



The economic consequences of varying the rate of grazing on eastern Montana rangeland  
by Harold H Ramsbacher

A THESIS Submitted to the Graduate Faculty in partial fulfillment of the requirements for the degree  
of Master of Science in Agricultural Economics  
Montana State University  
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**Abstract:**

The scope of the study is limited to the economic implications of varying the rate of grazing on given areas of range in Eastern Montana. The optimum grazing rate was estimated between three relative intensities of range resource use ((1) heavy, (2) moderate, and, (3) light) by different combinations of cow numbers and surface acres.

The general methodological procedure of the study is to: (1) formulate a ranch budget describing a cattle ranch typical to Eastern Montana; and (2) substitute experimental production data from the United States Range Livestock Experiment Station, Miles City, Montana, grazing trials into the ranch budget in order to estimate the average net returns accruing to each of the three levels of grazing use.

The conclusions of the study indicate that grazing at a moderate level of range resource use is the more profitable alternative, but this conclusion must be qualified because of the lack of market grade data previous to 1955. Budgets using market grade data for 1955 indicate that the light rate of grazing would rank in a more favorable position if grade data had been available for the entire study period. .

The last chapter<sup>1</sup> points out the experimental models necessary to produce range resource combination data that will be applicable to proper economic analysis.

THE ECONOMIC CONSEQUENCES OF VARYING THE RATE OF  
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20

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Submitted to the Graduate Faculty

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at

Montana State College

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## ABSTRACT

The scope of the study is limited to the economic implications of varying the rate of grazing on given areas of range in Eastern Montana. The optimum grazing rate was estimated between three relative intensities of range resource use ((1) heavy, (2) moderate, and (3) light) by different combinations of cow numbers and surface acres.

The general methodological procedure of the study is to: (1) formulate a ranch budget describing a cattle ranch typical to Eastern Montana; and (2) substitute experimental production data from the United States Range Livestock Experiment Station, Miles City, Montana, grazing trials into the ranch budget in order to estimate the average net returns accruing to each of the three levels of grazing use.

The conclusions of the study indicate that grazing at a moderate level of range resource use is the more profitable alternative, but this conclusion must be qualified because of the lack of market grade data previous to 1955. Budgets using market grade data for 1955 indicate that the light rate of grazing would rank in a more favorable position if grade data had been available for the entire study period.

The last chapter points out the experimental models necessary to produce range resource combination data that will be applicable to proper economic analysis.

## PART I

### STATEMENT OF THE PROBLEM

#### Introduction

Livestock ranching is one of the major types of agricultural production in Eastern Montana. The 1950 Census of Agriculture reports: 65 percent of the total number of classified farms or ranches in 1949 were livestock farms other than dairy and poultry, 86 percent of all operators interviewed reported having breeding beef cows.<sup>1/</sup>

Much of Eastern Montana is best suited for livestock production, because the semiarid climate, soil, and topography impose a delicate balance between favorable and unfavorable growing conditions for tilled crops and in some cases range vegetation. Holscher<sup>2/</sup> reports that in the Northern Great Plains:

"The total vegetation . . . in the spring of 1937, was only 10% of what it had been in 1933, before the drouth years. . . . By 1943 the vegetation on the experimental range had recovered 92% of the area it had lost as a result of the drouth, and cactus, while present was no longer conspicuous on the range."

Drought has occurred on the average of once every five years at Miles City, Montana, during the period 1878 to 1939, but the drought periods did not occur regularly as five-year cycles.

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<sup>1/</sup> James R. Gray and Chester B. Baker, Organization, Costs and Returns on Cattle Ranches in the Northern Great Plains, 1930-1952, Montana Agricultural Experiment Station Bulletin 495, Bozeman, Montana, December 1953, p. 6.

<sup>2/</sup> Clark E. Holscher, "Controlling of Prickly Pear," Western Livestock Journal, Nelson R. Crow Publications, Volume 22, Number 42, 1944, p. 7.



Beef cattle have formed one of the most favorable enterprises to the plains rancher because of the vast acres that must remain in grazing forage. It has been estimated that approximately 75 percent of the land in the Northern Great Plains is utilized as grazing land.<sup>1/</sup> Crop agriculture (mainly spring wheat) now occupies considerable areas of the rolling glacial plains north of the Missouri River, but it accounts for only a small part of the northern plains roughlands that lie south of the Yellowstone River. Probably less than 10 percent of this land was ever plowed.<sup>2/</sup>

Generally, the ranchers of the northern plains have evolved their type of ranch operation to take advantage of the production opportunities best afforded by the natural resources and markets. They have had to do this or "go broke." Eastern Montana ranches have a natural feed balance through the grazing season, because the natural vegetative composition is comprised of midgrasses and shortgrasses. Shortgrasses provide late summer and early fall range requirements, and the midgrasses provide the spring, early summer, and late fall grazing. Usually, sufficient winter feed can be produced to balance the rangeland grazing capacity. The feeds commonly grown are: alfalfa, small-grain hay and straw, corn, sweet clover, and native hay.

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<sup>1/</sup> Bradford Knapp, Jr. and A. L. Baker, Crossbred Beef Cattle for the Northern Great Plains, United States Department of Agriculture Circular 810, U. S. Government Printing Office, Washington, D. C., 1949, p.2.

<sup>2/</sup> Mont H. Saunderson, Western Livestock Ranching, Minneapolis, Minnesota, The University of Minnesota Press, 1950, p. 26.

To maintain this balance of natural resources and livestock numbers now and in the future is the big job of the plains rancher. Overgrazing discriminates against the midgrasses in favor of the shortgrasses, thus causing a shortage in early spring and late fall grazing (unless the supplemental feeding periods are extended). Hay is usually a very expensive substitute for grass, though, and better range management and development would probably be a more effective and cheaper means of attaining the forage-animal balance.

During periods of high precipitation and abundant range forage many ranchers have increased the number of cattle on the ranges. But the weather invariably will change, and the operator who has increased his operation is unwilling to sell on a declining market unless absolutely forced to. Hurtt reports that:

<sup>00</sup>Worse than a single drought or dry year is a succession of such years. In such a period the operator who has made a practice of grazing his range to the limit of usable forage finds to his dismay that the interval between such droughts is insufficient for the forage to regain its vigor. As a result, the second year of drought hits harder than the first, and for the operator it may well mean ruin.<sup>001/</sup>

It now seems doubtful that numerical increases of livestock resulted in any material increase in meat after the maintenance requirements of the breeding herds were met.<sup>2/</sup>

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<sup>1/</sup> Leon C. Hurtt, Managing Northern Great Plains Cattle Ranges to Minimize Effects of Drought, United States Department of Agriculture Circular 865, U. S. Government Printing Office, Washington, 1951, p.2.

<sup>2/</sup> Leon C. Hurtt, Cattle Production Increased on Northern Great Plains Under Conservative Stocking, Northern Rocky Mountain Forest and Range Experiment Station, Missoula, Montana, Research Note 22, May 1942.

Steers are sometimes included in the herd, because they can usually be disposed of earlier in the season and have a more available market than "wet" cows. The use of steers to insure greater flexibility in the rate of stocking in times of extreme drought may prove beneficial in conserving needed range forage for the foundation herd.

#### Research Problem

There have been wide differences of opinion among ranchers concerning the methods of achieving the proper balance between livestock numbers and range forage, but essentially the producer must be concerned with the yearly costs and returns from the breeding herd as well as the permanent condition of his range forage. The balance of range forage and supplemental feed requirements must give the greatest net returns from livestock production in the long run.

The scope of this study shall be limited to the economic implications of varying the rate of grazing on given areas of range. The combination of resources (cows and forage acres) which will give the maximum net returns currently and in the long run will be estimated.

The optimum economic rate of combining land and cows will be approximated by the use of budgets. The general methodological procedure of this study is to: (1) formulate a ranch budget describing a ranch typical to the area; and (2) substitute experimental production data from the United States Range Livestock Experiment Station, Miles City, Montana, grazing trials into the ranch budget in order to estimate the net returns accruing to each of the three grazing intensity levels.

### The Hypothesis

The hypothesis of the study is: either excessive or very light use of the range resources of Eastern Montana will increase yearly costs per animal unit and/or reduce the current and long-run net returns to the livestock rancher.

### The Sources of Data

The main source of secondary data for the formulation of a budget for the organization of the typical family-operated cattle ranch of Eastern Montana (taken as the averages of the years 1932 through 1955) was the recent study by Gray and Baker.<sup>1/</sup> The data from this publication were brought up to date through 1955 by Mr. James R. Gray.<sup>2/</sup>

The empirical data substituted into the "typical" ranch organization were obtained from the manuscript, Vegetation, Soil, and Cattle Responses to Grazing on the Northern Great Plains Range, by M. J. Reed and R. A. Peterson. This study, an analysis of the Miles City grazing trials, will be published in the near future. The above mentioned manuscript was supplemented and brought up to date (1946-1955) with livestock and plant production data from the files of the Forage and Range Branch, Agricultural Research Service, United States Range Livestock Experiment Station, Miles City, Montana.

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<sup>1/</sup> James R. Gray and Chester B. Baker, op. cit., pp. 1-107.

<sup>2/</sup> James R. Gray, Agricultural Economist, Farm Economics Research Division, ARS, USDA, Agr. Econ., New Mexico State College, Las Cruces, New Mexico.

## PART II

### DEVELOPMENT OF THE MODEL (BUDGET)

#### Ranch Organization

The ranch organization of the "typical" family-operated cattle ranch<sup>1/</sup> in this study is based on the average organization of the family-operated cattle ranch in the Gray and Baker cattle ranch study for the period 1932-55.

The land tenure status of the typical family-operated cattle ranch is given in Table I. An additional 108 animal unit months (AUM's) of grazing are furnished by a public range permit.

TABLE I. LAND TENURE - TYPICAL FAMILY-OPERATED CATTLE RANCH ON THE NORTHERN GREAT PLAINS, 1932-55.

| Acres                | Owned | Leased | Total |
|----------------------|-------|--------|-------|
| Range and Pasture    | 1,577 | 1,621  | 3,198 |
| Crop Lands Harvested | 199   | ---    | 199   |
| Idle and Waste Lands | 75    | ---    | 75    |
| Total                | 1,851 | 1,621  | 3,472 |

The Livestock Plan -- The average number of animals for each class of livestock on the Northern Great Plains family-operated cattle ranches during the period 1932-55 was used in compiling Table II. Livestock

<sup>1/</sup> A family-operated cattle ranch is defined as a range livestock organization which produces at least 50 percent of its gross income from beef cattle, and the labor and management is supplied primarily by the operator and his family.

numbers are converted to animal units (AU's) on the basis of the relationship between different livestock classes with respect to their need for food.

TABLE II. CONVERSION OF LIVESTOCK CLASSES TO ANIMAL UNITS IN THE TYPICAL FAMILY-OPERATED CATTLE RANCH.

| Class of Stock | No. Head | AU Equivalent | Animal Units |
|----------------|----------|---------------|--------------|
| Mature Horses  | 11.8     | 1.0           | 11.80        |
| Dairy Cow      | 2.7      | 1.2           | 3.24         |
| Dairy Heifer   | 0.5      | 0.7           | 0.35         |
| Sub Total      | ---      | ---           | 15.39 AU's   |
| Beef Cow       | 67.7     | 1.0           | 67.70        |
| Beef Heifer    | 14.7     | 0.7           | 10.29        |
| Beef Steer     | 8.6      | 0.7           | 6.02         |
| Beef Bull      | 2.3      | 1.2           | 2.76         |
| Calves         | 40.4     | 0.4           | 16.16        |
| Sub Total      | ---      | ---           | 102.93 AU's  |
| Grand Total    | ---      | ---           | 118.32 AU's  |

The ranch study's beef herd was comprised of mixed classes including steers. To make the average "typical" livestock budget comparable to the experimental data available, it was desirable to exclude the steer class and keep only enough calves to use as stock cow replacements. At the same time, it was essential to keep the total animal units of beef cattle in the "adjusted" budget equivalent to the total number of animal units (102.93) of beef cattle in the livestock organization of the typical cattle ranch in the Gray and Baker study. Also, it was desirable to keep the remaining animal age and sex classes in the same proportion respective

to each other as was experienced in the original study. The following is an account of the procedure used to change the mixed beef herd into a cow-calf operation. The formula below was constructed from Table II to meet the criteria mentioned above.

(1) X equals the number of "cow equivalents" in the "adjusted" livestock organization.

$$(2) \frac{(67.7 \text{ cows})(1.0X \text{ AU's})}{67.7 \text{ cow units}} + \frac{(14.7 \text{ heifers})(0.7X \text{ AU's})}{67.7 \text{ cow units}} \\ + \frac{(2.3 \text{ bulls})(1.2X \text{ AU's})}{67.7 \text{ cow units}} + \left( \frac{14.7 \text{ calves}}{67.7 \text{ cow units}} + .04 \right)^{1/}$$

(0.4X AU's) = 102.93 AU's.

(3) 1.0X AU's of cows + .1519X AU's of heifers + .0408X AU's of bulls + .1028X AU's of calves = 102.93 AU's.

(4) 1.296X = 102.93 AU's  
X = 79.4 AU's of cows  
.1519X = 12.06 AU's of heifers  
.0408X = 3.24 AU's of bulls  
.1028X = 8.16 AU's of calves

(5)  $\frac{79.4 \text{ AU's}}{1 \text{ AU equivalent}} = 79.4 \text{ cows}$   
 $\frac{12.06 \text{ AU's}}{0.7 \text{ AU equivalent}} = 17.2 \text{ heifers}$   
 $\frac{3.24 \text{ AU's}}{1.2 \text{ AU equivalent}} = 2.7 \text{ bulls}$   
 $\frac{8.16 \text{ AU's}}{0.4 \text{ AU equivalent}} = 20.4 \text{ calves}$

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<sup>1/</sup> Percentages of calves in cow herd is obtained by adding .04 to the percentage of the heifers. This procedure maintains a sufficient number of calves for replacement purposes.

With the above data, Table III was compiled. Livestock prices<sup>1/</sup> and production data are averages taken from the cattle ranch study. The livestock inventories and purchases were calculated on the basis of average prices paid by farmers for the period 1932-55, while average prices received by farmers for the same period were used to determine the livestock sales values.

Death losses are averages of the years 1932-55. Death losses are not given explicitly for the seasonal calves but they are shown indirectly because the calving percentage employed in the study is actually based on the number of calves raised to weaning age.

The average number of beef cows sold each year is approximately 14 percent of the cow herd. The number of animals from the other beef classes that were sold each year are the animals not needed for the replacement of animals sold, died, or consumed at home.

The ending inventory (December 31) is the same as the beginning inventory (January 1) because each inventory reflects the average number of animals for the years 1932-55. The ranch livestock organization (other than the beef herd) will be identical to Table III in all subsequent livestock budgets, as it is the net returns due to changes in beef animal units for a given area of land that is to be evaluated.

Now, with the typical beef herd organization set up in Table III, the calving percentage and animal weights of the beef herd will be

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<sup>1/</sup> Prices received for beef animals were taken from Agricultural Statistics, United States Department of Agriculture, United States Government Printing Office, Washington, D. C., 1952 and 1955.



TABLE III. ADJUSTED LIVESTOCK BUDGET -- TYPICAL FAMILY-OPERATED CATTLE RANCH, 1932-55.

| Class                        | Inventory<br>Jan. 1 |             | To Raise |               | To Buy |             | Home<br>Use<br>Unit | No.<br>Died<br>Head | Sales        |             | Inventory<br>Dec. 31 |             | Cash Sales<br>± Inv.,<br>minus<br>Purchases<br>\$ |
|------------------------------|---------------------|-------------|----------|---------------|--------|-------------|---------------------|---------------------|--------------|-------------|----------------------|-------------|---|
|                              | Unit                | Value<br>\$ | Born     | Need<br>Repl. | Unit   | Value<br>\$ |                     |                     | Unit<br>Head | Value<br>\$ | Head                 | Value<br>\$ |   |
|                              |                     |             |          |               |        |             |                     |                     |              |             |                      |             |   |
| <u>Variable Organization</u> |                     |             |          |               |        |             |                     |                     |              |             |                      |             |   |
| Beef Cows                    | 79.4                | 7,225       | ---      | 14.5          | ---    | ---         | 1.0                 | 2.4                 | 11.1         | 1,522       | 79.4                 | 7,225       | 1,522   |
| Beef Heifers                 | 17.2                | 1,187       | ---      | 20.4          | ---    | ---         | ---                 | 0.9                 | 5.0          | 697         | 17.2                 | 1,187       | 697   |
| Beef Weaned Calf             | 20.4                | 898         | ---      | 20.8          | ---    | ---         | 0.4                 | ---                 | ---          | ---         | 20.4                 | 898         | ---   |
| Beef Seasonal<br>Calf        | ---                 | ---         | 60       | ---           | ---    | ---         | ---                 | ---                 | 39.2         | 2,075       | ---                  | ---         | 2,075   |
| Bulls                        | 2.7                 | 435         | ---      | ---           | 0.9    | 145         | ---                 | 0.1                 | 0.8          | 156         | 2.7                  | 435         | 11  |
| <b>Sub Total</b>             | ---                 | 9,745       | ---      | ---           | ---    | 145         | ---                 | ---                 | ---          | 4,450       | ---                  | 9,745       | 4,305   |
| <u>Constant Organization</u> |                     |             |          |               |        |             |                     |                     |              |             |                      |             |   |
| Milk Cows                    | 2.7                 | 333         | ---      | ---           | 0.2    | 18          | ---                 | ---                 | 0.7          | 96          | 2.7                  | 333         | 78  |
| Dairy Heifers                | 0.5                 | 22          | 1.3      | ---           | ---    | ---         | ---                 | ---                 | 0.8          | 40          | 0.5                  | 22          | 40  |
| Swine: Hogs                  | 5.3                 | 148         | ---      | ---           | ---    | ---         | 2.0                 | ---                 | 3.3          | 107         | 5.3                  | 148         | 107   |
| Pigs                         | ---                 | ---         | 7.0      | ---           | ---    | ---         | ---                 | 1.0                 | 0.7          | 20          | ---                  | ---         | 20  |
| Poultry: Hens                | 44.0                | 44          | ---      | ---           | ---    | ---         | ---                 | ---                 | 44.0         | 44          | 44.0                 | 44          | 44  |
| Chicks                       | ---                 | ---         | ---      | ---           | 100    | 14          | 46.0                | 10.0                | ---          | ---         | ---                  | ---         | 14  |
| Doz. Eggs                    | ---                 | ---         | ---      | ---           | ---    | ---         | 300.0               | ---                 | 433.0        | 134         | ---                  | ---         | 134   |
| Horses                       | 11.8                | 543         | ---      | 3.0           | ---    | ---         | ---                 | ---                 | 3.0          | 135         | 11.8                 | 543         | 135   |
| Colts                        | ---                 | ---         | 3.0      | ---           | ---    | ---         | ---                 | ---                 | ---          | ---         | ---                  | ---         | ---   |
| <b>Sub Total</b>             | ---                 | 1,090       | ---      | ---           | ---    | 32          | ---                 | ---                 | ---          | 576         | ---                  | 1,090       | 544   |
| <b>Total</b>                 | ---                 | 10,835      | ---      | ---           | ---    | 177         | ---                 | ---                 | ---          | 5,026       | ---                  | 10,835      | 4,849   |

allowed to vary (shown in Appendix A<sub>1</sub> and E<sub>1</sub>) according to the production yields actually experienced on the Northern Great Plains during the period 1932-55. Price of beef will be held constant (in Appendix A<sub>1</sub>) in order that the values reflected will be due to production changes -- not to price fluctuations. The total average value of beef sold was \$4,500, a return of \$56.67 per beef-cow of the age of two years and over in the typical herd.

Hay and Crop Plan -- The typical budget for hay and crop production is compiled in Table IV. The inventories are set up so that the totals approximate the average investment in feed and seed for the typical (average) Northern Great Plains cattle ranch during the period 1932 through 1955. Price averages for the period 1932-55 are held constant for beginning and ending inventories. Feed stocks are kept constant for beginning and ending inventories because the feed that is sold and/or fed is assumed to be replaced by the intervening harvest period.

The hay and crop yields are averages for 1932-55 taken from the cattle ranch study, and the AUM's of grazing allotted to the rangeland is the average rate for the Northern Great Plains family-operated cattle ranches.<sup>1/</sup>

Feed Requirements -- Table V gives the feed requirements for the livestock listed in Table III. The requirements are based on the average feeding standards for the Northern Great Plains cattle ranches for the years 1932-55.<sup>2/</sup>

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<sup>1/</sup> James R. Gray and Chester B. Baker, op. cit., p. 41.

<sup>2/</sup> Ibid., pp. 52, 53.

TABLE IV. BUDGET FOR HAY AND CROP PRODUCTION -- TYPICAL FAMILY-OPERATED CATTLE RANCH, 1932-55.

| Crops             | Yield   |             | Total<br>Units | Inventory<br>Jan. 1 |       | Disposal     |        |                | Inventory<br>Dec. 31 |       | Gross<br>Receipts<br>Cash Sales<br>+ Inv.<br>Change |        |
|-------------------|---------|-------------|----------------|---------------------|-------|--------------|--------|----------------|----------------------|-------|---|--------|
|                   | Unit    | Per<br>Acre |                | Unit                | Value | Feed<br>Seed | Unit   | Gross<br>Sales | Unit                 | Value |   |        |
|                   | Acres   | Bu.         |                | Bu.                 | \$    | Lbs.         | Unit   | \$             | Bu.                  | \$    |   |        |
| Corn              | 12.6    | 12.8        | 161            | 161                 | 156   | 9,660        | ---    | ---            | ---                  | 161   | 156   | ---    |
| Wheat             | 26.0    | 11.9        | 309            | 309                 | 399   | 26bu.        | 283bu. | 1.29           | 365.00               | 309   | 300   | 365.00 |
| Oats              | 13.6    | 22.5        | 306            | 306                 | 148   | 9,120        | ---    | ---            | ---                  | 306   | 148   | ---    |
| Barley            | 8.4     | 18.5        | 155            | 155                 | 112   | 6,936        | ---    | ---            | ---                  | 155   | 112   | ---    |
| Alfalfa<br>seed   | 5.0     | 0.87        | 4.4            | 4.4                 | 113   | 27.6         | 3.9bu. | 25.61          | 90.34                | 4.4   | 113   | 90.34  |
|                   | Acres   | Ton         | Ton            | Ton                 | \$    | Ton          |        |                |                      | Ton   | \$  | \$     |
| Alfalfa<br>hay    | 29.5    | 1.08        | 31.9           | 31.9                | 427   | 31.9         | ---    | ---            | ---                  | 33.0  | 441   | 14.00  |
| Other tame<br>hay | 21.6    | 0.94        | 20.3           | 20.3                | 272   | 20.3         | ---    | ---            | ---                  | 20.3  | 272   | ---    |
| Wild hay          | 81.9    | 0.64        | 52.4           | 52.4                | 702   | 52.4         | ---    | ---            | ---                  | 52.4  | 702   | ---    |
| Alfalfa hay       | 2.9     | 1.08        | 3.1            | 3.1                 | 42    | 3.1          | ---    | ---            | ---                  | 3.1   | 42  | ---    |
|                   | Acres   |             | AUM            | AUM                 |       | AUM          |        |                |                      |       |   |        |
| Range<br>AUM's    | 3,198.0 | ---         | 940            | 940                 | ---   | 940.0        | ---    | ---            | ---                  | ---   | ---   | ---    |
| Grazing<br>Permit | ---     | ---         | 108            | 108                 | ---   | 108.0        | ---    | ---            | ---                  | ---   | ---   | ---    |
| Idle and<br>Waste | 75.0    | ---         | ---            | ---                 | ---   | ---          | ---    | ---            | ---                  | ---   | ---   | ---    |
| Total             | 3,472.0 | ---         | ---            | ---                 | 2,371 | ---          | ---    | ---            | 455.34               | 2,385 | ---   | 469.34 |

TABLE V. NORMAL FEED REQUIREMENTS -- TYPICAL FAMILY-OPERATED CATTLE RANCH, 1932-55.

| Kind                         | No.  | Hay<br>Tons | Grain<br>(lbs.)     | Protein Conc.<br>(lbs.) |
|------------------------------|------|-------------|---------------------|-------------------------|
| <u>Variable Organization</u> |      |             |                     |                         |
| Beef Cows                    | 79.4 | 52.8        | 5,161               | 937                     |
| Beef Heifers                 | 17.2 | 9.2         | 1,118 <sup>a/</sup> | ---                     |
| Calves                       | 20.4 | 9.0         | 2,346               | ---                     |
| Bulls                        | 2.7  | 5.0         | 929                 | 140                     |
| Sub Total                    | ---  | 76.0        | 9,554               | 1,077                   |
| <u>Constant Organization</u> |      |             |                     |                         |
| Milk Cows                    | 2.7  | 8.10        | 11,340              | 378                     |
| Dairy Heifers                | 0.5  | 0.22        | 20                  | ---                     |
| Swine: Hogs                  | 5.3  | ---         | 5,130               | ---                     |
| Pigs                         | ---  | ---         | 7,088               | ---                     |
| Poultry: Hens                | 44   | ---         | 3,740               | ---                     |
| Chicks                       | 90   | ---         | 2,250               | ---                     |
| Horses: Mature               | 11.8 | 22.30       | 5,322               | ---                     |
| Colts                        | ---  | ---         | ---                 | ---                     |
| Sub Total                    | ---  | 30.62       | 34,890              | 378                     |
| Grand Total                  | ---  | 106.62      | 44,444              | 1,455                   |

<sup>a/</sup> Two-year olds were fed the same rate of grain as aged cows.

The feed requirements for the "constant portion" of the livestock feed budget, Table V, will also be used in the constant parts of subsequent grazing intensity budgets.

Feed and Seed Costs -- The difference between the animal requirements in Table V and the feed raised in the crop plan in Table IV indicates the feed purchases needed each year, or on the other hand, the feed surpluses that may be carried over to the next year as changes in the

feed inventory. Hay, grain, and protein supplements were fed to the typical beef herd each year, and the costs for these items varied each year according to the amount fed due to range and weather conditions. Mineral, seed, leasing, and grazing costs are itemized in Table VI as averages for the study period, and this latter group of costs was held constant for each year of the study. Feed prices are averages from the cattle ranch study for the years 1932 through 1955.<sup>1/</sup> Public grazing fees are based on the Bureau of Land Management grazing fees for the period 1936-55. The average value of the privately leased grazing land was \$9,288, and the cost of leasing this land was estimated at a 5 percent capital charge.

TABLE VI. MINERAL, SEED, AND LEASING COSTS -- TYPICAL FAMILY-OPERATED CATTLE RANCH, 1932-55.

| Item         | Unit        | Price           | Cost    |
|--------------|-------------|-----------------|---------|
| Salt         | 2,395 lbs.  | \$1.41/cwt.     | \$33.80 |
| Corn seed    | 1.7 bu.     | 5.57/bu.        | 9.50    |
| Grazing fees | 106 AUM     | 0.07/AUM        | 8.00    |
| Sub Total    | ---         | ---             | 51.30   |
| Lease fees   | 1,621 acres | 5.73/acre at 5% | 464.41  |
| Total        | ---         | ---             | 515.71  |

The variable costs of hay, grain, and protein concentrates were totaled with the constant costs of minerals, seed, etc. each year to estimate the feed costs in Table IX for the typical cattle ranch.

<sup>1/</sup> James R. Gray and Chester B. Baker, op. cit., p. 43.

Labor Costs and Requirements -- Yearly labor requirements for the family-operated cattle ranch are based on data for the years 1945-52. The years previous to this period reflect the transition from animal power to mechanized farm equipment and are not especially meaningful in this study.

TABLE VII. YEARLY LABOR REQUIREMENTS -- TYPICAL FAMILY-OPERATED CATTLE RANCH.

| Item                               | Unit         | Hours Total | Pre-harvest Hours | Harvest Hours | Man-days (10 hr. days) |
|------------------------------------|--------------|-------------|-------------------|---------------|------------------------|
| <u>Constant Ranch Organization</u> |              |             |                   |               |                        |
| <u>Crops</u>                       | <u>Acres</u> |             |                   |               |                        |
| Corn                               | 12.6         | 50.4        | 50.4              | ---           | 5.0                    |
| Wheat                              | 26.0         | 130.0       | 62.4              | 67.6          | 13.0                   |
| Oats                               | 13.6         | 68.0        | 28.6              | 39.4          | 6.8                    |
| Barley                             | 8.4          | 54.6        | 25.2              | 29.4          | 5.5                    |
| Alfalfa seed                       | 5.0          | 36.0        | ---               | 36.0          | 3.6                    |
| Alfalfa hay                        | 29.5         | 265.5       | 53.1              | 212.4         | 26.6                   |
| Other tame hay                     | 21.6         | 129.6       | 43.2              | 86.4          | 13.0                   |
| Wild hay                           | 81.9         | 388.6       | ---               | 368.6         | 36.9                   |
| Alfalfa straw                      | 2.9          | ---         | ---               | ---           | ---                    |
| Garden                             | 0.5          | 100.0       | ---               | ---           | 10.0                   |
| <u>Livestock</u>                   | <u>Head</u>  |             |                   |               |                        |
| Cows milked                        | 2.7          | 378.0       | ---               | ---           | 37.8                   |
| Horses                             | 11.8         | 483.0       | ---               | ---           | 48.3                   |
| Sows and gilts                     | 12.3         | 442.8       | ---               | ---           | 44.3                   |
| Hens and pullets                   | 44.0         | 74.8        | ---               | ---           | 7.5                    |
| Chicks raised                      | 90.0         | 27.0        | ---               | ---           | 2.7                    |
| Sub Total                          | ---          | 2,608.3     | 262.9             | 839.8         | 261.0                  |
| <u>Variable Ranch Organization</u> |              |             |                   |               |                        |
| Beef cows                          | 79.4         | 1,191.0     | ---               | ---           | 119.1                  |
| Other beef cattle                  | 40.3         | 443.0       | ---               | ---           | 44.3                   |
| Sub Total                          | ---          | 1,634.0     | ---               | ---           | 163.4                  |
| Grand Total                        | ---          | 4,242.3     | 262.9             | 839.8         | 424.4                  |

Labor requirement data for the period 1953-55 are not available at this time, but it is assumed that they will not differ greatly from the averages (1945-52) used in Table VII.

The hired labor cost in Table VIII will depend on the amount of family labor available. The labor cost is based on an average rate of \$4.15 per day.<sup>1/</sup>

TABLE VIII. LABOR COSTS -- TYPICAL FAMILY-OPERATED CATTLE RANCH, 1932-55.

| Item         | Days  | Wage/Day | Cost  |
|--------------|-------|----------|-------|
| Family labor | 356.5 | ---      | ---   |
| Hired labor  | 67.5  | \$4.15   | \$280 |
| Total        | 424.0 | ---      | \$280 |

Budget Summary

The budget summary is shown below in Table IX for the typical ranch organization. Power and machinery, building repair and depreciation, perquisites, and government payments are taken as averages of the period 1932-55 from the range cattle study. Taxes, miscellaneous, and livestock costs are adjusted to the change in animal classes from a mixed steer-cow-calf herd to an exclusive cow-calf operation. Other items listed in the summaries were developed in previous discussion.

All items not pertaining explicitly to the beef organization were held constant for the period 1932-55. Feed expenses reflect the following

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<sup>1/</sup> Ibid., pp. 59-63.

TABLE IX. 1932-55, AVERAGE COSTS AND RETURNS FOR A TYPICAL NORTHERN GREAT PLAINS CATTLE RANCH -- HISTORICAL AND CONSTANT PRICES.

|  | Unit    | Prices                   |          |
|--|---------|--------------------------|----------|
|  |         | Historical <sup>a/</sup> | Constant |
| Beef prices received                   | Dollars |                          |          |
| Calves (cwt.)                          | "       | ---                      | 13.86    |
| Cows and bulls (cwt.)                  | "       | ---                      | 13.33    |
| Total cash receipts                    | Dollars | 5,702                    | 5,644    |
| Grain                                  | "       | 389                      | 455      |
| Beef sales                             | "       | 4,658                    | 4,500    |
| Calves                                 | "       | 2,230                    | 2,098    |
| Cows                                   | "       | 2,268                    | 2,245    |
| Bulls                                  | "       | 160                      | 156      |
| Other livestock and livestock products | "       | 510                      | 544      |
| Government payment                     | "       | 145                      | 145      |
| Ranch perquisites                      | Dollars | 605                      | 632      |
| Hay inventory change                   | Dollars | 12                       | 21       |
| Gross ranch income                     | "       | 6,319                    | 6,297    |
| Total expenses                         | Dollars | 3,859                    | 3,884    |
| Livestock                              | "       | 184                      | 195      |
| Power and machinery                    | "       | 1,436                    | 1,346    |
| Building and repair                    | "       | 244                      | 226      |
| Miscellaneous                          | "       | 491                      | 514      |
| Taxes                                  | "       | 541                      | 454      |
| Wages                                  | "       | 214                      | 280      |
| Feed (excludes hay)                    | "       | 749                      | 869      |
| Net ranch income                       | Dollars | 3,859                    | 2,413    |

<sup>a/</sup> See the Appendices.



costs: the difference between grain fed and grain raised, purchases of protein concentrates, minerals, and leasing and grazing fees. The costs for the amount of hay fed in excess of the 107.7 tons raised on the ranch are recorded as negative changes in the hay inventory in Table IX.

Net ranch income (NRI) is calculated by subtracting total ranch expenses from the gross ranch income. The NRI (\$2,413) represents the return to the rancher for his labor, management, risk-bearing, interest on his investment, and the labor contributed by his family. The average annual net returns per cow over the age of two years in the beef herd was \$30.40 for the period.

A more detailed tabulation of the typical ranch's beef production, summaries of ranch expenses, and ranch income is available in Appendices A, B, C, D, E, F, G, and H.

The typical ranch organization developed above will be used as the framework within which the experimental data from the grazing trials at the United States Range Livestock Experiment Station, Miles City, Montana will be substituted in place of the typical livestock production and grazing data from the range cattle study. The subsequent "grazing trial" budgets will estimate net ranch incomes accruing to each of the three respective grazing intensities: (1) heavy, (2) moderate, and (3) light.

### PART III

#### APPLICATION OF EMPIRICAL DATA TO THE MODEL (BUDGET)

##### The Source of Empirical Data

The problem of proper stocking has been studied at the United States Range Livestock Experiment Station, Miles City, Montana, since 1932. A representative area of the Northern Great Plains rangeland was selected as the site of the grazing trials. Two sets of experimental range pastures were established; one set on rather gently rolling land was used as summer range, and the other set was located in rougher country for winter grazing. The summer grazing season ordinarily extended from May 15 until November 15 each year and the winter season included the remaining six months. Two pastures of each set were lightly stocked at 38.8 acres per cow-year; two were moderately stocked at 30.5 acres per cow-year; and two were heavily stocked at 23.1 acres per cow-year.

All the range pastures were somewhat similar. The pastures were wedge-shaped, and each set radiated from a central well from which stock water was equally accessible. Salt was placed in each range pasture as an aid in obtaining uniform distribution of grazing. Topography was not a factor in distribution of grazing on either the summer or the winter range pastures.<sup>1/</sup>

Three groups of high quality Hereford breeding cows were stocked on the range pastures during 1932-55. The first group was carried through

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<sup>1/</sup> Clark E. Holscher and E. J. Woolfolk, Forage Utilization by Cattle on the Northern Great Plains Ranges, United States Department of Agriculture Circular 918, U. S. Government Printing Office, Washington, D. C., June 1953, p. 2.

early August, 1936, when they were sold because of uncertainties of feed resulting from the drought. The second group was started in 1937 and continued through November, 1945 when they were sold for salvage as open ten-year olds. The third group was started in the spring of 1948 as yearling heifers. This group dropped their first calves in the spring of 1950.

Cows were bred to registered Hereford bulls during a six-week period in June and July. In 1935 and the period 1939 through 1955 bulls were shifted between pastures periodically to equalize the possible effects of individual bulls. In the other years, one bull was furnished per pasture except in two years when a single bull was moved through a circuit of all pastures twice each day.

Detailed records were kept of how the range and cattle were affected by the weather and the three rates of stocking. The records contained vegetation data, supplemental feed required for each group of cows, and individual cow and calf weights recorded at 28 day intervals.<sup>1/</sup>

To estimate the probable effects of grazing at different levels of use on the typical family-operated cattle ranch empirical data from the Miles City grazing experiment will be substituted into the typical ranch organization.

The land tenure organization of the typical cattle ranch (Table I), will remain the same for the subsequent grazing intensity budgets. Hay,

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<sup>1/</sup> M. J. Reed and R. A. Peterson, Vegetation, Soil, and Cattle Responses to Grazing on the Northern Great Plains Range, Unpublished manuscript, pp. 18-20.

grain, and ranch enterprises other than beef will have the same acreages, animal numbers, and yields as the typical ranch. Prices received and paid by the rancher will remain constant through the years, 1932-55, and between the different grazing level budgets. The desired end is to reflect the results of varying the rates of grazing, and this is accomplished by varying the number of beef animal units on a given area of range (3,558 acres).<sup>1/</sup>

The Ranch With a Heavy Rate of Grazing --  
Prices Held Constant

Using the same general ranch organization that was developed previously for the typical cattle ranch, all the ranch enterprises and management practices are carried over into the heavily grazed cattle ranch except for those practices employed in the beef cattle enterprises.

The number of beef animals for the heavy grazing rate are calculated by dividing the acres per cow-year (23.1 acres) into the surface acres grazed (3,558 acres). The constant ranch livestock organization (15.39 AU's) was subtracted from the quotient (154 AU's) to give 138.61 AU's in the beef herd. The animal units in the beef herd were then substituted into the general formula developed on page 8.

(1)  $X$  = the animal units of cows in the herd.

(2) 154 AU's minus 15.39 AU's (horses and dairy) = 138.61 AU's (beef animals).

(3)  $\frac{2}{X}$  cows + .1519X heifers + .0408X bulls + .1028X calves = 138.61 AU's.

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<sup>1/</sup> Three hundred and sixty acres are allowed for the 108 AUM's of public grazing permit for the typical cattle ranch. This method will subject the public range to a similar degree of use as the private land.

<sup>2/</sup> See page 8 for the derivation of the formula.

(4)  $1.29X = 138.61 \text{ AU's}$

$X = 106.95 \text{ AU's} = 106.95 \text{ cows}$

$.1519X = 16.24 \text{ AU's} = 23.2 \text{ heifers}$

$.0408X = 4.36 \text{ AU's} = 3.6 \text{ bulls}$

$.1028X = 10.99 \text{ AU's} = 27.5 \text{ calves}$

In Appendix B<sub>1</sub> the livestock inventory except for the calf crop is held constant for each year of the study. Replacements are withheld from the calf crop each year in order to replace the animals in the herd that are culled, slaughtered and lost due to death each year. The number of animals slaughtered and culled are based on the cattle ranch study while death losses are based on empirical data from the Miles City grazing experiments.

The beef herd for the heavily grazed ranch is applied in Appendix B<sub>1</sub> to the marketing procedure experienced in the typical ranch budgets. The total value of beef sold each year is then shown in Appendix B<sub>1</sub> as a component of the total cash receipts. The yearly sales of beef from the heavily grazed range averaged \$5,736 for the study period. Average organization, production, and costs and returns for the period, 1932-55, are given in Tables X and XI.

The heavily grazed ranch budgets increase in livestock, tax, and wage costs (relative to the typical ranch budgets) reflect the larger herd size of the heavily grazed ranch, while the rise in miscellaneous costs reflect the increase in board for hired labor. Feed costs (exclusive of hay bought) are the same for each year except 1938 and 1944 when protein

TABLE X. 1933-55, AVERAGE ORGANIZATION, AND PRODUCTION FOR A TYPICAL NORTHERN GREAT PLAINS CATTLE RANCH WITH THREE INTENSITIES OF GRAZING USE.

|                    | Unit   | Rate of Grazing |          |        |
|--------------------|--------|-----------------|----------|--------|
|                    |        | Heavy           | Moderate | Light  |
| Land in ranch      | Acre   | 3,472           | 3,472    | 3,472  |
| Cropland           | "      | 199             | 199      | 199    |
| Rangeland          | "      | 3,198           | 3,198    | 3,198  |
| Miscellaneous      | "      | 75              | 75       | 75     |
| Crops harvested    | Acre   |                 |          |        |
| Grain              | "      | 60.6            | 60.6     | 60.6   |
| Hay                | "      | 133.0           | 133.0    | 133.0  |
| Other crops        | "      | 5.0             | 5.0      | 5.0    |
| Livestock on ranch | Number |                 |          |        |
| Beef cows          | "      | 107.0           | 78.1     | 58.9   |
| heifers            | "      | 23.2            | 16.9     | 12.8   |
| calves             | "      | 27.5            | 20.1     | 15.1   |
| bulls              | "      | 3.6             | 2.7      | 2.0    |
| Dairy cows         | "      | 2.7             | 2.7      | 2.7    |
| heifers            | "      | 0.5             | 0.5      | 0.5    |
| Chickens           | "      | 44.0            | 44.0     | 44.0   |
| Hogs               | "      | 5.3             | 5.3      | 5.3    |
| Horses             | "      | 11.8            | 11.8     | 11.8   |
| Beef animals sold  | Number |                 |          |        |
| Calves             | "      | 53.8            | 45.9     | 35.7   |
| Cows               | "      | 27.0            | 15.8     | 11.9   |
| Bulls              | "      | 1.25            | 0.9      | 0.7    |
| Weight per animal  | Pounds |                 |          |        |
| Calf               | "      | 359             | 396      | 396    |
| Cow                | "      | 1,005           | 1,080    | 1,076  |
| Bull               | "      | 1,315           | 1,461    | 1,461  |
| Beef sold          | Pounds |                 |          |        |
| Calves             | "      | 19,501          | 18,209   | 14,354 |
| Cows               | "      | 21,111          | 17,059   | 12,797 |
| Bulls              | "      | 1,644           | 1,315    | 1,023  |

TABLE XI. 1933-55, AVERAGE COSTS AND RETURNS FOR A TYPICAL NORTHERN GREAT PLAINS CATTLE RANCH WITH THREE INTENSITIES OF GRAZING -- CONSTANT PRICES.

|  | Unit    | Rate of Grazing |          |       |
|--|---------|-----------------|----------|-------|
|  |         | Heavy           | Moderate | Light |
| Beef prices received (cwt)             | Dollars |                 |          |       |
| Calves                                 | "       | 13.86           | 13.86    | 13.86 |
| Cows and bulls                         | "       | 13.33           | 13.33    | 13.33 |
| Total cash receipts                    | Dollars | 6,880           | 6,117    | 4,977 |
| Grain                                  | "       | 455             | 455      | 455   |
| Beef sales                             | "       | 5,736           | 4,973    | 3,833 |
| Calves                                 | "       | 2,703           | 2,524    | 1,990 |
| Cows                                   | "       | 2,814           | 2,274    | 1,707 |
| Bulls                                  | "       | 219             | 175      | 136   |
| Other livestock and livestock products | "       | 544             | 544      | 544   |
| Government payments                    | "       | 145             | 145      | 145   |
| Ranch perquisites                      | "       | 632             | 632      | 632   |
| Hay inventory change                   | "       | -652            | 271      | 436   |
| Gross ranch income                     | "       | 6,859           | 7,020    | 6,044 |
| Total cash expenditures                | Dollars | 4,193           | 3,716    | 3,401 |
| Livestock                              | "       | 281             | 211      | 175   |
| Power and machinery                    | "       | 1,346           | 1,346    | 1,346 |
| Miscellaneous                          | "       | 590             | 512      | 458   |
| Taxes                                  | "       | 497             | 452      | 420   |
| Wages                                  | "       | 518             | 272      | 107   |
| Feed                                   | "       | 735             | 697      | 685   |
| Building and repair                    | "       | 226             | 226      | 226   |
| Net ranch income                       | Dollars | 2,666           | 3,304    | 2,627 |

supplements were fed to the heavily grazed beef herd. In Appendix B<sub>2</sub> the constancy in the feed costs over the period of the study reflects the fact that no grain or protein concentrates were fed to the experimental animals at Miles City, Montana, except for the years stated above. The purchases of hay (when hay fed exceeded hay raised) are denoted as negative changes in the hay inventory in Table XI.

During the years 1938, 1950, 1951, 1952, and 1954 it was necessary to remove the experimental animals from the summer grazing trial pastures before the predetermined date of November 1.<sup>1/</sup> Range management personnel have indicated that the moderately and lightly grazed pastures would probably have carried their animals through these periods without supplemental feeding. Therefore, extra feed costs have been charged against the heavily grazed ranch budgets for these years to account for the length of time that the summer grazing period was short of meeting the end of the normal grazing season.

The total expenses for the heavily grazed ranch averaged \$4,193 which when subtracted from the gross ranch income of \$6,859 leaves a net ranch income of \$2,666 or a net return of \$24.90 per cow over the age of two years in the beef herd.

The gaps in the Appendices for the years 1937, 1946, 1947, 1948, and 1949 reflect the lack of production data from the Miles City experiments.

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<sup>1/</sup> November 1st is the end of the grazing period for the later experiments, but the earlier experiments used November 15th. However, the author has arbitrarily chosen the former date for the purpose of the study.



The Ranch With a Moderate Rate of Grazing --  
Prices Held Constant

The production responses from a moderate intensity of grazing were "plugged" into the budgets of the typical ranch organization to estimate the effects of this type of range and livestock management upon the net income of the plains rancher.

The total animal units of beef animals for the moderate intensity of grazing were calculated by dividing the acres per cow-year (30.5) into the surface acres grazed (3,558 acres). The constant ranch livestock organization (15.39 AU's) was subtracted from the quotient (116.6 AU's) to give 101.21 AU's in the beef herd.

The animal units of beef animals were then substituted into the same general formula as on page 8. The resulting number for each class of beef animals is as follows:

78.1 cows  
16.9 heifers  
2.7 bulls  
20.1 calves

The beef herd for the moderately grazed ranch was then used to construct Column 4 in Tables X and XI. The total value from the sale of beef animals averaged \$4,973 yearly for the moderately grazed ranch.

The 1938 feed costs in Appendix C<sub>2</sub> show the one year of the study that protein concentrates were fed to the moderately grazed beef animals. Hay purchases and surpluses are given in Table XI in change of hay inventories.

Total ranch expenses for the moderately grazed ranch averaged \$3,716 -- a decrease of \$477 from the average total expense of \$4,193 for the heavily grazed ranch. The gross ranch income (GRI) for the moderately grazed ranch was \$7,020 which gave an average net ranch income (NRI) of \$3,304. The net returns for the moderately grazed ranch averaged \$42.30 per cow over the age of two years in the beef herd.

The Ranch With a Light Rate of Grazing --  
Prices Held Constant

The same general procedure employed in the construction of the heavily and moderately grazed ranch organization budgets was utilized in compiling the budgets for the cattle ranch with a light rate of grazing (38.8 acres per cow-year). Tables X, and XI and Appendices D<sub>1</sub>, D<sub>2</sub>, and D<sub>3</sub> give the results for the study period.

Feed costs for the year 1938 reflect the purchases of protein concentrates. Hay purchases and surpluses are itemized in Appendix D<sub>3</sub> under hay inventory changes.

The GRI for the lightly grazed cattle ranch averaged \$6,044 while the total ranch expenses averaged \$3,417. The difference of the above figures gives a NRI of \$2,627 for the lightly grazed ranch for an average net return per cow two years old and over of \$44.60 for the study period.

Budgets Using Historical Prices

Estimation of net ranch income computed with prices actually experienced is interesting with respect to how price fluctuations interacted

with the physical production responses to comprise the yearly uncertainties experienced by the plains rancher during the study period. The summaries for the budgets using historical prices are given in Appendices E, F, G, and H.

The yearly prices of cattle sold were taken from Agricultural Statistics 1952 and 1955. Prices received and paid for other commodities during this period were based on the 1910-14 indices.

The average costs and returns for the period, 1933-55, are given in Table XII for the three intensities of grazing. The average net ranch incomes for the heavily, moderately, and lightly grazed ranches are \$2,514; \$3,075; and \$2,332 respectively. As in the case of the budgets with constant prices, the sequence of largest to least net returns according to grazing use is the same, but there are slight changes in the magnitude of the returns.

The results for the budgets with historical prices are probably not too meaningful in terms of grazing use implications because the fluctuations in price may entirely or in large part shroud the reactions of grazing responses if the two factors act in opposite directions. Or on the other hand, price fluctuations may actually give false impetus to grazing results if the two factors change in the same direction.

Therefore, the ranch returns that were developed in the previous budgets with the assumption of constant prices will be analyzed in the next section of the thesis in terms of beef production as affected by range condition and weather fluctuations.

TABLE XII. 1933-55, AVERAGE COSTS AND RETURNS FOR A TYPICAL NORTHERN GREAT PLAINS CATTLE RANCH WITH THREE INTENSITIES OF GRAZING USE -- HISTORICAL PRICES.

|  | Unit    | Rate of Grazing             |          |       |
|--|---------|-----------------------------|----------|-------|
|  |         | Heavy                       | Moderate | Light |
| Beef prices received                   | Dollars |                             |          |       |
| Calves                                 | "       | -----Historical prices----- |          |       |
| Cows and bulls                         | "       | -----Historical prices----- |          |       |
| Total cash receipts                    | Dollars | 6,539                       | 5,897    | 4,826 |
| Grain                                  | "       | 367                         | 367      | 367   |
| Beef sales                             | "       | 5,515                       | 4,878    | 3,802 |
| calves                                 | "       | 2,604                       | 2,507    | 2,018 |
| cows                                   | "       | 2,697                       | 2,200    | 1,651 |
| bulls                                  | "       | 214                         | 171      | 133   |
| Other livestock and livestock products | "       | 488                         | 488      | 488   |
| Government payments                    | "       | 169                         | 169      | 169   |
| Ranch perquisites                      | Dollars | 581                         | 581      | 581   |
| Hay inventory change                   | Dollars | -545                        | 247      | 331   |
| Gross ranch income                     | Dollars | 6,575                       | 6,731    | 5,738 |
| Total expenses                         | Dollars | 4,061                       | 3,656    | 3,406 |
| Livestock                              | "       | 256                         | 192      | 160   |
| Power and machinery                    | "       | 1,436                       | 1,436    | 1,436 |
| Building and repair                    | "       | 241                         | 241      | 241   |
| Miscellaneous                          | "       | 561                         | 487      | 436   |
| Taxes                                  | "       | 595                         | 541      | 503   |
| Wages                                  | "       | 383                         | 201      | 79    |
| Feed (excludes hay)                    | "       | 589                         | 558      | 551   |
| Net ranch income                       | Dollars | 2,514                       | 3,075    | 2,332 |

## PART IV

### INFERENCES TO BE DRAWN FROM THE STUDY

#### Limitations of Comparing the Grazing Intensity Budgets With the Typical Cattle Ranch Study Budgets

While the data from the cattle ranch study are averages of the family-operated cattle ranches on the Northern Great Plains, the beef production data used to construct the grazing intensity budgets are the results of an experiment conducted in a specific area of the Northern Great Plains. Management and physical production responses respective to the two different sources of data cannot be assumed to be comparable in all cases. Therefore, the main inferences to be drawn from the study are restricted to the results from the heavily, moderately, and lightly grazed ranch budgets.

#### Range Condition, as it Affects Net Ranch Income

Major trends in range vegetation are usually set by weather conditions, and these trends are modified by the intensities of grazing use. This is especially true as shown in Figure 1, where the changes in forage production due to fluctuations in weather are greater than the differences due to grazing and stocking treatments.

Vegetation data obtained from the Miles City grazing experiments indicate that the moderate rate of stocking approximated an optimum in maintaining range forage productivity. The relative condition of the lightest and the moderately stocked ranges was apparently about equal. In Figure 1, forage yields indicate that the light and moderately grazed







































































































































