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Sheep on Wind Swept Winter Range of the Red Desert.

RANGE SHEEP PRODUCTION ON THE RED DESERT AND ADJOINING AREAS

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*In cooperation with the U. S. Department of Agriculture.
An Economic Study of Range Sheep Production on The Red Desert and Adjoining Areas

A. F. VASS
HARRY PEARSON

INTRODUCTION†

This is a second number of a series of publications dealing with the organization, management, and cost of operation on the livestock ranches of Wyoming. The first publication‡ dealt with cattle production on the prairie ranches. This publication deals with the results of the different systems of management, the cost of production, and the returns on the investment of the woolgrowers who operate on the Red Desert and its adjoining territory.

The livestock producers of Wyoming are confronted with many problems which are expensive for them to solve, and it is the function of the Agricultural Experiment Station to aid in their solution. The woolgrowers, in most cases, have a vast fund of information in their account books, and in their memories, but these facts have not been tabulated and analyzed in such a way as to give the operator the full value of his own experience as well as that of his neighbors.

The Wyoming woolgrowers' neighbor is not his competitor in producing and determining the price of wool. His competitor is the wool grower in foreign lands. It is the competition from Australia, Argentine, and similar countries that we must meet. In order to do this we must analyze our costs, and make all possible reductions thereon. The future of the state of Wyoming depends very largely on the successful management of its cattle and sheep industries—industries that should be put on a cost study basis as are all other large industries.

The purpose of this publication is to show the operator the better methods of practice in running his sheep, as measured by the returns on investment, and to point out, by comparative study

*Range and Ranch Studies in Wyoming—No. 2.
†Martin Reinholt of the United States Department of Agriculture assisted in collecting 8 records in the Rock Springs area.
‡Wyoming Agriculture Experiment Station Bulletin No. 147.
of the different systems of management and the returns therefrom, the strong and weak points in the operations on each of the 65 ranches studied. The cost of production and the returns therefrom are used as a measure of successful management. It is also hoped that this publication will enable the operator to make better use of his book figures in determining the cost of production, and will show him the better methods of practice in running his sheep, by a study of the returns that are being secured on investment under the different systems of management.

If a wool grower ranked at the top of the list in all his methods of operation there would be very little for him to gain from the study, as he would have no weak points in his management. The survey would then be of value to the men who were not at the top. That no one manager was good in all of his operations was very clearly brought out by the study. There was no one operator who ranked at the top in all the problems of management. It is not human nature for a man to be exceptionally good along all lines, and this was found to be true in the studies of the management of the sheep ranches. There was no one operator who ranks first in even one-half of the operations involved in successful management. There were weak points in certain phases of the management on each of the 65 ranches. The study sheet sent out to each operator showed him his rating in each operation compared to the other 64 wool growers.

Wyoming ranks first among the states in the total value of her sheep and sheep products, and, when environmental factors are considered, is perhaps as well adapted to the sheep industry as any other state in the Union. The broad expanse of wind-swept winter ranges, where the summer growth of vegetation is cured by nature in almost perfect condition, makes it possible for the flockmaster to carry his sheep through the winter with practically no feeding, thereby reducing his cost of production.

The high, mountainous summer ranges on our National Forests, with their luxuriant growth of weeds and grasses, abundance of fresh water, and cool climate, make ideal conditions under which to handle sheep, and result in the production of both wool and lambs of the highest quality. Figure 1 shows the mid-
summer forage found in the mountain parks on the summer ranges.

The practice of carrying the excess production of the fat years over into the lean years is a good one and had the recommendation of Joseph, who operated down in Egypt. It is one that we shall use in working out the production costs, and profits and losses on sheep ranches. An operator may make 8 per cent one year and lose 10 per cent the following year, due to such factors as precipitation, and winds, factors over which he has no control.

Due to the rather favorable prices paid for wool and lambs, during the years of 1923-25 inclusive, a great deal of interest has been centered in the sheep industry in both the United States and the world at large. The wool and lamb growers, the lamb feeders, and the consumers, have all shown great interest in the business. Bulletins on wool and lamb production are now beginning to make their appearance from experiment stations of the Middle West.

Sheep are being advocated for every farm by some writers. That sheep are not especially well adapted to the moist lowlands is shown by the fact that they are native to the range uplands and dry plateaus. When bred on farms in the humid region they are subject to foot rot and parasitic diseases.
The wool industry, as carried on in most parts of the world, is an extensive type of agriculture and tends to disappear from regions of dense population and high priced land. This tendency is shown in the central European countries where the number has decreased 75 per cent during the last 50 years. The same change has taken place in the United States. In 1840 the center of the sheep industry was in Vermont. By 1880, Ohio had become the center. The westward movement continued, carrying the center of the industry into the Mississippi Valley in 1880. By 1900 nearly three-fifths of the sheep were in the Western Range States, which will long continue to be the important lamb and wool producing section. As the population and settlement of a country increases, the number of sheep decreases. They have been crowded to the arid and semi-desert regions in other countries as in the United States. A region in the temperate zone that has less than 15 inches of rainfall is, by the very nature of the vegetation, better adapted to the production of wool and feeder lambs than to other types of agriculture.

Sheep make better use of the weeds and underbrush, so common on our National Forests and rugged mountain ranges, than do cattle and horses. The same is true of the desert range where the chief type of forage is salt sage and sage brush. Sheep are especially well adapted to those areas with a rainfall of 10 inches or less. These arid areas serve as their winter feeding ground, and the rough mountains with their abundant rainfall serve as their summer ranges.

Figure 2 shows the number of sheep produced in several of the most important wool producing countries. Australia has long continued to be the leading sheep producing country. This is due to the arid climate and long distance to markets. The annual precipitation of Australia is less than 15 inches over a greater part of the continent, and less than 10 inches over a large area. One or two years of drought in Australia have more effect on the price of wool than any increase or decrease in sheep that has taken place in the United States.

The drought in Queensland during the season of 1926-27 is reported to have caused a loss of some 4,000,000 head of sheep which is about 20 per cent of the total number. The 1926-27 wool
clip in New South Wales is estimated by Foreign Crops and Markets (1927) at nearly 500,000,000 pounds which is a record figure. The production of wool in Australia for the 1926-27 season is very close to the high point of production reached in 1890. A drought year on the continent will materially reduce the number of sheep.
CONSUMPTION OF WOOL IN UNITED STATES.

Figure 3. The Domestic Production and Consumption of Wool.
The Tariff Board (1912) shows that the calamitous drought which began in the latter half of the decade 1890-1900 and culminated in 1902 reduced the flocks by 44,212,874. This loss was again made up within the next 8 years.

The number of sheep in Argentine has declined from 60,000,000 to 40,000,000 during the last 20 years. This decrease has been due to the settlement and development of the former sheep ranges. There has been a slight increase in sheep during the last few years. A marked increase in the sheep industry in Argentine is not to be expected. High prices have stimulated, and low prices will retard, the wool industry in that country.

Sheep production in New Zealand is conducted under somewhat different climatical conditions than in most countries. The rainfall is sufficient in most sections for general farming. No marked increase in sheep production is to be expected in New Zealand and the industry may decrease as dairying and general farming increases. Mutton and lambs, rather than wool, have been the important factor in the export trade of New Zealand.

The United Kingdom produces farm flocks rather than range bands of sheep. It is one of the few countries where sheep continue to be of considerable importance even though the population has become dense. The moist cool climate is favorable to the growing of grass, and grazing. The United Kingdom has been the breeding ground for our mutton breeds.

Little is known of Russia and her sheep conditions. It is estimated that over 50 per cent of her looms and spindles have been lost as a result of the World War. Russia is attempting to stimulate her wool production by increasing the price of coarse wool 20 per cent.

The Union of South Africa is a region well adapted to the production of wool and an increase in the exports from this country is to be expected. Recent high wool prices have had a stimulating effect upon production. The Union of South Africa ranks next to New Zealand in production. There has been a marked improvement in the quality of the wool. The Union, in the future, will play an important part in the export wool market.

The United States ranks fourth in the total number of sheep, eleventh in number of sheep to 100 inhabitants, and tenth in the
number of sheep per square mile. The arid west with its rolling desert regions and rugged mountain ranges is, at the present time, the center of the sheep industry.

Figure 3 shows the domestic production and imports of wool from 1860 to 1926. The average annual production of wool in the United States during the last 40 years has been 295,000,000 pounds and the production any one year has not varied more than 10 per cent from this amount. The average annual consumption during this same period has averaged about 515,000,000 pounds or an average import of 225,000,000 pounds. The United States produces from 50 to 60 per cent of the wool that it consumes.

HISTORICAL REVIEW

The first livestock to occupy the Wyoming ranges were cattle. Sheep were not introduced until about 1870. At that time Durbin brothers of Cheyenne trailed in 800 head from New Mexico for slaughter. They brought in 1500 more in 1871. In 1878 there were 9000 sheep in the state. The great snow storm of 1878 almost wiped them out. There was after this a gradual increase until in 1884 there were over 500,000 sheep in the state. Figure 4 shows the number and value per head from 1885 to 1927. From 1885 to 1898 the average value of sheep per head was $2.10, while the average value of cattle per head was $24.75. During this period one cow was worth more than 11 sheep. The low price of sheep tended to discourage the sheep industry for a long period of years.

The first real upward movement in the number of sheep started in 1898 when the prices started up and in three years the price of sheep doubled. The price started down in 1901 but the wool growers continued their increase in number through 1902. The precipitation in 1902 for the entire state was less than 10 inches. The loss the following year was the largest on record. The average loss from exposure for the entire state was 115 per thousand. The losses were greatest on the desert range. Many of the operators in the Red Desert area lost more than 50 per cent of their sheep.
In all of the semi-arid and arid sections of the United States, moisture is the limiting factor in plant growth, and so it is but natural to expect that there will be a correlation between the amount of precipitation and the number of animals on the range. Up until 1902 there had been sufficient range feed for the sheep, even during the years of low rainfall, but at this point the increase of sheep from 2,800,000 in 1900, to 5,600,000 in 1903 was too much for the drought years to support and as a result the losses were
enormous. The number in the state dropped 2,000,000 in two years.

The losses during such periods take place in three ways: first, actual death losses due to exposure and starvation; second, forced sales, which mean low prices; third, losses due to the poor physical condition of the ewes which results in reduced wool and lamb yields. It was during such drought years as the above that many of our former wool growers, who were not the best of managers, were forced into other occupations.

From 1903 to 1905 there was a drop of over 2,000,000 in the number of sheep in the state. The precipitation for the following five years, 1905 to 1909 inclusive, was much above the average, during which time there was a rapid increase in the number of sheep. The price of sheep was also rising during this period. The year 1907 was a dry year which caused an interruption of the upward trend of sheep and a sharp break in prices the following year. The following two years, 1908 to 1909, were very mild ones and the increases were very rapid. The number and price of sheep increased 37 per cent and 78 per cent, respectively, for the two years. The number of sheep reached the high point of 7,000,000 in 1910, a number that has not been approached since.

The years of 1910 and 1911 were ones of very light rainfall with severe winters. The result of the losses is shown by the 2,000,000 drop in number in one year. The drop in number and price from 1910 to 1912 was 34 per cent in number, and 40 per cent in price in the two years, due to over-stocked ranges, forced sales, and heavy winter losses.

The following article taken from the Fourteenth Annual Report of the Wyoming Board of Sheep Commissioners gives a good idea of the losses that took place at this time:

"The winter of 1911-12 was the greatest check the sheep industry of this state has experienced in several years. In several instances the entire flock was annihilated and in eight cases the herders perished with their bands.

"A great many flock masters succeeded in surmounting the difficulties of getting feed to their flocks, and giving them care otherwise when possible, until they were gratified with the percentage that they had saved.

"When the April storms swept over this state many of these men, who up to that time had been quite fortunate were in the short time of forty-
eight hours left entirely destitute of live sheep. The fact that more sheep were lost at this late date, due to the extreme exposure and weakened condition is the most discouraging feature. There was a great shortage of lambs and decided injury to the wool clip as a consequence of the foregoing facts.

1916 was another dry year, and the winter losses were again heavy, but the rapidly rising prices of wool and lambs prevented a marked decrease at this time, so that the number remained about the same until 1919.

The price started upward in 1912 and continued upward reaching the high point in 1918. The losses had been so severe in 1910 to 1912 that it required several years for the operators to recover. They were just getting back to normal when the drought year of 1919 occurred. Coming as it did at the same time as the world-wide agricultural depression, the results were again disastrous. One old time operator on the Red Desert is reported to have lost over 10,000 head at this time. Many of the wool growers were "more than broke." They had lost their profits from the good years, and were in debt hundreds of thousands of dollars for sheep that they did not own. The fair prices during the last few years have enabled many of them to again recover.

The price of sheep dropped 55 per cent during the three-year period 1920-22 and the number decreased 1,500,000 during the same period. The price again started upward in 1923 and continued upward until 1926. The number has been gradually increasing since 1923. Another dry year occurred in 1924, but the ranges were not overstocked, so that the losses were light.

We have had five drought periods during the last 34 years, at which times the losses to the wool growers were enormous. It is at these periods that the poorer managers and speculators are weeded out of the business. A man may start in and make money in sheep during the good years, in spite of the fact that he is a poor manager, but it is not at all likely that he will survive the first severe winter.

If cost figures are to be used to determine a fair price for wool and lambs, the losses that take place during the drought years should be considered along with the profits that are made during the good years. The writers have taken into consideration these
losses in their 1915-26 operation figures which are given in table III of this bulletin.

There has been a marked improvement in the quality of the lamb and the quantity of the wool during the last 36 years. A memorandum of the wool clip and sales of one of the largest outfits operating in the state, shows that the average weight per fleece from 86,000 head of sheep was 4.4 pounds for the year 1891. The weight of the fleece on the same outfit 36 years later showed 100 per cent increase. The improvement in the lambs has been almost as great.

The range sheep industry in Wyoming has always been one involving risk, to the point of speculation, and it will long continue to have the element of risk associated with it. The very nature of the method involved in securing the scant winter forage, found on the desert away from natural protection and supplementary feeds, makes the range sheep industry one of uncertain returns, and there is no practical way that it can be made as safe as where livestock are run under fence and fed during the winter.

A blizzard, accompanied by a heavy snow fall, may occur. It becomes impossible for the herder to hold his sheep and they drift with the storm. If the storm continues for some time the sheep will become exhausted and drop and will soon be buried in the snow and freeze to death. The herders sometimes lose their lives in such storms.

Due to lack of water the desert range cannot be used in the summer. The operator must wait until there is sufficient snow on the range to supply water for the sheep, which means that it must be used, if used at all, during the winter months.

It is not practical for the wool grower to have buildings and supplementary feed stored at a sufficient number of points on the desert so as always to enable the herder to reach one of them with his band within a few hours. The operator does the next best thing. He culls his herd closely, for he cannot take chances on old or weakened ewes under the above conditions, stores a little supplementary feed at some strategic point, sends his $30,000 band of sheep and $75 per month herder out on the desert, and hopes for the best.
Under the above conditions of operation the word "free range" is somewhat of a misnomer. The cost of the feed is the cost of harvesting it, which very often turns out to be many times what it is worth. When one attempts to place a monetary value upon the open range lands the above factors should be taken into consideration. The losses following drought years and severe winters have always been heavy and will long continue to be. The idea of some of the early operators was that a pelt was more valuable than a live ewe with a big feed bill, but the high value of ewes
during recent years has changed the above idea. Greater care is
now taken to prevent loss, but even under present methods of
management, years like 1910-1912 would result in enormous losses
to the wool grower. Sufficient profits must be made during the
good years to carry the operator through the lean years that are
sure to come. The profits made in 1925, the year of this survey,
and one of the best sheep years on record, were not as large as
they should have been to make up for the years of losses.

Figure 5 shows the heavy death losses that occurred during the
winter following the drought year. The losses are listed as those
due to diseases and those due to exposure. The losses due to dis-
ease do not vary as much as those due to exposure.

The extreme losses usually occur the year following the
drought, due to the fact that starvation takes place during the early
part of the following year. Such losses occurred in 1903, 1912
and 1920. When the drought and overstocking is unusually severe
the losses may take place the same year as the drought. Such
losses occurred in 1910 and were the result of overstocking. When
the dry year came there was not sufficient feed to carry the animals
until the end of the year.

This overstocking and death loss is one result of the use of the
so called “Free Range.” In order to hold a given range one must
keep it fully stocked during the good years, which means that it
will be greatly overstocked during the drought years. If the oper-
ator had some control over the range so that he would not have to
keep it fully stocked during the good years it would mean that he
could keep down his death loss. A range will produce more feed
during a drought year if it has not been closely grazed the previous
year. By not being forced to overstock during the good years he
would have fewer animals and more feed during the drought year,
which would reduce his death loss.
REVIEW OF LITERATURE

Hislop (1917) in his studies of sheep operations sent out questionnaires to the wool growers and from their replies he concluded that the lamb crop for the state of Washington was 92.32 per cent and that the operators were using one ram per 65 ewes. The lambs weighed 73.5 pounds, and the wool per fleece 9.5 pounds. The average cost per head per year for a ten year period preceding 1915 as given by the ranchers was $2.59.

In the studies of one-night camps vs. established bed-ground Fleming (1922) found that the lambs gained 1.2 more pounds in weight in 58.5 days under the “one-night camp system” than was gained by the “established bed-grounds” lambs in 63.8 days. The sheep under the bedding-out system utilized 1.82 acres per sheep per 100 days compared to 2.33 acres per sheep per 100 days when they were returned to an established camp each night.

Fox (1924) in his circular on “A Flock of Sheep on Every Farm” states that a ewe’s fleece usually pays for her keep so that the money received from lambs is practically clear profit.

Barber (1924) in his studies made for the Idaho Wool Growers found the cost of carrying a range ewe to be $10.17 per head in 1924. The 1925 cost was $11.96 per head and the 1926 cost $11.36 per head. The marketable lamb crops were 88.3 per cent, 87.9 per cent, and 93.4 per cent for the three years respectfully. Under the above conditions lambs were produced in 1925 at $10.91 per hundred and wool at 36.0 cents per pound. The feed and grazing costs were higher than on the Wyoming ranches which accounts to some extent for the larger lamb crop. The interest and depreciation costs were lower. The depreciation and death loss per ewe on the Idaho ranches was figured at $1.90 per head compared to the $1.93 per head which was found to be the cost on the Wyoming ranches. The above information was based upon questionnaires.

Potter (1925) reports the cost of producing wool and mutton on the Eastern Oregon ranges. The cost for carrying a ewe one year was $7.99, and the returns per ewe was 52 pounds of lamb and 8 pounds of wool. If we give a pound of wool 3½ times the value of a pound of lamb, it would have cost 35 cents per pound to produce wool and $9.98 per hundred to produce lamb. It is impos-
sible to make direct comparisons between Oregon and Wyoming conditions. The ram charge was 20 cents per ewe which is less than one-half the charge on Wyoming ranges. Potter reports 50 ewes per ram whereas the Red Desert operators runs 30.2 ewes per ram. The grazing cost and feed bill are greater, and the labor cost less on the Oregon ranges as compared to the Wyoming ranges. Potter places the marketable lamb crop at 80 per cent, which is several per cent higher than the marketable lamb crop in Wyoming. The average value of ewes was placed at $8.44 and of yearling ewes at $11.00. The ewes were used six years on the Oregon ranges.

Jennings (1925) in his studies on farm flocks in the Red River Valley of North Dakota and Minnesota found what he considered to be the cost of producing lambs and wool, and stated that it was $7.00 per hundred for lambs and 20 cents per pound for wool. No charge was made for straw feed nor for fall and spring pasture on stubble and grain crops. Interest was charged at the rate of 5 per cent on the value of the breeding flock at the beginning of the year. The winter feed charge was $1.74 per head, which the author states was rather low due to the unusually mild winter. Five ewes, out of a flock of 67 died, and 5 were culled. The decrease in the value of the flock per head for the year, where no lambs were added to the flock, was placed at 50 cents which is about one-fourth the amount of the loss due to death and depreciation on Wyoming, Oregon, and Idaho ranches.

The above figures indicate that a low cost of production of wool and lamb can be shown on the general farm where no charge is made for a great deal of the feed, where the interest on investment is figured at a rate considerably below what the farmer has to pay, and where death loss and depreciation can be figured at 50 cents per head.

The farms studied by Jennings are in the marginal regions that can produce lambs and wool successfully when prices are high. There is a tendency for the farmers in the marginal regions to buy sheep for their farm operations when the prices are high, which sends the price of the old ewes even higher, but at the first signs of a weakening of the market, the farmer disposes of his sheep which
has its effect in depressing the market to a lower level, until there is no profit to the wool grower who is in the business continually, and must continue to run sheep. It is these marginal regions that make it difficult for the Wyoming cattle and sheep men.

**METHOD OF PROCEDURE**

One of the best ways of determining the successful business methods and management practices of handling livestock in a given region is by studying the practices and results obtained on a large number of ranches. In practically all livestock regions there can be found examples of successful and unsuccessful ranches. It was for the purpose of getting a record of the organization and operations of a large group of wool growers that the Department of Agronomy of the University undertook the task of making an economic survey of the methods of management, cost of production, and returns on investment, of the wool growers' operations on the Red Desert and its adjoining ranges.

In addition to the analysis of the business side of these ranches the details of the system of management followed on each ranch was studied. A careful study was also made of the influence of weather, land settlement, taxation, credit, marketing problems, and the post war deflation upon the sheep industry in this region. A record of the business of each ranch was made from January 1, 1925 to January 1, 1926. This information, from individual wool growers, included a complete inventory at the beginning and end of the year, total crop and livestock production, details of ranch receipts and expenses, an outline of the management policy, and future plans together with reasons for the methods and practices followed.

Sixty-five of the largest and most representative ranches in the area were selected for the study. No operator with less than 500 sheep was included in the survey. It was the purpose of the authors to study the production of range sheep, and not farm flocks. A record sheet especially prepared for this survey, was used. The figures on the business operations of the 65 ranches were given by the operators, from their account book and from
records, to our field men who visited the wool growers during the summer of 1926. The figures of many of the large holders were taken directly from the books of their bookkeepers, who as a rule, are located in the larger towns. These records and all other information taken from each ranch have been guarded as confidential, and the permanent files of this information carry the outfits marked by key numbers rather than by name. Additional information drawn from the Wyoming Experiment Station, Weather Bureau, Census Reports, Bureau of Agriculture Economics, and Forest Service, has been analyzed and used in an attempt to learn the true conditions concerning ranching problems and operations.

The records were taken during the summer of 1926 and tabulated and analyzed in the department during the following months. Sheets were prepared showing the complete analysis on each of the 65 ranches, and copies returned to the operators at their annual wool growers' meetings.

Return on investment, rather than labor income, was used as a measure of successful management. Capital is a more important item than owner's labor in the production of livestock on Wyoming ranges.

Land was divided into grazing and crop land, and was given its assessed value. The values of all livestock were placed at what they could be sold for at that time. Lambs on hand January 1 were placed in the yearling class. The cost of operation per sheep unit, and per ewe, was determined. A ram, a yearling, or a ewe, constitute a sheep unit. Horses and cattle were given a value of three and one-half sheep units. This rate of $3.50 to 1 is based on value, and cost of operation, and represents a careful study of the above factors.

The scale of wages allowed the operator for his time is the one adopted by the Idaho Wool Growers Association, and is based upon the number of sheep handled by the outfit. Horse labor, an item not here-to-fore mentioned by writers on sheep costs, is charged against the sheep unit. In all cases the horses were kept for labor on the ranches and were therefore figured as an operating expense.

The prevailing rate of interest on loans was 8 per cent and this amount was allowed the operator on all investment regardless
of whether it was owned or borrowed capital. The costs of operation therefore include 8 per cent interest on the investment. The figure for return on investment used in the correlation tables is the amount above 8 per cent that was made by the operator, after allowing the above interest and all other costs. Any return above or below this amount is credited to management and represented by return on investment, which is shown in the correlation tables.

THE AREA DESCRIBED

LOCATION

The region known as the Red Desert lies in southern Wyoming. The survey includes the operators in Carbon, Sweetwater, Uinta, and parts of Lincoln, Sublette and Albany counties. The operators for the most part wintered on the Red Desert and summered on the Wyoming, Hayden, Medicine Bow and Routt National Forests. Figure 6 shows the location of the area studied.
Figure 7. The Wind Sweeps the Snow From the Exposed Areas and Permits Grazing.
The Green River in the western section, flowing to the south, and the North Platte in the eastern section, flowing to the north, drain the area. The Continental Divide separates these two rivers.

Doctor Aven Nelson (1898) defines the Red Desert as all that arid section of salt-impregnated soil in southern Wyoming, in which the salt sage predominates, and which, on account of the absence of suitable stock water can only be used for winter pasture.

CLIMATE

The climate of the state is a very important factor in livestock production, and especially in the region under study. Figure 5 shows the enormous death loss that takes place during the drought years. The region is subject to extremes in precipitation and temperature changes. A raging blizzard may come up with only a few hours warning which may result in death loss of both herder and sheep.

The average annual precipitation of the Red Desert area is less than 10 inches, which is not sufficient for a good growth of the sod grasses, but does favor the growth of the salt sages and similar plants. Sheep, which make better use of this type of vegetation than do cattle, are especially well adapted to this area. Another factor that makes the region better adapted to sheep than to cattle is the scarcity of suitable stock water. Sheep can go longer without water, and can make better use of snow than can cattle. The above conditions limit the use of this range to winter sheep "feeding."

Very little rainfall occurs during the summer months, the heaviest precipitation coming during the months of March, April, and May. The moisture that falls during the summer months is rapidly dissipated, by the dry winds and sunlight. The wet spring snows are the most beneficial for plant growth, but they may, if they come in the form of a blizzard, prove to be disastrous to the wool grower. The light snows, coming throughout the greater part of the year, are the most valuable and available sources of water supply. The wool grower cannot go onto the range in the fall until there is sufficient snow to serve as stock water for his flocks.

The region has its share of the winds which are, on the whole, beneficial to the stockmen. A heavy snowfall without wind may
be disastrous to the sheep men. The brilliant sunlight melts the surface of the snow which freezes into a crust of ice during the night. Such a condition shuts off the supply of feed and results in starvation, unless the operator can get feed, in the form of corn, cottonseed cake or hay, to the sheep. He cannot always do this and even when he can the cost is very great. The winds usually prevent the above conditions by blowing the snow off of the high points thus permitting the sheep to secure feed. The prevailing winds are from the west. Figure 7 shows the manner in which the wind sweeps the snow off of the higher areas and allows the sheep to feed thereon.

The rainfall on the summer ranges, which for the most part are in the National Forests and their adjoining foothills, differs from that on the Red Desert. The summer ranges lie at an altitude of from 7,000 to 10,000 feet and are noted for their cool summers, frequent showers, and abundant growth of vegetation. The days are cool and the nights are chilly. Light snowfalls are not uncommon on our higher ranges during the summer months. Snows of winter stay on the ranges until late in the summer.

Figure 8 shows the snow on the upper feeding grounds in the middle of July.
Figure 9. The Reason Why Pack Outfits Instead of Sheep Wagons are Used on the Summer Range.

TOPOGRAPHY

The Red Desert, being on the Continental Divide, is a high undulating plateau, crossed and intersected at intervals by low ranges of hills. The general elevation is about 7,000 feet with the land sloping to the Green and North Platte rivers. Some of the streams have their origin in the foothills of the area and have an irregular flow, being fed by melting snows in the spring, and thunderstorms in the mountains, during the summer months.

The valleys of the creeks are more or less level with undulating patches here and there. Most of the area has a well defined drainage system. There is one area in the northern part that does not have an outlet to its drainage. Here it forms large shallow alkali lakes.

The topography of the summer range needs little description. On the Wyoming National Forest is found some of the roughest ranges on the continent. Figure 9 shows a typical summer range area on the above forest.

Pack outfits instead of wagons are used by most of the operators on their summer ranges. The sheep reach their summer feeding grounds over well defined mountain trails that are in some cases dangerous to pack animals.
SOILS

The soils of the Red Desert, like all soils of the arid west, differ materially in the different parts of the region. Being derived in most cases from the green and red shales they are high in the soluble salts, and very low in nitrogen. Through the process of leaching, even though it has been light, some formations have lost, and others have gained in salt content. The region as a whole contains less of the sandy and gravelly types of soils and more of the heavier types than is the case in most arid regions. The abundance of shales account for the presence of the clay and silt soils. The alkali accumulations on the surface, occur where the surface drainage is poor.

Figure 10 shows a typical soil on the plains area sloping down to the alkali sections. There is a very noticeable salt accumulation beginning at a depth of three feet and extending downward for a couple of feet. This accumulation of calcareous material indicates the depth to which the rainfall penetrates. When such land is placed under irrigation these accumulations of salt tend to rise and may cause trouble.

The soils on the summer ranges differ greatly from those on the Red Desert. Due to the abundant summer rains in the mountains the soluble salts have been leached out to a considerable extent. Alkali in this region is very uncommon. Due to the greater vegetative growth the soils contain more organic matter. During the process of weathering the finer soil particles have been washed away leaving the sands and gravels. In the creek and river bottoms are found the silt loams and gravelly loams.

The washing away of the finer soil particles has reduced the water holding capacity of the soils on the slopes, and explains why the annual and perennial weed types of vegetation are found instead of the sod grasses. The former are more likely to have deep tap roots which reach down into the subsoils, whereas the sod grasses have fibrous shallow roots that soon dry out. On the lower and less precipitous areas where the finer soil particles have accumulated one finds the grasses.
Figure 10. Type of Soil in the Winter Range Area of the Red Desert.
The vegetation of this area is especially well adapted to sheep. The predominating type is the common sagebrush (*Artemisia tridentata*) which grows on most of the soils that are not too highly impregnated with the alkaline salts. Bud-sage (*Artemisia spinescens*), which grows in large bud-like clusters of flowers, furnishes a great deal of feed, although it grows to a height of only a few inches. Silvery-sage (*Artemisia cana*) is found on the richer soils, and furnishes food in the form of long tender shoots.

The salt sages probably rank first in the amount of forage produced and in nutritive value. Nuttall's Salt-sage (*Atriplex Nuttallii*) is widely distributed over the area, and is highly prized by the sheep men. Doctor Nelson estimates that it furnishes one-half of the whole feed supply. It is a perennial with a woody base and will stand close and severe grazing. Nelson's Salt-sage (*Atriplex pabularis*) is very similar to the above, except that the woody base is almost wholly underground. It is found in soils that contain rather large amounts of salts. Tumbling Salt-sage (*Atriplex volutans*) is an annual species that makes a large spreading growth. Spiny Salt-sage (*Atriplex confertifolia*) commonly known as shad scales is a valuable forage plant. The fruit and leaves produced during the summer drop off in the autumn and are piled up by the winds under the shrub or in the hollows of the plains.

Slender Wheat-grass (*Agropyron tenerum*), Western Wheat-grass (*Agropyron spicatum*), Indian Millet (*Erisocoma cuspidata*), Giant Rye-grass (*Elymus condensatus*), and Desert Juniper (*Juniperus Knightii*) are found intermingled with the sage-brushes and salt-sages, and furnish considerable feed.

The type of forage on the summer or mountain range is very different from that on the Red Desert. The summer range forage is distinctly herbaceous, in contrast with the scrubby, woody plants of the winter range.

The National Forests are more or less timbered but sufficiently open to allow growth of the weeds and grasses. Even the denser timber is interspersed with parks or meadows containing a luxuriant growth of the weeds and grasses. Figure 1 shows such a
mountain park and the type of vegetation growing thereon. The rainfall is sufficient for a rank growth of vegetation. The soil which has a low water holding capacity is, in many cases, the limiting factor in the growth of the grasses.

The National Forests, especially the Wyoming National predominates in what we call a browse and weed type of vegetation with limited amounts of the wheat, spear, and brome grasses. This may be attributed to the rough and rugged nature of the country which does not allow the accumulation of soil and organic matter sufficient for the grasses. It is what Sampson (1919) would call the Second Weed Stage of development. This stage is characterized by a fairly well decomposed soil. It lacks organic matter and water holding capacity to make it well adapted to the grasses.

The perennial weed type of plants are found in the rough canyons and steep sloping sides and valleys. The leveler bottoms are occupied by true grasses. Figure 11 shows the browse type of vegetation found on much of the mountain areas. One may ride for hours down the mountain canyons, where the luxuriantly growing herbaceous plants reach well to the shoulders of the horse. The sheep are on these mountain ranges for only a short time, 70 to 75 days, yet the carrying capacity is very great considering the short period that they are run thereon.
Figure 12. The Hidden Valley of Greys River Showing the Abundance of Feed.

Figure 12 shows the type of vegetation found in the Greys River, and shows the abundance of feed found in this hidden valley. There are more perennial weeds at this point than in most cases due to the fact that this area is near the Corral Ranger Station and has been grazed off very closely. Due to the grass type of forage in this valley, cattle permits are issued for a region one-half mile wide on either side of the river. Back of this is the sheep range.

The luxuriant growth and predominance of the weed type of vegetation on many of our rougher mountain ranges make them preeminently fitted for sheep. The lower less rugged ranges are better fitted for cattle.

The death loss due to poisonous plants is greater on the summer range than on the winter range, due to the fact that most of the poisonous plants are found in the weed type of plants.

TRANSPORTATION

The area is served by the Union Pacific Railroad system which passes through the central part of the area, and places the wool grower in direct connection with the Omaha, Kansas City, Denver, Chicago, and eastern markets. The shearing pens are located along or near the railroad.
The sheep are sheared as they reach these railroad points on their way from the winter to the summer range, and the lambs are taken from the flocks when they reach the railroad points on their way from the summer to the winter range.

By handling the flocks in the above manner the products that the wool growers have to market are harvested near the shipping point, thereby reducing the cost of transportation. The men who are feeding the lambs and sheep, bill them to the terminal markets with the feeding privilege enroute.

The headquarters of most of the outfits are located in or near the towns, and the owners in many cases are the business men of their respective communities.

**RANCH INVESTMENT**

**TABLE I**

**SHOWING RANCH INVESTMENT**

<table>
<thead>
<tr>
<th>Item</th>
<th>Price</th>
<th>Amount</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land—Grazing, 14,179 acres at</td>
<td>$2.36</td>
<td>$33,578</td>
<td>25.49</td>
</tr>
<tr>
<td>Crop, 515 acres at</td>
<td>15.98</td>
<td>8,231</td>
<td>6.25</td>
</tr>
<tr>
<td>Ewes, 4,705 at</td>
<td>11.706</td>
<td>55,076</td>
<td>41.82</td>
</tr>
<tr>
<td>Yearlings, 1,257 at</td>
<td>9.68</td>
<td>12,167</td>
<td>9.23</td>
</tr>
<tr>
<td>Rams, 156 at</td>
<td>20.54</td>
<td>3,205</td>
<td>2.43</td>
</tr>
<tr>
<td>Cattle, 83 at</td>
<td>49.93</td>
<td>4,144</td>
<td>3.15</td>
</tr>
<tr>
<td>Horses, 37 at</td>
<td>55.92</td>
<td>2,069</td>
<td>1.57</td>
</tr>
<tr>
<td>Buildings and Improvements</td>
<td>7,193</td>
<td>1,552</td>
<td>1.18</td>
</tr>
<tr>
<td>Machinery and Equipment</td>
<td>4,511</td>
<td>1,552</td>
<td>1.18</td>
</tr>
<tr>
<td>Feed and Supplies</td>
<td>1,552</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$131,726</strong></td>
<td><strong>100.00</strong></td>
<td></td>
</tr>
</tbody>
</table>

The average investment per ranch was $131,726 of which 53.48 per cent was in sheep. The investment in land, buildings, and improvements was 37.2 per cent of the total investment. The average acreage per ranch was 14,694 valued at $2.84 per acre. Five hundred and fifteen acres were irrigated for hay and pasture, and were valued at $15.98 per acre. The remaining 14,179 acres were used for grazing and were valued at $2.36 per acre.
The irrigated lands yielded one-half to one ton of hay per acre. The grazing lands represented the better dry land areas of the section and had a carrying capacity of from 8 to 15 acres per sheep for year long grazing.

One per cent of the total investment was in feed and supplies for livestock. This shows the narrow margin of surplus feed on which the wool grower operates. Very little feeding is done at any season of the year except in the case of an emergency. A small amount of feed such as hay, grain or cottonseed cake was kept on hand, to care for the flocks during severe storms, during which they may be unable to secure their own feed.

Buildings and improvements represented 5.5 per cent and machinery and equipment represented 3.42 per cent of the total investment.

There was an average of 83 head of cattle per ranch, which were grouped on a few of the ranches. Most of the sheep operators had no cattle at all. The cattle were valued at $49.93 per head, which was perhaps a little above their selling price.

There were 37 horses per ranch with a value of $55.92 per head. They were used very largely for saddle and pack animals in caring for the sheep.

Of the 53.48 per cent of investment in sheep, 41.82 per cent was in ewes, 9.23 per cent in yearlings, and 2.43 per cent in rams. There was one ram for 30.2 ewes. The average value of the breeding ewe was $11.71 per head. The yearlings were valued at $9.68 at the beginning of the year, and the rams at $20.54. The lambs were worth $8.20 in the fall at market time. The value of the yearlings was obtained by adding to this value the cost of carrying the lamb until January 1, which was found to be $1.48. This gave the yearling a value of $9.68.

The value of the 2-year-old ewes was arrived at by adding to the yearling cost the cost of carrying the yearlings one year which was found to be $5.71 (75.6 per cent of the cost of carrying a sheep unit), and subtracting therefrom the value of the wool clip of 6.5 lbs. at 38.8 cents or $2.51. This gave a value of $12.88 for the 2-year-old ewe.
The average percentage of the total number and the values of the ewes in the breeding herd on January 1 were as follows:

<table>
<thead>
<tr>
<th>Per cent</th>
<th>2-year-olds</th>
<th>3-year-olds</th>
<th>4-year-olds</th>
<th>5-year-olds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>29.5</td>
<td>26.2</td>
<td>23.4</td>
<td>20.9</td>
</tr>
<tr>
<td>Value</td>
<td>$12.88</td>
<td>$13.29</td>
<td>$11.06</td>
<td>$8.83</td>
</tr>
<tr>
<td>100.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$11.71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The weighted average value of the ewes was $11.71. The value of the 3-year-old ewe is placed at a higher value than the 2-year-old ewe. This is contrary to the usual method used by writers who give the ewe entering the herd the greatest value, with a fixed depreciation in value for each succeeding year. When this latter method was used it gave the outfits, who were keeping a large percentage of their lamb crop, a greater return than the operators who were keeping just enough for replacement, indicating that we were giving the 2-year-old ewe too high a value. When the $12.88 value for the 2-year-old ewes was used, it corrected this discrepancy and gave the same return on those outfits that were selling lambs as on those that were keeping them.

The wool growers also objected to having the 2-year-old ewe given a higher value than the 3-year-old, and in actual practice the 3-year-old will sell for more than the 2-year-old, due to the poorer lamb crop of the latter.

When the 2-year-old ewe was inventoried at a value sufficient to allow 4 years depreciation and a culling value of $6.60, it was necessary to inventory her when she entered the breeding flock at $14.10, in order to give an average value of $11.71 to the breeding herd. This showed too great a profit on the yearlings that were being kept for the breeding flocks.

Figure 13 shows the correlation of the return on investment to the percentage of the total investment which is invested in sheep. The correlation was \( +.474 \pm .065 \). As the percentage of investment in sheep increased the return on investment increased. Of the 14 operators who had less than 45 per cent of their total invest-
ment in sheep, there was only one that was making more than 6 per cent on his investment. The remaining 13 were making from less than 6 per cent to losing 20 per cent on their investment. Of the 51 operators who had 45 per cent or more of their capital invested in sheep 29 were making more than 6 per cent and 22 were making less.

**Figure 13. Correlation of the Rate of Return on Investment to the Percentage of the Total Investment that is in Sheep.**

There are always other factors of management influencing returns which means that a wool grower may have the proper distribution of his capital and still be losing money due to poor management. So it is not possible to secure a perfect correlation in the study of any one factor.

The actual returns that are being secured show that as the percentage of investment in sheep increases the returns are more favorable, and that the operator, under present conditions of operation, should have from 45 to 70 per cent of his total capital invested in sheep. Above that amount it becomes more speculative, for it
means that he has very little controlled range, and during the years of drought and severe winters, his losses will be greater. On the other hand, if he has less than 45 per cent of his total capital in sheep it means that he has too much invested in land and equipment, and not enough in the thing from which he must secure his return.

The average investment in sheep of 53.48 per cent of the total capital shows a good distribution. It is the operator who has less than this, who is not likely to do well.

LAND TENURE

The results of the survey show that if the wool grower owns his range he should have about 43 per cent of his total capital in sheep, 10 per cent in improvements and equipment, 2 per cent in feed and supplies, 1 per cent in horses, and the remaining 43 per cent, in land. This is somewhat higher than the actual investment in land which averaged 31.75 per cent on 65 ranches studied. This low investment of 31.75 per cent is due to the fact that the operators did not own all of the land over which they grazed.

The value of range land is determined by its carrying capacity and the cost of operation in securing the feed. A study of 1,764,314 acres of controlled grazing land showed that it would carry 225,000 sheep for 5 months. It required 18.8 acres of this land to carry a sheep for 12 months. This figure is in keeping with the ones suggested by the officials of the National Forest and representatives of the wool growers, at their meeting in Carbon County in 1926. They concluded that a permittee should control 15 acres of grazing land outside the National Forest, for each sheep permitted to go on the forest. As sheep were on the National Forest for 74 days it meant that 15 acres was required for 291 days or 18.8 acres to carry a sheep one year.

The present investment in land is $6.40 per sheep unit. The operator pays a grazing fee of 23 cents per sheep unit which would allow 7 per cent for interest and taxes on a land investment of $3.29. This latter amount added to the present investment of $6.40, gives a total land investment of $9.69 per sheep unit. This
would be about 48 per cent of the total investment and is as much as the operator can afford to have in land when he owns all his range, where there will always be an element of risk involved in securing the feed.

If it requires 18.8 acres of arid grazing land to carry a sheep unit for one year, and the investment in land per sheep unit is $9.69, the value of the land will be 52 cents per acre. If we allow 7 per cent on the land investment, to cover interest and taxes, the grazing costs will be 68 cents per sheep unit. The cost of purchased feed is 46 cents which added to the 68 cents gives a feed cost of $1.14, which is about one-sixth of the total cost of carrying a sheep unit one year. When the losses and expenses involved in securing this scant vegetation are taken into consideration, the $1.14 is as much as the wool grower can afford to pay for the feed. On the above basis the tax rate should not exceed one-half cent per acre.

The present value of $2.36 placed on the owned grazing land is too high, and carries a rate of taxation in excess of its value. The owned land, as a rule, represents the better lands and has a carrying capacity 2 to 3 times that of the Red Desert, which would give the owned land a value of $1.00 to $1.50 per acre which is not more than half the present appraised value of $2.36. As the product of our grazing lands is feed, it cannot have a greater value than the amount of feed it will produce, the value of which depends on its accessibility.

Other things being equal the value of the land increases and decreases with the value of the sheep and their products. With the 1925 value of sheep at $11.70 the value of the 18.8 acres of land necessary to carry the sheep would be 62 cents per acre, a rather high value under present conditions.

The average value of sheep per head in Wyoming from 1910 to 1926, inclusive, was $7.35, and is perhaps a fair figure to use in determining land values. On the basis 18.8 acres per head, and 43 per cent in land, the range land would have an average value of 39 cents per acre over the 12-year period.

The above values given to the Red Desert grazing lands are based upon the assumption that they will be used in connection
with summer range in the mountains, for they do not lend themselves to year-long grazing, and would have a much lower value if there were not summer range lands available to be used in connection with them. This subject will be discussed more fully under National Forests vs. Open Range.

A careful study of sheep operations under range conditions, and over a long period of years, indicate that the investment in land without improvements should not exceed the investment in sheep, where all of the land used in the operation is owned.

A fair distribution of capital under present conditions where all land is owned would be:

<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land without improvements</td>
<td>43</td>
</tr>
<tr>
<td>Sheep</td>
<td>43</td>
</tr>
<tr>
<td>Buildings and improvements</td>
<td>6</td>
</tr>
<tr>
<td>Machinery and equipment</td>
<td>4</td>
</tr>
<tr>
<td>Feed and supplies</td>
<td>3</td>
</tr>
<tr>
<td>Horses</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The above rule will not apply to pasture and meadow lands in the farming region. The additional costs on such items as death loss, labor, and depreciation takes away at least 50 per cent of the value of the feed on the desert and mountain ranges, as compared to the feed on the pasture lands of the Middle West.

If the range wool grower could own and control his ranges for his flocks and still keep his taxable values on land and improvements proportionate to the taxable values on sheep, he could afford to own the land he uses, and would no doubt take better care of his range and secure better returns. As it is at present the man who owns land must pay a penalty for so doing.
FINANCING

The average investment per operator was $131,726, of which 20.8 per cent was borrowed capital and 79.2 per cent owned capital. The loans were very largely on the sheep on which the borrower paid 8 per cent interest. There were very few exceptions to the above. The risk involved on sheep operations, running under desert and forest conditions, is what makes the above rather high rate of interest. It is for the above reason that we allow 8 per cent interest to the operator for his owned capital. It would seem to be no more than a fair rate of interest to allow on money invested in a business that is so uncertain in its returns and profits. The very nature of the conditions under which the wool grower operates makes it impossible to prevent losses during periods of extremes in temperature and precipitation.

RECEIPTS AND EXPENSES

The average receipts on the 65 ranches, as shown in Table II, were $49,645 of which $25,089 was from the sale of sheep, $19,853 from the sale of wool, $978 from the sale of cattle, $325 from crops, and $259 from miscellaneous sales. The increase in inventory on the ranches was $3,141 or 6.33 per cent which shows the amount of increase in the number of sheep run per ranch. The sheep were given the same value at the end of the year as at the beginning, when they belonged to the same class as yearlings, 2-year-olds, etc. 90.52 per cent of all receipts were from lambs and wool.

The total expenses per ranch were $29,682 of which $24,869 or 83.79 per cent was for current expenses. Purchases of livestock were made to the extent of $3,998 and the depreciation on buildings, improvements, machinery, and equipment was $815.
**TABLE II**

**RANCH STATEMENT**

Ranch Investment $131,726.

<table>
<thead>
<tr>
<th>Receipts</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheep</td>
<td>$25,089</td>
</tr>
<tr>
<td>Wool</td>
<td>19,853</td>
</tr>
<tr>
<td>Cattle</td>
<td>978</td>
</tr>
<tr>
<td>Crops</td>
<td>325</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>259</td>
</tr>
<tr>
<td>Increase in Inventory</td>
<td>3,141</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>$49,645</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expenses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Purchases (Livestock)</td>
<td>3,998</td>
</tr>
<tr>
<td>Current</td>
<td>24,869</td>
</tr>
<tr>
<td>Depreciation on Building &amp; Improvement</td>
<td>366</td>
</tr>
<tr>
<td>Depreciation on Machinery &amp; Equipment</td>
<td>449</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>$29,682</td>
</tr>
</tbody>
</table>

Ranch Income $19,963
Interest on Borrowed Capital 2,194
Ranch Income from Owned Capital 17,769
Interest on Investment 8,143
Labor Income 9,666
Operator's Labor 2,507
Return on Investment 7,119
Rate of Return on Investment 5.40

The average labor income per ranch, after allowing interest on borrowed capital and owned capital was $9,666. The value of the operator's labor was placed at $2,507, which conforms to the wage scale worked out by the Idaho Wool Growers and which is explained in the discussion on "unpaid labor."

The "return on investment" rather than labor income is used as a measure of successful management. The former is used as a measure because capital is a more important and more expensive item than is the operator’s labor, on Wyoming ranches. The item of interest is four times greater than the item of operator’s labor. The amount that the operator was allowed for his labor on each individual ranch was based on the number of sheep under his management.
The return per ranch above expenses was $7,119. The average investment per ranch was $131,726. The rate of return on investment, after allowing 8 per cent on the borrowed and owned capital of the operator, was 5.4 per cent.

The receipts from wool were 40 per cent of the total receipts, which may seem a little high, but it is due to the fact that many of the lambs were used for replacement instead of being sold. Where all wool and lambs are sold the receipts from wool will range from 33 to 40 per cent of the total receipts from both lambs and wool. The percentage of the total receipts received from wool becomes less as the lamb crop increases.

RATE OF TURNOVER

By rate of turnover is meant the percentage of sales, to the total investment, or to the percentage of investment in sheep.

The average rate of turnover on total investment was 39 per cent and ranged from 84 to 19 per cent, depending to some extent on the amount of capital in real estate.

A better way of measuring the successful management is to determine the rate of turnover of the capital in sheep. This turnover ranged from over 126 per cent to 46 per cent with an average of 70.8 per cent.

There are so many factors like liquidation, increased inventories, and real estate holding that enter into the rate of turnover that it is not possible to draw any conclusions from extreme cases of high and low turnover, without knowing the above mentioned conditions. A 70.8 per cent turnover is a good one for a livestock enterprise, and means that for each $11.71 invested in a sheep there were sales of lambs, wool, and culled ewes to the extent of $8.26. This amount of sales may have cost more than $8.26. Turnover should not be confused with profit, although there is a very close correlation between turnover and return on investment. Turnover is not a thing that is within the control of the operator, except in so far as it is influenced by other factors which are within his control.
A very high rate of turnover means very little investment in things other than sheep, a good crop of weighty lambs, a low death loss of ewes and lambs, and a good wool clip. If the management is poor on any of the above it reduces the rate of turnover.

The rate of turnover on sheep is much greater than that on cattle, and it must be to show a profit. The cost of carrying a ewe a year is three-fourths of her value whereas the cost of carrying a cow one year is about two-fifths of her value. Turnover, although it has been used as such, is not a good measure of successful management, because it does not take into consideration the cost of the products sold.

COST OF PRODUCTION
TABLE III
SHOWING COST OF PRODUCTION

<table>
<thead>
<tr>
<th>ITEMS OF COST</th>
<th>1925</th>
<th>1915</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per</td>
<td>Per</td>
</tr>
<tr>
<td>Labor (Paid)</td>
<td>$1.47</td>
<td>$1.47</td>
</tr>
<tr>
<td>Labor (Unpaid) Owner</td>
<td>.38</td>
<td>.38</td>
</tr>
<tr>
<td>Supplies (For Labor)</td>
<td>.74</td>
<td>.74</td>
</tr>
<tr>
<td>Horse Labor</td>
<td>.14</td>
<td>.14</td>
</tr>
<tr>
<td>Feed (Purchased)</td>
<td>.46</td>
<td>.46</td>
</tr>
<tr>
<td>Shearing</td>
<td>.24</td>
<td>.26</td>
</tr>
<tr>
<td>Grazing</td>
<td>.23</td>
<td>.23</td>
</tr>
<tr>
<td>Taxes</td>
<td>.18</td>
<td>.18</td>
</tr>
<tr>
<td>Auto</td>
<td>.09</td>
<td>.09</td>
</tr>
<tr>
<td>Repairs</td>
<td>.05</td>
<td>.05</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>.23</td>
<td>.23</td>
</tr>
<tr>
<td>Interest on Owned Capital at 8 per cent</td>
<td>1.28</td>
<td>1.28</td>
</tr>
<tr>
<td>Interest on Borrowed Capital at 8 per cent</td>
<td>.34</td>
<td>.34</td>
</tr>
<tr>
<td>Depreciation on Building &amp; Improvement</td>
<td>.05</td>
<td>.05</td>
</tr>
<tr>
<td>Depreciation on Machinery and Equipment</td>
<td>.07</td>
<td>.07</td>
</tr>
<tr>
<td>Death Loss</td>
<td>.76</td>
<td>.77</td>
</tr>
<tr>
<td>Depreciation on Ewes</td>
<td>1.16</td>
<td>.61</td>
</tr>
<tr>
<td>Ram Service</td>
<td>.44</td>
<td>.33</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td><strong>$6.71</strong></td>
<td><strong>$8.34</strong></td>
</tr>
</tbody>
</table>
In figuring the cost of production, three groupings have been made. The first two groups include all costs for the year of 1925, and the third group is the cost of operation for the 12-year period of 1915 to 1926 inclusive. Table III shows the cost of operation per sheep unit, and per ewe, in 1925, and the average cost of operation per ewe over the 12-year period. Lambs are not counted as sheep units. Yearlings, ewes, and rams are counted as sheep units; horses and cattle as $3\frac{1}{2}$ sheep units.

**LABOR (PAID)**

The amount paid for labor was $1.47 per sheep unit, and it was found from the records of those men who had kept them during the last 12 years that the present rate of wages was very close to the average for the entire period. Yearlings required less labor than the ewes and the rams more labor. The amount of labor spent on a horse or a cow was equivalent to the amount spent on $3\frac{1}{2}$ sheep. The prevailing rate paid sheep herders and camp tenders was $75 per month and ranged from $60$ to $85$. Any and all paid labor used on the ranches were charged against the sheep unit. Practically no feed was sold, so that the labor used in producing hay, was working for the livestock. Labor will be discussed more in detail under factors influencing profit.

**LABOR (UNPAID)**

Unpaid labor was 38 cents per sheep unit and represents the salary allowed the manager. It is based upon the scale adopted by the Idaho Wool Growers Association, and is as follows:

**SCALE OF WAGES ALLOWED OPERATORS FOR THEIR OWN TIME**

<table>
<thead>
<tr>
<th>Number of Sheep</th>
<th>Wage per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 to 1,000</td>
<td>$50</td>
</tr>
<tr>
<td>1,000 to 1,500</td>
<td>75</td>
</tr>
<tr>
<td>1,500 to 2,000</td>
<td>100</td>
</tr>
<tr>
<td>2,000 to 3,000</td>
<td>125</td>
</tr>
<tr>
<td>3,000 to 5,000</td>
<td>150</td>
</tr>
<tr>
<td>5,000 to 10,000</td>
<td>200</td>
</tr>
<tr>
<td>Over 10,000</td>
<td>300</td>
</tr>
</tbody>
</table>
Using the above scale the average salary allowed the manager on the 65 ranches studied was $2,507, which is not a large salary considering that the average manager is handling a $131,726 organization.

SUPPLIES (FOR LABOR)

The cost of supplies per sheep unit was 74 cents and represents the supplies for labor. This item is a part of the labor cost. It ranges from 25 cents to $2.00 on the different ranches. The more labor the more supplies. Some outfits feed their help better than others. Some buy their supplies at high retail prices and others buy at wholesale prices. Supplies constitute an item that can well be given a little more careful study by the operators.

HORSE LABOR

Horse labor was found to cost 14 cents per sheep unit, and ranged from 4 cents to 45 cents. Autos and trucks are used to replace some of the horse labor on the winter range. It takes a lot of horses to care for sheep. The summer bands on the Wyoming National Forest consisting of about 1,200 ewes, use two men and from 6 to 8 head of horses. The horses were used for the purpose of operating the outfit and so their cost must be charged against the producing animals.

The horse cost was arrived at in the following manner: There were a total of 416,541 sheep units other than horses. There were 173 sheep units per horse. It cost $6.71 to carry a sheep unit one year. So a horse representing 3½ sheep units would cost $23.48, including all costs. This amount divided by 173 equals 14 cents, the cost of horse labor per sheep. This figure cannot be materially reduced, and will go up as horses increase in value.

FEED AND SUPPLIES

Feed costs represented the amount purchased, and ranged from a few cents to $1.74 with an average cost per head of 46 cents. This represents payments for corn, cottonseed cake, salt, and in some cases, hay. These feeds are used primarily to carry the bands through adverse weather, to condition the bucks, and to care for weakened ewes and lambs. A higher feed bill than the
average is justifiable if an operator can thereby improve his lamb crop, produce heavier lambs, and reduce his death loss.

The feed bill of the Wyoming wool grower is one of the lowest paid by the wool growers in any of the states. The very nature of his operation requires that it be low. Just how much more he can afford to feed, in order to reduce the death losses and increase his lamb crops, is one of the problems of the wool grower that should receive more study and investigation.

Many of the operators prefer corn to cottonseed cake, due to the fact that the desert range vegetation is high in protein and is balanced better by a feed high in carbohydrates, than one high in protein. The operators to the east of the Red Desert who have more of the grass type of forage often prefer the cottonseed cake. Cottonseed cake is high in protein and should be fed with feeds low in protein. Corn is low in protein and should be balanced with feeds high in protein. The price of cake and of corn and their storage possibilities are also determining factors.

**Shearing**

The shearing costs averaged 26 cents per ewe and represent wages, board for the shearers, sacks and twine. The shearsers, as a rule, are given a flat rate of from 12 to 15 cents per head. The wool growers' associations have made rules and regulations regarding wages, some of which have been lived up to.

The chart sent out to the individual operators who gave us records giving the cost of the various items, show several ranches with less than a 12 cents per head shearing cost. This is accounted for by the fact that it was not always possible to separate the cost of labor and supplies for shearing, from the general accounts of labor and supplies.

**Grazing**

The grazing fees were 23 cents per sheep and include all fees paid out for forest permits and leased land. They ranged from nothing to $1.00 per head. This item, of necessity, must be kept very low due to the high costs involved in securing this scant and inaccessible feed on the winter and summer ranges.
Taxes were 18 cents per sheep unit and ranged from 8 to 40 cents, depending on how much land the operator owned. The high assessed value of much of the grazing land places a penalty upon the man who owns it. Leasing rates, which are really based on the producing power of the land are about the same as the tax rates. The man who owns the land receives no interest on his investment. This condition has discouraged ownership. The less land a wool grower owns the more easily he can dispose of his outfit if he so desires.

The average value of investment per sheep unit over the 12-year period, 1915-1926, was $15.10, instead of the $20.15, the average investment in 1925. The rate of taxation was also lower which gave a tax cost per head of 12 cents instead of 18 cents, the present rate.

An assessed value of 39 cents per acre as discussed under Land Tenure would be sufficiently high for the Red Desert grazing land. An assessed value above that discourages ownership and retards development. The people of the state of Wyoming own one-third of the land in the state. The land taxes of the state are carried by this one-third. The high assessed valuation of the land now owned is what discourages further ownership, and leaves the people, who are now land owners, carrying the burden of those remaining areas that are not privately owned. By placing a penalty on ownership of land we discourage the most vital thing in our whole agricultural system.

AUTOMOBILES AND TRUCKS

Automobiles and trucks are used by many of the outfits to carry the supplies out to their herders. They are used during the summer to carry provisions and supplies up to the edge of the mountainous areas where they are met by the pack outfits and carried on into the feeding grounds. Where trucks can be used to advantage they are a saving in horse and man labor.

REPAIR

The repair item was not kept separate from the other expense items in many of the ranches. It ranged from 9 cents to $1.00 on
those ranches where it was kept. In some cases it was carried over into the miscellaneous account. Under miscellaneous we placed the expenditures that could not be separated out as belonging under one of the above items.

INTEREST

The operator was allowed 8 per cent interest on his owned capital, which amounted to $1.28 per sheep unit. The same rate was allowed on his borrowed capital. The amount allowed for interest during the 1915-1926 period was 8 per cent on the capital invested, which was $15.10 per sheep unit. This gave an interest charge of $1.21 instead of $1.62, the amount allowed in 1925.

DEPRECIATION

The depreciation of buildings and improvements was figured at 5 per cent of their value. The investment per sheep unit was $1.10 which gave a depreciation charge of 5.5 cents.

The depreciation on machinery and equipment was figured at 10 per cent of the investment. The investment per sheep unit in equipment and machinery was 69 cents, which gave a depreciation charge of 7 cents.

DEATH LOSS

The death loss for the 1925 operations is figured on a 6.46 per cent loss. The two-year-old ewes on entering the herd were valued at $12.87. Pelts were valued at $1.00, allowing for the ones not recovered. The cost of replacement, due to death loss, was 76 cents per sheep. The lamb loss is not figured in as only the lambs on hand at market time in the fall are considered.

The death loss for the 1915-1926 period was placed at 12 per cent which is a figure arrived at after a careful study of the losses over that period. The ewes entering the breeding herd were given a value of $9.81 and the pelts a value of 90 cents. The average annual death loss per ewe for the 12-year period was $1.07.

The season of 1925 was an unusually good one from the standpoint of death loss, and is much below the average. In considering the death loss of the business we must average in the years of heavy losses as well as the years of light losses. Figure 5 shows
the enormous losses during the bad years. The losses of 1903, 1910, 1912, and 1919 give some idea of the extent of the losses that may occur during the bad years. Figure 5 is for the entire state, whereas the losses of the Red Desert operators are far greater than the average of the state. They operate under less controlled conditions, and at greater risk. The very nature of their grazing lands makes it more difficult to prevent loss than on the better sheltered and more controlled areas.

**DEPRECIATION ON EWES**

The depreciation figures are based on 4 years of use, or 4 lamb crops, which is the average period of use on the Red Desert. In a band of 1,000 ewes 250 must be replaced each year. 64.6% have died which leaves 185.4 to be culled out. They are worth $12.87 on entering the herd and have a value of $6.60 as culls, which means a loss of $6.27 on 185.4 head or $1,162 which represents the loss on a band of 1,000. Placed on a ewe basis the loss is $1.16 per head.

The average annual depreciation for the 12-year period 1915-26 was less than in 1925, due to the fact that more of the old ewes died and there were not so many left to cull out. The average value of the young ewe on entering the band was less than in 1925, which meant that the difference between the value of the ewe, when she entered the breeding flock and her cull value, was less for the 1915-1926 period. The average depreciation loss for the 12-year period was 61 cents per ewe.

**RAM SERVICE**

The ram service is a charge that has often been left out of cost of production studies on sheep, but it must be charged against the breeding ewe. This charge was found to be 44 cents and was arrived at as follows: The purchase price was $28.60. The rams were used 3 years and then traded at a value of $10.60. The death loss was 12 per cent, and the pelts valued at $1.60. This gave a death and depreciation loss of $7.07 per head. The cost of carrying a ram a year was one and one-third times the cost of carrying a sheep unit, or $8.95, which when added to the death and deprecia-
Figure 14. Rams on Winter Range.

Photograph by Charles J. Belden, Pitchfork, Wyo.
tion loss gives a total cost of $16.02. The wool clip from the rams was valued at $2.64 which leaves a net cost per head of $13.38. There was one ram per 30.2 ewes which makes the cost per ewe 44 cents. The rams must be cared for in a separate band, and given better care than the rest of the sheep, which increases their cost of maintenance. Figure 14 shows a good bunch of rams on winter range.

Where the rams were used 4 years and then discarded the following method has been used: The value of the rams entering the herd was $28.60. The replacement loss was $7.15. The cost of running them one and one-third times as much as a sheep unit, or $8.95, making a total cost of $16.10. They sheared 11 pounds of wool, worth, on the average, 25 cents, which leaves a net annual cost per ram of $13.35. There was 1 ram for 30.2 ewes, making an annual cost per ewe of 44 cents. The above method is based on the rams serving 4 years. There is, however, a death loss continually taking place among the rams, which would increase the cost somewhat above the 44 cents. The ram charges for the 1915-1926 period was figured as three-fourths of the 1926 charge, due to less capital invested, and lower operating costs.

**TOTAL COST**

The total cost per sheep unit was $6.71. In this case no depreciation was figured, as the band was being kept up by replacement. There was no ram charge as rams made up part of the sheep units.

In the case of the ewe, the cost was $8.34. The items of cost per ewe were very similar to those of the sheep units except depreciation and ram service.

Using the 3.5 to 1 as the ratio of the cost of carrying horses and cattle, to that of carrying sheep, the cost of carrying cattle was $23.46 per head which is sufficiently large. A ratio of 6 or 7 to 1, which some writers have used, would be out of all proportion to the actual costs of running the two classes of livestock on the range.
Although the outfits studied were operating under similar conditions the cost of carrying a sheep unit a year ranged from $4.50 to $12.50 with an average of $6.71.

The most important factors in causing this variation in costs are as follows: percentage of investment in sheep, number of sheep handled per man, and lamb crop. These will be discussed under the heading, Factors Influencing Profits.

RETURNS ON INVESTMENTS

The average rate of return on investment for the 65 operators was 5.4 per cent, after allowing for all expenses, including a wage for the managers, and an 8 per cent interest charge on all capital.

It is a common statement that the wool growers all operate alike, and that the figures from one outfit will tell the whole story. If such were the case a study of this kind would be of little value. That they do not operate alike is shown by the fact that the returns on investment during the year in which the study was made, ranged from a profit of 22 per cent to a loss of 20 per cent with a gradual graduation between the two.

The wool grower received an average price of 38.7 cents for his wool and 12 cents for his lambs, and under those conditions there were 18 of the 65 operators, or 28 per cent, who were not making the 8 per cent interest allowed on the investment. These 18 operators were losing 5.4 per cent instead of making 5, 10, or 15 per cent, as many of the other operators were doing. A study of the correlation charts will show the range of returns the wool growers were making.

A large chart was prepared for the study and analysis of the management, organization, and returns of each of the individual operators. All of the factors that influence the profits of the different outfits were analyzed in detail. The returns, costs, and all other items were arranged in order, from the best to the poorest. A copy of this chart was sent to each individual operator with the items on his ranch underscored, so he could see at a glance just where he stood in his costs of operation and returns.
It is possible, by this method of analysis and comparison, to point out the strong and weak point in the management of each of the individual operators. By the study of this chart it is possible for the operators to see wherein they are weak when compared to what some of the better ones are making.

The returns of the operators ranged from 22 per cent above costs to minus 20 per cent below costs even after allowing them all the same prices for their lambs and wool. There were 18 of the 65 operators who were producing at a loss, even when allowed 38.8 cents for their wool and 12 cents for their lambs which was the average prices received by the wool grower. These losses could all be accounted for by the organization and management of the outfits. The more important factors will be taken up more in detail in the following discussion on Factors Influencing Profits. The greatest value of this work, is naturally, to those men who have given us records.

The following table shows the returns per ewe for 1925. All figures are based on the average of the 65 ranches studied.

**TABLE IV:**

<table>
<thead>
<tr>
<th>Operation Cost and Return per Ewe, 1925</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receipts—73.24% lamb crop of 68.4-pound lambs:</td>
</tr>
<tr>
<td>50.1 pounds lamb at $.120.................$6.01</td>
</tr>
<tr>
<td>8.87 pounds wool at 387..................3.43 $9.44</td>
</tr>
<tr>
<td>Expenses including interest at 8%...........$8.34</td>
</tr>
<tr>
<td>Profit per ewe ................................1.10</td>
</tr>
<tr>
<td>Rate of interest return above 8% on $20.15 investment........5.4%</td>
</tr>
</tbody>
</table>

The lamb crop was 77.8 per cent and the death loss 5.86 per cent, leaving a 73.24 per cent lamb crop of 68.4-pound lambs to sell at 12 cents. The wool clip was 8.87 pounds and sold for 38.7 cents. The total receipts per ewe, from wool and lambs, was $9.44. The expenses were $8.34, leaving a profit of $1.10 on an investment of $20.15. The rate of return was therefore 5.4 per cent. This rate of return is the same as the average secured on the ranches where lambs were kept for replacement and culled ewes were sold. This indicates that the authors have given the proper value to the yearlings and 2-year-old ewes.
The following table gives the cost and return per ewe over the 12-year period of 1915-1926.

### TABLE V.
**OPERATION COST AND RETURN PER EWE, 1915-1926**

<table>
<thead>
<tr>
<th>Expenses</th>
<th>$7.52</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receipts—67% marketable lamb crop of 65-pound lambs:</td>
<td></td>
</tr>
<tr>
<td>43.5 pounds lamb at $1.017</td>
<td>$4.42</td>
</tr>
<tr>
<td>8.00 pounds wool at .3695</td>
<td>2.95</td>
</tr>
<tr>
<td>Loss per ewe</td>
<td>.15</td>
</tr>
<tr>
<td>Actual return on investment, ($15.10)</td>
<td>7.0%</td>
</tr>
</tbody>
</table>

The cost of the individual items of production during the 12-year period were discussed under Cost of Production. The lamb crop, over the same period, was 72 per cent, with a death loss of 7 per cent, leaving a 67 per cent lamb crop of 65-pound lambs for market. The average price of western lambs for this period was $1.17 per hundred, and the average price of wool based on records of sales over this period, was 37 cents per pound. The receipts were $7.37 and the expenses $7.52 which resulted in a loss of 15 cents per ewe when 8 per cent had been allowed on investment. The average investment per ewe over this period was $15.10. The actual return on investment, not allowing an interest charge, was 7 per cent. The operators during this 12-year period made wages and 7 per cent interest on the total investment.

Table VI gives the cost and the returns on the 1926 operations in the Red Desert area:

### TABLE VI
**OPERATION COST AND RETURN PER EWE, 1926**

| Receipts—74% lamb crop of 68-pound lambs: |
| 50 pounds lamb at $1.13 | $5.65 |
| 8.2 pounds wool at .330 | 2.71 |
| Expenses per ewe | $8.34 |
| Profits per ewe (above 8 per cent interest) | .02 |
| Actual return on investment | 8.3% |

The expenses for 1926 was approximately the same as for 1925. Barber (1926) in his report for the Idaho Wool Growers reports 5 per cent less cost in 1926, compared to the 1925 costs.
The Wyoming costs did not change materially. In some cases a higher value was placed on the breeding ewe during the latter year.

The lamb crop was above normal in per cent and weight. The price received averaged $11.30 per hundred, which gave a receipt from lambs of $5.65. An 8.2-pound wool clip gave a return of $2.71. The total receipts per ewe for the year was $8.36. The operators made their 8 per cent interest on investment, and wages for their management.

The years of 1925 and 1926 were above the average in lamb crop and below the average in death losses.

Under the present costs of operation it is only during the unusually favorable seasons that the Red Desert wool growers can produce wool for 33 cents and lambs for $11.30 and still make the 8 per cent interest that they have to pay for borrowed money. The cost of production over the 12-year period was 33 cents for wool, and $11.22 per hundred for lambs. The investment per ewe during this period was $5 less than it was in 1925.

FACTORs INFLUENCING PROFITS

DISTRIBUTION OF INVESTMENT

One of the most important factors influencing the return on investment was the amount of land owned by the operator. The larger the percentage of his capital in land the less are his chances for making a fair rate of return on his investment. Figure 13 shows this correlation.

Under the present system of using leased lands, open ranges, and national forests, the operator should have from 50 to 70 per cent of his total investment in sheep.

Where the range land is owned at a fair valuation the operator should have about the same amount invested in sheep as he has invested in land, and the total of these two should represent from 85 to 90 per cent of his total investment. With the present scale of assessed land values, the operator cannot afford to own his own range.
A great deal has been said and written regarding the large scale operations of the Wyoming wool growers. That they do operate on a large scale is shown by the number of sheep units, capital invested, and labor per ranch.

The average number of men per ranch was 10.7 and the number of acres owned per ranch averaged 14,694. The amount of land owned was less than one-third of the area necessary to carry the sheep. The remaining land necessary for operation was leased land, national forests, and public domain. There were 6,538 sheep units per ranch. The average investment per ranch was $131,726, and represents the largest amount of capital of any survey that has yet been made. This statement is based on the examination of some 882 surveys made in different sections of the United States.

Figure 15 shows the sheep wagons and equipment on one outfit where they are left at the edge of the summer range. From this point on the range becomes too rough for wagons, and the packoutfits must be used.

The present survey is, however, the first study of its kinds on range sheep operations, and it may be that sheep surveys, when
made in other western states may show as large an investment.

There seems to be a general opinion that the small wool grower can operate more efficiently than the large outfits. In order to study the influence of size we based the grouping of the ranches on the number of breeding ewes per ranch.

**TABLE VII**

INFLUENCE OF NUMBER OF EWES ON THE RETURN ON INVESTMENT

<table>
<thead>
<tr>
<th>Number of EWES Per Ranch</th>
<th>Number of Ranches</th>
<th>Average Number of Ewes per Ranch</th>
<th>Rate of Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000 or less...</td>
<td>6</td>
<td>848</td>
<td>2.64</td>
</tr>
<tr>
<td>1,001 to 2,000...</td>
<td>7</td>
<td>1,585</td>
<td>3.06</td>
</tr>
<tr>
<td>2,001 to 3,000...</td>
<td>11</td>
<td>2,427</td>
<td>4.46</td>
</tr>
<tr>
<td>3,001 to 4,000...</td>
<td>15</td>
<td>3,054</td>
<td>4.93</td>
</tr>
<tr>
<td>4,001 to 5,000...</td>
<td>7</td>
<td>4,009</td>
<td>6.06</td>
</tr>
<tr>
<td>5,001 to 6,000...</td>
<td>4</td>
<td>5,506</td>
<td>8.68</td>
</tr>
<tr>
<td>6,001 to 7,000...</td>
<td>5</td>
<td>6,473</td>
<td>8.65</td>
</tr>
<tr>
<td>7,001 to 8,000...</td>
<td>4</td>
<td>7,418</td>
<td>9.49</td>
</tr>
<tr>
<td>8,001 to 9,000...</td>
<td>4</td>
<td>8,293</td>
<td>7.35</td>
</tr>
<tr>
<td>9,001 and above...</td>
<td>2</td>
<td>30,532</td>
<td>2.68</td>
</tr>
</tbody>
</table>

Table VII shows the influence of the number of ewes per ranch on the rate of return on investment. All the outfits were allowed the same price for their wool and lambs, 38.7 cents for their wool, and $12.00 per hundred for their lambs. All were operating under range conditions. There were no farm flocks. If labor income had been used as a measure the result would have been more marked in favor of the larger operator, insomuch as there was more capital invested on which to make returns, and also due to the fact that the larger the outfit the larger the salary allowed the operator.

A study of the table shows that the returns on investment of the small outfits was less than on the larger outfits, and that the rate of return increased as the number of ewes increased up to 6,000 head. Above that number there was no consistent trend in the movement of the rate of return. There were only two ranches in the group above 9,000 and inasmuch as the average number of ewes per ranch for these two ranches was 30,532 the results might indicate that the operations were on a little too large a scale for best returns.
Figure 16. Sheep on the High Rugged Fanges of the Rockies.

Photograph by Charles J. Belton, Pickett's, Wyo.
The results indicate that the best returns were made on those ranches where the number of breeding ewes ranges from 4,000 to 9,000. Above and below those numbers the returns were somewhat lower. The above number would represent an investment per ranch ranging from $110,000 to $250,000. The average for the 65 ranches studied showed an average investment of $131,726, which is well within the limits for successful management.

The Wyoming sheep industry lends itself to large scale operation, and it would seem that the dividing up of our ranges for small scale operations would not be advisable at the present time.

LABOR

The number of sheep handled per man ranged from 1,380 to 247, with an average of 609. Lambs are not counted in the above. The total cost of labor, both paid and unpaid, and supplies, was $2.59 or over 38 per cent of the total cost of running a sheep. That there is opportunity for improvement in this item was well brought out by the survey.

The cost of paid labor and supplies on the outfits operating on the national forests was $2.41, and for those on the open range it was $1.79. This difference is due to the greater expense involved in handling sheep on rugged mountain ranges, as compared to the more rolling foothills of the open ranges. The bands must be smaller in order to handle them on mountainous areas, and the expenses incurred by the herders and camp tenders are greater.

Figure 16 shows sheep feeding on a summer range on our National Forests and gives an idea of the difficulties of handling sheep on such ranges.

Figure 17 shows the correlation of return on investment to the number of sheep handled per man, which was $+ .433 \pm .068$. Of the 27 operators handling less than 625 sheep per man there were only 11 of them that were making 2 per cent or more on their investment. The remaining 16 were making from 2 per cent to losing 18 per cent by their operations. Of the 38 operators handling 625 and more sheep units per man there were only 8 who were making 2 per cent or less on their investment while the remaining 30 were making above 2 per cent, to as high as 14 per cent on their investment.
There were 17 ranches on which the operators were handling more than 775 sheep per man and there was not one of the 17 that was not making more than the interest allowed him on his investment.

Under the actual operating conditions, as they exist on the sheep ranches, we find that there is a correlation between the number of sheep handled per man, and the return that is being made. The manner in which the operators handle their labor is about as important a factor as the percentage of their total capital which is invested in sheep.

![Figure 17. Correlation of the Number of Sheep Handled Per Man to the Return on Investment.](image)

An operator who handled less than 550 sheep per man under range conditions has a very poor chance of making a favorable return on his investment. In the case of range cattle, where they are not fed during the winter, one man should handle 150 head.

Eight of the outfits were handling over 1,000 sheep per man. Under certain conditions an operator may justify high labor costs
due to the better attention he gives his bands, which should result in a higher lamb crop and lower death loss. If an operator is not above the average in the two above mentioned items, and his labor costs are above the average, the fault is very likely to be in his labor management. The suggestion is not for harder work and longer hours for the laborers, but for better organization and management, and the study bring out the fact that the management of labor is the one phase in which operators differ most and, which is perhaps the most important one in influencing profits.

In order to determine just how important the number of sheep handled per man is to the lamb crop a correlation of the above two factors was worked out. This is shown in Figure 18. There is a slight correlation but it is not so pronounced as in the case of the number of sheep handled per man and the return on investment.
Of the operators handling over 1,000 sheep per man there were 3 with a lamb crop above 80 per cent and 6 with a lamb crop below 80 per cent. Of those handling less than 550 sheep per man there were 8 with a lamb crop above 80 per cent and 8 with a lamb crop below 80 per cent.

From the above we conclude that the number of sheep handled per man is not such an important factor on the lamb crop, and that good lamb crops were being secured where 700 and more sheep are being handled per man.

LAMB CROP

The lamb crop on the 65 ranches ranged from 100 to 50 per cent with an average of 77.8, and the operators considered the year an unusually favorable one for lambs. This is the docking count and not the number available for sale in the fall. The loss during the summer was 5.9 per cent. Lambs are the most important source of revenue the wool grower receives from his ewes. Wool represents from $\frac{1}{3}$ to $\frac{2}{5}$ of the returns. The remainder is lambs. The low lamb crop secured on our ranges has been one of the most discouraging features of the industry. That it is not practical to attempt to secure the high lamb crop of 100 per cent, that is reported to be secured by some of our neighboring states, is a well recognized fact. Their ewes are fed and given care that it is not possible to give them under our range conditions.

That we can, however, increase our lamb crop, and at the same time make a greater return to the operator is brought out by Figure 19 which shows the correlation of the lamb crop to the rate of return on investment. Of the 16 operators who had less than a 72 per cent lamb crop there were only 3 of them who were making more than 6 per cent above operating expenses, whereas the remaining 13 were making less than 6 per cent interest. Of the 24 operators with a lamb crop above 84 per cent there were 16 making more than 6 per cent interest above operating costs and the remaining 8 were making less than 6 per cent interest.

Under actual range conditions the operators who were securing the higher lamb crop were the ones who were making the greater returns. There were three operators who were securing high lamb crops and still not doing exceptionally well. Their weak
point were in other lines of management, which the good lamb crop could not entirely overcome. One of these three operators had only 26.9 per cent of his total capital in sheep. Another had very light lambs, and the third was handling 352 sheep per man. The case of the last man brings out a point before mentioned. If a good lamb crop is secured at the expense of too much labor it is not good management.

The 5 operators who ranked highest in the returns on investment had lamb crops ranging from 88 to 98 per cent and their average return on investment was 19 per cent. One way of reducing the cost of production is by securing a better lamb crop. Figure 20 shows an excellent lamb crop sheltered in the foothills of the mountains.

Table VIII shows the influence of the lamb crop on the cost of production of wool and lambs when operating costs remain con-
Figure 20. An Excellent Lamb Crop.

stant. The wool and lambs are given a price that will balance the expense item.

TABLE VIII

INFLUENCE OF LAMB CROP ON LAMBS AND WOOL COSTS

Lamb and wool costs with a 70 per cent lamb crop of 65-pound lambs:

Receipts per ewe:  Production Costs:
45.5 pounds lamb at $ .115  $5.23
  8.0 pounds wool at .389  ...  3.11  $8.34
Expenses per ewe: $8.34

Lamb and wool costs with an 80 per cent lamb crop:

Receipts per ewe:
52 pounds lamb at $ .105  $5.46
  8 pounds wool at .360  ...  2.88  $8.34
Expenses per ewe:     $8.34

Lamb and wool costs with a 90 per cent lamb crop:

Receipts per ewe:
58.5 pounds lamb at $ .100  $5.85
  8.0 pounds wool at .311  ...  2.49  $8.34
Expenses per ewe:     $8.34
Lambs can be produced at $1.00 less per hundred weight and wool at 3 cents less per pound when the wool grower is able to market an 80 instead of a 70 per cent lamb crop. For each 3 per cent increase in the lamb crop the operator will make 1 per cent more on his investment, providing that his costs remain the same in both cases. An operator can afford to spend 65 cents more per head each year on his ewes, if by so doing he can increase his lamb crop 10 per cent.

The relative values given to wool and lambs in Table VIII are arbitrary ones, based primarily on conditions as they existed in 1925, and upon the assumption that a pound of wool is worth approximately three and one-third times that of a pound of lamb.

The weight of the lamb was another important factor and ranged from 58 to 85 pounds. The lighter lambs were produced by the outfits that were lambing late in the season and whose summer range was not of the best. Late lambing is practiced to prevent losses that may occur due to the late spring storms.

The trend in recent years in the sheep industry has been toward a mutton and wool type combination. The Northwest is better adapted to the above combination than are the ranges of the Southwest. The cooler climate of Wyoming is more favorable to the mutton and wool type combination.

In some cases the producers have gone to the extremes and produced a lamb that is too large and is being discriminated against by the feeders. The feeders are demanding the light lambs weighing from 60 to 70 pounds in preference to the heavier lambs. They expect to put a gain of 25 to 30 pounds on their lambs, and have a finished lamb weighing 85 to 90 pounds. Lambs coming off the range weighing 75 to 80 pounds should be fat enough to go directly to the packing house.
TOTAL AND RELATIVE WEIGHT OF INVESTMENT,
LABOR AND LAMB CROP

In order to determine the combined effect of the following factors, per cent of investment in sheep, number of sheep handled per man, and per cent lamb crop, to the return on investment a multiple correlation study was made of them. A solution of the normal equation gave a multiple correlation of $R = .638$, showing a reasonably high degree of relationship.

The standard error of estimate $P_E \text{(est } x) = .6745 \times 1.656$ or 1.117 is interpreted in terms of $X$, and is relatively low.

The regression equation for the linear solution was $X_1 = .211 X_2 + .245 X_3 + .178 X_4$, 170.89 where $X_1$ refers to the return on investment, $X_2$ to the number of sheep handled per man, $X_3$ investment on sheep and $X_4$ to percentage of lamb crop.

From the same calculation we find also that the three above factors taken as one hundred enter into the ability of an operator to get returns in a ratio of about 7:8:6 or that 33 per cent of that ability is due to the number of sheep handled per man, 38 per cent is due to the distribution of investment and 29 per cent is due to the per cent of lamb crop.

The $R$ of .638 together with the standard error of 1.117 would seem to indicate that the most influential factors in determining the rate of return had been considered.

NATIONAL FORESTS AND OPEN RANGE

Two-thirds of the 65 operators ran on the National Forest during the summer months, and the remaining one-third ran on their controlled range and public domain. The average number of days that the sheep were on the national forest was 77 days on the Wyoming National, 72 days on the Medicine Bow and 70 days on the Routt.

Most of the operators who did not run on the forests, summered their herds on the high ranges, similar in many respects to those on the forest.

The high, mountainous, summer areas surrounding the Red Desert is the natural summer feeding grounds for the sheep that
July, 1927  
An Economic Study of Range Sheep

run on the Red Desert during the winter, and to operate successfully a wool grower should have access to both, be they national forests, privately owned lands, or public domain. To separate them is like separating water rights from arid lands to which the water rights have formerly been applied. The value of one depends on its combination with the other, for alone they are of little value. The attempt, that is commonly made, to determine the value of one in terms of what it is worth to the other is not a fair method. The values given the Red Desert lands is based on their use as a winter range, and would not be worth the values placed on them, if they had to be used for year-long grazing.

Considerable has been made of the fact that a ranch on the Red Desert, which carries grazing permits on the forest, is worth more than one that does not have summer grazing permits. Some have interpreted this to mean that the permit is worth more than was being paid for it, due to the fact that it increased the value of the ranch. It is true that the permits add to the value of the ranch, for without a place to run the bands during the summer the desert ranges would be of little value. The same may be said of the summer ranges. They would not have the value that is credited to them were it not for the adjoining winter ranges.

The value of the summer range cannot be measured in terms of the value of the winter range, any more than the value of the winter range can be measured by the value of the summer range. The two go hand in hand, and can no more be separated than can arid lands and water rights thereon. Arid lands without water rights are of little value, water rights without land are of less value. Combine them and they are valuable. The value of one cannot be measured in terms of the value of the other, and so it is with our summer and winter ranges, and just because the summer grazing permits adds to the value of the ranch, does not mean that the price paid for the permits is too low and that they should be raised to the point where they would not give value to the ranch land. This would be giving them the value of their own worth, plus the value of the ranch land or winter range, for without the summer range the winter range has very little value. Taking the summer range
from the winter range is like taking the water rights from the arid lands, to which they have been granted.

It is not the purpose of the writers to attempt to show that operators can run as well off, as on the forest. The forest ranges are our summer ranges and are essential to the operation of the winter ranges. The following comparisons that we have made are with operators running on the high summer ranges inside and outside of the forest boundaries. They represent 290,000 head of sheep, in the former case, and 135,000 head in the latter.

The outfits going on the National Forests had 54.81 per cent of their total capital invested in sheep compared to 50.64 per cent, for the operators remaining on the open range. The former had an 80.83 per cent lamb crop of 69.95-pound lambs and the latter a 70.91 per cent lamb crop of 66.9-pound lambs.

The death loss of lambs and ewes was greater on the National Forests. There was no noticeable difference in the investment per sheep unit under the two different systems. The labor and supply costs were 62 cents greater on the National Forests which is due to the rougher range and greater expenses in handling the sheep. Pack outfits must be used instead of sheep wagons.

The feed and grazing costs were 39 cents higher on the open range. The wool clip was 9.10 pounds on the open range compared to 8.77 on the forest. This difference in weight may have been due to more dirt in the wool clip from the open range flocks.

The average annual carrying cost per ewe, on those outfits which ran on the National Forests, was $8.42, and $8.24 on the open range outfits. A study of the two types of operation bring out the fact that there is no material difference between the two methods. The better lamb crops of slightly heavier lambs secured on the forest is counter-balanced by the greater costs and heavier losses that occur thereon.

Results secured on different areas of the same National Forest will show greater differences than is shown between the forest and open ranges. In both cases the costs involved in getting the feed is about all the operator can afford to pay for it. The National Forests offer better summer feed than do the open ranges but the cost involved in handling sheep on more rugged mountain ranges
is greater, and the death losses, from poisonous plants, predatory animals, straying, and other causes is also heavier.

The above considerations should be taken into account when attempting to determine the feed value of a range. The most important thing in determining the feed value of a range is its accessibility, and its association with nearby ranges, which will permit of the best economical use of the feed on both the summer and winter ranges.

SHEEP MANAGEMENT ON THE RANGE

The management of sheep on the summer and winter ranges differs in many respects. The bands going on the summer range consist of about 1,200 ewes and their lambs. A herder, a camp tender, three or four pack horses and two or three saddle horses go with each band. The sheep wagons are left at the edge of the summer range where a supply camp is established. Supplies are brought to this wagon camp by trucks or teams and are there met by the camp tender with his pack outfit, and carried to the herder's camp.

The sheep go on the forest about July 1 and remain thereon from 70 to 75 days. They are counted in by the forest officials. The bands leave the forest about the middle of September and are trailed down to the foothills and out toward the winter range. The bands are trailed or grazed down to the shipping point where the lambs, that are to be sold, are cut out.

The breeding ewes have an ear mark that indicates her age. The ewes, as they leave the forest are counted out and in some cases "mouthed out." By "mouthing out" is meant the examining of the mouth of the ewe to see if her teeth are good for another year. If she is to be culled at the shipping point, she is given a mark that will so designate her. Only the older ewes are examined, by most outfits. This "mouthing out" may take place at the shipping point, or at the time the lambs are separated for marketing. Figure 22 shows the "counting" and "mouthing out" process as the ewes are leaving the national forest.
Figure 22. "Mouthing Out" Ewes as They Leave the Summer Range.
Figure 23. Ready for a Day's Grazing on the Range.
Photograph by Charles J. Beldon, Pitchfork, Wyo.
When the bands have had the culled ewes and lambs taken out for market they are grouped into groups of from 2,000 to 2,500 including lambs, and are moved toward the winter range.

Sheep wagons instead of pack outfits are used with the bands on the fall, winter and spring ranges. There is one herder, and one sheep wagon and camptender, to a band. A truck is often used to carry out provisions to the camp tender.

Prior to going on the winter range the bands are moved to the bucking quarters where the rams are turned in with the ewes and left with them for 30 to 40 days. The rams are turned in with the ewes the first two weeks in December, and are removed at the end of the breeding season. The rams are then handled in separate bands until the next season. This makes the cost of carrying rams somewhat more than for the ewes, as mentioned under ram charges.

The bands are trailed back to the shipping points in the spring where they are placed in the shearing pens. Following the shearing the sheep are moved out again towards the foothills and lambing grounds. Very few lambing sheds are used by the Red Desert operators. They rely on natural protection for their lambing grounds.

Figure 23 shows a protected area similar to the ones used for the lambing grounds. The trees and rough topography afford some protection to the band in case of late spring storms that are likely to occur. The feasibility of lambing sheds for the range wool growers is one that the writers are studying at the present time.

The sheep are trailed on and off their allotments over well defined trails, and they must await their turn at the forest boundary to go on the trail. The first bands over the trail find excellent feed, but as more and more bands pass over the trail, the feed question becomes more difficult. It is on these barren trails that many sheep are lost due to poisonous plants.

Sheep operations would be comparatively safe and simple if it was not for the death losses that take place. The death loss of ewes was over 6 per cent and lamb losses almost as much in 1925, a year which was an exceptionally favorable one.
for low losses. The weather was favorable at both bucking and lambing time.

The five most important causes of loss are: 1st, drought years; 2nd, severe storms at shearing and lambing time; 3rd, deep snows during the winter, shutting off the feed supply; 4th, poisonous plants; and 5th, losses due to predatory animals and straying away.

**Drought Losses**

The losses during the drought years is a difficult problem and is made worse by overstocking the range during the good years. Figure 5 shows that the losses are very much greater on those drought years which occur at a time of overstocking. This is shown by the severe losses which occurred in 1903 and 1910. The precipitation in 1919 and 1924 was as low as during the above mentioned periods, but the losses were not nearly as great due to the fact that the sheep ranges were carrying about 3,000,000 less sheep, during the latter years. If we can keep the number of sheep on our ranges in the state around three and one-half million head instead of letting them go up to double that number it will aid in reducing the heavy drought losses. Our ranges will support three to four million sheep during the good years and leave a little surplus growth of feed, which is reflected in the better growth of the plant. More feed is produced by the plants during the drought year when they have not been over-grazed. The feed produced during the dry year will go further in feeding the smaller number, and thereby prevent loss. The wool growers should adjust their operations and numbers so as to leave a little surplus plant growth during the good years to carry through the drought years. This will aid in reducing the disastrous winter losses, that we may be headed towards at the present time.

**Storm Losses**

The losses due to the severe storms at bucking and lambing time may be controlled to some extent by following the above suggestions on drought years, for if the sheep are in good condition they are better able to withstand the storms.
Better lambing facilities may have to be resorted to. One operator on the edge of the Red Desert had been lambing three days and had 270 lambs when the blizzard of April 8, 1927, hit him. He lost every lamb that he had. The operator has his choice of late lambing or lambing sheds. Later studies will show the extent to which lambing sheds can be recommended.

**HEAVY SNOWS**

A heavy snow fall during the winter months, if not followed by wind, may shut off the supply of feed resulting in heavy death losses. The wool grower may have feed stored at certain points, but it may be impossible to bring the sheep and feed together.

If the snow is not too deep the sheep may paw down through the snow with their short hoofs and get at the feed, as shown in figure 24.

The wool grower must always take a chance on the heavy snow falls and trust that they will not come, but if they do come, he hopes they will be followed by winds. More and better feeding facilities will aid in reducing the losses. There is a limit, however, to which the operator can go in securing and distributing supplementary feed. The better condition the sheep are in when the storm hits them the lighter will be the loss.

**POISONOUS PLANTS**

The loss due to poisonous plants is no small one. Especially is the true on the National Forests. Beath (1921) estimates the losses to be as great as three per cent. He mentioned the importance of fatigue, which probably accounts to some extent for the heavy trail losses. A precaution is an abundant salt supply. Animals are likely to acquire a depraved taste for toxic plants if not given sufficient salt. The plants that cause the most losses of the sheep in the region under discussion are the lupines, death camas, woody-aster, and loco.

Good management goes a long way in preventing poisonous plant losses. The herder should be able to recognize the
poisonous plants. Animals should be kept away from poisonous areas while on the trail, and above all, should not be bedded-down in such areas. It is when the animals are extremely hungry that the poisonous plants do the greatest damage. If there are poisonous areas that can not be avoided, having the animals filled up on other feed when they reach the poisonous areas, will be a great help in preventing losses.

Most animals will not, as a rule, eat the poisonous plants if they can secure other food. There are exceptions, however. Poisonous plants are more harmful at certain stages of their growth than at others and the range may be so handled as to use them at the time when they are the least poisonous.

**PREDATORY ANIMALS**

It is impossible to secure reliable information of the percentage of loss due to the different causes. It is impossible to know just what caused the loss. All that the herder knows is that certain lambs and sheep are not among those present. Some operators estimate that the losses due to predatory animals and straying ranges from 3 to 8 per cent of the lamb crop. Coyotes, wolves, wild cats, mountain lions, and bears are the chief killers.

Figure 25 shows one of the fellows who cause sheep losses. Predatory animal losses are more within the control of the herder than any other one factor. The wool grower should pay close attention to his herders and the losses they are sustaining. He should also take advantage of every measure that will reduce the predatory animals.
Figure 25. One of the Killers Captured.
Photograph by Charles J. Beldon, Pitchfork, Wyo.
MARKETING

There are four common methods used in marketing the wool. 1st. The wool may be sold to eastern wool firms before it is sheared. 2nd. Representatives from the eastern firms may purchase the wool at the close of the shearing period. 3rd. Buyer and seller may not agree upon a price and the wool may be consigned to the wool dealers, the dealers advancing a part of the value of the wool. The dealer grades and sells the wool at a fixed charge per pound, and after deducting all charges for grading, storage, selling and interest on advanced money, remits the proceeds to the grower. 4th. Consigning to the National Wool Exchange, an organization of wool growers, whose function it is to grade and market the wool in an orderly manner. The exchange does not advance money on the consigned wool. It is placed in bonded warehouses, and the money is advanced to the wool grower on these warehouse receipts by the finance company, that operates through the intermediate credit banks. The greater part of the wool is sold outright to the representatives of the eastern wool merchants.

Figure 26 shows the interior of a wool sacking shed. The fleeces are packed about 40 to the sack which weighs from 300 to 400 pounds.

Lambs may be sold on contract in the spring or directly to the feeders at the time they are taken from the ewes in the fall, or they may be shipped directly to market. It is a common practice to grade out the better lambs and send them direct to the terminal markets where they are sold as slaughter lambs.

Figure 27 shows the prices paid on the Omaha market for the different classes of sheep. The spring lambs begin coming on the market about June 1 and the last year's lambs go into the yearling class at this time. This is shown by the rise which takes place in lamb prices about June 1. The spring lambs come on at about 2½ cents above the price of yearlings.

The prices of fat and feeder lambs run very close together, the spread being less than one cent a pound. The real spread to the feeder is shown when September and October feeder
prices are compared with December and January fat prices. In 1923 feeder lambs sold for 12 cents in September, and fat lambs sold in January the following year for 12 cents, allowing no spread for the feeder. The price of fat lambs rose rapidly from January to April until they reached the high point of 15 cents in April and May. The price then dropped to $12.60. Fat spring lambs started in at about $13.50. The feeder did not receive any spread on his operations unless he held for the February and March markets, at which time his fat lambs were likely to go into the heavier weights which were $2.00 less per hundred than the light and handy class. The wool grower received a good price for his lambs this year when compared to what the packer paid.

The 1924 Omaha price for September feeder lambs was $11.75 and the January price of fat lambs $16.50, giving the feeder a $4.75 per hundred spread on his operations. There was a rapid drop in lamb prices during the next few months. The spread between the heavy and light lambs ranged around $2.00 during the 1924 period. The wool grower sold his lambs for about 2 cents less than he should have received, when compared to what the packer paid for the fat lambs.

The lamb feeders made so much profit in 1924 that they started the feeder prices at $14.00 in the fall of 1925, and sold them in January at about the same price. The lamb feeders who were on the December market received from $15.00 to $15.75 for their lambs, and those who finished in February sold down to as low as $13.00. The wool grower received a little more for his 1925 crop of lambs than the feeder could afford to pay. The spread between the heavy and light lambs during 1925 was about $2.00 per hundred.

The 1926 price movements were very similar to the 1923 movements. Feeder lambs sold in the fall at $12.50 and sold in January as fat lambs at about $12.00. The February and March prices of fat lambs rose rapidly the same as it did in the 1923-24 season. The heavier lambs rose more rapidly in price than did the light lambs until there was only one dollar between the two classes.
The price paid for good ewes during the four-year period, 1923-26, averaged about $6.50 per hundred pounds, with the high point at about $8.50, in the early spring, and the low point around $5.00, during the culling months in the fall. Cull ewe prices followed those of good ewes with a difference of $2.50 per hundred between them.

A study of the highest prices paid for the winter fed lambs show that for a 21-year period, March prices reached the high point in 9 out of the 21 years. December prices were high during 6 of the years, and January and February show three years each when the peak of prices was reached during that month.

Ezekiel (1927) in his studies of the factors related to lamb prices found that the 96 per cent of the variation in monthly lamb prices during the 1907-23 period could be ascribed to the relation of lamb prices to 7 objective factors influencing the men who compose “the market.” The general price level of all products, and the per capita production of lamb under inspected slaughter, were the most important of the factors; the prices of steers and veals were next in significance, though much less important; and the changes in business activity, in hog prices, and in per capita demand for lamb, was the least important.

A study of the daily prices and receipts of feeder and fat lambs on the Omaha market from January 1, 1926, to May 31, 1927, a period of 17 months is shown in Table IX.

<table>
<thead>
<tr>
<th>TABLE IX</th>
<th>DAILY RECEIPTS AND PRICES OF FEEDER AND FAT LAMBS ON THE OMAHA MARKET</th>
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</thead>
<tbody>
<tr>
<td>Monday</td>
<td>Tuesday</td>
</tr>
<tr>
<td>Daily receipts</td>
<td>12,934</td>
</tr>
<tr>
<td>Feeder price</td>
<td>$12.77</td>
</tr>
<tr>
<td>Fat price ......</td>
<td>13.13</td>
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</tbody>
</table>

The above figures, each representing an average of some 72 days, show that the receipts were heaviest during the first two days, but that there was no material difference in the price paid on the different days.
Figure 27. Omaha Weekly Prices on the Different Classes of Sheep, 1923-1927.
FEEDER'S SPREAD

A factor that influences the profits of the wool grower is the amount of spread in price that the feeder must have in order to carry on his operations successfully. The price of corn is an important factor and one that is pretty hard to forecast at the time that most of the lambs are contracted for.

The average spread that the feeder has taken during the last four years averages about $1.50 per hundred weight, based on the price of both classes at the same point, be it feed pens, or terminal markets. Considerable depends on the use of cheap feeds, like by-products from the sugar factories.

Better management in feeding may reduce this spread. Colorado (1927) in a preliminary report on the feeding results secured at Fort Collins finds that lambs which cost $11.75 can be fattened and sold at $10.87 and permit the feeder to break even, where the lambs are run in the corn, and beet fields, and fed corn, siloed pulp, and alfalfa. When they were fed the above ration but not allowed to run in the beet field, the final cost of the fattened lambs was $11.65 when $11.75 had been paid for the feeders. From the Colorado Experiment Station's results, one would conclude that the spread of $1.50 to $3.00 per hundred is not necessary and that the wool grower should receive about the same for his feeder lambs as the feeder receives for his fat lambs.
SUMMARY

One-half of the area of the State of Wyoming is better adapted to range sheep production than to other types of agriculture. The 12 to 15 inch rainfall line marks the boundary between the cattle and sheep ranges, except in the mountainous areas. Where the rainfall is less than 10 to 15 inches the vegetation changes from a grass type to a sagebrush type. The sheep make better use of the latter than do cattle. Lack of drinking water makes the arid regions poorly adapted to cattle. Sheep can go longer without water, and can make better use of the snow.

The rugged and mountainous forest lands, due to their type of vegetation and cool climate, are well adapted to lamb and wool production during the summer months. The desert ranges are well adapted to the wintering of the sheep. Their combination gives them a value which is much greater than the total value of the two, when they are figured alone. The value of one cannot be measured in terms of the value of the other.

The fact that grazing permits on the summer range increases the value of a ranch does not mean that the permit is worth more than is being paid for it. It simply means that the permit is a necessary part of the organization. The same is true of the summer range, as its value depends on the user having access to the winter range.

The number of sheep in the state has been influenced very largely by the annual rainfall. The losses, during severe winters following years of drought, have taken away much of the profits of the wool growers.

The average investment per outfit was $131,721, with 37.2 per cent in land, buildings, and improvements. Fifty-three and eight-tenths per cent of the total investment was in sheep. An operator, under present conditions, in order to operate successfully should have from 50 to 75 per cent of his capital in sheep. Where all range is owned the investment in sheep should be about the same as the investment in land, and some of the land should be mountain range.
The average value of the breeding ewe was $11.71. The two-year-old ewes were valued at $12.88, a value slightly below that of the three-year-old ewe. The old ewes were culled, after four lamb crops, and sold for $6.60.

The carrying capacity of the winter range is 18.8 acres per sheep. An assessed value of 39 cents per acre would permit the operator to own his winter range, providing he has summer range on which he can run.

The loans were very largely on sheep and paid eight per cent. The operators were in sound financial conditions. Financing was not a serious problem.

Fifty per cent of the total sales were from sheep, 40 per cent from wool, and two per cent from cattle. There was an increase of 6.3 per cent in inventory of sheep, which showed a tendency for the wool growers to increase their flocks.

The 1925 cost of carrying a ewe was $8.34. The carrying cost of a sheep unit was $6.71, and ranged from $4.50 to $12.50, depending on the organization and management, and the range conditions under which the wool growers operated.

The receipts per ewe in 1925 from a 73.24 lamb crop of 68.4 pound lamb worth 12 cents, and 8.87 pounds of wool which sold for .387 cents, were $9.44.

The profits that were made in 1925 ranged from 22 per cent to minus (—) 20 per cent interest on the investment. The average return, after allowing the prevailing rate of interest of 8 per cent, was 5.4 per cent on an investment of $20.15 per sheep. The costs to operators on the forest were $8.40 per ewe compared to $8.13 on the open range. A better lamb crop of heavier lambs made up for the additional cost.

Lambs and wool were produced at a cost of 33 cents per pound and $11.30 per hundred weight in 1926 which paid operating costs, including salary for the manager, and 8 per cent interest on the investment.

The operating costs for the 12 year period, 1915-26, was $7.52 per ewe. The receipts from a 67 per cent marketable lamb crop of 65 pound lambs at $10.17 per hundred, and eight pounds of wool at 37 cents per pound, were $7.37. The oper-
Wyorning Agricultural Ex perinient Station

ators lacked one per cent of making the 8 per cent interest al-

lowed them on their investment of $15.10 per ewe.

The following factors were the important ones in con-
trolling returns: Range conditions, percentage investment in
sheep, lamb crop, labor, death losses, weight of the lambs, and
weight of the fleeces.

The conditions of the range which the operator controlled
had a marked effect on lamb crop, weight of lambs and death
losses. Poor and over-stocked ranges reduced profits.

The larger the percentage of his capital that the oper-
ator had in sheep, and the less in land, the better his returns.
The present assessed values of grazing lands places a penalty
on ownership, and explains to some extent why less than one-
third of the land in the state is in private ownership. The cor-
relation between return on investment and percentage of in-
vestment in sheep was $+.486±.063$.

The number of sheep handled per man is a measure of
labor and is a factor of major importance. One of the weakest
points of the average manager was the inefficient use of labor.
The average number of sheep handled per man, including
ranch labor, was 609 with a range of from 247 to 1,380. There
should be from 650 to 1,000 sheep handled per man depending
on conditions. The correlation between the number of sheep
handled per man and return on investment was $+.461±.065$.

The small lamb crop secured on our ranges is one of the
most discouraging features of the sheep industry. Weather
conditions at bucking and lambing time, have considerable to
do with it. Feed and range conditions are very important fac-
tors. Many of the operators attribute their poor lamb crop to
poor range conditions. Better care and better protection, when-
ever feasible, and practical, should be employed. Ewes, show-
ing a weakened condition, should be brought to the home
ranch. The correlation between lamb crop and number of
sheep handled per man was very slight. The use of more labor
was justifiable if it resulted in a better lamb crop, but in most
cases it did not. The correlation between the rate of return
and lamb crop was $+.348±.074$. 
The death losses on ewes ranged from 2 to 22 per cent and on lambs from 1 to 15 per cent, with an average of 6.5 per cent for ewes and 5.9 per cent for lambs. The 1925 losses were much below the average of those over a period of years. Twelve per cent for ewes and 8 per cent for lambs are the figures given by the wool growers as the average death loss for the 12 year period 1915-26.

Death losses due to years of drought, and severe storms, is perhaps the most important factor in reducing the profits of the wool grower. This is shown in figure 5 which represents a study over a long period of years. The losses can be reduced in a practical manner by better range condition and better care of ewes.

The wool growers, who were making the most favorable returns, were running from 4,000 to 9,000 ewes. The larger and smaller outfits were not making so good a return. The average number of ewes per operator was 4,705, and ranged from less than 1,000 to over 30,000.

The weight of the lambs averaged 68.2 pounds and ranged from 58 to 85 pounds. The weight of the lambs had some influence on the returns. Time of lambing, range conditions, and type of sheep were the controlling factors on the weight.

The average weight of the fleece was 8.8 pounds and ranged from 11 to 6 pounds. An open season resulting in a high shrinkage percentage accounted for some of the heavy fleeces. There was a slight correlation between weight of fleece and rate of return.

The combined weight of the factors of the percentage of investment in sheep, number of sheep handled per man, and lamb crop, on the rate of return, gave a multiple correlation of +.638. The grazing range and its condition, a factor very hard to determine, accounted for most of the remaining differences.

A spread of from 1 to 2 cents per pound between feeder and fat lambs is required under present conditions for the average lamb feeder to operate.
The Omaha receipts of feeder lambs were greatest on Monday and Tuesday, but the market price was as good on Wednesday, Thursday, and Friday as on the first two days.

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LITERATURE CITED
Report of the Board of Sheep Commissioners of the State of Wyoming, 1912.