchmen should consider stocking a combination of cattle, sheep and goats, rather than cattle or sheep alone. In particular years, due to changes in price relationships or other factors, stocking with individual species might yield higher returns. However, for proper range use and maximum production over many years, a combination of livestock should be grazed.

There was little difference in production value per acre under moderate and heavy stocking during the period covered by this study. Ranchmen would be wiser to stock moderately during periods of similar climatic conditions, however, since range condition improved under moderate stocking and deteriorated under heaviest stocking.

Probably it would be possible to stock at a heavier rate and thus increase production without lowering range condition in years when moisture conditions are more favorable. Flexibility in stocking to meet changing rainfall and vegetative conditions is necessary. This may be achieved by careful culling and early sale of culled breeding animals, holding over calves, lambs, or kids in the fall or by purchasing other dry stock for sale after quick gains, or when grazing conditions begin to deteriorate. A safe method of achieving this flexibility would be to utilize 70 percent of the animal units for the base herd and 30 percent for dry stock. For example, if a ranch unit were estimated to be capable of carrying 100 animal units safely, under this plan 70 animal units would be obtained from the base herd and 30 animal units from dry stock.

Economic Analysis of Year-Long Grazing Rate Studies on Substation No. 14, Near Sonora

Leo B. Merrill and Jarvis E. Miller*

IN THE EARLY 1900's, ranchmen on the Edwards Plateau recognized the possible value of grazing cattle, sheep and goats in combination on a given range, and began bringing in sheep and goats to graze with their cattle. Since that time, most of the ranches on the Edwards Plateau have been grazed with the three types of livestock.

In order to determine the advantages as well as the disadvantages of combination grazing, an experiment was set up on Substation 14, located between Rocksprings and Sonora, in 1949. The objectives of this experiment were to determine the effects of combination grazing as contrasted to grazing of single classes of livestock at different rates of stocking. Twelve 40-acre pastures were stocked with cattle, sheep and goats; cattle and goats; cattle alone and sheep alone. Each type or combination of livestock was stocked at three rates—48, 32 or 16 animal units per section.

The cattle, sheep and goats were castrated males from yearlings past to twos past. For the purposes of this study 6 sheep, 6 goats, or 1 steer were considered to be 1 animal unit.

This report covers the results of the first 7 years of this research. During much of this period, the area was affected by drouth. The extent to which these results are applicable to present and future situations will depend upon the recurrence of similar conditions. This research is continuing and later results will be released periodically.

ALTERNATIVE MANAGEMENT DECISIONS FACING RANCHMEN

Ranchmen, depending on their goals, values, circumstances and similar factors make different decisions concerning stocking rates and livestock management. One basic problem involves the decision concerning the intensity of grazing. By intense grazing, it may be possible to maximize cash returns over a short time. However, intense grazing will result in damage to the range resource in terms of a lower carrying capacity, with the results being felt at a later time. Therefore, in this area, a ranchman must make a basic choice between a higher cash return in the short

*Respectively, associate in range management, Substation 14, Sonora, Texas, and associate professor, Department of Agricultural Economics and Sociology, College Station, Texas.

run versus a higher cash return in the longer run. This analysis was made to assist in making decisions of this type.

PASTURE PRODUCTIVITY USING DIFFERENT TYPES OF LIVESTOCK

The comparisons of physical production from similar pastures stocked with different combinations and types of livestock are difficult because several different products are obtained and it is difficult to assign values to changes in vegetative conditions of the range. For example, average animal production of the three stocking rates per acre from cattle grazed alone was 9.0 pounds of beef; from sheep grazed alone, 4.9 pounds of mutton and 2.7 pounds of wool; from cattle and goats, 5.0 pounds of beef, 2.1 pounds of goat and 1.4 pounds of mohair; for cattle, sheep and goats, 5.6 pounds of beef, 2.0 pounds of mutton, 0.7 pound of wool, 1.1 pounds of goat and 0.7 pound of mohair, Table 1. Different vegetative responses have been obtained under these grazing treatments.

The manager of a ranch must have some idea of the relative production of livestock products under different systems of stocking, if he is to make decisions which maximize economic returns. In order to obtain output information which would be meaningful and comparable under such conditions, a gross value of production per acre was computed for each pasture. Prices

contents

Summary	2
Introduction	3
Alternative Management Decisions Facing Ranchmen	3
Pasture Productivity Using Different Types of Livestock	3
Effects of Stocking Rates on Productivity	5
Pastures Stocked with Cattle Alone	6
Pastures Stocked with Sheep Alone	6
Pastures Stocked with Cattle and Goats	6
Effects of Grazing on Future Production	7
Value of the Range Resource	7
Value of Future Production	8
Acknowledgments	8

TABLE 1. AVERAGE PRODUCTION PER ACRE, PASTURES STOCKED WITH SELECTED LIVESTOCK BY STOCKING RATE, 1949-50 THROUGH 1955-56

Stocking rate	Cattle alone			Sheep alone			Cattle and goats			Cattle, sheep and goats		
	Beef	Mutton	Wool	Beef	Goats	Mohair	Beef	Mutton	Wool	Goats	Mohair	
	Pounds											
48 animal units	11.3	6.3	4.0	6.3	3.1	2.1	6.7	2.8	1.1	1.7	1.0	
32 animal units	9.6	5.3	2.7	6.2	2.4	1.5	6.2	2.2	.8	1.2	.8	
16 animal units	6.1	3.1	1.5	2.6	.9	.7	4.0	1.0	.4	.4	.4	
Average	9.0	4.9	2.7	5.0	2.1	1.4	5.6	2.0	.7	1.1	.7	

used to compute the gross value of production per acre were averages of the prices reported for the 7-year period. Specifically, they were:¹

Cattle—Average July price of good and choice 500-800 pound feeder steers at Fort Worth (\$23.85 per hundredweight).

Sheep—Average July price of good and choice feeder lambs at Fort Worth (\$17.00 per hundredweight).

Goats—Average July price of slaughter goats at San Antonio (\$7.50 per hundredweight).

Wool—Average July price received by Texas ranchmen for grease wool (\$.60 per pound).

Mohair—Average July price received by Texas ranchmen for mohair (\$.90 per pound).

Because of the severe drouth and the extremely poor grazing conditions, supplementary feeding was necessary during 3 years. In 1952, only cattle were fed, and the feeding period lasted from January 28 through June 8. The following season (1952-53), all livestock were fed the same amount per animal unit from December 1 until April 15. During the 1953-54 season, all livestock were again fed from January 12 through April 24. All feed costs were valued at the price actually paid for the feed. Feed costs and shearing charges were deducted from the gross value of production per pasture to obtain gross returns.

Estimating future production from grazing is extremely difficult because of changes in weather and management practices. However, in an attempt to determine the future production from pastures managed in different ways, estimates of expected carrying capacity were made by an inter-agency committee composed of personnel of the Texas Agricultural Experiment Station, Texas Agricultural Extension Service, Soil Conservation Service, Texas Game and Fish Commission, Texas Section of the American Society of Range Management and Texas Education

¹Sources of market prices

Cattle—Cattle and calves: Monthly average price per 100 pounds, Fort Worth, Agricultural Marketing Service, United States Department of Agriculture.

Sheep—Sheep and lambs: Monthly average price per 100 pounds, Fort Worth, AMS, USDA.

Goats—Market News Branch, AMS, USDA.

Wool and Mohair—Mid-Month Local Price Reports (Texas), Agricultural Estimates, AMS, USDA.

Agency. To make these determinations, the committee surveyed all the pastures in the grazing study to appraise the current condition of the range and estimated carrying capacities.

In order to obtain comparable information, estimates were made of carrying capacities that would maintain a constant range condition. These estimates were used to measure the change in carrying capacity resulting from different grazing intensities. They are not to be interpreted as general recommendations.

The figures showing value of production provide a means of comparing the productivity of similar pastures when stocked with different types and combinations of livestock. During 1949-50 through 1955-56, for example, the average value of production from pastures stocked with cattle, sheep and goats was the highest, at \$2.64 per acre, compared with \$2.42 for cattle and goats, \$2.34 for sheep alone and \$1.79 for cattle alone, Table 2. Differences in average value of production per acre were not statistically significant for sheep alone, cattle and goats or cattle, sheep and goats. The average value of production per acre was significantly lower for cattle alone than for the other livestock combinations.

Production of these pastures varied widely from year-to-year. For example: the average value of production (from all pastures) ranged from a low of \$1.30 per acre in 1952-53 to a high of \$3.43 per acre in 1955-56. The average value of production per acre was highest for

TABLE 2. AVERAGE PRODUCTION VALUE PER ACRE OF PASTURES STOCKED WITH SPECIFIED LIVESTOCK, 1949-50 THROUGH 1955-56¹

Years	Cattle alone	Sheep alone	Cattle and goats	Cattle, sheep and goats	Average
					Dollars
1949-50	2.97	3.01	3.13	3.43	3.13
1950-51	1.06	1.59	1.85	1.98	1.62
1951-52	.38	1.76	1.98	1.90	1.50
1952-53	.45	1.12	1.74	1.90	1.30
1953-54	2.75	3.17	2.89	3.17	3.00
1954-55	1.54	2.35	2.05	2.40	2.08
1955-56	3.35	3.36	3.32	3.69	3.43
Average	1.79	2.34	2.42	2.64	2.36

¹Average of three stocking rates.

cattle, sheep and goats grazed in combination. Production tended to be most variable in the pastures where cattle alone were grazed. In those pastures, the value of production ranged between \$3.35 and 38 cents per acre. Average annual deviation from the average for the period was \$1.06 for cattle; 77 cents for cattle, sheep and goats; 72 cents for sheep; and 59 cents for cattle and goats.

The pastures in which cattle, sheep and goats were grazed had the highest average value of production per acre for the 7-year period, but they did not have the highest value each year. In 1951-52, pastures stocked with cattle and goats had a slightly higher value and in 1953-54, pastures stocked with sheep alone had the same values of production per acre as those stocked with cattle, sheep and goats.

There was no noticeable difference in trends in livestock production from the pastures stocked with different types and combinations of livestock, Figure 1. However, pastures stocked heavily with cattle alone and sheep alone showed definite decreases in productivity in 1951-53. There also have been changes in the range conditions and carrying capacities of the different pastures which will be discussed later.

EFFECTS OF STOCKING RATES ON PRODUCTIVITY

In an economic comparison of stocking rates, it must be remembered that carrying capacity will vary from one ranch to another, therefore, the figures used here for moderate or heavy grazing rates might not apply elsewhere. It is also difficult to take into consideration the possible deterioration or improvement of the forage resource during a short period. For this reason, the use of animal production data alone may lead to erroneous conclusions.

Vegetation surveys have revealed that there has been a marked change in range condition and estimated carrying capacity on the experimental pastures stocked at the three rates. The average estimated carrying capacity of the heavily stocked pastures was 20 percent lower in 1956 than in 1949. The carrying capacity of the moderately stocked pastures did not change and that of the lightly stocked pastures had increased slightly during that period.

It is significant that during the severe drouth years of 1951-54, it was necessary to provide supplemental feed in the heavily grazed pastures to prevent severe death losses. Feeding was not necessary in the moderately and lightly grazed pastures, but the animals were fed the same amount per head as on heavily grazed pastures in an attempt to keep influences comparable. It appears that castrated males of the age limit used, reacted more slowly to deteriorating range conditions than breeding animals would have.

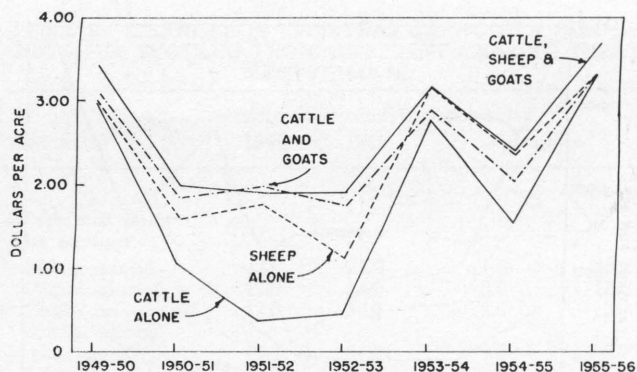


Figure 1. Average value of production per acre of pastures stocked with specified livestock, averages of stocking rates.

It is also significant that the moderately and lightly grazed pastures carried an estimated 5 and 11 animal units, respectively, of deer during the period; while deer would not remain on the heavily grazed pastures. Thus, the moderately grazed pastures actually carried 37 animal units and lightly grazed pastures carried 26 animal units per section during the period.² No attempt has been made to assign an economic value to deer units, or to give credit to the lightly and moderately grazed pastures as a result of carrying these units of deer.

During the period of study, animal production per acre tended to be greater when pastures were stocked at 48 compared with 32 and 16 animal units per section, Table 3. It is difficult to make direct comparisons of production from the pastures stocked with different kinds and combinations of livestock. Expressing production in terms of average values shows that the pastures stocked at 48 units per section produced an average annual value of \$3.03 as compared to \$2.49 for pasture stocked at 32 units. How-

²Merrill, L. B. and Young, V. A., Range Management Studies on the Ranch Experiment Station, Texas Agricultural Experiment Station, College Station, Texas, Progress Report 1449, 1952. Merrill, L. B. and Young, V. A., Results of Grazing Single Classes of Livestock in Combination with Several Classes When Stocking Rates Are Constant, Texas Agricultural Experiment Station, College Station, Texas, Progress Report, 1726, 1954. Merrill, L. B., et al., Livestock and Deer Ratios for Texas Range Lands, Texas Agricultural Experiment Station, College Station, Texas, MP-221, 1957.

TABLE 3. AVERAGE GROSS PRODUCTION VALUE PER ACRE BY STOCKING RATE, 1949-50 THROUGH 1955-56¹

Years	Stocking rate		
	48	32	16
	Dollars		
1949-50	4.51	3.24	1.66
1950-51	2.14	1.70	1.02
1951-52	1.95	1.58	.99
1952-53	1.20	1.65	1.05
1953-54	3.77	3.41	1.81
1954-55	2.63	2.40	1.23
1955-56	4.98	3.45	1.86
Average	3.03	2.49	1.37

¹Averages of grazing treatments.

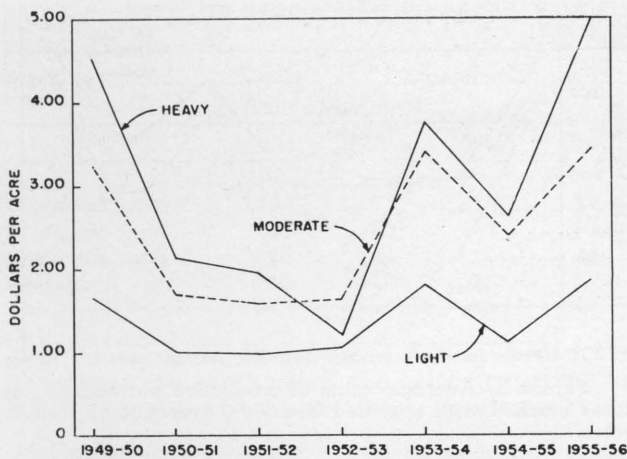


Figure 2. Average value of production per acre at heavy, moderate and light rates of stocking.

ever, this difference was not statistically significant. These stocking rates, however, yielded results which were significantly greater than the \$1.37 for pastures stocked at 16 units. Pastures stocked at the heaviest rate had the highest average production except in 1952-53, when pastures stocked at 32 animal units were higher, Figure 2.

Production from the pastures stocked at 48 animal units per section was more variable from year-to-year than that from the other rates. Annual deviation from the average was \$1.20 per acre for the heavy rate, 75 cents for the moderate rate and 34 cents for the light rate.

These data indicated little difference between trends in the average production of pastures stocked at the heavy and moderate rates. There is some indication of a slight upward trend in the average animal production from the lightly stocked pastures, but it has not been great.

Pastures Stocked with Cattle Alone

When pastures were stocked with cattle alone, about the same average production value per acre was obtained from both the 32 and 48 animal units per section rates, \$2.23 from the heaviest stocked and \$2 from the moderately stocked pastures, Table 4. This difference was not statistically significant. Light stocking rates

TABLE 4. AVERAGE GROSS PRODUCTION VALUE PER ACRE, PASTURES STOCKED WITH CATTLE AT THREE STOCKING RATES, 1949-50 THROUGH 1955-56

Years	Stocking rate		
	48	32	16
	Dollars		
1949-50	4.62	2.71	1.60
1950-51	1.36	1.12	.71
1951-52	.05	.59	.52
1952-53	.37	.84	.88
1953-54	3.54	3.76	1.94
1954-55	1.31	1.80	1.50
1955-56	5.08	3.10	1.86
Average	2.23	2.00	1.29

exceeded the production from the heavy or moderate rates in the 1952-53 season. The heavy rate yielded the highest average gross value the first 2 years and in 1955-56, but the moderate rate was higher between 1951-52 and 1954-55. This emphasizes the fact that cattle must have good range conditions in order to obtain maximum productivity.

While there is little indication of separate trends in the average gross value from the three pastures, there have been significant changes in their range conditions. Carrying capacity of the pasture grazed at the heaviest rate is estimated to have declined about 20 percent after 7 years of stocking at the heavy rate. The carrying capacity of the pasture stocked at the moderate rate has remained about the same as it was at the start of the experiment, while the carrying capacity of the lightly stocked pasture has increased about 7 percent.

Pastures Stocked with Sheep Alone

When sheep were grazed alone, the highest average gross value per acre was obtained from the pastures stocked at 48 animal units per section, Table 5. This rate yielded an average of \$3.28 per acre, compared with \$2.37 for the 32 animal units and \$1.35 for the 16 animal units. The heaviest rate of stocking yielded the highest gross value each year except during 1952-53, when the moderate rate was higher. However, differences between the heaviest and the moderate rates were not statistically significant.

Gross returns varied greatly from year-to-year for all three rates of stocking. However, there was less variation at the light rate. While there appeared to be no definite trends in gross returns of the pastures stocked at the three rates, the estimated carrying capacity in the pasture stocked at the heavy rate had declined about 26 percent during the 7 years, that of the moderately stocked pasture declined about 7 percent, while that of the lightly stocked pasture increased about 7 percent.

Pastures Stocked with Cattle and Goats

When cattle and goats were grazed together, the highest average gross return per acre was obtained from the pastures stocked at 48 animal

TABLE 5. AVERAGE GROSS PRODUCTION VALUE PER ACRE, PASTURES STOCKED WITH SHEEP AT THREE STOCKING RATES, 1949-50 THROUGH 1955-56

Years	Stocking rate		
	48	32	16
	Dollars		
1949-50	4.53	3.11	1.38
1950-51	2.27	1.50	.99
1951-52	2.56	1.56	1.15
1952-53	1.05	1.27	1.00
1953-54	4.38	3.39	1.75
1954-55	3.20	2.54	1.32
1955-56	4.98	3.25	1.86
Average	3.28	2.37	1.35

TABLE 6. AVERAGE GROSS PRODUCTION VALUE PER ACRE, PASTURES STOCKED WITH CATTLE AND GOATS BY STOCKING RATE, 1949-50 THROUGH 1955-56

Years	Stocking rate		
	48	32	16
	----- Dollars -----		
1949-50	4.36	3.62	1.41
1950-51	2.40	2.04	1.11
1951-52	2.60	2.27	1.08
1952-53	1.85	2.33	1.04
1953-54	4.00	3.17	1.50
1954-55	2.86	2.40	.89
1955-56	4.90	3.45	1.61
Average	3.28	2.76	1.23

units per section, \$3.28 versus \$2.76 for the 32 and \$1.23 for the 16 animal units per section, Table 6. The heaviest rate yielded the highest gross return every year except 1952-53, when the moderate rate was higher, Table 6. However, differences between the heaviest and moderate rates were not statistically significant. Carrying capacity of the pastures stocked at the heaviest rate declined about 20 percent. The moderately stocked pasture's carrying capacity remained about the same, and that of the lightly stocked pasture increased slightly.

EFFECTS OF GRAZING ON FUTURE PRODUCTION

While these data represent actual production from these pastures, they do not reflect the changes in range conditions which were observed. In order to obtain a measure of the changes in range conditions, estimates of future carrying capacities were made for each pasture.

Pastures stocked at the heavy rate were estimated to have declined approximately 21 percent in carrying capacity, Table 8. The pasture stocked only with sheep had declined approximately 26 percent, while those stocked with other kinds and combinations had declined 19 percent.

Pastures stocked only with sheep at the moderate rate had declined approximately 7 percent, while the carrying capacities of the pastures stocked with other kinds and combinations of livestock showed no decline.

TABLE 7. AVERAGE GROSS PRODUCTION VALUE PER ACRE, PASTURES STOCKED WITH CATTLE, SHEEP AND GOATS BY STOCKING RATE, 1949-50 THROUGH 1955-56

Years	Stocking rate		
	48	32	16
	----- Dollars -----		
1949-50	4.53	3.52	2.25
1950-51	2.53	2.15	1.26
1951-52	2.58	1.91	1.21
1952-53	2.27	2.18	1.24
1953-54	4.15	3.33	2.04
1954-55	3.16	2.84	1.19
1955-56	4.98	3.98	2.10
Average	3.46	2.84	1.61

TABLE 8. CHANGES IN CARRYING CAPACITIES (ANIMAL UNITS PER SECTION) FROM DIFFERENT GRAZING TREATMENTS, 1949-56

Treatment	Estimated carrying capacity ¹			
	1949	1956	Changes	
	----- Units -----		----- Percent -----	
48 Animal units per section				
Sheep alone	42.0	31.0	-11.0	-26.2
Cattle alone	42.0	34.0	- 8.0	-19.0
Cattle and goats	42.0	34.0	- 8.0	-19.0
Cattle, sheep and goats	42.0	34.0	- 8.0	-19.0
Average	42.0	33.3	- 8.7	-20.7
32 Animal units per section				
Sheep alone	42.0	39.0	- 3	- 7.1
Cattle alone	42.0	42.0	0	0
Cattle and goats	42.0	42.0	0	0
Cattle, sheep and goats	42.0	42.0	0	0
Average	42.0	41.2	- .8	- 1.8
16 Animal units per section				
Sheep alone	42.0	45.0	+ 3	+ 7.1
Cattle alone	42.0	45.0	+ 3	+ 7.1
Cattle and goats	42.0	45.0	+ 3	+ 7.1
Cattle, sheep and goats	42.0	45.0	+ 3	+ 7.1
Average	42.0	45.0	+ 3	+ 7.1

¹Estimated carrying capacity, animal units per section, that would maintain a constant range condition.

All of the lightly stocked pastures were estimated to have increased in carrying capacity approximately 7 percent.

Value of the Range Resource

An attempt was made to evaluate the effects of the different grazing treatments on the value of the range resources. A rental value of \$1 per acre was assumed for 1949. Since it was estimated that the heaviest grazed pastures had declined an average of 21 percent in carrying capacity by 1956, the 1956 value was assumed to be 79 cents per acre. In the same manner, the 1956 value of the moderately stocked pastures was assumed to be 98 cents per acre, and that of the lightly stocked pastures was assumed to be \$1.07.

TABLE 9. CHANGES IN CAPITALIZED VALUE¹ OF PASTURE PER ACRE RESULTING FROM DIFFERENCES IN STOCKING RATES, 1949-56

Stocking rate	1949 ²	1956 ³	Change	
			Total	Per year
	----- Dollars -----			
48	20.00	15.86	-4.14	-0.59
32	20.00	19.65	-0.35	-0.05
16	20.00	21.42	+1.42	+0.20

¹Based on rental values.

²Based on a rental value of \$1 per acre and capitalized at 5 percent.

³Based on changes in estimated carrying capacity between 1949-56.

TABLE 10. SUMMARY OF AVERAGE AND ADJUSTED¹ GROSS RETURNS PER ACRE, BY TYPE OF LIVESTOCK, BY STOCKING RATE, SONORA, 1949-50 THROUGH 1955-56

Stocking rate	Cattle	Sheep	Cattle and goats	Cattle, sheep and goats	Average
48 Animal units per section					
Gross return	2.23	3.28	3.28	3.46	3.06
Change in pasture value	-.54	-.75	-.54	-.54	-.59
Adjusted gross return	1.69	2.53	2.74	2.92	2.47
32 Animal units per section					
Gross return	2.00	2.37	2.76	2.84	2.49
Change in pasture value	0	-.20	0	0	-.05
Adjusted gross return	2.00	2.17	2.76	2.84	2.44
16 Animal units per section					
Gross return	1.29	1.35	1.23	1.61	1.37
Change in pasture value	+.20	+.20	+.20	+.20	+.20
Adjusted gross return	1.49	1.55	1.43	1.81	1.57

¹Considering changes in pasture value.

Capitalizing these rental values at 5 percent shows that the value of the range in the heaviest stocked pastures declined \$4.14 per acre or 59 cents per acre per year during the period of the study, Table 9. The capitalized value of the moderately stocked pastures declined only slightly (35 cents or 5 cents per year), while the lightest stocked pastures increased an average of 20 cents per year.

When these changes in the value of the range resource are related to the value of production, any advantage of the heavy stocking rate is overcome. The extra cash returns from heavier stocking were obtained through consumption of the basic range resource. When this value is considered, the average value of production per acre per year for the pastures stocked at the heavy and moderate rates were approximately the same, \$2.47 versus \$2.44. For the lightest stocked pasture, the value remained low, \$1.57 per acre, indicating that the slightly increased carrying capacity achieved at that rate of stocking was not enough to offset the reduction in livestock production, Table 10.

Value of Future Production

Based on the future stocking rates which it was estimated would maintain a constant range condition, and the average value of production per animal during the 1949-50 through 1955-56

TABLE 11. ESTIMATED FUTURE, 20-YEAR VALUE OF PRODUCTION PER ACRE¹ FROM PASTURES STOCKED WITH SPECIFIED GRAZING TREATMENTS

	Stocking rate			
	48	32	16	Average
	Dollars			
Cattle alone	28.65	40.10	44.40	37.72
Sheep alone	30.01	42.92	52.60	41.84
Cattle and goats	41.65	56.15	61.59	53.13
Cattle, sheep and goats	46.94	62.70	68.60	58.44
Average	36.81	50.47	56.79	48.03

¹Based on estimated carrying capacities which will maintain constant range conditions and average production and prices, 1949-56, and deducting rental value of pasture (\$1 per acre).

grazing seasons, a future (20 year) value of the production per acre for each grazing treatment was computed. If these pastures are stocked as recommended and if rainfall and price conditions are comparable to the 1949-50 through 1955-56 period, the estimated average future value of production from the lightest grazed pasture is \$56.79 per acre, compared with \$50.47 for the moderately grazed pastures, and \$36.81 for the heaviest grazed pastures, Table 11. The difference between the lightest grazed pastures and those moderately grazed was not statistically significant. However, the difference between the heavily grazed and the lightly and moderately grazed pastures was statistically significant.

On the average, pastures grazed with three types of livestock (cattle, sheep and goats) have the highest expected future value of production per acre, \$59.44, compared with \$53.13 for pastures stocked with cattle and goats. Pastures stocked with cattle alone and sheep alone have considerably lower future values of production.

ACKNOWLEDGMENTS

The authors acknowledge gratefully the assistance of R. J. Hildreth, assistant director, Texas Agricultural Experiment Station, Gerald W. Thomas, dean of agriculture, Texas Technological College and Calvin C. Boykin, Department of Agricultural Economics and Sociology, in the treatment of the material and compilation of the manuscript; of Howard Boswell, editor, Soil and Water Magazine, for helpful suggestions toward clarification of the publication, and to the following for their help in improving its readability to the layman: E. B. Keng, Soil Conservation Service, Sonora, Texas, and Frank Bond, Fred T. Earwood, W. B. McMillan and Edwin Sawyer, supervisors of the Edwards Plateau Soil Conservation District and ranchmen in Sutton and Edwards counties.