



Labor use on livestock ranches in Montana
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Abstract:

In the interests of society and in the interest of the individual in most cases, it is necessary that the productive units within our economic system make the most efficient use of our natural resources, and that they maintain a degree of flexibility during crucial periods. This is expected in the ranching industry as in any other. During the the present emergency period, the impact of the labor shortage has forced a test on ranchers as to the degree of flexibility that they can maintain during crucial periods. This study was proposed to determine and analyse variations in the intensity of labor use, variations in the ability to substitute other factors for labor during labor shortages, and variations in the effective seasonal use of labor, on 64 ranches in Montana, classified according to size, and type of operations for specified areas.

Of the two areas studied, the plains and the mountains, it was found that the ranchers of the plains area used labor the least intensively, and that they spread their labor most effectively over the year. No differences were observed between the ranchers of the two areas in ability to substitute other factors for labor during shortage periods.

Of the three sizes studied, the large, medium and small, it was found that the large ranchers made the least intensive use of labor, and spread it most effectively over the year, while the medium size ranchers were able to substitute other factors for labor during shortage periods to the greatest extent.

Of the three types studied, sheep, cattle and combination sheep and cattle, it was found that the sheep ranches on the average used labor the least intensively. This was primarily due to the fewer number of small sheep ranches with high labor requirements. The combination ranches were best able to substitute other factors for labor during shortage periods, and the sheep ranches made the most effective seasonal use of their labor.

It was discovered that ranchers substituted for labor quite extensively. This was accomplished by substituting poorer quality labor, capital in the form of machinery, and different types of management such as delaying inputs for future return.

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FOREWORD

In the words of John Maynard Keynes, ". . . the ideas of economists and political philosophers, both when they are right and when they are wrong, are more powerful than is commonly understood. Indeed the world is ruled by little else. Practical men, who believe themselves to be quite exempt from any intellectual influences, are usually the slaves of some defunct economist. Madmen in authority, who hear voices in the air, are distilling their frenzy from some academic scribbler of a few years back. I am sure that the power of vested interests is vastly exaggerated compared with the gradual encroachment of ideas. . . . soon or late, it is ideas, not vested interests, which are dangerous for good or evil."

ABSTRACT

In the interests of society and in the interest of the individual in most cases, it is necessary that the productive units within our economic system make the most efficient use of our natural resources, and that they maintain a degree of flexibility during crucial periods. This is expected in the ranching industry as in any other. During the the present emergency period, the impact of the labor shortage has forced a test on ranchers as to the degree of flexibility that they can maintain during crucial periods. This study was proposed to determine and analyze variations in the intensity of labor use, variations in the ability to substitute other factors for labor during labor shortages, and variations in the effective seasonal use of labor, on 64 ranches in Montana, classified according to size, and type of operations for specified areas.

Of the two areas studied, the plains and the mountains, it was found that the ranchers of the plains area used labor the least intensively, and that they spread their labor most effectively over the year. No differences were observed between the ranchers of the two areas in ability to substitute other factors for labor during shortage periods.

Of the three sizes studied, the large, medium and small, it was found that the large ranchers made the least intensive use of labor, and spread it most effectively over the year, while the medium size ranchers were able to substitute other factors for labor during shortage periods to the greatest extent.

Of the three types studied, sheep, cattle and combination sheep and cattle, it was found that the sheep ranches on the average used labor the least intensively. This was primarily due to the fewer number of small sheep ranches with high labor requirements. The combination ranches were best able to substitute other factors for labor during shortage periods, and the sheep ranches made the most effective seasonal use of their labor.

It was discovered that ranchers substituted for labor quite extensively. This was accomplished by substituting poorer quality labor, capital in the form of machinery, and different types of management such as delaying inputs for future return.

LABOR USE ON LIVESTOCK RANCHES IN MONTANA

CHAPTER I.

BACKGROUND; PROBLEM AND METHOD OF ANALYSIS

THE PROBLEM

In order for a business or production firm to exist in our constantly changing economic world, the operator must continuously make changes to meet varying circumstances. This is especially true in the process of production. It is the purpose of this study to show how and to what extent ranchers, as production operators, are able to meet recurring fluctuations in the form of a shortage of one of the factors of production, namely, labor.

It is impossible for a business or productive industry to settle down strictly to a routine of using the same tools day after day, of working the same men day after day, and of producing the same product in the same amount day after day. The dynamic aspect of our economic society prompts some of the laborers employed by the business men to quit their jobs for a better position elsewhere. People are constantly demanding new types and kinds of consumption goods. Price fluctuations cause variations in the productive or business scheme. Competition forces him to invest in up-to-date capital goods, to install new machines and fixtures, to replace worn out or obsolete equipment, and to adapt new methods and techniques of management in order that he may maintain his status as an operator of a production or business firm.

The extent by which the business man uses efficiently ^{1/} the factors of production including land, labor, capital, and management, and the degree of flexibility ^{2/} by which he keeps up with this changing aspect determines whether or not he is successful.

The same is true of livestock production on the Great Plains of the West. In fact, these varying circumstances take on added significance as is the case of most agricultural enterprises, for such enterprises have to cope with not only variations in the inputs of purchasable or controllable factors such as labor, machinery etc., but with climatic variations as well. To further complicate the matter the rancher has to base his plans on a production period of at least two or three years in length, which is the approximate time that it takes to increase his breeding herd by growing calves or lambs into breeding stock. If during this period, prices drop, if the demand changes, or if one of the factors of production becomes scarce to the industry, the rancher stands to lose. In the case of a hat manufacturer, for example, he, on the other hand, is only obligated to plan over a period of six to

^{1/} Efficiency at this point, implies the meaning of the combination of factors in such proportions that the maximum profits are attained

^{2/} It should be emphasized, however, that flexibility can hardly be divorced from efficiency, in fact, flexibility is a criterion of efficiency, flexibility of a kind which adapts to the conditions prevailing. But, for the purpose of the study at hand efficiency in the use of factors, especially labor is to be thought of as the most efficient use during relatively normal times. Flexibility is to be considered as the ability to substitute one of the factors of production during abnormal periods of restricted use. Substitution is further discussed in Chapter III.

eight months. Should prices or styles change, he, in a relatively short time, can shift his operations and produce an entirely different style of hat in varying quantities that can be marketed to his advantage.

Comparing this situation with that of the rancher, it is quite obvious that the rancher's problems are more intensified. But, whether the problem is one of a shortage of a factor used in production, one of a price change or one of a demand for a new type of product, the rancher who is to survive and who is to obtain a profitable return for his investment is the one who is so located and so conducts his operations that a high degree of flexibility is attained, and the one who makes the most efficient use of the input services at his command. It should be emphasized that this last statement, especially applies to the Great Plains rancher, who in a high risk area is continuously subject to fluctuations, fluctuations which may mean dismal failure overnight unless provision has earlier been made to carry through the crisis, such as providing for reserves of hay.

A very fundamental and basic question that might be asked at this point is: how do ranchers meet these fluctuations? The answer is that such flexibility is attained by the process of substitution, substituting land, labor and capital, substituting methods of management, or substituting one final product for another. If one of the factors of production becomes scarce to the industry or if the price of one of the factors rises in comparison to the prices of the other factors, the rancher substitutes factors until he achieves the highest profit

combination. If one or more methods of management are more profitable than a method used by a rancher, he will substitute the more profitable technique for the less profitable. If the demand for his final product, such as beef, falls, the entrepreneur will produce a different product for which the demand is sufficient, such as mutton.^{3/} He, essentially is substituting one final product for another. Such, in a general way, is how substitution is employed by a rancher.

Labor as one of these factors of production requires numerous considerations in its employment. First, and at all times is required efficiency in its use. A second consideration evolves from the fact that often the rancher finds that his labor supply is disturbed or restricted as is the case during the present emergency period, and it is necessary to replace labor with some other factor in order that he may maintain production. A third consideration comes from the fact that labor is quite different from the other factors of production, in that the people of our society compose the labor force that is used by the rancher or any other industry. Therefore, labor cannot be treated as an inanimate object, which if not used remains stored in a warehouse where the productive entrepreneur can seek its service at will.

^{3/} The case of ranchers shifting strictly from a beef industry to a sheep industry is merely given here as an illustration of the Principle of Substitution. Actually, the elasticity of substituting beef production for sheep production completely is very low, because of the difficulty involved in such a shifting process, and because of individual preference. However, ranchers may shift to a certain degree especially in the case of combination ranchers who produce both cattle and sheep.

Consequently, an obligation arises as to its welfare throughout the year and someone has to assume this obligation whether it be society or the individual rancher.

At the present time with labor rationed to the industry through the consequences of action taken by Selective Service, and the general migration of labor to areas of high-paying jobs, the availability of labor on ranches at the needed time becomes an acute problem. An intense need has consequently developed for a knowledge of labor use on ranches throughout the state. It has become desirable for the rancher and for other agricultural industries to use the least amount of labor possible, to be able to substitute for labor to the highest degree possible, and to spread labor use out over a year's time so that effectiveness in seasonal labor use is attained to the greatest extent.

When the war is over the desirability of these characteristics will take on a different value, perhaps. For example, ranchers may be encouraged to employ as much labor as they can effectively use, as the pool of labor may be large through the consequences of unemployment. However, from past developments in social security, indications are such that social legislation will be prompted for the good of all. If such occurs, it is likely that full and efficient use of our natural resources will be stressed, which means that ranchers who use labor in the least intensive manner will be desired. Those who are able to meet fluctuations in the supply of the controllable input factors and in

prices will also be desired. And finally the type of rancher will be desired who makes the most effective seasonal use of labor.

In the realm of farm and ranch management research several questions arise in regard to this matter. Which ranchers under various conditions and situations are making the most efficient use of labor? Along with this question, which ranchers under various conditions and situations are best able to substitute for labor during shortage periods and how do the factors associated with efficiency of use and substitutability compare?

Are the ranchers who make the most efficient use of labor during normal times the ones who can substitute to a greater extent during periods of labor shortage, and are they the ones who distribute their labor use over a years time the most effectively? For example, we may observe that the cattle rancher in the plains area with a large outfit uses labor the least intensively. Can he, at the same time, when labor is restricted, make substitutions for labor and still maintain his normal production, and does he spread his labor demands evenly throughout the year so that one or two periods do not require a major share of his total labor supply? An additional question may be asked; in what ways are the ranchers able to substitute for labor during periods of restricted use?

With these troublesome questions in mind this study was conducted with the following purpose:

1. To determine variations in intensity ^{4/}of labor use for ranches according to size and type of ranch within specific areas.

2. To determine variations in the ability to substitute other factors for labor on ranches according to size and type of ranch within specific areas.

3. To determine what factors of production and what methods of management are being substituted for labor on ranches according to size and type of ranch within specific areas.

4. To determine how ranches according to size and type of ranch within specific areas, compare as to degree of intensity of labor use, as to the extent of ability to substitute, and as to the effectiveness of labor use.^{5/}

Scope and Method

For the purposes of this study 64 ranchers were interviewed to obtain primary data from which the various determinations were made and analyzed. The main analytical tool used as the basis of the study

^{4/} In referring to variations in intensity of labor use, it should be recognized that such are not the only criteria for measuring efficiency in the production of livestock. Actually, in determining which rancher or group of ranchers are making the most efficient use of the natural resources, land and capital should be taken into consideration. However, during emergency periods such as the present, from a social point of view it becomes more desirable for labor to be used in the most economical manner. Consequently, within the scope of this study, labor was the principal item of interest.

^{5/} By effectiveness in labor use is meant the degree to which labor is used by months throughout the year.

was the Principle of Substitution and upon it hangs much of the analysis proper. Its theoretical background is discussed in the following paragraphs. The measurement of intensity of labor use was made on the basis of labor months used per animal unit. Substitution ratios were determined to measure the extent to which ranchers are able to substitute other factors for labor during shortage periods.

In all of our economic activities we are continuously substituting less expensive things and less expensive ways of doing things^{6/} for that to which we attach value. The principle here involved is commonly known as the Principle of Substitution. This is a very useful analytical tool in economics, because as Marshall says, "it permeates all the economic adjustments of the modern world".^{7/}

The Principle of Substitution is especially adapted to production analysis in determining the ratios of the factors of production or input services that go into the production process. The general rule thus applied in bringing about the most profitable combination of input services, is to substitute these services one for another until the ratio of the marginal increment of the input services to their respective prices are equal. If, for example, land and labor are used to

^{6/} This can be thought of as a less expensive way of doing things or as an alternative way that involves the least sacrifice in terms of money capital or total satisfaction.

^{7/} Marshall, Alfred, Principles of Economics, 8th edition, Macmillan and Company, Limited, London, 1926, Book V., p. 405

produce potatoes, and the price of labor rises in relation to land, then land will be substituted for labor until the marginal return to both labor and land is equal to their respective marginal costs or prices.^{8/} The same applies where one of the products is rationed to the industry and where the price of the final product rises. With a rise in the price of the final product it may pay the producer to increase the scale of his enterprise, but he will be forced to restrict the use of the rationed factor and increase the inputs of the other factors. He increases the amounts of the other factors until their marginal increment is equal to their respective prices.

From an analytical sense, there are two types of substitution--static and dynamic, and within each of these types there are two subtypes--absolute and relative. Consider, for example, how a rancher conducts his managerial operations. He makes a plan covering a whole production period based on expectations of what he thinks will happen in the future, relative to prices and the available supply of input factors. In preparing this plan he substitutes one factor for another under his determination of the most profitable plan results. Such is considering substitution from a static viewpoint. As he places this plan in operation, unforeseen conditions arise and he again substitutes to meet these varying circumstances. This type of substitution is

^{8/} For a more detailed account of substitution, see Boulding, Kenneth E., Economic Analysis, Harper and Brothers, New York, 1941, pp. 489-501.

a dynamic process, where substitution is exercised to meet varying circumstances during the production period. Within each of these each of these major types of substitution, absolute and relative substitution occur. Absolute substitution is apparent in a case where the same amount of a given factor such as labor is used over two periods, but where in the latter period an increase is made in the proportion of another factor that is used with the given factor in a production process. Relative substitution is the case where the given factor is decreased in the amount used over two production periods, and where the proportion of a second factor used in the production process is increased.

The Principle of Substitution is used as the primary analytical tool for this study. As was outlined in the introduction, the main purpose was to determine how and to what extent ranches in Montana can substitute other factors for labor during shortage periods. Primary concern is given to substitution from the relative dynamic point of view. Supplementing this, determinations and comparisons were made relative to substitutability, intensity and effective seasonal use of labor.

The data analyzed for this study were taken from farm and ranch labor records the majority of which were collected by the author and others of the Montana Experiment Station staff throughout the State of Montana in the summer and fall of 1942. Some of the records used

for this study were gathered by Vocational Agricultural Instructors for a farm and ranch labor study sponsored by the Agricultural Economics Department of the Montana Experiment Station.

Of the total farms and ranches interviewed, 64 were classified as ranches on a two-thirds income basis. These 64 ranch labor records were used as the primary source data for this study. The information was taken from the original schedules and placed on cards from which the data were arranged, classified and cross tabulated.

To obtain a relative idea as to the representativeness of the sample the various distributions by size and type were compared to Census material and to another study based upon a larger number of ranches. It was discovered that the sample was heavily weighted with small and large ranches. The medium sized ranches were least represented in the sample. (See Tables I and II.)

It was also discovered that the sample was not representative in regard to type of ranch; i.e., cattle, sheep or combination, when comparing the sample with 9130 ranches used by Michaelsen^{9/} in a study on size, income and organization of ranches. (See Table III.) Also, it was found that the sample was not entirely representative of the areas from which it was taken in that by a study of Michaelsen's tables^{10/} it was discovered that from a universe of 9130 ranchers

^{9/} Michaelsen, Leon C., Size, Income and Organization of Ranches, Montana State College Thesis, Bozeman, Montana, 1938, p. 38.

^{10/} Ibid, p. 27.

TABLE I.-- NUMBER OF RANCHES IN SAMPLE, NUMBER OF RANCHES IN UNIVERSE*, AND PERCENT OF MONTANA RANCHES INCLUDED IN SAMPLE ACCORDING TO SIZE OF RANCH, MONTANA, 1942

Size (acres)	Number of ranches in sample	Number of ranches in universe	Percent of Montana ranches in- cluded in sample
Under 3	0	74	0
3-99	1	45	2.22
100-259	9	331	2.72
260-499	5	742	0.67
500-999	11	1,519	0.72
1,000-4,999	22	3,375	0.65
5,000-9,999	6	508	1.18
10,000 & over	10	328	3.05
All Sizes	64	6,922	0.92

*Data taken from U. S. Dept. of Commerce, Fifteenth Census of the United States, Agr. Vol. III, Part 3, (Western States), 1930, p. 100.

TABLE II.-- COMPARISON OF THIS SAMPLE WITH THAT OF 9130 RANCHES USED IN STUDY CONDUCTED BY LEON C. MICHAELSEN,* ACCORDING TO SIZE OF RANCH, MONTANA 1942

Size of ranch (animal units)	Percent of ranches Michaelsen's sample	Percent of ranches this sample
1-99	29.4	48.4
100-299	48.8	29.7
300 & above	21.8	21.9
All Sizes	100.0	100.0

*From Michaelsen, Leon C. Size, Income, and Organization of Ranches, Montana State College Thesis, Bozeman, Montana, 1938, p. 43.

TABLE III.-- COMPARISON OF THIS SAMPLE WITH THAT OF 9130 RANCHES USED IN STUDY CONDUCTED BY LEON C. MICHAELSEN*, ACCORDING TO TYPE OF RANCH, MONTANA

Type of ranch	Percentage distribution of Michaelsen's sample	Percentage distribu- tion of this sample
Sheep	17.3	26.6
Cattle	70.1	42.2
Combination	12.6	31.2
All Types	100.0	100.0

*From Michaelsen, Leon C., Size, Income, and Organization of Ranches, Montana State College Thesis, Bozeman, Montana, 1938, p. 38.

there were 5998 ranches on the plains and 3132 from the mountains compared to this sample of 22 ranches from the plains and 42 from the mountains. For the purposes of this study and based upon variations in ranch labor use, the state was divided into two areas, the plains area and the mountains area. The dividing line was based upon the type of farming analysis conducted by Johnson and Saunderson.^{11/} The type of farming areas included in the plains group were numbers 1, 3, 4, 5, 6, and 7. Those included in the mountains group were numbers 2, 8, and 9. (See figure 1.)

The size groupings were divided on the following basis in terms of animal unit: one cow -- 1 animal unit, one steer or heifer -- .75 animal units, one ewe -- .20 animal units, and one wether or yearling ewe -- .15 animal units.

The types of ranches were based on the following classifications: sheep, cattle, and combination cattle and sheep. The dividing lines between the class were determined on the basis of 75 percent of the animal units. If for example, a ranch had 75 percent or over of its total animal units in sheep, his ranch was classified under the sheep type.

For these 64 ranches according to size and type of ranch for specific areas the intensity of labor use was determined in terms of

^{11/} Johnson, Neil W. and Saunderson, M. H., Types of Farming In Montana, Mont. Exp. Sta. Bul. No. 328, Bozeman, Montana, October, 1936.

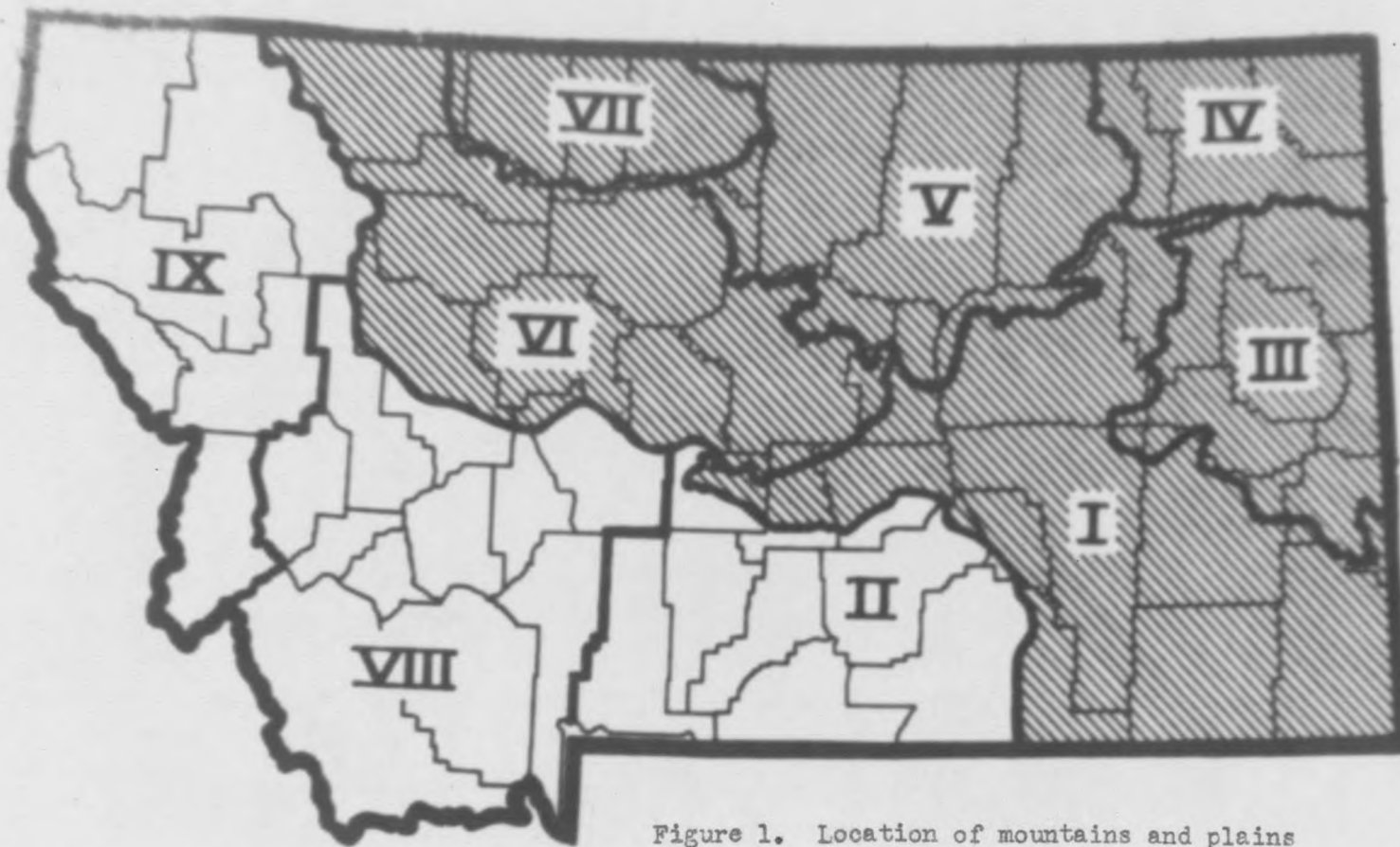


Figure 1. Location of mountains and plains areas in Montana.

labor months required per animal unit. These determinations are analyzed in Chapter 2. In Chapter 3 appears the analysis of the determinations on variations in the amount of labor employed from 1941 to 1942, the variations in the number of animal units maintained from 1941 to 1943, and the variations in the ability to substitute for labor in 1942 in terms of "substitution ratios." The substitution ratio for each ranch was determined by dividing the index number of animal units in 1942 (1941 as the base) by the index number of labor months used in 1942 (1941 as the base).^{12/} Determinations on how ranches are substituting other factors for labor during the current labor shortage period appears in Chapter 4. In Chapter 5 comparisons are analyzed for all ranches according to size and type of ranch for specified areas in Montana, as to the intensity of labor use, as to ability to substitute other factors for labor, and as to the effective seasonal monthly labor distribution.

It should be recognized that the sample used for this study in some respects is not representative, and this fact should be kept in mind in reading the manuscript. However, this does not indicate by any means the conclusions are not valid, for throughout the analysis cognizance is taken of the respects where the sample is not representative.

^{12/} See Chapter 3 for a more detailed account of the substitution ratio.

CHAPTER II.

FACTORS ASSOCIATED WITH INTENSITY OF LABOR USE

INTRODUCTION

The purpose of this chapter is to analyze the association of various factors with variations in intensity of labor use. The principal factors given attention are size of ranch, type of ranch, and location. The calculation to be employed to determine the factors associated with variations in intensity of labor use is the ratio of man labor months used to maintain one animal unit. By a method of cross tabulation, the variations in ratios of man labor months used per animal unit have been determined for different areas, for different size groups, and for different types of operation.

This material will not only be of use to the individual rancher but will also be of use to the public administrator in directing action programs and giving direction to agricultural policy. The rancher in starting up a business or while he is conducting his ranching business, is often confronted with problems of deciding upon what type of ranch he should undertake, what size of ranch he should attempt to maintain, and where he should be located to make the most efficient use of his own managerial ability and of the productive factors that he may have at his disposal or those which he is capable of employing. A determination of which of the factors mentioned above has the most effect upon the degree of labor use and the extent of such, will aid in making such decisions.

The public administrator is primarily concerned with making the

most efficient use of our natural resources, as well as with the welfare of the people concerned. It is vital for him to know which of the factors, size, type or location of ranches are most influential in minimizing the intensity of labor use, and to what extent, so that he may make wise decisions as to where available labor should be allocated, and as to what ranches should be encouraged in order to build a strong and efficient agricultural economy.

AREA AND LABOR USE

The first factor that is given consideration is location.^{13/} For the purposes of this analysis the state was divided into the plains and the mountains regions. This grouping was based upon differences in climate, soil, topography, vegetation and other physical factors which naturally affect the intensity of labor use and the ability of ranchers to substitute other factors for labor during shortage periods. It should be recognized that there are sharp differences in the physical environment that are in a degree peculiar to each ranch which affect his methods of operation and, consequently, his methods of labor use. It is important, then, that each rancher adapt his management to the specific environmental

^{13/} The information describing the areas used in this study was taken, primarily from the following:

Saunderson, M. H. and Vinke, Louis, The Economics of Range Sheep Production in Montana, Mont. Agr. Exp. Sta. Bul. 302, Bozeman, Montana, June, 1935.

Johnson, Neil W. and Saunderson, M. H., Types of Farming in Montana, Mont. Agr. Exp. Sta. Bul. 328, Bozeman, Montana, October, 1936.

Saunderson, M. H. and Chittenden, D. W., Cattle Ranching in Montana, Mont. Agr. Exp. Sta. Bul. 341, Bozeman, Montana, May, 1937.

factors that characterize his ranch, in order that he may obtain maximum output and returns to management. If the study were to be complete, it would be necessary to group the ranchers into areas no larger than townships and to study the physical factors that are peculiar to each township. Even then, one would have to take special precaution in making his dividing lines. In making use of the results at hand the only recourse for the rancher is to apply the situations described to his individual ranch, and use his own judgment in making adjustments that are necessary for his individual case.

The mountains area, as outlined in this study, comprises approximately two fifths of the total land area of the state. Its topography is characterized by rough mountain ranges, productive valleys and foothills with an elevation ranging from 3000 to 7000 feet. The surface structure varies from rocky formations on the mountains to the productive silts and clay soils of the valleys. In spite of the fact that a large share of the mountain slopes are gravelly and contain little humus, vegetation of a kind that is particularly valuable for livestock grazing thrives well. The lower valleys have developed soil containing more humus and consequently, provide hay for winter feeding.

The mean annual rainfall of the specific sections included in the mountains region vary from $8\frac{1}{2}$ to 22 inches with 15 inches as an approximate average. These differences cause considerable variation in type of vegetation and the availability of water for livestock. However, the natural surface water, along with many springs and seepages generally

provide sufficient water. The snowfall in the mountains averages about 60 inches which means that cattle and sheep have to be fed for quite long periods in the winter, usually from 3 to 5 months. This has a decided effect on the amount of labor used. Temperature in this area averages from 39 to 46 degrees. March temperatures usually are quite favorable for lambing and calving.

The native vegetation of the mountains area consists largely of the tall grasses of which the fescues and bunch grass are most important. In addition, sage on the hills and lower mountain slopes and a large variety of edible weeds and brouse on the higher mountain slopes provide adequate grazing during the grazing season.

The plains area is quite different in many respects than the area just described. The general elevation is about 3000 feet with variations up to 5000 feet in the foothill regions next to the mountains. The northern two fifths of this area has been glaciated and the topography is level or gently rolling except in a few portions where erosion has had an effect. To the south is found rougher country such as is prevalent in the Bear Paw, Big Snowy and the Bighorn Mountains.

The soil of the whole plains area varies from the fertile glacial drift to the gravelly soils in the northern section; and from silt, clay and sandy loam to the shale, clay and gravelly soils of the southern part. Rainfall varies on the average from $11\frac{1}{2}$ to 21 inches with a mean of from 13 to 15 inches. The availability of water is more of a problem on the plains and it has been found that the ranchers have resorted to

building reservoirs and to tapping artesian wells. Snowfall is considerably less on the plains, ranging on the average from 12 to 69 inches with 36 inches as the most typical. In many instances the wind blows the snow clear on large sections making winter grazing available. In fact, the author found in a few cases in the southeastern part of the state where ranchers were depending entirely on winter grazing. Feeding periods throughout the area ranges from one to four months.

The mean temperatures on the plains are essentially the same as in the mountains, ranging from 38 to 46 degrees. However, this comparison does not carry a great deal of significance in view of the fact that the plains area is subject to more extreme fluctuations in weather conditions than is the mountain area. March temperatures often are lower and storms and winds more frequent. This makes the lambing and calving seasons especially critical on the plains, which naturally necessitates the use of more labor.

The vegetation is characterized by native grasses of the short grass type. Grama grass and buffalo grass are most prevalent. Grasses generally make rapid growth during the spring period when moisture is sufficient and dry up during the summer. Sage is quite prevalent and is often grazed quite extensively during the winter period.

The physical environmental factors just described as characterizing the two regions used in this study, naturally have an effect upon labor use. They are especially influential in causing crucial periods when labor is most needed. An example of this would be a sudden snow

storm in the peak of the lambing or calving season, which naturally would call for more individual attention and thus more labor.

With this general description of the areas as background, it is simpler to analyze the influence of location upon the intensity of labor use. The 22 ranchers from the plains used labor less intensively than the 42 ranches in the mountains. The average labor months used per animal unit was .254 in the first case and .348 in the second. (See Table IV.)

TABLE IV.-- RATIOS OF MAN LABOR MONTHS USED PER ANIMAL UNIT ACCORDING TO LOCATION OF RANCH, 64 MONTANA RANCHES, 1941

	Area		Both areas
	Plains	Mountains	
Labor months used per animal unit	.254	.348	.315
Number of ranches in sample	22	42	64

It was realized that the sample taken is not homogenous and that these results may not be entirely representative of the state. Consequently, a weighting system was set up based upon information as to numbers within the various size, type and area groups from Michaelsen's study of 9130 ranches.¹⁴ (See appendix tables.) Assuming that the average intensity ratio within the various groups were representative, they were thus weighted and the average labor months used in the plains ranches was .274 per animal unit compared to .344 labor months per animal unit for the

¹⁴ Michaelsen, Leon C., op. cit., pp. 38 and 43.

mountain ranches. Thus, the original results were not greatly changed by weighting according to numbers of ranches in the universe.^{15/}

There are a number of reasons why the ranchers on the plains use labor less intensively than those in the mountains. Foremost, is the fact that they have less snowfall and a shorter feeding season. This means that they are not required to put up as much hay in the summer time and are not required to feed as long in the winter. Both of these processes require a great deal of labor. In some places on the plains sheepmen and cattlemen alike depend entirely upon winter grazing to see them through the winter. In the mountains, it takes more labor to herd the animals since the rougher terrain means a greater likelihood of animals straying. The lambing and calving season in the mountains also requires more labor since the cows or ewes have to be fed straight through the period, while on the plains this season is generally later. It comes at a time when new grass is available and when less watching and care is required.

SIZE OF RANCH AND LABOR USE

A factor that many feel has an influence on intensity at which labor is used is size of operations. For the purposes of this study, the size of ranch has been measured in terms of animal units. The smallest size group contains all of those ranches carrying from 1 to 99 animal units. The medium size includes those ranchers running between 100 and

^{15/} When further reference is made to the term "weighted according to universe numbers" it is to be understood that the weighting system is based upon the 9130 ranches used in the Michaelsen study.

