T H E S I S

AN ECONOMIC STUDY OF THE RANGE CATTLE INDUSTRY IN COLORADO.

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AN ECONOMIC STUDY OF THE RANGE CATTLE INDUSTRY IN COLORADO.

HISTORICAL SKETCH OF RANCHING.

Ranching was one of the most important pioneer industries in Colorado and has been the pioneer industry throughout history. In order to fully appreciate the position of ranching in Colorado a brief sketch of the historical side of ranching and man's effort to produce his own raw materials for food and clothing after he had passed out of what is known as the hunting and fishing stage, will be discussed.

ECONOMIC STAGES.

HUNTING OR FISHING STAGE: In this stage men gathered their own food by hunting and fishing and by gathering wild berries, fruits and vegetables. Most of this food was eaten raw. In this stage there was very little division of labor.

The next stage was the Pastoral stage where primitive man first attempted to subdue the wild bull, horse, dog and sheep. Here once more man's intelligence created him king; it enabled him to discern among the beasts of the forest those which would be most useful to him by furnishing him with flesh, milk, muscular strength, soft warm fur - all the resources of their instructive and sagacious faculties. In this respect the work of our early ancestors is so complete that the lapse of many centuries has added but little to the riches acquired by them.

DOMESTICATION OF ANIMALS: What species of the wild animal was first chosen for domestication and at what epoch it was first tamed is a question, which, though often discussed, has as yet received no satisfactory answer. The indications are that the dog was the first animal subjected to the dominion of man. The eminently sociable disposition of the dog, the innumerable varieties which the species present and its valuable qualities, natural or acquired, all tend to prove that it was one of the earliest companions of man, whom it has never since abandoned, whom it has every where followed.

Townsend has said: "The dog is the first element in human progress. Without the dog man would have been condemned to vegetate eternally in the swaddling clothes of savagery. It was the dog that effected the passage of human society from the savage to the patriarchal state, in making possible the guardianship of the flock. Without the dog there could be no flocks and herds; without the flock there is no assured livelihood, no leg of mutton, no roast beef, no wool, no blanket, no time to spare; and consequently, no astronomical observations, no science, no industry.

"The great number of our domestic animals, commonly regarded as originally natives of Central Asia, are on the contrary of European origin. Their primitive stock, whether single or multiple, goes back in the case of many of them to a remote antiquity; that is to say, at least as far back as the fourth epoch. Of course, this same original stock may

exist no longer, except in the fossil stage. That of the dog, of the horse and of the ox are cases in point. A few of the animals came from America at a comparatively recent epoch. These are the guinea pig, the turkey, the musk, duck,and the Canadian goose."

According to Professor J. Cossar Ewart "the Turbary sheep which seems to have accompanied Neolithic man in all his wanderings was evolved in Turkestan from the native wild Urial, that from Turkestan it found its way into Europe where it was widely distributed in prehistoric times. It was characterized by tall legs and horns like a goat, but there existed also a sheep with large curved horns and a four-horned sheep."

Professor Fairfield Osborn says"that British Shorthorn cattle are descended from an indigenous occidental race, domesticated in Europe by Neolithic man. While the naturalists as a rule agree that the urus was the only wild ox in Europe and that an eastern derivation of European cattle is in the highest degree improbable, some believe our modern breeds are descended from varieties originally domesticated in Asia. Horses descended in several localities from the forest horse in Germany, the Arab strain from the desert, the Steppe type is traced up to the modern Irish hunters and a fourth type appeared among the Siwalki Hills of India and is the oldest known true horse."

In the progress of civilization the beginnings are usually feeble, obscure, and limited. These are reasons why this should be the case with the first attempts at agriculture or

or horticulture. Between the custom of gathering wild fruits, grains and roots and that of regular cultivation of plants which produce them, are several steps. A family may scatter seeds around its dwelling and provide itself the next year with the same products in the forest. Certain trees may exist near a dwelling without our knowing whether they were planted, or whether the hut was built beside them in order to profit by them. War and the chase often interrupt attempts at cultivation. Rivalry and mistrust cause the imitation of one tribe by another to make slow progress. The lowest savages know the plants of their country, but the examples of the Australians and Patagonians show that if they do not consider them productive and easy to rear, they do not entertain the idea of cultivating them. In order to cultivate plants they must be within reach, have not too rigorous climate; in hot countries, the moderate duration of drought some degree of security and settlement; lastly, a pressing necessity, due to insufficient resources in fishing, hunting, or in the production of indigenous and nutritious plants such as the chestnut, the date palm, the banana, or the bread fruit tree. When man can live without work it is what he likes best.

DOMESTICATION OF PLANTS: History shows us that wheat, maize, sweet potatoes, tobacco, and other plants, especially annuals, were widely diffused before the historical period. The various causes which favor or obstruct the beginnings of agriculture explain why certain regions have been for thousands

of years peopled by husbandmen, while others are still inhabited by nomadic tribes. It is clear that owing to their well-known qualities and to the favorable conditions of climate, it was at an early period found easy to cultivate rice and several leguminous plants in Southern Asia, barley and wheat in Mesopotamia and in Egypt, several species of Panicum in Africa; maize, the potato, the sweet potato and the plant from which we obtain tapioca in America. Centers were thus formed whence the most useful species were diffused. Agriculture appears to be as ancient in China as in Egypt, and the constant relations between Egypt and Mesopotamia lead us to suppose that an almost contemporaneous cultivation existed in the valleys of the Euphrates and the Nile.

In America agriculture is perhaps not quite so ancient as in Asia and Egypt, if we are to judge by our civilization of Mexico and Peru, which does not date even from the first centuries of the Christian era. However, the widespread cultivation of certain plants such as maize, tobacco, and the sweet potato, affords evidence of a considerable antiquity, perhaps two thousand years or there abouts.

TRADES AND COMMERCE STAGE: After agriculture has been firmly established we find people gradually grouping together in small villages, later this developes into large cities where we have the industrial stage. Where a few people in town take care of the needs of the agriculturists before this the farmer was self sufficing and did his own blacksmithing,

now the industrial groups do this work and we have a division of labor.

THE TRIBAL STAGE: Primitive people in the tribal stage did not have money or the use of credit but a system of barter; they had slaves who did all the work.

There was a tribal organization with a chieftain and a council. At certain times during the year these councils would meet to transact business. At this time there was great feasting. At these councils the land was divided up and new members elected. The study of American Cliff Dwellers and Hopi Indian organizations gives one an excellent idea of how the tribe was organized, business transacted, land divided and protection given to the tribe.

The land was divided up with the oldest sons having the first choice; land was divided for four generations and after that they ceased to divide the land. Land is handled in a similar way today with the Toas Indians. Each family has a certain plot of land that it farms. They have a governor over the entire village including a council. Some times the different villages meet and form a council. They run sheep, cattle and goats in much the same way as primitive people described in the Brahan laws.

THE MOVEMENT ACROSS EUROPE OF RANCHMEN.

PASTORAL STAGE: The earliest evidence which we possess in regard to those Germans among whom the English tribes were

included dates from a time when they had not completely emerged from a nomadic state; apart from this direct evidence we might have inferred on general grounds that they must have pursued a pastoral life at some period. The economy of any tribes who lived in the distant home of the Aryan race must have been of this character, while the wandering tribes, not the incursion of a horde of conquerors, is scarcely intelligible unless we suppose them accompanied by their flock and herds. One most important occasion for the wanderings of these tribes must have been the lack of fodder, and they would take the direction which presented the least obstacles to their continued livelihood from their herds. Level plains and river courses would offer favorite lines of progress; while the rapid multiplication, which seems to have continued in the regions from which they came, would always urge an onward movement. But at length they would find themselves opposed by obstacles which prevented any farther advance; there were no means of transportation by which a nomadic people could convey their herd across the German Ocean, while the Roman armies prevented the farther progress of the barbarian tribes, as tribes. In some such way as this the English were forced to settle down on a strip of land in Fusia, where they were sooner or later compelled to eke out their subsistence from their herds by means of tillage, and from which they subsequently emerged to conquer Britain.

From the descriptions which we read of nomadic peoples in the present day, we can form a fairly clear idea of the economy

of similar tribes long ago. In the management of the herd, in successful breeding and training, there is opportunity for the constant exercise of forethought and skill. The land over which the cattle range is not appropriated. Each family, however, possesses its own herd; and there may also be an understanding, for mutual convenience, between two septs or families, as to the runs which their cattle are to occupy respectively.

Caesar says the tribes were mostly occupied with hunting and warfare, and they derive subsistence from their herds and the spoils of the chase; but they hardly devoted themselves to agriculture at all. Under these circumstances it is quite clear that the assignment of land which Caesar describes must either have been forest for game or pasturage for cattle; in any case, it was waste land they wished to use, as they could have little interest in securing possession of fields that were suitable for tillage. What they wished to have was the right to use a well-stocked range and the lands thus assigned were common to the members of a particular family for the time being, and were not held in severalty.

The above system is very similar to our present method of handling our National forest grazing ranges where each permittee is allowed to run a certain number of cattle for a given period, and also in the case where cattle of several individuals are run together in one large pool on the forest ranges.

The early Greeks, as they come before us in the Homeric poems, are rather a pastoral than an agricultural race. It is

in their herd of cattle, sheep, and swine, rather than in the produce of their lands, that the wealth of the kings consisted. It was cattle which furnished them with a measure of value; and cattle together with slaves, were the most valuable spoil which they secured in their military and piratical expeditions. The insecurity of property was too great to allow of the planting of trees, or crops, which would of course lie at the mercy of an invading enemy . Oxen, sheep and goats found abundant pasture in early times in Greece.

AGRICULTURAL STAGE AND RISE OF GOVERNMENTS: In the pastoral stage the government is very unstable; as soon as a more stable government is formed we have the agricultural stage developing. The younger more ambitious men need more room and move out toward the frontier leaving the older people to engage in farming and the establishment of towns and villages. This very same system applies as well today as it did then. The most primitive form of agriculture in England was that known as "wild field-grass" husbandry. Joint occupation and joint tillage were its characteristics. Fresh tracts of grass were successively taken in, ploughed, and tilled for corn. As the soil became exhausted, they reverted to pasture. Such a practice may belong to some portion of the Celtic race or to the nomadic stages of civilization. This system is practiced today in our western states where new pastures are ploughed up and later allowed to return to pasture or grazing land.

This "wild field-grass" husbandry was displaced in most

parts of England by the permanent separation of arable from pasture land. This fixed division of tillage and grass, introduced into this country possibly by people accustomed, like the Romans or the Anglo Saxons, to a drier and less variable climate, became the basis of the agricultural organization of the mediaeval manor.

Today we are in the stage or nearing it at least where there will be this same division between permanent tillage land and permanent grass as was practiced preceding the English system.

In the eleventh century all the country in England outside the larger towns was divided into manors, into districts that is to say, in each of which one person, called the lord, possessed certain important and valuable rights over all the other inhabitants. Picturing an eleventh-century manor in Middle and Southern England, there was a village street, and along each side of it the houses of the cultivators of the soil with little yards around them; as yet there were no scattered farmhouses such as were to appear later. Stretching away from the village was the arable land, divided usually into three fields, sown one with wheat or rye, one with oats or barley, while one was left in fallow. The fields were again subdivided into what were usually called "furlongs" and each furlong into acre or half-acre strips, separated, not by hedges, but by "balks" of unploughed turf; and these strips were divided among the cultivators in such a way that each man's holding was made

up of strips scattered up and down the three fields, and no man held two adjoining pieces. Each individual holder was bound to cultivate his strips in accordance with the rotation of crops observed by his neighbors. Besides the arable fields there were also meadows, enclosed for hay harvest, and divided into portions by lot or rotation or custom, and after hay harvest thrown open again for the cattle to pasture upon. In most cases there was also some permanent pasture or wood, into which the cattle were turned, either "without stint" or in number proportioned to the extent of each man's holdings.

The land was regarded as the property of the lord. It was divided into the part cultivated for the immediate benefit of the lord, the demesne, and that held by the tenants, the land in villenage, the latter being usually three-fifths or two-thirds of the whole. The whole of the land of the manor, both demesne and villenage, was cultivated on an elaborate system of joint labor. The only permanent laborers upon the demesne itself were a few slaves; all or almost all the labor there necessary was furnished by the villains and town people, as the condition on which they held their holding, and under the supervision of the lord's manager.

The fundamental character of the manorial group regarded from an economic point of view was its self-sufficiency, its social independence. Few of the necessaries of life were ever bought by the cultivators of the soil, and whether corn that they raised was fetching three shillings or six shillings in

a distant market made little difference to the inhabitants of the villages. Each village had its mill, and nearly every house had its oven and brewing kettle. Women spun and wove wool into coarse cloth and hemp or nettles into linen; men tanned their own leather. The rough tools required for cultivation of the soil and the rude household utensils needed for the comforts of the daily life were made at home. In the long winter evenings, farmers, their sons, and their servants carved the wooden spoons, the platters, and the bowls. They fixed handles to the scythes, rakes, and other tools; cut the flails from holly or thorn, and fastened them with thongs to the staves; shaped the teeth for rakes and harrows from ask or willow and hardened them in the fire; cut out the wooden shovels for casting the corn in the granary; fashioned ox yokes and bows, forks, racks, and rack-staves; twisted willows into scythe-cradles, or into traces and other harness gear. The activities of the manor were but slightly commercialized and markets where men might be confident of obtaining money for their wares were scarcely known.

Under the condition which prevailed in the fourteenth and fifteenth centuries, little advance in farming practice could be expected. The strenuous idleness of the military ardours of youthful lords were generally absorbed in field sports. There was little to mitigate either man or beasts the horrors of winter scarcity. Famine trod hard upon the heels of fasting. But with the decay of feudalism land owning became a busi-

ness and farming a trade; agricultural progress demanded less personal dependence, a freer hand, a larger scope of individual enterprise.

With the dawn of the Tudor period began the general movement which gradually transformed England into a mercantile country. This new movement is described as enclosure. The word includes various processes but that special form of enclosure was prominent which meant the break-up of the mediaeval agrarian partnerships and the substitution of private enterprise for the collective efforts of village associations. Agriculturally the period is one of transition toward the modern spirit and form of land cultivation.

If we turn from the cultivation of the soil to the management of livestock, we shall find that no great progress had been made in this branch during the years 1700 to 1760. Davenport in 1700 estimates the net carcass of black cattle slaughtered at this time at 370 pounds and of a sheep at 20 pounds. A century later Eden calculated "that bullocks now slaughtered in London weigh at an average 800 pounds, sheep 80 pounds and lambs about 50 pounds each." Young in 1786 put the weight of bullocks and sheep at 840 pounds and 100 pounds respectively. These improvements came after 1760. It was not until 1760 to 1786 that Bakewell perfected the new breed of sheep, Lescesters, and improved the breed of long-horned cattle, and that the brothers Culley obtained the short-horn, or Durham cattle from the breed in the valley of the Tees. There was a substi-

tution of scientific for unscientific farming stock growing.

WHY WE ARE STOCK MEN IN COLORADO.

This pastoral period in development of the west was but typical of what happened in sections of the country. The ranchers were the advance guard of the army of agriculture, and grazing was the transition stage between hunting and trapping and settled agriculture. Professor Turner tells us that there was such a "rancher's frontier" in Virginia at the close of the seventeenth century. Travelers of the eighteenth century found the "cowpens" among the canebrakes and pea-vine pastures of the South and the "cow drives" took their droves to Charleston, Philadelphia and New York. Thence the rancher was crowded on to new frontiers beyond the Mississippi out upon the semi-arid plains and up into the mountains. Today he retains but little land which is suitable to more intensive uses.

RANCHING IN THE UNITED STATES: About the first cattle ranching in the United States began in the East. The cattle of Carolina at this time were very fat in summer, but as lean in winter, because they could find little to eat and had no cover to shelter them from the cold rains, frosts, and snows which lasted three or four days. Only cattle designed for butchery were fed, and they were finished out on potatoes, straw, and grain. They always wintered in the open fields for there were no buildings at all in the country. During the winter of 1731, 10,000 cattle died from hunger and cold. The people did not

change their system as they did not understand how to make hay. One planter had 200 calves marked, which he let run in the woods with other cattle. No one looked after them except to bring them together in the evening where they were bedded down near the house.

At times they butchered cattle, salted the meat and shipped it to the Antilles islands. The practice of an orderly agriculture had not progressed far in North Carolina even by the end of the colonial period. The bounty of nature and the vast extent of land made careful and systematic methods of culture or care of cattle seem unnecessary to the colonist, and he subsequently adopted wasteful and extravagant practices. In 1775 circumstances gave the farmers of North Carolina a superiority over most other colonies because they had plenty of land, and secondly, vast herds of cattle.

The lack of sea ports, kept people from settling there, and made the land less valuable, consequently every settler got large land grants. These men engaged in the cattle business, these herds becoming very large and the profit from these herds was exceedingly great. It was not an uncommon thing for one man to own from 300 to 1200 head, and even 2000 head in some cases. Their management was to let them run loose in the woods all day and to bring them up at night by the sound of a horn. Sometimes, particularly in winter, they kept them up during the nights in enclosures, giving them little food and letting the cows to the calves; this made them come home more

regularly. Such herds of cattle were found in none of the other colonies. At that time the woods were all used in common and people's property had no other boundary or distinction other than marks cut in trees, so that the cattle had an unbounded range. But when the country became more cultivated, estates were surrounded by enclosures, and consequently the number of cattle kept were in proportion to their own lands only.

In 1832 immigrants from Virginia, the two Carolinas and Georgia, immigrated in the ancient fashion,in the southern wagon, to Missouri and the Southwest. This is a vehicle almost unknown in the North, strong, comfortable, commodious, containing not only a movable kitchen, but provisions and beds. Drawn by four or six horses, it subserves all the various intentions of house, shelter and transport, and is, in fact, the southern ship of the forests and prairies. The horses that conveyed the wagons were large and powerful animals, followed by servants, cattle, sheep, swine, dogs, the whole forming a primitive caravan not unworthy of ancient days. The procession moved on with power in its dust, putting to shame and uncomfortable feelings of comparison the northern family with their slight wagons, jaded horses,and subdued, though jealous, countenances. Their vehicle stops; and they scan the strong southern hulk, with its chimes of bells, its fat negro drivers and its long train of concomitants, until they have swept by.

The southern settlers who immigrated to Missouri and the

country southwest of the Mississippi, by their show of wagons, flocks and numbers, created observation. Ten wagons were often seen in company. It is a fair allowance that a hundred cattle, besides swine, horses and sheep, and six negroes accompanied each. The train, with the tinkling of a hundred bells, and the negroes wearing the delighted expression of a holiday suspension from labor in their countenances, formed one group, and the family slowly moving forward, formed another, as the whole was to be seen advancing along the plains. It presented a pleasing and picturesque spectacle in those days. The extent of the westward movement may be measured with approximate exactness by comparing the position of the frontier line from decade to decade.

In the decade 1820 to 1830 Florida was transferred from Spanish jurisdiction and became a territory of the United States; Missouri had been carved from the southeastern part of the Old Missouri territory and admitted as a state. During this period the Indians, especially in the South, had still delayed settlement to a great extent. The Creeks and the Cherokees in Georgia and Alabama, and the Choctaws and the Chickasaws in Mississippi, occupied large areas of the best portions of those states and successfully resisted encroachment upon their territory. Westward people had moved across the southern part of Alabama and joined that body of settlement which was previously found in the drainage basin of the Mobile river. The Louisiana settlements had but slightly increased. The settle-

ments in Arkansas were as yet very sparse.

In 1840 we find the Cherokee, Creek, Choctow and Chickasaw Indians had been removed to the Indian territory and their country had been opened up to settlement.

In 1850 the limits of our country had been further extended by the annexation of the State of Texas and of territory acquired from Mexico by the treary of Quadalupe Hidalgo. We find Texas with a considerable extent of settlement; in general, however, it was very sparse, most of it lying in eastern part of the state and being largely dependent upon the grazing industry.

In 1860 the strip of Arizona and New Mexico south of the Gila river had been acquired from Mexico by the Gadsden Purchase in 1853. Texas had filled up even more rapidly, its extreme settlements reaching the 100th meridian.

SPANISH RANCHING: Cattle were first brought into the United States, southwestern section, by the Spaniards as early as the Coronado Expedition in 1540. The first Spanish settlement in the Southwest was in New Mexico. Sheep were introduced and cattle were raised by the inhabitants of the colony before the revolt of the Indians in 1680. The cattle ran at will and wandered over large areas.

In the later seventeenth century the energetic Jesuit missionary, Father Kimo, introduced stock raising in Arizona. In connection with missionary work he established ranches in the valleys of the Magdalen, the Atlas, the San Pedro and Santa Cruz rivers. The labor was performed by the Indians. When the

forty-niners passed thru Arizona they found the Pima Indians raising cattle and using oxen for farm work.

TEXAS RANCHING: Cattle were brought into Texas in the early part of 1700 and cattle business flourished in Eastern Texas, a little later cattle ran wild on unsettled land being known by their ear marks. They were plentiful around San Antonia and large numbers were reported between the Colorado and Brazos rivers.

There was little to encourage interest in stock raising. The climate and pastures were favorable to rapid increase of stock. The country was agricultural and produced an abundance of meat, hides, lard, tallow, wool, flour, grain, mules and salt, but the restrictions on trade made business unprofitable. Trade with New Orleans, the chief market, was illegal, but the restrictions were released when Louisiana was ceded to Spain. Droves of cattle, sheep, horses and mules were driven to this market usually in the autumn when the rivers were fordable and pastures were good.

Some French cattle were brought in from Louisiana. In 1830 there were said to have been 100,000 cattle in Texas, of which the Spanish breed made up almost four-fifths.

RANCHING IN CALIFORNIA: In California the first cattle were raised at the missions in 1769. Later about twenty missions spread out and started cattle raising,getting their original start from the mission at San Diego and from those in Lower California. The Spanish government established four presidios

which also engaged in cattle raising for their own consumption. Hides and tallow were the chief products. In 1830 there were several large ranchers which owned from ten to fifteen thousand head of cattle each. The labor was performed on these ranches by Indians who lived in rude huts.

The cattle industry in California developed rapidly upon the discovery of gold in California. The increase in population soon brought about a scarcity of food, a good demand for cattle and high prices. Cattle were even trailed in from the East. The United States census data shows that cattle jumped from 262,000 head in 1850 to 1,175,000 in 1860.

SPREAD OF RANCHING NORTHWARD THRU THE GREAT PLAINS AREA: The rush into California for gold gave an impetus to the cattle industry of Utah, Montana, Nevada, Wyoming, and Colorado. The Mormons entered the cattle business extensively using the best grass in Utah. They got their original cattle from the emigrants trails leading to the gold camps. This was in 1850. In 1861 cattle from Texas were driven into Utah. From Texas cattle were driven to all the above named states for stocking purposes. During the Civil War the cattle industry suffered for a lack of markets.

After the war there was a big demand for Western cattle in the Eastern markets. The consumer lived far from the ranches where the beeves were produced. The success of the cattle industry depended upon the solution of the problem of adequate transportation. The long drive was the first method used. Later, cattle were driven to St. Joseph, Missouri and into Kansas.

From here they reached Chicago by rail.

The farmers first settled on the timbered areas where the soil was sandy and of very little use but it provided logs for their cabins and rails for their fences. They lived by hunting a great deal and by farming the poorer areas first. The prairies required heavy implements to cultivate it. It also had to be fenced and as this was in the days before barb wire the men did not think it profitable to have rails any great distance so they were confined to the edge of the woods.

Later these farmers leaned to handle the heavy soils so we have them coming into the corn belt on the prairies and the same way to Colorado. From the prairies they went to the dry farming sections and started to grow drought resistant crops. Then we had the temporary use of ranching land. The barbwire was a great aid to the ranching industry. Before windmills came in the ranchmen settled along the rivers and tributaries. There was no water to speak of so they utilized this grazing land by running sheep which they thought could go without water.

These ranchmen found after heavy losses that sheep could exist on succulent feed but would perish in times of drought. In the early 90's these ranchmen started boring wells for water. Soon after ranchmen leased the land, and later, when crowded too much, many purchased land, especially that which controlled the water, and there by the grass.

HISTORICAL SKETCH OF RANCHING IN COLORADO: Land in Colorado was common property at first,protected by Indians, who burned the range off in order to keep the grass good. Later, white men came along and disputed the rights of the Indians when their grass got short. They made a large circle out over the plains which they grazed. Next came the community ownership of land; following this men started to claim water holes; started to draw lines around a certain area and claim the land. The ranchmen had certain laws. They divided the range and governed their business according to the law of the range.

They tried to change the range law into civil statutes and claim squatters sovereignty. The ranchmen ran drift fences and enclosed the water. This was about the time of the wire cutting which was started by nestors coming in and also by the need of ranchmen for better grass.

The government established civil laws and price of land increased in value. Ranches were fenced and the whole ranching business was reorganized upon a scientific basis. The ranchmen became established on a permanent basis, used more capital, better stock, studied carrying capacity of the ranges, diversification, and numerous other problems which confronted the ranchmen. The large inefficient ranches were gradually being replaced by better managed ranches and this will continue in the future.

The first white man came into the section that is now known as Colorado when Plymouth Rock was still an unknown

boulder on the shore of the Atlantic. They were Spaniards who conquered Mexico, established New Spain, and drifted up the Rio Grande valley from what is now Old Mexico into the San Luis Valley of southern Colorado. It was two centuries later before the white men from the shores of the Atlantic began to struggle up the valleys of the Arkansas and Platte rivers, seeking to explore the unknown West. It was not until the quest for gold brought the Argonauts into the Pike's Peak region that the cattle business started in this section.

The first cattle of any consequence brought into this section were brought by the gold seekers who drove their ox teams across the plains, accompanied by a few milk cows. Upon their arrival in Colorado at the gold diggins, the first effort of the explorers was to rid themselves of some of their oxen.

The sore-footed, the gaunt and worn out animals were turned out to die, or wrestle their own living, as fate might decree, and men were hired to herd the oxen retained as a connecting link with the East. It was only when the half starved, crippled, and almost dead oxen, turned out to die, reappeared later on rolling in fat and were gathered in, slaughtered and sold as beef that the minds of some who had had agricultural experience began to awaken to the possibilities of live stock production in this section.

The first improved cattle to find their way into Colorado were brought in 1861 by Duke Green and Ed Shook who came from Oskaloosa, Iowa. The cattle consisted of twenty high-grade

Shorthorn cows, and a purebred bull. Samuel Hartzel, who for many years was one of the most extensive cattle raisers in Colorado, had been operating in a limited way, buying up worn out oxen and converting them into beef.

To quote Mr. Hartzel: "I used to get the broken-down animals very cheap, from $10 to $20 per head, and when fattened they were worth $90 to $100 each. I remember that in the spring of 1863, I sold ten big beef steers to a butcher from Hamilton for $1000. I delivered them to him at Canon City, and he drove them home." Mr. Hartzel bought Mr. Green's interest in this lot of Shorthorns, and later, after Shook had had a hair-raising experience with the Indians, he sold his interest also to Hartzel, and turned his face again toward Iowa. Mr. Harzel related some thrilling experiences which he had with the Indians, but he stayed with his ranch in the South Park country and built up an extensive cattle business, remaining actively with it until 1911 when his well-known herd was disposed of.

Evidently Mr. Hartzel was progressive for as early as 1864 he journeyed back to Clay County, Missouri, and purchased 150 Shorthorns, two bulls and 148 females, bred from a purebred foundation which had been brought into Missouri by their former owner, Thomas Gorden of Kentucky. It required nearly two years for Mr. Hartzel to deliver the cattle to his ranch in South Park. A part of the journey westward was attended by many hazards on account of Indians, but thru the aid of a

detachment of the United States Army stationed at Fort Larned, Kansas, the journey was safe-guarded and the herd considerably increased in numbers, owing to the coming of calves along the journey. Undoubtedly the introduction of these well-bred Shorthorns into Colorado in that early day had more to do with the improvement of Colorado cattle than any other effort along this line.

It will be remembered that "Al" Neale of Montrose made repeated exhibits at the International Livestock Exposition in Chicago, winning the feeder championship three times out of four. A striking demonstration of the character of the cattle which he had been raising on the western slope for many years. Cory brothers built up a large herd of Shorthorns at their ranch at Hayden near the northwest corner of the State.

It was not until along in the 70's that Herefords found their way into Colorado. About thattime the Kansas Pacific Railroad reached Denver. John E. Painter recalls that John Zweck of Longmont made a purchase of three Hereford bulls from the herd of T. L. Miller, Beecher, Illinois, one of the greatest forces in the early Hereford activities. Then came, along in the early 80's, heavy losses, due to extreme winter conditions, followed by a long decline in prices which drove many men out of the cattle business. After the panic of 1893 things remained at a standstill, until 1897, when there were signs of a revival.

DESCRIPTION OF A FEW RANCHES OPERATING IN COLORADO IN THE EARLY DAYS.

THE PRAIRIE CATTLE COMPANY: The Prairie Cattle Company's property was in three divisions. The Arkansas, or Northern Division, extended from the Arkansas River on the north to the state line of Colorado and New Mexico on the south, a distance of seventy miles, and from a line drawn north and south at a distance of ten miles west of the town of La Junta on the Atchinson, Topeka and Santa Fe Railroad it extended a distance of fifty miles eastward, embracing a territory of 3,500 square miles, or 2,240,000 acres. On this princely range there were 53,982 cattle. To manage this herd 300 horses were used by the ranchers. The value of land was $163,992; of cattle, $1,-705,000, making a total of $1,791,492.

In May, 1883, this Scotch Company was quoted as follows:

Name of company	No. shares issued	Par value of shares (*)	Am't paid per share (*)	Issue	Price (*)	Avg. dividend and bonus
Prairie Cattle Co., Ltd.	12,500	10	5	1st	9 7/8	27 5/6 %
" " " "	25,000	10	5	2nd	9 3/4	27 5/6 "
" " " "	12,500	10	5	3rd	9 7/8	19 1/2 "

(*) In English pounds sterling.

Following is a description of cattle business by the manager of the Colorado Cattle Company on Craig or Barnum Ranch, Hermosilla, near Spanish Peaks, on Huerfano River, giving the possibilities of the cattle business from 1863 to 1879.

Cost of land, 10,000 acres,	$50,000
Herd of 4000 good cows could be bought at $18 cash, or	72,000
80 good Shorthorn and Hereford bulls at $50	4,000
Total investment	$126,000

By careful buying in the spring one should get 70 per cent of calves with the cows, or say 2000 calves. Of these, on the average, one-half, or 1400, will be heifer calves. At the end of the first year affairs should stand as follows:

1400 heifer calves will be yearlings worth	$14,000
1400 steers worth $10 each	14,000
Total	$28,000
With a herd of this size expenses may be put at not more than	$ 5,000
and for contingencies, sundries, and ordinary losses it is safe to take 4% on capital invested in stock, say on $76,000	$ 3,040
	$ 8,040
Profit at end of first year	$19,960
At end of second year the 1400 heifers are 2's worth $5 more, $15	$ 7,000
And of 2800 (70%) of 4000, new yearling calves, and average of one-half, or 1400 heifers worth $10 cash or	14,000
1400 two-year-old steers worth an additional $6 each	8,400
And 1400 new yearlings are worth $10 each	14,000
Total	$43,400
Deduct expenses	$ 5,000
Add 4% interest on $76,000 plus $19,960 equals $95,960	3,838
	$34,562
At the end of the 3rd year the original 1400 heifers are three-year-olds and worth an additional $3 per head or	$ 4,200
The yearling heifers of last year are two-year-olds and worth an additional $5 each	7,000
There are 1400 yearlings from the original stock worth	14,000
And of the offspring of the 3's (70% of 1400 equals 980) one-half or 490 are heifers worth	4,900

The original 1400 steers are 3's and worth an additional $10 each or	$14,000
The 1400 steer calves of last year are 2's and worth an additional $6 or	8,400
And there are 1400 yearlings, offspring of original stock and 490, offspring of new three-year-olds - in all 1890 at $10 each	18,900
Total	$71,400
Deduct expenses on 5400 cows, say	6,050
Interest 4% on ($95,960 plus $34,562) equals $130,522	5,221
Total	$11,271
Profits at end of third year	$60,129
Total net profit for three years	$114,561

1. No allowance need be made for depreciation of stock as the cattle can with proper care always be sold for beef.

2. If profits be invested in cattle, they will be largely increased.

3. No account is taken of interest on profit.

4. No account is taken of the gradual improvement in the quality of the stock.

5. Profit can often be made by buying cattle and keeping them for a year.

6. During the latter part of the winter and the spring, the food is of course poorer than before, and, as cattle are not in the best condition, there is much demand for good beef for local consumption. By feeding cattle during those months for sale in Colorado, excellent gains should be realized. Good beef on the hoof was worth four and a quarter cents per pound in Pueblo in the spring of 1879.

7. A ranch purchased in southern Colorado at present prices is almost sure, in view of the great increase in business and the decrease of suitable land, to appreciate considerably in value, say at least 10 per cent per annum.

It will be plain to anyone who will examine carefully into the matter that under favorable circumstances profits will amount up each year in an increasing ratio and he can

readily make figures for himself. In the meantime we have a balance sheet at the end of the third year as follows:

Assets

Ranch with 3 years' appreciation at 10%	$65,000
5400 cows at $18	97,200
60 bulls at $50	4,000
1400 two-year-old heifers at $15	21,000
1090 yearling heifers at $10	10,900
1400 three-year-old steers at $26	36,400
1890 yearling steers at $10	18,900
1400 two-year-olds at $16	22,400
Total	$283,800

Liabilities.

Capital put in ranch		$50,000
Capital put in stock		76,000
Capital used in expenses		28,149
Profits on stock, three years	$114,651	
Profits on ranch	15,000	129,651
Total		$283,800

A risk to be taken into account would be a possible outbreak of disease at some time, but out of profits as shown an insurance fund could readily be created. That so many cattle will be raised that prices will greatly fall need not be a matter of present fear; for leaving out the two most important factors, the great and increasing demand for our beef in Europe, and the new uses to which it is put in this country, our population has hitherto increased faster than the supply of good meat.

It is the aim and determination of the writer to state things, as far as in him lies, exactly as they are, and he

would quote that excellent though unrecorded saying of the wise man: Blessed is he that expecteth nothing for he shall not be disappointed. Is it admissible to engage in the raising of cattle? Answer, yes. Provided, first, that person knows the business thoroughly himself, is willing to learn, or will give a portion of his profits to a trusty man to manage for him; second, that he can command adequate capital; and third, he will not chafe at the loneliness and deprivations of the life.

Summary - Cow Herd

Age of cow in yrs.	No.of cows	No.of calves	No.of heifer calves	Value when yrlgs. at $10 per head	Increased value when 2 yrs. old at $5 per head	Increased value when 3 yrs. old at $3 per head	Value when 3 yrs. old at $18 per hd
1	4,000	3,200	1,600	$16,000	$ 8,000	$ 4,800	$28,800
2	4,000	3,200	1,600	16,000	8,000	4,800	28,000
3	5,600	4,480	2,240	22,400	11,200	6,720	40,320
4	7,200	5,760	2,880	28,800	14,400	8,640	51,640
5	9,440	7,552	3,776	37,760	18,880		49,280
6	12,200	9,856	4,928	49,280			38,628
7	16,096	12,877	6,438 at $6 per head				72,000
Original cows at $18 per head							366,308

Allow losses of 20 per cent on cows.
Steers at 2's where run a year and sold at an advance of $10 at a profit.

Steers.

Age of steer in yrs.	No, of calves	Value when yearlings at $10 per head	Increased value when 2 yrs. old at $6 per hd.	Increased value when 3 yrs. old at $10 per hd.	Value when 3 yrs. old at $26 per hd.
1	1,600	$16,000	$ 9,600	$16,000	$41,600
2	1,600	16,000	9,600	16,000	41,600
3	2,240	22,400	13,440	22,400	58,240
4	2,880	28,800	17,280	28,800	74,880
5	3,776	37,760	22,656		60,416
6	4,928	49,280			49,280
7	6,438	at $6 per head			38,628
					$364,644
Total product in 7 years, costing $72,000 included cost of cows					730,952
The profits or increase on the 7th year would be or 50 per cent on the entire capital of $500,000 above.					254,792

1863 - 1879

Ranch is 140 miles south of Denver, 20 miles from Pueblo on the Huerfano River.

91,000 acres in this government grant.
500,000 acres of upland dry land.
$100,000 spent in buildings, stock and improvements.
Cost $350,000 for Hermosillo ranch.
10,000 steers.
100 bulls, horses, etc.
4000 acres in cultivation.
15,000 acres in timber.

Reference: New Colorado and Santa Fe Trail by A. A. Hayes Jr., Harper and Bros., Franklin Square, New York.

Ranching in 1881 and 1882.

Capital Invested in Stock Mixed Herd of 500 Head.

150 young cows and calves at $15	$2,250.00
100 two-year-old heifers at $12	1,200.00
100 two-year-old steers at $12	1,200.00
75 yearling heifers at $7	525.00

75 yearling steers at $7	525.00
10 high-grade bulls at $75	750.00
	$6,450.00

Capital Invested in Ranch, etc.

Seventeen miles of wire fence, enclosing approximately 10,000 acres	$2,380.00
Ranch, corrals, etc.	250.00
Horse and equipment	250.00
Total	$2,880.00

Summary of Account for Five Years*

Year	Stock	Value	Sale of 3-year-old steers		Expense	Profit
1	530	7,140.00	100 @ $18	$1,800	$ 680	$1,120,00
2	655	8,465.00	75 " 18	1,350	750	600.00
3	852	11,200.00	60 " 18	1,080	850	230.00
4	1,063	14,620.00	100 " 22.50	2,250	1,100	1,150.00
5	1,321	18,477.50	130 " 22.50	2,925	1,500	1,425.00
Profit on sale of steers.....						$4,525.00
Value of stock at end of five years.....						18,477.50
Capital invested.....						23,002.50
Profits in five years ($4,525 profit, plus $12,027.50 increased value of herd,) equals.....						$16,552.50

Note: 85 per cent calf crop, 5 per cent loss natural causes, net 80 per cent crop. No loss on grown cattle.

Improvement by use of good bulls figured at 25 per cent.

Expenses figuring one good man at $40 per month with several men extra to assist during branding, etc., have been taken into account. Cost of feed of horses and bulls included.

No allowance for rent of land as at present there is no trouble getting good range for a nominal sum.

Start with capital of $10,000.

One man and three horses can care for 500 cattle. Figure 10 acres per animal and cost of fence at $140 per mile.

*Reference: Colorado as an Agricultural State by William E. Pabor, Assoc. Editor, Colorado Farmer, Denver, Colorado. Published by Orange Judd Co., New York. Page 630. 1883.

*Colorado by Frank Fossett. C. G. Crawford, printer, 49 Park Place, New York. 1879.

Coronado travelled this country in 1542, travelling south from Kansas to New Mexico. One of the first cattle ranches in this area was the Mermosilla Ranch, a Spanish land grant of 97,000 acres described above and located near the Spanish Peaks in Southern Colorado. A number of the ranches were operated by large English and Scotch cattle companies under the Prairie Cattle Company and under the J J brand. These large cattle companies operated over four or five counties. A description of the range country as written by Will James applies to Colorado. In those days the only fence was a little "wrango" horse pasture and the big pole corrals. The hills were black with cattle then, more cattle than this country will ever see again; there was a lot of freedom, no mortgages and the nearest neighbor was fifteen miles or so away. Some of these ranches were paying taxes on fifteen thousand head of cattle (which means that they were running closer onto twenty-five thousand critters)

These ranches had a certain amount of deeded land. Some of it government land that they had bought for as low as two bits an acre, later they obtained land from the homesteaders who would leave the country and trade their "three hundred and twenty" for a ticket back home. Some of these men came up the trail to Colorado with the first herds from Texas, the cattle were mostly head,and horns averaging six feet from tip to tip. They were "top hands" and reckless as they make 'em; had nothing but a string of broncs and good health. They traded their wages for cattle and every fall you could see the cow

hand bringing home his summer's wages, all good young she-stock he had bought here and there, along with a few "slicks" he thought might be his. His herds kept increasing and spreading over the government range; his little squatter's right was three hundred and twenty acres and the unsurveyed land about him was the same as his. He wasn't crowded for room.

Then out of a clear sky came the smell of sheep; all was O. K. at first because the cowmen figured there was plenty of range for every body, even sheep. But soon enough the sheep kept getting thicker and the range poorer which started the crowding on the cowmen's best bits of country, mostly Eastern Colorado. There were a few parleys without the voice of the "smoke wagon" being heard. But sheep and sheep herders do not have much respect for words or rules or country; so they went at it to start spoiling it all and the cowmen went on to finishing what the sheepmen had started. With the result that mostly sheepmen and sheep were missing. The government could not do much; they would have had to pinch about four states.

The cattlemen won for a spell and all went well again outside of the damage sheep had done to the range. The dust beds they had made out of the good grassy benches were beginning to show signs of life, the air was pure as ever, and cattle were getting fat. The cattlemen were all good folks once more tending to their business in the land that was theirs. They were the first to blaze the trail to it; they made that land a big beef producing country; it was their home and naturally

they wouldn't allow a stinking sheep coming along and leaving nothing but the bad oder.

One day a neighbor moved in and took a "squatters." A few months later another sets up a tent and starts a shack, up river this time and only two miles away. Well that was all right there was lots of room but the cowmen could not see how they were going to make a living farming. They said the country was too dry. Any way they kept coming and it wasn't long before the cowman couldn't follow the old trails much more. The cowman bought all the government land he could, but that was no where near enough to run even one-fifth of his cattle. His leases couldn't hold the homesteader back, only sheep. Some of his best springs were filed on and taken away from right inside his lease. It was a losing fight; their range was being taken from them one way or another and they didn't have much heart to save what was left. So they tried it another way and speculated some. In the meantime theircattle were still eating what little feed the sheep hadn't shoved into the earth, and the cowboy was still swapping a few shots with the sheep-herder and batting him over the ear with the six shooter every chance he got.

The freighters were kept busy hauling out the nesters. He would take them, their lumber, grub, and all, and set them way out somewhere on the prairie wherever their particular homestead was located. Few of them had enough money to buy an outfit like teams and wagons, and they went out any way,

figuring on buying the next spring; besides, they would know better what they wanted when they got there.

The first few had no neighbors to go to and borrow from. It seemed that they were all alone in the whole world. The booster had most of the people who had come west to homestead believing that all was fixed for them out here. All they would have to do would be to go out and farm a little, the windmill would be running and the chickens waiting to be fed. Some paradise! And no wonder they flocked after they heard so much about the climate being so fine and the soil being so rich. The soil was fine, all right, and the climate good, but it needed water to grow what they planted. Well they planted and waited, planted and waited in succession for years. The crop would come up fine in the spring, just fine enough for feed, they dry up. It was a cow country and should have been left such. But the nesters kept on hoping and working; the little money they had brought with them was gone, and the little homestead was all they had.

There were many like that; with all kinds of hopes and little knowing what they had to buck up against. The pioneer stockman who had lost his country to them was man enough to help them. He liked fair play, and even though he didn't get it from some, that's the way he dealt. Plenty of times the cattlemen would find some of their horses or cattle shot down. Before the nesters came in, the latch-string hung out always; but with the nester or what followed him it wasn't safe to be

too hospitable and leave the door open. A 30-30 carbine would disappear, or blankets, also saddles and grub; so the padlock was fastened to the cow camp and will stay there as long as there is one.

After a few dry seasons the dry land farmers became discouraged. They were mighty glad to sell for enough to get back home on and in this way the cowman attempted to get his old range back. He bought all the homesteads he could get that were proved on. Though the cowman was sorry for the nester, he knew there was no use, this was a cow country and always would be. The nester's fences were torn down and built up again, but it took in a bigger territory. Some places the fence was a solid ten miles long and five miles wide. Some cattlemen still run their stock out on the free range where it is available, but they are not doing good and the winters leave many a bone pile in the coul'ees.

A little later the cowman came across a whole outfit of tents, mules, and men in high laced boots. They were surveyors and engineers looking over the prospects for a dam and irrigation canal. The ranchman right away gets fighting mad. He felt it was a new trap to beat and crowd him out of what he's built, scraped together, and saved. He was satisfied to be left alone the way things were. The fact that the irrigation system would make his land worth ten times more didn't faze him any. There sure didn't seem to be any use of fighting any longer; progress wanted his freedom.

The dam was built and the ranchman helped to build it. Most of his government lease was taken away from him; being under the canal and subject to irrigation, the land was sold at a high price and this time the nester was called a "farmer" and came in to stay. There was water and plenty of it, little ditches ran through the river bottom and alfalfa began to grow. Hay stacks and a few head of dairy stock were seen here and there. The ranchman held on and refused to sell any of his land. The range being over-crowded for years was mostly loco and sagebrush and rocks. The stirrup high "blue joint" was gone. He had to cut down his herd and some where what he kept would have to be fed in winter. His own land had to be divided up with more fences and ditches, mowers and hay rakes bought, and the cowman tried to get himself used to seeing it all. It sure hurt,but it had to be. His white and brockle-faced stock crowded the fences at first fall. There was no more rustling in them and the hay he had cut looked better to them than the dry range. The cowman didn't wonder; he knew how it was going to end, and it cut pretty deep when his cow-punchers would ride in with wire pliers fastened to their saddles instead of the good old shooting-iron at their belts.

RANCH LANDS.

LAND AS A FACTOR OF PRODUCTION: Land is one of the most important factors in the production of livestock. The various amounts used, the value and the method of handling it have a very direct bearing on the cost of producing cattle. In fact at present it is "the" question in the cattle business today that is causing the ranchmen so much worry.

The economist's definition is as Marshall says, "By land is meant the material and the forces which nature gives freely for man's aid, in land and water, in air and light and heat." Professor Ely says, "Land means nature as one of the two original factors in production, the other being labor, while capital, the third factor in the category, is a derived factor resulting from the action of labor upon nature."

Ely points out that land has thirteen characteristics not common to other goods. The first six are:

1. Land is something ready made.
2. Limited in quantity.
3. Has gradations in fertility and situation, these gradations being such in degree as to make them a peculiarity of land.
4. The peculiar relation of land supply to population.
5. The immobility of land.
6. The relative and even the absolute permanency of land.

AREA AND EXTENT OF GRAZING LAND IN THE WORLD.

As the amount of beef produced in foreign countries sets the price of beef in this country and Colorado, it is necessary to study the extent of foreign grazing lands.

In the tropics and subtropics we have 23,000,000 square miles, only about 5,000,000 square miles of which is arable. There are 3,800,000 square miles in pasture with adequate rainfall;in addition to this there are 10,000,000 square miles of land suitable for grazing purposes most of which is too dry for farming.

In the temperate zone there are 2,500,000 square miles of grazing land with adequate moisture, all of which is potentially arable but which is used as grazing land at present to a limited degree. In addition there are 10,000,000 square miles of land that has sufficient moisture but which cannot be put under the plow.

ARABLE LAND OF THE EARTH*

Tropical and Subtropical Zones

Total land area	23,000,000	sq. mi.
Land too arid for crops	8,000,000	" "
Land with adequate rainfall	15,000,000	" "
Probably one-third ultimately arable	5,000,000	" "
Cultivated at present	1,200,000	" "
Arable land in pasture	600,000	" "
Potentially arable not used for crops or pasture	3,200,000	" "

Temperate Zones

Total land area	29,000,000	" "
Land too dry for crops	7,600,000	" "
Land too cold for crops	6,400,000	" "
Land with adequate rainfall & heat	15,000,000	" "
Probably one-third untimately arable	5,000,000	" "
Cultivated at present	2,500,000	" "
Arable land in pasture	1,500,000	" "
Potentially arable not used for crops or pasture	1,000,000	" "

*O. E. Baker, Land Utilization in Annals of Association of American Geographers, 1922.

GRAZING LAND OF THE EARTH.

Tropical and Subtropical Zones

Grazing land too dry for crops	4,000,000	sq.	mi.
Grazing land with adequate rainfall but not arable	10,000,000	"	"
Grazing land with adequate rainfall and potentially arable	3,800,000	"	"

Temperate Zones

Grazing land too dry for crops	7,000,000	"	"
Grazing land with adequate rainfall but not arable	10,000,000	"	"
Grazing land with adequate rainfall and potentially arable	2,500,000	"	"
	37,300,000	"	"
Total land in world	52,000,000	"	"

This indicates that 70 per cent of the world's area can be utilized for grazing at present and that 31,000,000 square miles or 60 per cent can be utilized for all time to come. In making this calculation I have made an allowance for deserts, swamps and forest land.

AREA AND EXTENT OF GRAZING LANDS IN THE UNITED STATES.

UNITED STATES: According to O. E. Baker, United States Department of Agriculture, we had in 1920 about 1,100,000 acres of land in absolute forest, grazing, and desert land. He has estimated that there are 503 million acres in improved land and 300 million acres of potential improved land so that we will always have about 50 per cent of the land in grazing land. This indicates that there will always be a large area in permanent grazing land which will have to be utilized by

livestock. Mr. Baker says the problem involved in the relationship between the people and the land is especially pressing, because we are at the turning point in our national history. We have reached the stage in our agricultural development when there is practically no more potential agricultural land left unutilized that does not involve unprofit-expense for reclamation or clearing. Much of our agricultural land could be cultivated more intensively, however, when higher prices for agricultural commodities justify the increased cost of production.

The country has been settled; it is now being resettled. Certain pasture lands are being broken and some forest lands cleared for crops, while other hilly or sandy lands, formerly used for crops, are being allowed to revert to pasture or forest. Some people are leaving the land and moving to the cities, while others are taking their places on the land. Moreover, we have entered the economic arena of the world. Our exports of agricultural products are greater than ever before, but in a few years our imports may exceed our exports. It is a transition time, and our agricultural situation is uncertain.

It is estimated that our population will have increased to 145 to 150 million people by 1950, a year that many of us are likely to see. How to feed, clothe, house and provide the necessities of modern life for these forty additional millions of people is the immediate problem confronting the American nation.

It will be necessary for western ranchmen to increase the productiveness of the western ranges by more and better scientific methods of handling their land and livestock.

Use of the Land Present and Potential in the United States*

Land Area of the United States	1,903,269,000	acres
Improved land 26.4%	503,073,007	"
Potential improved land	300,000,000	"
Land in harvested crops 19.7%	375,431,734	"
Absolute forest grazing and desert land 53.9%	1,100,000,000	"
Improved land not in crops (half in pasture)	138,000,000	"
Irrigable land	30,000,000	"
Drainable	90,000,000	"
Forest and cut over	50,000,000	"
Unimproved pasture	130,000,000	"

Land Utilization in Colorado*

Improved land 11.7%	7,744,757	acres
Land in harvested crops 8.2%	5,416,712	"
Area irrigated	3,348,385	"
Estimated irrigable land	5,000,000	"
Wet land in need of drainage	66,000	"
Forest land	8,700,000	"
Forest land suitable for crops after clearing	480,000	"
All land in farms or ranches 36.9%	24,462,014	"
Approximate land area of state	66,341,120	"

The above table indicates that about 80 per cent of the land in Colorado can be utilized for grazing and that from 60 to 70 per cent can be classed as permanent grazing land.

*U. S. Census 1920.

Land Classification in Colorado*

Total	66,341,120 acres
Fruit land	30,129 "
Irrigated land	2,286,592 "
Dry farm land	11,166,930 "
Natural hay land	271,988 "
Grazing land	18,008,349 "
Productive coal land	103,219 "
Now productive coal land	114,088 "
Timber land	784,709 "
Now productive mining claims	247,204 "
Productive mineral land	10,166 "
Other mineral land	34,520 "
Railway right of ways	137,071 "
Town and city lots	152,526 "
Total patented	33,347,491 "
Homestead and certificate of purchase	8,653,865.82"
Government land open to homesteaders	7,753,218 "
State land unappropriated	2,991,689.18"
National forests	13,277,038 "
Total now patented land	24,021,945.18"

*Colorado Yearbook 1923.

The above table indicates that there are about 18 million acres of pasture land in Colorado, 27 per cent of the total land area of the State. Only 15 per cent of this is improved land, 85 per cent is classed as unimproved.

LAND CLASSIFICATION: Professor Ely calls attention to a number of possible classifications of land. Some of these are based on water supply, such as humid land, semi-arid land and arid land; others are based on use such as agricultural, forest land, and mining land.

TYPES OF RANCH LAND: There are two types of ranch land based on the relative permanency of the use of those lands.

There are lands which are only temporarily devoted to grazing. These lands are submarginal farm lands at present and are used by the ranchmen for grazing until the farmer will use them for farm land, when prices of farm products warrant their use as such.

The second division is the permanent ranch land used for grazing. This land consists of land wholly untillable, tillable land still in grass and cultivated land, the latter in small patches.

Ranch lands are also differentiated on the basis of the length of time they are grazed, into year-long land, summer range land and winter range land. The year-long land in Colorado is found primarily in the southeastern section of the State. Some of the forest ranges are used as summer range for a period of from three to five months or more. Ranch lands may be defined as all those lands which are utilized to best economic advantage when devoted primarily to grazing rather than to cultivated crop production. This does not mean that some land may not be cultivated. The chief purpose of cultivated land in connection with ranches is to furnish an emergency feed supply for sick and weak animals, or for work stock. It should also be available for purposes of wintering cattle in high altitude areas where no winter range is available.

GRADES OF RANCH LAND: The grades of ranch land are determined by a comparison of the net values of their products. Other factors being equal, these grades of land are dependent

upon the productivity of the land and its accessibility to the market. Grade No. 1 ranch land, other things being equal, is that land possessing the highest carrying capacity and being nearest the market; grade No. 2 next; grade No. 3 next and so on, while the lowest grade would be land having the lowest carrying capacity and being located farthest from the market.

PRODUCTIVITY: The characteristics determining the productivity of ranch land are the quantity, quality, variety and constancy of vegetation produced and the production afforded. This means the highest amount of cover, palatable and nutritive value of grass thruout a series of years. The best land from the standpoint of variety of cover is that which furnishes the greatest variety of desirable forage, most advantageously distributed thruout the grazing season.

DISTANCE FROM MARKET: J. H. Van Thurren's "Der Isopeite Staat" presents land under two classes, namely, farm and ranch land. He placed farm lands between the ranch lands and the market city, and graded them on the basis of bulk, perishability and value of products. No. 1 ranch land would be that ranch land which is nearest to the market; No. 2 next and so on.

TAXATION OF RANCH LANDS: The ranchman has special problems in taxation because he usually markets but one crop a year; it takes two or three years to mature an animal and the range country suffers from severe droughts at times. Under these con-

ditions it is extremely difficult to pay taxes as this money is needed to purchase feed to keep the livestock from perishing.

Adam Smith stated the following principles in regard to taxation: (1) The subjects of every state ought to contribute towards the support of the government, as nearly as possible, in proportion to their respective abilities... (2) The tax which each individual is bound to pay ought to be certain, and not arbitrary. The time of payment, the manner of payment, the quantity to be paid ought to be clear and plain to the contributor, and to the other persons.... (3) Every tax ought to be levied at the time and in a manner which is most likely to be convenient for the contributor to pay it... (4) Every tax ought to be so contrived as both to take out and to keep out of the pockets of the people as little as possible, over and above what it brings into the public treasury of the state. The taxes on grazing land often amounts to more than the lease value of the land. Many cattlemen are obtaining the grazing privileges in 1924 on the land by merely paying the taxes.

LAND MEASUREMENT: Land may be measured in terms of acres or in terms of its productive capacity and efficiency. When one speaks of the size of a given area of land he usually expresses himself in terms of acres or sections. When lands of widely different qualities and which are used in different ways are compared, the measurement in terms of acres and sections may be grossly misleading. Such a comparison may lead the man

of Northern Colorado on 160 acres of the best irrigated land to think of his cousin on the Western Slope on 3000 acres of land as a land baron. The former, however, may represent more wealth, require greater managerial skill to operate and yield a greater return than the latter. A more satisfactory basis in this case would be on the factors of production, land, labor, capital and managerial ability in both farming and ranching areas.

THE CARRYING CAPACITY OF THE RANGE.

As a rule the carrying capacity of a range means the amount of forage produced on a given range in a given space of time. Ranchmen think of it as the number of mature animals that can be carried per section during the grazing season. The annual carrying capacity is defined by B. Youngblood and A. B. Cox to mean the power of the range to support certain numbers and proportions of livestock of the several types and classes which may be grazed on it during any particular year with best utilization of the vegetation and with least injury to the desirable forms of plant life.

It is very necessary that the ranchman know what his annual and normal carrying capacities are so that he can stock up to the limit in good years and cut down in bad years. It is best to buy a few surplus animals during good years and maintain the regular herd at the normal carrying capacity of the range. The normal carrying capacity means the power of the

ranges normally to support certain numbers and proportions of livestock of the several types and classes,year in and year out, without injury to the desirable vegetation.

Among cattlemen, the cow is the unit of measurement of carrying capacity. Bulls and other cattle one year and over are considered head for head as consuming the same amount of vegetation as a cow. Calves are not counted because it is considered that what they consume is counter-balanced by the yearlings consuming that much less than a cow. Farm Management workers consider two calves equivalent to a cow and two-year-olds of all other cattle as equivalent to a cow. Doctor Fraps of the Texas Agricultural Experiment Station has worked out a ratio,using the cow as a unit of measure, which is superior to either of the above. A carrying capacity unit may be defined as the amount of forage or dry matter required to maintain a mature mother cow on the range for one year.* The normal carrying capacity of a given range is the number of available carrying capacity units produced one year with another over a period of years covering at least one weather cycle.

The exact numbers, types and classes of livestock required to utilize the carrying capacity will vary from season to season, from range to range and in accordance with the weights and jaws of the livestock. It may run something like 70 per cent cattle, 20 per cent sheep, and 10 per cent goats.

*Bulletin No. 297 - Texas Agricultural Experiment Station.

The value of carrying capacity, is measured by (1) the quality, quantity and variety of forage produced, (2) the market demands for the products, and (3) efficiency of production and marketing.

FACTORS AFFECTING CARRYING CAPACITY: (1) Climate; (2) Topography (soils); (3) Percentage of turf or covering; (4) Variety and quality of cover; (5) Supplemental feeding; (6) Water distribution; (7) Amount distribution of sale; (8) Diversified ranching; (9) The ranch layout; (10) The size of ranches; (11) Grazing system; (12) Managerial skill; (13) The form of tenure; (14) Drought; (15) Overgrazing; (16) Undergrazing.

CLIMATE: The carrying capacity of mountain ranges is cut short because it is limited to the summer grazing by the long severe winters. Other sections in the southeastern part of the State are limited by extremely hot summers.

TOPOGRAPHY: The death losses are greater on the open plains from blizzards and less in the rough broken country which affords protection. The latter has a great deal to do with the variety of forage, more varieties are usually found in broken topography.

SOILS: The vegetation and carrying capacity are determined largely by the character of the soil and climate. The soils of the Plains are uniform to the extent that they are dark in color and are underlaid by a zone of lime carbonate accumulation. (Fig. 1) They differ, however, in the degree of dark-

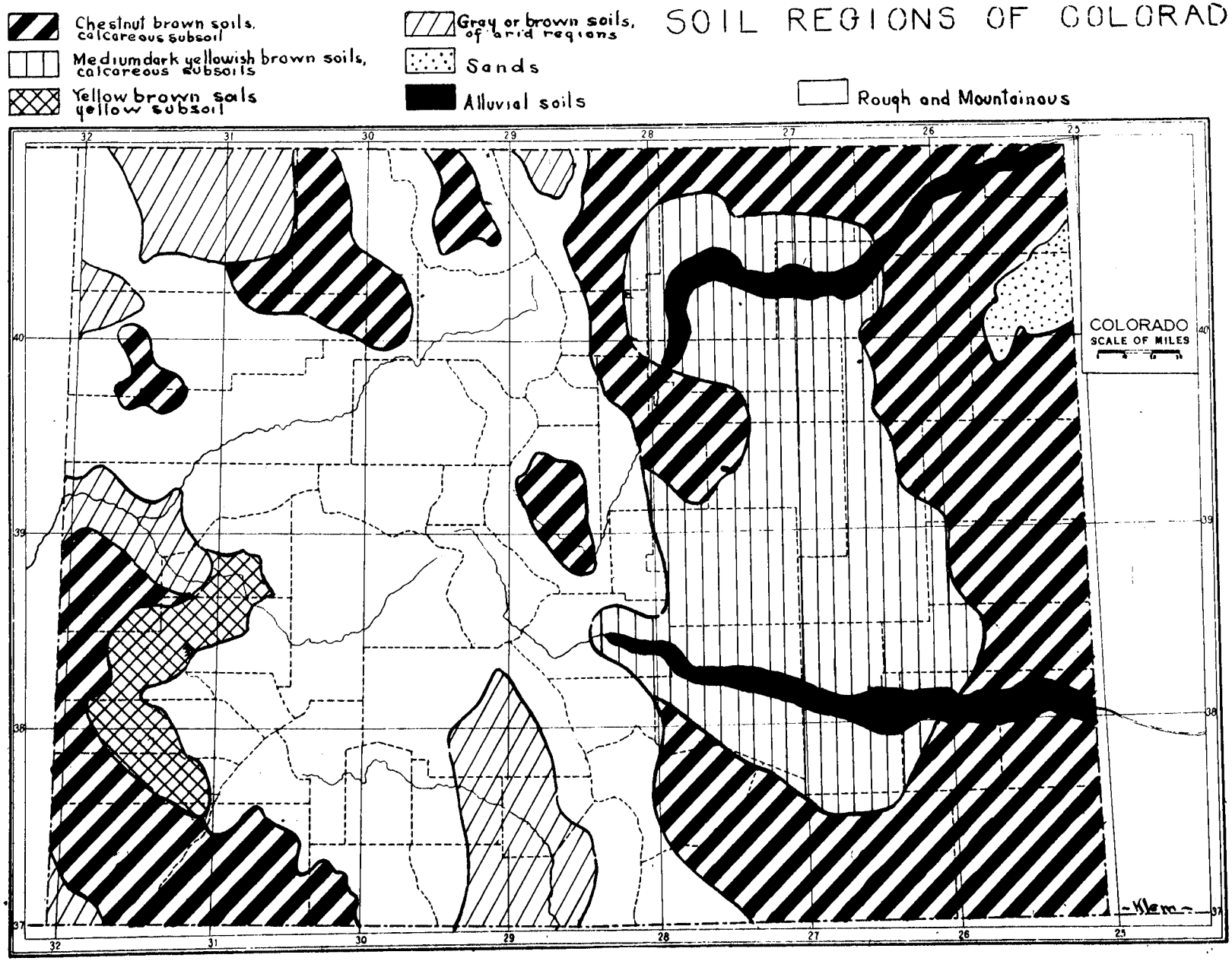


Fig. 1. Vegetation is determined largely by the character of the soil and climate.

ness of the soil color from place to place and in the depth as well as in other minor characteristics of the carbonated zone. The change in color and the change in depth to the zone of carbonate accumulation are complementary; as the color decreases the carbonate zone rises and vice versa. There is a progressive decrease westward in the darkness of the soil color. In most of the area the soils are approximately mature except for the areas of sands.

The character of the soil in the "dark brown belt" of Colorado is shown by the following profiles.

Profile at Akron Experiment Station, Akron, Colorado.

1. Brown silty loam, defloculated, showing a pronounced horizontal or layered arrangement in natural position 0 to 8 inches.

2. Dark brown, columnar clay or clay loam, compact rather hard when dry, columns half an inch to one inch in diameter, each having well defined horizontal breakage.....8 to 16 inches.

3. Gray loose, highly calcareous material..... 15 inches plus.

Profile three miles west of Two Buttes, Colorado.

1. Brown clay loam, dark shade, somewhat granular, 0 to 8 inches.

2. Brown clay loam, cloddy, 8 to 11 inches.

3. Calcarious horizon, 11 inches plus

Not including the sand hills, the mature soils of the area do not vary widely. Areas of sand occur on the plains in the region of Wray, Colorado, east of Sugar City, Colorado, along the Arkansas and South of Springfield.

The "brown belt" is a discontinuous belt, broken up in several separate parts, the location and extent of each being shown on the map in figure 1. The soils of this belt are the lightest in color of all the Plains soils and the carbonate zone beneath, the shallowest. The color of the soil is brown rather than distinctly dark brown, but as compared with the lighter soils of the deserts it may be placed with the dark soils. Like the other Plains soils it has developed under a grass cover but one of somewhat less dense growth than on the other belts. A profile measured three miles east of Wild Horse, Colorado, is as follows:*

1. Light brown loam loosely deflocculated 0 to 6 inches.

2. Brown loam, darkish shade, columnar breakage on drying, 7 to 17 inches.

3 Gray calcareous zone, 17 inches plus.

In the southern part of the area the grass cover is less dense than anywhere else east of the mountains and the vegetation assumes an appearance approximating that of the desert vegetation. The soils are still lighter in color except where dominated by the color of the parent rock, a brown shale, and the salt content is sufficient to cause the development of a rather well defined profile. A profile measured three miles northeast of Avondale, Colorado, is as follows:

*Soils of the Great Plains. C. F. Marbut, Annals of the Association of American Geographers, Vol.XIII, June 1923, No. 2.

1. Light brown loose structureless sandy loam, 0 to 3 inches.
2. Brown sandy clay loam columnar breakage, 3 to 13 inches.
3. Gray loose calcareous material, 13 inches plus.

PERCENTAGE OF TURF OR COVERING: The grazing capacity varies directly with the percent of cover. A ranch having, say, fifty per cent of the area covered with solid rock, alkali spots or desert sands, has a carrying capacity of only fifty per cent of that with complete cover.

EFFECT OF VARIETY AND QUALITY OF COVER ON THE CARRYING CAPACITY: Some ranges produce a large amount of vegetation low in palatability and digestibility and small variety. Animals are more certain of a balanced ration when the ranges are covered with a considerable variety of vegetation. It is highly desirable to utilize the grasses when they are in season or they will be wasted by livestock. Grasses that cure well should be preserved for winter grazing. Utilize weeds by sheep summer.

SUPPLEMENTAL FEEDING: Best results come from separating the weak animals from the herds and flocks and feeding them roughage that can be produced on the ranch until the grazing is again good, and from feeding mother cows cottonseed cake from two to ten weeks during calving, depending upon the condition of the livestock and the ranges. The mountain ranches winter cattle entirely on native or alfalfa hay, feeding about one and one-fourth tons per animal.

WATER DISTRIBUTION: The range would be more uniformly grazed if wells were so distributed that livestock did not have to go farther than one-half mile for water. There is a limit, however, to the number of wells that can be utilized profitably on a ranch. Cattle should have water at least once a day.

AMOUNT AND DISTRIBUTION OF SALT: The carrying capacity appears to be effected negatively by an inadequacy of salt on ranges and positively by inducing the animals to consume forage which they might not otherwise gather and also to digest and assimilate this feed with a higher degree of efficiency. It is necessary to distribute salting places properly, especially on the National forest ranges in order to control grazing adequately. A range cow should have approximately ten pounds of salt per head per year.

DIVERSIFIED RANCHING: Ranch lands are getting too high in price and successful ranching too difficult for the ranchman to grow cattle, sheep or other livestock purely from personal choice as in days gone by, regardless of combinations of livestock required for complete utilization of the carrying capacity of his ranges and the relative market prices of these types of livestock. Where conditions are satisfactory sheep should be run in connection with cattle. In many cases it is also profitable to combine dairying, farming or other enterprises, with cattle in a small way in order to have more than one source of income.

THE RANCH LAYOUT: There should be pastures enough to make possible the proper classification of different types of livestock, as the separation reduces injury to the cover due to trampling and overgrazing. Pastures should be moderate in size neither too large or too small. The headquarters should also be well located, usually in the center or middle of one side of the ranch in place of in a corner.

SIZE OF RANCHES: Small ranches are usually over stocked and large ranches fail to utilize all of carrying capacity due to poor location of water, layout, fences, less supplemental feeding and slacker management.

THE GRAZING SYSTEM: Continuous grazing is very detrimental to carrying capacity. The year-round plan of grazing livestock on the same pasture neither makes provision for reserving pastures for winter nor does it provide for the grazing of those areas which produce different kinds of grazing and browse at a time when they afford the greatest amount of forage. There must be some system of rotative grazing so that not all pastures are grazed at the same time, but that each pasture is grazed in its proper season. Deferred grazing allows the principal plants to produce a seed crop. The animals are then allowed to harvest the grasses and browse and to tramp seeds into the ground. This should be practiced on at least one-fifth of the ranch area each year. By diversified rotative grazing is meant rotative grazing into which different types and combinations of livestock are grazed in orderly rotation and suc-

cession with a view of making the best of the range and at the same time meeting the requirements of plant growth.

MANAGERIAL SKILL: The skillful manager detects any indication of under or over grazing and he also knows the number, types and classes of livestock which he may run on his various pastures without injuring the vegetation. He may be able to run more animals on his range than his neighbors run because of better judgment as to how to graze his range.

THE FORM OF TENURE: Ranches having the greatest carrying capacity are those operated by owners. The ranches having the least carrying capacity are those which are part owned and part leased. This is due to inadequate improvements and because operators have over-stocked in an attempt to increase their income to make land purchases. Operating entirely on leased land tends toward speculation.

DROUTH: Protracted drouth reduces the percentage of cover and affects the vigor of the remaining forage plants.

OVER GRAZING: Overgrazing may be due to over-stocking with a given type of livestock or with a combination of different types. Evidence of overgrazing can be easily determined by noting the class of plants. A lower class of forage and numerous weeds make their appearance on an overstocked range. The good grasses will be displaced by others, bare spots will appear and the land will become badly erroded.

UNDERGRAZING: Those ranches which are overgrazed by cattle are likely to be undergrazed by sheep. The cattle crop

too closely the vegetation of which they are fondest and leave untouched much of the other vegetation which sheep would utilize. On many ranches there are undergrazed areas due to poorly distributed watering places and improper salting.

BUILDING UP DEPLETED RANGES: The most successful method is to practice deferred grazing along with livestock diversification and if seed is available considerable advantage might be gained by artificial reseeding on certain ranges where it is practicable. The seed can be scattered by hand if carried on the saddle and thrown out when bare spots are passed. This is practiced on a number of ranches. On the forest reserve ranchmen might be permitted to run an economic herd of cattle, enough for one rider to handle, and allow the ranchmen to fence the range with proper drift fences and provide them with long time leases, say ten years. If this is done cattlemen will make an effort to build up the range, remove poison weed and increase the carrying capacity.

PASTURE IN THE PLAINS AND INTER-MOUNTAIN AREA OF COLORADO: Colorado is characterized by two distinct types of range, the great plains and the intermountain type of range. The plains region extends from the eastern border of the state to the foothills of the Rocky Mountains. The region is comparatively level with the northern half draining into the Platte and the southern half draining into the Arkansas River. Altho dry farming is increasing in extent in many parts, the chief industry is livestock production. Failure of cultivated crops is not

uncommon in this region, because of limited rainfall coupled with comparatively high temperature in summer, low air humidity, the prevalence of drying winds, and high evaporation.

The normal annual rainfall averages less than 20 inches, with an annual variation from 7 to 30 inches. In Colorado much of the unirrigated land in the South Platte and most of that in the Arkansas Valley are suitable only for grazing, as is also most of the southeastern portion of the state in which the average annual precipitation is less than 16 inches. Production is determined by the quantity of water available. The lack of available water operates entirely against increasing production by intensive methods. The necessity for reducing production costs thru extensive methods is indicates. Stabilization thru the use of livestock to insure the continuance of the agricultural unit as a going concern thru the poor years, in order that the returns of the good years may be realized, is an indicated necessity. Corn, grain sorghums, wheat, Mexican beans, native sod, bromegrass, and alfalfa, with livestock, is the dominant ranch type indicated. The primary object of cultivation in this section is to produce feed-stuff, with an addition to the income from the uncertain but sometimes heavy crop of wheat and corn produced at relatively small expense as a part of the rotation. The corn is largely replaced by the sorghum in the Arkansas Valley and southward. Less than four per cent of the land in the plains was in harvested crops in 1919. Winter wheat exceeds both spring wheat and corn in acreage in a tier

of counties in north central Colorado.

Table 1. Per Cent of Crop Area Devoted to Crops Named.*

Year	Corn & Kafir	Wheat & Rye	Oats	Hay	Veg.	For-age	Sugar beets	Beans	Crops Acres Thousands
1909	12.1	12.7	10.2	47.8	4.4	3.0	4.0	.2	2692
1919	18.8	24.5	6.1	37.6	1.8	.8	3.1	1.2	5417
	6.7	11.8	-4.1	-10.2	2.6	2.2	-.9	1.0	

*U. S. Census 1920.

CHARACTER OF FORAGE IN THE MOUNTAIN AREAS: The chief forages in the San Luis Valley of Colorado are blue, salt and fescue grasses; Baltic rush, and sagebrush. The grazing season averages from seven to nine months and the area required to support a cow varies from 30 to 40 acres. Other mountain valleys produce the blue, fescue, wheat, brome and redtop grasses; Baltic rush, and "weeds" or miscellaneous herbaceous plants with an estimated carrying capacity of from 15 to 25 acres per cow with a grazing season of three to six months.

VEGETATION OF THE PLAINS AREA IN COLORADO: A change in either the rainfall, the soil texture, the soil depth, the available soil moisture, or the dryness of the air will be accompanied by a change in vegetation, if the other factors remain constant. The quantity of rainfall is greater in the southern than in the norther portion of the plains area and a deeper layer of soil with moisture available for plant growth is produced. But this increase in moisture supply in the southern part is equalized by the higher water requirement. For example, to produce a ton of dry matter, alfalfa required 518 tons of water at Williston,

North Dakota; 630 tons at Newell, South Dakota; 853 tons at Akron, Colorado, and 1005 tons at Dalhart, Texas.*

The profile or depth of soil is not in itself the factor which determines the plant cover. Both the vegetation and the soil profile are determined largely by the same factors, chiefly the parent soil material and the climate. Under the same climatic condition soil texture modifies the profile profoundly. The profile layers lie deeper in the lighter soils and nearer the surface in the heavy soils. The depth of these layers, especially the layer of carbonate accumulation, can be correlated with the plant cover through the medium of available soil moisture. When this difference in depth is due to variation in soil texture the effect on the plant is due both to the change in the water-holding capacity of each unit of soil and the quantity of soil moisture available. A heavy soil will hold one inch of rainfall in the surface six or eight inches. The surface moisture is lost rapidly by evaporation. The soil moisture is readily available to the roots and growth is rapid and luxuriant. The same amount of rainfall would penetrate to a foot or more in sand. Growth would be less rapid since not all of the moisture is available to the roots at the same time and they must be pushed far into the soil to reach the moisture supply. Moisture, within the quantity retained in dryland soils, does not move to the roots through

*The Water Requirements of Plants as Influenced by Environment by L. I. Briggs and H. L. Shantz. Second Pan-American Scientific Congress, Washington, D. C. Dec. 27, 1915.

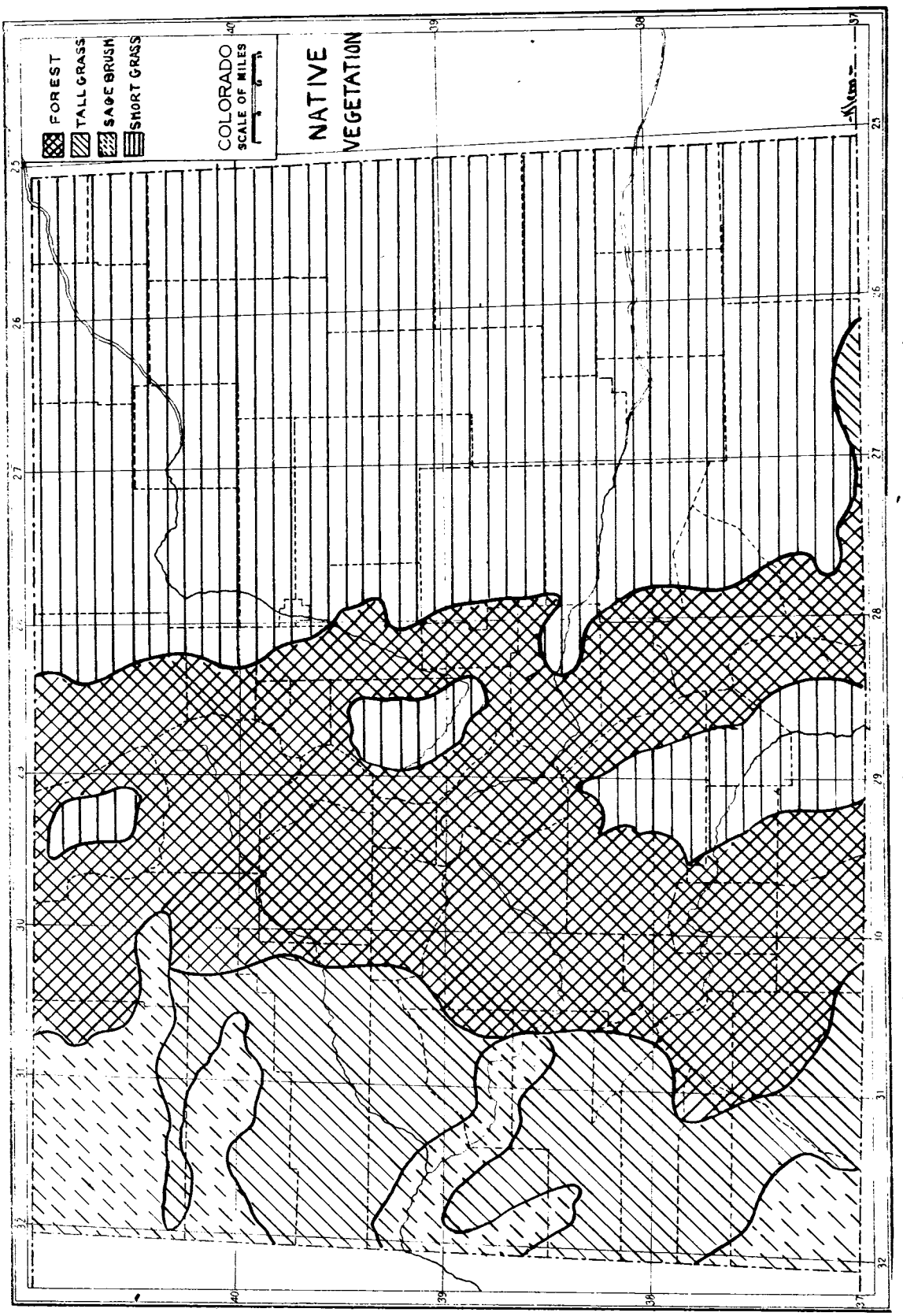


Fig. 2. Map showing the area and location of the three main types of forage in Colorado.

any considerable distance. The roots must therefore grow to the moisture supply. Consequently more time is consumed and drouth delayed much longer in sand than in heavy land. This is true of the cultivated as well as the native crops.

Vegetation has an important reaction on the soil profile. In eastern Colorado the layer of carbonate accumulation develops at 14 to 18 inches under a short grass vegetation. Had there been no vegetation to absorb the soil moisture the layer of carbonate accumulation would never have developed. When the vegetation is destroyed by cultivation the depth of moisture penetration is greatly increased, even if the land is continuously cropped. The depth of soil to the layer of carconate accumulation is a measure of the depth of moisture penetration under the natural vegetation during all but exceptional years. The soil profile affords, therefore, an indirect measure of the condition during normal years. Unless other factors interfere vegetation and soil profiles can be closely correlated.

In outlining areas characterized by different types of vegetation, the occurrence of the type on mature soil, soil with a well developed profile, should first be considered. These types of vegetation are climax types which have come into equilibrium with the soil and climatic conditions. Breaking destroys the vegetation and overgrazing often modifies it profoundly. It is therefore necessary to take these factors into consideration in deciding which type represents the

original vegetation. These precautions are especially necessary in regions where most of the original vegetation has been destroyed. Failures to recognize the stages of succession would often lead to erroneous estimates of the importance of different communities.

SHORT GRASS (Plains Grassland): The typical appearance of this grassland as a whole is that of a closely pastured meadow. Except during years of more than normal rainfall the taller growing plants are almost entirely absent, and the vegetation presents the appearance of extreme monotony. There is very little variation in appearance from north to south or east to west. Changes in the vegetation within the area are due largely to difference in soil texture, run-off or flood water irrigation which affect the available soil moisture supply. The transition to the tall grass formation is gradual on the east where many of the taller plants occur. On the west many species characteristic of the foothill region enter and modify the pure short grass cover, which is characteristic of the central portion of the area.

In spring the short grasses start growth as soon as the temperature conditions are favorable. Many flowering plants vary the monotony of the short grass cover. If the season is unusually dry these plants may fail to put up flower stalks. If the season is unusually moist annuals and herbaceous perennials often become a prominent component of the vegetation. By far the most important plant is grama grass (Bouteloua

gracilis), which occurs throughout the extent of this formation. Buffalo grass (Bulbilis dactyloides) is much more important than any other species with the exception of grama grass. Wire grass (Aristida longiseta) and mountain sage (Artemisia frigida) also dominate small areas, the former on the extreme eastern border of the state and the latter bordering the foothills. Over grazing or breaking destroys the plant cover and initiates a succession leading to the reestablishment of the original vegetation. This succession varies somewhat in different parts of the area. The following stages may be recognized: (1) an annual weed stage, (2) a perennial stage consisting chiefly of mountain sage or wire grass, all valueless for grazing, (3) the short grass reestablished in a period of 30 to 60 years.

As a rule the vegetation starts growth when suitable temperatures occur in the spring. The frost-free period is from 120 days along the north foothills section to 160 days in southeastern Colorado. Seasonal growth although usually initiated by suitable temperatures, is seldom terminated by low temperatures. The more important sections that are favored by earlier springs and later falls and, consequently, longer growing seasons than normal for the latitude, are the Arkansas Valley in southeastern and the upper South Platte Valley in northeastern Colorado. The rainfall decreases from east to west and from south to north, ranging from 12 inches to more than 20 inches in the higher parts of the Arkansas-Platte

Divide. More than 75 per cent of the annual rainfall occurs between April first and October first. There is also a decided tendency toward drouth in June. The part of the Arkansas Valley east of the mountains, in common with the rest of eastern Colorado, is occasionally visited by dry spells lasting several weeks at a time. The records of the Pueblo station show that since June, 1888, there have been 48 periods of 20 to 60 days without a measurable amount of precipitation, 21 periods of 20 to 62 days during which the precipitation was 0.01 inch, and 26 periods of 20 to 65 days during which precipitation of 0.01 inch occurred twice. These dry spells are most likely to occur in autumn and winter, which have a total of 35 and 38 times respectively, as against 12 in spring and 10 in summer.

The moisture available for growth in this formation at the beginning of the growing season seldom exceeds that held in the first one or two feet of soil, of the equivalent of two to three inches of rainfall. The stored moisture and the rainfall of spring and early summer enable growth to continue until early in July. At that time practically all the stored water and that added by the rains has been consumed. The plants then pass into a douth-rest condition which may be broken occasionally by summer or fall rains. During exceptionally wet years, growth may continue almost without interruption throughout the whole season. In extremely dry years, the period during which moisture is available in the soil may be so short

that even buffalo grass, which can flower within 30 days, is prevented from flowering. The dominant species of this formation are without exception drouth-enduring plants. They are able to grow rapidly during periods when moisture is available and to pass into a dormant condition when drouth occurs. They resume growth quickly when moisture is again supplied. The majority of the annuals can ripen seed during a very short season of growth and are able to produce a few seeds even during the drier years. By this formation we may recognize the following principal plant associations: Grama grass, grama and buffalo grass, grama and western needle grass, wire grass, western wheat grass, grama grass and mountain sage, grama and Muhlenbergia. (See Fig. 3)

The grama grass association in Colorado forms only a narrow band near the foothills section. This grassland occupies a soil which is very shallow, ranging in depth from 8 to 18 inches to the layer of carbonate accumulation, below which is a permanently dry subsoil. The soil moisture available during normal years is equivalent to from one and one-half to two and one-half inches in rainfall, the supply being replenished by occasional rains during the period of plant growth. The growth period is generally terminated by drouth. It is excellent grazing land with a carrying capacity of from 15 to 30 cattle per section. During years of more than normal rainfall, land characterized by this association produces excellent small-grain crops.

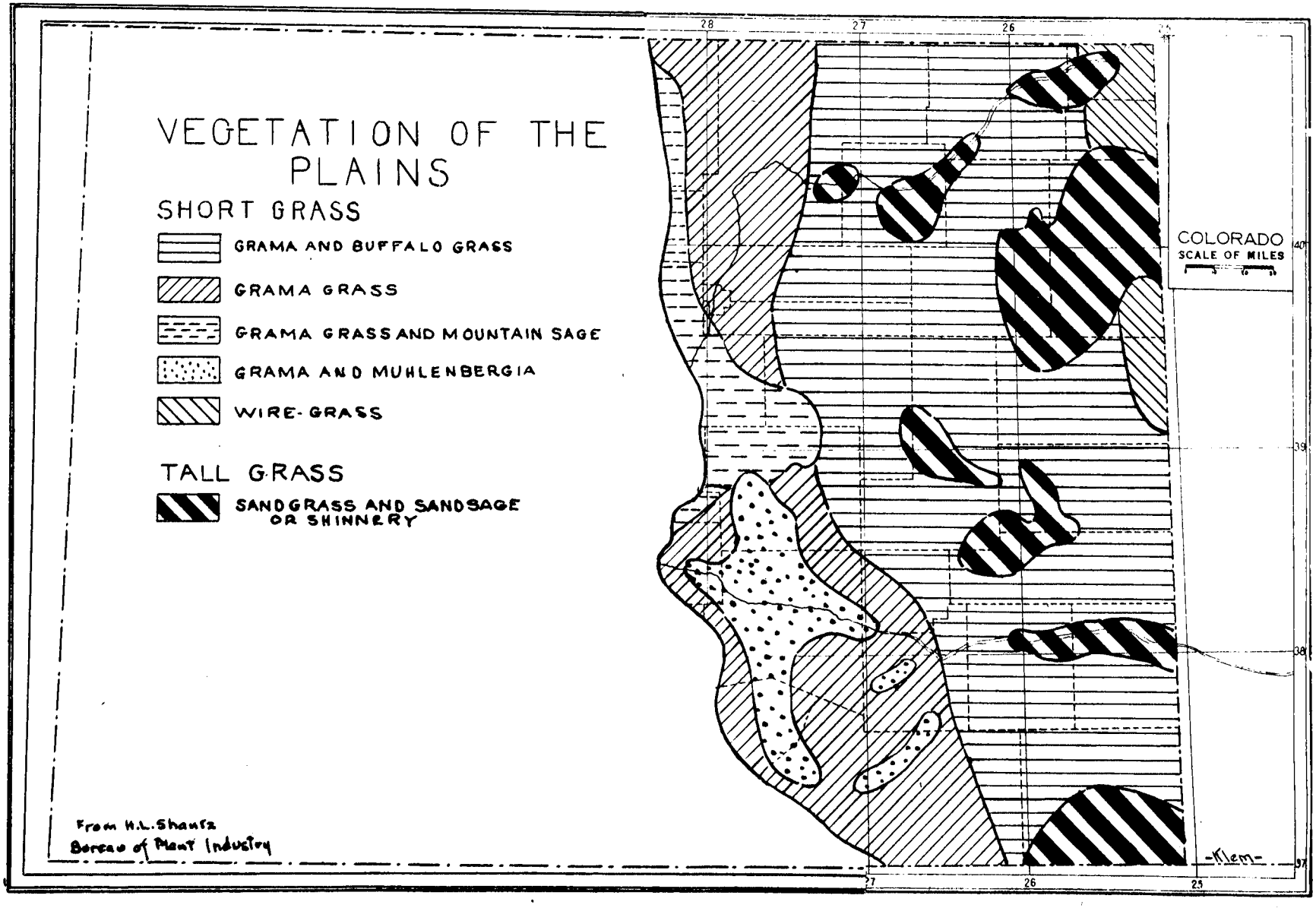


Fig. 3. Map showing the principal plant associations in the Plains area of Colorado.

GRAMA AND BUFFALO GRASS ASSOCIATION: The grama and buffalo grass association is typical of the Colorado plains. The plant cover is often uniform and covers the ground with an open or dense mat like growth. During wet years the short grass flowers and many annuals and perennials become prominent in the plant cover. The rainfall over this area is somewhat higher than over the grama grass area and ranges from 15 to 20 inches. Evaporation measurements vary from 35 to 55 inches. The soil is not as shallow as under grama grass, the depth to the layer of carbonate accumulation ranging from 14 to 18 inches. The soil moisture stored in the soil at the beginning of the growth season amounts to the equivalent of from two to three inches, except during abnormally dry or abnormally wet years. Alfalfa to produce a ton of dry matter requires in this association in eastern Colorado about 800 tons of water. The frost free period is from 120 to 160 days in duration. The period of growth, however, is often as short as from 30 to 60 days on account of drouth. Soil moisture records for the native vegetation extending over a period of nine years at Akron, Colorado, show available moisture in the third foot of soil only once during this period. During several years no available moisture was recorded in the second foot. This association furnishes excellent grazing land with a carrying capacity of from 20 to 40 head of cattle per section. Crop production is good during years of more than normal rainfall. Small grains do fairly well in medium or wet years, but fail in dry years.

Sorghum and short season corn are grown.

WIRE GRASS: The wire grass association is an abbreviated name for what in full should be grama and buffalo and wire grass association. The ground is covered by a mat of short grasses. Overtopping this mat the wire grass and other taller plants may become so dense as to obscure the short grasses entirely. The soil is much deeper to the layer of carbonate accumulation than in the grama and buffalo grass association. The soils are chestnut brown with the layer of carbonate accumulation at a depth of from 18 to 30 inches. Rainfall is approximately 18 to 22 inches and the evaporation from 40 to 55 inches. The quantity of water stored in the soil at the beginning of the growth season is greater over this area than over the grama and buffalo grass area and may amount to the equivalent of from two and one-half to three and one-half inches of rainfall. Water is not stored from one season to the next and almost every year the entire available supply is exhausted during the month of July when the plants pass into a drouth-rest condition.

As grazing land this is a little better than grama and buffalo grass. Much of the land in this area is crop land. The principal crops are corn, winter wheat, barley and the grain sorghum farther south. This region is one in which crop production is unusually good during favorable years but in which crop failures are the rule during years of less than normal rainfall.

GRAMA GRASS AND MOUNTAIN SAGE: Along the mountain front grama grass is often mixed with a great variety of plants which are more typical of the mountain grasslands. The soils are often not well developed but consist of loose granitic gravels. Where land is level and favorable for cultivation conditions are much better than in the grama grass areas farther east. Small grains are the chief crops grown in this area. As grazing land it will carry from 20 to 30 cattle per section.

GRAMA AND MUHLENBERGIA: Near the mountains conditions become so extreme as to temperature and drouth that grama grass gives way to Muhlenbergia gracillima. With this often occurs the cane cactus (Opuntia arborescens). This association characterizes land of inferior production, even as grazing land, and of doubtful value for crop production.

TALL GRASS (Prairie Grassland): This area is dominated by tall, luxuriant and relatively deep-rooted grasses. With these are associated a large variety of herbaceous flowering plants. During spring the prairie is a veritable flower garden, but grasses are dominant over the whole area. They never produce the low mat-like cover characteristic of the plains grassland, but a bunch-like growth. The prairie is a relatively tall wheat grass or bluestem grassland, while the plain is a short buffalo and grama grass land. In general appearance the vegetation of the plains resembles a closely pastured field, while that of the prairie resembles a relatively luxuriant meadow. There is only a relatively small area of the tall

grass in Colorado. (See Fig. 3)

SAND GRASS AND SAND SAGE: In regions where the rainfall is low and the evaporation high, but where the soil is very light in texture, there occurs an associes very similar to the bluestem bunch grass association. Sand grass (Calamovilfa longifolia), sand sage (Artemisia filifolia), bluestem bunch grass (Andropogon scoparious), and a large number of other grasses characterized the area. This associes represents an early stage of vegetation on sand hills which will give way gradually to bluestem bunch grass when the soil has been stable and somewhat heavier in texture. The conditions here are not as favorable for plant growth as in the bluestem bunch grass land, the soil being light, sandy and poor in nutrient material. Since this soil is loose and sparsely covered by vegetation it allows deep penetration of the rain water, some of which is lost to the subsoil, as is shown by the permanent streams which flow from such areas. The vegetation on this sand land continues to grow long after the plants on the adjacent hard land have dried out. In the sand hills of Eastern Colorado much of this land has come under cultivation. Fairly good crops of corn and sorghum are produced. Occasionally on the heavier land wheat is grown, but as a rule danger of soil blowing is too great. These areas are principally valuable for the production of forage. During the early days before the adjacent hard lands were occupied by farmers it was customary to save

the sand hills grazing for periods of snow falls when it was impossible to graze the short grass on the adjacent lands.

PROPER UTILIZATION OF VEGETATION.

The stockman is faced with the problem of fences when handling the feed situation in the most economical and profitable manner. Many ranchmen prefer small pasture fences so that they may practice pasture rotation or deferred grazing, but the majority of the range is only under a few large pastures and the stock is allowed to run at random and make choice of feeds, which frequently results in a shortage of the best or most palatable forage for winter use. In most cases, however, the winter grass is segregated from summer grass and not utilized until the proper time.

Under present conditions the tendency is not to stock the ranges at their maximum carrying capacity but at the rate that the grama and other grasses will carry through the year. The reason for this is that these grasses are the principal winter feed and the pastures are stocked according to the number of head that can be wintered or carried through a periodic drouth. On the prairie ranches where year-long grazing is practiced the actual number of animal units, grazed per section was 41 cow units per section in 1922. This varied from 17 cow units to 68 cow units per section. In the latter case there would be serious over grazing during a period of drouth.

If the pastures were so divided that all the summer types

of forage plants were utilized when palatable, and the winter curing types were saved, many more head could be run per section. Many cowmen could increase the carrying capacity by allowing sheep on their ranges, but sheep are not allowed on their ranges. These men are laboring under false impressions, and are merely losing that revenue which would be theirs by addition of this class of livestock. They can not get the most returns per section of land until all classes of vegetation are utilized. A few ranchmen in the San Luis Valley are successfully running cattle, sheep and goats on the same range, during fall, winter and spring. During the summer the sheep are run three months on the high forest range which is not adapted to cattle grazing.

The pasture should be so stocked that there will be a sufficiency of forage for a carry-over during a periodic drouth and through the winter, especially in the southeastern section of the state, without much supplementary feed. The practice is to allow 100 pounds of cottonseed cake per cow but this can be reduced to a few pounds per head with the proper utilization of grass. The rate of carrying capacity will have to be determined by the ranchman himself through his experience in that locality, since the climatic conditions of Colorado vary so greatly. These conditions vary to such a degree that different conditions are found in adjoining counties, and in many areas within these counties.

PASTURE ROTATION: It has been thoroughly and often demonstrated that with continuous grazing of any grass, it will survive for a period of three or four years only, depending somewhat on the amount of rainfall before it begins to decline or die out. This is caused by the fact that the grasses do not have an opportunity to re-seed. Stock preferring the choicest of the grasses will keep them cropped to the ground, thus giving opportunity for injurious and lower order of grasses and weeds to appear and thrive. It is only on over grazed areas that we find loco, larkspur, and many other injurious weeds giving the stockman trouble.

If a range is cut into pastures, different pastures can be given a season or two of rest; that is, defer grazing for a season or two seasons at least until the grasses have matured their seed. In Colorado the cattle can be kept off the pastures until the first of Autust with surprising results. This will greatly increase the carrying capacity of any range by not only allowing the old grasses to get a new start from the root system, but also grass that comes from the seed. A pasture which has been permitted to re-seed itself will carry from one-fourth to one-third more cattle on the same area than before.

SIZE OF RANCHES.

CHANGES IN SIZE OF RANCHES: The westward movement of crop farming into Colorado has been retarded by the ownership of the land by wealthy cattlemen, but the ranches are now being broken up and sold off in family sized parcels. Probably the greatest agricultural problem in the grazing area is the reorganization of the ownership of the land into economic units neither too small nor much too large for the support of a family. One man can handle approximately 6,000 acres of prairie land and 1700 to 2000 acres of mountain valley land which will carry approximately 450 head of cattle. The area of these ultimate ranch units will vary with the physical conditions, the distance from railroad, and the capacity of the ranchman, but will tend to approximate a gross production per ranch equivalent to $4,000 to $5,000.

The size of ranches is ordinarily measured in sections of land. Such a measure of size is ample if one is concerned primarily with area. If one wishes to speak of the size of ranches in terms of production of ranch products, then he must think in terms of unit of area multiplied by the carrying capacity or production of that area. The most important idea to get out of this is what is the most efficient size ranch in a particular locality. This depends upon a number of factors, such as the amount of money or capital invested, the physical factors, such as topography, soil, climate, distance from market

and natural vegetation; the management ability of the ranchman, and lastly, the political factor.

The size of ranch that produces the lowest cost of production in the long run is the one which is most efficient. This varies in different sections. In Eastern Colorado the 8-10 section ranch proves to be the best size, while in the mountain areas of the state about 2,000 acres, containing both hay and pasture land. The following table gives an idea of the size of ranches in four important beef producing counties.

Table 2. Size of Ranches in Four Important Beef Producing Counties in the West. 1/

Size of Ranch in Acres	Number of Ranches in 1920			
	Cochran County Tex.	Hockley County Tex.	Jackson County Colo.	Cherry County Nebr.
0- 3	---	---	1	1
3- 9	---	---	---	3
10- 19	---	----	---	1
20- 49	---	---	---	9
50- 99	---	---	---	20
100-174	---	---	29	74
175-259	---	---	9	45
260-499	---	1	32	220
500-999	1	4	43	477
1000 plus	13	13	68	814
Total number ranches	14	18	182	1664
Average acres per ranch	30,234	22,740	1,287	1,792
Per cent of ranches operated by tenants	14.3	16.7	6.6	20.2
Average improved acres	185	179.7	513.6*	355.7

*Largely irrigated land used in production of native hay for winter feed.

1/ U. S. Census 1920.

The above table brings out the fact clearly that the present land classification system used by the United States Census does not cover ranches at all. The land in Jackson County as shown above is nearly all irrigated and represents the winter range used by cattlemen, who use the forest ranges for summer grazing. The 513 acres of improved land is all native hay. It requires about three to four acres of the type of land represented in Jackson County to carry a cow, while it requires about ten acres per head in Texas areas.

RANCH CAPITAL.

Ranch capital is divided into several heads: land, improvements, machinery and equipment, productive livestock and work stock. In addition, money may be needed for working funds. Capital is defined as wealth, other than land, which is used by its owner to secure an income rather than for direct enjoyment, according to economists. The per cent of investment in various classes of capital varies a great deal on a given ranch, on a leased ranch where no capital is invested in land the percentage of capital invested in cattle may be as high as 95 per cent. The average investment per ranch on 15 ranches studied in the plains area in Colorado in 1923 was $103,916, 50.8 per cent of which was in owned land, and 39.4 per cent in cattle. The average investment per acre of owned land amounted to $15.09. The investment in land, buildings, equipment, and livestock amounted to $80.23 per cow. The average ranch

had 36 miles of fence worth $94 per mile. New fence cost $150 to $250 to build.

DISTRIBUTION OF INVESTMENT PER RANCH, PER ACRE AND PER COW: The average investment on 26 mountain ranches studied in 1923 was $132,410, 48.2 per cent of which was in owned land, 36.1 per cent in cattle, 6.5 per cent in buildings, corrals and water improvements, 2.9 per cent in fences, 1.9 per cent in work horses, 1.9 per cent in homes, used for personal use of the ranchman, 0.7 per cent cattle equipment; 0.8 per cent farm equipment, 0.2 per cent in horse equipment, and 0.9 per cent in hay equipment. These ranches averaged 10,146 acres in size, of which 8,218 acres were in grazing land and 1,437 acres in hay or crop land. The owned pasture land was worth $8.40 per acre while the hay land was worth $33.75 per acre. Leased land averaged $.22 per acre for grazing land and $1.22 for hay meadows. The average yield of hay is approximately one ton to the acre. Seventy-two per cent of all land operated was owned, the balance was mostly leased state land with some leased from private parties. The leases ran from eight cents per acre to 33 cents per acre. There are wide variations from the above depending upon the amount of deeded land and the system of ranching practiced. (See table 3)

Table 3. Distribution of Investment per Ranch, Per Acre and per Cow.

26 Mountain Ranches in Colorado, 1923.

Capital invested in:	Investment			
	Per Ranch	Per Acre of owned land	Per cow unit	Pct. of total
Owned land (without improvements)	$63,835	$11.87	$51.37	48.2
Buildings, corrals, water system, etc.	8,594	1.59	6.92	6.5
Fences	3,848	.72	3.10	2.9
Productive livestock	47,784	8.89	38.45	36.1
Work stock, saddle and work horses	2,491	.46	2.00	1.9
Cattle equipment	991	.19	.80	.7
Farm equipment	949	.18	.76	.7
Horse equipment	295	.05	.24	.2
Hay equipment	1,124	.21	.90	.9
Residence, personal	2,499	.46	2.01	1.9
Totals	132,410	24.62	106.55	100.0

On an average prairie ranch in Colorado made up of 3,500 acresof leased land and 12,000 acres of deeded land it requires about $80,000 in capital which will be distributed as follows: 45 per cent to deeded land, 9 per cent to improvements, 2 per cent to equipment, 2 per cent to work stock and 42 per cent to productive livestock,mostly range cattle.

On a typical mountain ranch of 2,000 acres of leased land and 3,000 acres of deeded land, mostly hay meadow, the total capitalization will run $125,000, 45 per cent of which will be in deeded land, 10 per cent in improvements, 3 per cent in equipment, 2 per cent work stock and 40 per cent in range cattle.

Table 4. Distribution of Capital Invested in Cattle Ranches in Four Important Range Cattle Counties in the West.*

Items	Jackson County Colo.	Cochran County Tex.	Hockley County Tex.	Cherry County Nebr.
Value of land and buildings per farm	$31,214	$126,145	$105,541	$27,203
Implements & machinery	1,062	1,266	1,555	844
Livestock	15,321	100,987	60,779	7,958
All property	47,597	228,398	167,875	36,045
Value of land alone per acre	22	4	4.50	14

*U. S. Census 1920.

The following table gives an inventory of livestock together with the acres of cereals per ranch in Jackson County, Colorado, compared with three typical livestock counties in the West.

Table 5. Livestock and Crops per Ranch in Range Country.*

	Jackson County Colo.	Cochran County Tex.	Hockley County Tex.	Cherry County Nebr.
No. work stock per ranch	18.55	23.9	19.85	14.8
No. Dairy cows 2 yrs. plus	3.00	.5	.16	2.18
No. swine all ages	1.47	9.28	9.56	13.
No. sheep all ages	5.16	---	---	3.67
No. chickens	22.05	45.9	63.6	50.4
Improved acres per work stock	27.7	7.7	9.1	24.0
No. beef calves less than one year	68.1	163.	297.	26.
No. heifers 1-2 years	29.8	206	263.6	12.3
No. cows 2 years plus	94.7	1,110	280.5	44.7
No. steers 1-2 years	28.6	---	112.	12.5
No. steers 2 years plus	17.0	15	205.7	16.8
Bulls one year plus	4.28	42.2	19.2	1.65
Total No. beef cattle	242.6	1,536.2	1,117.8	114.
Acres all cereals per ranch	1.12	33.8	35.3	54.
Acres corn	---	13.5	16.3	33.8
Acres wheat	.01	---	---	4.06
Acres oats	.62	---	---	6.16
Acres hay	468.0	98.8	12.7	271.0

*U. S. Census 1920.

CASH EXPENSES PER RANCH: Considerable capital is required merely to take care of the cash operating expenses on the average ranch as shown in the following tables.

Table 6. Cash Expenses per Mountain Ranch in Colorado, 1923.*

Items of Expense	Cattle expense per ranch	Hay expense per ranch	Total expense per ranch	Per cent of total
(1) Labor costs				39
Hired labor	1526.54	2444.88	3971.42	
Board	313.50	324.65	638.15	
Groceries & fuel	109.65	92.96	202.62	
(2) Interest paid	2445.77	32.23	2478.00	20
(3) Taxes	930.04	523.50	1453.54	12
(4) Feed purchased				9
Concentrates	170.15	85.85	256.00	
Roughage	806.12	46.31	852.42	
(5) Land Leases and pasture rents	617.92	147.08	765.00	6
(6) Misc. - inspecting, marketing, legal, etc.	408.68	78.54	487.23	4
(7) Repairs				3
Irrigation system	---	31.23	31.23	
House	48.54	---	48.54	
Fence	76.54	1.62	78.15	
Other machinery	10.81	189.73	200.54	
(8) Forest reserve grazing fee	250.50	6.38	256.89	2
(9) Automobile expense	166.15	67.31	233.46	2
(10) Salt	104.50	.62	105.12	1
(11) Vaccine	66.58	---	66.58	1
Veterinary & dip	11.12	3.73	14.85	
(12) Water	---	72.69	72.69	1
(13) Seed	---	47.12	47.12	
(14) Hardware	23.92	19.31	43.23	
(15) Telephone	32.96	7.15	40.12	
(16) Insurance	34.77	3.15	37.92	
(17) Threshing, twine and sacks	---	23.73	23.73	
(18) Blacksmith	3.88	6.54	10.42	
(19) Association fees	10.15	---	10.15	
(20) Oil, gas	---	8.77	8.77	
	8168.79	4265.08	12433.89	

*Average size 10,146 acres of which 8,218 acres were in grazing land and 1,437 acres in hay or crop land.

Table 7. Cash Expense per Prairie Ranches, 1923.*

Items of Expense	Per Ranch	Per cent of total
Interest paid	2852.87	30
Land leases	1411.26	15
Labor charges:		18
Hired labor	1375.53	
Board for labor	265.66	
Groceries and fuel	76.46	
Taxes	1346.33	14
Feed purchased:		
Concentrates	1240.33	15
Roughage	126.20	
Automobile expense	205.06	2
Repairs:		
Machinery	58.47	2
Fence	55.47	
Irrigation system	13.80	
House	3.40	
Miscellaneous:		
Travel, legal, etc.	104.60	1
Veterinary and dip	76.60	1
Vaccine	74.06	1
Salt	69.06	1
Insurance	39.20	
Hardware	29.60	
Blacksmith	26.00	
Oil and gas	23.80	
Seed	21.27	
Telephone	11.87	
Association fees	8.06	
Total ranch expense	9514.96	

*Average size of ranch was 20,618 acres of which 217 acres were in crop land.

RANCH TENURE.

COLORADO RANCH TENANCY AND LEASING: Federal census data covering the past forty years show that the practice of renting ranches by owners to others for ranching purposes is practiced to some degree in Colorado. In 1920, 6.6 per cent of the ranches were operated by tenants in Jackson County, Colorado, which is practically 100 per cent cattle ranching.

ECONOMIC ADVANTAGES AND OBJECTIONS: The more outstanding economic advantages of tenancy are set forth as follows:

1. Opportunity to engage in ranching with limited capital.

2. Partly solves the problem of obtaining suitable and sufficient ranch laborers.

3. Utilization and hastened development of land otherwise not likely to be grazed such as brush ranges and hill lands, large estates awaiting subdivision, and lands poorly situated as to soils, water conditions, climate, towns, and markets.

4. Augmenting of land values through tenant activities.

5. Increased financial prosperity to community and to land owners.

The main economic objections to tenancy are:

1. Tendency toward range and soil deterioration and overgrazing.

2. Poor ranching methods.

3. Neglect of land, buildings and equipment, partly traceable to the failure to give the tenant security in his rights to unexhausted improvements.

4. Sending earnings out of the community in some cases.

5. Postponement of the subdivision and sale of large holding.

6. Retardation of cooperative movements.

Tenancy is a good thing economically for the locality where it occurs, and in its total effect upon the state as a whole, provided it is an adjunct to and not a substitute for ownership.

Socially it is good in so far as it represents the entrance into ranching of worth while people, worth while from the standards not only of social value but of a permanent ranching, who will build up the country and furnish the brawn and brains so necessary to American progress.

TENANCY OF THE FUTURE: According to the general feeling of well informed cattlemen throughout the state, the concensus of opinion is that in the future tenancy should be excluded in cases where it is possible to subdivide large ranches, and sell fairly to bona fide purchasers. Whether the future shall include or exclude tenancy is closely linked with the question whether lands can be divided and sold or must continue in the hands of tenants. Sentiment or business acumen may result in the owner's wish to retain his property, but the feeling in most livestock communities is that subdivision and sale is preferable to tenancy in that ownership by operator makes for stability of interest, permanency of ranching, and marked improvement in ranch practices.

Reasons why tenancy is not a stepping stone to ownership are set forth as follows:

1. The relatively low prices for ranch products.

2. High prices asked for suitable or desirable hay and ranch lands.

3. Difficulty of borrowing money except upon tangible assets, in other words, insufficient command of capital to make the first payments, often substantially heavy.

4. High costs of production where labor must be hired or materials purchased.

5. Operation of federal income tax which causes owners to postpone selling.

Suggested changes and recommendations for improvement follow:

1. Use of the stock-share lease method instead of the cash basis.

2. Insistence by owners upon better ranching methods.

3. Ranch units of a size which will insure use of the best possible ranching practice, including greater intensity and diversification.

4. Guarantee of possession and long time leases so that tenants may make improvements.

5. More binding and enforceable contracts.

6. More interest by owners in maintaining, if possible, the hay producing, crop producing power and carrying capacity of the land.

7. Supplying by tenant with sufficient working equipment, particularly livestock, to insure his interest and to increase his responsibility.

GENERAL OBSERVATIONS: The renting and leasing of many Colorado ranch lands follow certain general rules based on long time custom or local practice. Leases are the result of bargaining between prospective tenants and owners. They therefore reflect the bargaining ability of the respective parties. Lack of uniformity in size, productive capacity, equipment, location, and operating costs of ranches, coupled with the personal characteristics of landlord and of tenant

require that each lease be largely treated as an individual case. The terms of payment for property vary through wide extremes because of the great difference existing in soil types, topography, crop producing power, and carrying capacity of grazing lands, distance to market, and amount and condition of improvements.

Terms cover not only rentals in cash or crops but improvements asked of the tenant, such as seeding of alfalfa or native hay, leveling land, clearing of sage brush and timber, putting in ditches and drains and construction of buildings. Provisions governing rights, and reservations by both parties depend on the type of ranching involved. The integrity of both parties is a factor in drawing up of leases. The more valuable the investment the more carefully are provisions included to insure the upkeep and care of buildings or equipment.

HAY LAND OR HAY RANCH LEASES: The share rent usually runs one-half to landlord where he furnishes land, buildings, water, work stock, implements, and occasionally one-half the feed. Because of the demand for something of a definite form, a sample lease is here inserted. It provides a skeleton outline in which all agreed details can be inserted.

HAY RANCH LEASE.

This agreement made and entered into by and between_____ _____, second part the following described premises situated in the County of _____ and State of _____, to wit:
(Insert property description) (give description of land) all

in Township_____, Range _____ in _____, together with all ditch rights, water-rights and irrigation privileges to said land belonging or in any way appertaining to said land for the term of _____ year, commencing on the first day of ___ _____,19__, and ending the first day of _____, 19__ and thereafter from year to year upon the written consent of both said parties hereon endorsed, at the annual rental of an undivided one-half of the total crop production of said premises, both hay and pasture, the disposal of each year's crop to be agreed upon by the parties hereto in the fall of such year.

The said part___ of the second part, Lessee, agrees as follows:

1. To thoroughly ditch, irrigate and care for said premises in such a manner as to produce the largest hay crops. 2.To properly harvest and protect the crop so that same shall have the largest possible value; and if the crop be not properly harvested and cared for, then first part___ shall have the right to enter upon the premises and have the crop harvested and cared for at the expense of second part___. 3. To keep all improvements and equipment on the premises in good condition and repair. 4. To use said premises for no purpose that would be in any way injurious to same, or to the disadvantage of the owners. 5. To properly guard and protect said premises against loss by fire or otherwise, and against the removal of any property belonging with or to said premises, and against loss or injury to crops by allowing livestock or strays in the fields. 6. That no timber on said premises may be cut or used except with the written consent of said first part___. 7. That the premises may not be sublet or assigned without the written consent of said first part___. 8. That the premises shall be kept clean and tidy, and that accumulations of manure shall be hauled out and spread upon the meadows. 9. That said second part___ accept the premises and improvements as they now are. 10.That breach by second part___ of any of the covenants herein contained shall terminate this lease. 11.That at the expiration of this lease, or termination of same under the preceding section, second part___ will without further notice quit and surrender the possession and occupancy of said premises in as good condition as careful use and natural wear and decay thereof will permit.

It is further understood and agreed that this lease is subject to sale of the premises by said first part___ and in case of such sale being made this lease shall terminate upon notice of such sale being given to said second parties; provided, that in case of such termination of the lease second party shall be reasonably paid by first part___ for any work actually performed by said second part____ toward the making of the next crop.

It is further undetstood and agreed between the part____ hereto that said premises have not heretofore been kept in good condition and repair and for this reason much special work will have to be done, such, for instance, as new fencing for a summer pasture, repair or rebuilding of barn, etc. It is agreed that these matters as they come up may be arranged under separate agreements.

In witness whereof the parties hereto have hereunto subscribed their names and signed a duplicate this _____ day of _____ 19___.

_____(Seal)

_____(Seal)

_____(Seal)

Witness:

_____

LEASING LIVESTOCK RANGES AND RANCHES: The majority of ranges and livestock ranches are leased for cash, the owner furnishing land, sometimes building fences, and stock water. There is much variation in character of the land, from swamp or overflow to sparsely covered rolling hills or rocky, precipitous mountain lands, in leasing rates, in length of leasing and in size of holdings. Carrying capacity varies widely in different parts of the range country, as do the extent, nature and value of the improvements. Holdings vary in size from one section to several thousand acres. Cash rates run from five cents to as high as two dollars an acre a year. Length of leases is from one to fifteen years, with a goodly number of two, three and five year leases. Annual leases are not particularly suited to most phases of livestock handling and hence are

not favorably considered unless the range is in addition and secondary to hay land. Rents are usually payable annually in advance.

A number of ranchmen practicing diversification run both sheep and cattle. Following is a specimen from a widely used sheep contract where ranchmen run sheep on shares.

SHEEP CONTRACT.

This contract, made and entered into in duplicate this _____day of _____ A. D. 19___, by and between _____ _____Party of the first part, and _____ Party of the second part,

WITNESSETH: That in consideration of the mutual covenants and promises hereinafter contained, the parties hereto have agreed as follows:

1. The party of the first part, being owner_____ of the following described sheep, has _____ this day delivered to part___ of the second part_____ head of prime breeding ewes and _____head of ewe lambs, all marked with the following paint mark " " and ear marked as follows: To be held by said part___ of the second part in accordance with conditions and provisions hereinafter contained. 2. That this agreement shall continue and be in force for a period of _____ years from the date hereof, unless sooner cancelled and revoked by part_____ of the first part, as hereinafter provided. 3. Part___ of the second part agrees to care for said flock of sheep in accordance with the custom of the best sheep men in this locality, for the term of years covered by this contract, subject to the general supervision and direction of part___ of the first part. No sheep shall be run with said flock except the above described flock and their increase. Part___ of the second part shall earmark and paint brand described above and shall also paint brand the entire flock after shearing or as often as may be necessary. Part___ of the second part shall keep a record of the number of sheep in said flock at all times, the increase thereof and the number that die and the cause thereof, No sheep, pelts or wool shall be sold by part___ of the second part, without the consent of the part___ of the first part. 4. Part___ of the second part agrees to pay all expenses of lambing, feeding, shearing, herding and all other expenses necessary for the proper care of said sheep, except where herein otherwise provided. 5. Part___ of the first part agrees to

furnish a sufficient number of bucks for said flock and to care for same when they are not in the flock and to pay all taxes upon said flock. 6. The following items of expense shall be paid by the part___ hereto in ecual parts:

(a) The cost of wool sacks.
(b) The delivery of the wool.
(c) Forest reserve grazing fees.
(d) Grain and other feed for the bucks whil in the flock.
(e) The cost of hay, pasture or other feed for the sheep.
(f) The cost of dipping said flock.

7. Such hay, pasture and other feed as the part___ of the first part deems necessary shall be purchased under his direction for said flock. 8. Said sheep shall be dipped for scab, ticks, or other physical ailment when part___ of the first party shall so direct. 9. That part___ of the first part reserve_ the right to cancel this contract and to take possession of said flock of sheep when, in his judgment, the said part___ of the second part___ is not taking proper care of said sheep or is neglecting the same. If such cancellation takes place before November 1st of any year, the part___ of the second part shall receive a reasonable compensation for the care of said flock from the preceding November 1st to the date of said cancellation less any loss suffered by part___ of the first part, caused by such neglect. 10. Part_of the first part reserve_ the further right to cancel this contract on the first day of November of each year and to take possession of said flock. 11. In the fall of each year the breeding ewes shall be mouthed and there shall be taken from said flock all ewes with broken mouths and all ewes that may be too old for breeding purposes. A sufficient number of ewe lambs shall then be left in the flock to make up and maintain the original number of head of sheep in said flock, consisting of _____ head of prime breeding ewes and ___ head of ewe lambs and in the discretion of the part___ of the first part there may be left an additional number of ewe lambs to provide against future losses from said flock. The old ewes removed from said flock, as above provided, and the balance of the lambs shall then be sold. 12. Part___ of the second part shall deliver the wool clip to the town of _____ and shall also deliver at the town of _____ the pelts of all sheep that may die. 13. The proceeds from the sale of wool and pelts, and from the sale of the old ewes and lambs shall be divided equally between the part___ of the first part and the part___ of the second part, but there shall first be deducted from the share of the part___ of the second part all items of expense hereinafter provided to be paid by him, and all sums advanced to the part___ of the second part, by part__ of

the first part, and all bills of part___ of the second part guaranteed by part___ of the first part. 14. At the expiration of this contract, or in the event of cancellation as above provided, the sheep then held by part___ of the second part shall be mouthed and all ewes with broken mouths and all ewes too old for breeding purposes shall be taken out and first part___ shall receive _____ head of prime breeding ewes and _____ head of the best ewe lambs. Any surplus of ewes or lambs and all old ewes so removed from the flock shall then be divided equally between the parties hereto, provided first part___ shall have the option to purchase at the then prevailing market price the share of the part___ of the second part.

IN WITNESS WHEREOF, the parties hereto have hereunto set their hand and seals this day and year first above written.

_____(Seal)

_____
Part__ of the first part

_____
Part__ of the second part

GENERAL PROVISIONS COMMON TO RANCH LEASES: Certain provisions are common to all leases. Outstanding in careful wording and frequent appearance is the provision for insuring payment of rents in full and complete accordance with the stipulations of the lease. The lease sets forth the amount of rent, and when, where, and how payable. Cash rents are usually specified as stated amounts, usually payable either annually, semi-annually or quarterly as agreed upon. Payment in advance is usually exacted from cash renters. Share leases designate the proportion of product which is to be paid to the landlord, stipulate how this share shall be selected and prepared, and stipulate the place of delivering the owner's share. Reservation of the privilege of selling the total output by the

landlord is sometimes part of the contract.

Second only in importance to rental notes and methods of payments are provisions by which the landlord retains full control of the property at all times. These provisions vary in phraseology but are designed to permit the taking over of the property in the event of apprehension concerning prompt and full payment of rents, or if the tenant fails to live up to his agreement. Similar provisions are those designed to prevent assigning or subletting of the lease.

Of little legal importance but of considerable significance are stipulations to the effect that the property is to be handled in a ranchman-like manner, after the custom of the community. A clause common to many leases specifically exempts the landlord from liability for any injury or damage to lessee's share of livestock or crops from fires, drouths, insufficiency of irrigation water, floods or similar catastrophes. Occasionally leases under which the landlord furnishes work stock and ranch implements contains a clause setting forth that the equipment furnished is to be used solely in ranching the demised property and in delivering to market the crops or products produced thereon. A rather common provision sets forth that the tenant to the best of his ability is to keep the premises free and clear of weeds, squirrels, gophers, and similar pests. When irrigation ditches constitute a part of the rented properties many leases provide that the tenant shall properly work the banks and keep them in good condition and repair. The

cutting of firewood is a factor in leases in both timber sections and where wood is scarce. Some leases prohibit the cutting of any wood, others specify that fallen or dead trees only are to be used. Landlords often reserve rights to themselves for cutting timber for fuel.

In sections of Colorado where there is much buying and selling, it is a common practice, in the event of a bona fide sale of leased lands, to provide for reimbursing a tenant for work done up to the time of cancelling the lease. Many leases stipulate that the premises are to be kept in good condition, fences and building to be maintained in good repair, equipment to be kept in good shape with any lost, broken, or worn out parts to be replaced. In the case of buildings and fences, the usual plan is for the landlord to furnish the necessary materials and the tenant to do the work, the same plan commonly being followed in repairing ditch gates and boxes. Many leases contain a clause giving the tenant the option to purchase the property, or in the event that the landlord ultimately decides to sell, to allow the tenant to have the first chance of purchasing. To provide redress in the event that the tenant does not perform his work in a good and ranch-like manner, neglects any of his duties in connection with the handling of the ranch, or fails to live up to the terms of the lease, almost all contracts provide for the landlord's completing work for the cost plus an added percentage or even retaking possession with the tenant agreeing to peaceable surrender. When movable equipment

is furnished by the landlord, it is customary to list in itemized form the implements, machinery, livestock, harness, etc., even to such articles as eveners, tools, wire stretchers and posthole diggers. The right to sell such items is sometimes reserved with use granted the tenant until sale is made.

PREPARING THE LEASE.

LEGAL REQUIREMENTS: According to the statutes a lease to be legal must (a) be written if granted for more than one year, (b) not exceed a period of fifteen years if for ranch or farm property, (c) be acknowledged and recorded in the local county courthouse if granted for more than one year, and (d) be actually delivered to the grantee (tenant) by the grantor (landlord).

FRAMEWORK OF THE LEASE: An agreement which shall fairly protect landlord, tenant and property should be a written instrument setting forth all the details which constitute the working agreement. It should be worded as simply as is consistent with a clear statement of what is agreed upon and must conform to the legal requirements of such documents. The legal framework is built upon the following premises:

1. There must be something conveyed. 2. There must be agreements to deliver and accept. 3. There must be a definite statement of the extent and bounds of the property. 4. There must be set forth the term covered by the lease. 5. There must be a financial or other good and valuable consideration involved.

Terms common to every ranch lease as:

1. Date lease is drawn. 2. Names, designations, and

addresses of contracting parties. 3. Statement that property is being leased by landlord and lease accepted by tenant. 4. Description of property being leased. 5. Date when possession is to begin. 6. Length of time that lease is to run. 7. Types of ranching to be followed. 8. Rental rate, amount and division of income; method of making payments, how, when and where. 9. Ranching methods to be used. 10. What is to be furnished by each party. 11. How operating funds are to be provided; contribution of each party. 12. Tenants assurances and guarantees. 13. Landlord's assurances and guanantees. 14. Provisions for renewing or terminating lease. 15. Safeguards to insure proper fulfillment of contract. 16. Signatures. 17. Witnesses. 18. Sealing and recording.

ITEMS TO BE CONSIDERED: There are certain general provisions which are pertinent to all leases. These are listed below for the suggestive value that they possess. Items such as these should be given careful consideration when framing a lease and either accepted and incorporated in the lease or else rejected as neither vital nor necessary.

GENERAL PROVISIONS: Items of general nature which should be considered in drawing up a ranch lease are listed below. These supplement the items set forth under "Legal Requirements."

1. Disavowal of partnership, if joint responsibility is not contemplated in order to avoid partnership liability for debt or other obligations. 2. Reservation by landlord of certain buildings, pastures or other property. 3. Extent of supervision by landlord. 4. Extent of landlord's activities in directing ranching operations or in disposing of ranch products. 5. Permissible use by tenant of pasture, wood, timber, gravel, game and ranch products for personal or family use. 6. Permissible sale of manure, gravel, rock, timber and wood. 7. Provision for reimbursing tenant in event that the property is sold prior to the termination of the lease. 8. Designation of bank where undivided funds are to be deposited. 9. Authorization for use of undivided funds; handling receipts and expenditures. 10. Restricting activities of tenant to property covered by lease. 11. Prohibitions regarding renting or leasing landlord's property. 12. Right of ingress or egress by landlord or his agent; right to inspect property. 13. Subletting or assigning lease by tenant. 14. Living on property during lease. 15. Submitting inventories of ranch property. 16. Submitting inventories of

ranch property at stated intervals. 17. Changes in conditions of lease in the event of fire, floods, accidents, death, or other conditions beyond the tenant's control. 18. Protection of tenant if litigation or seizure of landlord's title occurs. 19. Terms governing money advances by landlord, when and how obtainable, when and how repayable, interest rate. 20. Adjusting differences by arbitration in cases of disputes. 21. Upkeep of buildings, fences, and wells; supplying materials and labor. 22. Repair of implements and machinery. 23. Control of weeds, predatory animals, rodents and other pests in accordance with federal, state and county laws and mutual agreement between parties to the lease. 24. Care of lawns, shrubbery and other landscape plantings. 25. Payment of taxes. 26. Carrying insurance on growing or harvested hay or crops, livestock, feed, or carrying employer's liability insurance. 27. Purchase and maintenance of water stock. 28. Payment of fuel, power and water bills. 29. Erection of temporary or permanent irrigation structures. 30. Liability for damages resulting from flooding neighboring lands or public roads. 31. Sales of ranch products through specified agency. 32. Delivery of landlord's share to designated place. 33. Reservation of ditch and drainage rights of way. 34. Keeping premises and buildings clean, sanitary and in repair. 35. Keeping account of receipts, expenditures, and inventory changes. 36. Provision in event of death of one or all of the lessees when two or more tenants are involved in the contract. 37. Keeping livestock confined or under fence. 38. Erection of new ranch buildings and fences. 39. No alternations or improvements of structures to be made without landlord's permission. 40. Reserving, maintaining, and protecting rights of way and ranch roads; restrictions as to the opening of new roads. 41. Precautions to be taken against fire, fire lanes plowed around fields and pastures. 42. Care of work stock, including the hiring of competent help. 43. Provisions for the raising of feed for, and the keeping of any animal strictly for the benefit of the tenant, e.g., family cow, horse, goats, sheep, or chickens; raising of vegetables for tenant's use. 44. Privilege of landlord hiring work done if tenant fails to conform to requirements of lease and deducting cost from receipts before turning tenant's share over to him. 45. Keeping articles deemed extra hazardous by insurance companies which may increase the rate of fire insurance; premises not to be used in violation of any law, ordinances or regulations. 46. Preparing ranch products for sale.

SPECIAL PROVISIONS FOR LEASES OF LIVESTOCK RANGES or RANCHES: In addition to a consideration of the general provisions discussed above there are certain special items which

should be weighed when drawing up lease of livestock ranges.

The following are indicative:

1. Kind of livestock to be kept. 2. Amount of stock permitted. 3. Amount of outside livestock, other than tenant's permitted. 4. Maintenance of boundary, corrals and cross fences. 5. Maintenance of stock watering equipment, tanks, windmills, troughs and pipe lines. 6. Keeping water holes open, and protected. 7. Killing squirrels, coyotes, and other pests. 8. Segregating of livestock showing symptoms of diseases, preventing so far as is possible contamination of range corrals. 9. Keeping off livestock known to be diseased. 10. Keeping gates closed. 11. Details of feeding, whether feed is to be sold, e.g., any hay put up, and method of feeding on meadows or range. 12. Reseeding of range, rotation or pastures, or deferred grazing. 13. Bringing weedy hay on place. 14. If landlord furnishes livestock, details of handling such as branding, painting, altering, breeding, feeding, and selling. 15. Replacement of stock lost by reason of disease, accident, aging or consumption in camp. 16. Care of sires, of saddle horses, and equipment. 17. Registering of brands. 18. Disposal of dead animals.

LABOR AS A FACTOR OF RANGE CATTLE PRODUCTION.

QUANTITY OF LABOR REQUIRED: As a general rule it requires the entire time of one man to handle a herd of 500 head of mixed cattle. That includes cows, bulls, heifers, a few steers and the offspring. From five to eight per cent of the total cost of producing a calf is made up of the item of labor. One man can take care of about ten sections of range land on the plains according to data gathered by the author in 1922 and 1923 in Colorado.

QUALITY OF LABOR REQUIRED: At least one-half of the ranch labor requires specialized labor, men with ability above the ordinary, capable of managing a ranch or at least capable of acting as overseers, or foremen. Only about one-eighth of the labor on the average ranch in Colorado is made up of extra labor. The extra labor is employed in spring and fall roundups to help with branding, vaccination and shipping of cattle.

It requires considerable skill, tact and diplomacy to handle ranch labor. The manager must be able to plan his work ahead with a definite plan, doing work which must be done at a certain time with the use of regular men. If work is properly scheduled there will be plenty of work to keep men employed at all times. Less urgent work can be laid aside for bad or rainy weather or during slack periods in summer or winter.

THE USE OF RANCH LABOR: To anyone who knows anything of ranchmen and ranch life, it is useless to suggest that ranchmen work harder in order to reduce their labor cost. The majority of ranchmen are already working up to the limit of their ability, at least during the haying and cropping season. In increasing the efficiency of labor the following factors will probably be the most important.

An attempt should be made to get a more even distribution of labor throughout the haying and cropping season by means of a good rotation of feed crop and hay. This will involve the equipping of every hay or crop laborer with enough horse power and with the size and type of machinery that will enable him to do the greatest possible amount of work. Many of our ranchmen are using old fashioned methods and machinery for harvesting their hay and grain crops. In the haying season it is much more profitable for the ranch operator to supervise the work and see that all equipment is kept in good order rather than to try to take the place of a hand in the field. The planning of all ranch work so that every operation that is not definitely fixed as to time or season may be fitted in between the busiest, or "peak-load" periods, when every minute may be of special importance in producing or saving a crop. The practice of letting livestock harvest crops, hay and feed themselves in so far as is practicable will assist in securing a more even distribution of labor. Furthermore, the use of a careful follow-up system to help in planning and executing the work from week to week and day to day will bring about a more efficient use of available ranch labor.

TABLE 8. DISTRIBUTION OF LABOR ON A TYPICAL CATTLE RANCH IN COLORADO, 1923.

Months	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals
Riding and care of cattle	25	23	20	32½	28	8	6	7	15	14	18	16	212½
Hauling and winter feeding hay	54	51	24	14½	6					10	17	65	241½
Repair fences & corrals	3				28½		56			37	12		136½
Care of horses & chores	30	30	30	30	30	30	30	30	30		30	30	330
Hauling manure	14	10	6							4	8		42
Dragging meadows			23½	20									43½
Breaking and grubbing brush			37½	46½		21							105
Seed and harvest oats					6					6	4		16
Repair machinery & harness		11				13							24
Plowing				6	4								10
Cleaning & building ditches				24	14	25	14						77
Irrigation						33	22	14					69
Miscellaneous	12	7	8½	5	6	9	8	21	8½	6½	11	8	110½
Harvesting hay						45	145	184	229				603
Painting and repairing buildings											19	8	27
Manager's labor	30	30	30	30	30	30	30	30	30	30	30	30	360

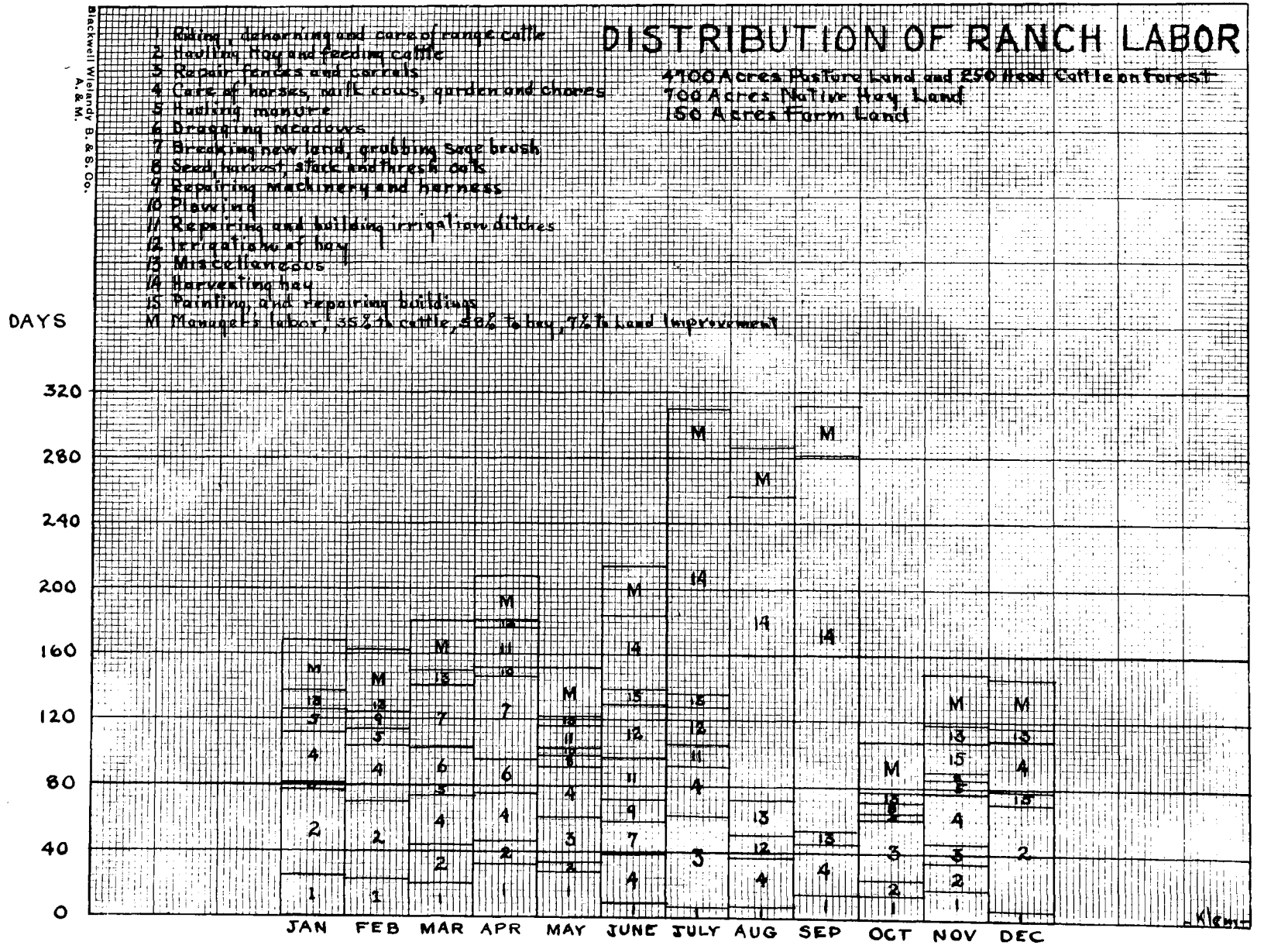


Fig. 4. Distribution of ranch labor on a typical mountain cattle ranch in Colorado, 1923.

In any plan to make the best use of labor, no one of the factors mentioned is likely to solve the problem entirely. Each one, however, will help use labor to somewhat better advantage, and the combined effect of several or all of the factors will certainly go a long way toward betting necessary work done. During the haying or cropping season a saving in man labor is often made by working horses in shifts, changing teams every half day. Most ranches usually carry enough horses to make the shift at such times.

PLAN THE RANCH WORK: In general all ranch work may be divided roughly into three classes: Fixed, semi-fixed and movable.

Fixed work: Good ranchmen know that a large part of the work of the ranch must be done at definite periods. Each of the planting, cultivating, and harvesting operations must be done usually within a few days or a week of a definite date if best results are to be obtained. These dates may vary somewhat from one year to another, but the time allotted to each operation cannot usually be extended beyond a few days without serious injury or loss to the crop or injury to the livestock. Because of this fact it is very important that the crop work, haying, etc., be pushed with the greatest possible energy at these critical periods. This can be done only by carefully planning so that the entire time of every man and horse may be used to the best advantage. This means that every machine, harness and tool be on hand, thoroughly overhauled,

and in as nearly perfect working condition as possible before the critical time comes. So also has been somewhat definitely fixed, altho perhaps to a lesser extent, much of the work connected with livestock operations such as feeding, breeding, salting, moving cattle to forest ranges, and general management.

Semi-fixed work can usually be shifted from one to three or four weeks. Beyond this is cannot ordinarily be moved without loss or disadvantage. Branding, dehorning, castrating, dipping, marketing and moving cattle are good illustrations of semi-fixed work.

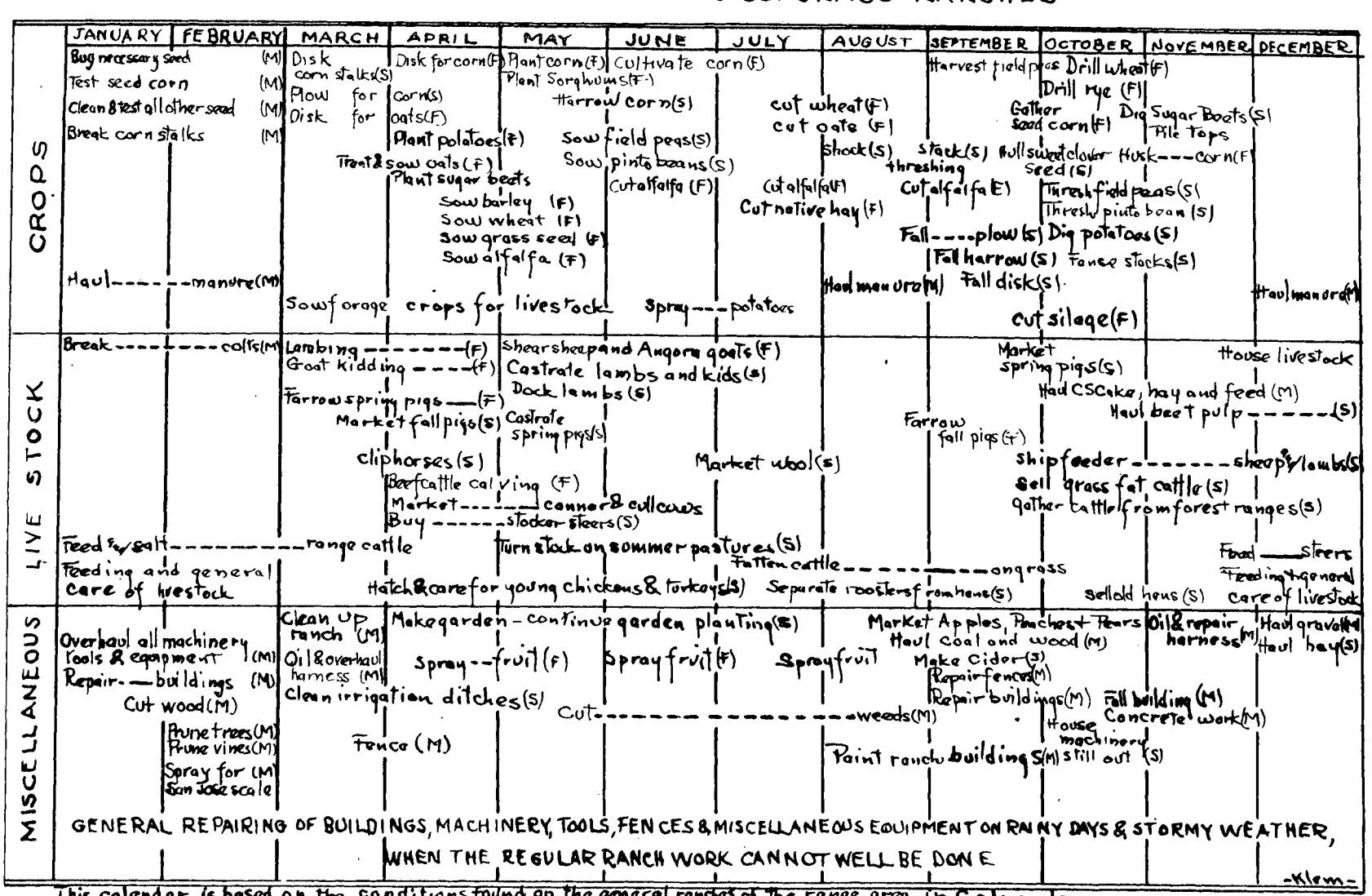
Movable work can usually be shifted over considerable periods, usually from one to two or three months, and frequently it can be shifted to almost any time during the year, depending on the time when it can best be fitted in. Hauling manure, over-hauling and repairing ranch machinery, building new buildings or fence, repairing headgates and hauling feed and fuel are good examples of movable work.

Plan to Fit Together the Three Classes of Work: In planning the ranch work, the operator should aim to have the semi-fixed work fit in between the fixed work just as largely as possible. The movable work should be fitted in between the other two classes. If this can be done it will go a long way toward securing the greatest amount of work from the labor at hand. The most successful ranchmen already carry out this scheme to a considerable extent, but even they will need to

study their operations and make every possible improvement during this period of high production costs. Such improvement will be of special importance, however, on the large number of ranches where the matter has received practically no attention up to date.

The accompanying work calendar listing practically all of the operations that are likely to occur on any Colorado livestock ranch, and showing the approximate dates when they should be done, may be helpful in planning the ranch work. The important aim in planning the ranch work is to make sure that no semi-fixed or movable work will need to be done when the critical crop or livestock operations must have the labor or suffer. Enough unavoidable delays will still come in even with the best made plans, but without such plans delays are certain to be much greater.

LET LIVESTOCK HARVEST CROPS: Much labor can be saved by letting livestock harvest crops instead of harvesting them by hand. This is especially true of the practice of growing pork on forage crops and also of hogging-down corn and other crops, and of growing the fattening market hogs on the self-feeder as practiced on a large number of ranches where diversification is the rule. Beef cattle and sheep are especially fitted to consume large acreages of corn, sorghums, alfalfa and legumes with the minimum use of labor. A combination of beef cattle or sheep, or both, with hogs would therefore be well adapted to the consumption of our irrigated and dry land



This calendar is based on the conditions found on the general ranches of the range area in Colorado. Many operations listed will vary with latitude and season, and, to some extent, with individual ranches. The letters following the operations listed above are used to indicate their classification: (F), for fixed work; (S), semi-fixed; and (M), for movable work.

Fig. 5. Work calendar listing all of the operations that are likely to occur on any Colorado livestock ranch.

crops in the range districts and the best utilization of our man labor. One of the prominent ranchmen in the Arkansas Valley has made it a practice for a number of years to fatten his range calves and steers by pasturing them on growing alfalfa with a grain supplement of shelled corn fed in self feeders. This method of utilizing alfalfa has put on excellent gains with a minimum of feed and labor.

PLAN ALL WORK SOME TIME AHEAD: The most important operations either with crop or animals are seldom overlooked. Much time is often lost, however, by not keeping careful tab on the miscellaneous work such as overhauling and repairing machinery and tools, fixing fences, and other work. Through being neglected at the proper time (i.e. usually between the busiest seasons and on rainy days and bad weather). these matters often conflict with the most important work at the rush periods. Every such miscellaneous job that could have been done at some other time means practically a waste of time at the most critical periods when every hour is of the greatest importance in producing or saving a hay or grain crop.

RANCH CREDITS.

The credit requirements of the cattleman begin with the initial herd, run through the period of gestation, and continue through the period of raising the offspring to maturity. The total period of credit requirements may be as long as three years. Profits come from the increase of the herd. It may be two or even three years before the initial indebtedness incurred in purchasing the herd, or in keeping and maintaining it during the period when the increase is maturing, can be liquidated through the sale of the increase to the best advantage.

SHORT TIME CREDIT: Credit should be available on a basis of maturity which will assure the ranchman that he will not be pressed for payment before his product is ready for market and until he can sell it at what is, in his judgment, the best advantage. Our present system up to within a few months ago has been clearly inadequate as it required the ranchman to produce continuously under the disadvantage of pressure to liquidate his borrowings at a time when his product was not ready and when the market was already overstocked. In order to bridge the present gap it has been found necessary to establish the intermediate credit banks which will handle this type of credit. The ranchmen have plenty of facilities for producing short time credit that will permit them to purchase feeds, supplies and take care of labor requirements. At present

the chief agencies for credit are the local banks and cattle loan companies. In some cases the loans are made without any security other than a promissory note from the borrower, but more commonly the borrower is required to give a mortgage on his live stock or land.

CREDIT NEEDS OF CATTLE RANCHING: Recently the use of credit or financial statement has become quite common in connection with cattle loans. As a rule an examiner inspects the herd occasionally to see that the value of the security pledged for the loan is protected. In order to be eligible for rediscount at Federal reserve banks cattle paper must have a maturity not to exceed twelve months and must be presented by a member bank. The credit needs of a 3000 acre ranch fully stocked and equipped are about $75,000; a 7500 acre ranch requires $100,000; a 15,000 acre ranch $200,000, and a 50,000 acre ranch will require $500,000 in capital. This amount of credit is more than the total capital and surplus of a half dozen small country banks as we usually find them in the range country. It means that practically all the credit must be obtained from ourside sources.

The following table shows the amounts of money necessary to handle the labor and feed items together with the mortgage debt percentage indicating the amount of credit necessary to operate cattle or livestock ranches in Jackson County, Colorado, compared with three prominent range cattle producing sections of the West.

Table 9. Short Time Credit Needs of Ranchmen in Four Typical Areas Producing Beef Cattle. *

	Jackson County Colo.	Cochran County Tex.	Hockley County Tex.	Cherry County Nebr.
Cash paid for labor	$1,362	$1,102	$1,097.7	$394
Cash paid for feed	1,396	2,250	1,373.3	408
Mortgage debt as a per cent of value of land & bldgs.	37.6	--	24.8	25.7

*U. S. Census 1920.

Investigations show that lack of adequate capital is the greatest cause of ranch failures. The ranchman is a business man, and as such, to an increasing degree, take cognizance of the natural laws upon which commercial success depends. If he hesitates to procure adequate working capital because of his fear of putting a lien on his ranch, and then buys his supplies on long-time credit instead of paying cash, he is in fact putting a lien on his earnings and paying not only for his purchases but also a share of the losses, as well as interest on capital which a business house operating on credit basis must of necessity charge to those who pay. The ranchman with the mortgage on his property, who pays promptly for everything he buys, soon acquires a commercial credit in the community far higher than that of the man, who thru a fear of a mortgage lien, is always behind in payments, never has the necessary machinery and equipment, and sooner or later sinks to the position where he cannot secure a bank loan when he wants it, and is regarded as a poor customer at the village store. It

is just as true of the ranchman as of the business man that he who employs an adequate working capital discounts his bills for cash, has money in the bank and a check always ready for any bills that come, is the one who succeeds. While the ranchman who clears his indebtedness thru the sale of ranch products at the end of the season, though incurring heavy current obligations during the growing and producing period, may be looked upon as a success, it is none the less true that he has paid a much higher rate of interest at the bank for his short-time accommodation, and in the event of crop failure or drought, low prices and consequent inability to pay, he will have an accumulation of demand obligations to embarrass his finances and impede his operations during the succeeding year.

LONG-TIME CREDIT: Studies indicate that with the greater capital furnished through the medium of long-time ranch mortgages the livestock man receives a much larger gross return. The changing economic conditions in Colorado are tending steadily to increase the amount of capital required for the average ranch and the proportion of that capital required for the average ranch and the proportion of that capital which must be found by borrowing on mortgages. The livestock business, more in proportion perhaps, than any other industry, operates on borrowed money. It is a matter of cold hard fact that a ranch mortgage is,in these days, a necessity for the young ranchman,

and a support without which he can hardly succeed in weathering the uncertain storms of ranching life. Millions of dollars have been loaned to our livestock men by banking institutions, by mortgage companies and by individuals. All have done their part, but they have all been subject to the vicissitudes of financial depression, too often making it imperative for them to demand repayment at times when the ranchmen would experience the most difficulty in repaying or replacing their loans.

Naturally, the ranchman has felt the need of a more stable method of financing his operations. Fortunately for him the Intermediate Credit bank and Federal Farm Loan bank, Joint Stock Land banks and life insurance companies are peculiarly suited to his requirements. To them the allurements of speculative business are denied and they are not subject to any of the exigencies peculiar to banks and like institutions in times of financial stress. They do not need to call in their loans to meet the demands of depositors. Their principal object is to keep their funds invested. They are uniformly able and willing to renew and extend the accommodation, provided the borrower has shown a proper appreciation of his "silent partner" by prompt payment of interest, and by proper maintenance of his ranch at least to the standard of condition and value existing at the time of the mortgage.

PER CENT MORTGAGE DEBT TO VALUE: The following data from the 1920 Census shows that the per cent of mortgage debt to value on land and improvements in three prominent beef cattle

counties of the United States was as follows: Jackson County, Colorado, 37.6 per cent; Hockley County, Texas, 24.8 per cent, and Cherry County, Nebraska, 25.7 per cent.

Prairie ranches in Colorado had 34 per cent indebtedness on land and 36.5 per cent on cattle, while the mountain ranches had only 8.9 per cent of the value of land mortgaged and 32.4 per cent of the cattle value in 1922. These figures indicate that one-third of the capital of average ranches must be obtained from loans secured by mortgage. In recent years the ranchman has awakened to the advantage and realized the desirability of permanent loans. The ranchman must be given the funds he needs with the least possible friction and annoyance and at the lowest expense.

The greatest good to the livestock industry will come when the ranchman is made to realize that his loaning agency insists on a legitimate use of the funds borrowed in the upbuilding and advancement of ranching, and that the ranchman who does not so use his funds can not have loans from the insurance companies, Intermediate Credit bank, Federal Farm Loan bank and Joint Stock Land bank. It is a mistake to loan simply upon the value of the security. The loan should also be based upon the honesty, industry, thrift and capacity of the borrower. When the ranchman is made to appreciate the loan as a cooperation with him and an encouragement of his thrift and industry, he will regard his"silet partner" as a welcome, if necessary

one, and appreciate that his mortgage is not entirely a lien, but in greater measure a support.

MEANS OF ACQUIRING A RANCH.

The ranchman's means of acquiring land are as follows:

(a) Free land
(b) Land settlement
(c) Gift and inheritance
(d) Savings
(e) Credit or lease

The free distribution of farms by the government practically no longer exists. Although over one-tenth of the total area of the United States remains unappropriated and unreserved, this land is nearly all desert or semi-desert and unsuitable for the production of crops. Most of this land can be used for grazing purposes, particularly during spring and fall when the vegetation is more abundant. Six hundred and forty acres of this land is not enough to support a family so it should be either leased or sold at a reasonable rate in large acreages, preferably five to ten sections.

In Colorado it is a matter of common observation that ranchmen who are able to do so, assist their sons in buying ranches. This assistance may be relatively very great in the case of a wealthy ranchman who has a small family; and again it may be very small in the case of a ranchman in moderate circumstances who has a large number of children among whom he wishes to distribute his assistance. There is always a number of men who start as tenants and who because of superior

ability and foresight are able to save enough money to purchase a small ranch. When a young man has saved enough money to pay some share on the price of a ranch, he borrows the remainder and makes an investment, a mortgage being given to secure the loan. The ranchman should have every facility for acquiring a knowledge of the facts and principles which underlie his art in order that he may so operate his ranch as to win large profits from which to save enough money to invest in land.

EFFECTS ON RANCHMEN OF THE RECENT CATTLE DEPRESSION: If one goes to enough ranches in Colorado and learns of the private settlements with creditors by means of which great numbers of young men have lost their entire savings; learns also of the greater number whose debts are larger than their resources, but who are struggling along hoping for a way out, one will have no doubt concerning the grim reality of the situation. The percentage of ranch owners who lost their ranches will approximate 20 to 30 per cent in Colorado. Some of these have left the ranches, some have gone back to work as hired managers, but many are continuing as ranch operators with debts exceeding their resources. Some of these last will recover, but many will go on struggling against impossible odds. The persons who have lost their property are largely energetic men who have worked hard, and by years of close economy, have saved enough to make a part payment on equipment or on a ranch.

The question is often asked, "Why did the ranchman not save his money when times were good so that he could stand the hard times?" Many ranchmen did save when prices were high, and many of them are picking up additional land and cattle that their neighbors are forced to sell. But the young man who was most thrifty and saved the most money and who bought a ranch in recent years did not have time to get out of debt. Paying for a ranch is frequently a life-time job. Many of these young men would have been better off financially at the present time if they had not saved money, for then they could not have bought ranches.

Ranching is a personal business. A man enters it at a certain time. If he happens to enter just before a great decline in prices occurs he is likely to lose allhis savings unless he is one of the very few who enter without heavy debts. If a ranchman happens to sell his ranch in a period of high prices, he is likely to move to town and take his money with him so that it is removed from the cattle business. If he dies in a period of high prices, one of his sons may take the ranch and buy out the other heirs. With falling prices his inheritance is likely to be lost entirely.

EFFECT OF A DECLINING PRICE LEVEL ON RANGE CATTLE PRODUCERS' PROSPERITY: If all the ranchmen's money were used for the purchase of general commodities, he would be concerned with the price paid to producers for ranch products and the price that he has to pay for retail purchases for living and

for his business. But most ranchmen hire labor and are, therefore, concerned with the wages of ranch labor and the quantity and quality of labor available. All ranchmen hire other labor, such as riders, hay help, carpenters, blacksmith, and the like, so that they are concerned with the amount of ranch products necessary to hire these persons. One of the most important considerations is the payment of interest and taxes. Ranchmen, therefore, are concerned with the quantity of ranch products necessary to make such payments. In so far as the money goes for these purposes, it is the money price of ranch products and not their purchasing power that is important. For the ranchmen who bought in recent years and who are not out of debt, these items are the dominant ones. In a large measure they can stop buying clothing, ranch equipment, and can greatly reduce expenses for food; but there is no way to escape taxes, interest, and payments on debts. The portion of the ranching population that is in comfortable circumstances is most concerned with comparative prices of what they sell and what they buy, but the portion of the population now in financial difficulty is concerned with the quantity of ranch products required to pay interest, taxes and debts.

RATE OF TURNOVER OF INVESTED CAPITAL: Ranching is a very slow industry. If one raises a cow, she is a constant source of expense for over two years. Production does not reach its maximum for several more years. The ranchman hopes that the cow will pay for the investment in raising her by the time

she is perhaps seven years old. A good ranch building is expected to pay for itself in about forty or fifty years. For such reasons, capital investment in cattle ranching is very high in proportion to receipts. The rate of turnover varies with the type of ranching. For the prairie type of ranching using the data obtained for 1922 it requires an average of ten years, and on the mountain type of ranch it requires an average of eight years, to make sales equivalent to the total capital invested. The following table gives the rate of turnover of invested capital on forty-one Colorado cattle ranches in 1922.

Table 10. Rate of Turnover to Invested Capital.

No. of ranches	Average total investment	Sale of Livestock per ranch	Per cent of turnover
17 Prairie ranches	$ 80,953	$ 7,271	9.0
24 Mountain ranches	123,167	16,042	13.0

A decline in the general price level makes the period much longer. A business that has a turnover three times a year has a good chance to get adjusted to deflation in a year as does the cattle business in many years. One of the common errors in dealing with ranch statistics is to add the hay and stock raised on it, and to assume that the resulting total represents the income of the ranchman. Such additions are of interest and may be useful for some purposes, but the cash income of the ranchman is, of course, the product of quantities

sold times price. It may be interesting to figure the value of the pasture grass and they hay eaten by a steer, but it is the weight of the steer and its price per pound with which the ranchman is concerned.

AN ECONOMIC STUDY OF THE RANCH LAYOUT.

HOW RANCH LAYOUTS HAVE DEVELOPED: The first task of the ranch settler was to provide a shelter for himself and his family. In deciding on a location for his ranch headquarters, little or no attention was paid to its convenience as a center for ranch operations. The most important considerations were that the buildings should be near a supply of good water, preferably a spring, and that they should afford some protection from Indians and storms.

As cattle were run in the open before the day of the barbed wire fence no effort was made to lay the ranch out in pastures. The only fence would consist of a picket fence made of cedar posts closely woven together with smooth wire near the headquarters. There were a few small corrals built around the ranch headquarters in which the ranchman handled their horses, and nursed a few orphan calves. One of the factors that has influenced the development of ranch layouts is the size of the grants of land made to the early settlers. Much of the ranchland in Colorado was sold or given to the settlers in small tracts of from 160 to 640 acres. The general plan followed in making grants to settlers was to give each settler enough land to maintain a family. There were a few Spanish land grants which were recognized in Colorado when the land was acquired by the United States from Mexico. These grants contained about 100,000 acres each. Some of these grants

dating back to 1803 still remain intact, and are operated as a unit for ranching purposes. Others have been divided up into family sized tracts, some of which have been put under irrigation. The amount of land necessary for ranching varies widely according to the natural productivity of the soil in different regions, little allowance appears to have been made for this factor in laying out ranches for settlement. These original homesteads were supposed to be cultivated but fortunately the ranchmen did not depend on the productivity of the soil for their living but ran a few sheep or a herd of cattle. Most of the original ranches started out with an area of about 160 acres of homestead land. The ranches today are composed of a number of originally small ranches or parts of ranches. Ranches were added to by means of purchase of relinquishments, public domain from the government at $1.25 per acre, desert claims, tree claims, railroad lands, certificate of purchase, abandoned ranches, railroad lands, gift, inheritance and by outright purchase or purchase for delinquent taxes or by foreclosure. Ranches have been laid out in all shapes and forms. Some of them are strung out for miles and miles. Such long, narrow ranches were never adapted to economical operation. Land was often situated at one end of the ranch, 15 or 20 miles from the headquarters and too remote for economical operation, and is usually directly across the fence from a pasture of another ranch which in turn has headquarters ten miles away. This mistake in laying out ranches

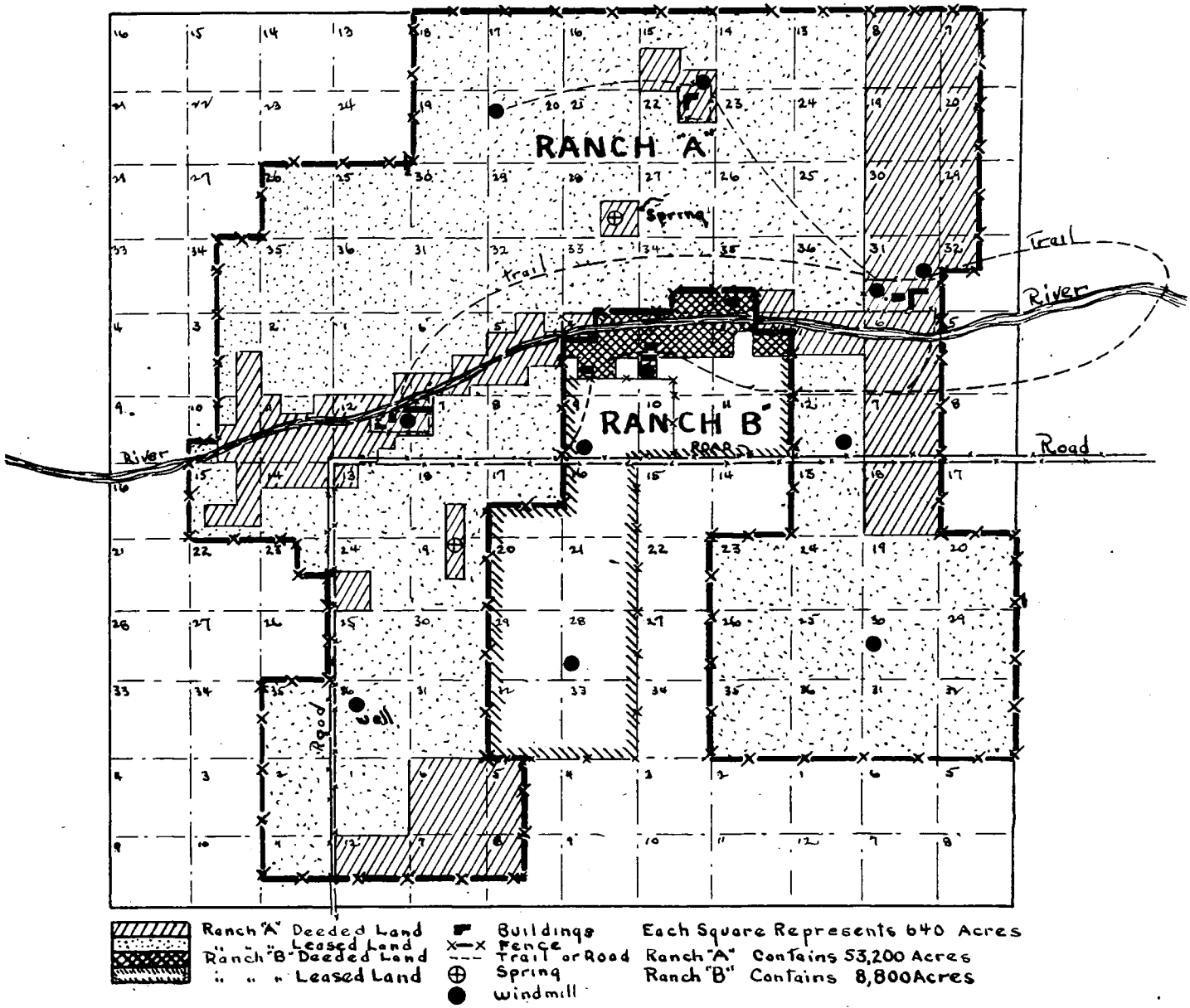


Fig. 6. Map showing a small ranch entirely surrounded by a large ranch. Note that all water is controlled by deeded land.

has cost Colorado ranchmen many thousands of dollars in lost time traveling to and from remote pastures.

In the process of combining ranches in the past to keep pace with changing conditions, it has not always been possible to procure land adjacent to the ranch already owned, which accounts for the poor arrangement of most of our ranches today. Another important reason why the land was laid out in long narrow strips was to control the water along the streams. Control of the water meant control of all the grazing land for miles away from the stream. Other ranches purchased or homesteaded small plots of land surrounding springs for the same purpose. Figure 6 gives an excellent illustration of this method of laying out a ranch.

Pastures are usually kept as large as possible to economize on fencing. The cost of fence maintenance is a big item on the modern ranch and is one of the chief reasons for keeping pastures large. The size of the ranch, the type of ranching, and the system of pasture rotation, limit the size of pastures on any ranch. With the practice of more or less definite pasture rotations such as spring, summer, fall or winter pastures, it is desirable to have as many pastures as there are seasons in the rotation. In addition it is important to have pastures where the yearling heifers and bulls can be kept separated from the breeding herd. It is also desirable to have pastures where the fat cattle can be held until shipping time without the necessity for disturbing the balance of the

herd. Trap pastures are convenient for handling sick or weak cattle or for handling horses and bulls.

Physical features such as the shape of the ranch, differences in soils and vegetation or drainage, streams or dependable water supply, often make it impossible to have all the pastures arranged in the most convenient manner. Throughout much of the arid region of Colorado, suitable watering places for animals are scarce, and have been for years. Struggles for a control of water holes have occurred ever since the days of the ox teams coming up the Arkansas Valley. If a man controlled the only watering place on a region, he held the region so far as grazing was concerned and for this reason we had many range wars in the early days over the water situation. Most of the small ranchmen took up the drainage area and valley of a stream. Each owned a tract of land with some water for stock and some had enough for irrigation. All ran stock on the public domain. All went well until the ranges became overstocked by others doing the same thing. In order to protect his range the ranchman was forced to buy up the claim of a neighbor, and a year or two later that of another. As time went on he acquired land at prices beyond any reasonable hope of returns, but his land now held all the watering places of his part of the valley. Other ranchmen did the same, and shortly a half dozen of them occupied the whole drainage area. "Tramp" stockmen could not come in for feed on the open range because there was no place to water their stock. Thus it

happened that the necessity of protection gave rise to large ranches having a monopoly on watering places. They owned five to ten per cent of the land, but virtually owned also the 90 to 95 per cent of public range which was useless without the "key" land which the ranchers actually had under fence.

LOCATION OF PASTURES WITH RESPECT TO THE HEADQUARTERS: Travel between the headquarters and the pastures is not directly productive work. It is merely getting ready to do something. For this reason pastures should be as readily accessible to the buildings and corrals as possible. The average distance between the headquarters and the pastures or hay meadows depends chiefly on the size of the ranch, the shape of the ranch, the location of the buildings and corrals with respect to the pastures, and the size and arrangement of the pastures. Other factors remaining constant, the larger the ranch the greater the distance between the headquarters and the pastures. This is one of the most important factors limiting the size of ranches. If the size of a ranch be indefinitely increased, a point will be reached where the advantages of greater size are offset by the time lost in travel between corrals and pastures. Any further increase in size means a duplication of buildings and corrals. (See Fig. 7)

The shape of the ranch is nearly as important as the size in its effect on the distance to pastures. All long, narrow shapes are bad, since they mean that much of the land is farther from the headquarters than it would be if the ranch were

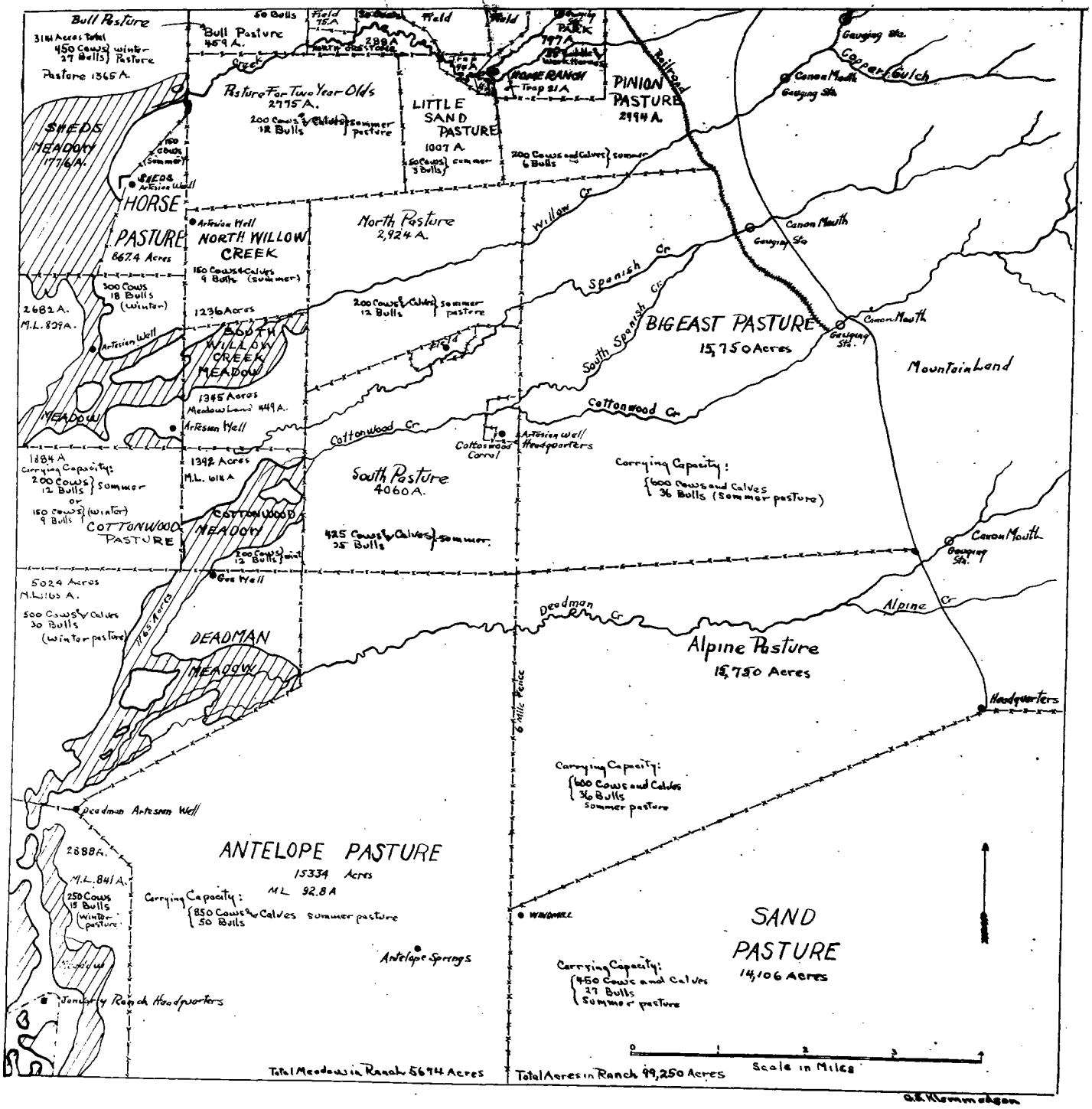


Fig. 7. A well arranged Colorado mountain ranch of approximately 100,000 acres showing arrangement and carrying capacity of pastures, together with location of headquarters, hay land and water.

more nearly square. Square or nearly square ranches permit the most convenient arrangement of pastures with respect to buildings and corrals. (See Fig. 8) The ideal arrangement is to have half of the land on each side of the highway with the buildings and corrals in the center of the ranch. By this arrangement the travel to fields or pastures may be reduced to a minimum, and yet the advantages of living on the highway are retained. With any shape of ranch and with the usual systems of ranching, the most advantageous location for the buildings from the standpoint of labor efficiency is in the center of the group of pastures, with the crop and hay land located as near as possible. A location in the middle of the side of the ranch on the road is usually preferable to one in the corner nearest town. It is usually desirable to have as many pastures and fields as possible corner on the ranch headquarters or water improvements.

Because of the greater cost of grazing distant pastures, ranchmen tend to under graze such pastures, and over graze pastures close at hand.

FENCES: The early settlers on Colorado ranches made fences of rails in the mountain districts and of cedar pickets in the rough country on the plains. Changing conditions have made desirable the elimination of many fences, especially the rail fences which are common in North Park and many other inter-mountain areas. The increase in land values has made land occupied by fences a factor worthy of consideration. Labor is

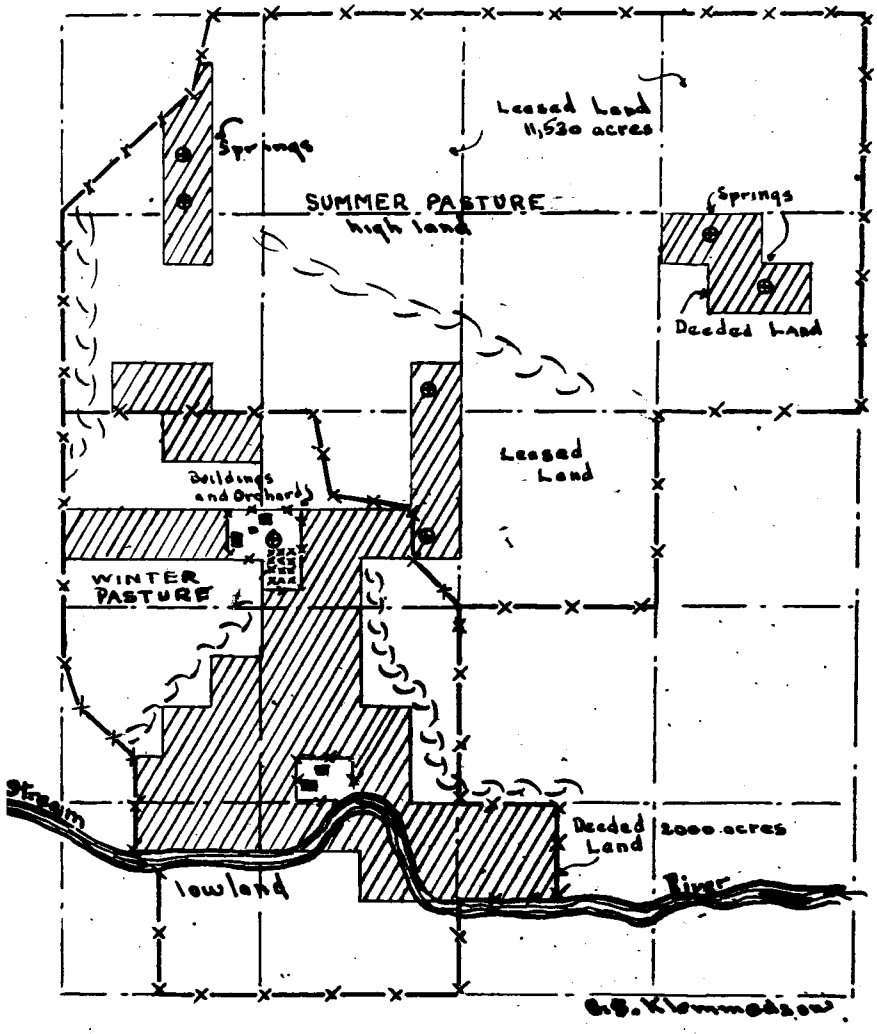


Fig. 8. Ranch layout showing how springs and water and fertile valley is controlled by owned land, which in turn controls the leased land.

no longer cheap, and fencing materials must be purchased at increasing prices. As a result of these changes, the problem of fencing ranches suitable and economically has become an important one. A few years ago the poles, posts and rails were obtained in the forest with little cost except cheap labor. Today the forestry people make a charge for railsand labor is very expensive. In most cases the modern barbed wire fence is replacing the old rail buck fence. The barbed wire fence is practically the only kind of fence being built under present conditions, and will become more important as it replaces other types of fence.

COST OF FENCE MAINTENANCE: The average amount of fence maintained on each prairie ranch was 36 miles, valued at $94 per mile, or 54 cents per acre. Both labor and other costs of building new fence are included as upkeep costs, since with a number of ranches it is a safe assumption that the new fence built in any year will approximately represent the normal necessary replacement. The amounts and costs of fencing, posts, rails, and woven wire and other material purchased, were taken from the ranch accounts in each case. It costs from $150 to $250 per mile to build good fence in 1933. Aside from interest and taxes, the principal cost in the upkeep of pastures is the cost of maintaining fences. Since the amount of fence to the acre is affected by both the size and shape of the pasture, these factors are of some importance.

LOCATION OF THE RANCH HEADQUARTERS: The ranch headquarters, as the term is here used, is that part of the ranch which is occupied by the main group of ranch buildings, together with any adjoining corrals, the home orchards, and the home garden. A part of the area of every ranch must be devoted to these purposes, the size of the necessary area depending on the size of the ranch, the type of ranching, and other factors. Land necessarily occupied by well planned buildings is usefully employed and adds to the value of the ranch. Since the headquarters usually occupies the best land, it is essential that it be well planned in order to make the best use of the land as well as of labor.

The location of the headquarters with reference to the hay meadows, crop land and pastures has already been discussed. The ideal location for a ranch headquarters is on the public road in the center of the crop and pasture area. With ranches of small or moderate size it is best to locate the buildings and corrals as near the center of the pasture land as it can be placed and still be on the road. With very large ranches the importance of saving labor in travel to and from the pasture is so great that it is best to locate the headquarters at the center of the ranch.

The ideal location for a headquarters is on a slight elevation, sufficient to give drainage but not enough to make hauling difficult. It is advisable to have the headquarters sheltered from strong prevailing winds by a windbreak. In

spite of natural limitations it is possible and practicable to greatly improve the layout on nearly all ranches. There is no particular layout to fit all cases. Every ranch presents an individual problem which must be studied and considered separately. Changes in ranch layouts have not kept pace with changing livestock and agricultural conditions, and as a result most ranches now need rearranging.

SYSTEMS OF RANCHING AND FEEDING CATTLE.

PROPORTIONING THE FACTORS OF PRODUCTION: In the production of ranch products, all the factors of production, land, labor and equipment are brought into play; but there is no definite proportion in which they must of necessity be combined in order to bring the calf or lamb crop into existence. The number of calves produced on a given area of land will be greatly influenced, however, by the amount of labor and equipment associated with the land. What determines the proportioning of the factors of production are:

(1) Prices of range products
(2) Prices of land
(3) Prices of labor
(4) Prices of capital
(5) Ability of the manager

The law of increasing and diminishing returns operates when increasing amounts of labor and equipment are associated with or applied to a given area of land. A small amount of labor and equipment per section may produce 30 calves per section running 60 cows; double the amount of labor and equipment may produce 50 calves, whereas three times the amount may produce only 55 calves per section or per 60 cows. In the first instance the law operates to give increasing returns; in the second, diminishing returns.

At any given place, there is a certain proportion in which the factors combine most profitably. If less or more than a certain amount of labor or equipment be associated

with a given area, the profits will be less than they should be. The proportion which is right for one ranch at a given time may be wrong for another. This may be due to differences in the physical and biological character of the land or to differences in location with respect to the market.

METHODS OF RAISING BEEF IN THE MOUNTAINS: In the process of raising and fattening beef cattle, there are three types of feeding. These are employed in rotation, each at its appropriate season of the year. The first is mountain range feeding, beginning with the late spring and summer months, after the snow has melted and the gree grass has come up. The mountain range is the primary breeding round of the cattle and the place where the beef crop is begun. Wild grass is of course the least expensive kind of feed, but not always the most economical for the production of high-grade beef, unless supplemented by other kinds of fat producing feed. Mountain ranges are found extensively in the western part of Colorado.

The second type of feeding is known as valley grass forage.As the winter approaches the herds are driven down from the mountain ranges into the valleys where they are fed on grass freshened by summer rains. It is the policy of most stockmen to keep their cattle off of these grass pastures during the summer so that the feed may be preserved for winter.

About the first of November a few cattle are started on native hay, weaker cattle being added until in March and April the entire herd is placed on feed. The average amount of hay

fed during the winter will average approximately one and one-half tons per head, some ranchmen feeding more and others less.

FEED RATIONS: Feed fed cattle in the San Luis Valley on meadows on one of the ranches keeping a record was as follows: Cow and calf 45 lbs. hay per day or two tons hay per cow and calf in three months, January 1st to April 1st; or, cows, 27 lbs., calves, 18 lbs. Yearlings were fed 18.5 lbs. per day for 131 days or 2,419 lbs. per head during the feeding season. Steers, coming two's, were fed 39 lbs. per head for 48 days. Sheep received 2.5 lbs. per head per day for 109 days, beginning December 10th.

In North Park, Colorado, it is a common practice among cattle feeders to feed their cattle on native hay alone, without the addition of concentrates. This system is attributed to the fact that there is an abundance of hay. The results on two ranches in which 187 North Park calves, averaging 130 days in one case and 150 in the other, shows that on the average the calves required 16 lbs. of hay per head per day and that they gained .75 pounds a day. For each 100 pounds gain there were required an average of 2,060 lbs. of hay.

On one ranch with 57 yearling steers, averaging 663 pounds which were fed 130 days on hay alone, the cattle required 34.6 lbs. of hay per head daily and they gained .94 pounds a day. For each 100 pounds gain there were required an average of 3,739 lbs. of hay.

On another ranch native hay was fed as the only roughage with corn as a supplement. Thirteen bull calves averaging 415 pounds were fed an average ration of 3.2 lbs. corn and 11 lbs. native hay for 150 days. They gained 1.27 pounds a day. For each 100 pounds gain there were required an average of 252 lbs. of corn and 866 lbs. of hay, making the feed cost per 100 pounds gain $6.76 with corn at $1.65 per hundredweight and hay at $6 per ton. These are typical of the results obtained in this area.

Table 11. Feeding Results with Four Lots of Young Cattle in North Park, Colorado, During the Winter 1922-23.

	Lot 1	Lot 2	Lot 3	Lot 4
Class of cattle	Bull calves	Calves	Calves	Yearlings
Number of head	13	44	143	57
Date weighed in	Jan. 4	Jan.5	Jan.4	Jan.4
Avg.wt.at beginning	415.38	503.3	382.2	663
Avg. gain per head	191.16	117.7	93	123
Avg. daily gain	1.27	.8	.71	.94
No. days on feed	151	150	130	130
Avg. wt. at end	606.54	611	475.2	786
Date weighed out	June 4	June 3	May 14	May 14
Average ration:				
Corn, pounds	3.2	--	--	--
Hay "	11	17	15	34.6
Feed per 100 lbs.gain:				
Corn, pounds	252	--	--	--
Hay "	866	2120	2000	3739
Feed cost per 100 lbs. gain:	$6.76	$6.36	$6.00	$11.22

Note: Corn @ $1.65 per cwt., hay @ $6.00 per ton.
Hay in lots 1 and 2 weighed; hay in lots 3 and 4 measured.

Table 12. The Average Percentage Composition of North Park Native Hay as Analyzed by the Colorado Experiment Station.

	Water	Ash	Crude Protein	Carbohydrates: Fiber	Carbohydrates: Nitrogen Free Extract	Fat
Hay in barn 1/	7.13	7.61	9.65	26.32	47.09	2.2
Hay in stack 1/	12.7	7.55	6.43	27.2	43.32	2.5
Alfalfa*	8.6	8.6	14.9	28.3	37.3	2.3
Corn*	10.5	1.5	10.1	2.0	70.9	5.0
Oats*	9.2	3.5	12.4	10.3	59.6	4.4

1/ Hay analysis on A. E. Dwinell ranch.
* Average analysis as reported by Henry & Morrison's "Feeds and Feeding."

"Dry-lot feeding" is the final process in bringing into market condition those cattle which it has been impossible to fatten on grass. This type of feeding is usually engaged in by inter-mediaries called "feeders" who are usually independent of the stockmen. The stock raisers, running their herds in the mountains in summer and fattening them in the valleys in fall and winter, usually select those ready for market as they come into condition usually at the end of the summer grazing season and sell them for beef, retaining a certain percentage for reproduction purposes so that the herds may be perpetuated. Older cows and steers not fat enough for market, are culled out and sold to feeders. These animals of course do not bring as much per pound to the raisers as do fat cattle, but it is often more economical to pass them on to the persons engaged in "priming" than to put them through another season

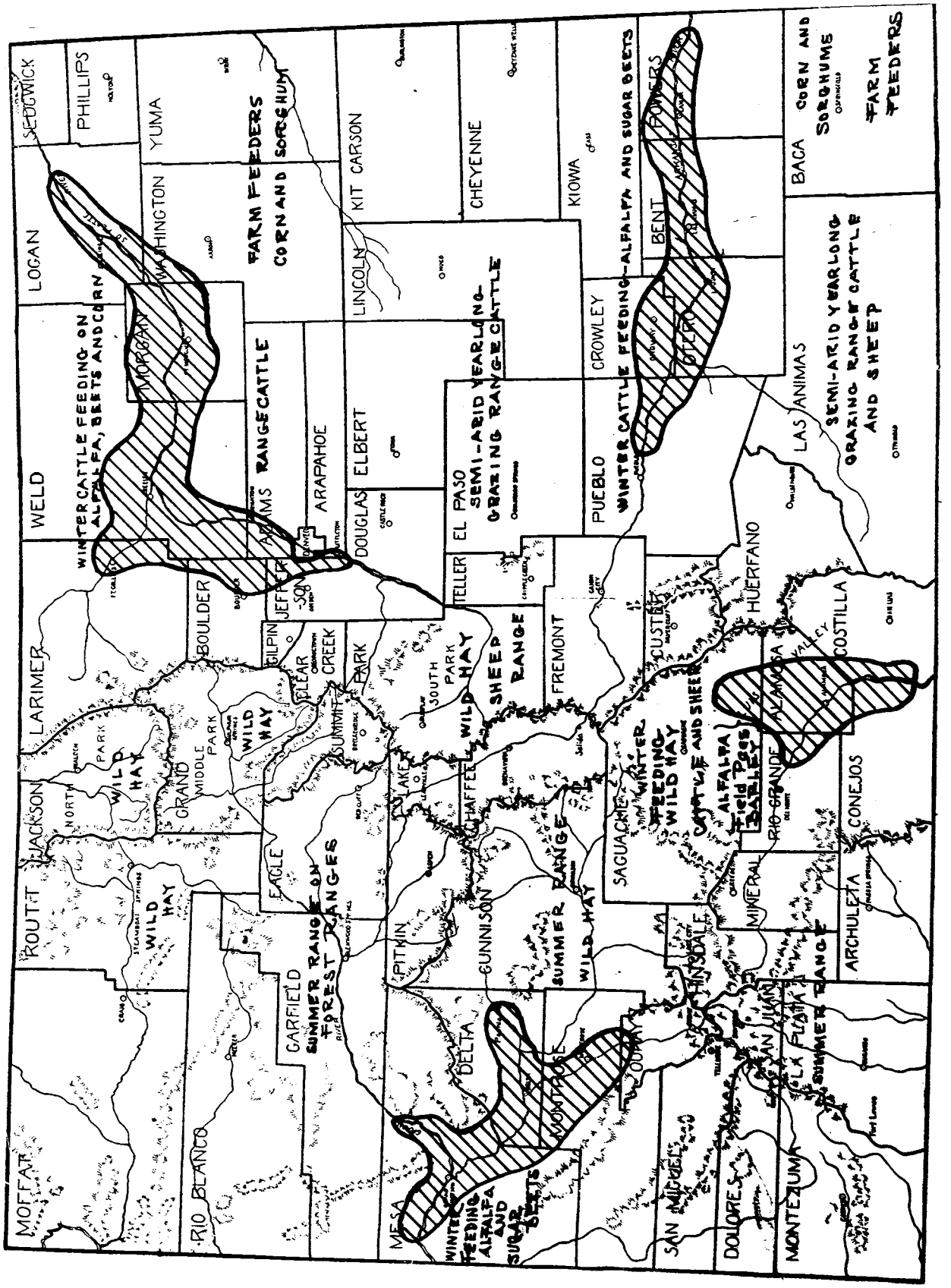


Fig. 9. Map showing types of livestock production in Colorado, 1924.

of fattening on the range.

In the Middle West "feeder cattle" are fed out on corn, but in Colorado alfalfa hay, sugar beet tops and pulp and small grains together with some corn and molasses are used. These feeds produce a grade of beef not far inferior to that produced by corn. Naturally many feed lots are found in the sugar beet districts of Northern Colorado and the Arkansas Valley where sugar producers engage in feeding as a means of utilizing surplus beet tops and pulp. (See chart showing cattle feeding areas in Colorado.)

Following are some of the rations fed by cattle feeders in Northern Colorado during the winter of 1924-25.

1. One feeder feeding 32 three-year-old steers from the Western Slope in Colorado, half of which were purchased October 20th and the balance November 20th. Average weight in yards 977 pounds. Steers received 120 lbs. wet pulp, 31 lbs. cottonseed cake and alfalfa hay.

2. Another feeder was feeding 96 head of yearling steers 70 lbs. pulp, 5 lbs. alfalfa hay, 5 lbs. barley, 1 1/2 cottonseed meal, and 5 lbs. of molasses at an average cost of 22.6 cents per head per day.

3. One feeder using 110 two and three-year-old steers was feeding the following ration: 75 lbs. beet pulp, 5 lbs. alfalfa hay, and 2 lbs. beet tops for roughage. In addition he fed 4 1/3 lbs. corn chop, 5 1/2 lbs. dry pulp and 3 lbs. cottonseed meal. The cost per head per day amounted to 31.7 cents.

4. Another typical ration which was fed by another feeder to 120 head of three-year-old steers was as follows: 30 lbs. potatoes; 6 lbs. alfalfa hay; 8 lbs. dried beet pulp; 2 lbs. corn chop, and 1 1/2 lbs. cottonseed meal at an average cost of 25.9 cents per day.

5. Another man was carrying thru 297 head of yearlings and two's for the spring grass feeder market on the following ration: 8 lbs. corn silage, 10 lbs. potatoes and 13 lbs. alfalfa hay. These cattle were not receiving any grain and

and the cost per head per day was 13.75 cents.

6. One farm was feeding 205 head of two-year-old steers 130 lbs. of wet beet pulp, 16 lbs. of cut corn, 5 lbs. alfalfa hay, 6 lbs. of beet sugar syrup and 2 lbs. of cottonseed meal.

7. Another farm is feeding 43 heifers the following ration: 2.3 lbs. shorts, 4 lbs. beet sugar syrup on hay, 1.2 lbs. cottonseed cake and 13 lbs. of alfalfa.

The above rations will give a good idea of the rations commonly fed by cattle feeders in Northern Colorado.

Colorado is primarily a "grass range" state as distinguished from the corn-feeding states of the great Middle West such as Iowa, Kansas, Missouri and Nebraska. Colorado mountain cattle are fed largely on natural pasture, many are sold directly from the range to the packers. This means less expensive feeding in the long run, but a slightly lower grade of beef on the whole, and a longer period of turnover of cattle investment, the average turnover on 26 mountain ranches studied in 1923 being 37 per cent and varying from 5 to 119 per cent. The corn belt feeder buys grown animals, fattens them in a few months, and gets his money. The ranger raises his beef from calves, runs them out over the mountains or prairies while growing, and sells them at the end of from one to three years.

The range methods of raising stock involves the uncertainty of climatic conditions. In extremely severe winters, for instance, cattle on the open range will die in large numbers, and in summer drouths the death rate will be equally high from lack of feed and water. The year of 1924 saw an average of 50 deaths from exposure, poison weed, predatory

animals, etc. per 1000 head of cattle.

TYPES OF BEEF CATTLE PRODUCTION ON THE PLAINS: The method of handling beef cattle on the Plains area is indicated in the following table which gives the number of head of various classes of beef cattle on 15 prairie ranches studied on January 1, 1923.

Table 13. Classes of Beef Cattle on 15 Cattle Ranches in Colorado, January 1, 1923.

Classes of cattle	Per cent of total
Cows	39.8
Calves	23.7
Two-year-old heifers	7.6
One-year-old heifers	10.3
Bulls	1.3
Yearling steers	7.3
Two-year-old steers	4.2
Three-year-old steers	3.4
Four-year-old steers	2.1
Five-year-old steers	.3

Note: The four and five-year-old steers were all on one ranch.

The average for the State as reported by the 1920 Census on January 1, 1920, was as follows:

Cows over two years	36.9%
Calves	22.7%
Heifers (1-2 years)	11.3%
Bulls one year and over	1.8%
Steers (1-2 years)	11.5%
Steers two years and over	13.9%

The steer figures include steers in the feed lots in Northern Colorado and the Arkansas Valley on January 1,1920. In the other regions cattle move off the range at a fairly young age.

WINTERING CATTLE IN THE PLAINS AREA: Cattle are wintered as far as possible on native pastures reserved for that purpose. Some ranchmen prefer to begin feeding before the cattle become very thin, others delay feeding as long as possible. Practically all cattle are fed on the pastures. The principal feeds used for wintering are cottonseed cake, native and alfalfa hay and the grain sorghum fodders. The amounts of feed fed vary in accordance with range and weather conditions. Severe storms and cold weather demand heavy feeding to prevent heavy death losses, particularly early in the spring when the cattle are thin. The common allowance of cottonseed cake for cows and bulls is one pound per head per day.

Extra care and feed are usually given the weak cows, especially those that are to calve in the spring. Some ranchmen continue the period of winter feeding of the cow herd until the calves are dropped or the spring grass is of sufficient growth to afford good grazing. Steers and dry cows ordinarily need little attention except in case of storms. Some producers, however, feed yearling steers cottonseed cake or roughage on the grass during the winter to keep them growing.

As winter approaches ranchmen in the prairie districts must either buy grain, cottonseed cake or other dry feed on the market or from homesteaders, oftentimes at high winter prices, or sell off surplus stock for beef regardless of their condition and market value. Stockmen, holding their cattle

for higher prices often try to feed more animals than their ranges will support. When the summer pasture has been exhausted, the temptation is to turn herds into the pastures which should be kept for winter use. Such practices may bring disastrous results later in the season.

Grain is not generally fed to cattle except in case of calves or yearlings. Corn obtained from adjacent farms is often substituted for cottonseed cake when corn is cheap and cake high in price. The most practical method of conditioning bulls is by feeding two pounds of cake per head per day on the grass for 60 to 75 days in the late winter or early spring, with access to roughage.

Table 14. Summary of Annual Feed Fed Per Cow, Weanling Calves and Yearling Steers - 15 Prairie Ranches in Colorado, 1923.

Class of cattle fed	Cows	Calves	Yearling Steers
Number of head fed	10,311*	2,387	388
Kind of feed consumed:			
Corn	9.0	100.2	133.8
Cottonseed cake	50.2	48.4	36.3
Native hay	53.5	19.3	61.8
Alfalfa	74.4	121.1	149.5
Sorghum grain fodder	170.8	898.7	280.4
Corn stover	9.1	21.8	---
Corn silage	42.6	140.8	---
Millet hay	3.9	---	---

*All cows are included as the number fed varied from week to week depending on the condition of cattle and weather.

Table 14 gives the amount of feed fed per cow unit for each ranch separately. Cows on the average ate 50 pounds of cottonseed cake, 9 pounds of corn and 354 pounds of roughage

during the winter feeding season. Weanling calves were fed an average of 100 pounds of corn, 48 pounds of cottonseed cake and 1200 pounds of roughage, mostly sorghum grain fodder and hay. Yearling steers received an average of 134 pounds of corn, 36 pounds of cottonseed cake and 498 pounds of roughage made up of sorghum grain fodder, native and alfalfa hay. No other classes of steers were fed. One lot of weanling calves that were fed out is included in the above table.

Cattlemen who make arrangements to handle their cattle with supplementary feeds such as grain, cottonseed cake, corn fodder, sorghum fodder or silage for a short period can generally continue to put on economical gains in the fall and stand a better chance of hitting a good market, unless they follow the foregoing plan. The general run of ranchmen are compelled to come on the market at the unfavorable time. A good share of the ranches studied are following the above practice of feeding at the present time. After the first killing frosts about the 15th of October, the range grasses cease to put on noticeable gains, and the man who brings his calves and yearlings in at this time benefits from the supplementary feeds fed to this class of cattle, by continued gains on his stock. Yearlings and calves were the only class of steers fed on the ranches. The feeding of these younger cattle means a quicker turnover of his investment. The average turnover of the investment in cattle on 15 prairie ranches studied in 1923 was 21 per cent, varying from 18 to 35 per cent.

SUMMER RANGE ON THE NATIONAL FOREST.

Though the western ranges are of low carrying capacity, requiring from 8 to 40 acres of pasture per animal, depending upon the degree of rainfall, the much greater area of land available for use at low cost makes up for the small production of beef per acre. On 15 prairie ranches studied in 1923 the average beef production was 16 pounds per acre, varying from 7 to 27 pounds. Colorado is fortunate in possessing large tracts of national forest reserve pastures, upon which stockmen are permitted by the government to graze their cattle at a comparatively small rental, usually a little over 10 cents per month. The acreage in National Forest Reserves in the State, with estimated grazing capacity and charges per head of cattle, is shown in the following table.

Table 15. Number of Cattle, Sheep, Goats and Horses Grazed and Carrying Capacity of National Forest Ranges in Colorado 1917 to date.

Year	Cattle (number)	Sheep & goats (number)	Horses (number)	Total Units* (number)	Acres per Unit
1917	347,871	918,092	**	485,584	20.6
1918	400,833	1,106,423	10,553	577,349	17.3
1919	401,967	1,069,905	**	562,452	17.7
1920	375,000	1,018,000	13,600	541,300	18.4
1921	374,300	987,300	12,600	534,995	18.7
1922	355,510	855,170	11,566	495,351	20.2
1923	335,610	845,466	11,034	473,464	21.1
1924	299,919	880,661	9,355	441,373	22.7

Data from Forest Service U. S. D. A.
Note: *Sheep equivalent to 15 per cent of mature cow.
**Horses included with cattle.

About ten million acres of the thirteen and one-quarter million acres in the National Forests of Colorado furnish pasturage and feed during the summer for over 25 per cent of the cattle and 40 per cent of the sheep owned in the State. The average grazing season for cattle and horses is about five months and the fee for this period is 50 cents per head for cattle and 62 cents for horses. The average season for sheep is about three months and the fee is 8 1/4 cents per head. The fees have been based on a flat annual rate regardless of variations in character of individual ranges.

The above table indicates that in an effort to fully utilize the carrying capacity during the war period, ranges were possibly stocked above their normal carrying capacity. The table shows that there has been a gradual decrease in numbers of both cattle and sheep grazed upon the ranges since the peak period of 1919 and 1919.

COST OF RUNNING CATTLE ON THE FOREST RANGES: The average cost of running range cattle from 1,193 ranches on 14 National forest ranges in Colorado, 8 forest ranges in Utah, 4 forest ranges in Wyoming, 4 forest ranges in Idaho and one range in Montana during the summer grazing season of 1923 was 77 cents per month per head, or $3.62 per season. The cost figures were obtained on 138 ranches running 34,265 head of cattle under the individual system, where each owner does his own riding, and on 24 cattle pools made up of 1,148 members running 39,072

head of cattle. A similar study covering approximately 42,-000 head of cattle was made in Colorado in 1922.

The cost of running cattle under the individual system of handling was 82 cents per head per month and under pool method 73 cents per head per month. Death loss and other loss of cattle represented 44 per cent of the total cost of running cattle on the National forest ranges, labor 28 per cent, and grazing fees 15 per cent. The other 13 per cent of the total cost covered charges for salt, saddle horses, interest on range improvements, and cost of repairing and maintaining drift fences and trails, and grubbing poisonous plants. Pool cattle were placed on the ranges approximately the 20th of May and were removed the 15th of October, making an average grazing season of 145 days. Cattle under the individual unit system ran on the range an average of 133 days. Ranchmen had to drive cattle an average of 12 miles from the ranch to the forest range under the pool system and an average of 8 miles under the individual system, altho in many cases ranchmen adjoined the reserves/in some cases other cattlemen and had to drive as far as 75 miles to the forest range.

INDIVIDUAL SYSTEM COMPARED WITH THE POOL METHOD OF RUNNING CATTLE: Table compares the cost of running cattle under the individual system with cattle run under the pool system in 1923. Under the pool system members cooperate to hire a rider or several riders to look after the cattle while on the National forest range during the summer season. All

expenses of herding and salting cattle, maintaining drift fences, camps or trails are pro-rated at the end of the grazing season to each ranchman on the basis of the number of head of cattle run by him in the cattle pool. This charge varies from a few cents to more than a dollar per head per season, in some cases, depending upon the amount of range improvement work completed and the length of the grazing season. The cattle pool is designed to save labor in handling cattle on the range.

In this study the cattle pool was twice as efficient as were individuals in the amount of labor required to handle the same number of cattle. Cattle run under the individual system required 52.5 days of riding to care for 100 cattle while the pool system required only 25 days of riding to handle the same number of cattle per season. This labor included placing cattle on forest, care while on the forest, and gathering cattle in fall. Cattle pools are established not only to reduce labor costs but to avoid too frequent disturbance of cattle occasioned by individuals working the range at different times. Where a pool exists, the custom is that the entire range is worked at a single working at the various seasons. This system minimizes the scattering of cattle from their accustomed range. The cattle pools operated eleven per cent cheaper than the individual system. Pool riders received an average wage of $3.45 per day while owners under the single unit system had an average allowance of $2.18 per day for the same kind of labor. Because of the larger number of days riding in handling cattle

under the individual method than under the pool system the labor cost was 19 cents per head higher with a total of $1.12 per head per season while the cost for labor on pool cattle was only $.93 per head.

The grazing fee on cattle run under the pool system was nine cents higher per head than on individual cattle, primarily because the pool cattle ran on the range 145 days whereas the individual cattle were on the range only 136 days, and because pool cattle paid higher rate per month in some cases. Horse expense was five cents per head on pool cattle while it amounted to 10.5 cents on cattle run by individual method because it required twice as much riding to handle cattle under the latter method.

The cost of salt was approximately the same in both types of management being somewhat higher on ranches doing their own riding. Expense in maintaining range improvements, depreciation, and interest on investment on range improvements was higher on the ranches under the individual system as there was a duplication of camps, corrals and other improvements which was eliminated, to a certain extent, under the pool system.

Table 16. Cost Per Head and Relative Importance of Different Items of Cost of Running Cattle on Fourteen National Forest Ranges in Colorado, Wyoming, Idaho, Utah and Montana in 1923. (73,337 cattle).

Items of Cost on Forest Range.	Cost per Head		Per cent of Total Cost	
	Pool system	Individual outfits	Pool system	Individual outfits
	(cents)	(cents)		
Grazing fee	60.2	51.1	17.2	13.6
Regular range riders, herding cattle	31.3	35.6	8.9	9.5
Extra riders, gathering cattle	16.7	11.4	4.8	3.1
Owner and other unpaid labor costs	39.4	51.9	11.2	13.8
Groceries or board for riders	5.6	13.0	1.6	3.5
Salt placed on forest range	12.0	11.8	3.4	3.2
Freighting salt to forest range	2.5	3.8	.7	1.0
Horse shoeing for saddle horses used	2.2	3.2	.6	.8
Horse feed and pasture for saddle horses while on range	2.7	7.3	.8	1.9
Expenses in maintaining drift fence	5.8	4.9	1.7	1.3
Expense for new trials, grubbing poison, etc.	1.5	.9	.4	.2
Other expense driving cattle to range	1.8	5.8	.5	1.6
Depreciation on range improvements at 10%	6.3	11.4	1.8	3.0
Death and other losses of cattle on range	159.3	156.4	45.4	41.7
Interest on range improvements at 6%	3.7	6.9	1.0	1.8
Totals	$3.51	$3.75	100	100

The following table makes a comparison between a number of factors entering into the cost of handling cattle on the range under pool and individual system.

Table 17. Comparison of Important Factors Entering into Cost of Handling Cattle Under Pool and Individual System. Fourteen National Forest Ranges, 1923.

	Method	
	Pool	Individual
Number of cattle run on forest range upon which cost was obtained	39,072	34,285
Number of days cattle were grazed on range	145	136
Number of days riding on range per 100 cattle	25	52.5
Average number of days riding per month per 100 cattle	5.2	11.6
Average wage paid or allowed per day for riding	$3.45	$2.18*
Number of miles from ranch to range	12	8
Total cost of running cattle on range per season	$3.51	$3.75
Grazing fee (per season)	.60	.51
Cost of labor handling cattle per season	.93	1.12
Cost of salt	.15	.16
Pounds of salt distributed to cattle	6.3	7.2
Percentage death loss on forest range	5.3	5.0
Death and accident loss, cost per head	$1.59	$1.66

*Work done by operator and unpaid members of family was charged at the prevailing rate of wages paid hired hands doing similar work.

GRAZING FEE: The grazing fee was fairly uniform on all forest ranges averaging from 10 to 12 cents per head per month. The grazing fee represented 17.2 per cent of the total cost of running cattle on the forest range in the case of cattle run in pools and 13.6 per cent of the total cost in the case of cattle running under the individual system. At the present time no allowance is made in the grazing fee for differences in ranges caused by carrying capacity, poisonous plants, lack of improvements, inaccessibility or loss by drifting of cattle. The figures that form the basis of this report indicate that it is unprofitable for ranchmen to run cattle on areas infested with poisonous plants. Profits in ranching are influenced not by the number of animals run on the forest range, but by the number and quality of the animals sold off the range. The ranchman who had a high death loss among his cattle and such a low percentage of calf crop that it takes the larger part of the increase for replacements, can make no profit running cattle on the forest ranges even though he stock the range to the limit and pay comparatively little for the use of the range in the way of grazing fees. Certain minimum expenses must be met regardless of the calf crop or death loss.

It is the man, who by superior management and well improved range, is able to secure a calf crop above, and a death loss below the average, that has the best chance for making profits. It costs less to run cattle where there are good

range improvements and where death loss from poisonous plants can be kept at a minimum. It is found that ranchmen can not apply improved management methods in many cases because they are not properly organized for the purpose and in many cases are hesitant about cooperating. Few ranchmen stop to figure up just what it costs them to run cattle on the forest ranges, a practice which would help greatly in the solution of their range problems.

Table 18. Distribution of Cattle by Classes Among the Cattle Studied on Fourteen National Forest Ranges in Colorado, Wyoming, Utah, Montana and Idaho. 1923.

Class of cattle	Pools	Individuals	Total	Pct. of total
Cows	12,118	14,751	26,869	35.8
Bulls	1,264	835	2,099	2.8
Two-year-old heifers	3,793	3,222	7,015	9.3
Yearling heifers	3,774	3,882	7,656	10.2
Yearling steers	3,815	5,043	8,858	11.8
Two-year-old steers	4,414	3,261	7,575	10.1
Three-year-old steers	113	1,013	1,126	1.5
Calves*	992	2,620	3,612	4.8
Cattle not classified, mostly cows and calves	8,889	1,314	10,203	13.7
Totals	39,072	35,941	75,013	100.0

*Only a few ranches reported on calves.

Cattle associations or pools enable the ranchmen to secure the low costs incident to the handling of a large number of cattle under standard methods and practice. It enables the ranchmen to apply the highest types of scientific and practical skill in the solution of range problems.

LABOR REQUIREMENTS IN RUNNING CATTLE ON FOREST RANGES: The labor question is one of the most important problems in connection with running cattle on the National forest ranges. Large amounts of labor are required to drive cattle to the range and to handle and gather cattle as they drift down from the ranges in the fall. Large savings in labor can be made by running cattle in large units or by running cattle in pools. It required 25 days of riding to handle 100 head of cattle for a season of 145 days or 5.2 days per month under the pool method, while it took 52.5 days of riding per season of 136 days of 11.6 days per month to handle the same number of cattle under the individual system. This indicates that the pool system studied was twice as efficient in handling cattle as were individuals because pools operate with an average of 1,628 head of cattle while the individual outfits average 248 head per unit. Table 19 shows the amount of labor required to handle various sized units and brings out the fact that cattlemen who run cattle on the National forest ranges should graze a large enough number of cattle to have the most economic unit. If compelled to reduce the number of cattle to less than an economic unit, their operating costs for labor per head becomes prohibitive.

Table 19. Comparison of Days of Labor and Cost of Labor Between Various Sized Herds of Cattle Run on Fourteen National Forest, 1923.

Number of Head in Herd.	Days of riding required per 100 cattle	Wages paid per day for herding cattle	Labor cost per season per 100 cattle
100 to 200 head	94.7	$ 2.30	$217.81
201 " 500 "	46.9	2.72	127.57
501 " 1100 "	37.9	2.38	90.20
1101 " 1650 "	25.0	3.68	92.00

Table shows that it required almost three times as much labor or days of riding to handle a unit of 100 to 200 cattle as it did to handle a larger unit of 500 to 1100 head of cattle, making a saving of $127 per 100 head of cattle in labor costs. Where ranches adjoin the forest range and where the range is well fenced the amount of labor can be reduced to a minimum, for very little labor will then be required other than distributing salt and an occasional visit to see that cattle are doing well.

Table 20. Amount and Value of Labor Required to Handle Cattle Under Pool and Individual Systems on Fourteen National Forest Ranges in 1923.

	Pool	Individual
Average number of cattle per unit	1628 head	248 head
Number of days riding per 100 cattle per season	25 days	52.5 days
Number of days riding per month per 100 cattle	5.2 "	11.6 "
Average cost of owner and hired labor per day	$3.45	$2.18
Average wage rate of hired riders per day	3.47	1.90
Average wage rate of owners and unpaid labor per day	3.43	2.87
Value of groceries used per man per day	.23	.37

It is very difficult to get an accurate estimate of the value of horse labor, as a number of the horses received only pasture, and grain is often brought to the mountain ranges without charging it against the cost of running cattle on the forest ranges. It is also very difficult to get an accurate estimate of the value of groceries and board, for a few ranchmen do their riding from the home ranch and return to the ranch for meals. In many cases calves or yearlings are butchered and no value placed on the meat consumed by riders.

IMPROVEMENTS ON THE SUMMER RANGE: The average investment for range improvements amounted to $284 per ranch under the individual system and $734 per cattle pool. This amounted to an investment of $114 per 100 cattle in the case of individuals and $45 per 100 cattle in the case of cattle pool, or an average investment of $78 per 100 head of cattle when all cattle are considered. Table 21 gives the average investment per 100 head for the various kinds of range improvements.

Table 21. Value of Range Improvements per 100 Head of Cattle on Fourteen National Forests in 1923.

	Investment per 100 cattle		Investment on all ranches per 100 cattle
	Pools	Individuals	
Camps on forest land	$ 9	$42	$25
Camps on private land used for grazing in connection with forest ranges	11	33	21
Water improvements	2	3	3
Other improvements, corrals, etc.	6	6	6
Drift fences	16	30	23
Totals	$45	$114	$78

Building of drift fences in more recent times has come to be looked upon as an investment that pays dividends. The carrying capacity of the ranges may be greatly increased and livestock much more efficiently handled by a more scientific organization of the grazing area. Fences are the most important and the most expensive of all permanent improvements on the forest range. The addition of permanent improvements increases the expense of running cattle on the ranges by (1) the amount of interest on their original cost, (2) their upkeep and operating expense, and (3) their depreciation. On the other hand they add to the ranch income directly or indirectly by (1) reducing the cattle losses, (2) increasing the percentage of calf crops, (3) increasing the carrying capacity of the ranches, (4) improving the quality of the cattle, and (5) reducing the expenses of management. Permanent improvements become a burden when they are more expensive than is necessary for present or future needs. Range improvements are badly needed on a number of forest ranges at present.

CATTLE DEATH LOSSES ON FOURTEEN NATIONAL FOREST GRAZING RANGES IN 1923: Reports from ranches under study show that one-fifth of the cattle death losses for the entire year occurred on the home ranch while four-fifths of the losses occurred on the forest grazing ranges. The death losses reported on leased State land were negligible, as only one per cent of the total death loss occurred on State land. The average death loss on the forest ranges for pool cattle was 5.3 per cent and

the average death loss on the individual herds was five per cent. The average value per head of cattle lost was $32 on the pool cattle and $31 on the cattle run under the individual system. The average cattle loss on all ranches, from all causes, on home and forest range was 6.6 per cent. This includes losses of calves as well as mature stock, as no record of the number of calves owned or dropped was obtained. Deaths among these calves increased the percentage death loss shown somewhat more than if calves were disregarded.

Table 22. Comparison of Cattle Death Losses on Fourteen National Forest Ranges with Losses on Leased State Land and Losses on Home Ranch as Reported by Ranchmen on 73,337 Head of Cattle During the Season of 1923.

Losses	Pool Cattle		Individuals		All Cattle Ranches	
	No. of head	Pct. of total loss	No. of head	Pct. of total loss	No. of head	Pct. of total loss
On forest ranges	2078	79.6	1709	76.4	3787	78.2
On State land	32	1.2	9	.4	41	.8
On home ranches	502	19.2	518	23.2	1020	21.0
Total loss	2612	100.0	2236	100.0	4848	100.0

Table 23 shows the variation in death losses as they occurred in different cattle pools, the average death loss being 5.3 per cent of the total number of cattle run on the forest ranges. Table 24 shows how death and other losses were classified as to cause of loss. Poisonous plants caused the largest number of losses, with estray second in order.

Table 23. Death Losses as Reported by Individual Cattle Pools in Colorado Compared with Death Losses in Wyoming, Montana, Utah and Idaho, 1923.

State	National Forest	Number of cattle in pool	Number of head lost	Per cent death loss
Colorado	White River	1025	102	10.0
	Gunnison	4580	305	6.7
	Routt	450	15	3.3
	Holy Cross	2400	72	3.0
Wyoming	Medicine Bow	1400	56	4.0
	Wyoming-Bridger	1000	30	3.0
Montana	Lewis and Clark	625	15	2.4
	Lewis and Clark	400	8	2.0
Utah	Manti	2201	264	12.0
	La Sal	1825	115	6.3
	Uinta	8000	500	6.2
	Cache	600	26	4.3
	Dixie-Sevier	1084	43	4.0
	Powell	695	28	4.0
	Fishlake	2050	82	4.0
	Powell	1000	38	3.8
	Manti	1419	49	3.5
	Uinta	977	29	3.0
	Cache	1048	28	2.7
	Fillmore	405	10	2.5
	Powell	1275	15	1.2
Idaho	Nez Perce	750	89	11.9
	Cache	1344	118	8.8
	Saw Tooth	2519	41	1.6
Total		39,072	2078	5.3

Table 24. Causes of Death Losses of Cattle on Thirty-one National Forest Grazing Ranges in Colorado, Utah, Idaho, Wyoming and Montana in 1923. (73,337 cattle)

Causes of Losses on Forest Ranges	Number of head lost		Per cent of total loss	
	Pool herds	Individual herds	Pool cattle	Individual ranches
Poisonous plants	815	613	39.2	35.4
Estray	538	239	25.9	13.8
Blackleg	167	139	8.0	8.0
Unknown causes	147	277	7.1	16.0
Theft	107	189	5.6	10.9
Bog holes	88	43	4.2	2.5
Lightning	65	32	3.1	1.9
Poverty	39	--	1.9	--
Predatory animals	28	46	1.3	2.7
Lack of drift fences	27	41	1.3	2.4
Accident	14	41	.6	2.4
Cattle snowed in	13	4	.6	.2
Scours	11	19	.5	1.1
Big brisket	10	34	.5	2.0
Bloated	5	--	.2	--
Railroads	--	12	--	.7
Total losses	2078	1729	100.-	100.0
Avg. per cent death loss	5.3	5.0		

Cattle are at the present time the most important kind of livestock run in the National forest, and natural conditions suggest that they always will be. The system of ranching has changed within the past few years. It has become more stabilized with the passing of the land into private ownership and the fencing of the range, and will become more intensive as capital accumulates, prices of beef rise, and the importance of producing enough forage and providing sufficient range to keep the cattle through the winter becomes more pressing. The

ranch must be big enough to carry from 100 to 300 head of cattle which means that a ranchman must have permits to run a good share of these on the forest ranges. Slowly the large ranches will be divided, as many have been in the past, and small ranches, on the other hand, consolidated into units of this size. Not all the large ranches will be divided, however, nor all the small ranches consolidated, because there are as great differences in men as in land.

RANGE SANITATION AND PREVENTION OF DEATH LOSSES.

It is not generally realized that common diseases and pests of range stock cause an enormous animal loss to Colorado cattle growers. These losses are not only direct through the death of animals, but also indirect in the lower calf crop resulting from weakened breeding stock. These losses amounted to 2.3 per cent for the first half of 1924, and on the average amount to about five per cent on the prairie ranches and three per cent on the mountain ranches per year. All the diseases causing this loss are due to germs by which they are perpetuated. Some of these diseases are contagious, others infectious, each is caused by a specific germ. For example, the disease known as "authrax" is always caused by the germ known as authrax bacilli. Authrax is never found unless the germs of the disease are present. The same specific principle applies to all

other contagious and infectious range diseases such as blackleg, tuberculosis, and lumpy jaw. A few years ago these diseases threatened the live stock industry of this country, while today they can be avoided by the use of preventive serums, and there is no longer any reason why serious losses should occur.

In diseases where preventive serums are used, and in those diseases for which no preventive serums have been discovered there are still methods of preventing the spread of disease on the range. One of the best ways to prevent the spread of disease over the range by dogs, wild animals, magpies, buzzards, etc., is to properly dispose of the animals which died of blackleg, authrax or lump jaw. All diseased animals should either be burned or buried and the germs not allowed to be scattered broad cast over the pastures. Some say that burning and burying are impracticable; others that it is impossible, but it is one way to make the ranges of Colorado the most healthful in the country. Often several dead cows are found in a water hole. It is certainly not impossible to remove them so that the water will not become so contaminated that other deaths will be caused from drinking from this hole. A systematic, persistent, co-operative effort, rigidly carried out by the stockmen, will surely result in reducing the enormous financial loss due to disease and pests.

Death loss amounted to ten per cent of the total net cost of producing a calf up to weaning time, being 3.4 per cent on

cows and 6.4 per cent on bulls on 15 plains ranches in 1923. There was wide variation in the per cent death loss incurred on the different ranches, being as much as 23.1 per cent on one ranch. The death loss amounted to 25,702 pounds of beef per ranch valued at $1,341 in 1923.

Table 25. Losses of Beef Cattle on 15 prairie ranches in Colorado in 1923.

Class of cattle	Per cent death loss
Calves	1.2
Cows	3.4
Bulls	6.4
Two-year-old heifers	1.6
Yearling heifers	2.9
Yearling steers	3.9
Two-year-old steers	2.7
Three-year-old steers	2.0
Four-year-old steers	1.5
Five-year-old steers	3.7

The heaviest loss was on bulls which was 6.4 per cent. The next heaviest loss was on yearling steers and heifers, with cows following in order. Death loss on mature steers was fairly heavy, ranging from 1.5 per cent to 3.7 per cent. Death loss is caused from bogging down in holes near the streams, lightning accident, poverty, calving, old age, black-leg, loco, blizzards and severe storms.

FACTORS AFFECTING THE PRICE OF RANGE CATTLE IN COLORADO.

Of all the problems confronting the western stockman none is more important than that of marketing. This problem is made more complex by reason of the seasonal nature of his product, the fact that much of it requires further finishing before it is ready for consumption, and, because of the great distance intervening between the place of production and the marketing and consuming centers.

Ordinarily livestock is marketed when in best condition and in as much as range animals are finished on grass it is natural that they would be marketed in the fall at the end of the grazing season. While the number of all cattle slaughtered during this autumn period is the largest of the year, the percentage of slaughter to marketings is the smallest, and the percentage of the stocker and feeder shipments is the greatest. The fall movement, by furnishing a large part of the supply of feeder cattle, determines to a considerable extent what the future supplies of beef will be as a large number of them are returned to farms for feeding. It also causes an economic disadvantage to the range stockman that should receive serious consideration from the standpoint of orderly marketing.

SEASONAL MOVEMENTS OF RANGE CATTLE; A study of seasonal movement of cattle and calves from the range states to the stockyards shows some variation in the time of marketing in

the different states, but not enough for a system of orderly marketing. There appears to be six distinct areas with respect to time of marketing. Idaho, Nevada, Utah and Colorado, for instance, market cattle at about the same time. Colorado cattle are shipped to Denver and the Missouri River markets. Colorado is also finding an outlet for some of her cattle in California. About 35 per cent of the year's shipments from these states are marketed during October and November; July is the low month with three per cent. The fall movement in these states begins with a few shipments in September, and during the five months ending with January 63 per cent of the year's total are marketed. The market movement in these states is better distributed thruout the year than in some of the other states because of a certain amount of feeding done in the irrigated districts. The fed cattle, which are finished on hay, beet tops and some grain, are marketed thru the winter and spring months.

Table 26. Per Cent of Range Cattle Sold Fat or as Stockers and Feeders in Western Range States, Compared with Colorado.

State	Per cent fat	Per cent stockers & feeders	State	Per cent fat	Per cent stockers & feeders
Arizona	12	88	New Mexico	30	70
Calif.	100	--	N. Dakota	31	69
COLORADO	40	60	Oklahoma	49	51
Kansas	55	45	Oregon	55	47
Montana	64	36	Texas	25	75
Nebraska	37	63	Utah	76	24
Newada	49	51	Wyoming	50	50

Data from Bureau of Agricultural Economics, fall of 1923.

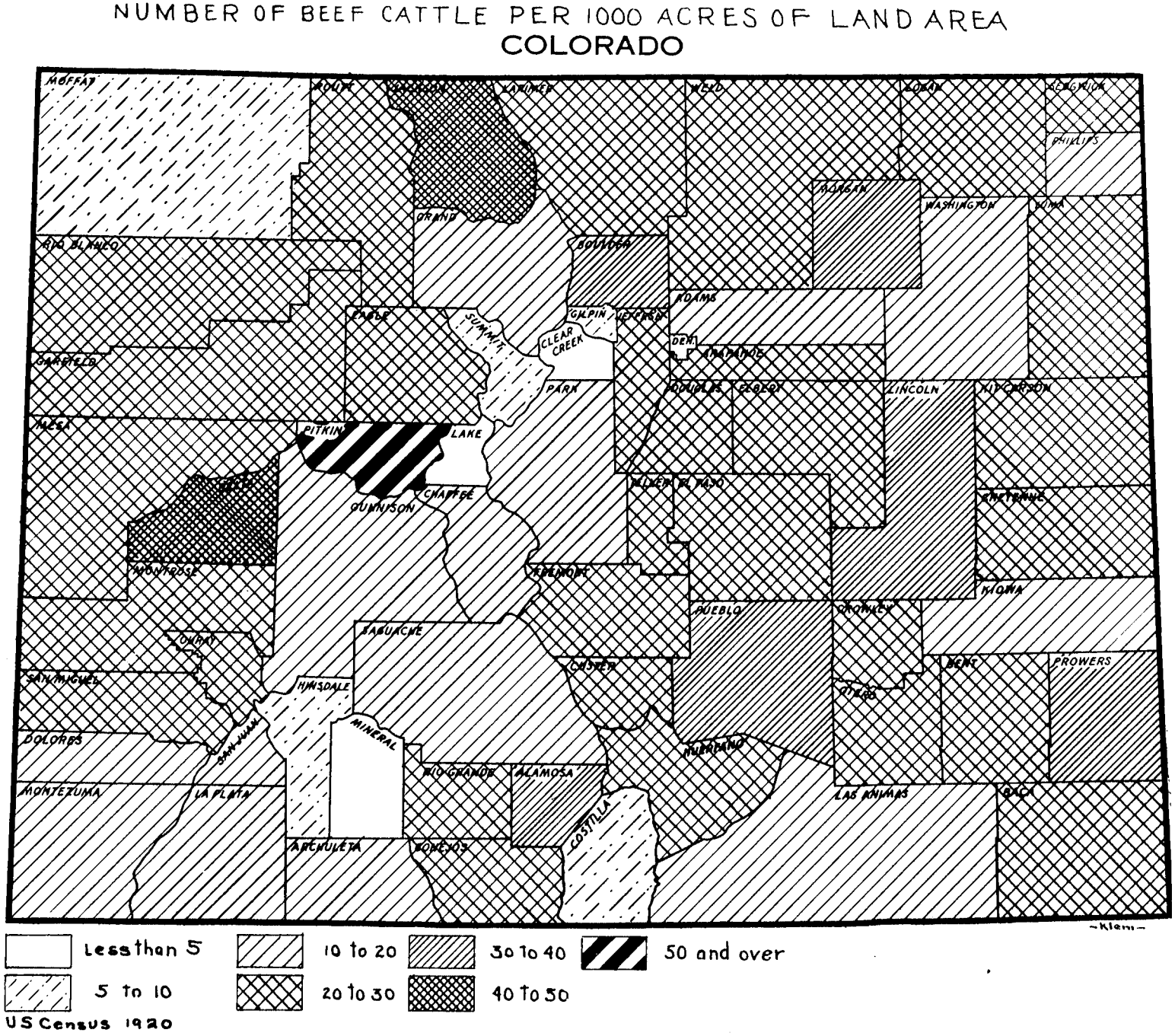


Fig. 10. Number of beef cattle per 1000 acres of land area in Colorado, 1920.

In Montana and Wyoming most of the cattle are finished on grass and 78 per cent of the year's movement takes place between September to November. Texas, Washington and Oregon market their cattle at about the same time. Furthermore, they market them more uniformly thruout the year than any of the other range states. Southwest Texas begins to market grass fat cattle as early as May and the balance of the state has fairly uniform marketing, averaging about ten per cent per month between May to November. California cattle are marketed largely from April to July, inclusive, 63.6 per cent being marketed during this period, and most of them are consumed within the state. Relatively few of the Arizona cattle are in condition for slaughter when ready for the market and they find an outlet mostly as stockers and feeders, largely going to California. New Mexico cattle are marketed in largest numbers from September to November, 55 per cent being shipped during that period. The records of the Denver Union Stock Yards Company show the receipts of cattle at the stockyards together with the percentage of these receipts originating in Colorado. The per cent of the cattle either slaughtered or reshipped as feeders to Colorado points is also shown. Table 27 gives this record for the ten-year period 1914 to 1923 inclusive.

Table 27. Receipts of Beef Cattle at the Denver Union Stock Yards and the Percent Originating in Colorado from 1914 to 1923

Year	Total number of animals* received	Per cent of receipts originating in Colorado	Per cent slaughtered or reshipped to Colorado points
1914	442,738	56.6	54.7
1915	424,341	66.3	53.6
1916	601,460	62.2	42.8
1917	653,377	62.4	50.1
1918	728,268	62.1	52.8
1919	823,727	62.6	49.2
1920	616,565	60.4	50.2
1921	481,502	68.9	52.0
1922	656,245	65.8	44.9
1923	619,882	70.1	46.8
1924	630,353		
10-yr.avg.	604,810	63.7	49.5

*Figures from the Thirty-eighth Annual Livestock Report of the Denver Union Stock Yards Company and "Colorado's Agriculture", page 21.

Table 28. Receipts of Cattle and Sheep in 1923 from Colorado by Markets of Destination. Number of head.

Market destination	Number of Head	
	Cattle	Sheep
Buffalo	---	---
Chicago	7,381	589,765
Denver	392,640	901,741
East St. Louis	3,366	7,067
Fort Worth	---	---
Indianapolis	84	---
Kansas City	82,993	485,108
Oklahoma City	---	---
Omaha	101,822	313,147
St. Joseph	33,924	367,913
Sioux City	13,000	4,148
Wichita	---	---

1923 data from Bureau of Agricultural Economics, Marketing Livestock, Meats and Wool Division.

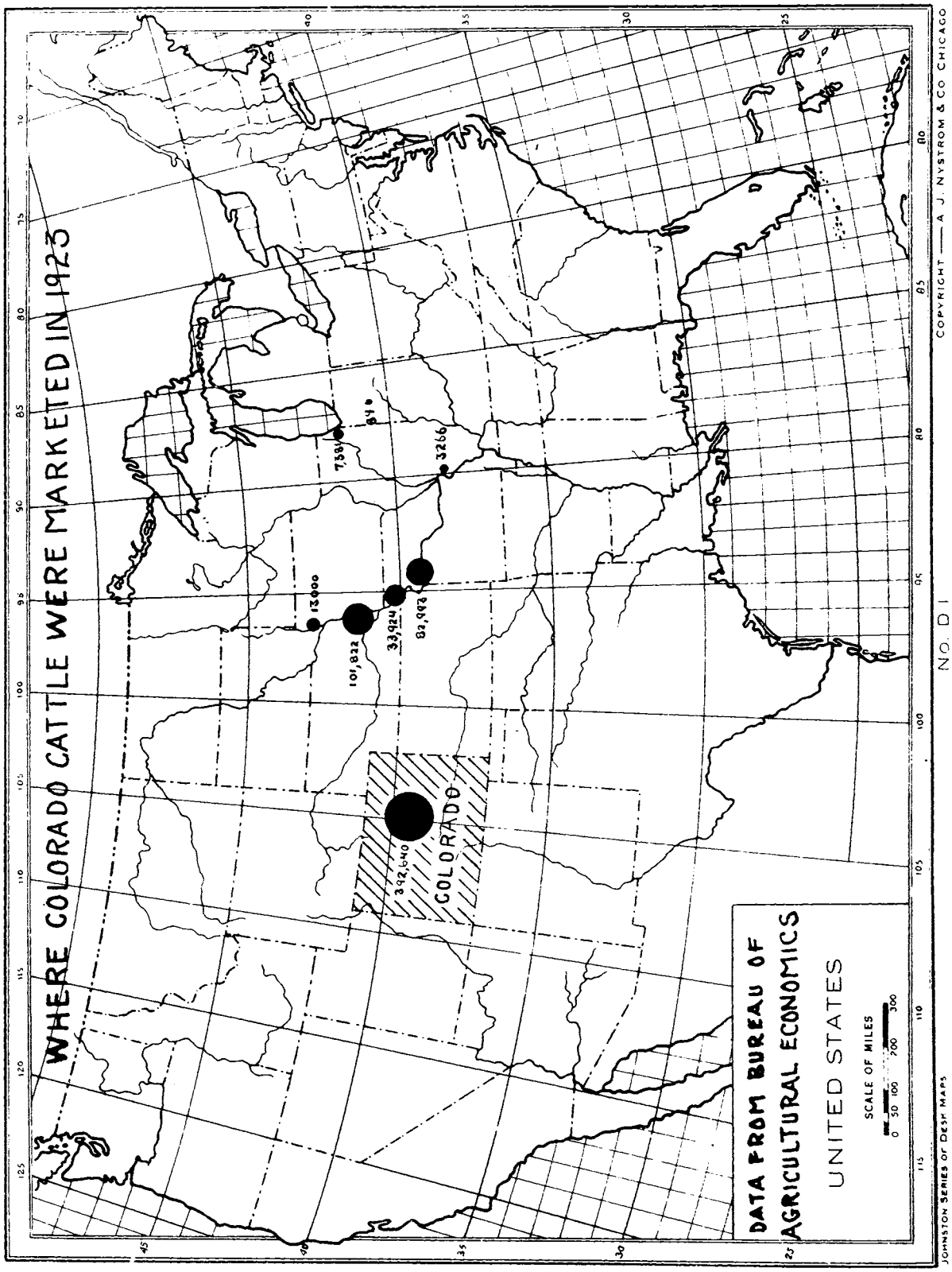


Fig. 11. Receipts of cattle from Colorado by markets of destination in 1923.

PRODUCTION AND PRICE OF CORN AS AN INFLUENCE ON THE PRICE OF CATTLE: For fifteen years before 1914 the price of fat steers averaged 12.06 times the December first price of corn. Divide the fifteen years into three groups and you will get nearly the same average. When the price of fat cattle is 12.06 times the December first price of corn farmers will buy cattle to feed. On October first, 1924, the price of cattle was 8.16 times the price of corn and farmers could not see where they could make a profit buying cattle so they did not purchase feeders.

The annual corn production of the United States has varied from its lowest mark 850 million bushels in 1894, to its highest mark, 3208 in 1920.

Each of the low production corn years of 1894, 1897, 1901, 1903, 1907, 1908, 1911 and 1913 was followed the next year with a decrease in cattle receipts. The lowest cattle receipts of 186,000 in 1914 followed the low corn production of 2,496 million bushels in 1913. During these years corn prices made higher levels than the preceding years except in the years 1903 and 1909. A smaller number of cattle were fed on each of these occasions. Each of the heavy corn productions in the years 1896, 1900, 1902, 1906, 1910, 1912 and 1915, caused lower prices for corn and higher prices for cattle. The year 1924 has been a year of low corn production, and high prices for corn with heavy receipts of cattle. Since there were only five corn crop failures before 1901 there is small probability

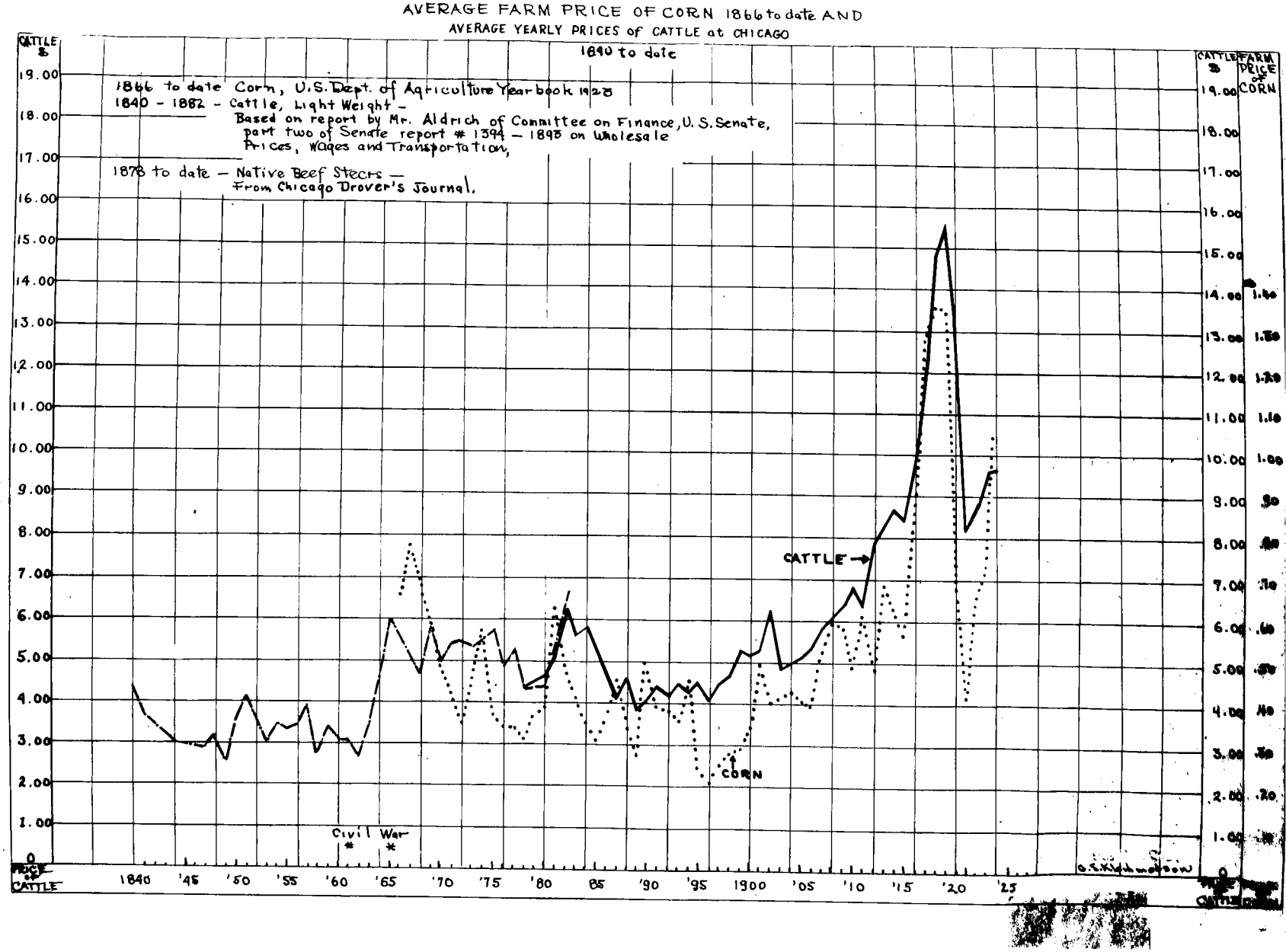


Fig. 12. Average farm price of corn compared with average yearling prices of cattle at Chicago from 1866 to date.

of there being one in 1925. With a good corn crop and lighter receipts of cattle following a short corn crop it is reasonable to predict that cattle prices will be higher in 1925.

BEEF CATTLE RECEIPTS AND PRICES: In the accompanying charts I have attempted to show the relationship between receipts of beef cattle on the Chicago market and the average price. The Chicago market is used as it is the basic beef market of the country. In most instances, prices paid for beef cattle on the markets are based on the Chicago prices.

These charts were worked out to show that there is not necessarily a true relationship between receipts and prices. In figure 13 you will note that over a period of years there is a fairly true relationship between the receipts and price curves. That this curve is not true indicates that there are factors other than the receipts which influence the price paid for beef cattle. Otherwise, if the law of supply and demand functioned as freely as it should, whenever the receipts of beef cattle declined over a period of a year's time there should be a corresponding increase in the average price paid for beef cattle. That this is not true is indicated by a close study of this chart. The years 1916 to 1921 inclusive, should not be taken as a criterion, however, as business conditions the country over were abnormal.

In our history of the cattle business since it started in the last fifty years, it has been a continual up and down,

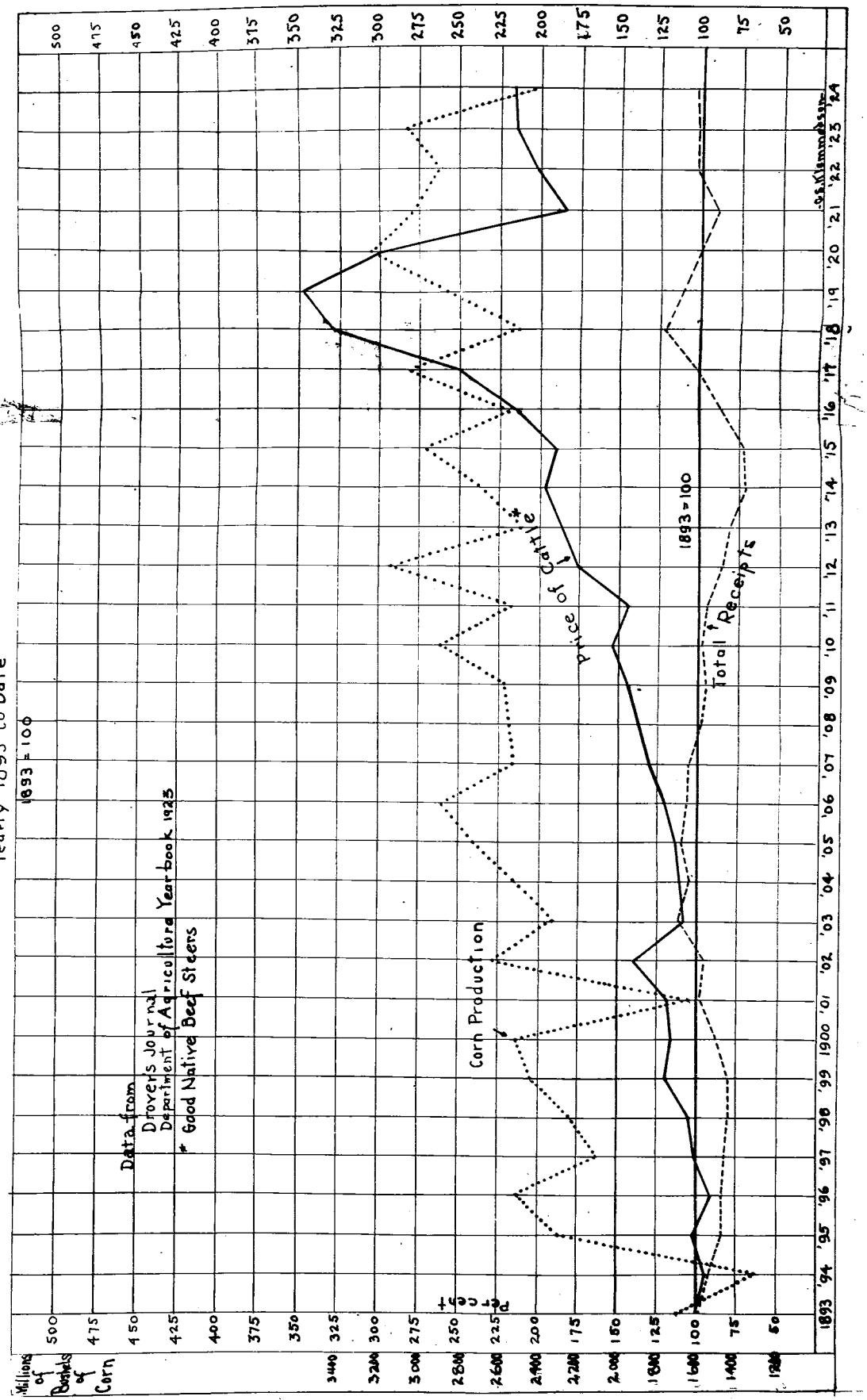


Fig. 13. Relation between receipts and prices of cattle and the production of corn yearly from 1893 to date.

a profit-fattening, and a later blood-letting, and the middle sources waxed strong. Only a marketing reform will make a stabilized cattle industry. Irrespective of what the cattleman does, there is going to be a profit period soon. The probable program in cattle will be about as follows: (1) Advance in Middle West on quality cattle fall of 1924 and spring of 1925. (2) Advances on bulk cattle. (3) Money relief for cattle operations and for restocking of ranches and for feeder and stocker cattle purchases to men who have plenty of feed in 1925. (4) An effect in the spring of 1925 or next fall on feeder values, stock values and ranch values. The wise man will buy the present cheap young steers and hold them for greater steer values that are certain. The other wise man is the one who maintains his herd up to present numbers, for better prices are in sight for the fall of 1925. The ranchman never had a better opportunity to begin the establishment of a herd. He can now lay in a foundation of breeding stock of choice quality at prices that are bound to prove profitable. If he is a business man, he will take advantage of the opportunity.

Study of the accompanying chart shows the relation between cattle receipts and average annual prices since 1893. Receipts increased greatly during the war, but prices also increased; receipts fell off after the war and prices did likewise. In 1921 both began another movement upward. This does not mean that the law of supply and demand has not been in operation;

it merely means that conditions of demand, due to war, to industrial conditions, to the gradual increase of population, etc., have often outweighed the influence of supply.

CYCLES OF OVER AND UNDER PRODUCTION: Beef cattle have marked cycles of over and under production. The periods of rising or falling prices varied from six to nine years, averaging about eight years. Prices of beef cattle were high compared with other commodities in 1885, 1899 and 1915. The low points were 1891 and 1906, and again in 1923. The period of rising and purchasing power that ended in 1915 lasted nine years and the decline that then began lasted eight years. Presumably the prices of beef cattle will rise, compared with other things, for a period of about eight years. Probably they will reach average prices by about 1928 and be more profitable than the average from 1928 to 1936 with the peak about 1932. This means that if the general price level falls, beef cattle will fall less rapidly or may rise more rapidly. Since sheep are profitable, the competition with beef cattle may be expected to be very keen for the next few years.

Following the Civil War there was a considerable period of low prices for beef cattle. The purchasing power did not turn upward distinctly until 1881. It is possible that deflation may have some influence that is particularly unfavorable for beef, but it seems more probable that the regular cycles will continue. Apparently the cycles of over and under production are so dominant as to have gone on for the last thirty-eight

years as the dominating factor. The number of beef cattle on January 1, 1907, was 52 million. It decreased to 36 million on January 1, 1914. This striking decrease resulted in high prices which reached a peak in 1915. The high prices resulted in an increase in numbers to 45 million on January 1, 1919. The low purchasing power is resulting in a decrease in number. On January 1, 1924, there were only 42 million. For the two years 1923 and 1924, the purchasing power of beef cattle averaged 54 in Colorado and 78 in Iowa. This difference was due in part to high handling charges which affected Colorado adversely. It was even more due to changes in demand. The corn fed beef make a choicer grade of meat than do cattle from Colorado. When food is very cheap the demand for the choicer types of food is very great. The demand for the poorer grades is low. The ranchman who happens to have the favored product may be doing very well unless the supply is abnormal, but the producer of staple foods who is in debt is in severe difficulty.

FACTORS AFFECTING THE SUPPLY OF RANCH PRODUCTS: The shipment of calves and breeding cows, forced by the necessity to pay long outstanding debts, is cleaning the range of its breeding cows. This situation means something to the man on the range and to the farmer who breeds for beef. It means that the western ranges are being depopulated. The fact that the ranges are being depopulated inevitably means the scarcity of beef within a few years and the scarcity of beef cattle means higher prices. Decreased calf crops due to seasonal or other

reasons, selling of cow herds under loan pressure, and failure of cowmen to make money have decreased the production on the ranges. Investigations show that it costs on the average $30 a head to produce a yearling steer or heifer on the range, and the average net price has not been near that figure. These are important causes for a reduced supply.

1. Increasing wages, which intensify the critical nature of the demand for quality beef on the part of labor effects the demand and finally the supply.

2. A deterioration in the quality of western range beef, due in part to the droughts and in part to late rains which prevent the curing of the grasses and resulting in unfinished carcasses at time of marketing, effect demand.

3. The relative volume of feed in the corn belt, which makes it possible to produce corn fed beef at prices that would compete with grass fed cattle.

4. The decrease since the war in the value of hides and by-products, which make the carcass more dominantly the determining factor in the price of cattle.

The factors which enter into the price of cattle may be logically classified as follows:

1. The percentage of dressed beef which may be obtained from a live animal.

2. The value of that dressed beef as sold by the packer.

3. The value of by-products, including hides, tallow and offal.

4. The overhead cost of buying, killing, cooling and selling these products.

5. The cost of transporting live animals from the ranch or shipping point to the slaughter point.

6. Making an allowance for a reasonable profit to the packer for the work and service which he renders in manufacturing the live animal into dressed beef and salable by-products.

MARKET HINDRANCES: Apparently the packers are selling dressed beef at only a legitimate profit above cost. The ratio between prices paid by them for cattle on the hoof and prices at which they sell dressed beef to the butchers, is only slightly higher than before the war, and the differences may be accounted for by the enormous decline in the price of by-products, a source from which the packer ordinarily expects to cover overhead expenses.

The following table shows results per hundredweight, live and dressed, also per head. It shows that Swift and Company paid $66.97 per head for cattle on the average during 1923; received $68.35 for the meat and $12.17 for by-products. This left a margin of $13.55 for expenses and earnings. Expenses including freight amounted to $12.45 leaving earnings (before deducting interest) of $1.10 per head.

Table 29. Cattle Operations, Fiscal Year 1923.*

	Per cwt. live	Per cwt. dressed	Per head
Received for meat 530 lbs. avg. wt.	$ 6.97	$12.91	$68.35
Net returns from by-products, including hides	1.24	2.30	12.17
Total received	8.21	15.21	80.52
Paid for live cattle 981 lbs. avg. wt.	6.83	12.65	66.97
Total expenses, including freight	1.27	2.35	13.45
Profit - before charging interest	.11	.21	1.10

*Swift & Company, Yearbood 1924.

LOW BY-PRODUCT VALUES AFFECT CATTLE PRICES: It will be noticed from the table that prior to 1921 Swift and Company paid more for cattle than was received for the dressed beef. This was made possible by the relatively large returns from by-products, including hides. The past three years have been abnormal in this respect, due to small return from by-products, and high expenses. A decline in hide prices during 1923 prevented a return to normal by-product values.

Table 30. Swift and Company Cattle Operations per Head, Fiscal Years 1915 to 1923.*

Fiscal years	Paid for live cattle	Received for meat	Net returns from by-products incl. hides	Total expenses incl. freight	Profit & loss before charging interest
1915	$72.49	$63.28	$18.58	$ 7.73	$1.64
1916	73.68	63.98	19.08	7.73	1.65
1917	84.45	68.97	24.09	7.32	1.29
1918	92.70	81.45	22.06	9.79	1.02
1919	102.82	88.21	25.59	11.68	.70 loss
1920	93.85	86.31	21.17	13.69	.06 loss
1921	67.53	75.32	8.51	15.17	1.13
1922	64.72	67.25	13.45	11.46	2.52
1923	66.97	68.35	12.17	12.45	1.10
Unweighted avg.	79.91	73.68	18.30	11.00	1.07

*Swift and Company Yearbook 1924.

COMPETITION FROM DAIRY INDUSTRY INCREASING: The Department's estimate for January 1, 1924, showed an increase of 33 per cent in milch cows over 1910. The range states now have 13 per cent of all the milch cows in the country. That the dairy industry is growing in the West is indicated by an esti-

mate of an increase of 14 per cent in the number of cows and heifers two years old and over in the far western states on June 1, 1924, as compared with the same date in 1923. The dairy industry deserves the serious consideration of the western cattlemen because of its increasing competition. Not only does it compete through the production of milk, butter and cheese, which are food products that can be substituted for meat but it competes directly by supplying quantities of meat. The dairyman has a large surplus of animals which he sells on the same market patronized by the rangeman. This surplus includes not only worn out dairy cows and bulls but also many thousands of comparatively young animals which have failed for one reason or another, to come up to the standards set by the dairyman. Furthermore, these dairy cows yield a grade of beef which competes directly with grass beef, hence the beef cattleman suffers more from this competition than does the grower in the corn belt.

THE RANCHMAN'S FOREIGN MARKET: The history of our foreign trade is beef and its related products shows an expanding export up to a high point of about 1,175,000,000 pounds in 1906, a very rapid decline to a large net import in 1914, a modest recovery of net export during the war, since then the net exports have declined. The ordinary figures on beef exports tell only part of the story of the foreign trade connected with our cattle industry. During the period of heavy export, the shipments of live cattle to England orginarily

accounted for more than one-half as much as our shipments of dressed beef and beef fats taken together. Since 1912 the movement of cattle has been inward, largely from Canada, in the form of feeder stock for fattening in the corn belt. In 1919 this movement reached the high total of 642,395 head of cattle. Since the war our exports of live cattle have reappeared and exceeded the live imports in 1921 and 1922. With these exceptions, the estimated slaughtering weight of the imports has exceeded that of the live exports. The exports of dressed products include very heavy amounts of beef fats. The heaviest recorded shipments go to Holland, the ultimate destination for a large part probably being England. It is impossible to separate all the beef products in the customs records, but the error involved from neglecting the miscellaneous items is not large. A somewhat larger error appears in estimating the slaughtering weights of the live animals imported and exported. Had not the fats been included since the war the results would have shown a net import in this late period. It must also be remembered that in addition, we have a net import of cattle hides of very large proportions. In 1923 this amounted to 268,071,688 pounds with a value of $43,672,821.

Table 31. Estimated Annual Production, Exports, Imports, and Consumption of Beef in the United States.1/

Year	Slaughter			Exports (Domestic)	Imports (less re-exports)	Consumption	
	Total	Federally inspected	Other			Total	Per capita
	Million pounds			Million pounds			lbs.
1907	7,319	4,336	2,983	352	---	6,967	79.7
1908	6,676	3,955	2,721	228	---	6,448	72.4
1909	7,071	4,189	2,882	163	---	6,908	76.2
1910	6,733	4,054	2,679	110	---	6,623	71.8
1911	6,497	3,984	2,513	92	---	6,405	68.4
1912	5,920	3,731	2,189	56	---	5,864	61.7
1913	5,913	3,595	2,318	46	35	5,902	60.8
1914	5,639	3,601	2,038	88	253	5,804	59.3
1915	5,816	3,979	1,837	382	125	5,559	56.0
1916	6,118	4,362	1,756	279	23	5,770*	57.3
1917	6,686	5,169	1,517	359	25	6,243*	61.1
1918	7,320	5,638	1,682	706	125	6,753*	65.2
1919	6,283	4,774	1,509	282	53	6,090*	58.0
1920	6,463	4,578	1,885	148	43	6,514*	61.2
1921	6,194	4,113	2,081	45	23	6,230*	57.8
1922	6,747	4,610	2,137	37	32	6,711*	61.4
1923	6,916	4,725	2,191	33	24	6,918*	62.5

1/Bureau of Animal Industry.
* Includes differences between quantities in storage at beginning and end of year.

Since the passing of the big western ranges, cattle raising and beef production suffered a steady decline until the advent of the World War. The totals show that the war greatly stimulated production until the end of 1918. Since that year there has been a falling off, although a sharp recovery is seen in 1922 and 1923. Exports of beef at one time formed a large and important branch of our foreign trade, but by 1913 they had largely disappeared and foreign beef began to come in. The exports were large from 1915 to 1918 solely because

of the war needs and have since almost disappeared. Imports of meat previous to 1913 were so small that they were not enumerated separately in the commerce reports. Imports of beef in 1914, however, were quite considerable. At this period the sources of cheap beef in the Southern Hemisphere, especially in Argentina, had developed enormously and they had, in fact, supplanted the United States in the overseas trade with Europe.

Consumption of beef was lowest in 1915, having decreased 24 pounds per head of the population during the preceding eight years from 1907. Notable increases occurred in 1918 and in recent years.

Table 32. Estimated Annual Production, Imports, and Consumption of Veal in the United States.*

Year	Slaughtered			Exports (domestic)	Imports (less re-exports)	Consumption	
	Total	Federally inspected	Other			Total	Per capita
	Million pounds			Million pounds			lbs.
1907	626	210	416	---	---	626	7.1
1908	605	203	402	---	---	605	6.8
1909	684	230	454	---	---	684	7.5
1910	687	235	452	---	---	687	7.4
1911	657	229	428	---	---	657	7.0
1912	668	239	429	---	---	668	7.0
1913	488	176	312	---	---	488	5.0
1914	433	158	275	---	5	438	4.4
1915	428	168	260	---	1	429	4.3
1916	536	220	316	---	1	537	5.3
1917	662	296	366	---	1	663	6.5
1918	765	352	413	---	1	766	7.4
1919	804	378	426	---	5	809	7.7
1920	838	402	436	---	8	846	7.9
1921	748	367	381	---	4	752	7.0
1922	793	397	396	---	5	798	7.3
1923	871	444	427	---	2	873	7.9

*Bureau of Animal Industry.

The unusually large veal slaughter since 1918 does not correspond with the cattle slaughter in the same period which declined until 1923. It is accounted for partly by the droughty conditions in the West which induced heavy marketings of young stock during 1919, and the relatively higher prices for calf products in other years. Country slaughter of veal is proportionately larger than for any other class of animals. The federally inspected slaughter of calves in 1909 was about one-third of the total slaughter, and since then it is estimated to have increased to about one-half of the total. The consumption of veal practically corresponds to the production as the exports are too small to be recorded, while the imports are insignificant.

The present export demand for beef is large, but we have difficulty in competing with other countries and that difficulty will continue. The chief competition in beef exports comes from the southern hemisphere. England is the chief importer and in the decade before the war she so expanded her sources of supply that the trend of the average import price was actually downward, while our price trend was very markedly upward. It is no wonder in such circumstances that the supplies from the United States practically disappeared on the British market during that period. Recently, according to the Department of Agriculture, the costs of production in Argentine appear to be materially lower than ours. Uruguay and Brazil have also increased their exports materially and can readily

continue the increase. South Africa offers considerable possibilities in the export of beef and already contributes to the world trade.

The beef market has been unprofitable recently for New Zealand and Australia and their output is not being developed as rapidly as it might were the competition from South America less severe. Market conditions which would be profitable for America and Colorado producers would probably greatly stimulate production in Australasia. It is estimated that the world total cattle population has increased by 14,000,000 head since before the war. This figure may be an exaggeration on account of the vagaries in the Argentine census reports, but it is certain that the cattle population has increased greatly in many of the surplus producing countries. The foreign market is now taking large quantities of beef fat from us and may continue. It appears to be quite certain that the American corn crop can compete on the world's markets when converted into animal fats. If it were not for the opposition of those who raise cattle for sale as feeders in Colorado and other western states, the farmers of the corn belt could probably expand their profits from fattening Canadian feeder cattle for the export market. Even with a high duty there is now a large import of such stock for fattening and this helps along what little/beef export that does exist.

PRICES OF CATTLE IN CANADA, ENGLAND AND UNITED STATES: In 1923 it cost $44.25 to land a 1200-pound steer in Great Britain. The cost of marketing a fat 1200-pound steer from Canada to St.Paul was $5.81 less than it was to market the same steer in Toronto, from western Canada, or $.48 per one hundred pounds; in the case of a 900-pound stocker it was $4.44 or $.49 per one hundred pounds. The tariff helped producers of fat cattle but it did not help the producers of thin stuff in states such as Colorado.

Table 33. Index Numbers of Beef Prices in Canada, United States and England, 1921 to 1924.

Period	Canada		U. S.			Ar-
	Winni- peg	Tor- onto	Chica- go	New York	Eng- land	gen- tina
Jan.1,1921 -May 31,1922	100	100	100	100	100	100
June 1,1921 -Dec.31,1921	77.6	75.9	94.6	92.8	70.5	84.5
Jan.1,1922 -Dec.31,1922	88.1	82.7	87.6	91.5	65.6	73.6
Jan.1,1923 -Oct.31,1923	81.1	76.4	94.6	98.2	65.6	73.6

Data from U. S. Tariff Commission 1924.

Table 34. Exports of Cattle in 1923.

Exported to:	Number	Per cent of total
Canada	1,601	2.60
Mexico	49,223	80.05
Bermuda	25	.05
Cuba	2,559	4.11
Other West Indies	50	.08
United Kingdom	6,417	10.44
Belgium	1,443	2.34
France	---	---
Germany	---	---
Other countries	198	.35
Totals	61,486	100.0

Bureau of Agricultural Economics.

Exports of cattle from Canada to the United States form but a very small percentage of domestic marketings during 1922 and 1923, being one and one-half per cent of total United States slaughter but equivalent to 12 1/2 per cent of Canadian surplus so it helped the Canadians a great deal. Most of these cattle arrive at one market, St. Paul, where domestic marketings are heavy. Receipts of live cattle from countries other than Canada or Mexico are impracticable owing to shipping costs and quarantine. Canadians are developing the fattening of younger cattle the same as they are in the United States. Most of the imports from Canada were light butcher cattle weighing less than 1050 pounds.

Table 35. Imports of Cattle.

	Number	Per cent of total
Mexico	20,301	8
Canada	242,676	92
Totals	263,887	100

Data from Bureau of Agricultural Economics.

WORLD CATTLE SUPPLY: In order to show the change in the position of the world's cattle since the war the following statement has been compiled comparing the total numbers of cattle by continents in 1922 with those of 1919.

Table 36. Position of the World's Cattle Since the War.*

Continents	Number of Cattle in 1922 (or 1921)	Number of Cattle in 1919 (or 1920)	Actual figures	Percentages
	Millions			
Europe	94.4	90.4	plus 4.0	plus 4.4
North America	80.7	83.7	minus 2.4	minus 2.9
South America	28.2	27.8	plus 0.4	plus 1.5
Asia	126.5	127.1	minus 0.6	minus 0.5
Africa	28.4	25.7	plus 2.7	plus 10.3
Oceania	17.9	15.8	plus 2.1	plus 13.3
Totals	376.1	369.9	plus 6.2	plus 1.7

*International Yearbook of Agricultural Statistics. International Inst. of Agri. Rome.

It will be seen from the figures that the reductions shown in the stocks of North America and Asia have been largely set off by the gains in other countries and especially Europe. In Europe the heavy losses suffered during the war have been almost made good and, although the complete totals are not available, it may be stated that the prewar situation has been practically re-established. The most marked increases have taken place in Russia with 1,300,000 head; in Romania with 900,000 head; in France with 800,000 head and to a less extent in numerous other countries. Very few European countries show any falling off in their total cattle stocks, though mention should be made of the reduction of about 450,000 head in Great Britain and Ireland.

After Europe, in order of importance as to actual increases, come Africa, Oceania and South America. In Africa the increase of 2,700,000 is chiefly distributed among the

Union of South Africa, Southern Rhodesia, the Protectorate of Southeast Africa, Unganda, Nigeria, Madagascar and French Morocco, while in French Sudan and Tunis considerable reductions are recorded. Australia and New Zealand in Oceania and Argentina in South America were almost entirely responsible for the increases recorded in these two continents.

As regards North America and Asia the reductions in the first case will be found in the figures for the United States and Canada, though for Canada the change is quite inconsiderable, and in the second case in the figures for India.

RELATION OF THE CATTLE ENTERPRISE TO GENERAL BUSINESS CONDITIONS: The manager has been designated as the person who organizes and directs the productive factors, and also assumes a large measure of business risks and uncertainties. The function of the manager has become such an important one in modern society that it is often convenient to regard him as a fourth factor in production, distinct from other classes of laborers. He has been well called a captain of industry, for he commands the industrial forces, and upon him more than any one else rests the responsibility of success or failure.

A great need of modern ranching is for intelligent direction, which looks well beyond the feeling of the moment. The cattleman or entrepreneur must get the habit of planning and budgeting, of fixing careful attention upon the future. As the use of such planning becomes habitual, unbridled

guessing will be displaced by more careful estimates guided by all available facts. The cattleman has no more important problem than that of forecasting demand for his beef products. He cannot afford to be misled by outward appearances and such phrases as "The shelves of the country are bare", or, "The shelves of the country are glutted". He must have full and timely statistics well and clearly presented and be able to use them.

The ranchman must not be afraid of being called a pessimist for fear that he will affect the country adversely thru proper pessimism. The time to be a bull in the United States is not when everybody else is a bull. At that time the country is surfeited with bulls. The time when the country needs bulls is when bears are running wild. It is no credit to be optimistic when the country is suffering from over-production. The cattlemen must learn these things in order to be successful entreprenuers. Any cattlemen who undertakes to apply to the future a knowledge of the past finds himself obliged to watch three things: the trend of general business, of his own industry as a whole, and of his particular part of the cattle industry. The main reason why so many cattlemen are broke today is not because of poor credit but a lack of education and inability or unwillingness to study the above three things.

For one hundred years cattlemen have been succeeding by "guess". Young men by the hundreds have started in with a common ambition to succeed. A small fraction of them, quite

by accident, learned the combination that would work in the ranching business. They succeeded and prospered. The others struggled, groped, wore themselves out and died. The following generation, the rich man's son and the poor man's son, started in all over again just where their fathers had started so far as any real knowledge was concerned. Each succeeding generation was forced to start at the bottom without any of the knowledge of experience gained by those who had experimented and struggled for years before all of this served only as proof of the crying need for some sort of organized knowledge on the most important of all businesses, that of making a living.

Today the various facts of business have been reduced to the place where it is possible to forecast the various features of the business cycle, the business seasons of prosperity, decline, depression and improvement, with remarkable accuracy. There are a few fundamentals of success which may save the cattleman from unnecessary loss and grief. These fundamentals apply to every cattleman at some stage of his career. Every cattleman who succeeds employs them, consciously or unconsciously, whether he knows it or not, and it is safe to say that you will "get there quicker if you know where you are going." Statistics, so far as we are concerned, will be understood to represent concentrated information reduced to the exact basis of figures. This gives us a tremendous field. Since, however, we are interested only in statistics which affect the cattle

business, and general business, we will discard the rest and concentrate on this particular branch. These figures divide themselves into two distinct classes which we distinguish as (1) comparative statistics, and (2) fundamental statistics. Comparative statistics, for the use of the livestock man, relate to the weight, quality age and method of production of livestock, together with such figures as are published by the cattle associations, agricultural colleges, United States Department of Agriculture and other sources. They are the figures that appear on his books; the figures which represent the inside condition of his livestock business. From the ranchman's point of view comparative statistics include all particulars, debt, earnings, cost of production, general business, and financial condition of any given ranch.

Fundamental statistics, on the other hand, reflect the situation in the broad general field which touches every one. These underlying conditions such as prices, money, wages, etc., are of tremendous importance because they affect a ranchman's business fundamentally. They govern the purchasing power of his corn belt feeder or consumer, the price and supply of cattle and feed materials which he uses in the production of beef and the living conditions of the hired hands he employs on his ranch. The importance of comparative statistics is generally accepted and understood. Hence, prominent livestock men now freely spend much money for bookkeepers, that they may

record the data necessary to compile comparative statistics. Few ranchmen, on the other hand, make any systematic effort to collect data and study fundamental statistics. Those who have gone to the trouble to do so are conspicuous in their own community because of their unusual prosperity and what their friends call "good luck". The reason is this: Fundamental statistics are more important to a ranchman than those reflected in the figures of his own books, for fundamental conditions have more to do with his success.

A recent investigation of Professor David Friday, then in the Economic Department of the University of Michigan, revealed the more or less astonishing fact that the largest portion of business profits and losses result from changes in fundamental conditions. A more recent investigation by the Babson Statistical Organization, covering over four hundred concerns and representing twenty-six leading branches of industry, revealed the fact that 57 per cent of business profit is the result of changes in fundamental conditions, while but 43 per cent of business profit is the result of competitive efficiency. From a study made of profits made in feeding cattle in the corn belt and a study of the production of range cattle in Texas and Colorado, the same results are shown.

All financial history has consisted of distinct cycles and although of different duration each cycle has consisted of five periods, namely, (1) the period of prosperity; (2) a period of decline or strain; (3) a panic, or period of depres-

sion; (4) a period of revival or improvement. These always follow one another in the same sequence and cause a constant change of surface conditions with which one must reckon. Common sense dictates that so long as conditions keep changing and are bound to continue to do so, the first step is that of defence. The cattleman must have up-to-date facts on current conditions in every part of his field of activity. He must know just how things stand so that his decision may apply to the situation as it is.

It is also obvious that these same constant changes which harass and befuddle the average cattleman, offer a remarkable opportunity for profit provided one can tell what the next change will be and when it will take place. Fundamental statistics treat of underlying conditions and are employed for determining general market and whether or not it is wise to purchase, or to sell, or to do neither. Ranchmen use these data in order to purchase cattle only when they are low, holding them or expanding the business from two to four years until they are high. Many such livestock men increase their profits with practically no risk and very little trouble. Fundamental statistics clearly show the livestock man when to buy and increase his number of cattle or sheep, and when to reduce his number of head of livestock. They also enable stockmen to forecast money conditions in order that he may intelligently decide whether to borrow the money or expand his ranch business, or to reduce his loans and indebtedness. Moreover, at all

times, these figures show the ranchman the conditions of business throughout the country, so that he always knows whether the growth or contraction of his business is proportional to that of his competitors.

Upon careful thought, it must be admitted that the fortunes of American cattle kings must have been created by a knowledge of these facts, rather than simply by selling to the packers at a nominal profit. It is true that certain fundamentals of character were necessary, but character alone was not enough. It is evident that the outstanding factor which marked the success of these great captains of industry was their method of operation. Unlike their competitors they refusted to "guess". They studied the fundamental statistics of the country.

The most important single piece of business information that the ranchman can have is that which tells him at what stage of the changing course of business he is in, at any given time. There are a number of subjects which should be studied in order to guage the situation correctly, but the sifting process of years has reduced the number which are of practical and definite use for the cattleman. In selecting these the following characteristics are necessary: (1) comprehensive and authoritative figures on the desired subject must be obtainable; (2) the figures must extend over a sufficient number of years to show the trend. This process of selection has

given us about twenty-five or thirty subjects on which available data for the study of United States business trends can be obtained. For convenience the subjects may be grouped under twelve headings, as follows:

(1) New construction and real estate.
(2) Bank clearing and check transactions.
(3) Business failures.
(4) Labor conditions, indexes of employment.
(5) Money conditions.
(6) Foreign trade.
(7) Gold movements and money rates.
(8) Commodity prices.
(9) Investment conditions.
(10) Crop and livestock conditions, and other production figures.
(11) Railroad and industrial profits.
(12) Social and religious factors.

Each of these business subjects has its own significance. While no one subject can be relied upon at all times the majority are always reliable. The best plan, therefore, is to combine a representative number of barometer subjects into one or more indexes similar to those of the Harvard, Brookmire or Babson Economic Service. It is well to correct the original figures so as to eliminate the effect of seasonal fluctuations. Aside from allowing for usual seasonal movements in the subjects and reducing them to a common denominator, however, no other modification is necessary or desirable. The Harvard University Committee on Economic Research has prepared a manual of instructions for the comparison of the business of an individual concern with the Harvard Index of General Business. A knowledge of general business conditions as well as a know-

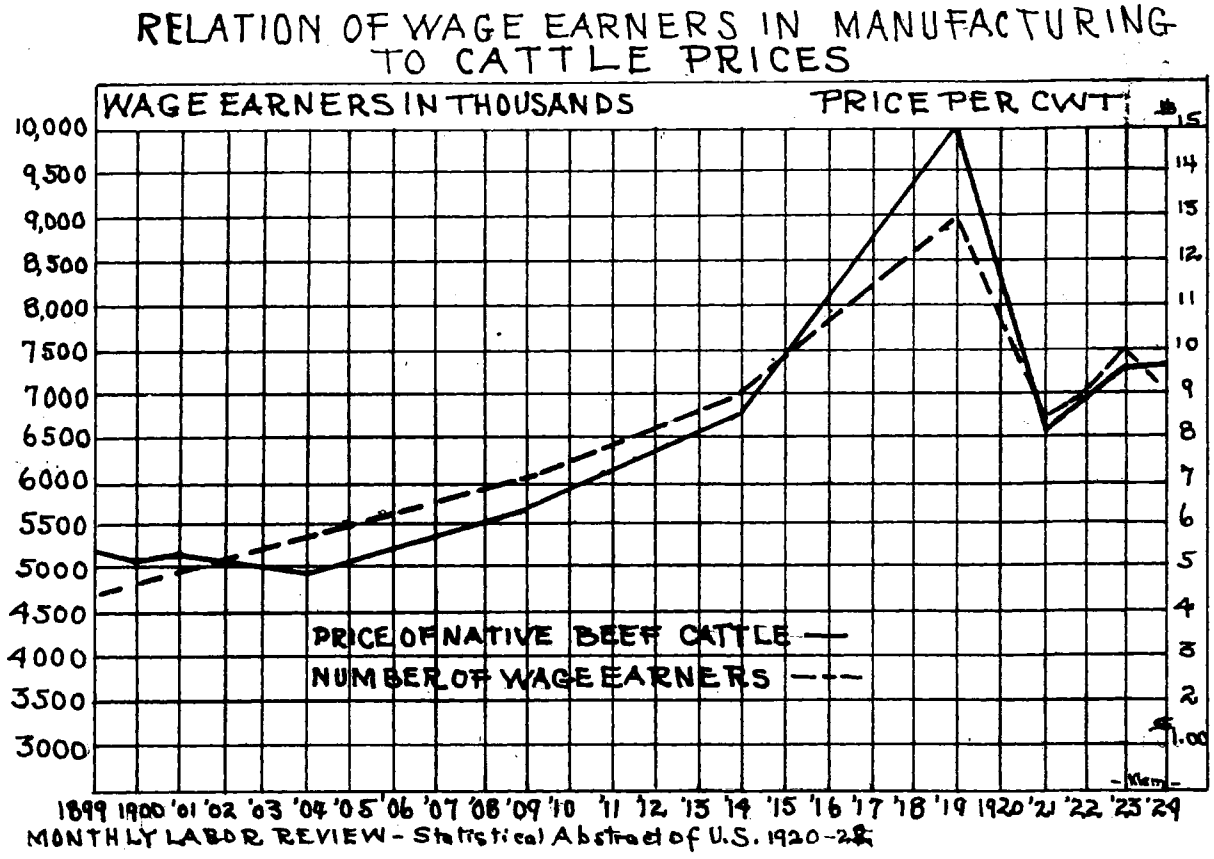


Fig. 14. Relation of wage earners in manufacturing industries to cattle prices.

ledge of the livestock business will aid the ranchman materially in marketing his ranch products. The employment of labor is a very good index of what to expect in the way of cattle prices. When labor of the country is well employed the demand for beef is increased, which results in higher cattle prices. If the number of wage earners employed in manufacturing were platted for every year, beginning 1899 to 1924, the wage earners' curve and cattle prices are so related that they would ascend almost parallel from 1904 to 1914. Due to war conditions the demand for beef from 1914 on was out of line with respect to the supply of beef so the index would not be of much value during that period.

There is considerable correlation between the pig iron production, price of pig iron and prices of cattle. The increased prosperity and better business as shown by increased pig iron production has a very direct effect in pulling up the general price level of cattle. Changes in cattle prices quite generally lag behind iron production increases or decreases and for this reason the production of pig iron can be used as a barometer in predicting future cattle prices. Other factors have a tendency to make the above vary somewhat as in the case of hog production the tendency will be to pull down cattle prices.

SEASONAL SURPLUS: A tabulation of cattle and calf receipts at all public markets for five years shows that October is, on the average, the month of heaviest marketing, November second,

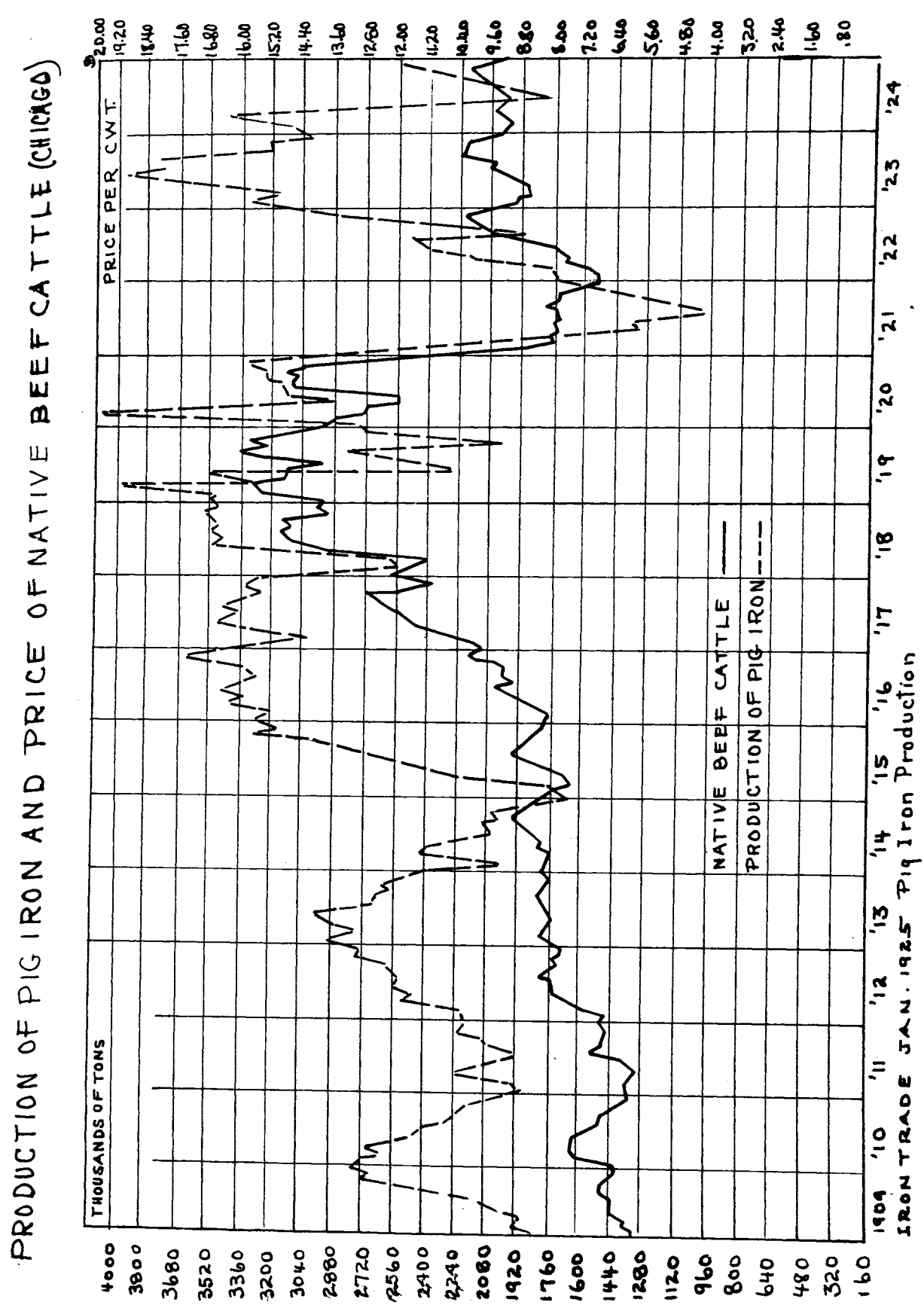


Fig. 15. Influence of the production of pig iron and on the price of native cattle from 1909 to date.

and September usually third. As a rule February is the highest month. Normally over 40 per cent of the total number marketed during the year go to market during the last four months. These seasonal surpluses usually react to the decided disadvantage of the producer in the form of dull trade and lower prices. It is found that good beef cattle prices are usually highest in August and September and lowest in December, January and February.

TRANSPORTATION: The ranchman, like every other shipper, is interested in adequate service at reasonable rates. He puts adequate service first, because losses incident to lack of service or inadequate service are likely to be greater than the cost of adequate service. Adequate service means that cars must be furnished when and where the ranchman wants them, on reasonable notice; that these cars be in good order and fit for the required service.

Ranchmen recognize the importance of the relation of the price of transportation to the price of ranch products. At present we have no index of transportation rates which will enable us to know how the price of transportation has moved in relation to the price of cattle, sheep or other ranch products. When such an index has been set up the movement of the price of ranch products may be compared with the movement of freight rates upon ranch products, and careful analysis of these movements may enable us to determine just what influence freight rates have in increasing or decreasing prices.

MARKETING RANGE CATTLE.

The great need in the beef market during the next ten years will be for finish, and well-bred cattle such as the mountain districts and some sections of the plains are now producing. We have heard much from various sources during the last few years as to the profits in feeding inferior animals; but inferior animals do not finish efficiently in terms of the homegrown feeds of the farm or ranch. As each year goes by the price level on western cattle is going to be determined as much by what corn belt cattle feeders can pay for feeders as by what the packer can pay for grass beef. It is, therefore, to the interest of all Colorado producers to use the best grade of bulls in order that their steers shall possess the physiological ability to make meat cheaply and quickly. The marketing of calves and yearlings from the mountain ranges proves the practical nature of feeder production and indicates how a greater return per acre of grass can be secured.

The prospect for the breeders making more money thru the inter-position of the feeder is not perfectly apparent; but if he does not spend his energy on attempting to fatten cattle, but instead runs enough calves or yearlings simply to utilize his grass for growth, his costs will be cut down, his volume will be increased, and his profits will thereby be made a little more certain. The market for stocker cattle depends upon feed in the corn belt and sugar beet areas. Feed is a factor of

primary importance. If the corn belt is wrestling with a surplus of grain there will be a good demand for cattle. Five per cent of the nation's corn crop is marketed in the form of beef, but in the corn belt 25 per cent is so marketed. Stubble fields yield a wealth of feed and tempt feeders to buy thin cattle to utilize these waste products. In many localities labor expense will restrict silage making, and curtail winter beef making. Early September frosts in the corn belt do immense damage and often catches thousands of acres of immature corn. Farmers are able to use much of this soft or damaged corn in the production of fat cattle which increases the demand for feeder cattle.

The marketing system provides services that span distance and time between ranchmen and consumers. The products of the ranch usually come into the local or large markets in relatively small lots of ungraded, unstandardized raw material for which the producer assumes no responsibility. The western ranchman has been chiefly occupied with the problems of production, involving all the uncontrollable forces of nature and the combating of livestock diseases and predatory animals. He is concerned with individual production rather than with service, marketing and distribution. Until such times as livestock producers consider production in its relation to consumer demand and satisfaction, they are unlikely to materially improve their condition. At present for the most part the livestock producers leave to others the selection, grading, standard-

izing and assembling of products as well as the risks involved in marketing. The vast bulk of ranch products is transported to large centers for assembling, grading, converting and distributing. In practically all local markets in which ranch products are offered beyond the immediate community needs, a variety of agencies exist for the purchase, preparation for market, and handling.

The first function performed by agencies within the local market is the assembling of numerous small lots of products which have to be graded as to quality, variety, and fitness for market. The great bulk of ranch products is harvested and marketed during a small portion of the year, whereas consumers' demands spread over as large a portion of the year as possible. Consumers buy frequently and in exceedingly small quantities, and demand that commodities be conveniently available at a moment's notice. Consumers in different localities have marked preferences as to grade, appearance and type of quality of ranch products or livestock. This leads to specialization of ranchmen who can afford to cater to this demand as in case of the S M S Ranch of Texas. This method is illustrated by the disposal for many years of the "S M S" brand of calves and short yearlings on mail orders. It is believed that this system would lend itself most readily to individual effort in selling the product of a single outfit operating on large scale.

The agencies within the local market buy with the consideration of the risks and services involved in assembling, selecting and grading, standardizing, transporting and marketing such products as hides, wool and mohair and cattle. They establish their margins so far as competitive buying and competitive selling will permit, to protect themselves against the various risks and secure a profit on their transaction. In communities where production is reasonably uniform and standardized, such as Highland Cattle Breeders Association of Texas, North Park Cattle Association in Colorado, the agencies within the local market usually pay better prices in the proportion in which their risks are reduced and the degree to which the producer assumes responsibility for the character of his product.

Ranchmen do not always sell their product in local markets, but offer them for sale to buyers through commission men in primary or terminal markets. In a number of cases auction sales of feeder cattle have been held in a number of the heavy feeding sections of the corn belt. In 1923, 6,000 head of range cattle from range areas of Colorado were shipped in train load lots to Iowa feed lots to be auctioned off in the above manner. Thousands of calves and yearlings from many sections sold in this manner during the fall of 1923. When cattle or sheep are shipped to the terminal markets, they are graded and any portion that is not sufficiently mature, fat or otherwise unfit for market, are disposed of at the cost of the

producer. In such instances the producer not only loses heavily on the commodity, but pays transportation cost of products which should not have been shipped.

With the better organization and standardization of ranch production, the organization of ranchmen's cooperative associations, the evolution of grades more accurately reflecting the qualities of ranch products in relation to use, the estsblishment of concentration points within the areas of production issuing receipts or certificates which clearly indicate such grades and guarantee the physical protection and quality of product, it should be possible to develop a system of commodity exchanges through which these ranch commodities may be sold and under which such products will move directly from areas of production to points of use under prior sale without the necessity of previous inspection and with the assurance of delivery of a product by grade conforming to the users' or consumers' requirements. The S M S people are doing this in a private way and a few cattle associations are attempting to do the same.

In the primary and terminal markets, commission men, wholesalers, and buyers maintain warehouses, refrigeration and facilities for the protection and conservation of commodities. The transportation agencies are required to provide facilities for protection of commodities in transit. All of these activities involve investment and operating expense and

require the employment of men and equipment. Practically all facilities in local, primary and terminal markets are the results of individual initiative or the enterprise of a comparatively small group. This results in lack of coordination of facilities, utilities and operations. All of these things add materially to cost without adding either value or service to the commodity.

While the large bulk of ranch products coming into terminal markets represent finished products of the producers, they are raw material to be converted into articles of food, clothing, materials, and finished products of great variety to satisfy the complex demands of modern society. Livestock is of interest to the consumer only as the source from which clothing materials, shoes, fabrics, and numerous articles of utility and convenience are derived.

Out of the spread between the producer and the consumer compensation for all of these services must be found, and this brings the American public face to face with the problem of devising a less expensive and more efficient system of distributing ranch products. Cost of distribution is made of an infinite number and variety of costs of materials and services, each of which influences other and all ofwhich combine to make the price which the final consumer pays. These factors vary in influence upon one another and upon the final price from year to year, from month to month, and even from day to day.

They are each a part of a complex and flexible price structure which is extremely sensitive to governmental, economic, and psychological forces such as taxes, interest rates, freight rates, custom, habit, usage, and practice of producers, consumers, manufacturers and distributing agencies.

The situation of the ranchman can be materially improved by a standardization of production of ranch products in producing centers of Colorado so as to permit more economic selection, grading and preparation of commodities in the producer's local markets. Ranchmen should develop cooperative associations to hasten the standardization of ranch products, improve the distributive process, and reduce their costs.

MARKETING OF CATTLE PRODUCTS IN TERMINAL MARKETS: Approximately 90 per cent of the fresh beef and veal is chilled; very little is frozen under ordinary conditions because chilled beef usually sells at a premium over frozen. Chilled meat, however, is highly perishable; it must be maintained at temperatures ranging from 32 to 38 degrees. It is the aim of domestic producers to market their chilled meats within a few weeks after the animal is slaughtered. This necessity for quick marketing has been a factor in the development of extensive marketing organizations by the large packers, although the concentration of production has, of course, largely grown out of the greater efficiency of large scale production and marketing

Two general methods of fresh meat distribution have been developed. First, the branch house for distribution of meat in the large cities and towns, and second, the car route for distribution of meat to small villages. The large packers own fleets of refrigerator cars in which fresh meat is shipped directly to the branch houses of which there are over twelve hundred in the United States. Through the branch house the packers distribute the meat directly to the retail dealers in the cities. Retail dealers in the smaller towns get their meat directly from the peddler car which covers a regular route at different intervals. One of the large packers has over 500 such car routes. By these two methods nearly every part of the country is directly reached. Frozen, pickled, and canned beef, and beef by-products such as hides, tallow, oleo oil, oleo stearin, bones, and fertilizer are marketed much more slowly than fresh beef, often not for several months after the slaughter of the animals.

DISTRIBUTION OF RANCH PRODUCTS: In the early days of this country there were practically no problems of distribution because people lived simply. The population was largely agricultural. Families produced their own foodstuffs and clothing materials and found means for the construction of shelter close at hand. Movement of commodities from place to place was carried on almost wholly by ships and settlements were, therefore, confined to the land contiguous to the ocean or inland waterways.

At first, factories were located close to raw materials. Production was upon a small scale and the cost proportionately large per unit. Distribution was largely local and the cost of distribution relatively small. With the development of machinery, rapid means of transportation and the evolution of the principle of mass production, there came about a revolution in the relationship between the costs of manufacture and distribution until today we have the opposite situation to that which existed thirty years ago - mass production at low unit cost and national distribution at high unit cost.

Distribution contemplates two primary functions: First, the movement of commodities from the place of production to the place of consumption; second, the carrying of the commodities from the time of production to the time of consumption. Speaking generally, economics in distribution must be effected by reducing the distance which the commodity is moved from the place of production to the place of consumption or by reducing the time intervening between production and consumption. This statement, however, must not be taken too literally. Both of these factors are the product of a large variety of elements. The effect of distance from the market in the case of ranch products may to a certain extent be modified by the concentration of production and the ability to ship large quantities. The rate of tomorrow in its relation to interest, rent, storage and other charges

in which time is a factor is an important element. It costs more to sell in small quantities than in large quantities and to sell at a long distance than at short distances.

Perhaps no exact formula can be established which will measure accurately the relationship costs of distribution and volume, distance and time, but in general it is perhaps safe to assume that the cost of distribution increases in proportion to the area of distribution, the number of transactions and the competition enocountered. A ranchman's average cost of selling and distributing his yearling production of beef may be 15 per cent of the sales price. The average cost of sales and distribution to within five hundred miles radius of his ranch may be five per cent, while the average at his local town may be only one per cent. If the unit of sales at a distance is small, the cost of sales and distribution in the more distant area will be still larger.

Some recent analyses that have been made of livestock on even the most modern ranches developed a most amazing and unnecessary duplication of breeds, kinds, size and class of livestock kept. It must be obvious that the closer the ranchman can approximate his livestock production to the consumer's requirements in point of accurately graded, quantity, quality and size, and the closer that he can produce in relation to those requirements, the smaller will be his cost of doing business.

All of this goes directly to the point of analysis. This

point heretofore has been too largely, I think, in the direction of volume production, careless marketing with the purpose of forcing ranch products through channels of distribution with too little regard for volume and character of consumer's requirements. The time has come to reverse this process; to begin with a more careful analysis of the consumer's requirements with a view of relating those requirements more directly to the beef and livestock production which can most economically reach the consuming territory.

My observation is that the greatest obstacle encountered in bringing about better methods of livestock production or distribution is the ranchman. It is surprising how difficult it is to inculcate into ranchmen an intelligent self-interest in their own affairs. Less than one per cent of the ranchmen in Colorado have adequate accounting systems. Relatively few keep sufficiently accurate or comprehensive records to furnish a basis for sound judgment of their own experience. Doubtless, if all ranchmen and distributors were as efficient as the most efficient, great reductions could be made in the cost to the consumer.

Improvements must come through a better understanding of the processes of production, assembly, conversion and dispersing of ranch products and their relation to each other. This means the accumulation and organization of larger basis of information drawn from the experience and records of successful livestock business and the making of this information

available not only to those who are in the livestock business but to those who want to go into the business and to those who want to learn how the livestock business is operated and how it ought to be done.

No discussion of the problem of distribution and the excessive costs which characterize it would be complete without some reference to the part played in producing these costs by the variety and character of the consumer's requirements for goods and services. It seems necessary to recognize the right of the consumer to buy where and what he will. But there can be no doubt that a better knowledge of what these requirements are and a better organization of industry and commerce to meet them would result in economics of distribution. In considering the savings which can be made by greater efficiency, quicker turnover, elimination of waste on the part of any single agency in the chain of distribution, it must be remembered that the price which the consumer pays is the result of the addition and compounding of the costs of thousands of elements of service and material.

The woman who buys a package of dried beef or sausage at the corner grocery pays not only for the beef in the package but for a pasteboard box and an air-tight wrapper and a part of the rent, interest, profits of the merchant, cost of delivery, carton in which the packages were shipped, part of the wages of the lumberjack who felled the tree and the mill operator who helped to convert it into pulp out of which the

carton was made, part of the wages of the engineer, fireman and brakeman who ran the train that transported the carton; part of the cost of the rails and engine and part of the cost of coal that produced the steam that ran the engine, ad infinitum. The price which the consumer pays is a complex of thousands, perhaps millions, of other prices. Reduction in every element of cost which goes to make up the final price must be effected all along the line if the sum total of distributive costs which constitute a great over-burden which the consumer pays is to be reduced.

WHERE DOES THE CONSUMER'S DOLLAR GO? How are these costs distributed between producer, converter, wholesale and retailer? Table 37 shows that in 1913 the shipper or producer received an average of 90.1 cents out of the dollar the consumer paid for fresh beef after paying 3.9 cents for transportation, feed, and commission. The packer paid 94 cents live cost and 9.7 cents for selling, transportation and packing, making a total of 103.7 cents. He sold fresh beef to the retailer at 86.5 cents and sold by-products at 18.3 cents, making a total of 104.8 cents, thereby realizing a profit of 1.1 cent. The retailer paid 86.5 cents and had an operating cost of 10 cents and a profit of 3.5 cents, equaling the 100 cents which the consumer paid for fresh beef.

In 1916 the producer received an average of 99.4 cents out of the dollar the consumer paid for fresh beef after paying 0.4 cents for transportation, feed and commissions. The packer

paid an average of 103.4 cents live cost and 9.3 cents for selling, transportation, and packing, making a total of 112.7 cents. He sold fresh beef to the retailer for 79.6 cents and sold by-products for 29 cents, making a total of 108.6 cents and showing a loss of 4.1 cents. The retailer paid 79.6 cents and had an operating expense of 17.5 cents and a profit of 2.9 cents, equaling the 100 cents which the consumer paid for fresh beef.

In 1921 the producer received an average of 67.7 cents out of the dollar the consumer paid for fresh beef after paying 5.3 cents for transportation, feed and commissions. The packer paid an average of 73 cents live cost and 15.1 cents for selling, transportation, and packing, making a total of 88.1 cents. He sold fresh beef to the retailer at 78.8 cents and sold by-products for 10.8 cents, making a total of 89.6 cents, thereby realizing a profit of 1.5 cents. The retailer paid 78.8 cents and had an operating cost of 18.5 cents and a profit of 2.7 cents, equaling the 100 cents which the consumer paid for fresh beef.

The retailer's cost of operation had increased from 10 cents in 1913 to 18.5 cents in 1921, and in the same period profits decreased from 3.5 cents to 2.7 cents per dollar of sales.

Table 37. Distribution of Dollar Consumer Pays for Fresh Beef.*

	1912-13	1915-16	1920-21
Production:			
Shipper receives.....	90.1	99.4	67.7
Transportation.....	2.6	2.6	3.6
Feed.....	.7	.7	.8
Commission.....	.6	.7	.9
By-products	18.3	29.0	10.8
Cost live.....	94.0	103.4	73.0
Distribution:			
Selling.....	3.5	2.6	4.2
Transportation.....	2.9	3.0	5.3
Packing expense.....	3.3	3.7	5.6
Packer's profit.....	1.1	14.1	1.5
Operating expense (retailers).....	10.0	17.5	18.5
Retailer's profit.....	3.5	2.9	2.7

*Report of the Joint Commission of Agricultural Inquiry Part IV.

PRICE SPREADS ON RANCH PRODUCTS: Few things arouse more bitterness in the ranchman's mind than the spread between the prices he gets for his products and the prices paid for the same goods by the ultimate consumer. This spread, in the case of many products, has increased in the last decade. Various explanations of this fact have been offered. These explanations, according to the United States Department of Agriculture, are mostly incorrect because founded on unreliable data. It is often charged that the margin between prices paid to farmers and prices exacted from consumers largely represent an unfair profit taken by distributing agencies. Studies made by the Department, however, have shown that net profits taken by so-called middlemen are an insignificant part of the total spread.

Such profits seldom amount to more than five per cent of the consumer's price, and generally they are less than five per cent of it.

It is the cost of furnishing distributing service rather than the profit taken by the distributors that widens the spread between producers' and consumers' prices. Distribution costs, as a matter of fact, generally account for about 95 per cent of the spread. This has been demonstrated by investigations which the department has made to determine what portion of the retail price accrues to each agency in the marketing chain in the case of several important commodities. It has been shown that service costs incurred in the distribution process affect consumers' prices much more than those prices are affected by fluctuations in the farm value of agricultural products.

The solution, therefore, of the problem of the high cost of living, with which we are struggling, presents two aspects. First, that of reducing the general level of prices, and second, that of reducing the wedge between what the producer received and what the consumer pays.

In the train of more definite facts and more thoroughly organized knowledge of distribution, there will follow better organization of livestock production and marketing, reducing the number of grades of ranch products produced, making possible their combination in large volume and their sale in more direct relation to market requirements. There must also be more

intensive study of corn belt feedlot demands and study of consuming markets and market demands in relation to production so that the flow of ranch products to the consumer will be more even and more nearly in accord with consumer demands. The flow of ranch products and hence the velocity of capital required to move them must be speeded up in transit and distribution. The genius which evolved mass production must now be turned to the development of more efficient and serviceable distributive machinery.

Accordingly, the department is making investigations to find out how these costs can be reached. They are affected by the efficiency of the methods used in handling commodities. An important influence is the business environment in which any particular distributing process is done. Another factor is the adequacy of the facilities used. It has been figured, for example, that about 25 per cent of the trucking charge for handling fruits and vegetables in New York City is due to idle time occasioned by the use of unsuitable facilities. Service costs, says the Department, are the important points of attack in any study of price spreads. The line of advance would seem to be in the direction of improvement in handling facilities, speeding up sales processes, effecting economics in packing, transportation and handling in wholesale and retail markets. In other words, more efficient service at each stage in the marketing process offers a better prospect of increased returns to the grower than a lessening of the net profits of wholesale

jobbers and retailers, since these profits are only a fraction of the total price spread.

MARKETING GOOD VERSUS COMMON CATTLE: The thing we are suffering from is relative overproduction. This means that the cattle man must go in for better products, higher grade of produce and comply with the wants of the consumer. There will be less bulk, this bulk has been the cause of low prices. There must be higher values for improved grades, better beef. Ranchmen have made their money from increased land values in the place of sales of produce.

There are certain axioms which are applicable to both productive and selling processes. I may briefly outline them in this way.

1. It costs less to sell a standard calf than one which is not standard.

2. It costs less to sell few classes or types than many.

3. It costs less to sell large quantities than small quantities.

4. It costs less to sell ranch products that have a continuous and established demand than those which have a seasonal demand or which are new to the market.

5. It costs more to sell ranch products for which consumer demand has not been definitely established than one for which consumer demand has already been created.

It is perfectly clear that a thousand calves or yearlings of a well-known and well-established brand carefully and accurately graded, will bring a larger price than a thousand calves or yearlings of ungraded cattle of several nondescript

breeds and mixed type, or, even than a thousand head of cattle of several types, some of which are established in the market and some of which are not. It is obvious, also, that a thousand cattle can be sold cheaper in one lot than in ten lots or in a hundred lots.

The ranchmen cannot apply these axioms because they are not organized for the purpose; they cannot be applied by the middleman's organization in full because standardization and the production of cattle to fill a specific or particular demand is a process of production rather than of distribution. The cooperative can furnish, and in many cases has furnished, a valuable service to the ranchman and to the country in the grading of his product. But standardization must begin not with the cooperative selling agency, but with the cattleman on the ranch.

A standard calf, one of uniform quality, size, age, growth and color, etc., can only be produced under fairly uniform conditions and methods of production. Studies have been made in recent years in the development of improved ranching methods, the control of animal diseases, poisonous plants, predatory animals, in the breeding and selection of animals in seeding, cultivating, harvesting of forage plants and in range herd management.

It is in the development of better and more standard qualities and the application of uniform methods that the great

field of cooperation lies. The full measure of success of the cooperative depends largely upon its ability to put into effect standard methods of improving the quality of the range herd by systematic breeding to a certain standard, selection of good bulls, keeping only the choicest cows, to have as early as possible, all calves dropped within two months' time to insure uniformity of age and growth. To do this remove the bulls from the cows in the fall on a definite date and keep them separated from the cow herd until the proper time when they will then be put back with the cows, reduce the number of grades and standardize quality, size, age, color and quality of the cattle. This means the application of cooperative organization upon the ranch or cooperative ranching, as well as cooperative marketing. For example, there are a number of communities in Colorado where only a few years ago it was not uncommon to find each locality producing cattle of a number of types and breeds. Such cattle were not desirable feeding animals, because it was impossible to finish or fatten them evenly and they were therefore sent to the market lacking in uniformity of type, color, weight and quality, or condition.

Mixed herds of cattle at this time are not desired on any market. They are discriminated against and must sell for exceedingly low prices. Mixed herds are disappearing in communities where stockmen cooperate with the majority of their neighbors in propagating the same breed. These communities

are becoming noted for the production of a uniform type. Cattle feeders go to these districts because they can secure cattle of uniformity.

A comparison of the returns from good and common calves is given in the next table. For this purpose the returns from one of the seventeen Colorado ranches producing good calves are compared with those of another ranch on which common calves are produced. An effort was made to choose for this comparison two ranches on which the cost of producing good and common calves would be fairly comparable. However, this was impossible because of the disturbing influences of other factors such as variations in per cent of calf crop and in methods of management which may have as much or more effect on the cost of producing calves as the quality of their breeding. We might expect that calves of good quality might cost somewhat more than common calves because of their greater investment in the breeding herd which might result in a higher risk figure and more depreciation in the case of the best quality cattle. Breeding cattle of good quality, however, have this higher value because they are capable of producing more valuable calves. The difference in sales value of the calves more than makes up for any difference in the cost of producing them.

RETURNS FROM GOOD AND COMMON CALVES: (Comparison of calf sales on two Colorado ranches in 1922).

	Good calf	Common calf
Weight when sold, pounds.....	350	310
Sale price per hundredweight....	$7.71	$5.07
Sales price per head.....	$26.98	$15.72
Greater sales value of good calf as compared with common calf...	$11.26	

It has been the aim of beef cattle breeders for over a century to produce higher quality in the meat animal. Although it is difficult to measure the extent to which our beef breeds have been improved, we can safely say that it has been considerable.

The ideal beef type desired by breeder and feeder of beef cattle is an animal that will produce the largest proportion of the highest priced cuts of beef when slaughtered. This implies a low-set animal of straight lines, broad and deep bodied, and smoothly covered with a thick, even layer of firm flesh. A fine texture of hair and hide usually indicate a high quality of meat. An animal of poor breeding usually deposits its fat around the internal organs instead of interspersing it among the more valuable cuts of lean meat. This type is characterized by such undesirable features as light hindquarters, high flank, narrow, thin loin, small heart girth and long narrow head and neck.

The purpose of the following items is to show the incentive for further improvement of our beef breeds. A product that more nearly fulfills the requirements of the consumers is usually enough more valuable to make its production profitable. The story begins with two calves on the range, one

common and one good, and compares them at different stages until they reach the consumer.

GOOD CALVES EXCEL COMMON CALVES ON THE RANGE BECAUSE: (1) The weigh more at the same age. (2) They sell for more per hundredweight. (3) They mature earlier. (4) They are in demand as killers, feeders and stockers, while common calves are fit mainly for stockers. (5) They may cost more to produce but they sell for much more.

IN THE FEED LOT: This is illustrated by two feeder steers, one grading good and the other common. As good quality calves sell for the most money when they leave the range there must be some explanation of this fact in their performance in the feed lot and at the fat cattle market. To make this comparison between the feed lot performance of good and common steers, figures obtained in DeKalb County, Illinois, during the winter of 1922-23 by the United States Department of Agriculture and the University of Illinois are used.

Good and Common Cattle in the Feed Lot in Illinois During 1922-23.

	Good Steers	Common Steers
Number of droves.....	15	26
Number of cattle.....	703	1785
Number of days on the farm.....	174	143
Purchase weight, pounds.....	888	824
Gain in weight, pounds.....	298	189
Sale weight, pounds.....	1186	1013
Average daily gain, pounds.....	1.71	1.32
Purchase price per cwt.....	$7.00	$5.13

	Good Steers	Common Steers
Original cost per head.....	$62.16	$42.27
Value of feed.....	36.93	28.26
Other costs.....	5.29	4.86
Cost of animal out of feed lot	$107.52	$78.25
Pork and manure credit.....	6.41	6.07
Net cost out of feed lot.....	$101.11	$72.18
Amount sold for out of feed lot..	107.62	72.64
Profit per head.....	$ 6.51	$ .46
Sale price per cwt.(out of lot)..	$ 9.07	$ 7.16
Necessary margin to break even...	1.52	1.99
Farm price of corn.....	.54	.54
Price returned per bu. of corn fed	.73	.55
Cost of silage per ton.....	5.00	5.00
Amount that could have been paid for feeders and break even.....	7.73	5.18

Amount of Feed and Other Costs
Per 100 pounds Gain.

Feed:		
Grain, pounds.....	664	693
Silage, pounds.....	1261	1871
Protein concentrates,pounds...	21	29
Molasses, pounds.....	10	3
Mixed hay.....	225	315
Stover and straw.....	102	152
Pasture, days.....	9	8
Feed cost per 100 pounds gain....	$12.32	$14.92
Other costs.....	2.82	4.07
Total cost of 100 pounds gain	$15.14	$18.99
Pork and manure credit.....	2.14	3.21
Net cost of 100 pounds gain...	$13.00	$15.78

It will be noticed that because of the better use of feed, greater gain per day and higher sales price when finished, the feeder of the good steers could have paid as much as $7.73 per hundredweight for them, while $5.18 per hundredweight was the most that could have been paid for the common steers and still break even.

GOOD STEERS EXCEL COMMON STEERS IN THE FEET LOT BECAUSE: (1) They require less feed per pound of gain. (2) They require a shorter feeding period for same gain. (3) They require less margin between purchase and sale price. (4) They sell for more per hundredweight. (5) They make greater daily and total gains. (6) There is greater pride in owning them.

AT THE MARKET: "On the Hoof" and "On the Hook" the two grades of fat steers and their carcasses are compared at the market. Weights and prices used in these comparisons are actual average figures taken from the Chicago market October 1 to 31, 1924. The two comparisons follow:

	Good Steers	Common Steers
"On the Hoof"*		
Live weight, pounds.....	1160	978
Selling price per cwt.....	$9.85	$6.33
Sale price per head.....	$114.26	$61.91
Dressing percentage.....	56%	51%
Difference.....	$52.35	
"On the Hook"*		
Weight, pounds, carcasses	650	499
Wholesale price per cwt...	$16.78	$10.75
Sale price per carcass....	$109.07	$53.64
Difference.....	$55.43	

*Bureau of Agricultural Economics.

When market steers of the two grades are compared on a carlot basis, including marketing costs, the contrast is even greater than that shown above, because the freight, commission, yardage and insurance charges are the same in both cases. Using average figures at the Chicago market for October, 1924, two shipments of steers from the same point to

Chicago are compared. A carload of 20 steers, grading good, netted $803.82 more than a carload of 24 common steers of approximately the same total weight.

An analysis of the quality of cattle slaughtered at Chicago during 1923 shows that two-thirds of them failed to grade as high as "good". Only 8.2 per cent were prime and choice; 25.6 per cent graded good; 42.6 per cent graded medium; 19.6 per cent, common; and 4.0 per cent, cutter and canner. These figures show that there is still great opportunity for improving the quality of the cattle slaughtered in the United States. It should be kept in mind, however, that these percentages represent an analysis of all cattle slaughtered. Great numbers of dairy cattle that are killed annually greatly reduce the total average quality. A wider use of purebred sires and better breeding methods hold the greatest opportunities for improving the quality of our market beef cattle. However, the feeder also should keep in mind the fact that proper feeding may raise feeder steers to a higher grade when finished. Good steer beef has the following characteristics:

Conformation: Fairly blocky and smooth; thick flesh; broad loin; full round; symmetrical shoulder, and deep rib.

Finish: Well distributed covering of creamy white and firm fat; moderate supply of kidney and cod fat.

Quality: Flesh firm and velvety; moderately fine grained; mellow; light red; some marbling and juicy.

Common steer beef has the following characteristics:

Conformation: Angular and rangy; shallow; narrow loin; light round; heavy shoulder and shallow rib.

Finish: Scanty covering of yellowish fat; little or no kidney and cod fat.

Quality: Flesh soft; moist; very dark red; coarse grained; stringy and no marbling.

The difference between good and common carcasses is that the former are used largely to supply the better class of trade such as large hotels, dining cars and discriminating households, while the latter furnish the bulk of beef used by low class restaurants, contract commissaries, construction camps and cut-rate shops.

JUDGING THE GRADE OF MEAT: From the housekeeper's standpoint the grade of meat is determined by the following points which are applicable to all classes of dressed beef.

1. The color and texture of the lean meat, and the extent to which it is marbled with fat. Bright red color and even grain are the most desirable.

2. The thickness of the meat covering the bone, that is, the proportion of meat to bone.

3. The amount and character of the fat and its general distribution and color.

4. Amount of inside fat such as kidney fat on the loin cut and layer fats on the inside of the ribs.

CUTS OF BEEF: In any one carcass the parts of the animal that have been exercised are made up of tougher muscle or coarser fiber and are drier; for example, the neck and the shank. The less exercised parts, which are embedded in the bone structure, have more tender muscle fiber and are more likely to have a protecting layer of fat on the outside as well as marbled fat throughout the lean. Prime rib roasts and

porterhouse and sirloin steaks show these characteristics.

EFFECT OF GRADE ON OTHER CHARACTERISTICS: In general, differences between tough and tender cuts are more accentuated in low grade beef than in the good or medium beef. The proportion of bone is higher as a rule in low grade than in good or medium beef. The proportion of fat is lower in low grade beef than in the medium and good grades. The best cut from a low grade animal may be inferior in texture, flavor and juiciness to a less choice cut from high grade beef. In other words, a prime rib roast taken from poor beef may prove to be less desirable than rump or chuck from a higher grade carcass.

COOPERATIVE MARKETING.

Many organizations have sprung up in Colorado during the last two years in which cattlemen have agreed to pool their feeder calves and steers for sale to Corn Belt feeders. For this reason they are confronted with the necessity for producing a uniform product. Some of these organizations have rules and regulations and requiring that only certain grade bulls can be used. These organizations recognize that systematic effort must be made to induce stockmen to push this movement. When a large number of well bred steers and heifers of the same age and breeding are found in one locality, it seems to create a new interest in the subject of breeding, and stimulates the stockmen to take advantage of the opportunities offered by such organizations.

Where these organizations are operating, the class of animals that they have for sale has become widely known and a good market has been established. Feeder buyers are always attracted by the possibility of buying a number of cattle in one neighborhood and the surplus stock can be disposed of much more rapidly than where each stockman tries to make sales through his own individual efforts. Three special methods for marketing livestock co-operatively have been evolved by the western range cattlemen. These may be called the mail order method, the auction method and the feeder-buyer method.

The first method is illustrated by the disposal for many years of the "S M S" brand of calves on mail orders.

The second method is the one originated by the Highland Hereford Breeders' Association, Marfa, Southwestern Texas, and has been successfully operated by this organization for three years. This association composed of a number of ranchmen who produce high grade cattle of uniform breeding and character, functions as a co-operative enterprise. This association conducts a series of auctions each fall at central distributing points in the Corn Belt. The various owners who are to consign cattle to each of these sales are selected in accordance with a plan carefully worked out in advance and the standard of quality of the individual consignments is fixed by a sifting committee, composed of members of the association. The sales last year were held at Decatur, Illinois, and Indianapolis,

Indiana. The North Park Cattle Growers' Association (Colorado) has sold cattle at Atlantic and other points in Iowa, under the same system for the past two years.

The third method is the exact reverse of the second. It contemplates bringing corn belt farmers or feeder-buyers to the range country every fall at the instigation of a co-operative association of breeders, there to obtain their requirements, either at auction or by private deals with members of the association. This plan was successfully demonstrated last year by the newly organized Midland Hereford Breeders' Association of Midland in western Texas. Over 15,000 head of the 1923 crop of calves and about 21,000, 1923 calves were sold to corn belt buyers, a large percentage of these going to Iowa.

The Ohio Farm Bureau Federation through their feeder-buyer, have purchased from four to six thousand head of cattle each year in Colorado for the past three years under the above system.

DIRECT PURCHASE OF RANGE FEEDER CATTLE: Direct cooperative purchase of feeder cattle and calves from the range was undertaken in an experimental way by the Ohio Farm Bureau Federation in cooperation with the Ohio Live Stock Shippers' Association. This was the first time such a project had ever been conducted cooperatively. The following report will give an idea of their method of handling the purchase of cattle direct from the range to the feed lot.

Purpose: The aim and purpose of the project was two-fold. First, to secure fresher cattle than can usually be secured from the markets; and second, to secure them at a little less cost than those of like quality obtainable at the markets.

Forty loads of calves, yearlings and two's were purchased on the ranges of Colorado and delivered direct to the feed lots of Madison and Fayette counties, Ohio. The purchasers quite generally agreed that the cattle were fresher than the cattle they usually got from the markets. They considered them slightly cheaper than like quality could have been secured at the markets at the same time.

Plan: The plans for conducting the project are briefly:

1. All orders must originate through a county live stock company or county farm bureau.

2. Each order must be placed on the regular official contract form and properly executed.

Important features of the contract are:

(a) Understand that the contract is a bona fide and binding one.

(b) Give a clear detailed description of the kind, quality and number of cattle wanted. However, some latitude should be given in the number of cattle and in the weight and quality in order to load and ship to the best possible advantage as well as make an advantageous buy for the purchasers which the buying agent can frequently do if he is given a little leeway as to weight, quality and number. This privilege will be exercised by the purchasing agent only when he considers it to the advantage of the purchaser.

(c) Be sure to name the railroad station where the cattle are to be delivered.

(d) Designate the bank on which the draft is to be drawn and have the bank approve the contract and payment of the draft.

(e) Execute the contract in quadruplicate. Send original and first copy to the Ohio Farm Bureau Federation, one copy should be retained by the purchaser and one by the county live stock company or farm bureau.

Admission charged: Accompany each order with $20 to cover the cost of purchasing. Two dollars of this amount will go to the county live stock company or farm bureau handling the order and representing the state organization in the delivery of cattle and adjustment of insurance losses. One dollar will go to the Ohio Live Stock Shippers' Association for the purpose of defraying general overhead in the conduct of the project as printing, telephones, telegrams, etc. The remainder, $17.00, will be used to cover the per diem and expenses of the purchasing agents. Any saving in this amount will be returned pro rata to the purchasers.

Insurance: Insurance to cover injury or total loss of cattle in transit will be carried cooperatively. A premium of fifty cents per head for cattle and forty cents for calves will be charged. All losses, in so far as possible, will be paid from the premiums collected. Any savings in premiums will, after losses have been paid and a reasonable insurance reserve created, be returned to the purchasers in proportion to the premiums paid. (The shipping losses in 1920 were almost negligible and a large per cent of the premiums collected were returned to the purchasers.) Any losses in excess of the total amount of premiums collected will be borne pro rata by the purchasers.

Settlement: The Ohio Farm Bureau and Ohio Live Stock Shippers' Association have provided a revolving purchasing fund of $10,000 which has been placed for the disposal of the purchasing agent who is under $25,000 bond. Checks will be issued for the cattle purchased.

A statement of the cost of each load of cattle will be wired the Live Stock Marketing Department of the Farm Bureau and a sight draft drawn against the purchaser in an amount to cover the cost of cattle and insurance. The purchaser will pay freight and feeding charges when the cattle are delivered.

Cost of Cattle: It costs the ranchman seventy-five cents to one dollar per hundredweight to market their cattle in the open market. (Freight, yardage, feed and selling commission included.) That same dollar will cover the expense of taking those same cattle direct from their pasture to the Ohio feed lots. Therefore, the aim is to split the first marketing cost with the ranchman and thus benefit him as well as the Ohio feeder, each to the amount of about fifty cents per hundredweight. Bargaining ability, cut-back, shrink, grade and location are factors which enter into the practical working out of the theory, but in the main, the purchases are made on the above basis.

One Purchaser to Car: Two or more feeders may split a load of cattle at home but order the cattle in the name of one party and make their division after the cattle are delivered.

One Kind of Cattle to Car: It is not practical to ship more than one kind of cattle in a car. Yearlings or two-year-olds, for instance, may not be purchased or loaded at the same point. Order only one kind or grade of cattle to be shipped in a car.

Purchasing Agent: They engaged a large cattle breeder and feeder as the purchasing agent. This buyer was a member of their last season's purchasing committee and his successful range experience makes him a very valuable man for this position. Other purchasing agents will be selected as the volume of orders warrants.

Agent on Range: The purchasing agents will be on the range from September 10th until November 1st. Orders will be filled and shipped at the time desired as nearly as possible. However, it should be remembered that the purchasing agent has no interest other than the purchasers', therefore some leeway should be given as to time of purchases and delivery. The orders should be placed as early as possible so that he may know how many cattle and calves are wanted in order to make adequate purchasing arrangements. Send orders direct to the Ohio Farm Bureau Federation, Live Stock Marketing Department.

Cattle of one breed: Uniform loads of cattle or calves of one breed only are invariably shipped unless a mixed load is ordered by the purchaser.

Horned or Dehorned: Either horned or dehorned cattle may be had. The horned cattle can usually be purchased for slightly less than dehorned cattle. Most Ohio feeders prefer and buy dehorned cattle. Specify whether horned or dehorned cattle are wanted, or name the difference in price per hundredweight at which farmer will accept horned cattle of the same quality.

Cattle Branded: Most of the cattle carry a brand. Some of the brand marks are quite plain but in the majority of instances the brand mark is scarcely noticeable. In this regard the "direct from the range to feed lot cattle" are no different than those coming from the market.

Cut-back: Cattle will not be purchased and loaded as they run on the range, thus necessitating a purchaser accepting one or more highly undesirable cattle in a car. In purchasing

cattle it is an established rule of the range to first "throw out all unmerchantable cattle". Unmerchantable includes blinds, crooked backs, deformed, diseased, etc., cattle. Next the cut back is made, that is throwing out the per cent of least desirable cattle agreed upon in the purchase. This ranges from five per cent to 20 per cent, according to the quality and price of the cattle. By this established plan cattle of rather uniform grade are secured.

Shrink: When cattle are purchased by the pound instead of by the head, they are given a one to three per cent shrink, depending upon the distance from the pasture to the scales or are weighed up after standing twelve hours in a dry lot.

Calf weights: Calves weigh from 300 to 400 pounds. The average is usually 350 pounds to 375 pounds.

Heifer calves: Heifer calves of the same weight and quality as steer calves can be bought for two to five dollars less per head. Calf feeders are now generally buying mixed loads and frequently straight loads of heifers.

Transportation Department: The transportation department of the Ohio Farm Bureau will determine the route and movement of each car of cattle in order to get the lowest possible freight rate and most direct movement. Freight bills will be audited for any possible overcharge or irregularities.

Freight: The freight rate on cattle in car load minimum from the range territory to central Ohio points varies from 80 to 95 cents per hundredweight. Including feed and bedding the total cost will be about 90 cents to $1.20 per hundredweight when car carries minimum weight.

Time in Transit: Last season the cattle were moved in special trains on practically passenger schedule and came through with only two feeds and resting periods. We will likely not ship in special trains this season but we hope to and will make every effort to have the cars come through in good time.

Number in Car: The minimum weight on cattle is 22,000 pounds. Cattle of any age can usually be loaded to make this weight. Twenty-two to twenty-five 1000-pound steers, 28 to 35 yearlings and 45 to 55 calves make the minimum weight.

Ranchmen Cooperating: The Colorado Farm Bureau and Colorado Stock Growers' Association, assisted by the Colorado State Agricultural College are carrying out plans proposed last season for the listing and showing of cattle and generally

cooperating in putting across this project. We expect to enlist the cooperation of other local and state organizations in feeder producing sections in perfecting a direct route from range to feed lot to the mutual advantage of both producer and feeder.

During the year 1923 the following associations were organized for the purpose of selling cattle direct from the range to corn belt buyers.

Northeast Panhandle Breeders' Assoc., Canadian, Texas.
Gunnison Stockgrowers' Assoc., Gunnison, Colorado.
Western Colorado Farm Bureau Livestock Marketing Assoc., Montrose, Colorado.
North Park Stock Growers' Assoc., Walden, Colorado.
Wichita-Brazos Breaks Hereford, Assoc., Benjamin, Texas.
The Arizona Cattle Growers' Assoc., Phoenix, Arizona.
The Lea County Hereford Breeders' Assoc., New Mexico.
Addington County Association, Oklahoma.
Beaver County Hereford Feeder Cattle Assoc., Oklahoma.
Coucho Hereford Breeders' Assoc., San Augelo, Texas.
Ten Sleep Cattle Assoc., Ten Sleep, Wyoming.

SYSTEMS OF MARKETING CATTLE: The principal systems of marketing cattle are listed as follows:

1. Shipping to central markets direct.
2. Selling to country buyer for shipment to central markets.
3. Shipping to central markets through cooperative shipping associations.
4. Direct marketing to local butchers.
5. Selling direct to packer-buyer, or speculator in the country.
6. Shipping direct to the packing house.
7. Slaughtering on ranches and selling carcass as meat.
8. Auction sales in corn belt.
9. Selling on the range to cooperative buyers.
10. Selling direct on mail orders.

In 1916 central markets received more than 71 per cent of the beef cattle marketed, and in 1917, 76 per cent. Since then there has been a slow but steady decrease in the percentage of cattle disposed of through public stockyards. The

tendency within the past two years is to market a larger percentage of cattle direct to corn belt feeders or direct to the packers. In 1918 about 75 per cent, in 1919, 74 per cent, and in 1920, 70 per cent passed through public stock yards, whereas in 1921 the apparent proportion of marketed dropped to 67 per cent.

Selling direct to a speculator or packer-buyer on the range and shipping direct to the packing house is practiced a great deal in California, Arizona and New Mexico, and to some extent in Colorado.

COST OF PRODUCTION OF RANGE CATTLE.

There are very many opportunities today for decreasing the cost of production of ranch products. A careful survey of the situation shows, however, that many known economies are but imperfectly utilized in practice at present. Inertia, lack of knowledge and the fact that decreased cost per unit of product is of less importance to the ranchman than increased profit per section, keep economies from being adopted as rapidly as they are discovered. Many known improved ranching practices are in process of gradual adoption; many improvements will yet be discovered. In the matter of cattle raising much has been accomplished in increased meat production per thousand of the livestock population through younger slaughtering alone. This materially reduces the feed consumption per unit of meat produced. Such economies are by no means exhausted. Not only

does the cost of beef in terms of feed consumed decrease with better bred cattle, but the cost decreases just as truly in terms of money spent per unit of production.

The cost of raising beef cattle varies with the cost of feed, the price of labor and interest rates on cattle. The percentage of total cost represented by various factors of production is approximately as follows: Depreciation and replacement of herd, 31 per cent; interest, 26 per cent; pasture and winter feed, 18 per cent; miscellaneous, 9 per cent; hired labor, 7 per cent; taxes, 6 per cent; death loss, 3 per cent.

The feed factor is subject to the widest variations, due both to the continual fluctuation of prices of hay, cake and pasture, and the varying climatic conditions which make the amount of feed an uncertain element. The cost of feed is therefore not only the largest factor in the net production cost, but it is a variable which never can be determined by the stockman beforehand. Consequently he must take long chances. In years of heavy rainfall and favorable climatic conditions, he may be able to fatten or winter his cattle on comparatively cheap range grass, and make good profits. In a season of drouth or severe blizzards he may lose ten per cent of his animals and be put to the necessity of buying expensive hay, roughage or cake to fatten or save those remaining. In such a case he would have to sell at a price below cost of production and his losses would be great.

Other ordinary expenses of the cattle raiser have increased more rapidly than the selling price of beef. He must now pay higher rent, build fences, cultivate some of his land for raising hay, and pay more for his foreman and cowboys. The problems of making a profit on beef under modern conditions hinges largely on the cost of hay or other feed as has been stated.

This is even more true in Colorado where hay must be fed during the months when snow is on the ground. Fortunately large irrigation projects have made possible the raising of large quantities of alfalfa and native hay in the valleys of Colorado. But even hay in the stack costs something, and the price soars with the same causes which force the stockman to buy feed, namely, the failure of rains. Studies in Colorado show that the cost of native hay in 1922 in the stack was $5.50, alfalfa was somewhat higher, costing about $8.00.

On the mountain ranches four acres of pasture, 20 acres of forest range and one and one-half tons of native hay were required to keep an animal one year. Obviously with cattle selling on the hoof at six cents per pound and hay at $6 per ton, each animal must increase in weight 100 pounds a year to cover the cost of hay alone. To cover the rental or interest on four to 30 acres of summer pasture, pro-rata of operating expenses, and original cost of the animal as a calf, it must put on another 100 or 150 pounds, making a total of 250 pounds per year, which stock of good breed will just about do in the

range areas of Colorado. In most parts of the prairie section stockmen attempt to bring their cattle into beef condition without the use of hay or feed except as a last resort. This requires usually good pasture, supporting on an average one animal for every nine or ten acres, and favorable weather conditions. Ranges of such capacity are valued at $10 per acre, and bring from .07 to .15 cents per acre rental.

In Colorado the net cost of producing a 350-pound calf on the prairie ranches was $28 in 1922 and $27.66 in 1923; and a 400-pound calf in the mountain regions, $31.68 in 1922 and $29.78 in 1923. These figures do not include interest on investment or a charge for the ranchman's own labor.

Obviously, the cost of running calves on such a range for the first year is too high to allow of a profit. To make his cattle pay out the stock raiser must hold them until they are long yearlings, until increase in weight, and higher quality of beef, due to the addition of fat, will bring a higher price per pound than can be realized from calves.

Following is a statement of the annual cost of carrying a range cow in 1923 and cost of raising a calf to weaning time on fifteen prairie ranches.

		Cost	
		Per Cow	Per Calf
Feed for breeding herd: (lbs. per head) (10,130 cows, 5,313 calves)			
Cottonseed cake,	50.2 lbs.	$1.32	
Native hay,	53.5 "	.13	
Alfalfa	74.4 "	.23	
Sorghum grain fodder	170.8 "	.30	
Corn stover	9.1 "	.01	

		Cost	
		Per Cow	Per Calf*
Millet hay,	3.9 lbs. @ .01		
Corn silage	42.6 "	.08	
Ear corn	9 "	.05	
Total		$ 2.13	$ 4.06
Salt 10.6 lbs.		.08	.15
Hired labor, 5.8 hrs. @ 21.4 cents		1.25	2.38
Repairs, 2% on investment in improvements and equipment		.10	.20
Miscellaneous expense		.58	1.10
Taxes 1.3% on total investment		1.46	2.78
Death loss, 3.4% on cows, 6.4% on bulls		1.28	2.45
Depreciation on breeding herd		2.24	4.28
Depreciation on equipment		.26	.49
Depreciation on improvements		.45	.85
Leased grazing land 13.7 acres @ 10¢		1.37	2.61
Interest paid on land @ 7.2%		1.56	2.97
Interest paid on cattle @ 7.7%		1.75	3.34
Net Cost to Ranchman		$14.51	$27.66
Deductions from profits:			
Interest on operator's equity in land @ 6%		2.77	5.29
Interest on operator's equity in cattle @ 6%		1.14	2.17
Interest on equity in equipment @ 6%		.09	.18
Operator's unpaid labor 2.3 hrs. @ 18.8 cents		.42	.79
Gross Cost		$18.13	$36.09

*The cost per calf is greater than the cost per cow because only 59 cows out of 100 produced calves.

Following is a statement of the annual cost of carrying a range cow in 1923 and cost of raising a calf to weaning time on 26 mountain ranches in Colorado.

			Cost	
			Per Cow	Per Calf*
Feed for breeding herd:				
Native hay,	2,443 lbs.	$4.52		
Alfalfa hay	139 "	.34		
Oats and barley chop	1.3 "	.03		
Cull potatoes	7.2 "	.01		
Adjustment to take care of bulls fed with cows		.17		
Total feed cost			$ 5.07	$ 8.55
Salt, 9.4 lbs.			.11	.18
Hired labor			2.22	3.74
Repairs			.18	.30
Miscellaneous expenses			.56	.94
Taxes on land and cattle			1.02	1.73
Death loss on breeding herd			1.69	2.84
Herd depreciation			2.12	3.56
Depreciation on equipment			.39	.66
Depreciation on improvements			.60	1.01
Rent of grazing land			.95	1.60
Interest paid on land			.93	1.56
Interest paid on cattle			1.84	3.11
Net Cost to Ranchman			$17.68	$29.78
Deductions from profits:				
Interest on operator's equity in land @ 6%			4.19	7.06
Interest on operator's equity in cattle @ 6%			1.50	2.52
Interest on operator's equity in equipment			.14	.24
Operator's unpaid labor			.42	.71
Gross Cost			$23.93	$40.31

*The cost per calf is greater than the cost per cow because only cows out of 100 produced calves.

CUTTING THE COST OF PRODUCTION: A number of ranchmen are cutting the cost of production by making use of rented pea fields, stubble and beet top fields. One of the most expensive operations is putting up hay and then feeding it thru the winter. There are cattlemen in the state who do not put up nearly as much hay now as they did once. Enough hay to carry their cattle thru the storms and let them harvest the rest is their method.

A steer on a full feed of hay will eat his weight in hay per month. A number of ranchmen are supplying pasture to the cow herd and feeding hay only to growing young cattle and steers. Where two cuttings of hay are secured the cost of production can be cut by putting up the first cutting the first of July, and then letting the second cutting stand in the field for winter pasture.

A number of ranchmen in the San Luis Valley and North Park area in Colorado, where the dryness of the season permits, mow the second cutting and rake and bunch it in the field by double raking, that is, going down the wind rows until the rake is filled then missing about 30 feet and bring this up to each pile with the rake on the way back. Each bunch will hold about 80 to 90 pounds of hay that will keep in fine shape. This method eliminates the cost of feeding as well as the cost of stacking.

On the average it costs from $2.50 to $3.00 per ton to cut, rake and stack hay. It can be cut, raked and bunched

for a dollar a ton. This would make a saving of $2.00 per ton. It costs from 50 to 75 cents per ton to feed from the stack, making a saving of $2.50 per ton in all with this method. As it requires approximately one ton to winter a cow this reduces the cost of wintering $2.50 per head. The first cutting is of course stacked. The cattle waste very little hay where it is bunched.

It is a good plan to let them eat over a quarter at a time conserving fresh bunches for March and April which are generally the hardest months for cattle in Colorado. One of the ranches in the San Luis Valley trying this method feeds 3000 tons of hay each winter, 1500 of which will be bunched, resulting in a saving of $3,750 during the winter feeding season.

Other ranchmen are cutting the cost by reducing the amount of hay fed to from 400 to 1000 pounds of hay per animal in winter and by leasing or renting additional winter grass or pasture.

There are thousands of tons of hay and a large amount of small grains in our region which wont pay freight charges if they are shipped out during certain years of depression. If the stockmen and farmers get together the result will be to turn it all into good beef and lambs. The specifications can be varied to meet the views of the stockmen and the available feed supplies, but the plan which has met with the most favor in sections of the West is where the farmer feeds from

100 to 150 days and takes the value of the increase in weight as his pay plus one-half of the margin.

No where in the United States are there more favorable conditions of range and farms in close proximity as in the great regions between the mountain ranges of Colorado. Great valleys of the fines soil intersperse the mountain ranges which form the forest reserves, the summer grazing grounds. In the next ten years it should be one great stock farm where breeding to finishing could be practiced; where most of the livestock could be driven to feed lots without using one stock care or one mile of railroad, except for the final marketing. Not one feeder lamb or steer ought to be shipped out of those regions; all should be finished there.

COST OF MARKETING CATTLE: The following table shows the average price per hundredweight received by the producer after deducting freight, feed, yardage charges and commission charges, together with the amount and distribution of those charges.

Table 38.

Year	Gross per cwt	Commission	Feed and yardage	Freight	Shipper receives
1912-13	$6.49	$0.05	$0.05	$0.28	$6.10
1915-16	6.75	0.06	0.07	0.24	6.37
1920-21	6.64	0.09	0.10	0.44	6.00

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Table 39. Distribution of Marketing Expense on Eight Ranches in North Park, Colorado, 1923.

Cattle sold at:	Denver	Missouri River Markets	Auction Sales to Feeders Atlantic, Ia.
Gross Sales	$86,851.63	$85,993.69	$61,896.00
Marketing expense	8.42	8.82	17.9
Freight	5.42	6.16	8.8
Yardage	.63	.62	---
Feed	1.01	.89	1.1
Insurance	.09	.01	---
Inspection	.04	.01	---
Commission	1.17	1.12	8.0
Cattle Assoc. fees	.01	.01	---
Auction charges	.05	---	---

Extra feed and auction charges for selling carload lots of cattle shown at the Denver Stock Show are included in the Denver sales. Cornbelt sales show eight per cent for commission charges. The men in charge of the corn belt sales furnished the yards for holding cattle.

In comparing sales under three methods, that is, ranch sales, auction sales in corn belt and river markets, and sales at Omaha, St Joe and Sioux City, it was found that no system was the best on all classes of cattle.

Yearlings brought an average of $42.30 on the ranch, $33.10 to $37.85 in Iowa auction sale and $30.65 at the river markets, indicating that the ranch sale was the best when net returns were considered.

Two-year-old steers brought from $48.95 to $50.00 in the auction sale in Iowa while they netted $55.90 when sold at the river markets at approximately the same dates. Three-year-old steers brought $55.00 in auction and only $46.00 on the ranch.

On two ranches studied in Gunnison County who sold cattle both at auction in Iowa and on the ranch it was found that the cattle sold at auction brough $2.90 or seven per cent more than cattle sold locally on the ranch. These are net returns.

COST OF PRODUCING HAY ON FIFTEEN CATTLE RANCHES IN COLORADO, 1922.

The following cost statements were taken on three ranches in the San Luis Valley and on twelve ranches in North Park, Colorado, during the summer of 1922. Hay is extensively grown in these areas primarily for the purpose of wintering range cattle. These areas are representative of the native hay producing areas of Colorado. North Park is a natural depression in the Rocky Mountains of Northern Colorado. It covers about 1,400 square miles, including all of Jackson County. The North Platte River drains the entire field in North Park. It has its source in a network of clear rapid streams which rise in the mountain walls of North Park. Considerable quantities of snow lie in the crevices and on the protected slopes in the high altitudes of the region practically throughout the year and are a constant source of water supply. In addition to furnishing excellent water for the range stock, these streams supply an abundance of water for irrigating the pastures and hay meadows which occupy the greater portion of all stream valleys. The abundance of good water furnished by the streams of the region and the consequent excellent forage have been prime factors in the shipment from North Park of some of the finest cattle ever produced. Owing to the high altitude of the Park floor and the consequent shortness of the growing season, agriculture, aside from the production of native hay,

has not been successful and but small inroads have been made by the farmer on the range lands. The elevation of the surface varies from approximately 7,900 feet above sea level in the valley bottoms and the lowest depressions to 8,100 feet at the town of Walden.

According to the 1920 Census of the United States the acreage and value of hay exceeds those of any other crop in Colorado. Approximately 1,600,000 acres or 32 per cent of the crop area of the State is given to the production of hay. The hay grown on the ranches included in this cost study is native hay produced under irrigation. San Luis Valley is much larger than North Park and the altitude is about 7,000 feet above sea level.

There are three ways in which the hay is harvested in Colorado. The operator may hire the labor and put the hay up himself; he may contract for harvesting the hay or growing and harvesting the hay, or he may lease the hay ranch on a share basis. Ten of the ranches in this study put up their own hay, four contracted and one leased out the ranch. Contracting proved to be the most profitable method of putting up hay in this study. Detail labor requirements were obtained upon eight ranches in North Park and are given in a separate statement.

The items in table 40 which enter into the cost of producing hay are divided into two groups, operating costs and

charges against profits. The prime production cost of a ton of hay is the total operating cost on the hay ranch divided by the number of tons produced. Before this figure can be used as a basis for the determination of selling price it is necessary to add to it the proper portion of the charges against profits. The operating costs include labor, machinery charges, board, horse labor, taxes and miscellaneous expense. The charges against profits include interest on land, machinery and work horses at the rate of six per cent.

The ranches studied vary in size from 475 to 5,200 acres of hay land. The fair market value of this land runs from $20 to $100 per acre, with the average approximately $30. This cost statement covers a total acreage of 22,325 acres, giving an average of 1,488 acres. It costs from $4 to $5 per acre to brub sage brush land in preparing raw land for irrigation. New ditches cost about one dollar per acre and it costs one dollar per acre to fence the land. Each year on a number of ranches it is the policy of the operators to bring some new land under irrigation. When hay ranches are leased or contracted the operator as a rule furnishes the machinery, horses, pasture for the hay horses and pays the land taxes. The contractor furnishes all labor, grain for hay horses and maintains the machinery in good running condition.

In order to thoroughly ditch, irrigate and care for a hay ranch in such a manner as to produce the largest possible

hay crop at a low cost, it is necessary for the ranchman to possess unusual ability. He must be able to plan his work, organize his crew, exercise good judgment, come to quick decisions in case of unfavorable weather or accident, and, above all he must be able to handle large crews of men. It is absolutely essential that he know how to handle irrigation water. The method of spreading the water, the time it is applied and removed, and the quantity of water available determine to a large degree what the hay crop will be. Any delay in stacking operations is very costly; the valuable time of a large stacking crew is lost; tons of hay may be lost by leaching, extra handling and difficulty in raking and handling of poor hay all add to the cost. For this reason it is much better for the ranch operator or manager to spend his time supervising the work rather than to attempt to take the place of a hand on the haying crew.

It requires about two weeks' work with a crew of several men each spring to clean out the ditches and make necessary repairs to the irrigation system. The irrigation work is alloeed to flow upon the hay meadows about the middle of May and one or more men are required to handle the water until a week before mowing starts. On the larger ranches mowing is almost a continuous operation from the time cutting starts until the close of the haying season. From one to a dozen mowers are operated depending upon the acreage, yield and size of crew. Irrigation usually starts about the middle of

May and not much work outside of irrigating and ditch work is necessary until about two weeks before haying. At this time a trip is made to the timber to obtain small poles for use in making rake teeth, or to be used in repairing slide stackers. Another trip is made to town to obtain oats which are fed to horses during haying. One or two days are spent in riding roundup at this time to gather in the horses that have wintered on the open domain. From one to two weeks are spent in breaking young horses, repairing and oiling harness, repairing old machinery and in building new machinery, such as sweeps, slide stackers and pushers. A supply of extra rake teeth are peeled from the saplings obtained in the timber. Hay rakes are put together, sickles are ground and the stage is set for the annual haying. The ranch operator takes a trip to an adjoining village and rounds up his hay crew, consisting of college youths, men from neighboring cities and friends who wish to spend a vacation away from the intense heat in other sections of the country, enjoy cool nights and earn fairly good wages.

SIZE OF HAY CREWS: The size and arrangement of the hay crew varies with the size of the ranch and whether the hay is light or heavy. Some ranches have one man who spends his entire time grinding sickles; others have a man who divides his time between sickle grinding and taking care of the mess wagon or cooking. As a rule the operator of the ranch spends his entire time in supervising the haying while

in some cases the operator takes the place of an extra hand. On a number of the ranches the teams on the mowers were changed at noon and fresh teams used. Most ranchmen used two stackers to the stack but in some cases only one was used but he received a much higher rate of pay.

In table 40 where more than two horses are used to the machine, it indicates that fresh teams were supplied at the noon hour or that four young horses were used the entire day. In most cases the ranchmen use more horses than indicated in the table, during the season. The horses for the most part are range horses and used only during the haying season, about 60 days out of the year.

TABLE 40. STACKING CREWS USED WITH SLIDE STACKER IN NORTH PARK, COLORADO.

Size of Ranch (acres)	Entire Crew		Mowers		Rakes				Stacker Driver		Stackers	Sickle Grinders	Cook	Relief Teams
					Sulky		Sweep							
	Men	Horses	M	H	M	H	M	H	M	H	M	M	M	H
475	10½	14	2	4	2	4	2	4	1	2	1	1/2	--	--
500	14	22	4	8	4	8	2	4	1	2	2	1/2	1/2	2
700	9½	18	2	4	2	4	2	4	1	2	2	1/2	--	--
725	12	26	3	12	3	3	2	4	1	2	2	1/2	1/2	2
1000	10½	28	3	12	2	4	2	8	1	2	2	1/2	--	2
1100	15	34	4	16	4	8	3	6	1	2	1	1	1	2
1500	17	34	4	16	4	8	3	6	1	2	2	1	1	2
1800	15	24	4	8	4	8	2	4	1	2	2	1	1	2

Table 41. Average Day's Work Per Ten-Hour Day.

Operation	Acres per day	Tons per day	Tons per hour
Mowing	12.3	11.2	1.1
Raking, sulky	12.3	11.2	1.1
Raking, sweep	17.7	16.0	1.6
Stacking	--	22.8	2.8

COST OF PRODUCING NATIVE HAY IN COLORADO: Following is a statement of the average cost and per cent of total on fifteen mountain cattle ranches in 1922 on a total acreage of 22,325 acres.

Items of Cost	Avg. cost	Pct. of total
Total production cost	$5.52	100
Operating cost	3.27	59.3
Charges against profits	2.25	40.7
Operating Costs:		
Labor	2.07	37.5
Board	.23	4.2
Horse labor	.30	5.5
Machinery expense	.28	5.0
Taxes	.33	5.9
Miscellaneous expense	.06	1.2
Charges Against Profits:		
Interest on land @ 6%	2.09	37.8
Interest on machinery @ 6%	.06	1.1
Interest on work horses @ 6%	.10	1.8

Labor and board constituted the largest items of cost, making a total of $2.30 per ton or 41.4 per cent of the total production cost. It was necessary for these ranchmen to sell their hay for $5.52 per ton in order to get six per cent on

their investment. The average yield per acre was .93 tons. The average size ranch was 1,488 acres. Four of the ranches, averaging 2,845 acres each, put up hay on contract at an average cost of $3.17 per acre (prime cost), while 13 ranches, averaging 995 acres each put up hay with hired labor at a cost of $3.35. The standard rate of pay for hay hands was $2.50 per day, stackers received from $3 to $8 per day, while labor on machinery, breaking horses, etc., was at the rate of $2 per day. The average rate for moving, raking and stacking hay was $2.08. The contract rate for fencing stacks was $.10 per ton.

Following is a statement of the cost of producing native hay on eight cattle ranches in North Park, Colorado, giving labor requirements, for the year 1922.

	Man hours	Cost per ton	Horse hours	Cost per ton	Total Cost
Labor Charges:		$		$	$
Before harvest -					
Cleaning & repairing ditches	.26	.05	.397	.026	.077
Repairing head gates, irrigation	.06	.023	--	--	.023
Hauling manure on meadows	.19	.04	.31	.02	.061
Irrigation	1.59	.30	.887	.059	.360
In harvest and after -					
Mowing	.89	.235	2.08	.137	.373
Raking, sulky	.89	.228	1.76	.126	.354
Raking, sweeping	.62	.165	1.41	.092	.250
Driving stacker team	.24	.044	.499	.033	.077
Stacking	.44	.177	--	--	.177
General supervision	.36	.097	.296	.020	.117
Fencing hay stacks	.18	.04	.197	.013	.053
Miscellaneous hay work	.02	.006	.010	.001	.007

	Man hours	Cost per ton	Horse hours	Cost per ton	Total Cost
Machinery labor -		$		$	$
Grinding sickles.....	.12	.032	--	--	.032
Repairing machinery.....	.127	.028	--	--	.028
Repairing harness.....	.048	.012	--	--	.012
Machinery expense -					
Blacksmithing.....					.003
Value of hay machinery repairs.....					.15
Gas, oil and lubrication for machinery.....					.028
Depreciation on hay machinery.....					.173
Cost of board (meals).....					.352
Taxes on land, equipment and horses.....					.366
Lumber for repairing headgates on irrigation system.					.049
Transportation of hay labor.....					.004
					$3.14

Deductions from profits:

Rental on hay land	.046
Interest on land investment at 6 %.....	2.28
Interest on hay machinery at 6%.....	.069
Interest on work horses at 6%.....	.143
Total deductions from profits.....	$2.54
Total cost per ton of hay.....	$5.68

SUMMARY AND CONCLUSIONS.

In presenting some of the problems which should be solved and carried out by livestock men I want to mention a few of the most important items in reducing the cost of production and increasing profits.

First we will have smaller ranches that will practice more intensive ranching, giving more consideration to range management, range improvement, and the problems of production. There will be less consideration of numbers and more consideration of quality. We will have better bulls, and more bulls, better management of bulls, breeding at certain seasons so as to provide more uniform calves. There will be a closer culling of she stuff and disposal of old cows.

The tendency will be to produce more feed to enable ranchmen to carry cattle thru periods of drought. We will see more feeding of cattle in Colorado. Less hay probably should be fed to cows and more to young beef cattle. In order to reduce the high cost of feed we must have greater efficiency in labor, lower cost, and a larger use of family labor.

Ranchmen should keep close records of animals, inventories according to age, sex, death loss, calf and lamb crops, operating expense, and returns from cattle sales. Investigations show that lack of capital is the greatest cause of ranch failure. Cattlemen must either individually or thru cattle associations make a study of supply and demand, conditions in their

own industry, and have a clear knowledge of general business conditions.

That diversified ranching will rapidly take the place of one crop or one class of livestock ranching in the range country is the assurance given by everyone who is familiar with range conditions in Colorado. Indeed, the change is already well under way. Cattle have always been the favorite class of livestock on many ranches but recently sheep, dairy cattle and special crops have been taken on. Diversification during the past few years prevented many of the ranches which have been studied from going bankrupt as the income from various sources enabled the ranchmen to take care of items of taxes, interest and in many cases provided for the ranchman's living.

The tendency is toward lighter cattle. Light medium weight cattle carry less and better distributed fat relative to beef content than do weighty, grass-fat stock. There has been an unusual spread between grass and grain fed cattle during the past three years.

Drought, blizzard, and prolonged, severe winters have never failed to play havoc with ranchers' calculations and have caused heavy loss to capital invested. These factors, with rising production costs and necessity for a quicker turnover of capital, have been forcing earlier marketing, at the same time that the demand has been for lighter slaughter beefs.

There is a tendency to make less grass-beef in Colorado. The tendency is toward a cow and calf basis on the range, just as the sheep industry passed from a ewe and wether to a ewe and lamb basis between 1900 and 1920. The development along this line in Colorado looks like the "hand writing on the wall" for the bulk of the old time range production.

What the future will bring forth in the development of prosperity for the ranchman is not fully revealed. The pessimists preach trouble from foreign competition and that we are fast turning from a meat eating nation to a milk and cereal eating nation. It is probable that the home market will in the long run offer better prices than that of foreign countries.

Those particular ranchmen who keep up to the times, as well as those few who cater to an insistent demand from abroad for a limited amount of special products, should find prosperity ahead. The individual ranchmen who follow the best practices in marketing and adjusting their supply to market demands will prosper. Ranching will be better off the less it is mixed with land speculation and the less it is subjected to the competition of ranch products turned out by land speculators. Assuming that the increase in land values will not have excessive importance in the near future, it would seem that since competitive forces operate much more slowly than is sometimes supposed, and since the future domestic demand promises to call for a constantly expanding quantity and improved quality, the average ranchman can look forward to the future with a fair

degree of assurance.

The main market demand which our ranch men and their advisors should study is the home one rather than the more alluring one in distant lands. It is to this domestic demand that quantity, type, and quality of our production should be adjusted. Standardization and proper distribution are the cattleman's great need. During the past twenty years or more, efficiency in production has been the outstanding development in the cattle business.

The efficiency so notable in production is, however, almost completely lacking in distribution. From the time a ranch product leaves the livestock man's hands to the time it reaches the ultimate consumer, the ranchman's selling price has, in a great majority of cases, been doubled and tripled, due to the cost of passing it through a number of intermediate hands, and to the profits which each middleman felt to be his due. You may say that the retailer is making an enormous profit on these articles. The probabilities are that the retail stores do not make even a fair profit during many phases of the business cycle, nor does producer or distributor. The trouble lies in the system. During the coming twenty years, the present inefficiency or lack of proper marketing methods will tend to be eliminated. Just as concentrated attention toward the goal of producing efficiency has brought results during the past, so will concentrated attention towards standardization and efficient distribution bring results during the coming years.

There will be increased demand for association activities. Individual producers are given to proceeding in the dark because they do not know what other producers are doing. They have no way of knowing how the supply of their product compares with the demand for it. They cannot adjust their producing activity to the conditions of the market. As a result there are frequently periods of serious over-production of certain classes of livestock, and conversely, periods in which supplies are very light, and the better informed producers reap a harvest because others have sized up the situation incorrectly.

Along with the formation of associations there will naturally rise an increasing demand for statistics covering production, sales, prices, costs, etc. The cattlemen that are most successful are those that know the most about their business.

We should be able to analyze effectually the problems of the range men, because the underlying facts are crystallizing of themselves. One of the developments to be looked for is the rapid application of statistical technique to the study of demand for livestock products. In ranch economics as in other sciences we desire knowledge mainly as an instrument of control. Control means the possibility of shaping the evolution of our western economic life to fit the developing purposes of our western people. Always the center of our interest lies in the changes that have taken place in economic behavior, the changes that are now taking place, the changes that may

take place in the future.

So, too, the distribution of incomes is better known because of records of Internal Revenue. We are getting fuller data concerning the output of commodities and range products; the Federal Reserve Board promises to measure the fluctuation of credit; statistical records of business cycles are being refined. In our history of the cattle business since it started in the last fifty years, it has been a continual up and down, a profit-fattening, and later a blood-letting, and the middle sources waxed strong. Only a marketing reform will make a stabilized cattle industry. The United States Department of Agriculture and the State Agricultural College are making extensive studies into the cost of retailing meat, and cost of production of range cattle and sheep, condition of range, marketing and numbers of cattle which will aid in solving these important problems.

Moreover, livestock men and others are coming to see that they cannot depend safely upon "hunches" in guiding policy; they need to know the facts before they act. This growing interest in economic fact is not a conjecture, it is proved by the recent establishment of a number of organizations for research into our problems. The Harvard Committee on Economic Research, the Wharton School Bureau of Economic Research, the National Bureau of Economic Research, the Institute of Economics, the Food Research Institute, the bureaus of business research

created in several universities and the far larger number of statistical organizations set up by business corporations, the packers, the livestock associations are significant signs of the times. With material from all these sources to aid us, we will find it far easier than ever before to carry our theoretical analysis to the practical stage.

The fundamentally important problem is how to render production more efficient. That problem is one that calls for many-sided cooperation. The commercial process of getting products from the producer to consumer has not been greatly improved since 1800. Why should a nation that needs ranch products suffer periodically an industrial depression in which men and machines stand idle by tens of thousands? To give full scope to modern engineering technique, production ought to be organized on a continuous scale. Through a readjustment of agricultural production such as is already extensively in progress, having indeed been virtually completed in certain important agricultural enterprises, the prices of ranch products will in the end be brought up to the general price level for the commodities and services from which the great majority of the population derives its livelihood. Any other method of curing the evil is economically inconceivable.

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