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Bulletin No. 228 - Type of Farming and Ranching Areas in Wyoming

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AGRICULTURAL
EXPERIMENT STATION
AND THE
UNITED STATES DEPARTMENT
OF AGRICULTURE
BUREAU OF AGRICULTURAL
ECONOMICS, COOPERATING

TYPE OF FARMING AND RANCHING
AREAS IN WYOMING

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*Mr. Marshall also served from 1923 to 1929.
†In cooperation with U. S. Department of Agriculture.
‡On leave.
INTRODUCTION

The various factors which influence and largely determine the kind of farming carried on within the borders of Wyoming vary materially in different parts of the State. The more important of these factors are elevation above sea level, land surface features, type and condition of soil, rainfall, length of growing season, transportation facilities, demand for the products that can be produced, and the availability of water for the irrigation of crops and for livestock. The types of farming now carried on in any given area are chiefly the results of the efforts of farmers and ranchmen to adjust their production programs and to organize their farms and ranches so as to obtain maximum returns under the influence of the causal factors just enumerated. In the beginning of the agricultural development of the State, most of the settlers had much to learn by the process of trial and error but finally, through the accumulation of information gained during years of experience and study, there has developed among farmers a more or less settled conviction as to the kinds of farming best suited to the various sections of the State. As a result a shifting has taken place during recent years toward the types of farming that fit best the conditions of the respective districts.

OBJECT OF STUDY

A type of farming and ranching study has been undertaken in Wyoming to acquire a more comprehensive understanding of the agriculture of the State as a whole; to determine what types of farming are being carried on in different parts of the State and why the agriculture is as it is; and finally, to differentiate the State into type-of-farming areas in each of which the agriculture differs considerably from that of all contiguous areas.

Differentiating the State into areas in this way gives a much clearer picture of the agricultural problems and possibilities in the State as a whole, as well as in each of the several areas. It orients
the research worker to the local problems of the respective areas and to the needs for further studies. It guides him, also, in placing, planning and organizing research projects. Such a study provides excellent material for teaching agriculture in the public schools and colleges, for making recommendations to farmers and ranchmen and for placing the proper limitations on such recommendations. Furthermore, the results of such a study should be of material assistance in the formulation of land-planning policies.

METHODS AND SOURCES OF MATERIAL

The methods used in pursuing the investigation and in presenting the results thereof have been historical, analytical, graphical, and descriptive. The settlement of the State and the development of its agriculture have been studied from their beginning; the influences of the physical, biological, and economic factors which have been and now are instrumental in molding types of farming within the State have been duly appraised; the geographical distribution of the crops grown and the livestock enterprises on a county basis and also the population and the number of farms by types in each voting precinct, or minor civil division, have been mapped and presented graphically; the State, after a careful analysis of the data assembled, has been divided into 17 distinct type-of-farming areas on the basis of the variations in the character of the farming done in the respective areas; and finally, the mapping of the State into type-of-farming areas has been verified and corrected by visiting and inspecting each area and by consulting county agents, assessors and others familiar with local conditions.

The principal sources of the data used in this study are as follows: Bureau of the Census, U. S. Department of Commerce; Geological Survey and Bureau of Reclamation, U. S. Department of the Interior; Bureau of Agricultural Economics, Bureau of Chemistry and Soils, Bureau of Biological Survey, and the Weather Bureau, U. S. Department of Agriculture; Wyoming State Experiment Station and Extension Service and the State Department of Agriculture. The economic field studies conducted by the Department of Agronomy and Agricultural Economics of the University of Wyoming have been especially helpful in making this study.

DEFINITION OF TERMS

Since this study deals more particularly with farms, types of farming and ranching, and types-of-farming areas, it is essential that the reader have a clear understanding of the meaning of these terms as used in this publication.
A FARM DEFINED

“A ‘farm’ for census purposes, is all of the land which is directly farmed by one person, either by his own labor alone or with the assistance of members of his household or hired employees. The land operated by a partnership is likewise considered a farm. A ‘farm’ may consist of a single tract of land or of a number of separate tracts, and the several tracts may be under different tenures, as when one tract is owned by a farmer and another rented by him. When a land owner has one or more tenants, renters or managers, the land operated by each is considered a farm. . . . The enumerators were instructed not to report as a farm any tract of land of less than 3 acres, unless its agricultural products in 1929 were valued at $250 or more.”

TYPE OF FARMING

A group of farms having a fairly high degree of similarity in the kind and proportion of the crops grown and the livestock handled may be said to be following the same “type-of-farming.” While this is the general concept of the term, it will be seen later that material deviations have been made in defining some of the individual types of farms. For example, 40 per cent or more of the gross income of the cash-grain farms of the State must be derived from one or more of the following grain crops: wheat, corn, barley, oats, emmer, spelt, rye, grain sorghums and flax. Furthermore, these crops may be grown in very different proportions on individual cash-grain farms. Thus, on some farms a very high percentage of the gross income may be derived from wheat, while on other farms either corn, barley, or oats may be the major crop.

TYPE-OF-FARMING AREA

Likewise, the term “type-of-farming area” refers to a part or portion of the State in which the agriculture thereof differs materially from that of the adjoining or neighboring areas. In defining this term, it is generally stated that within each area there is a fairly high degree of uniformity in the type, or types, of farming carried on and also in the physical and economic conditions which prevail. However, in differentiating the State into areas, it was found that uniformity of a high degree rarely exists, except in very small areas, either in type, or types, of farming practiced or in the physical and economic conditions which prevail. This is because practically all areas, except those under irrigation, grade insensibly into each other and no type of farming is dominant along the dividing lines of the respective areas. Where several types of farming are carried on within an area and no one of them predominates, the area is said to present a mixed type of farming.

“Fifteenth U. S. Census of Agriculture, Wyoming, 1930. Type of Farm, Statistics by Counties, Third Series.”
BASIS FOR CLASSIFYING FARMS BY TYPES

Source of income was the primary basis used in the United States Census of Agriculture, 1930, in classifying farms into types. That is, the type to which each farm was assigned was determined, in most cases, by the proportion of the gross income of the farm as a whole that came from some particular source. Source, in each case, refers to the product or products from which income is derived. On this basis the farms in Wyoming in 1929 were classified into 12 major types, one of which was subdivided into 5 minor types. Both the major and minor types and the more important products which characterize each as to source of income are listed below.

MAJOR TYPES-OF-FARMS

The total gross income from the products which distinguish each of the first eight of the major types (cash-grain to stock-ranch, inclusive) had to equal 40 per cent or more of the total gross income from all sources, there being no other source contributing as much as 40 per cent. The basis for classifying the other three major and the five minor types are stated separately. The major types are as follows:

Cash-grain.—Wheat, corn, barley, oats, flax, emmer and spelt.
Crop-specialty.—Sugar beets, potatoes, hay, dry beans, and alfalfa and clover seed.
Fruit.—All tree fruit, small fruit and grapes.
Truck.—All vegetables harvested for sale.
Dairy.—Milk, cream, butterfat, butter, and dairy cows and calves.
Poultry.—Chickens, ducks, geese, turkeys, and eggs.
Animal-specialty.—Beef cattle, sheep, hogs, horses, mules, goats, wool and mohair. This type has less than 10 acres of pasture land to each acre in crops.
Stock-ranch.—Beef cattle, sheep, hogs, horses, mules, goats, wool and mohair. This type has 10 acres or more of pasture land to each acre in crops.
General.—The general farms under the 1930 Census classification were made up of two groups: (1) those having less than 40 per cent of their total gross income derived from any one source and (2) those having 40 per cent or more of their total gross income derived from each of two sources.
Self-sufficing.—Farms on which 50 per cent or more of the total value of all products produced were used by the operator's family.
Unclassified.—Farms which were not operated in 1929, or for which the reports thereof were so incomplete as to prevent the computation of the gross income from the various sources.

Abnormal.—Farms of unusual type which differed materially from ordinary farms.

MINOR TYPES-OF-FARMS

The group of "abnormal" farms has been divided into 5 minor or sub-types as follows:

Institution or Country Estate.—(1) Institution—Farms either owned or operated by public or semi-public agencies such as colleges, schools, asylums, churches, etc. (2) Country Estate—Farms of 10 acres or more having residences valued at $25,000 or more.

Part-time.—Farms producing products valued at not more than $750 in 1929 and whose operators either reported some other occupation than farming, or who spent at least 150 days at work not connected with their farms.

Boarder and Lodger.—Farms having 50 per cent or more of the total gross income represented by receipts coming from boarders, lodgers, campers, etc.

Forest Products.—Farms on which the forest products sold represent 50 per cent or more of the total income from all sources.

Horse Farm, or Feedlot, or Livestock Dealer.—(1) Horse Farm—Farms on which the value of horses and mules sold in 1929 represented 50 per cent or more of the total gross value of all farm products. (2) Feedlot—Farms small in size, which produce little or no crops, on which relatively large amounts were spent for feed and on which 50 per cent or more of the gross income came from the sale of cattle, sheep and hogs. (3) Livestock Dealer—Farms on which little or no feed was purchased or produced, which reported the purchase and sale of large numbers of livestock in 1929, on which the sales of livestock that year represented 50 per cent or more of the gross income, and the operators of which reported occupations other than farming, or the spending of several days for pay in 1929 at work not connected with their farms.

The foregoing classification of farms has been used in this study with one exception: The two types “animal-specialty” and “stock-ranch” have been combined to form one group, or type, “stock-farms and ranches.” It will be noted from the above definitions of these two types that their distinguishing characteristic lies in the ratio of the area in pasture land to the acreage in crops. Under Wyoming conditions it has been deemed best to combine the two and use them as one type. It should be understood also
that a considerable number of the farms in some of the irrigated districts classified as animal-specialty are simply farms on which lambs or cattle were fed during the fall and winter for 60 or more days, the livestock being purchased as feeders at the beginning of the feeding period.

**COMPARISON OF FARMS BY TYPES**

The United States Census of Agriculture, 1930, reports a total of 16,011 farms in Wyoming in 1929. Of this number, 668 were unclassified. The division of the remaining 15,343 farms into types according to the foregoing scheme of classification is shown in table I. Stock farms and ranches made up approximately 36 per cent of the total number, crop-specialty 19 per cent, general 16, cash-grain 12, abnormal 7, dairy 5, self-sufficing 4, poultry 1, and fruit and truck less than one-half of 1 per cent each. In fact, there were but 5 farms that were classified as fruit farms and 37 as truck.

**TABLE 1**

Number and average size of farm and average gross income per farm from five sources for each of ten types of farm, Wyoming, 1929.

<table>
<thead>
<tr>
<th>Type of Farm</th>
<th>Number of farms</th>
<th>Average size of farm</th>
<th>Average gross income per farm from</th>
<th>Average from five sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>2,493</td>
<td>599</td>
<td>536</td>
<td>308</td>
</tr>
<tr>
<td>Cash-grain</td>
<td>1,783</td>
<td>757</td>
<td>1,633</td>
<td>272</td>
</tr>
<tr>
<td>Crop-specialty</td>
<td>2,839</td>
<td>401</td>
<td>2,750</td>
<td>275</td>
</tr>
<tr>
<td>Fruit</td>
<td>5</td>
<td>42</td>
<td>1,322</td>
<td>*</td>
</tr>
<tr>
<td>Truck</td>
<td>37</td>
<td>64</td>
<td>1,417</td>
<td>47</td>
</tr>
<tr>
<td>Dairy</td>
<td>812</td>
<td>410</td>
<td>258</td>
<td>408</td>
</tr>
<tr>
<td>Stock farm and ranch†</td>
<td>5,498</td>
<td>3,297</td>
<td>431</td>
<td>5,184</td>
</tr>
<tr>
<td>Poultry</td>
<td>215</td>
<td>254</td>
<td>153</td>
<td>93</td>
</tr>
<tr>
<td>Self-sufficing</td>
<td>537</td>
<td>350</td>
<td>45</td>
<td>30</td>
</tr>
<tr>
<td>Abnormal</td>
<td>1,124</td>
<td>391</td>
<td>333</td>
<td>823</td>
</tr>
<tr>
<td>All types‡</td>
<td>15,343</td>
<td>1,469</td>
<td>986</td>
<td>2,089</td>
</tr>
</tbody>
</table>

*Less than fifty cents.
†The ratio of pasture land to land in crops is the chief distinction between stock farms and stock ranches, the stock farms having less than 10 acres of pasture land to each acre in crops, while the stock ranches have 10 acres or more.
‡Does not include 668 unclassified farms.
Compiled from the U. S. Census of Agriculture, 1930.
The average size of farm for each of the ten types varied from 42 acres for the fruit farms to 3297 acres for the stock farms and ranches combined. Taken separately, the stock farms (animal-specialty farms) averaged 592 acres in size and the stock ranches 4273 acres. A very large proportion of the area in stock ranches is pasture land, and vast areas of grazing land in the national forests, in the public domain and also land owned by the State are used in connection with the operation of the stock farms and ranches. While the table presents the average size of farm for the several types, it must be kept in mind that size of farm varies widely within each of the different types.

The average gross income for each of the ten types of farms is shown in the last column of the table, the range being $356 for the self-sufficing farms to $7,355 for the stock farms and ranches. The average gross income of the stock farms and stock ranches considered separately was $4,123 for the former and $8,521 for the latter. The crop-specialty farms ranked second highest in average gross income and the abnormal farms second lowest. Considering the top line of table 1, it is seen there were 2,493 farms within Wyoming in 1929 that were classified as general farms and that their average size was 599 acres; that the average gross income of these general farms was $1,719; and that $536, $398, $465, $9, and $311 of the $1,719, respectively, were derived from crops, livestock, livestock products, forest products, and products produced on the farm and consumed by the operator's family. The data presented in the table permits a similar inspection of each of the other nine types of farms.

Table 2 presents data very similar to that shown in table 1 but on a percentage basis. By considering the first line of the table, it is seen that 31.1 per cent of the gross income of the general farms came from crops, 23.2 per cent from livestock, 27.1 per cent from livestock products, 5 per cent from forest products and 18.1 per cent from products used by the operator's family. Since neither of the 5 sources of income contributed as much as 40 per cent of the total gross income, the farms in this group were classified as general farms. Each of the other nine types derived over 40 per cent of their average gross income from one source. In the case of the self-sufficing farms an average of 65.6 per cent of the gross income consisted of products used by the operator's family. Hence their classification as self-sufficing farms. While the abnormal farms derived 53.9 per cent of their gross income from the sale of livestock, other specifications in the scheme of classification prevented them from being classified as either animal-specialty farms or stock ranches.
TABLE 2
Proportional distribution of the total gross income of each of ten types of farm that was derived from five sources, Wyoming, 1929.

<table>
<thead>
<tr>
<th>Type of farm</th>
<th>Percentage of gross income derived from each of five sources</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crops</td>
</tr>
<tr>
<td>General</td>
<td>31.1%</td>
</tr>
<tr>
<td>Cash-grain</td>
<td>72.2%</td>
</tr>
<tr>
<td>Crop-specialty</td>
<td>78.2%</td>
</tr>
<tr>
<td>Fruit</td>
<td>69.7%</td>
</tr>
<tr>
<td>Truck</td>
<td>80.1%</td>
</tr>
<tr>
<td>Dairy</td>
<td>9.4%</td>
</tr>
<tr>
<td>Stock farm and ranch</td>
<td>5.8%</td>
</tr>
<tr>
<td>Poultry</td>
<td>9.4%</td>
</tr>
<tr>
<td>Self-sufficing</td>
<td>12.5%</td>
</tr>
<tr>
<td>Abnormal</td>
<td>21.8%</td>
</tr>
<tr>
<td>All types</td>
<td>23.9%</td>
</tr>
</tbody>
</table>

*Less than .05 of one per cent.
Compiled from the 1930 U. S. Census of Agriculture.

Table 3 shows the percentage of the total gross income derived from each of the five different sources that was produced by each of the ten types of farms. Of the total income derived from crops, for example, the general farms contributed 8.8 per cent, the cash-grain farms 19.3 per cent, the crop-specialty farms 51.6 per cent and so on. As would be expected, the stock farms and ranches contributed a very high proportion of the total income derived from livestock and livestock products, 88.9 per cent and 65.9 per cent, respectively. The high proportion of the livestock products coming from the livestock farms and ranches is largely due to the sale of wool. The low percentage of the total gross income derived from the sale of livestock products that was contributed by the dairy farms is due to the fact that that type of farm occupies a minor position numerically in Wyoming.
TABLE 3
Proportion of the total gross income from each of five sources and of the total from the five sources that was contributed by each of ten types of farms, Wyoming, 1929.

<table>
<thead>
<tr>
<th>Type of farm</th>
<th>Crops</th>
<th>Livestock</th>
<th>Livestock products</th>
<th>Forest products</th>
<th>Products used by operator's family</th>
<th>Five sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>General</td>
<td>8.8</td>
<td>3.1</td>
<td>9.6</td>
<td>20.5</td>
<td>19.8</td>
<td>6.8</td>
</tr>
<tr>
<td>Cash-grain</td>
<td>19.3</td>
<td>1.5</td>
<td>2.4</td>
<td>2.6</td>
<td>9.0</td>
<td>6.4</td>
</tr>
<tr>
<td>Crop-specialty</td>
<td>51.6</td>
<td>2.4</td>
<td>6.0</td>
<td>4.7</td>
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</table>

*Less than .05 of one per cent.
Compiled from the 1930 U. S. Census of Agriculture.

HISTORICAL BACKGROUND
ACQUISITION OF WYOMING TERRITORY

Portions of the territory now constituting the State of Wyoming were claimed at times by Spain, France, Great Britain, Texas, and Mexico. The major part of the State lying east of the Continental Divide was acquired from France in 1803 by the purchase of the Louisiana territory; the greater portions of what are now Albany and Carbon counties came to the United States by the annexation of Texas in 1845; the triangular shaped area lying north of the forty-second degree of north latitude and west of the Continental Divide was acquired by the settlement of the Oregon question with Great Britain in 1846; and the southwestern part of the State was ceded to the United States in 1848 at the close of the Mexican war.

From 1848 to 1868 Wyoming was under the jurisdiction respectively of Nebraska, Utah, Oregon, Dakota and Idaho. An act passed by Congress and approved July 25, 1868, provided for a territorial government which was organized in 1869. In 1890 Wyoming was admitted to the Union as the 44th state.
THE FUR TRADE

When purchased from France in 1803, much of the Louisiana territory was a very rich field for the collection of fine furs. White men, at that time, had a very meager knowledge of the newly acquired territory, which was inhabited by roaming, warlike tribes of Indians who subsisted largely on the flesh of the buffalo and who used the skins of animals both for clothing and in the construction of their wigwams.

Immediately following the acquisition of the Louisiana territory, many citizens became obsessed with a desire for first hand information as to its character, resources, and possibilities. Responding to this impulse, hardy, adventuresome men soon began to penetrate the remote portions of the territory.

The early explorers of what is now Wyoming were quick to perceive the possibility of profit from trading in furs and at once engaged in that business. The fur trade was developed under three methods of procedure. The first and most popular was to exchange goods with the Indians for peltries. New wants were brought to the Indians by the white men and the easiest way the Indians could satisfy their wants was to exchange furs for goods. The second method was the organization of companies which employed hunters and trappers and sent them into the districts where fur bearing animals were plentiful. Under the third method, free, independent hunters and trappers operated in relatively small groups, disposing of their furs in the most advantageous markets.

Of the fur companies which operated in Wyoming, a half dozen of the principal ones were organized between 1807 and 1830. Competition among them was quite keen at times and, at the peak of their activities in the early 30's, it is said the fur companies alone had from 1200 to 1500 men in the mountains about the head waters of Yellowstone, Snake, Green and Platte rivers.

The fur companies generally maintained only temporary trading posts as it was often necessary to shift the location of their headquarters to more favorable districts. The first permanent trading post was established near the junction of the Laramie and Platte rivers in 1834. This post later became Fort Laramie and was sold to the government in 1849. The next permanent trading post was established at Fort Bridger in 1842. Fortifications were seldom built about the trading posts, except when the necessity was considered urgent.

The fur trade declined during the late 30's and by 1843, it is said, the beaver was almost exterminated and that but few men remained actively engaged in trapping and hunting. The fur trade, during this time, it should be well understood, was carried on under very hazardous conditions since many of the Indian tribes in the fur-bearing districts were opposed to the encroachments of the white men.
THE MOVEMENT WESTWARD

The movement westward through Wyoming had its beginning, of course, in connection with the fur trade and the exploration of the territory. During the 30's, however, it passed to a different phase. In 1832 several parties of fur traders and explorers were outfitted at Independence, Missouri, for the long journey up the Platte River, across the Continental Divide at South Pass and down the Snake River to the Columbia. Parties of missionaries, including both men and women, crossed the plains and mountains by the Platte-South Pass route and descended the western slope into Oregon and Washington during the years 1834-39.

The overland migration to Oregon and California started in 1841. That year a party consisting of men, women, and children, 15 in all, passed up the Platte and Sweetwater rivers on their way to the Pacific coast. The Oregon and California emigrants numbered 112 in 1842 and 1000 or more in 1943. The latter year the emigrants took with them horses, draft cattle, cows, farm implements and household goods. The overland travel to these two states increased year by year, reaching the peak following the discovery of gold in California in 1848. The number of gold seekers passing through Wyoming that year has been estimated all the way from 30,000 to 100,000.

The migration of the Mormons began in 1847. That year Brigham Young led a party of 143 men with a train of 73 wagons to Utah, via the Platte-South Pass route. The Mormon emigrants, including men, women and children, passing through Wyoming in 1848 numbered 2,388 and their wagons 792, while in 1849 the number declined to about 1,400. The overland migration to Oregon, California, Utah and the other western states continued until the completion of the Union Pacific railroad in 1869.

The immense freight business that developed between Missouri River points and the Rocky Mountain states made up no small part of the movement westward. The discovery of gold in California in 1848 and in Colorado, Nevada, Idaho and Montana during the years from 1858 to 1863 inclusive caused a great wave of population to flow westward. During the earlier years of this westward movement, freighting companies brought out the annuity goods which the government furnished the Indians. They also brought supplies to the army posts and the traders along the route of travel. After the mining boom got well under way, freighting became a colossal business. It is said that in 1865, six thousand wagons passed Fort Kearney, Nebraska, during a period of 42 days and that 75,000 oxen and 6,250 wagons were used at one time by a single freighting firm, Russell, Majors, and Waddell.
TRAIL SUPPLY STATIONS AND ROAD RANCHES

Following the decline in the fur trade, it became necessary for most of the men engaged in that industry to shift to other occupations and many of them drifted down onto the Oregon and Overland trails. Some acted as guides to the emigrant trains, since the danger of Indian raids and depredations was so great that it was advisable to have men in charge of the trains who were experienced in dealing with the Indians. Others set up trading posts or supply stations at strategical points along the trails to provide the necessities of the passing travelers. Such articles as flour, bacon, coffee, sugar, powder, shot and lead were generally in great demand.

Another source of profit to the traders along the trails was exchanging draft animals fit for travel for the weary, footsore, rundown oxen and horses of the emigrants. In making these exchanges, the trader usually exacted a substantial consideration in addition to the wornout, rundown animals received. The footsore animals received were turned out to rest and to graze upon the free grass. In a comparatively short time they were generally in good condition to be exchanged for other wornout animals.

Toll bridges and ferries were established at the more difficult crossings of the Platte, Sweetwater and Green rivers during the early years of the movement westward. Frequently trading stations were established at and operated in connection with the toll bridges or ferries. As the migration westward increased from year to year, it became increasingly difficult for the draft animals of the trains to obtain sufficient forage from the accessible grazing grounds. This developed a demand for hay. As a result, the owners of the trading stations located on the streams, began to put up native hay from the natural meadows along the water courses. In time, irrigation water was applied to these natural meadows. The profit to be derived from furnishing the travelers with fresh draft cattle induced many of the traders along the trail to engage in cattle raising. Thus, the development of these “road ranches” along the trail was the beginning of the agriculture of Wyoming.

THE INDIAN BARRIER

The territory of Wyoming made little progress in the development of its natural resources until during the late seventies. This, in part, was due to the persistent and ferocious resistance put up by the Indians against the encroachment of the whites on the Indian hunting grounds. In the very beginning the explorers and fur traders found most of the Indian tribes within the territory very hostile. Raids upon the emigrant and freight trains passing over the Oregon Trail were so numerous during the early
years of travel that they soon were considered a risk that all must bear who ventured along the trail.

The policy pursued by the government in handling the Indians of the Great Plains from the opening of the Oregon Trail in the 30's until towards the close of the 60's, had much to do with developing and maintaining an Indian barrier. That policy was based on the assumption that practically all of the Great Plains area lying west of approximately the 100 meridian would be of little agricultural value to white men that and the Indians could be taken care of most satisfactorily by placing them on reservations with extensive additional hunting grounds where they could obtain their subsistence by the chase.

The whole territory lying within the present borders of Wyoming was claimed by various Indian tribes at the time of the advent of the fur traders and trappers. While more or less unfriendly and hostile from the beginning, the Indians increased their resistance as they comprehended the significance of the encroachment of the white man on their hunting grounds and the ever increasing stream of whites moving westward over the emigrant trails.

It was finally decided to put an end to the Indian depredations by entering into solemn treaties with the various tribes concerned. With this purpose in view treaties between the United States and the several tribes were signed at Fort Laramie in 1851. It may be stated roughly that these treaties provided that practically all Wyoming territory should be Indian lands except that portion of the state lying (1) south and west of that portion of the Continental Divide extending from the Idaho state line to the head waters of the Sweetwater River and (2) south of the Sweetwater River and west of the Platte River. The United States was to pay the Indians $50,000 per year for 10 years. The several tribes agreed to confine themselves to their respective allotments of land, to cease their depredations and to allow the government a right-of-way through their lands for the emigrant trail. The Indians failed to live up to the provisions of the treaty of 1851. They would not remain within the boundaries of their respective allotments of land and they continued to raid the supply stations and road ranches along the trail, to steal horses and cattle and to attack and harass the emigrant and freight trains. The whites, likewise, would not keep off of the Indian land and kept up an incessant demand of the government to subdue the Indians, place them on reservations and make their hunting lands available for the use of the whites.

The conditions described above obtained until 1868 when two treaties were entered into whereby the Indians ceded to the United States all of that part of the Territory of Wyoming lying south
of the Platte and Sweetwater rivers and also that lying south and west of that portion of the Continental Divide extending from the headwaters of the Sweetwater River to the Idaho-Wyoming state line. The treaty of 1868 provided that all of the Wyoming territory lying north of the North Platte River and east of the Big Horn Mountains should be unceded Indian hunting grounds. Notwithstanding these treaties and the agreements entered into, Indian atrocities and depredations south of the Platte River continued. Indian troubles north of the Platte River continued until the termination of the Indian wars in the 70's. The troubles north of the Platte River were due, in large part, to the persistent efforts of the whites to traverse the Indian hunting grounds via the Bozeman Trail, and to their readiness to rush into the forbidden territory upon the announcement of the discovery of gold. The Indian barrier did not fully pass out of the picture until in 1881 when United States troops rounded up 1600 Indians at Fort Keough on the Yellowstone River and transferred them to the Standing Rock Reservation in Dakota.

AGRICULTURAL DEVELOPMENT

The development of farming and stock raising in Wyoming was very slow in getting under way. Although the whole State was overrun by explorers, fur traders and trappers during the first third of the 19th century, and although thousands of emigrants and gold-seekers traversed the State on their journey westward during the 40's, 50's and 60's, little consideration seems to have been given to the establishment of permanent settlements within the territory of Wyoming until during the late 60's. This, in large part, was due to the fact that the whole Wyoming Territory was an unsafe place for either settlers or stock raising prior to the consummation of the treaty of 1868.

The first permanent trading post in Wyoming was established near the junction of Laramie and North Platte rivers in 1834, the present site of the town of Fort Laramie. This post was fortified in 1836 and sold to the Federal Government in 1849. It may be considered the first permanent settlement, having been occupied continuously since 1834, first as a trading post, then as a trading post and fort, and later as a civilian community.

Fort Bridger, erected in the east portion of Uinta County in 1842, was the second permanent trading post established. Fifty-five Mormons settled near Fort Bridger in 1853 and established a supply station which they called Fort Supply. However, in 1858 they were called to Salt Lake and the place was abandoned. This seems to have been the first attempt to make a real settlement within the State.
Gold in paying quantities was discovered on the headwaters of the Sweetwater River in 1867 and by the close of that year the population of the district was estimated at around 2,000. Feeling the need of some authority to administer justice, the miners established a county which they named “Carter.” The action of the miners was legalized by the Dakota Legislature in a bill approved December 27, 1867, and a county government was organized in January, 1868. This was the first county organized within Wyoming. In 1869 the name of the county was changed to Sweetwater.

The development of Wyoming was given a great impetus by the building of the Union Pacific across the state during 1867 and ’68. The construction of this railroad cut the Indian country in two, i.e. into northern and southern segments; provided a means of moving troops and supplies rapidly across the Indian country; greatly reduced the danger, exposure and time element of travel; materially increased the rapidity of migration westward; and made possible the production of cattle and sheep on an extensive scale by providing transportation facilities to distant markets. All this gradually impressed the Indians with the futility of their resistance to the ever increasing westward movement of the whites.

Thousands of men were required, first, to construct the railroad and then to operate it. Coal mines were opened and placed in operation at Carbon, Rock Springs and Almy as soon as the road reached those places. The production of coal increased from 58,186 tons in 1869 to 8,456,664 tons in 1917. Coal operatives in 1930, made up 4.3 per cent of the gainful workers 10 years old and over of the state.

The signing of the Indian treaty in 1868 greatly stimulated the development of the southern third of Wyoming. A large stock ranch was established on Bear River, 50 miles north of Evanston, and claims were located on Muddy Creek in Uinta County that same year. In 1874, settlers located at Cokeville and on Fontenele Creek in Lincoln County. Permanent settlements were made at Big Piney during the 70’s and on Salt River in Star Valley of Lincoln County and in Jackson Hole in Teton County during the early 80’s. Practically all of the early settlers in the western part of the State engaged in cattle raising.

The southern third of Wyoming developed gradually for a decade following the signing of the Indian treaties in 1868. This, in part, was due to the danger of raids by the Indians whose hunting grounds lay just north of the Platte River. The Indians would dash across the river unexpectedly and drive off the cattle and horses of the settlers and commit other depredations. The Surveyor General for the territory of Wyoming in 1871 reported but 40 stock-raising outfits as grazing their herds that year within the
area lying south of the Platte and Sweetwater Rivers. The total number of cattle owned by the 40 outfits was approximately 86,000 head. Following the termination of the Indian wars in the late 70's, however, the cattle industry expanded by leaps and bounds. At that time the northern two-thirds of the State, except the Wind River Indian Reservation, became safe for stock ranching and settlement. The cattlemen were not slow in occupying the territory after the Indian barrier had been removed.

During the late 70's and early 80's the cattle business was very profitable and this led to the organization of many immense cattle companies. For example, one company operated 40 ranches and owned some 200,000 head of cattle. The cattle business was very simple during those early years. Grass was plentiful and the cattle were expected to find sufficient forage on the unlimited open range during both summer and winter. Thus, it is seen, little or no efforts were made to put up feed for winter. The number of cattle in Wyoming increased very rapidly during the early 80's, i.e. from about 278,000 head in 1880 to approximately 1,250,000 in 1886, the number remaining above one million until 1892. (See figure 1.) This marked increase in numbers was due primarily to the trail herds by which hundreds of thousands of cattle were brought in from the Southwest. In this way, the ranges were quickly overstocked. The overgrazing of the ranges, the severe drouth of the summer of 1886, and the hard winter which followed greatly curtailed the supply of forage and caused an enormous death loss. This situation and declining prices forced many large cattle companies out of business.

Sheep were first introduced into Wyoming in 1870 by the trailing of 800 head from New Mexico to Cheyenne for slaughter. In 1871, 1,500 more were trailed across Colorado to Cheyenne for the same purpose. The estimated number of sheep within the Territory in 1878 was but 9,000 head and these were almost exterminated by the severe winter of 1878 and '79. The United States Census of Agriculture credits Wyoming with having 140,000 sheep exclusive of lambs on June 1, 1880. By 1883 the estimated number had increased to 500,000. The first real increase, however, started in 1890 and continued each year until a very high peak was reached in 1902. Another high peak was attained in 1909. (See figure 1.)

Vass and Pearson1 have the following to say concerning the improvement of Wyoming sheep:

"There has been a marked improvement in the quality of the lambs and the quantity of the wool during the last 36 years. A memorandum of the wool clip and sales of one of the largest out-

1Wyoming Agricultural Experiment Station Bul. No. 156—An Economic Study of Range Sheep Production on the Red Desert and Adjoining Areas.
Figure 1
Livestock: Estimated number of cattle, sheep, horses, swine and dairy cows in Wyoming, January 1, each year, 1883-1937.
fits operating in the State shows the average weight per fleece from 86,000 head was 4.4 pounds in the year 1891. The weight of the fleece on the same outfit 36 years later showed 100 per cent increase. The improvement in the lambs has been almost as great."

Figure 1 presents both the absolute and proportional increase and decrease in the estimated number (1) of all cattle, sheep, and horses in Wyoming on January 1 each year from 1883 to 1937 and (2) of dairy cows and swine from 1890 and 1891, respectively, to 1937. It also presents the estimated number of all cattle, sheep, and horses combined and expressed in terms of beef cattle units. As here used, a beef cow represents a beef cattle unit. Cattle, sheep and horses were converted into beef cattle units by multiplying (1) the total number of all cattle minus dairy cattle by .83; the total number of dairy cattle by 1.1; the total number of sheep by .2; and the total number of horses by 1.13.

The data presented in figure 2 and table 4 give a fairly accurate picture of the progress made in the agricultural development of Wyoming from 1879 to 1934. Of the total land area of the State (60,528,000 acres exclusive of the Yellowstone National Park, U. S. Census of Agriculture, 1935) 124,000 acres were in farms and ranches in 1879. This increased each census year, reaching 28,162,000 acres in 1934. That is an increase from .2 per cent to 46.6 per cent. The area of irrigated land increased from 230,000 acres in 1889 to 1,236,000 acres in 1929. Likewise the number of farms increased from 457 in 1879 to 17,487 in 1934. The average size of farm varied greatly during the 55 years covered by table 4 but reached the maximum in 1934. The development of irrigation projects from time to time has tended to reduce the average size of farm, while the passage of much of the non-irrigable land into private ownership has made it possible for stock farms, stock ranches and dry farms to increase in size. The acreage of harvested crops increased each census period from 1879 to 1929 and then decreased materially in 1934, due to the severe drought of that year. The total acreage of crop land (crop land harvested, crop failure and crop land idle or fallow) was substantially the same in 1934 as in 1929. Throughout the 55-year period the feed crops strongly predominated, making up 77 per cent of the acreage of crops harvested in 1929 and 74 per cent in 1934.
LAND: CLASSIFICATION OF TOTAL AREA, WYOMING, BY CENSUS YEARS, 1879-1934

ACRES (MILLIONS)

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<tr>
<td>1929</td>
<td></td>
</tr>
<tr>
<td>1934</td>
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</tr>
</tbody>
</table>

Legend:
- Land not in farms
- Unimproved land in farms
- Other improved land in farms
- Crop land harvested

FIGURE 2
Land Classification of total area, Wyoming by Census years, 1879-1934.
The distribution of the population of Wyoming as of 1930 is shown by figure 3. The State, it will be seen, is very sparsely settled. That year the average number of persons per square mile was 2.4 for the State, excluding the Yellowstone National Park.
The number of persons per square mile in the several counties varied from .7 in Teton County to 10 in Laramie County. Cheyenne, the Capital of the State, had a population of 17,361 in 1930. Casper, the next largest city, had a population of 16,619 that year. No other city in 1930 had a population of 9,000. Thus, it is seen, there is no sufficient concentration of population in any given area materially to modify or mould the local type or types of farming carried on.

The population of Wyoming has increased steadily since the completion of the Union Pacific Railroad in 1869. The United States Census credits the State with a population of 9,118 in 1870. Material gains in population followed each decade, reaching 225,365 in 1930. That year the workers 10 years old and over gainfully employed were distributed among the major industries of the State as follows: Agriculture absorbed 33.3 per cent; manufacturing and the mechanical industries, 16.4; transportation and communication, 10.6; trades, 8.4; domestic and personal service, 8.0; professional service, 7.0; extracting minerals, 6.8; clerical occupations, 4.4; public service (not elsewhere classified), 4.3; and forestry and fishing, 0.9 per cent.
The type or types-of-farming to be found in fairly well developed areas are generally the result of the influences of two groups of forces. One group is physical and biological in character and includes such factors as surface features, elevation, latitude, climate, soil, crop adaptation, and animal and crop pests and diseases. The other group is economic in nature. It includes such items as distance to markets and shipping points, transportation facilities, demand for the products that can be produced, competition, cost of production, and prices which farmers pay and receive. Brief discussions of the influences of the more important of these factors follow that the reader may better understand the basis used in this study for differentiating the State into 17 type-of-farming areas.

**PHYSICAL FACTORS**

**Surface Features**

The surface features of Wyoming vary greatly in different parts of the State. They may be described broadly as consisting of level to undulating or rolling plains, alkaline depressions, valleys, basins, rough areas with deep canyons, foothills, and mountainous areas. The mountain ranges and peaks vary from low to lofty, and some of the basins are almost completely mountain-locked. Portions of the middle and southern Rocky Mountain systems are included, respectively, in the northwestern and south-central parts of the State. The combined mountainous areas occupy approximately one-fourth of the total land area.

The Continental Divide crosses the southwestern part of the Yellowstone National Park; enters Wyoming just west of the Yellowstone River; follows a general southeasterly direction along the crests of the Absaroka and Wind River ranges, reaching elevations of 12,000 to 13,000 feet; crosses the arid plains and depression of the Red Desert region at elevations around 7,000 feet; then rises to the summit of the Sierra Madre range; and crosses the southern boundary of the State a short distance east of its middle point. Thus, Wyoming forms a portion of the "roof" of the North American Continent, the runoff of the western side of the divide passing to the Pacific Ocean and the Gulf of Lower California while that of the eastern side eventually reaches the Gulf of Mexico.

The elevation above sea level within the borders of Wyoming ranges from 3125 feet where the Belle Fourche River crosses the State line into South Dakota to 13,785 feet at the summit of Gannett Peak in Fremont County, the average elevation of the State being approximately 6700 feet. Figure 4 shows the State divided
into seven elevation zones. The lower one contains all areas of less than 4000 feet elevation. The next four zones have vertical breadths of 1000 feet, the sixth zone ranges from 8000 to 10000 feet and the seventh contains all areas above 10000 feet. There are 30 or more peaks that rise above 12000 feet. Elevation and surface features are closely associated with climate and have a marked influence on the length of the growing season, temperature, the annual precipitation and the form in which it falls, i.e., as rain, snow, hail or sleet. These, in turn, largely determine the kind of crops that can be grown and the kind of farming that may be carried on.

The width of Wyoming from north to south is 4 degrees of latitude. The influence of this distance on temperature is approximately equal to 1000 feet in elevation. That is, the lower limit of the Hudsonian Zone in the Sierra Madre Mountains in the southern part of the State is about 1000 feet higher than in the Big Horn Mountains in the northern part. (Figure 4.)
Drainage Basins

The more important drainage basins of Wyoming are shown in figure 5. The surface runoff of basin number 3 reaches the Pacific Ocean via the Snake and Columbia rivers; that of basin 4 is carried to Great Salt Lake by Bear River; that of basins 5 and 6 reaches the Gulf of Lower California through Green River and its tributaries and the Colorado River; The Great Divide Basin, number 7, has no surface drainage outlet, the rainfall of this basin being very scant. The runoff of the other nine basins, (Nos. 1, 2, 8, 9, 10, 11, 12, 13 and 14) reaches the Gulf of Mexico via the Mississippi River and its tributaries. Area No. 12 is drained by two streams and their tributaries: The Cheyenne River and the Niobrara River.
Climate in Wyoming varies markedly with location. This is largely due to its close association with a land surface that ranges from level plains to rugged mountains and which has a variation in altitude of more than 10,000 feet. At one extreme are the high mountain ranges and peaks where snow storms and freezing weather may come any time during the summer and where the annual precipitation may reach 40 inches or more. At the other extreme are parts of the Big Horn Basin having an average frost-free period of 130 to 140 days and an average annual precipitation of less than 6 inches. Climate under such conditions is the dominant factor in the formation of soils and in determining the type or kind of farming that can be carried on most advantageously in the different localities of the State.
Precipitation.—Figure 6 shows the State divided into rainfall zones by isohyetal lines roughly drawn to indicate a variation of 5 inches in the mean annual precipitation within each of the rainfall zone areas. Because of the long distances between many of the weather stations, it has been necessary in the preparation of this figure to locate more or less arbitrarily the isohyetal lines in some localities. Variations in elevation were given due consideration in making the map. The respective rainfall zones, therefore, are to be considered only as close approximations.

Figure 6 shows three areas in the westcentral part of the State that receive a mean annual precipitation of less than 10 inches and three in the northern part that receive 20 inches or more. Very generally the zones having the highest precipitation coincide with the high mountain ranges. It was not considered practical to map the zones in 5-inch steps above twenty inches because of the lack of climatological data for the mountain areas. The precipitation of the eastern part of the State is typical of that of the northern portion of the Great Plains province.

Proceeding westwardly from the eastern border of the State, the mean annual precipitation gradually decreases until a point is reached where the influence of the mountains is encountered. From that point the rainfall generally increases until the crests of the mountain ranges are reached. The rainfall likewise increases on the western slope of the mountain ranges as the elevation increases. As the moisture laden atmosphere ascends the mountain slopes either from the east or from the west, the air is cooled and much of its moisture is condensed and falls as rain, snow, hail or sleet. Thus the air currents cross the mountain divides and descend into the valleys and basins depleted of much of their moisture. The Big Horn Basin, for example, is almost completely surrounded by mountain ranges and from whatever direction the wind may blow, the moisture content of the air is greatly reduced before it reaches the floor of the basin. This results in a rainfall so scant that all crops must be produced under irrigation. In this way the mountain ranges of the State have a marked influence on the precipitation received by the valleys and basins.

Table 5 presents additional precipitation data for 25 representative weather stations located in different parts of the State. The length of the weather record, the mean annual precipitation, the mean seasonal precipitation and the percentage that the seasonal is of the annual are given for each station. The table also presents the standard deviation for both the mean annual and the mean seasonal precipitation.

The use of the data presented in table 5 may be illustrated by a consideration of that given for Cheyenne and Laramie. The
### TABLE 5

Precipitation: Mean annual and mean seasonal at selected weather stations.

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*Seasonal precipitation is that falling from April to September inclusive.

†Standard deviation measures the extent to which annual and seasonal precipitation tend to deviate from the average. Standard deviation = \( \sqrt{\frac{\sum d^2}{N}} \)

‡Coefficient of variation measures the extent to which precipitation varies from year to year. Coefficient of variation = \( \frac{\text{Standard deviation} \times 100}{\text{Mean}} \)

Compiled from U.S. Weather Bureau Reports.

Records for these two stations cover a period of 61 years. The annual precipitation during that period averaged 14.2 inches at Cheyenne and 11.00 inches at Laramie, the standard deviation being 1.9 inches and 2.14 inches, respectively, for the two stations. That means that during approximately 68 per cent of the years of another 61-year period the annual precipitation is likely to fall
within a range of one standard deviation below and one standard deviation above the mean annual precipitation for each of the two stations, i.e., within a range of from 12.3 inches to 16.1 inches at Cheyenne and from 8.9 inches to 13.1 inches at Laramie. Since the range at Laramie is .4 of an inch wider than that at Cheyenne, the annual precipitation at Laramie may be said to be slightly more variable than that at Cheyenne. It also means that during approximately 95 per cent of the years of another 61-year period the annual precipitation is likely to fall within a range of two standard deviations below and two above the annual mean precipitation for each of the two stations, i.e, within a range of from 10.4 inches to 18.0 inches at Cheyenne and from 6.8 inches to 15.2 inches at Laramie.

The standard deviation also provides another means of comparing the variability of the annual precipitation at the several weather stations for which data are given in table 5. For instance, the annual precipitation at Pine Bluffs may be said to be more variable than that at Cody (1) since the weather records for these two stations are equal in length (23 years each) and (2) since the standard deviation for Pine Bluffs (3.7 inches) is larger than that of Cody (2.1 inches). Other stations having records of the same or approximately the same length may be roughly compared in like manner. Thus the standard deviation may be used as a means of judging the reliability of the mean annual precipitation when used as a basis for forecasting future annual rainfall and also in comparing the variability of the annual precipitation at the several weather stations represented in table 5.

The annual precipitation in different parts of the State varies greatly from year to year. Figure 7 has been designed to show such variations at 8 representative stations during a 28-year period. For example, the mean annual precipitation at Kirtley in Niobrara County during the 28 years was 16.54 inches. During that period the annual was above the mean 14 times and below it 14 times. The annual may be either above or below the mean for two or three years in succession. The most abnormal variations from the mean generally occur during the heavy rainfall years. At Kirtley in 1915 the annual was more than twice the mean for the 28-year period. The variations of the annual precipitation from the mean for any year at any of the 8 stations may be roughly read from the scale at the left of the figure.

The distribution of the annual precipitation from month to month during the year is a very important factor in Wyoming in the production of range forage and non-irrigated crops. This, in part, is shown by the 14 small bar charts superimposed on figure 6. In these small charts each of the 12 months is represented by a vertical bar, January being located at the left and December at the
FIGURE 7
Variation of the annual precipitation from the 28-year average at 8 weather observation stations, Wyoming, 1906-1933.
right. The mean monthly precipitation may be read in inches from the scale at the left of each of the small charts. These small charts show that in the eastern part of the State the most of the precipitation falls during the late spring and early summer. Table 5 shows that around 72 per cent falls between April and September inclusive, May, June and July being the high rainfall months at most of the stations. This distribution is known as the Great Plains type of rainfall. It is best adapted to the production of pasturage and the late maturing crops such as corn.

The annual precipitation is fairly well distributed throughout the 12 months of the year in the western part of the State, table 5 showing that around 54 per cent falls from April to September inclusive. Thus, it is seen, about one-half of the transition from the Great Plains type of rainfall to that of the Pacific Coast takes place between the eastern and western borders of the State. The chief characteristic of the Pacific type is its dry summer and wet winter seasons.

The monthly precipitation, like the annual, varies greatly from year to year. Wide departures each way from the normal are not exceptional. Another important characteristic of Wyoming climate is the marked tendency for the storms to be localized during the growing season. One locality may receive a violent downpour of rain and sometimes of hail while a few miles away no moisture at all may fall. These local storms during the summer are typical of both the eastern and western parts of the State. Occasionally they assume so-called "cloud burst" proportions.

Evaporation.—The ability of the atmosphere to absorb moisture from the surface of the ground over much of Wyoming during the growing season is relatively high. This is evident from the evaporation records kept at the field experiment stations located at Sheridan and Archer, Wyoming, during periods of 19 and 22 years respectively. The evaporation that occurred at Archer from April to September inclusive from a free-water surface during the 22-year period 1914-1935 averaged 37.12 inches and varied from a minimum of 30.36 inches in 1918 to a maximum of 43.95 inches in 1934. The minimum monthly evaporation for the 6-months period of the 22 years was 3.95 inches during April, 1933. The maximum during the same period was 9.51 inches during July, 1934. The record for Sheridan presents a very similar picture, the mean seasonal evaporation for the 19-year period being 34.86 inches.

The effectiveness of the annual precipitation for crop and range forage production is influenced considerably over most of the State by the evaporation of moisture from the surface of the ground. Fairly high day temperature during the summer months,
a high percentage of days of sunshine, a low relative humidity of the atmosphere, and frequent movement of the air are the chief contributing factors to a relatively high evaporation of soil moisture. Some moisture is occasionally lost, also, by surface run-off when heavy thunder showers occur during the summer.

**Length of Growing Season.**—The length of the growing season at any given point is largely determined by the elevation above sea level, latitude, and the topographical features of the land surface. In turn the length of the growing season, as indicated by the length of the frost-free period, in large measure controls the kind of crops that may be grown in any particular locality. The average length of the frost-free period in different parts of Wyoming varies from as low as 40 days in some of the high mountain valleys to as much as 135 to 140 days in localities more favorably situated. This has a marked effect on crop production. For example, wild grasses and to some extent tame grasses replace alfalfa as the hay crop in the high mountain valleys. Comparatively little fruit is produced on a commercial scale in Wyoming on account of the shortness of the growing season and other unfavorable conditions.

**Life Zones**

Wyoming presents a liberal variation in both plant and animal life. This is mainly due to a variation in altitude of approxi-

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mately 10,660 feet within its borders; to a range of 4 degrees in latitude; and to a wide variety of topographical features. Figure 8 presents the five life zones into which the surface of the State has been differentiated by the Bureau of Biological Survey, U. S. Department of Agriculture. From a comparison of figures 4 and 8 it will be seen that the Upper Sonoran Zone occupies the lower and warmer areas. As the elevation increases the other life zones occur, respectively, in the following order: Transition, Canadian, Hudsonian and Arctic-Alpine.

**Upper Sonoran.**—The Upper Sonoran is the zone of the broad-leaved cottonwood, juniper, saltbush and yucca. It covers most of the valleys and low plains and occupies approximately 30,000 square miles, nearly one-third of the State. It is by far the most important of the five zones for general crop production. This is due to its relatively low altitude, warmer climate, longer growing season, and to its extensive open and level to undulating areas of productive soil. Practically all of the irrigated areas where general farm crops are produced are confined to this zone. The nutritious grasses which grow within its borders, especially in the eastern part of the State, have made it a choice range for cattle. Considerable dry farming is carried on within this zone, especially in its eastern portions.

**Transition.**—The Transition Zone lies just above the Upper Sonoran. It is the zone of the narrow-leaved cottonwood and pure sagebrush and embraces the high plains, the basal slopes of the mountains and all except the highest of the foothills. It covers approximately 50,000 square miles, or a little more than half of the area of the entire State. Due to the extensive areas of grass land within this zone, it has been the chief support of the cattle and sheep industries in Wyoming. Large quantities of hay, consisting mostly of native and tame grasses, are produced under irrigation for carrying livestock through the winter. The limited amount of dry farming done in this zone is mostly confined to its northeastern portions. On the open plain where the change in altitude is gradual, the passage from the Upper Sonoran to the Transition Zone is frequently scarcely noticeable and the boundary lines in such localities must be more or less arbitrarily fixed.

**Canadian.**—The Canadian Zone is confined to the mountainous areas, the major portion of it being in the northwestern part of the State. It is the Boreal forest belt of spruce, fir, lodgepole pine and aspen. It occupies the high undulating plateaus, rolling hills, mountain slopes, divides of medium elevation, and open meadows and parks lying at elevations between the upper and lower borders, respectively, of the Transition and Hudsonian Zones. Much of the Canadian Zone is abundantly covered with
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forests and brush. Some areas have little or no value as grazing land because of the density of the forests. The annual precipitation of this zone is considerable when compared with that of the Transition. Much of it comes as violent showers during the summer and as deep snows during the winter. While the mountain meadows, parks and other open areas furnish excellent pasturage for cattle and sheep during the short grazing season, perhaps the chief value of this zone lies in the protection its plant cover renders to the watersheds of the State.

**Hudsonian.**—The Hudsonian Zone is the narrow belt of white-barked pine, dwarfed spruce and fir situated high on the mountains in the timberline region. It occupies but a very small portion of the area of the State. It may be seen from figure 8 that the Hudsonian Zone encircles the Alpine summits and crests of the highest ranges and peaks in rather narrow strips. It also caps all ranges and peaks having approximately timberline altitudes. The vertical breadth of these narrow strips vary from some 300 or 400 to about 1,100 feet. Practically an Arctic climate prevails within the Hudsonian Zone. During the winter it is buried under deep snow while in summer it is dotted here and there by immense snow drifts located in ravines and gulches which give them protection. The grazing season in this zone is very short.

**Arctic-Alpine.**—The Arctic-Alpine Zone occupies the treeless areas on mountain crests and peaks above timberline. The areas of this zone are widely separated by the divides, plateaus and valleys of the Canadian Zone. They are more closely separated, also, by the high divides occupied by the Hudsonian Zone. In addition to the Arctic-Alpine areas shown in figure 8, there are numerous other areas which are too small to be mapped. The rather luxuriant growth of Alpine grasses and sedges which occur where the soil is of sufficient depth for plant growth provides pasturage for mountain sheep and a few elk which are attracted to the high grassy slopes.

**Soils**

Wyoming presents a very wide range in the types of soil to be found in different parts of the State. This is largely due to variation in the parent rock from which the soils are derived; to variation in the climate, particularly in the annual precipitation; and to variation in age or maturity of the respective soils and in the manner of their formation. The more important parent rocks from which the soils have been formed are sandstones, conglomerates, limestones, shales, granites and, in the northwestern part of the State, igneous rocks. In some areas the parent rock has not been thoroughly decomposed or broken down and in many places it underlies a thin soil. Some of the thin soils lie on salty shales
and may become seeped and impregnated with alkaline salts in a short time after being brought under irrigation. In other areas the soil is deep, well-drained and productive when irrigated or when the annual precipitation is adequate for profitable crop production. Tracts of land varying in size from narrow strips and small patches to extensive areas occur here and there in different parts of the State that are too stony, gravelly, steep or thin to be of agricultural value except for grazing purposes.

The soils of a very large part of the State have the general characteristics common to the soils of the western part of the Great plains. In texture they vary from stone, gravel, or dune sand to stiff clay or gumbo. The principal soils are rather low in organic matter but well supplied with lime and potash. Their supply of phosphorus and nitrogen is only fair. Owing to their scant organic content, they are usually light in color, a light brown predominating. The surface mulch is much grayer than the top soil. For practical purposes the soils of the State may be classified roughly into the following eight groups:

Mountain Soils.—The mountain soils occupy approximately 13,258,000 acres or about 22 per cent of the total land area of the State exclusive of the Yellowstone National Park. This group includes all areas within the national forests, all wooded foothill land and all isolated rough areas covered with mountain brush and sub-alpine vegetation. It may be divided into two sub-groups, namely, the timbered soils and the grass land soils. The timbered soils are generally grayish brown loams or sandy loams which are more or less stony and shallow and which occupy the more rolling areas. The grass land soils occupy the valleys, basins and the smoother, undulating ridges. They are darker in color and less stony than the timbered soils. Both sub-groups are neutral to acid in reaction. While an annual precipitation of 15 to 25 inches favors vegetative growth, elevations ranging from 8,000 to 12,000 feet entail a short growing season and frequent frosts. Consequently the summer grazing of sheep and cattle comprise the chief agricultural use of this group of soils, the mountain valleys being generally well supplied with springs, streams and lakes. Its principal non-agricultural uses are hunting, fishing, recreation and the production of timber.

Brown Bench and Bottom Soils.—This group occupies the bottom lands along the streams, the more level terraces, the alluvial bench lands and the fans at the base of mountains, or a total of about 10,827,000 acres. The bottom lands are subject to occasional floods and high water table. The soils are mixed sandy to clayey in character with gravelly or sandy subsoils. The horizons

*Contributed by T. J. Dunnewald, Department of Agronomy, University of Wyoming.
soil layers) sometimes are not well defined. The level benches and terraces have a relatively sandy, brown surface and a compact chocolate brown loam to clay loam subsoil. A horizon of lime accumulation of varying thickness generally occurs at 8 to 24 inches below the surface. The beds of gravel and sand which often occur at depths of 30 to 50 inches assure good drainage on the benches and terraces.

These soils are the backbone of the agriculture of the State, about 1 1/4 million acres are irrigated and most of the ranch homes and farm communities are located upon them. Further extension of the irrigation of this group of soils depends upon future development of storage water. The bench soils produce alfalfa, sugar beets, potatoes, beans and other cash crops while the bottom lands produce hay and grain and provide winter pasture for the sheep and cattle industries.

Undulating Loams and Sandy Loams.—This group occupies about 6,417,000 acres and includes mostly residual soils developed upon sandstones, conglomerates, and sandy shales and sandstones. The soils are generally of good texture and productive under favorable climatic conditions. Much of the land occupied by this group of soils has been classified as second and third-grade dry farming land, a high proportion of it still being used for grazing exclusively. About one million acres have been dry-farmed with varying degrees of success. In some localities the so-called marginal land problems have developed. Favorable small areas where subsoil water or surface runoff accumulate without producing poor drainage can be dry farmed with more security. In some localities where the surface soil is sandy, it has become necessary to "strip" farm in order to prevent the blowing of the soil. A fairly stable dry farming community has been developed on these soils in the southeastern part of the State.

Shallow, Stony Loams.—This group covers some 24,332,000 acres and includes the more rolling and shallow plains and valley lands which are best adapted to grazing because of their uneven surface and shallow characteristics. Short grass and sage are the chief types of vegetation. The character, value and carrying capacity of the vegetation vary greatly from year to year as the annual precipitation and its distribution vary. During periods of reduced rainfall and snowfall, the shallow stony loam soils tend to be overgrazed while under favorable climatic conditions a recovery in the carrying capacity is quite evident.

Pierre Alkali Clays and Loams.—All of the larger areas of heavy, alkaline soils developed upon marine shales or produced by the accumulation of salts from these shales and all lands bearing
alkaline types of vegetation such as greasewood, shadscale, salt bush, and salt grasses are placed in this group. It includes about 4,948,000 acres. These soils often produce a good grade of pasture, especially during short periods of favorable moisture supply in the spring. Later in the season they may dry up and produce very little feed for livestock until the next favorable moisture period arrives. At present the use of these soils is restricted to grazing. Isolated areas might be reclaimed but the excessive expense entailed makes the undertaking impracticable.

**Red Soils.**—The larger areas of red soils or soils with red subsoils have been developed upon red sandstones or limestones or upon alluvial deposits derived from these rocks. There are two large areas of red soils, one bordering the Black Hills and the other lying on the west side of the Laramie Mountains. Smaller areas occur in the Big Horn Basin bordering the Wind River and Big Horn Mountain ranges. These soils cover some 524,000 acres. They have a high reputation for productiveness. They are partly irrigated and partly dry farmed, but a very large proportion cannot be cultivated because of unfavorable topography or scant rainfall or lack of irrigation water.

**Dune-sand.**—The sandhills of the State contain about 95,000 acres and are composed almost entirely of dune sand. The vegetation of the sand dune areas consists mostly of nutritious bunch grass, sage, and greasewood. Some attempts at farming and irrigation in the sand dune areas have been made. However, they are best adapted in general for grazing owing to the danger of soil drifting when cultivated.

**Gray-Brown Acid Soils.**—The soils of this group are confined to the northwestern corner of the State and have been developed upon rocks and materials of volcanic origin. They cover about 127,000 acres. Like the mountain soils, this group occupies areas of timbered lands having stony gray soils, open grass and brushy plains, and valleys having darker brown soils. Most of the soils of this group are distinctly acid and their use for agricultural purposes is reduced to a minimum.

**Land Classification**

The type or types of farming and ranching to be found in any given area depends, in part at least, on the adaptability of the land in said area to the various agricultural uses to which it may be put. A classification of Wyoming’s total land area (exclusive of the national forests and parks) as to its fitness for different agricultural purposes is presented, by counties, in table 6. The data in this table have been compiled from the report of a land
### TABLE 6
Classification of Wyoming's land area.

<table>
<thead>
<tr>
<th>Area and county</th>
<th>Area classified</th>
<th>Area irrigated</th>
<th>Dry-farming land</th>
<th>Grazing land</th>
<th>National forests and parks</th>
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*Includes considerable land within irrigation projects which may not be irrigated.

**Includes all land in northeastern Wyoming mapped by the Geological Survey as "Farming Grazing Land" and also the land in western Wyoming mapped as "Dry Farming Land."

†Includes the land in northeastern Wyoming mapped as "Grazing Forage Land."

‡Includes 21,720 acres in the Pathfinder Reservoir, about 95,000 acres of dune-sand hills located mostly in Carbon, Goshen and Sweetwater counties and 1,060,000 acres in Western Wyoming mapped as "Waste Land."

§Includes the Grand Teton National Park (96,000 acres) and 1,588,000 acres of National Forest land. The Yellowstone National Park is not included.

¶The U.S. Census of Agriculture gives 60,328,000 as the acreage of the same area (see table 4.)

Compiled from reports of the U.S. Geological Survey, Department of the Interior.
classification study made by the U. S. Geological Survey, Department of the Interior. In that study approximately 60,293,000 acres were mapped. The principal factors considered in classifying the land were: Surface features, texture and depth of soil, precipitation, crop yields, and native plant cover where the land had not been farmed. Distance to shipping points and lack of transportation were disregarded in grading the land. Experience in the use of land since the land classification study was completed in the eastern part of the State has shown quite clearly that practically all of the land classified as third grade dry farming land and much of that designated as second grade land should have been classified as grazing land.

The geographical distribution of the different classes of land presented in table 6 is shown in figure 9. In many instances there is a gradual blending or shading from one class of land into another and in such cases it has been necessary to locate more or less arbitrarily the boundary lines. It should be further understood that within the borders of any class of land there may be areas of other classes which are too small to be shown on a map as small as figure 9. When the soil survey of the State which is now underway is completed, it will give more detailed and accurate information for land classification purposes.

*Irrigated Land.*—The acreage given in table 6 as irrigated land (1,657,000 acres) includes all land to which water was applied when the land classification study was made; land watered by natural sub-irrigation; and considerable undeveloped land lying within irrigation projects to which water had not been applied. While figure 9 shows the distribution of the more important bodies of irrigated land, there are numerous relatively small irrigated areas scattered about the State which cannot be shown on so small a map. The area actually irrigated in 1929 as given by the U. S. Census of Agriculture, 1930, is 1,236,155 acres.

In that part of the State lying east of the Yellowstone National Park and the Continental Divide, the supply of water is adequate for but a relatively small proportion of the extensive areas of land that are well suited to the production of crops and pastureage under irrigation. Since the water of most streams is quite generally fully utilized during the irrigating season, further expansion of the irrigated area will largely depend on an increase in the reservoir facilities for storing the water that now passes down the streams unused. In fact, the agriculture of many of the irrigation projects, especially that of the smaller ones, would be made far more stable by materially increasing their water storage facilities without increasing the area irrigated. In that part of the State lying west of the Continental Divide much surplus water flows out...
of the State unused and it is estimated that approximately one million acres can be brought under irrigation by direct diversion of water from the streams.

Dry-Farming Land.—The lands of the State considered more or less suitable for crop production without irrigation have been graded on the basis of their productivity into first, second and third-grade dry-farming land.

The first-grade land, embracing 55,000 acres, lies in a single body in the southeastern part of the State. It all has a smooth to gently rolling surface, a productive soil of good depth and texture, and receives a mean annual precipitation of about 17 inches.

The 1,678,000 acres of second-grade land is distributed over the eastern and northeastern parts of the State. While the relief features of this grade of land are very similar to those of the first-grade, it has a lower crop yielding capacity. This may be due to a lower mean annual precipitation, to coarser or finer soil texture, to a lack of soil depth, or to a higher elevation and shorter growing season. While practically the same crops may be produced on the first and second-grade land, the latter grade is used more extensively for grazing and forage than for crop production.
The third-grade land comprises 4,126,000 acres and is more widely distributed over the eastern and northeastern parts of the State than the second-grade. It includes areas where either the soil, climate or surface features are less favorable for crop production than obtain in connection with the second-grade land. Trid-grade land has been used far more extensively for and is very generally much better adapted to grazing than for crop production.

**Grazing Land.**—The lands of the State that have been classified as best adapted for grazing purposes by the Geological Survey of the Department of the Interior included approximately 43,657,000 acres, i.e., the total amount of grazing land as given in table 6 less the area in the Pathfinder reservoir. This does not include the national forests which are largely used for grazing.

A considerable portion of the areas classified as grazing land and mapped in figure 9 would be productive crop land except for one or more of the following unfavorable factors: Rough or stony
surface features, coarse or tight soil texture, alkalinity of the soil, shortness of the growing season, inadequate mean annual precipitation or lack of irrigation water.

A large proportion of the grazing lands situated in the western two-thirds of the State exclusive of the national forests is owned by the federal government. An attempt to stabilize the livestock industry which, is dependent largely on the use of the public domain, and to prevent soil deterioration and overgrazing, the Federal Grazing Administration has organized five grazing districts within Wyoming under the Taylor Grazing Act as amended June 26, 1936. Figure 10 presents the boundaries of the five districts and also the boundaries of the national forests, the national parks and the Resettlement acquisition areas lying within the State as of June, 1937. Within these five districts there is a marked concentration of the federally owned grazing lands.

National Forests and National Parks.—Excluding the Yellowstone National Park, the national forests and national parks of Wyoming contain approximately 9,098,000 acres, a trifle over 15 per cent of the total area of the State. In general they occupy the rough and mountainous areas having relatively high altitudes. The national forests are useful to the State chiefly in four ways: They tend to stabilize the supply of water for irrigation by protecting the watersheds; they are one of the most important potential sources of our future timber supply; they furnish pasture for thousands of head of cattle, sheep and wild game during the grazing season; and they are useful for recreational purposes. The grazing of livestock is done under a system of permits issued by the Forest Service. Figures 9 and 10 show the location and extent of the lands lying within the boundaries of the national forests.

Not all of the land included within the borders of the several national forests is owned by the federal government, part of it being State land and part privately owned. The amount of such land in some of the national forests is relatively small while in others it is extensive. For example, when the Laramie Peak Extension to the Medicine Bow National Forest was recently established, approximately 60 per cent of the land was held in private ownership, either as patented land or land on which homestead filings had been placed; 10 per cent was State land; and 30 per cent was actually in the public domain.

BIOLOGICAL FACTORS

The biological factors, as contrasted with the physical, have played a minor role in the development of Wyoming agriculture. While not of sufficient importance to exercise major influences in the development of types-of-farming within the State, they have,
nevertheless, given rise to a series of burdens that must be borne by the producers of crops and livestock.

The more important of the biological factors which have been and are now affecting the production of crops and livestock in Wyoming naturally fall into four general groups: namely, (1) animal and plant diseases, (2) insects, rodents, and predatory animals, (3) weeds and (4) plant adaptation.

Animal Diseases

Of the animal diseases with which the livestock producers of the State must cope, the following may be considered among the more important: Bang's disease (infectious abortion); blackleg, a rapidly developing fatal disease in young cattle that is handled by preventative measures; hemorrhagic septicemia, a fatal infectious disease in various species of domestic animals and in some wild life; calf diphtheria, an infectious disease in calves and in some instances in cattle as old as two years; and encephalomyelitis (brain fever or meningitis) of the horse.

Plant Diseases

Bacterial wilt of irrigated alfalfa, Fusarium wilt of potatoes, bacterial blight of beans and potato psyllid yellows are among the more outstanding plant diseases of the State. Dr. G. H. Starr, Assistant Agronomist in Plant Pathology, Wyoming Experiment Station, has briefly summarized the influence of these diseases as follows:

"Bacterial wilt of alfalfa grown under irrigation has shortened the profitable life of this crop in Wyoming to about 5 or 6 years, making shorter rotations necessary in order to get the maximum production of hay. Before the appearance of this disease, it was quite common for alfalfa to occupy the land in livestock sections of the State for a dozen or more years. Wilt has not been found in alfalfa growing under dry land conditions in Wyoming.

"Fusarium wilt of potatoes has been quite severe in certain sections of Wyoming during the past five years, 1932-1936. This is especially true in the dry-farming section south of Torrington in Goshen County, where the production of certified seed potatoes has been practically discontinued on account of this disease. This area, however, contains a relatively small number of certified seed potato growers.

"The occurrence of bacterial blight of beans grown under irrigation has caused many bean growers to adhere to shorter crop rotations than were formerly used. However, this disease has not spread over the entire bean growing section of the State and a number of growers, especially in the Shell Creek district of Big Horn County, still grow beans continuously on the same land,
some of them for as much as 12 to 15 years. As might be expected, blight has made its appearance in that district and beans are likely to take their place in somewhat flexible crop rotations in the near future.

"The potato psyllid has been very prevalent during the past four or five years and has reduced the potato yield materially. In order to control this pest it has become necessary for growers to apply from one to three applications of lime-sulphur spray both in the dry-land and irrigated potato sections. The cost of spraying, together with that of the high priced sprayer, increases considerably the cost of raising potatoes."

**Insect Pests**

Grasshoppers, Mormon crickets, blowflies and potato psyllids are rated among the most damaging insect pests to crop and livestock production in Wyoming. Heavy infestations of grasshoppers and crickets occur occasionally in different parts of the State. The blowfly, by laying its eggs under the wool in the flesh wounds of sheep, causes some loss to wool growers. The damaging effect of the potato psyllid is discussed above under plant diseases.

**Rodents and Predatory Animals**

Ground squirrels, prairie dogs and jack rabbits are the principal offenders among the rodents of the State. Although efforts are constantly being made to hold these three pests in check, they take a heavy toll year after year from field crops and grazing forage.

The coyotes, wolves, wild cats, mountain lions, and bears are the chief killers among the predatory animals. They prey upon the livestock running on the national forests, especially on lambs and calves and also on grown sheep.

**Weeds**

The weeds of Wyoming may be grouped into three classes: namely, (1) the annuals which live but one year, (2) the biennials which produce seed the second year and then die, and (3) the perennials which live for several years, most of which reproduce both by seed and by underground rootstalks. Some of them may spread by means of the rootstalks without producing seed. This discussion will be confined to the perennial weeds since they present the more serious problems.

The perennial weeds of the State may be placed in two groups. The members of one class have underground rootstalks and infest irrigated crop and pasture land, ditch banks, and moist non-irrigated land. Of this type the wild morning glory or bindweed (Convolvulus arvensis), Canada thistle (Cirsium arvense),
Russian knapweed (Centaurea picris), white top (Lepidium draba), poverty weed (Iva axillaris) and quack grass (Agropyron repens) are the more important species. The weed problem became so serious that in 1935 the Wyoming Legislature passed an act authorizing the formation of weed control and eradication districts under which the State, the county and the owner of the land each pay one-third of the expense of operating under the law. Four counties formed and operated weed districts in 1936. Methods of controlling and eradicating weeds may be found in Wyoming Agricultural Extension Service Circular No. 33, "Wyoming Weeds and their Control."

The other type of perennial weeds consist of such poisonous plants as the lupines (Lupinus sp.), death camas (Zagadenus sp.), loco weeds (Astragalus sp.), woody asters (Xylorhiza sp.) and the larkspurs (Delphinium sp.). These poisonous plants are quite widely distributed over the range lands of the State, the infestation varying from little or none in some localities to quite heavy in other places. Some of these weeds are poisonous both to sheep and to cattle, others are poisonous to cattle only, while still others are poisonous to sheep and not cattle.

The greatest losses from poisoning generally occur during the spring and fall and where good feed is scarce such as along the much used trails over which several bands of sheep or several herds of cattle must pass when being taken to and from the national forests. Hunger from fatigue and the scarcity of nutritious feed cause the animals to eat the poisonous plants. The element selenium has received much attention during recent years as the source of poison in the poisonous plants.¹

Plant Adaptation

Plant adaptation plays an important part in maintaining the livestock industry in Wyoming. This point may be illustrated by a few examples:

The vegetation of the semi-arid Great Plains portion of the State consists, for the most part, of shallow-rooted, low-growing nutritious grasses which are well adapted to scant rainfall conditions. These grasses mature during midsummer, cure standing, and may be grazed any time during the year except when a rather deep snow mantle covers the surface of the ground.

The wild hay grasses (mostly sedges and rushes) are well adapted to the wet lands along the streams at both high and relatively low altitudes. In 1929, they made up approximately 29 per cent of the total harvested acreage of hay.

ECONOMIC FACTORS

General Principles

Economic factors have played an important role in developing the types of farming to be found in different parts of Wyoming. The State is yet young agriculturally and up to the present time it may be said that, by and large, farmers have striven for maximum net returns from the use of their labor and their investments in real estate, equipment and livestock. This involves the development of cultural and managerial practices and the selection and combination of crop and livestock enterprises that appear most likely to give the greatest net return. The attainment of this objective would be relatively simple if price-relationships and climatic conditions remained constant year after year. But with these factors changing more or less from week to week, from month to month, and from year to year, it becomes a most difficult problem.

Distance to Market

Wyoming is sparsely settled and her surplus products, in general, must be shipped long distances in order to reach the markets of the more densely populated areas. In part this handicap has been met (1) by converting the feeds and forage produced within the State into fat or feeder lambs and cattle which have a high value per unit of weight. Sugar beets, likewise, are converted into sugar; (2) by producing such crops as wheat and dry beans which are fairly well concentrated and which can be shipped long distances without being damaged; and (3) by producing alfalfa seed which usually has a high value per unit of weight.

Transportation

The construction and operation of the railroads and highways of Wyoming have had a material influence in its agricultural development. Several irrigated districts now produce cash crops for distant markets. Without railroad or highway transportation facilities, these districts would be largely restricted to the production of feed crops for livestock. Fat and feeder sheep and cattle are now usually transported to market by truck and rail whereas in the early days they had to be trailed long distances. The lack of transportation facilities, on the other hand, contributed materially to the development of a cheese making dairy type of farming in Star Valley in the western part of the State.

Improved Implements and Machinery

The development and introduction into the wheat belt of the Great Plains of such labor saving implements and machinery as the combined harvester-thresher, tractor, one-way disk plow, and the duck-foot cultivator (1) greatly increased the acreage that
one man can farm and (2) materially reduced the cost of crop production, especially the cost of producing wheat. These economic improvements had much to do with pushing the western fringe of dry farming into Wyoming where shifts were made in many localities from grazing to crop farming.

MAJOR AGRICULTURAL PROBLEMS

Wyoming, like the other states of the western Great Plains, is confronted with the necessity of making certain agricultural adjustments if her resources are to be conserved and used to the best advantage. Among the problems with which the State is confronted, the following stand out as of prime importance:

THE ADJUSTMENT OF NUMBERS OF RANGE LIVESTOCK CARRIED TO THE FEED RESOURCES OF THE RESPECTIVE INDIVIDUAL RANCH UNITS

The objective of this adjustment should be to obtain, over a period of years, the maximum gain in the weight of salable live-
stock and, at the same time, to maintain or improve the vegetative cover and carrying capacity of the grazing lands of the individual ranches. It is obvious that this adjustment in the numbers of livestock may be either upward or downward, depending on whether the individual ranch in question has been over- or understocked. It is probably safe to say that in many cases the adjustment should be downward and that it is often possible to produce more pounds of livestock by carrying a smaller number of animals.

Producing greater gains in weight with fewer animals is especially possible where there has been continuous overstocking. In attacking the problem it should be understood that the feed consumed by livestock is used (1) for maintenance or upkeep of the animal body and (2) for making growth or gains in weight. It should be further understood that the maintenance of the body is taken care of first and that the feed consumed in addition to that required for maintenance is then used in making increases in weight. Cows and three-year old steers when on full rations use approximately 73 per cent of the feed they consume for maintenance, two-year old heifers and steers around 70 per cent and yearlings about 63 per cent.¹ Thus, it is seen, that by overstocking to the extent of about 30 per cent practically no feed is left for making increases in weight, for the maintenance of the body is taken care of first and the overgrazing would cause a material decrease in the total amount of range forage produced.

The principle involved in adjusting livestock numbers to feed resources may be further illustrated by comparing the grazing of two fenced pastures of equal size and of equal carrying capacity. In one pasture 200 yearling steers are grazed for a year and in the other 300. The feed produced is sufficient to enable the 200 steers to make normal gains in weight without impairing the carrying capacity of the pasture. Let this be considered the maximum number of steers that can be carried without injuring the vegetative cover of the pasture. Since yearling steers on full feed use about two-thirds of the feed they consume for maintenance and the other third for making growth or increase in weight, it is obvious that the 300 steers will require approximately as much feed for maintenance as is consumed by the 200 head for both maintenance and growth. It follows, therefore, that the 300 steers would be on a very scant ration with little or no feed left for making increases in weight; that the hunger of the steers would not be satisfied; and that the pasture would be so seriously overgrazed as to damage the vegetative cover and subject the surface soil to wind erosion and also to water erosion when violent showers occur. In this case the problem is to reduce the number of steers

to the point where the pasture will produce sufficient vegetation (1) to give the steers enough feed for both maintenance and growth, (2) to maintain or increase its carrying capacity, and (3) to protect the surface soil from erosion.

The shortage of grazing forage and supplementary feed during seasons of drought must be duly considered in the adjustment of livestock numbers to feed resources if the maximum gains in the weight of the livestock carried over a number of years are to be obtained and if the carrying capacity of the grazing land is to be maintained. This may be done in large part by holding the number of livestock somewhat below the number that can be properly handled during years of average feed production; by carrying over into seasons of drought the surplus supplementary feed produced during average and good years; by the construction of small storage reservoirs and the drilling of wells to provide water so that the range lands may be grazed more evenly without the livestock traveling long distances for water; by a much wider use of deferred and rotational grazing; and by maintaining, within the limits of diminishing returns, high percentage calf and lamb crops.

In the case of range cattle production in the State, the writers are of the opinion that the ranch business as a rule will be materially stabilized by the selling of 1- and 2-year old steers instead of selling calves. Under drouthy conditions such as prevailed during 1934 and 1936, the ranch operators who produce steers can begin selling them as soon as it is apparent there will be a shortage of feed. If that does not relieve the situation sufficiently, the calves also can be sold in the fall after being weaned, leaving nothing to be carried through the winter except the breeding herd of cows. The sellers of calves, on the other hand, cannot materially reduce the number of cattle to be wintered without seriously reducing the size of the breeding herd. When a drouthy season is followed by a high producing year, the ranch operators who have disposed of their steers and calves will be able to build up a reserve of range and supplementary feed. It will generally be possible also for them to sell the surplus range forage or to utilize it by buying and bringing in either cattle or sheep.

LAND USE ADJUSTMENT PROBLEMS

The chief land use adjustment problems of Wyoming pertain very largely to the eastern part of the State where dry farming is practiced and where a great deal of land has been put under cultivation which experience has shown is sub-marginal to cash-crop farming, i.e., land that is best adapted to grazing purposes and to the production of feed crops to supplement the range forage.
The eastern portion of the State was first occupied by livestock ranchmen who obtained control of much of the desirable land along the stream valleys where water is available and also of much of the land that is best adapted to dry farming. The general influx of homesteaders occurred at a much later date. They filed on the land that was left in the public domain, many of them settling on inferior land that is unsuited to small scale and cash-crop farming. Moreover the farm units obtained under the 160- and 320-acre homestead acts are too small to be operated economically under the types of farming now prevailing. They are also entirely too small to be converted into stock farms and ranches which can be operated economically and which will return sufficient income to maintain satisfactory standards of family living. The problem of size of farm is closely related to the problem of shifting land to the uses for which it is best adapted. The consolidation of farms to form economical units for stock farms and ranches will likewise involve the problem of taking care of the settlers replaced. Furthermore the fact that low incomes are frequently due to inferior managerial ability of farm operators is not to be overlooked in making adjustments in the use of land, in the size of farms and in rehabilitating settlers.

SOIL CONSERVATION

Crop production is hazardous in eastern Wyoming where dry farming is practiced, chiefly because the annual precipitation is scant and variable; because the monthly distribution of the annual rainfall is quite irregular; and because most of the soils of that part of the State, especially the sandy soils, are subject to blowing when exposed to the wind after they have been dry farmed for a few years. The soils are subject also to water erosion during heavy local showers when unprotected by a vegetative cover. Successful dry farming under the conditions described above depends very largely on retaining much of the rainfall on the land where it falls and also in preventing both wind and water erosion. The accomplishment of these objectives call for the timely application of the most efficient methods.

A vegetative cover and the residue of crops and weeds left on the surface of the ground tend to hold the moisture where it falls and also materially to lessen both wind and water erosion. Strip farming has proven an effective means of decreasing the blowing of the soil and of retaining moisture where it falls. Contour listing land during the fall that is to be planted to row crops in the spring has proven to be an effective means of preventing surface run-off and the blowing and drifting of the soil both under irriga-

\(^3\)Bul. No. 12, Conservation Department of the University of Nebraska, "Relative Efficiency of Roots and Tops of Plants in Protecting the Soil from Erosion."
tion and dry farming conditions. Alfalfa is the leading soil building and conserving crop on the dry farmed lands as well as under irrigation. On the dry lands it is grown most frequently on the bottom lands of the stream valleys where the soil is generally more moist than that of the uplands. It is sometimes grown in rows about 42 inches apart, cultivated and used both for seed and for hay. The above mentioned practices are among the more important means in use for conserving the soil.

STABILIZING THE SUPPLY OF IRRIGATION WATER

While the larger of Wyoming’s irrigated districts have facilities for storing irrigation water, most of the smaller districts are irrigated by diverting water direct from the streams during the irrigating season. Variations in the annual precipitation cause corresponding variations in the seasonal flow of the streams. Thus there are years when the supply of irrigation water is plentiful and other years when there is a dire shortage in some districts. For example, the United States Census of Agriculture shows the harvested acreage of all crops in Uinta County in 1934 (a severe drouth year) was but 34,640 acres as compared with 52,840 acres in 1929, a fairly normal rainfall year. The handicap of fluctuations in crop production due to variations in the flow of the streams from which the irrigation water is diverted may be overcome in a large measure by the construction of reservoirs for impounding the water that flows down the streams unused during the non-irrigating season.

DRAINAGE OF IRRIGATED LANDS

It has been said that “all irrigated districts sooner or later have their drainage problems.” Wyoming has been no exception to this general statement. The 1930 United States Census of Agriculture gives 1,236,155 acres as the total irrigated area in Wyoming. Of the total irrigated area crops were harvested from 978,106 acres in 1929, the remaining 258,049 acres being used chiefly for pasture. Much of the irrigated land from which crops were not harvested has become seeped and more or less impregnated with alkali. If adequate drainage is provided in time, it prevents the land from becoming seeped. Drainage also prevents the soil from becoming impregnated with alkali salts. To reclaim land that has become sufficiently alkaline as to be detrimental to crop production, is a difficult and expensive undertaking. An impressive lesson that practically all of the older irrigation districts teach is that the need for drainage should be anticipated and the system constructed before the alkali salts have accumulated in detrimental quantities.
BIOLOGICAL PEST CONTROL

The farmers and livestock producers of Wyoming, as in the other neighboring states, have the alternative either of keeping up a continuous warfare against such pests as noxious weeds, predatory animals, rodents, insects, and plant and animal diseases, or of bearing the heavy losses caused annually by these pests. The perennial weeds are especially burdensome in the irrigated districts; the predatory animals prey upon the livestock of the State year after year, especially on the lamb crop; and plant diseases, rodents, and insects seriously damage crops and range forage, particularly during seasons of drouth. The effective handling of these biological pests very generally calls for cooperative concerted action by neighborhoods, districts and counties. (See the discussion of these pests under the treatment of “Biological Factors” above.)
GEOGRAPHY OF WYOMING AGRICULTURE

Wyoming's land area, as mapped by the United States Geological Survey in classifying the lands of the State, contains approximately 60,293,000 acres exclusive of the Yellowstone National Park. (Table 6.) Of this area about 39 per cent was in farms in 1929. Of the land in farms that year, 88 per cent was classified as pasture land, 10 per cent as crop land, and 2 per cent as other land in farms. The chief uses made of the 36,768,000 acres not in farms are grazing and national forests, other uses being parks, mining, railroads, highways, residences, and business and industrial locations.

Within the borders of the State great differences occur in surface features, texture of soil, climate, supply of water for irrigation, and in transportation facilities. Variations in these factors roughly determine the way in which the lands of the State are used for agricultural purposes. The chief purpose of this chapter is to present the geographical distribution within the State of (1) the crop enterprises, (2) the livestock enterprises, and (3) the farms classified by type-of-farm.

DISTRIBUTION OF CROP ENTERPRISES

Agriculturally Wyoming is chiefly a range livestock producing State, cash crop production being of much less importance. Measured in terms of the average acreage harvested during the 5-year period, 1928-1932, the more important crops ranked as follows, the figures representing thousands of acres: All kinds of hay, 1056; all wheat, 309; corn for all purposes, 188; oats, 136; barley, 119; sugar beets, 45; dry beans, 30; rye, 29; potatoes, 26; flax, 16; alfalfa seed, 10; and red and alsike clover seed, 3. The hay crops compared on the basis of thousands of acres harvested in 1929, ranked as follows: Alfalfa, 394; native or wild grasses, 305; miscellaneous crops, 146; tame grasses and clovers, 114; small grains, 88; and sweetclover, 9.

Figure 12 presents the approximate distribution of Wyoming's total crop land area as of 1929 and figure 13 shows the acreage from which all crops were harvested that year. In these two figures each dot represents 1,000 acres. Figures 14 to 23 inclusive show approximately where the more important crops were harvested in 1929, each dot in these figures representing 200 acres. Figure 11, a map showing the location of the respective counties, the principal towns and cities, highways, and the railroads of the State, will be found helpful in studying the figures which follow.

Crop Land in Farms, 1929

The approximate location of the land used for producing crops in Wyoming is shown in figure 12, each dot representing
FIGURE 12
Crop land: Total acreage, 1929.

1,000 acres. As here used, crop land includes the acreage from which crops were harvested in 1929, the land on which crops failed, and the land that lay idle or was fallowed that year. The figure shows a very uneven distribution of the land used for crop production, especially in the western and southeastern parts of the State. The reasons for this will be better understood by comparing figure 12 with figures 4, 6, 9, and 37. The bulk of the western part of the State is either too mountainous or arid for crop production without irrigation. For these reasons the greatest concentration of dots on figure 12 occurs in the areas which are irrigated as shown by figure 37. In the eastern and northeastern parts of the State where more or less dry farming is carried on and where the rainfall is heavier and the surface not so broken, the crop land is more evenly distributed.

All Crops: Acreage Harvested, 1929

Figure 13 presents the approximate distribution of the total acreage from which crops were harvested in 1929, each dot representing 1,000 acres. This figure differs from figure 12 by the
amount of land on which crops failed that year (96,284 acres) and the land that lay idle or was fallowed (188,633 acres), a total of 284,917 acres. The difference occurs mostly in the eastern part of the State where dry farming is practiced. The annual precipitation was above the average in the eastern part of the State in 1929 which was a fairly good year for dry farming. Were the two figures based upon data for 1934, a year of extremely low rainfall, there would be a material difference between the two maps.

Corn for All Purposes

The acreage of corn harvested in Wyoming for all purposes in 1929 is presented in figure 14, each dot representing 200 acres instead of 1,000 acres as in figures 12 and 13. Practically all of the corn crop is grown in the eastern part of the State where dry-farming is practiced, where the altitude is relatively low, and where the average annual precipitation is generally 15 inches or more. (Compare figures 4, 6, 9, and 14.) Of the total acreage of corn harvested in 1929, approximately 92 per cent was dry-farmed and 8 per cent was irrigated. Measured by the compara-
tive acreages of the respective crops harvested that year, corn ranked considerably below alfalfa, wild grasses used for hay, and wheat, and materially above oats, barley, and all other crops. During the 10-year period 1926-1935, the estimated harvested acreage of corn varied from 131,000 acres in 1934 to 229,000 acres in 1935. The low acreage in 1934 was chiefly due to the severe drought of that year.

In figure 14 no dots are to be found in eight of the western counties of the State. That means either no corn or less than 100 acres were harvested in each of the eight counties in 1929, since less than 100 acres are not shown where each dot represents 200 acres. Likewise but a single dot occurs in each of three other counties and only three dots in each of two counties. In other words, corn is of very minor importance in the western two-thirds of the State. This, in turn, is largely due to one or more of the following factors: High elevation, cool nights, short growing season, and the competition of other feed crops that are better adapted to that part of the State.
A comparison of figures 14 and 15 shows a greater harvested acreage and a much wider distribution of all wheat (spring and winter) in Wyoming in 1929 than of corn. The greatest concentration of the wheat crop that year was in the southeastern part of the State where dry-farming is practiced. The concentration is especially noticeable in Platte, Goshen, and Laramie Counties. Since no dots are to be found in Sublette County in figure 15, less than 100 acres of wheat was harvested in that county in 1929. While some wheat was grown in all other counties that year, it is of little consequence as a crop in the western two-thirds of the State.

The acreage devoted to wheat in Wyoming is fairly well divided between spring and winter wheat, the estimated harvested acreage during the 10-year period 1926-1935 averaging 139,000 acres for spring wheat and 106,000 acres for winter wheat. The harvested acreage varies greatly from year to year, the range during this 10-year period being from 56,000 acres in 1934 to 209,000
acres in 1929 for spring wheat and from 48,000 acres in 1926 to 164,000 acres in 1931 for winter wheat. The variation is chiefly caused by lack of sufficient soil moisture properly to germinate and maintain fall-sown wheat, by winter killing, and by drought during the spring and early summer. When wheat winter-kills or when there is insufficient soil moisture to establish the crop in the fall, the land intended for winter wheat may lie idle, may be fallowed, or may be planted to corn, spring wheat, oats, barley or some other feed crop. About 10 per cent of the harvested acreage of the Wyoming wheat crop in 1929 was irrigated and 90 per cent was dry-farmed.

**Oats**

A comparison of figures 14 to 17 shows that oats have a more general distribution throughout Wyoming than either corn, wheat, or barley. As a rule this crop is quite well adapted to most of the dry-farming sections and also to the cool summer climate of practically all the high-altitude, irrigated valleys that are too cool for the successful production of corn. Oats do well where the days

![Oats: Acreage harvested for grain, both threshed and unthreshed, 1929.](image-url)
and nights are cool whereas corn requires a fairly long growing season and warm nights. Oats are very popular as a feed grain for work animals, dairy cows, and breeding ewes and are generally produced for feeding on the farm or ranch where grown, notwithstanding their average yield under irrigation is about 350 pounds per acre less than that of barley. While the price of oats is usually a little higher per pound than that of barley, the differential is generally not sufficient to enable oats to compete with barley as a cash crop. A portion of the oat crop is cut green for hay and about 10 per cent of the 1929 grain crop was fed unthreshed. In the irrigated districts oats are commonly used as a nurse crop for alfalfa and clover.

**Barley**

The distribution of barley in Wyoming is very similar to that of oats. (Compare figures 16 and 17.) Like oats, barley is chiefly grown for feeding on the farms and ranches where grown. In the cropping system barley competes directly with oats, the two crops being adapted to practically the same climatic and soil con-
While barley is not so popular a feed crop as oats, it yields about one-third more in pounds per acre and a higher percentage of the crop is used for finishing livestock for market. Measured by the acreage of wheat, corn, oats, and barley harvested in 1929, barley ranked fourth as a grain crop. The estimated harvested acreage of barley during the 10-year period 1926-1935 averaged about 90,000 acres per year and varied during that period from as low as 42,000 acres in 1926 to 137,000 acres in 1929. Owing to the severe drought of 1934 there were but 43,000 acres harvested that year. The Wyoming price of barley per pound during the 10-year period 1926-1935 averaged about 14 per cent under that of oats. The higher yield of barley per acre, however, enables it to compete with oats as a feed crop.

**Sugar Beets**

The production of sugar beets in Wyoming is restricted entirely to the irrigated districts. (Compare figures 9, 18, and 37, the latter showing the irrigated areas of the State.) This is due
to the scant rainfall in the dry-farming sections of the State. Sugar beets are a bulky heavy commodity and their production is further restricted by the distances from the farms to the beet dumps and from the dumps to the sugar factories. The profitability of producing sugar beets depends quite largely on the yield per acre that can be obtained. The most successful growers generally produce beets in a cropping system or crop rotation that contains either alfalfa or sweet clover as the soil-improving crop. The feeding of livestock, either lambs or cattle, for the slaughter market has a prominent place in the farm economy. While the cropping system is usually carried on with considerable variation from year to year, it may be illustrated by the following rotation: Barley (alfalfa seeded with it), one year; alfalfa, three years; barley or potatoes, one year; sugar beets, two years. Sugar beets are seldom grown on the same land more than two years in succession and frequently but one year. The principal feeds for the feeding operations are alfalfa hay, barley and sugar beet tops, pulp and syrup. The manure from the livestock is an essential factor in securing high sugar beet yields.

FIGURE 19
Dry beans: Acreage harvested, 1929.
Dry Beans

The dry bean crop of Wyoming is mostly produced in two districts, the north central and the southeastern parts of the State. In the former district practically the whole crop is grown under irrigation while in the latter 86 per cent of the harvested acreage was dry-farmed in 1929. Of the total acreage harvested within the State that year, 80 per cent was irrigated and 20 per cent dry farmed. The bean acreage fluctuates considerably from year to year. During the 10-year period 1926-1935, the estimated harvested acreage varied from 16,000 acres in 1926 to 39,000 acres in 1935, the average for the period being 28,000 acres. As an irrigated crop, dry beans may compete with sugar beets or with potatoes and under dry-farming conditions with corn, potatoes, or one of the small grain crops.

Potatoes

Potatoes, like dry beans, may be considered one of the minor crops of Wyoming. From 1926 to 1935 inclusive, the estimated harvested acreage averaged 24,000 acres and varied from 13,000
acres in 1926 to 33,000 acres in 1932. Approximately 20,000 acres were harvested in 1929 and of that amount 40 per cent was irrigated and 60 per cent dry-farmed. The principal potato-producing section is in the southeastern part of the State. (See figure 20.) Goshen county, in 1929, led in the acreage of potatoes harvested, both irrigated and dry-farmed. The production of certified dry-land seed potatoes has become a very important enterprise on many farms in southeastern Wyoming, especially in Laramie, Goshen, and Niobrara counties.

**Alfalfa**

Alfalfa occupies the largest acreage and is the most widely distributed of all the crops grown in Wyoming. (Figure 21.) A total of approximately 412,000 acres of this crop was harvested in 1929, 398,000 acres for hay and 14,000 acres for seed. Of the total hay crop, 74 per cent or 293,000 acres were irrigated and 27 per cent or 105,000 acres were dry-farmed. The yield of hay per acre that year was 1.65 tons with, and 1.17 tons without irriga-
tion. The more important seed-producing counties, named in the order of the acreage of seed harvested in 1929, were as follows: Niobrara, Campbell, Sheridan, Crook, Johnson, and Weston. The principal hay-producing counties that year, mentioned in the order of their harvested acreage, were Sheridan, Park, Johnson, Lincoln, Crook, Fremont, Converse, and Big Horn. The alfalfa hay crop of Wyoming is closely related to the livestock industry of the State, a very large percentage of the crop being fed on the farms where grown or on neighboring farms. A very small proportion of the crop is shipped out of the State.

**Wild Hay**

Figure 22 presents the distribution of the 321,000 acres of wild or native grass hay harvested in Wyoming in 1929. Of the total acreage harvested that year, two-thirds were irrigated and one-third dry-farmed. The greatest concentration of the acreage of wild hay occurs in the irrigated districts. (Compare figures
In the production of wild hay Albany county leads, the harvested acreage in 1929 being 81,000 acres. Sublette, Lincoln, Carbon, and Goshen counties then follow, being named in the order of their importance measured by the acreage harvested. The principal non-irrigated wild hay producing counties are situated in the eastern part of the State, the more important of which are Campbell, Niobrara, Crook, Goshen, and Platte. Much of the wild hay is produced under conditions which are unfavorable for alfalfa. That is the elevation may be too high, or the water table too near the surface, or the soil unsuitable for plowing.

All Hay Crops

Wyoming’s hay crops in 1929 constituted 51 per cent of the total harvested acreage of all crops. The distribution of the harvested acreage of all hay crops is shown in figure 23. The areas of greatest concentration occur in the irrigated districts. In round numbers there were 1,035,000 acres of hay harvested in Wyoming.
in 1929. Of the total hay acreage that year, there were 398,000 acres of alfalfa; 321,000 acres of wild or native grass hay; 259,000 acres of all tame grasses and clovers; 56,000 acres of small grain cut for hay; and about 1,000 acres of annual legumes. Seventy-one per cent of the total acreage of hay harvested was irrigated and 29 per cent was dry-farmed. The wild grasses generally predominate in the high mountain valleys where the elevation is too great for the successful production of alfalfa. The bulk of the irrigated hay is produced in the western two-thirds of the State and the non-irrigated hay in the eastern portion.

DISTRIBUTION OF LIVESTOCK ENTERPRISES

The livestock enterprises play an important role in Wyoming agriculture with range sheep and beef cattle strongly predominating. This is chiefly due (1) to the high proportion of the total land area that is best adapted to grazing purposes; (2) to the relatively small amount of land that can be brought under irrigation at reasonable costs; and (3) to the scant and variable annual precipitation which makes dry farming very hazardous and even impossible over much of the State.

The distribution of the more important kinds of livestock within the State is presented in figures 24-28. A discussion of each of these figures is given in the text that follows. The distribution of horses, mules, and goats is omitted because of the minor importance of these enterprises when measured by gross income. On April 1, 1930 there were approximately 173,000 horses; 4,000 mules; and a little less than 3,000 goats within the State. The number of horses and mules have been decreasing for more than a decade. This is mostly due to the low prices of these animals which have prevailed during recent years and to the increased use of the tractor, truck and automobile.

Sheep and Lambs

Range sheep and beef cattle are of about the same importance in Wyoming. On April 1, 1930, the sheep and lambs on the farms and ranches of the State numbered approximately 3,426,000 head. Their distribution over the State is shown by figure 24, each dot representing 500 head. A comparison of this figure with figures 25-28 shows sheep are far more evenly distributed than either of the other kinds of livestock. This is due, in large part, to the scarcity of water in much of the central and southwestern parts of the State where the use of the ranges is largely confined to the winter grazing of sheep. During the winter grazing season, sheep are generally able to obtain sufficient water by eating snow whereas cattle and horses would perish for want of water. Hence that part of the State has become known as Wyoming’s winter sheep
range. (See Area 1, figure 37.) The sheep to be carried through the winter (not all within the State) are transferred from the summer and fall ranges to the desert ranges with the coming of snow in the fall. With the disappearance of snow and water on the desert they are again transferred to the spring and summer ranges. Most of the sheep produced in Wyoming are marketed as lambs. Many of them coming from the mountain ranges are marketed for immediate slaughter as "grass fat." The remainder is shipped to the feeding areas of Wyoming, Colorado, Nebraska, and other States from September to December to be finished for market. The fattening of lambs for market in Wyoming is somewhat limited. This phase of the industry is confined mainly to the irrigated areas of the Big Horn Basin and the North Platte River.

**Beef Cattle**

On April 1, 1930, approximately 824,000 head of all cattle were on Wyoming farms and ranches. Of this number about 73,000 were cows and heifers kept mainly for milk production.
The remainder, 751,000, may be considered as beef cattle. Figure 25 presents the distribution of the beef cattle in terms of beef cattle units, each dot representing 110 units. As here used a beef cattle unit is the equivalent of an average beef cow in the consumption of feed. Along the eastern border of the State the beef cattle are quite evenly distributed and are of much greater importance than sheep. That is, cattle are generally considered better adapted to the grazing conditions of the eastern part of the Great Plains portion of the State than sheep. In the western two-thirds of the State the distribution of cattle is more or less irregular. But few cattle are to be found in the central and south-central parts of the State except where water is available during the summer months. By comparing figures 24 and 25 it will be seen there is a concentration of cattle in certain areas where there is a scarcity of sheep and vice versa. For example cattle strongly predominate in Sublette and the western part of Sheridan counties while in most of the rest of western Wyoming sheep are easily in
Dairy cows and heifers 2 years old and over: Number on farms April 1, 1930.

the lead. A considerable portion of the three northwestern counties, Teton, Fremont, and Park, is closed to sheep and cattle, being reserved for wild life.

Some of the cattle produced in Wyoming, especially those coming from the mountain ranges, are shipped for immediate slaughter as grass finished. The remainder is generally shipped to distant feedlots to be fattened. The Hereford type of cattle generally predominates throughout the State. Where considerable milking is done, the Shorthorns may be in the lead.

**Dairy Cattle**

Approximately 73,000 head of cows and heifers 2-years old and over kept mainly for milk production were on Wyoming farms and ranches April 1, 1930. Their distribution within the State is shown in figure 26, each dot representing 100 head instead of 110 beef cattle units as in figure 25. The greatest concentration of dairy cattle occurs in the irrigated districts. The most intensive dairy area is Star Valley in the westcentral part
of the State. This valley is 50 to 70 miles from railroad shipping points and cheese is the principal dairy product marketed. There are extensive areas in Wyoming where no dairy cattle are to be found and there are no cities within the State that are large enough to create a substantial demand for market milk. Of the total value of the butter, cream, and whole milk sold, about 55 per cent was cream, 43 per cent whole milk, and 2 per cent butter. As a rule the cream is sour when sold, while there are some herds that are strictly dairy cattle, the cows milked are generally grades of beef or dual purpose breeding. The average production per cow milked in 1929 was around 4,260 pounds.

Swine

The approximate distribution of the 68,000 head of hogs 3 months old that were on Wyoming farms April 1, 1930, is shown in figure 27, each dot representing 100 head. The distribution of the hogs within the State is very similar to that of dairy cattle. About 84 per cent of the total number was in ten of the Great
Plains counties. While a few hogs are produced in the irrigated districts, the bulk of them are to be found on the dry farms of the State where they are mainly finished for slaughter on corn and barley.

Hog production in Wyoming has been declining during recent years. The number of hogs on Wyoming farms January 1 as estimated by the United States Department of Agriculture was 170,000 in 1928 and 57,000 in 1935. Only in 1931 was there an increase as compared with the estimate for the preceding year.

**Chickens**

The distribution of chickens over 3 months old on Wyoming farms April 1, 1930, is shown in figure 28. On that date about 80 per cent of the 16,011 farms within the State reported an average of 58 chickens per farm. Thus, it appears, that about one farm in five carried no chickens. Of the total number of farms 215 or 1.34 per cent were classified as poultry farms. The greatest con-
The concentration of poultry that year occurred in Goshen County where 90,000 were reported. Measured by the number per county in 1930, Goshen County is followed, respectively, by Laramie, Platte, Campbell, Sheridan, Big Horn, and Park counties. About 60 per cent of the farms reporting poultry sold an average of 410 dozen eggs per farm. The number of chickens raised in Wyoming increased about 40 per cent from 1919 to 1929, i.e., from 894,000 in round numbers to 1,258,000. During this same decade the number of chickens sold alive or dressed increased from 154,179 to 354,409 or 128 per cent.

**DISTRIBUTION OF FARMS BY TYPE**

The purpose of figures 29 to 36 which follow is to present the geographical distribution of Wyoming farms, first as a whole and second when classified into types of farming. Figure 29 shows the distribution of all farms, each dot representing the approximate location of 4 farms. In like manner figures 30 to 36 present the distribution of the six more important types of farms, each dot in each of these six figures representing fairly closely the location of 2 farms. The distribution of poultry, truck and fruit farms is not included because of their unimportance. (See table 1.)

The localization of Wyoming agriculture by type of farm as presented in these figures should not be looked upon as static or fixed. That is to say the classification of at least a limited number of farms may change more or less from one type to another from year to year when based on source of gross income. This is mainly due to the unequal shifts which occur in the prices of the commodities which farmers sell; to changes made in the acreage of the crops grown; to changes in the number of the different kinds of livestock kept; and finally to changes which may occur in climatic conditions which may be more or less detrimental to one enterprise and favorable to another.

The shifts in the classification of farms may be illustrated by considering a hypothetical farm in southeastern Wyoming whose gross income is ordinarily fairly evenly proportioned between receipts derived from beef cattle, grain, and seed potatoes. Under varying circumstances this farm might readily drop within either of four types, namely, general, stock-farm, cash-grain or crop-specialty. It would classify as a general farm with neither the beef cattle, the grain nor the potatoes contributing 40 per cent of the gross income; as a stock-farm with 40 per cent or more of the gross receipts coming from the beef cattle and with less than 40 per cent from either the grain or the potatoes; as a cash-grain farm with 40 per cent or more of the gross income derived from grain and with less than 40 per cent from either beef cattle or potatoes; and as a crop-specialty farm with the potatoes contributing...
40 per cent or more of the gross receipts and with neither the beef cattle nor the grain contributing as much as 40 per cent. Shifts in prices, in crop acreages, in livestock number and weather conditions can easily cause such shifts in the classification of many farms when the classification is based on the source of gross income. Therefore the distribution of farms by type as presented in figures 30 to 36 should be considered as subject to at least a limited amount of shifting from one type to another from year to year.

**All Farms**

The distribution of Wyoming's 16,011 farms as reported in the fifteenth U. S. Census of Agriculture is shown in figure 29, each dot representing the approximate location of 4 farms. As might be expected from a consideration of the physical factors which have been and now are influencing Wyoming agriculture, the farms are very unevenly distributed over the State. A comparison of figures 29 and 37 will show the greatest concentration...
of farms occurs in the irrigated districts where practically all land is in farms and where the farms are relatively small in size as compared with dry land farms and stock ranches. The most even distribution is to be found in the northeastern part of the State where a relatively high proportion of the total land area is in farms and ranches. There are vast areas within the State where but few or no farms or ranches are to be found. In general this is due to one or more of the following factors: Rough and rugged surface features, high elevation and short growing season, scant average annual precipitation, and soil conditions which prohibit successful crop production.

Stock Farms and Ranches

Stock farms and ranches as here used is a consolidation of two types as classified by the federal Bureau of the Census, namely, animal-specialty and stock ranches. In the Census classification animal-specialty farms have less than 10 acres of pasture
land per acre in crops whereas the stock ranches have 10 acres or more. It was deemed advisable to unite these two types in this study.

Figure 30 presents the distribution of the stock farms and ranches as classified on the basis of 1929 gross receipts, each dot representing 2 farms or ranches. That year this type numbered 5,498, there being 4,040 stock ranches and 1,458 animal-specialty or stock farms. The consolidated type made up a little more than one-third of the farms within the State. The stock farms and ranches combined are more widely and more evenly distributed over the State than any other type. This is chiefly due to the high percentage of the land area that is best adapted to grazing purposes. In the western part of the State where but little dry farming can be carried on in connection with range livestock production, there is a decided concentration of the stock ranches along the streams and in the irrigated districts where hay can be produced for winter feeding.

In the western part of the State, gross income on the stock farms and ranches is derived largely from the sale of beef cattle, sheep, and wool. A portion of the lambs and cattle sold goes as grass fat for immediate slaughter while the remainder is disposed of as feeder stuff. In the eastern part of the State a part of the gross income may be derived from hogs or grain produced as a side line.

**Crop-Specialty Farms**

Numerically the crop-specialty farms were second in importance in Wyoming in 1929, numbering 2,839 that year. Their distribution and the parts of the State in which each of the special crops is prominent are shown in figure 31. The greatest concentration of these farms occurs in the irrigated districts where cash-crop farming is an important feature of the agriculture. That is, in the northcentral and southeastern parts of the State.

The more important of the Wyoming special crops from which at least 40 per cent of the gross income must be derived in order for farms to classify as crop-specialty are as follows: Hay, sugar beets, dry beans, potatoes, and alfalfa seed. In some parts of the State and on some farms, the necessary 40 per cent of the gross income in 1929 came substantially from but one crop. Such was the case in the southwestern counties where range cattle and sheep strongly predominated, hay being the important special crop. Likewise in some of the dry farming areas the necessary receipts from special crops came from one or more of the following: Hay, potatoes, and alfalfa seed. From what has been said, it should be evident that a wide variation is to be found in the organization and production plans of the crop-specialty farms.
Cash-grain Farms

The cash-grain farms in Wyoming in 1929 numbered 1,783 and approximated 11 per cent of all the farms enumerated within the State by the fifteenth U. S. Census of Agriculture. As indicated by figure 32, about 90 per cent of these farms or 1,605 are located in the nine Great Plains counties in the eastern part of the State, a very high proportion of them being dry farmed. In the western part of the State, on the other hand, practically all cash-grain farms except some of those in Lincoln County are irrigated.

The principal grain crops produced on the cash-grain farms, measured by the acreages harvested in 1929, were wheat, corn, barley, oats, and rye. Wheat has been the chief cash grain crop, followed by corn. Barley, oats, and a large part of the corn are generally fed on the farm where grown or on neighboring farms. While it has been the general practice to crop dry farm land continuously, some wheat has been grown in alternation with fallow.
In a few localities where the soil is sandy and subject to blowing, some strip farming has been practiced. The average size of the cash-grain farms in 1929 was 757 acres. Fully 72 per cent of the average gross receipts that year came from the sale of grain, about 12 per cent from livestock, 7 per cent from livestock products, and 9 per cent from the farm produced products used by the farm family.

**Dairy Farms**

Dairy farming in Wyoming is not an important industry. Of the total number of farms in 1929 but 5 per cent or 812 were classified as dairy farms. While fairly well distributed in most of the farming communities of the State, as shown by figure 33, strictly dairy farms are very scarce in some counties, there being none of this type in Sublette County. Star Valley, located in the westcentral part of the State, is the only area where there is a marked concentration of dairy farms. This is an irrigated valley.
It was settled during the 80's by the Mormons who developed a cheese making type of dairy farming. During recent years the valley has largely turned to the making of high grade Swiss cheese and dried milk. It may be noted also from figure 33 that there is a slight concentration of dairy farms about the cities of Casper and Cheyenne and in some of the irrigated districts where the production of fluid market milk predominates. Of the 65,273 cows milked in Wyoming in 1929, a little more than 52 per cent were of beef or dual purpose breeding.

**General Farms**

The type "general farms" may include almost any kind of farming where less than 40 per cent of the total gross income is derived from any single enterprise. The exceptions are to be found among the type termed "abnormal farms." As would be expected from the foregoing definition, general farms vary widely in the combination and magnitude of their enterprises. As shown in figure 34, the general farms are quite well distributed in most of
the farming districts of the State. Numerically this type stands third, there being 2,493 general farms in 1929. In other words nearly 16 per cent of all farms within the State were general farms that year. Of the total number of general farms, 70 per cent or 1,749 were located in the ten Great Plains counties in the eastern part of the State. The average proportion of the gross income that came from the various sources in 1929 was approximately as follows: Crops contributed 31 per cent, livestock products 27, livestock 23, farm grown products used by the operator’s family 18, and forest products less than 1 per cent. These percentages of income varied greatly from farm to farm.

**Part-Time Farms**

Of Wyoming’s total number of farms in 1929, 5.8 per cent or 929 were classified as part-time. This type is to be found in almost all parts of the State where other types of farms are located. (See figure 35.) The average size of the part-time farms in 1929 was 319 acres. No other type averaged as small as part-
time except the fruit, truck, and poultry farms. An average of only 22 acres of crops were harvested on these farms in 1929. Part-time farms are generally much smaller about the cities and towns than out in the farming communities. The passage of the 320-acre and the 640-acre homestead acts doubtless contributed materially to the wide distribution of part-time farms throughout the State. Dry farms, to be operated economically and to provide income for a good standard of family living should be larger than 320 acres. Likewise, stock ranches should be much larger than 640 acres. Many families who have taken homesteads under these acts have found it necessary to obtain a considerable portion of their subsistence from outside sources.

**Self-sufficing Farms**

The self-sufficing farms of Wyoming numbered 537 in 1929. That year this type occurred in every county of the State except Hot Springs. (See figure 36.) The area of greatest concentration is on the Riverton irrigation project in the central part of
Fremont County in the westcentral part of the State. The most even distribution of this type occurs in Crook, Campbell, and Weston counties, more than one-third of all self-sufficing farms being in these three counties.

The average size of the 537 self-sufficing farms in 1929 was 350 acres. That year these farms harvested an average of 27 acres of crops per farm. Their gross income averaged $356 and came from five sources in the following amounts: Crops contributed $45, livestock $30, livestock products $45, forest products $3, and the farm produced products consumed by the operator's family $233. Thus it is seen the farm produced products used by the operator's family was a little more than 65 per cent of the gross income of the self-sufficing farms. It is not known whether the families on these farms subsisted on an average of approximately $356 or whether some or all of them had incomes from other sources.
The 17 type-of-farming areas into which the land area of Wyoming has been divided in this study are presented in figure 37, the areas being numbered from 1 to 17, inclusive. As here used, the term “type-of-farming area” is applied to a part of the State (1) in which the agriculture therein usually differs quite materially from that in contiguous or neighboring areas and (2) in which there is generally considerable similarity in the organization and operation of the farms making up the dominant type or types. At one extreme a single type may strongly predominate within a given area, as in the case of stock ranches in areas 1, 4, and 7. At the other extreme two or more types may be of nearly equal importance numerically. Such is the case in area 10 where the number of stock farms and ranches, cash-grain farms, and general farms differ but little. In the latter case, the area is said to have a mixed type of farming.

In differentiating the State into type-of-farming areas, it has been necessary to locate more or less arbitrarily some of the
boundary lines separating the respective areas. This is because the agriculture of one area may change very gradually and blend into that of an adjoining area. In other words, the farms of the dominant type of one area may become less numerous as the boundary line of the area is approached while the farms of the dominant type of the adjoining area increase. Especially is this the situation under non-irrigated conditions where dry farming and range ranching gradually blend into each other. The change is generally quite abrupt, however, between irrigated and dry farming areas.

Figure 37 shows Wyoming divided into the 17 type-of-farming areas; table 7 gives the area name and characteristics for each area; table 8 presents the approximate distribution of the various types-of-farms within each area, both in numbers and on a proportional basis; and figures 38 and 39 show, respectively, the first and second dominant type-of-farm in each area. Thus it is
shown by figure 38 that the first dominant type (stock farms and ranches) made up approximately 64.0 per cent of all the farms within Area 1 in 1929. In like manner figure 39 and table 8 show the second dominant type (part-time) constituted about 12.0 per cent of all farms in Area 1 that year. The distribution of farms in the respective areas is only a fairly close approximation. This is because the area boundary lines divide many of the minor civil divisions or voting precincts in such manner as to make it impossible to properly allocate the farms therein among the types-of-farming areas involved.

The differentiation of the State into geographic types of farming areas facilitates the study of Wyoming agriculture and its economic problems. The following sections describe farming and ranching by limited producing areas and seek to explain why the agriculture has developed as it has.
<table>
<thead>
<tr>
<th>No.</th>
<th>Area Name</th>
<th>Area Use Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Central and Southwestern Wyoming</td>
<td>Winter sheep grazing. Some cattle and sheep summer grazed where water is available.</td>
</tr>
<tr>
<td>2</td>
<td>Big Horn Basin</td>
<td>Range sheep predominating, also considerable cattle.</td>
</tr>
<tr>
<td>3</td>
<td>Laramie, and Medicine Bow Mts. and associated valleys</td>
<td>Range cattle, some sheep, hay occasional, general and part-time farming.</td>
</tr>
<tr>
<td>4</td>
<td>Cheyenne Plains</td>
<td>Range cattle with some dairy and part-time farming around Cheyenne.</td>
</tr>
<tr>
<td>5</td>
<td>Western Wyoming mountains and associated valleys</td>
<td>Mostly range cattle with considerable sheep.</td>
</tr>
<tr>
<td>6</td>
<td>Eastern slope of Big Horn Mountains</td>
<td>Range cattle predominating with considerable sheep.</td>
</tr>
<tr>
<td>7</td>
<td>Green and Ferris mountains</td>
<td>Mostly range cattle with some sheep.</td>
</tr>
<tr>
<td>8</td>
<td>Northeastern Wyoming Great Plains</td>
<td>Range cattle and sheep, wheat, corn, alfalfa seed, barley, and oats.</td>
</tr>
<tr>
<td>9</td>
<td>Black Hills</td>
<td>Range cattle and sheep, wheat, barley, oats, and corn.</td>
</tr>
<tr>
<td>10</td>
<td>Southeastern Wyoming Great Plains</td>
<td>Cash grain (mostly wheat), seed potatoes, cattle, some sheep and swine.</td>
</tr>
<tr>
<td>11</td>
<td>Torrington-Wheatland-Douglas irrigated areas</td>
<td>Hay, sugar beets, potatoes, small grain, corn, and cattle and lamb feeding.</td>
</tr>
<tr>
<td>12</td>
<td>Sheridan irrigated area</td>
<td>General farming, sugar beets, wheat, alfalfa seed, beef cattle, dairy, truck, and part-time farms.</td>
</tr>
<tr>
<td>13</td>
<td>Big Horn Basin irrigated area</td>
<td>Sugar beets, dry beans, lamb and cattle feeding, potatoes and cash grain farming.</td>
</tr>
<tr>
<td>14</td>
<td>Riverton-Lander irrigated area</td>
<td>Range sheep and cattle, alfalfa, and some barley, oats, and sugar beets.</td>
</tr>
<tr>
<td>15</td>
<td>Eden Valley irrigated area</td>
<td>Hay, range sheep and cattle, hay, oats, barley, and some dairying.</td>
</tr>
<tr>
<td>16</td>
<td>Bridger Valley irrigated area</td>
<td>Range sheep and cattle, dairying, and general and part-time farming.</td>
</tr>
<tr>
<td>17</td>
<td>Star Valley irrigated area</td>
<td>Dairying, range cattle and part-time and general farming.</td>
</tr>
</tbody>
</table>
### TABLE 8
Approximate distribution of farms in type-of-farming areas by type of farms, Wyoming, 1929.

<table>
<thead>
<tr>
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Compiled from unpublished data (count of farms by type) U. S. Census of Agriculture, 1930.
Area I. Central and Southwestern Wyoming, Autumn, Winter, and Spring Sheep Range

Description

Type-of-farming Area I is situated in central and southwestern Wyoming. (Figure 37.) It embraces parts of 9 counties and is much the largest of the 17 type-of-farming areas into which the State has been differentiated in this study. It includes approximately 17,500,000 acres or about 28 per cent of the total area of the State. With the exception of its northeastern and southeastern parts, Area I is almost completely surrounded by mountain ranges: The Medicine Bow and Laramie mountains lie to the east; the Owl Creek and the southern part of the Big Horn mountains to the north; the Wind River and the Salt River ranges to the west; and the Uinta Mountains to the southwest. These mountain ranges have considerable influence on the climate of the area.

For the most part Area I is a rolling to undulating plain or plateau, the major portion of which lies at an elevation of 6,600 to 7,000 feet, the extremes being from about 4,800 to 9,000 feet. (Figures 4 and 37.) The general level of the plain is occasionally interrupted by ranges of hills and low mountains. The more important of these are the Antelope Hills, and the Green, and Ferris mountains which together form a broken range across the central part of the area from west to east. The Red Desert, as now considered, lies wholly within Area I and may be said to extend from the bluffs along Green River on the west to those along the North Platte River on the east and from approximately the northern boundary of Sweetwater County on the north to the Wyoming-Colorado state line on the south.

The Continental Divide crosses Area I from northwest to southeast and from the divide the land generally slopes gradually towards the east and towards the west. By comparing figures 5 and 37 it will be seen Area I includes all of drainage basin No. 7 and parts of basins Nos. 5, 6, 8, and 13. Number 7 is known as the Great Divide Basin and has no surface drainage outlet. Basins numbers 5 and 6 drain into the Gulf of Lower California, numbers 8 and 13 into the Gulf of Mexico.

Three railroad systems, the Union Pacific, the Chicago and North Western, and the Chicago, Burlington and Quincy, serve the area and traverse it from east to west. The bulk of the meager population of the area is to be found in the towns along the railroads and in the vicinity of a limited number of coal mines and oil fields.
Climate

The climate is quite variable and is one of the dominant factors in determining the types of farming that may be carried on successfully. The growing season is short and varies from an average of about 100 to 130 days in different parts of the area. Frosts may occur at the higher elevations at any time during the summer. The long winters may be severe or relatively mild. Temperatures as low as 30 degrees below zero F. and severe blizzards which may last several days are to be expected occasionally. The dry rarefied atmosphere offers but little obstruction to radiation and to the passage of the sun's rays. Hence, the temperature may become fairly high during the middle of cloudless days but with the setting of the sun the atmosphere quickly becomes cool.

The mean annual precipitation is very low and varies from about 7 inches in parts of the Red Desert to 15 inches or more in some localities of higher altitude farther north. (Figure 6.) The scantiness of the rainfall renders dry farming hazardous and uncertain. The seasonal precipitation, that falling from April to September inclusive, averages about 50 per cent of the annual in the southern portion of the area and about 60 per cent in the northern part. Much of the seasonal precipitation is lost either by evaporation or by surface run-off, the moisture received from light showers during the summer being quickly dissipated under the influence of the winds and the unobstructed rays of the sun. Much of Area 1 cannot be used as summer range because of the scarcity of suitable water for livestock. Its use, therefore, is largely restricted to the winter season when snow provides the necessary water for livestock. Sheep can make better use of snow and of the browse type of forage than cattle. These are the chief reasons why sheep so strongly predominate in Area 1.

Although the precipitation that does the most good generally comes as snow, spring and early summer rains are very essential in the production of range forage for winter grazing. Snow usually melts so slowly that most of the water has time to sink into the soil, provided the surface of the ground is not frozen. Heavy, wet, spring snows especially are helpful in providing the necessary moisture for starting the growth of range forage for winter use in this semi-arid desert area. However, a snow storm that comes as a blizzard and lasts for several days may result in great disaster. Sheep drift with the storm, occasionally encounter some barrier and then pile up and smother, or they may drift with the storm until they become exhausted and freeze to death.

The wind plays an important role in the utilization of Area 1 as a winter sheep range. Without wind a heavy snow would be evenly deposited over the surface. The brilliant sunlight would then melt the surface of the snow sufficiently during the day for
it to freeze into a hard crust during the night. This would shut off the supply of forage. While such a situation is possible, it rarely happens because of the drifting of the snow. Ordinarily the winter snow is dry and accompanied by wind which blows the snow from the high points and ridges into drifts. This makes it possible for the sheep to secure feed from the exposed areas and the piling up of the snow into drifts renders the source of water more certain.

Soils

Figure 9 presents four classes of land lying within the borders of Area I, namely, grazing land, sand hills, third-grade dry farming land, and irrigated land. The grazing land occupies a very high proportion of the area. Because of a low carrying capacity, a million acres or more of the grazing land have been classified by the United States Geological Survey as "waste land." However, a large part of this land produces some forage and is used for grazing purposes. The sand hill areas, located in the northern parts of Sweetwater and Carbon counties, are used only as grazing lands. Practically all of the dry-farming land is located in northern Natrona County where crop production without irrigation can be considered a success only during exceptionally favorable years. The irrigated land is shown in black in figures 9 and 37 and represent a relatively small portion of the area.

Area I also presents a large variety of soil types, the range being from heavy clay at one extreme to dune-sand and gravelly and stony soils at the other. The area as a whole contains less of the sandy and gravelly types than do most arid regions. The abundance of shale rock within the area accounts for the high proportion of clay and silt soils. As a rule all the soils of the area are low in organic matter except in the floor of valleys and along creek bottoms where soil moisture is more plentiful. In localities having poor drainage, the soils occasionally become alkaline through the evaporation of water from the surface. In the central part of Sweetwater County and the northwestern part of Natrona County there are areas which contain large amounts of sub-surface sodium salts that have a potential market value.

Vegetation

Perennial desert shrubs are the predominating types of vegetation over practically the whole of Area I. Of these shrubs the common or black sagebrush (Artemisia tridentata) is the most prevalent. It grows on almost all soils not highly impregnated with alkaline salts. While large amounts of common sagebrush are consumed by livestock, chiefly by sheep, the salt-sages probably rank first as forage plants. Of the several species of the per-
ennial salt-sages, the more important are: Nuttall’s Salt-sage (Atriplex Nuttallii), Spiny Salt-sage or Shadscale (Atriplex confertifolia), and Nelson’s Salt-sage (Atriplex pabularis). Nuttall’s Salt-sage is perhaps the most important of the three. The Salt-sages are chiefly confined to the strongly saline areas such as the flats along creeks and the dry beds of alkaline basins. Shadscale is found particularly in the drier parts of the area, especially along the lower foothills. During the winter grazing season the sheep eagerly seek the leaves and fruit produced the previous season, which drop to the ground and are generally blown into the shallow depressions or into piles under the shrubs. Other important shrubs are Winterfat (Eurotia lanata), Bud-brush or Bud-sage (Artemisia spinescens), and Silvery-sage (Artemisia cana). Winterfat is highly prized as a sheep feed and is generally to be found throughout much of the area. It is a much branching light colored shrub that grows a foot or more high from a shrubby base. Bud-sage is also much relished by sheep. During May it puts forth numerous leafy stems which grow but a few inches high and is excellent feed at that time of the year. Silver-sage grows chiefly in alluvial soils along the banks of streams. In quality of forage it is very similar to common sagebrush but produces a much greater quantity of forage per unit of area covered.

Greasewood (Sarcobatus vermiculatus) largely takes the place of sagebrush on soils that are strongly alkaline, namely, the dry lake beds and the low flats immediately bordering the streams. With the greasewood there is generally a mixture of the salt-sages, and where the soils are strongly alkaline salt grass (Distichlis stricta) is usually present.

The average annual precipitation of the Red Desert or southern part of the area is insufficient, as a rule, to support a good growth of the grasses. Nevertheless considerable feed is furnished by Northern Wheat-grass (Agropyron dasystachyum), Western Wheat-grass (Agropyron Smithii), Indian Millet (Oryzopsis hymenoides) Giant Rye-grass (Elymus canadensis), and other grasses that are to be found interspersed among the sagebrush and salt-sages. Much of that part of Area I that lies north of the Sweetwater River receives more rainfall than the part lying to the south of the river and in the localities of heavier rainfall more grasses are intermingled among the shrubby plants.

Summarizing, it may be said that Area I is a high, arid, and rolling to undulating plateau where the winters are long and the summers short; that the mean annual precipitation is so scant over practically the whole area as to preclude crop production except under irrigation; that the major portion of the area cannot be used for summer range because suitable water for livestock is not available; that snow must be relied upon as the chief source of water
when winter grazing is practiced over much of the area; that sheep can make better use of the shrubby type of forage produced and of snow as a source of water than cattle; and finally that summer grazing is practicable only in the vicinity of the comparatively few watering places to be found within the area.

Crops

The acreage devoted to crop production is very meagre and is restricted almost entirely to the small and widely scattered irrigated tracts. The crops grown are chiefly fed to livestock as hay to supplement the range forage. Alfalfa is the most important crop grown, with wild hay second. All other crops are of but little importance. Figures 12 and 23 inclusive show the approximate distribution of the acreage of the principal crops harvested in 1929.

Livestock

The livestock enterprises are practically confined to sheep and beef cattle, the sheep strongly predominating. The distribution and relative importance of the different kinds of livestock within the area are shown by figures 24 and 28 inclusive. The sheep, it is seen, are well distributed over the whole area whereas the cattle are to be found mostly in the northern part. The Rambouillet, crossed more or less with the mutton breeds, is the dominant type of sheep. The beef cattle are mainly of Herford breeding. Poultry, swine, and dairy cattle are of very minor importance.

Types of Farming

Approximately 510 farms and ranches were located within Area I in 1929. Stock farms and ranches combined made up about 64 per cent of the total that year; part-time, 12 per cent; crop-specialty, 6; general, 5; dairy, 4; self-sufficing and unclassified, 3 each; and cash-grain and poultry, 1 per cent each. In addition of this there were a few truck, feedlot or horse and country estate or institutional farms. (Table 8.) Since the stock farms and ranches (mostly ranches) average much larger in size and do a much greater volume of business than do the farms of other types, they are of far more importance than is indicated by their percentage of the total number of farms in the area. The part-time farms are second in importance numerically. For the most part, they are located near the towns and in the vicinity of coal mines and oil fields. The general and crop-specialty farms are generally located on the various isolated irrigated tracts and the products of these farms are mostly sold to large scale livestock operators, hay being the principal crop grown on the crop-specialty farms.
The Dominant Type.—Stock farms and ranches, it has been shown, are the dominant type in Area 1. Of this group of farms a very high proportion are ranches. That is, they have 10 acres or more of grazing land to each acre in crops. Figures 38 and 39 show, respectively, which are the first and second dominant types of farming within the area. While both sheep and cattle or only cattle are handled on a commercial scale on a limited number of ranches, a very large majority of them are strictly sheep ranches.

As a rule the ranches of this area do a relatively large volume of business. A study\(^1\) made in 1926 of 65 sheep ranches located in the Red Desert and adjoining areas shows; that the average investment per ranch in 1925 was $131,726; that the average amount of land owned per ranch was 14,694 acres; that the land owned at that time was less than one-third of the area necessary to carry the sheep; that about 8 acres of grazing land was needed to carry a sheep through the winter grazing season; that the number of ewes kept per ranch averaged 6,538 and varied from 544 to 59,292 head; and that the operation of the 65 ranches required an average of 10.7 men and 37 horses per ranch. The horses were mostly used for hauling supplies, moving camp wagons and as saddle and pack animals in caring for the sheep.

The ranchmen of Area 1 generally keep their sheep on the range throughout the year. Area 1 is used during the fall, winter, and spring. The high mountainous districts which practically surround the area are used as the summer range from about July 1 to the middle of September. The foothills, or the lands lying between the summer and winter ranges, are grazed during the late spring and early summer and from about September 1 to late in November or early December. It is evident, therefore, that Area 1 is not self-sufficing as a complete producing area for the major portion of it can be used only during a part of the year. In addition to using their own land, the ranchmen graze their flocks on the national forests, on the public domain and on land leased from the State, from corporations and from private individuals.

The management of sheep on the summer and winter ranges differs in many respects. Those going on the summer range are divided into bands of 1,200 to 1,500 head of ewes with their lambs while on the winter range the bands consist of 2,000 to 2,500 ewes and ewe lambs held to maintain the breeding flock. With each band on the fall, winter, and spring ranges, there is a herder, a camp tender, and a covered sheep wagon that is equipped with a bed, stove, and cooking outfit. One man can usually haul the supplies and move the camps for two bands on the winter, spring, and fall ranges although two men per band are not uncommon. In

addition to this the camp tender assists with whatever supplementary feeding is done. A truck is generally used in hauling supplies to the camps.

In the spring of the year at about the time the snow begins to fail as a source of water, the bands are slowly trailed to the shearing pens which are generally located near the shipping points along the railroads. In the southern part of the area the shearing is usually done before lambing while in the northern part the lambing takes place first. The spring storms are usually more severe in the northern part of the area and consequently the lambing and shearing both occur somewhat later in the spring. The best of the range is usually reserved for use just prior to and during the lambing period. Good feed at this time has considerable influence on the size of the lamb crop and this in turn has much to do with determining the success or failure of the business. The lamb crop (the ratio of the number of lambs raised to the number of ewes) of Area 1 varies considerably from year to year and averages about 73 per cent.

After both shearing and lambing have been completed, the sheep are gradually trailed towards the high, summer range. At the edge of the summer range, the sheep wagons are left and a supply camp established. The sheep are divided into bands of 1,200 to 1,500 ewes and their lambs. A herder, a camp tender, 3 to 4 pack horses and 2 or 3 saddle horses go with each band. Supplies are brought to the supply camp by trucks or wagons and carried from there to the herder’s camp by the camp tender with his pack outfit. The sheep going onto the national forests are counted in by the forest officials.

The ewes with their lambs leave the summer range about the middle of September. They are moved gradually down to the foothills, out towards the winter range and to the shipping points where the lambs that are to be sold are cut out and separated into those that may be marketed as "grass fat" and those that must go as feeders. Either at the shipping point or as they leave the summer range, the older ewes are "mouthed out." That is, their mouths are examined to see if their teeth are good for another year. Some sheepmen cull their ewes severely in this way.

After the cull ewes and the lambs that are to be marketed have been taken out of the flock, the remaining ewes and the ewe lambs retained to maintain the breeding flock are grouped into bands of 2,000 to 2,500 head each. The ewe lambs are given an ear mark to indicate their age at the time they are docked in the spring. These bands are then moved out towards the breeding grounds and the winter range. As a rule the better part of the range is reserved for use during the breeding season.
The rams are usually placed with the ewes between the middle of November and the middle of December, the exact date depending on the time the individual operator desires the lambing to take place. The rams remain with the ewes for 30 to 40 days, there being one ram to about 30 ewes. The rams are generally conditioned by feeding just prior to the breeding season. At the beginning of the breeding season the weaker ewes and ewe lambs are generally separated from the main flock and designated the "hospital" bunch. This enables the operator to favor the weaker animals by placing them on the better grazing lands and by supplementary feeding.

From the close of the breeding season until shearing time, the rams are most frequently kept with the hospital bunch, in which case they are likely to get more supplementary feed than is necessary. Another method that is used less frequently is to bring the rams together from the flocks of two or more operators and herd them cooperatively. This is probably the most satisfactory method where enough rams can be assembled to permit of economical herding. From shearing time until the beginning of the following breeding season, a high percentage of the rams of Area I are herded cooperatively. A few operators keep their rams in fenced pastures at the ranch headquarters.

The production of sheep in Area I and in the adjoining areas used also as late spring, summer, and autumn ranges would be comparatively simple, safe and profitable were it not for the death losses that occur. With favorable weather conditions at both shearing and lambing time and with relatively mild winter weather, the annual death loss may be as low as 5 or 6 per cent. However, it may be as much greater under adverse conditions. Over a period of years the average is about 10 per cent for the ewes and 8 per cent of the lambs. The most important causes of death losses are: drouth years, overstocking the range during good years, severe storms at shearing and lambing time, deep snows and blizzards during the winter and early spring, poisonous plants, predatory animals, and straying.

During the drouth years the supply of forage generally becomes inadequate, especially if the range has been stocked to its carrying capacity during favorable years or even during average years. If the drouth is long and the following winter severe, the availability of range forage may become so scant as to force a material reduction in the size of the flocks at a heavy loss. With the ewes and ewe lambs thin in flesh and with the supply of forage on the winter range greatly reduced as a result of the drouth of the previous summer, the death loss is likely to be high provided a severe winter follows a drouthy growing season. The death loss may be high also when severe storms occur during shearing.
and lambing time. But few of the ranchmen use lambing sheds. The choice in management lies between suffering severe losses from time to time, providing a more abundant supply of supplementary winter feed, providing lambing sheds, or lambing at a later date. While late lambing generally increases the number of lambs raised, it also decreases their average weight at marketing time.

Most of the ranchmen of this area plan to do very little feeding except in cases of emergency. Small amounts of such feeds as hay, grain, and cottonseed cake are generally kept stored at strategic points to be used quickly when severe storms occur during which the sheep are unable to obtain their own feed. It must be understood, however, that it is not always possible to bring the sheep and feed together. In such cases the death loss may be heavy. Hay, grain, and cottonseed cake are sometimes fed to weakened ewes and ewe lambs in relatively small quantities to supplement a scant supply of feed on the winter range. The feeds used are generally purchased, very few of the sheepmen being equipped to produce their own feed.

Death losses due to poisonous plants often make up a considerable part of the total. Especially is this true with sheep summer grazed on the national forests, concerning which Vass and Pearson have this to say:1 "Sheep are trailed on and off their allotments over well defined trails. The first bands over the trail find excellent feed, but as more and more bands pass over the trail, the feed question becomes more difficult. It is on these barren trails that many sheep are lost due to poisonous plants." The greatest losses from poisonous plants generally occur when the sheep become fatigued and hungry. The poisonous plants which cause the greatest death losses among sheep are the lupines (Lupinus sp.), death Camas (Zygadenus sp.), woody-aster (Xylorhiza Parryi), and loco weed (Astragalus sp.). But little definite data are available as to the extent of the losses caused by predatory animals and from straying from the flock. Some have estimated it as from 3 to 8 per cent of the lamb crop. The chief killers are coyotes with occasional losses due to wild cats, mountain lions, and bears.

AREA 2. THE BIG HORN BASIN: RANGE SHEEP AND CATTLE

Description

Area 2 is located in the northwestern part of Wyoming. It embraces practically all of the four Big Horn Basin counties with the exception of the irrigated land lying along the streams in the floor of the basins and which together make up Area 13. (Figure

37.) Like Area 1 this area is almost completely surrounded by mountains: The Absaroka Range lies to the west, the Owl Creek Mountains to the south, the Big Horn Range to the east, and the Pryor Mountains (largely in Montana) to the north. In general the crests of these mountain ranges form the border of the area except on the north where the State line is the boundary.

The Big Horn Basin (areas 2 and 13 combined) is drained by the Big Horn River and its tributaries. The elevation of the floor of the basin varies from about 3,600 feet where the Big Horn River crosses the Wyoming-Montana state line to around 4,500 feet at the southern border of the basin where the Big Horn River emerges from a deep narrow canyon which cuts through the Owl Creek Mountains from the Wind River Basin. The Absaroka and Shoshone ranges on the west and the Big Horn range on the east rise quite abruptly from the foothills to slightly more than 13,000 feet at the higher summits. Thus, Area 2 has a range in altitude of approximately 10,000 feet.

The surface varies from practically level to undulating and rolling in the center of the basin to rough ridges, precipitous cliffs and steep mountain slopes on the outer border. The Big Horn River crosses the basin from south to north in a broad, open valley. Similar though smaller valleys occur along most of the streams that flow into the Big Horn River from both east and west. Practically all of the land now cultivated lies in the stream valleys. Approximately 29 per cent of Area 2 lies within the national forests and about 69 per cent has been classified as grazing land. The remaining 2 per cent is mostly irrigated meadow and pasture land. There is little dry farming done in Area 2.

Climate

Area 2 presents a wide range in climate. This is largely due to the variation in elevation within the area of some 10,000 feet. The average frost-free season at the lower elevations near the Wyoming-Montana state line varies from 125 to 150 days. As the elevation increases and as the mountains are approached the growing season becomes shorter until, at the other extreme, freezing temperatures may occur in the high mountain districts at any time during the summer. The mountain ranges surrounding the area have a marked influence, also, in determining the amount of the annual precipitation. From whatever direction the moisture-bearing winds may approach the area, the atmosphere is cooled as it ascends the mountain slopes. This, in turn, condenses most of the moisture which falls as rain, snow or hail as the air currents pass up the slopes and over the divides. As the atmosphere passes down the slopes into the basin below, it becomes warmer and capable of retaining more moisture. This results in a decrease
in the precipitation as the elevations within the area decrease, the minimum in the floor of the basin along the Big Horn River being less than a mean annual of 6 inches. As the mountains are approached from the lower levels the precipitation increases and reaches 25 inches or more in some localities, the upper limits on the high mountain ranges being unknown. Of the total annual precipitation around 70 per cent falls between April and September inclusive. Only in the higher foothills and mountain districts is the precipitation sufficient to support a dense growth of grass forage.

Soils

The soil types vary greatly in different parts of the area. The predominating type is a heavy clay loam with here and there areas of sandy clay loam, silt loam and gravelly soils. Shales frequently occur within the area and this in turn accounts for the presence of alkali in the poorly drained irrigated districts.

Vegetation

The vegetation in the lower and more arid portion of Area 2, including the lower slopes, consists of desert shrubs very similar to those of the Red Desert and are best adapted to grazing with sheep. The salt-sages, shadscale, winterfat, and common sagebrush with greasewood in the stream valleys make up the greater part of the vegetative cover. At successively higher altitudes the desert plants give way to common sagebrush, grama grass (Bouteloua gracilis), blue grass (Poa sp.), prairie June grass (Koeleria cristata), wheat grass (Agropyron sp.), weeds and forest growths of various kinds.

Summarizing the foregoing discussion it is seen, Area 2 includes the major portion of an intermountain basin that has a variation in altitude of approximately 10,000 feet; that the average frost-free season at the lower elevations varies from about 125 to 150 days, that the mean annual precipitation is inadequate for successful dry farming; that about 29 per cent of the area lies within the boundaries of national forests; that about 69 per cent has been classified as grazing land; and that substantially all crops grown are irrigated. It should be evident, therefore, that the area is best adapted to the production of range livestock. The area may be considered as a self-sufficing livestock producing area in as much as it provides year-long grazing and produces the bulk of the feeds used in carrying the young and breeding stock through the winter. The livestock produced seldom leaves the area until ready to be shipped either to the feed lots as “feeders” or to market for immediate slaughter as “grass-fat” animals. A considerable number of the livestock produced in this area is finished for slaughter on the irrigated farms in Area 13, which is also a part of the Big Horn Basin.
Crops

Crop production in Area 2 is restricted almost entirely to the growing of feed (chiefly hay) to carry livestock through the winter and to supplement range forage during extended periods of drought. Practically all crops are grown with irrigation. Alfalfa is the leading crop and is generally cut twice. It yields from 1.5 to 2.5 tons per acre. In Park County, timothy and clover are important crops. There is a limited amount of oats and barley grown, practically all of which is used as supplementary feed.

Livestock

The livestock enterprises associated with Area 2 are chiefly range sheep and beef cattle. While the sheep predominate, cattle are of considerable importance. Both the sheep and cattle are summer grazed in the rough and mountainous districts which form the outer border of the area, a large portion of which is in the national forests. Generally speaking, the steep and rougher parts of the summer range are grazed by the sheep. The lack of suitable water for livestock in much of the floor of the basin limits that part of the area to the winter grazing of sheep when snow must be relied upon as the source of water as in Area 1.

Types of Farming

As shown in table 8 and figures 30 to 36, a variety of types of farming are carried on in Area 2. The proportional distribution of all the farms within the area in 1929 was approximately as follows: Stock farms and ranches constituted 47 per cent; crop-specialty, 17; general, 16; part-time, 5; dairy, 4; unclassified, 3; cash-grain and poultry, 2 each, the other 2 per cent being made up of self-sufficing, boarder-lodger (dude ranches), forest product, horse or feed lot, and truck farms. In this area the crop-specialty and general farms are usually closely related to the livestock industry. The special crop grown on the crop-specialty farms is hay which is sold to the ranch operators, who, in turn, feed it to livestock. Likewise the general farms produce hay, grain, and livestock but have less than 40 per cent of their gross income derived from one of the three sources.

The Dominant Type.—Of the farms making up the dominant type in Area 2 (the stock farms and ranches), a high proportion are ranches. (Figure 38.) As compared with the ranches, the stock farms are relatively small, derive a much lower proportion of their gross income from livestock and livestock products and have a much higher proportion of crop land to grazing land. The discussion which follows pertains only to the ranches.
The stock ranches of this area may be grouped into three subtypes: Some are strictly sheep ranches, others are cattle ranches and still others are combination sheep and cattle ranches. The sheep ranches may be further divided into two groups: Those lambing on the open range and those lambing early in sheds. On the open range the lambing usually occurs during May while in the sheds it begins about March 15. Roughly $\frac{2}{3}$ of the lambing is done on the range and $\frac{1}{3}$ in the sheds. In addition to this the sheep ranches vary greatly in the number of sheep carried per ranch. A study of 30 flocks in the Big Horn Basin showed the number of sheep per ranch averaged 5,908 and ranged from 1,500 to over 35,000 head.

The sheep that lamb on the open range are managed in very much the same way as are the sheep in Area I. They are winter grazed in the desert portion of the area (the floor of the Big Horn Basin) in bands of 2,000 to 3,000 head each. A herder, a camp tender, a covered sheep wagon and a team or truck for hauling supplies and moving the camp wagon go with each band on the fall, winter, and early spring range. Light supplementary rations of hay, grain, or cottonseed cake are fed when necessary on account of severe storms or because of a shortage of forage on the range the same as is done in Area I. As the snow begins to fail as a source of water supply in the spring, the sheep are gradually moved towards the foothills and to the range reserved for lambing grounds. In this area lambing takes place before the shearing is done. After the shearing has been completed the bands are gradually worked up the foothill country toward the high, mountain, summer ranges, much of which lies within the national forests. The sheep are usually moved onto the summer range in bands of 1,200 to 1,500 ewes and their lambs about July 1 where they remain for about 75 days or until early in September, the exact dates depending on the weather and the condition of the forage. The foothill country lying between the summer and the winter ranges is used during the late spring, early summer, autumn, and early winter. The foothill range is usually supplemented during both the fall and spring by grazing the meadows, and the irrigated pastures at the ranch headquarters. Where the range is too rough for the sheep wagons, camp outfits and pack and saddle horses are used. In this area the sheep are culled and graded for market and managed during the breeding season just the same as in Area I.

The practice of shed lambing is a fairly recent development in the production of sheep in Wyoming and it requires considerable managerial ability on the part of the ranch operator in order to make it a financial success. Lambing in sheds begins about two months earlier than on the open range. The object in view is
materially to increase the percentage of the lamb crop and to produce milk-grass fat lambs that weigh from 80 to 85 pounds at the time the sheep must leave the summer range. The greater the percentage of the lamb crop that can be saved and the greater percentage of the saved lambs that can be marketed in the fall for immediate slaughter at these weights, the greater are the profits of the business likely to be.

In order to make a success of early lambing in sheds, the ranch operator must have exceptionally good early spring and summer ranges, the spring range being selected with respect not only to the supply of feed but also to the protection offered from storms. The ranch operator must be able, also, to obtain his supplementary feeds economically and to produce a high proportion of slaughter rather than feeder lambs. Otherwise they are penalized in the market, for feeders prefer lighter lambs. The availability of alfalfa hay, sugar beet pulp, grain and suitable winter, early spring and summer ranges, together with good management are the factors which make early shed lambing and the production of milk-grass fat lambs a possibility in the Big Horn Basin livestock area.

Lambing usually starts about March 15 and continues for some 45 to 55 days. An effort is made to save every lamb possible. Each ewe is examined to be sure she has sufficient milk for her lamb or lambs if there are twins. If a ewe does not produce the necessary milk, the lamb is placed with one that is a better producer. The ewes and lambs are kept within the sheds and pens and fed until the lambs are strong enough to go onto the range. Ewes with twin lambs are kept separated from those with single lambs and during the grazing season they are run in bands of 700 to 800 head. The idea is that ewes that nurse two lambs must have plenty of feed and for that reason they are not crowded on the range. The ewes with single lambs are run in bands of 1200 to 1500 ewes with their lambs.

The percentage of the lamb crop obtained by lambing early in sheds is considerably larger than that obtained on the open range. In addition to this the lambs weigh more when sold and they usually bring a better price due to their better finished quality. On the other hand, the cost of feed and labor and the investment are much greater. In order for early lambing in sheds to be successful financially, the increase in the value of the lambs when sold must be sufficient to more than balance the increase in costs.

The cattle ranches located in the foothills of Area 2 are very similar in management, organization and operation to those described in detail for Area 3.
AREA 3. THE LARAMIE, MEDICINE BOW AND SIERRA MADRE MOUNTAINS AND ASSOCIATED VALLEYS

Description

Area 3 is located in the southeastern part of Wyoming. It embraces practically all of Albany County and parts of Carbon, Natrona, Converse, Platte, and Laramie counties. It includes approximately 7,000,000 acres (close to 12 per cent of the total area of the State) and ranks fourth in size among the 17 type-of-farming areas of the State. For the most part the area is made up of mountain ranges and their associated valleys and foothills.

The Laramie Mountains extend across the eastern part of the area from north to south. These mountains, especially south of the Laramie River, consist more or less of rounded hills while north of that river they are higher and more rough and rugged. Except for Laramie Peak which attains an altitude of about 11,000 feet, this range seldom exceeds 9,000 feet. The southwestern part of the area includes the rugged Medicine Bow and the Sierra Madre ranges. The latter forms a part of the Continental Divide with elevations approaching 11,000 feet. The Medicine Bow Range has several prominent peaks, the highest of which rises to an elevation of 12,000 feet. The lowest elevation within the area, about 4800 feet, occurs in Platte County in the vicinity of Wheatland. The outer limits of the foothills of these three ranges, in general, mark the border of Area 3 on the north, east, and southwest. Practically the whole area is drained by the North Platte River and its many tributaries, the more important of which are the Laramie and Medicine Bow rivers.

A very prominent feature of Area 3 is the intermountain basin commonly known as the Laramie Plains. This basin lies between the Laramie and Medicine Bow ranges at an altitude varying from 7,000 to 7,500 feet. It is mostly drained by the Laramie and Little Laramie rivers. Its length from north to south is about 90 miles and its maximum width 30 miles. The surface of the basin is gently rolling. The broad valleys along the streams are separated by long, flat-topped ridges. The surface of the plains is broken by numerous depressions. The largest of these, locally known as Big Hollow, which is about 10 miles long and 3 miles wide with a maximum depth of 200 feet, lies between the two most important streams, the Laramie and the Little Laramie rivers. Big Hollow has no surface drainage outlet and within it are several small alkaline lakes or ponds. Numerous other lakes and ponds occur throughout the plains, the largest of which covers about one square mile. Many of these lakes have no surface
drainage outlet, their water being alkaline. During years of extreme drouth, as in 1934, some of them become quite shallow or dry.

A very important valley within Area 3 is locally known as the Saratoga-Encampment Valley. It is triangular in shape and lies between the Medicine Bow and Sierra Madre mountains. It is about 50 miles long and varies in width from one mile at the apex of the triangle near the Wyoming-Colorado state line to some 15 miles in the lower part of the valley at the north. The floor of the valley varies from rough and rolling in its upper portion to comparatively level at its lower extremity. It varies in elevation from about 6,600 to 7,500 feet or more.

The North Platte River flows through this valley from southeast to northwest in a comparatively narrow stream valley that is considerably below the floor of the valley proper. In places the river runs through narrow canyons. Numerous streams flow into the river from either side. In most cases these tributaries have cut out stream valleys which may be a mile or more in width.

As a rule the ranches are located in the stream valleys of the side tributaries of the Platte, where an abundance of hay is produced under irrigation. The Saratoga-Encampment Valley and the adjacent foothills and summer ranges of the Medicine Bow and Sierra Madre mountains, considered together, may be said to be an ideal beef cattle country.

Climate

The length of the growing season as measured by the frost-free period averages about 134 days on the eastern border of the area near Wheatland, 108 days at Laramie on the Laramie Plains, and 88 days at Saratoga in the western part of the area on the North Platte River. In the high mountainous districts killing frosts and even snow storms may occur at any time. The average mean precipitation on the Laramie Plains and in the Saratoga-Encampment Valley is 11 to 12 inches, while along the eastern and northern borders of the area it is around 14 to 15 inches. On the Medicine Bow and Sierra Madre ranges it may be as much as 30 or more inches. Along the eastern slope of the Laramie Mountains 70 per cent or more of the annual precipitation falls between April and September inclusive, while west of that range the seasonal precipitation is around 60 per cent of the annual. Heavy snows in the mountains usually provide an adequate supply of irrigation water. If the snow fall is scant, on the other hand, water shortages are likely to occur during the late summer and autumn and this, in turn, may materially curtail crop production and the pasturage of the irrigated meadows and irrigated pastures.
Soils

The territory included within Area 3 has been classified as grazing land, irrigated land, second and third-grade dry farming land and land lying within the national forests. (Compare figures 9, 10, and 37.) The grazing land occupies the major portion of the area and 1,226,000 acres lies within the borders of the Medicine Bow National Forest. A small amount of second-grade dry farming land occurs at a relatively high altitude in the southwestern part of the area just to the west of the Sierra Madre Mountains. (Figure 9.) Were it not for the short growing season this might have developed into a fairly satisfactory dry farming district. The irrigated land is widely though unevenly distributed over the area. It has been roughly estimated that around 300,000 acres of land in Area 3 are irrigated.

A considerable variation in soils occurs in this area as in other parts of the State. The soils of the Laramie Plains, for the most part, consist of clay loams and sandy loams with frequent admixtures of gravel. Heavy clay usually occurs in the depressions having no surface drainage. Small, poorly drained areas along Laramie and Little Laramie rivers and along the shores of small lakes usually contain excessive amounts of alkali. In the comparatively narrow valleys along the perennial streams of the area, the soils are fairly fertile and quite well adapted to irrigation. On the mountain slopes the soils are generally thin and gravelly. Strips of red sandy and sandy-loam soils derived from underlying granite and shale occur along the western limits of the Laramie Mountains.

Vegetation

The vegetative cover of Area 3 presents a fairly wide variety of plants. Merchantable timber occurs in the Medicine Bow and in the northern portion of the Laramie mountains. The shrubby plants are generally quite conspicuous, and numerous grasses, weeds, and flowering plants usually make excellent growths. In the foothills of these mountains the principal forage plants are grama grass, June grass, blue grass, wheat grass, three awn grass (Aristida longiseta) wire grass (Juncus balticus), and sedges. The forage furnished by these plants is supplemented by many weeds and flowering plants and by such shrubs as the common sagebrush, mountain mahogany (Cercocarpus montanus), squaw brush (Rhus trilobata), wild currants (Ribes cerium), service berry (Amelanchier alnifolia), and bitter brush (Purshia tridentata). In the upper mountain valleys and on the high slopes and ridges, the forage consists chiefly of the brome grasses (Bromus sp.), several fescues (Festuca sp.), rye grass (Elymnus glaucus), mountain timothy (Phleum alpinum), and pine grass (Calamo-
grostis sp.) to which may be added the mountain shrubs and many of the grasses, weeds, and flowering plants common to the foothills.

The vegetation of the Laramie Plains, for the most part, consists of grama grass, June grass, wheat grasses, needle grass (Stipa comata), three awn grass, salt grass, several blue grasses, Muhlenbergia (Muhlenbergia gracilis), and greasewood. Three awn grass and needle grass are especially noticeable on the benches. Along with several other grasses just named, Muhlenbergia and several of the blue grasses are prominent on the granitic, gravelly soils along the foothills. In the depressions having heavy clay soils, the wheat grasses form the principal part of the plant cover. Rabbit brush (Gutierrezia sarothrae) makes small growth in scattered localities.

The vegetative cover of the Medicine Bow and Sierra Madre mountains, the foothills of these mountains and their associated valleys is very similar to that of the Laramie Mountains and their valleys and foothills. However, a great percentage of these two ranges is covered by forests. The vegetation of the Saratoga-Encampment valley varies all the way from that of the Red Desert into which the valley merges on the north to that of the mountain foothills on the east, south, and west.

Summarizing the foregoing characterization, it may be said that Area 3 is a self-sufficing range livestock producing district. The three mountain ranges of the area provide excellent summer range for both cattle and sheep; the foothills and intermountain valleys and basins are grazed during the spring and autumn and to some extent during the winter; and the irrigated lands produce feed for carrying the livestock through the winter and also spring and autumn pasturage. Due to the high proportion of the range forage that consists of the true grasses, the area as a whole is better adapted to cattle than to sheep. The present facilities for storing water limits the expansion of irrigated cash-crop farming and the scant annual precipitation prevents the development of dry farming in localities where the growing season, the surface features, and soils are favorable to crop production.

Crops
A very high percentage of the crops grown in Area 3 are produced with irrigation. It is highly probable that much of the crops listed in the 1930 census reports as non-irrigated were grown under natural subirrigated conditions. Of the total acreage of crops harvested within the area in 1929, as much as 90 to 95 per cent was hay. The hay crops vary quite widely in different parts of the area. In Albany County, for example, wild hay constituted 85 per cent of the hay crop, alfalfa about 8 per cent and all tame
grasses and clovers 7 per cent. In Carbon County the tame grasses and clovers made up 54 per cent of the hay crop, wild hay 27 per cent, and alfalfa about 19 per cent. The wild hay is made up mostly of wire grass and sedges. The meadows have been developed without plowing, in most cases, by applying irrigation water to the land.

In time the yield of these wild hay meadows decreases. When this occurs it is quite a common practice to harrow the meadow with a heavy drag and then sow the tame grasses and clovers. Where conditions are more favorable to the tame grasses and the clovers than to the wire grass and sedges, the former are, in the course of time, likely to predominate. These irrigated meadows produce but one crop per year and yield about one ton per acre. A very limited amount of oats, barley and wheat are grown, the wheat being confined mostly to the eastern border of the area.

Livestock

The livestock enterprises associated with Area 3 are chiefly range beef cattle and sheep with the cattle predominating. The cattle are mostly of Hereford breeding and generally remain within the area until ready to be marketed. Many of the sheep, on the other hand, are summer grazed in the national forests of Area 3 and wintered in Area 1. An average of about 4 cows and 2-year old heifers per farm were kept mostly for milk production in 1929. About half of the cows milked were of beef or dual purpose breeding. There are a limited number of herds of strictly dairy cattle. The poultry consisted mostly of farm flocks of about 35 to 40 per farm. Hogs in this area are of very minor importance and averaged about 1.6 head per farm.

Types of Farming

A classification of 2,180 farms located within Area 3 in 1929 shows 10 or more types of farming are carried on in the area. Stock farms and ranches predominated that year and made up approximately 44 per cent of the total number of farms: Crop-specialty formed 13 per cent; general, 10; part-time, 8; cash-grain, 7; dairy, 6; unclassified, 4; self-sufficing, 3; and poultry, 2 per cent. The remaining 3 per cent was made up of a half-dozen types, none of which formed as much as one per cent of the total number of farms.

The stock farms and ranches are of far more importance than their proportional part of the whole number of farms would indicate. This is shown by the distribution of the gross income of all farms in the area in 1929 among the several types. Of the total gross income that year, the stock farms and ranches received approximately 82 per cent. This, of course, is mainly due to the
large volume of business done by the stock ranches as compared with that of the other types. By this same token crop-specialty ranked second in importance, dairy third and general farms fourth.

The crop-specialty farms are very closely associated with the livestock industry. The special crop grown on the farms of this type is hay which, in most cases, is purchased by ranch operators and fed to livestock. Furthermore a considerable part of the gross income of the crop-specialty farms is derived from the sale of livestock and livestock products. There are five creameries in Area 3, two at Laramie in Albany County, two at Casper in Natrona County, and one at Saratoga in Carbon County. The towns along the Union Pacific Railroad, the city of Casper in the northern part of the area, and the five creameries are the principal outlets for the products of the dairy farms.

The Dominant Type.—The farms making up the dominant type in Area 3 (the stock farms and ranches—figure 38) present a very wide range in size of business and plans of organization and operation. At one extreme are a few large ranches which may control as much as 150,000 to 175,000 acres of grazing land, 1000 to 1500 acres of meadow land and considerable irrigated or sub-irrigated pasture land located in the vicinity of the ranch headquarters, all of which is under the control of the ranch operator. At the other extreme are the relatively small stock farms (animal-specialty of the U. S. Bureau of the Census classification) that contain less than 10 acres of grazing land to each acre of crops, where barely 40 per cent of the gross income may be derived from livestock and livestock products and where the balance of the receipts may come from several sources such as crops, dairy cattle and dairy products, and poultry and poultry products. The stock farms are of minor importance in Area 3. In Albany County in 1929, there were 10 stock farms as compared with 228 stock ranches. This relationship should vary but little for the area as a whole. Since the stock ranches so strongly predominate, the discussion that follows will pertain to that sub-type unless stated otherwise in the text.

The stock ranches are fairly well distributed over Area 3 considering its rough surface features. (Figure 30.) They consist of (1) strictly cattle ranches, (2) strictly sheep ranches, and (3) of ranches on which both cattle and sheep are handled. Taking the 228 stock ranches of Albany County as reported in the 1930 U. S. Census of Agriculture as a representative sample of the area, it may be said that the ranches varied widely in size in 1929 and averaged 4,916 acres per ranch. Of 228 ranches approximately 6 per cent contained less than 500 acres; 17 per cent varied in size from 500 to 1000 acres; 50 per cent from 1000
to 5000 acres; 14 per cent from 5000 to 10,000 acres and 11 per cent contained 10,000 acres or more.

The 228 ranches in 1929, contained an average of 4445 acres of grazing land, 341 acres of crop land (mostly meadow land), 39 acres of plowable pasture land, and 91 acres of other land. That year the 228 ranches received an average gross income of $8,442. Average receipts from the different sources were reported as follows: $7,030 from the sale of livestock on 221 ranches; $1,472 from livestock products on 159 ranches; $997 from crops on 73 ranches; $151 from forest products on 27 ranches; $274 from boarders, lodgers, and campers on 18 ranches; and $301 from ranch produced products used by the ranch family. Of the 228 ranches 33 were operated by full owners, 105 by part-owners, 31 by cash tenants, 8 by other tenants, and 9 by managers.

While there are a number of sheep ranches and a few combination sheep and cattle ranches in Area 3, the cattle ranches predominate and we are chiefly concerned here with the latter type. The cattle ranch headquarters are generally located in the valleys at varying altitudes where water and suitable land are available for producing hay and pasturage under irrigation. A well balanced ranch may be considered as one where the management has control of or access to sufficient spring, summer, and fall grazing land to carry enough cattle to consume the hay and pasturage produced at the ranch headquarters. Where these are out of balance, the grazing land being seriously deficient, and the operator receives the major portion of his gross receipts from selling hay to the operators of other ranches out of balance in the opposite direction, the farm may drop into the crop-specialty type. Or it may be a general farm, should less than 40 per cent of the gross income be derived from any one source.

In considering the operation of a cattle ranch in this area, the year may be divided into four seasons: Winter feeding, spring grazing, summer grazing, and fall grazing. While the winter feeding season varies in length from year to year, it usually begins during the latter part of November and closes from April 1 to May 15. In other words its duration is some 4 to 5 months. Its length is largely determined by the coming of sufficient snow in the fall to stop the grazing of the meadows and pasture land reserved for late use; how completely the snow mantle remains throughout the winter; how early in the spring the snow mantle disappears; and by the altitude at which the headquarters of a particular ranch may be located.

The cattle are wintered at the ranch headquarters. On most ranches the herd is handled as a unit. When this is the case the cattle are all fed together once a day. The feeding consists of hauling the hay from the stacks and scattering it over the mead-
ows sufficiently to enable all cattle to feed. The hay is usually stacked in comparatively small ricks at convenient points on the meadow so that it is necessary to haul the hay but short distances. In feeding most operators aim to cover the entire meadow so that the manure will be well distributed. In order that the manure may still be more evenly distributed, the meadows are harrowed with a heavy drag in the spring after the cattle have been removed to the grazing range. The amount of hay required to winter a mature cow varies with the length and severity of the winter and the location of the individual ranch with respect to altitude and topography. The amount ranges from about three-fourths of a ton to two tons. One and one-third tons are probably a fair average.

There are exceptions to the above feeding program. Some operators make a practice of fitting the older steers for slaughter while others fit the best of their young stock for the fall and winter stock shows. In either case it is necessary to separate such animals from the main herd and to feed more liberally. The thin cows and two-year-old heifers that are producing calves are frequently given extra feed just before and during the calving season. The bulls, on some ranches, are given extra feed also to prepare them for the approaching breeding season. The bulls and cows with calves are usually fed until around May 1 while the feeding of the balance of the herd generally ceases about April 1.

The cattle summer in most cases on the Medicine Bow National Forest and other parts of Area 3 at high altitudes where the grazing season begins around June 1. One of the major problems of ranch operators is to provide sufficient spring grazing to carry their cattle from the closing of the winter feeding season to the opening of the summer range; that is, for about two months. The foothill range land lying below the summer range is used for this purpose but does not, as a rule, produce sufficient forage for the number of cattle that can be either wintered or summer grazed. This condition, in many cases, makes it necessary to graze the meadow lands late in the spring. The close cropping and trampling of the cattle at this time of the year is detrimental to the meadows and tends to materially reduce the quantity of hay produced. This situation, in turn, tends to cause an over-stocking of the foothill and other open spring range.

The urge, therefore, is to get the cattle onto the summer range as early as possible. However, in order to secure the maximum production of forage on the summer range, grazing cannot be started until the growth of the forage plants is well along. The forest supervisors, therefore, set the date at which cattle can go onto the national forests. Those sections having the lower altitudes or which receive the lightest snowfall are generally available first.
As a rule, the cattle are placed on the summer range about June 1. If the National Forest is used as the summer range, each ranch operator is allotted a definite area to which he takes his cattle each year over definite driveways set aside for that purpose. From 7 to 10 pounds of salt per animal are generally placed at the designated salt grounds which are selected with a view of keeping the cattle scattered. The bulls—about one to each 25 cows—are placed with the herd about July 1. In order to obtain a large calf crop, it is essential that bulls be kept well distributed among the scattered cows of the herd during the breeding season. Either the operator or hired riders look after the herd during the summer.

Hay harvest occurs while the cattle are on the summer range, usually between August 1 and September 15. A large part of the hay fed in this area is wild or native hay. It is composed mostly of wire grass (Juncus balticus) and nut grass (Carex sp.) Some meadows are a mixture of the wild grasses and tame grasses and clover. The yield is about one ton per acre. A haying crew usually consists of three men on mowers, two men on sulky rakes, three men on sweeps, one man at the stacker and two men on the stack. The pole slide stackers are almost universally used. A haying crew of this type can put up from 20 to 25 tons of hay per day.

The cattle remain on the summer range from 100 to 145 days. When cold weather sets in and snow begins to fall, the cattle drift to the lower levels of their own accord. This makes it necessary to hold the roundup not later than during the first half of October.

The sale of cattle may occur any time between August and the end of the year. The bulk of the sales are made, however, soon after the cattle are rounded up in October. During the roundup, market cattle are separated from the main herd that is to be carried through the winter. Some operators make a practice of grazing their market cattle for a couple of weeks on pasture especially reserved for that purpose. Following the roundup the main herd grazes the foothills, the meadows, and the irrigated pastures until snow or cold weather makes it necessary to begin feeding hay.

The management of the sheep ranches located in Area 3 is very similar to those described in Area 1. There is, however, less free public range than in Area 1, which makes for a larger investment in land. The carrying capacity of the range in Area 3 is greater than that of Area 1. Sheep operators in Area 3 provide considerably more supplementary feed as an assurance against bad weather than do those of the typical winter range sheep outfits to the west. Cottonseed cake is usually preferred as supplementary feed in this area whereas corn is generally used in the Red Desert.
These preferences may be explained, in part at least, by assuming that the cottonseed cake, which is high in protein, adds the needed supplement to a range where grass predominates, while corn more nearly balances the forage of the salt sage range which has a rather high protein content.

**Area 4. The Cheyenne Plains**

**Description**

Area 4 is located in the southeastern part of Wyoming between type-of-farming areas 3 and 10. It includes about 40 percent of Laramie County and a very small portion of the southern parts of Platte and Goshen counties, or a total of approximately 748,000 acres. It lies directly east of the Laramie Mountains and is the beginning of the Great Plains province in southeastern Wyoming.

The surface of Area 4, for the most part, is a rolling to fairly level plain that slopes to the east and lies at elevations ranging from about 5000 to 6500 feet. The more rolling portion is the beginning of the foothills of the Laramie Mountains. The area is drained by a number of small streams which flow to the east, some of them emptying into the North Platte River and others into the South Platte River. These streams furnish water for a limited amount of irrigation within their narrow, shallow stream valleys.

**Climate**

Area 4 has a variable climate that no doubt has been the dominant factor in shaping its agriculture. The extremes in temperature that have been recorded at Cheyenne, range from as low as —38° to as high as 100 degrees F. However, temperatures above 95 degrees rarely occur. The area is subject to considerable wind and velocities of 48 miles or more per hour have been recorded at Cheyenne every month in the year, the mean annual movement being about 11.2 miles. The relative humidity is low and the average length of the frost-free period in different parts of the area varies from about 104 to 130 days. The high prevailing day temperature during the summer months, the almost constant movement of the atmosphere, and its low relative humidity together cause a fairly high evaporation of soil moisture. The seasonal evaporation, that occurring from April to September inclusive, from a free-water surface at the Archer Field Station 8 miles east of Cheyenne averaged 37.12 inches during a 22-year period.

Area 4 forms a part of the low rainfall belt of the Great Plains Province and the mean annual precipitation in different parts of the area ranges from a low of about 13 inches to a high of 16 inches. The annual precipitation also varies greatly from
year to year. (Figure 7.) For example, the range for Cheyenne is from a minimum of 5.04 inches in 1876 to a maximum of 22.68 inches in 1905. While about 78 per cent of the annual precipitation falls from April to September inclusive, its monthly distribution during this period is very irregular. Considerable moisture is lost as surface runoff during thunder showers that occasionally occur during the summer months. The irregularity in the amount of the annual precipitation and its monthly distribution result in a wide variation in the quantity of grazing forage produced from year to year. These irregularities and the scant mean annual precipitation makes dry farming uncertain and hazardous.

Soils

Area 4 has been differentiated into four grades of land: grazing land, second- and third-grade dry farming land, and irrigated land. About three-fourths of the area is grazing land. The third-grade dry farming ranks second in acreage, the most of which is used for grazing purposes. There are but a few relatively small areas of second-grade land. The irrigated land is confined to narrow strips along the streams and makes up less than 2 per cent of the total area.

The soils vary from a fine-grained granitic gravel along the western border of the area, to sandy and clay loams elsewhere. The better soils of the eastern half of the area as well as those along the creek bottoms, are fairly productive when the rainfall is adequate or when irrigation water is applied.

Vegetation

The vegetative cover is a short grass association that varies considerably from locality to locality as soil and growing conditions vary. Mixed growths of grama, wheat grass, and June grass are generally to be found on the good loam soils of the gently rolling to level plains. On sandy soils there is considerable nigger wool (Carex filifolia), and needle grass is abundant on sandy loam soils. The carrying capacity of the grass lands varies from about 20 to 60 head of cattle per square mile during the grazing season.

Crops

The crops produced in this area are chiefly those associated with beef cattle production and consist mostly of hay and feed grains. While some alfalfa and tame grasses and clovers are grown for hay, the bulk of the hay crop consists of wild grasses (sedges and wire grass). The feed grains are mostly corn and barley. The eastern part of the area supports an occasional dry farm on which the principal crops are wheat, barley, corn, and potatoes.
Livestock

The production of beef cattle dominates the agriculture of Area 4. However there are a few flocks of range sheep, mostly on the western side of the area. The dairy cattle are mainly concentrated about the city of Cheyenne. Poultry is restricted very closely to ranch and farm flocks and hogs are largely grown for home and local use.

Types of Farming

The farms located within Area 4 have been grouped into eleven types. Stock farms and ranches in 1929 made up about 52 per cent of the total number; general farms, 12 per cent; part-time, 11; dairy, 9; cash-grain, 5; crop-specialty and unclassified, 3 each; poultry, 2; and self-sufficing, 1 per cent. No other type made up as much as one per cent. The dairy and part-time farms are concentrated about the city of Cheyenne where there is a market for fluid milk and where the operators of small farms have an opportunity to obtain part-time employment away from the farm.

The Dominant Type.—Cattle ranches are easily the dominant type in Area 4 (figure 38) and within its borders are some of the oldest ranches in the State. The grazing lands of the area are practically all fenced and held in private ownership. This makes it necessary for each operator to control by lease or ownership, all the land he uses. The ranches vary in size from less than 500 to more than 10,000 acres. Around 55 per cent of them range in size from 1,000 to 5,000 acres and about 13 per cent are 10,000 acres or more in size. In comparing areas 3 and 4, it may be said that in Area 4 the snowfall is not so heavy; that the snow-mantle covers the ground less continuously during the winter; that more winter grazing can be done, and that about half as much hay is required to carry cattle through the winter.

The organization and management practices of the cattle ranches in Area 4 are very similar to those outlined for Area 8. The ranch headquarters are generally located along the streams that cross the area from west to east, and where hay may be grown under irrigation or sub-irrigation. As in Area 3 the meadows are pastured after the hay crop has been removed.

Most ranch operators aim to market their steers when two and three years old. During drouth years this is not always possible. The drouth may so seriously curtail the feed on the summer ranges as to force the operators to summer graze the range reserved for late fall and winter use. This in turn reduces the supply of winter forage and forces a reduction in the size of the herd. Practically all cattle marketed from this area go as feeders.
AREA 5. WESTCENTRAL WYOMING MOUNTAINS AND ASSOCIATED VALLEYS

Description

Type-of-farming Area 5 occupies the mountainous parts of westcentral Wyoming. It includes all of Teton County and parts of Fremont, Sublette, Lincoln, Uinta, and Sweetwater counties, and ranks third in size among the 17 type-of-farming areas of the State. Its total land area approximates 8,720,000 acres.

Area 5 lies at elevations varying from about 6000 feet at points in Fremont and Lincoln counties to more than 13,000 feet on several of the higher peaks along the Continental Divide which crosses the area from northwest to southeast as the boundary line between Fremont and Sublette counties.

The surface of the area, in general, is rough and rugged. The crests of the sharp Absaroka and Owl Creek ranges form much of its northern boundary and within its borders lie a half-dozen more or less rugged mountain ranges, namely, the Wind River, Teton, Snake River, Gros Ventre, Salt River, and the Bear River ranges.

West of the Continental Divide Area 5 is drained by Green River which flows south into the Colorado River; by Bear River which flows north out of the Uinta Mountains, cutting across the Wyoming-Utah and the Wyoming-Idaho boundaries and eventually emptying into Great Salt Lake; and by Snake River which flows west out of Lincoln County, and empties into the Columbia River. East of the Great Divide the northern part of Area 5 is drained by Big Wind River which flows first in a southeasterly direction and then swings almost directly north where it becomes the Big Horn River. The southern part is drained by the Sweetwater River, a tributary of the North Platte.

Climate

The high elevations and rough mountainous topographical features of the area give it a rigorous climate. Snows and freezing weather may occur at any time during the year on the high mountain ranges. In the valleys the winters are relatively long and cold and the summers short. For example the frost-free period averages 43 days at Moran in Teton County, 62 days at Pinedale in Sublette County, 69 days at Dubois in Fremont County, 73 days at Cokeville in Lincoln County, and 86 days at Evanston in Uinta County.

The mean annual precipitation of the area varies from a minimum of about 10 inches in parts of Fremont, Sublette, Lincoln, and Uinta counties to as much as 30 inches or more on some of the high mountain ranges, the upper limits being unknown for
want of weather observation stations. Over a period of time the annual precipitation may vary above or below the mean from year to year as much as 50 per cent. (See the data presented in figure 7 for Evanston, Border, and Lander.) Approximately half of the annual precipitation falls between April and September inclusive as compared with 70 to 75 per cent in the eastern part of the State. Practically the whole area receives a heavy snowfall and this in turn tends to make the supply of irrigation water within the area reasonably certain. The heavy snowfall also tends to make the winter feeding season long and continuous. Much of the moisture that falls during the summer is lost either by evaporation or surface run-off. The moisture that falls as snow during the winter and spring is most beneficial to the growth of range forage. However, late spring and early summer rains are also very essential.

Soils

The lands lying within Area 5 may be roughly classified as follows: Some 4,686,000 acres lie within the boundaries of the national forests and 96,000 acres are occupied by the Grand Teton National Park. Around 3,559,000 acres have been classified as grazing land, about 350,000 acres as irrigated land and some 29,000 acres as dry farming land. Approximately 1,000,000 acres lying within Teton and Fremont counties have been closed to domestic livestock grazing. These closed areas are either densely timbered, rough and precipitous, or are reserved for wildlife.

About 55 per cent of the irrigated land is in Sublette County and the major portion of the dry farming land is confined to the foothills adjacent to Bear River and Salt River in Lincoln County.

This area is substantially covered by the mountain group of soils which may be divided into two sub-groups: The timbered and the grass land soils. The timbered soils are generally grayish brown loams or sandy loams which occupy the rough and rolling areas. The grass land soils are darker in color and less stony than the timbered soils. They occupy the valleys, basins, and the smoother undulating ridges.

Vegetation

The vegetative cover of Area 5 is very similar to that of Area 3. Since the area has a range of nearly 8,000 feet in elevation, the variation in the vegetative cover is rather striking. At one extreme are the Arctic-Alpine grasses and sedges which grow above timberline on the high mountain peaks and ranges where there is sufficient soil for plant growth. Such areas are grazed by mountain sheep and to some extent by elk. At the other extreme are the grasses, common sagebrush, salt-sages, winterfat, and
other semi-arid plants which occupy the foothills and valleys at the lower altitudes. Much of the area which lies in between the two extremes is covered with mountain brush or with forests of spruce (Picea Engelmanni), fir (Pseudotsuga mucronata), lodgepole pine (Pinus Murrayana), and aspen (Populus tremuloides) with grasses, flowers, and weeds interspread among the brush and timber and occupying the open spaces and parks. The flowers and weeds provide a considerable portion of the forage for sheep on the summer range. Some of the timbered areas have little or no value for grazing because of the density of the forests.

Crops

Practically all crops produced within Area 5 are grown under irrigation and are used to supplement the spring and fall range forage and to carry the cattle of the area through the winter. Hay makes up 98 per cent or more of the total acreage of crops harvested. In the high mountain valleys the hay crop is made up of wild grasses (chiefly rushes and sedges) and of the tame grasses and clovers. The meadows that receive an abundance of irrigation water, as is frequently the case, generally produce a hay crop that consists chiefly of rushes and sedges. On fairly well drained soils the tame grasses and clovers are increasing and at the lower altitudes alfalfa is generally the leading hay crop. Limited amounts of the small grains are produced by dry farming methods on the hills adjacent to Bear and Salt River valleys in Lincoln County.

Livestock

Area 5 is well adapted to the production of range cattle and the summer grazing of sheep. While the cattle predominate, sheep are of considerable importance. The cattle are generally kept within the area the year round whereas the sheep are winter grazed in Area 1 and summer grazed in Area 5.

Since a substantial portion of Area 5 as well as parts of Area 2 has been reserved for use of wild life, the game animals are of considerable importance in-as-much as they reduce the numbers of cattle and sheep that might be carried during the grazing season. It may be said, however, that the game animals also attract many tourists and hunters and otherwise influence the organization of recreational ranching.

The exact number of the different game animals within the area is not known. A fairly reliable idea of their importance is indicated, however, by the data for four counties presented in the accompanying table. There are but few antelope in Area 5.
TABLE 9

Game animals: Estimated number in four counties, Wyoming, 1927.

<table>
<thead>
<tr>
<th>County</th>
<th>Moose</th>
<th>Elk</th>
<th>Mountain Sheep</th>
<th>Deer</th>
<th>Bear</th>
<th>Antelope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teton</td>
<td>3,200</td>
<td>20,000</td>
<td>675</td>
<td>750</td>
<td>650</td>
<td>....</td>
</tr>
<tr>
<td>Fremont</td>
<td>65</td>
<td>1,900</td>
<td>380</td>
<td>2,500</td>
<td>75</td>
<td>3,800</td>
</tr>
<tr>
<td>Sublette</td>
<td>125</td>
<td>1,100</td>
<td>230</td>
<td>550</td>
<td>85</td>
<td>475</td>
</tr>
<tr>
<td>Lincoln</td>
<td>75</td>
<td>1,400</td>
<td>....</td>
<td>300</td>
<td>30</td>
<td>1,400</td>
</tr>
<tr>
<td>Total</td>
<td>3,165</td>
<td>24,400</td>
<td>1,285</td>
<td>4,100</td>
<td>840</td>
<td>5,675</td>
</tr>
</tbody>
</table>

Compiled from Wyoming Agricultural Statistics, Number 7, Page 21.

Types of Farming

While a dozen or more types of farming are to be found within the borders of Area 5, the stock farms and ranches are of prime importance. (Table 8 and figures 30 to 36.) This is chiefly due to the rough topographical features of the area, to its mountainous climate and soil conditions, to its isolation and lack of railroad transportation facilities.

Of the total number of farms within the area in 1929, approximately half was made up of stock farms and ranches. Named in the order of their numerical importance, the following types formed the other half: Crop-specialty, general, part-time, self-sufficing, dairy, boarder and lodger, cash-grain, unclassified, country estate or institutional, poultry, horse farms or feed lots, and truck farms. Of the types listed, crop-specialty farms are second in importance but should be considered a part of the cattle industry of the area. The special crop grown on the crop-specialty farms is hay which is generally sold to neighboring ranchmen who feed it to cattle. In addition to the income from the sale of hay, a considerable part of the gross receipts on the crop-specialty farms usually comes from livestock. Hence the close connection between these farms and the cattle industry.

While not important numerically, the boarder-lodger type is of growing interest. The farms of this type generally combine the production of livestock and the entertainment of summer vacationists who come from the more thickly populated areas of the East. These ranches are generally located in the high mountain valleys where hunting, fishing, and other recreational activities can be related to livestock production. They are usually equipped with automobiles, pack and saddle horses, camp outfits, and facilities for housing, boarding, and entertaining their summer guests, many of whom return year after year. The State University now offers a four-year course in recreational ranching.
The Dominant Type.—The stock farms and ranches, it has been shown, are the dominant type in Area 5. The crop-specialty farms follow as the second dominant type. (Figures 38 and 39.) The strictly stock ranches make up about 87 per cent of the dominant type and the stock farms 10 per cent.

The stock ranches vary greatly in size within the area. Approximately 31 per cent contained less than 300 acres in 1929, 24 per cent ranged in size between 300 and 999 acres, 36 per cent between 1000 and 4999 acres, and 4 per cent contained 10,000 acres or more per ranch. The average size also varied considerable in the respective counties making up the area. For example they averaged 463 acres per ranch in Teton County; 1690 acres in Uinta County; 1775 acres in Sublette County; 2383 acres in Lincoln County; 5031 acres in Fremont County; and 2583 acres in the five counties.

Most of the stock farms and ranches having headquarters within the area carry only cattle. A few of them carry only sheep, and a small number carry both sheep and cattle. Most of the outfits which summer graze their sheep on the national forests of Area 5 have their headquarters outside the area, mostly in Area 1. In fact many of the flocks summer grazed in Area 5 are not related to any ranch or ranch headquarters. The sheepmen simply establish their residences or headquarters at convenient points for managing their flocks and depend largely on year-round grazing and the buying of the necessary supplemental feeds. A few of them produce a limited amount of hay.

The beef cattle of this area are quite generally summer grazed on the national forests under a system of permits or on the tribal lands of the Shoshone Indian reservation leased from the Indian Agency. They are spring and fall grazed in the foothills and on the irrigated pastures and meadows of the home ranches and wintered on hay at the ranch headquarters. It should be understood also that the operators of a number of stock farms located in Area 14 and 17 summer graze their cattle in Area 5 and winter them at their ranch headquarters.

A detailed discussion of the organization and operation practices of cattle ranches is given in the description of Area 3. Such a discussion for Area 5 is omitted because of the similarity of the cattle ranches in the two areas. In like manner the description of the management of the flocks of sheep wintered in Area 1 will suffice for the management of the flocks summer grazed in Area 5. In many cases, in fact, they are the same flocks. That is to say, they are winter grazed in Area 1 and summer grazed in Area 5.
AREA 6. THE EASTERN SLOPE OF THE BIG HORN MOUNTAINS

Description

As its name implies, Area 6 includes practically all of the eastern slope of the Big Horn Mountains in northcentral Wyoming. It likewise includes the major portions of Sheridan and Johnson counties. Enclosed within its borders are approximately 3,700,000 acres of which 728,000 acres are included in the Big Horn National Forest. While it is essentially a range livestock area, there is also considerable cash-crop farming. As a livestock area it may be considered self-sufficing. That is, there is very little transferring of livestock across its boundary lines for either summer or winter grazing and very little feed is shipped into the area except cottonseed cake.

Area 6 presents a range in elevation of about 9,500 feet. The minimum is approximately 3,650 feet in the northeastern part of the area where Clear Creek flows across the boundary line into Area 8, whereas the maximum is 13,165 feet at the summit of Cloud Peak near the middle of the western boundary. The general slope of the area is to the east and to the northeast.

The surface features vary from rolling and more or less broken uplands and rather narrow and smoothly sloping stream valleys in the eastern part of the area to the high rough mountainous topography of the western portion. Between these two extremes are the rolling to rough foothills which parallel the Big Horn Range. While the slope of the eastern part of the Big Horn Range is quite steep and in places precipitous, the interior of the mountainous area consists, for the most part, of undulating plateaus and ridges with here and there rocky knolls and peaks. In the southern third of the Big Horn Range, the elevation drops off quite perceptibly and this portion of the mountains consists mostly of undulating grass lands with trees occurring only in patches on the rocky and shallow soil areas. The northern two-thirds of the Big Horn Range is rougher and more generally timbered. Interspersed here and there within the timbered areas are open grassy parks and mountain meadows which furnish excellent summer grazing for sheep and cattle.

The high mountain plateaus and hilly areas are generally dissected by deep narrow drainage channels from which numerous streams flow to the east and northeast across the area. Named from north to south the more important of these streams are as follows: Tongue River, Big and Little Goose creeks, Prairie-dog Creek, Piney Creek, Clear Creek, Crazy Woman Creek, and Powder River. These streams and their many fingerlike tributaries furnish water both for livestock and for the production of hay and grain feed crops under irrigation. Very little storage
facilities have been developed and, in general, the irrigation water is taken direct from the streams as used. During seasons when the flow of the streams is normal, the supply of water is fairly adequate for the land under irrigation. During severe drouthy years, such as 1934 and 1936, the supply, under present storage facilities, is inadequate which results in a material reduction in crop production. The supply of water could be stabilized and the irrigated area increased considerably by the construction of a system of reservoirs to impound the flood waters and the flow of the streams during late fall, winter, and early spring. The livestock industry, especially the cattle business, is intimately related to these streams and along them practically all ranch headquarters are located.

The Chicago, Burlington and Quincy Railroad passes through the northeastern corner of the area and the Wyoming Railway extends from Buffalo to Clearmont on the Burlington Line in Sheridan County. Buffalo is located near the center of the area. An oiled surface highway (U. S. 87) passes through the area from north to south and U. S. Highways 14 and 16 cross it from east to west.

**Climate**

The climate varies greatly between the lower and upper altitudes. For example, the frost-free growing season averaged 112 days at the weather station near Buffalo for a 25-year period and 125 days at Sheridan near the northcentral part of the area for a 28-year period. At the other extreme is the Arctic-Alpine climate on the summits of the highest peaks and ridges of the Big Horn Mountains where freezing temperatures may be expected at any time during the summer. Climate limits the grazing of the western part of Area 6 to the summer months, while much of the eastern part can be grazed during either summer or winter.

The annual precipitation likewise varies greatly within the borders of the area. While the upper and lower limits cannot be stated with precision, the range of the mean is from about 11 inches along the central part of the eastern border of the area to around 30 inches on the crest of the Big Horn Mountains. The mean annual precipitation at Buffalo, the county seat of Johnson County, was 12.6 inches for a period of 32 years. Of this amount an average of 72.5 per cent fell between April and September inclusive. That is, an average of about 9.1 inches fell from April to September. Owing to the torrential rains which occur, part of the spring and summer rainfall is lost as surface run-off.

The winter precipitation generally falls as dry snow, which, in the eastern part of the area, seldom covers the surface of the ground for but short periods at a time. This is due to the drifting
of the snow by the wind. In turn, this makes it possible to do considerable winter grazing along the eastern border of the area, provided, of course, there is forage to be grazed. Drouthy years, grasshopper infestations, overstocking of the range and severe winters may reduce winter grazing to a minimum. The winter snowfall in the mountains has much to do with the supply of water during the irrigation season.

Soils

The land contained in Area 6 has been classified as irrigated land second- and third-grade dry farming land, grazing land and land lying within the Big Horn National Forest.

As might be expected from its varied physiographic features, Area 6 presents a wide variation in soil types and soil conditions. These have been briefly characterized as follows:

"The granites of the Big Horn Range have produced friable brown soils with gravelly subsoils. They are neutral to acid in reaction. Where grass vegetation has predominated, they are dark brown to black in color and rich in organic matter and nitrogen.

"Glaciation of the mountain range has produced extensive bench lands with gravelly and stony subsoils. Erosion has left many of these old benches as high level topped mesas or ridges between the creek valleys. Most of these gravelly soils have a distinct lime accumulation horizon at 8 to 14 inches below the surface.

"Uplifted shales (from the mountains eastward) have produced, through weathering, heavy clay loam and clay soils of gray to nearly black color. In the moist valleys near the mountains, these soils are dark brown to black and contain considerable amounts of organic matter.

"Sandstones have produced light brown, deeply weathered, sandy loam and loam soils which make good dry farm soils where the subsoil is heavy and compact, giving good water holding capacity.

"Red soils have developed on red sandstones of the Pennsylvanian and Permian beds close to the mountain range. These are found near Barnum. Other red soils have developed on the DeSmet clinker beds, which are shales burned red by the burning of beds of coal interlaid with shales. These soils are extensive in several townships, running from Piney Creek, surrounding Lake DeSmet to Crazy Woman Creek. The area begins about 3 miles directly east of Buffalo.

1Soil Survey of Johnson County, Wyoming (Unpublished, 1936) by T. J. Dunnewald, Orel Tikkaner and Wesley Roath, University of Wyoming.
"Marine shales near Kaycee and close to the mountains have contributed much soluble salt to the drainage water and alkali soils have developed upon them. The salt has been carried down the valleys and produced greasewood flats and heavy alkali soils on some of the valley flats and slopes."

Vegetation

The vegetation of the eastern part of Area 6 is typical of the arid portion of the Great Plains. The most common grasses are grama grass and western wheat grass with needle grass and June grass of secondary importance on the lighter soils. The salt sages and winter fat also furnish considerable feed. Black or common sage brush, rabbit brush and prickly pear (Opuntia sp.) are generally to be found. Greasewood is common on the flats and benches where alkali salts impregnate the soils. The tree growth consists almost entirely of cottonwoods along the streams. In the mountainous portion of the area a sagebrush, grass and weed type of vegetation is generally found on the lower slopes and plateau areas and a timber-underbrush type on the upper slopes.

Crops

Crops are grown in Area 6 both with and without irrigation. The acreages of the respective crops cannot be stated definitely. Roughly estimated the total harvested acreage of irrigated crops in 1929 was around 64,000 acres and of the non-irrigated or dry land crops about 70,000 acres. Of the total harvested acreage of irrigated crops that year, about 70 per cent was hay, around 27 per cent consisted of the small grains, corn and flax, and some 3 per cent was made up of miscellaneous crops. Wheat, oats, and barley are the leading grain crops grown with irrigation, corn, rye, emmer, and flax being of minor importance. Alfalfa ranks very high in this area as an irrigated hay crop and represented, in 1929, from 85 to 90 per cent of the harvested hay acreage. The tame grasses and clovers were the second most important hay crop, the wild grasses being third and the small grains fourth.

The harvested acreage of the dry land crops produced within the area in 1929 also consisted mostly of grain and hay, about 53 per cent being grain, 42 per cent hay and 5 per cent miscellaneous crops. Wheat is the leading grain crop and in 1929 formed about 54 per cent of all the grain crops harvested. Barley made up about 17 per cent, and corn and oats 13 per cent each. Of the dry land hay crops, alfalfa constituted about 51 per cent of the harvested acreage; the wild grasses, 28; the small grains, 10; and the tame grasses and clovers, 11 per cent.
The hay and the oats, barley and corn are mostly fed on the farms where grown or in the immediate vicinity. A surplus of alfalfa hay is generally grown in the southeastern part of the area in the vicinity of Sussex, the surplus being baled and transported by trucks to outside markets. Most of the wheat which is produced mostly in the northcentral part of the area is sold on the general market.

**Livestock**

The livestock of the area consists mostly of range beef cattle and sheep, sheep predominating in the southern part of the area. There are sufficient horses to do the ranch work and to serve as saddle horses. There is one creamery located at Buffalo. The poultry consists mostly of chickens and turkeys. The chickens are restricted almost entirely to small farm and ranch flocks. Within the area are a few extensive turkey producers and about 5 car loads were shipped to outside markets each year during 1934 and 1935. Only a very few hogs are produced.

**Types of Farming**

The 872 farms and ranches located in Area 6 in 1929 have been grouped into a dozen types. Of the total number 43 per cent was stock farms and ranches. General farms made up 18 per cent; crop-specialty, 9; part-time and unclassified, 4 each; dairy and self-sufficing, 3 each; and poultry, truck, and some of the abnormal types made up the remaining 4 per cent. The general and the crop-specialty farms, and to some extent the cash-grain farms also, are generally very closely related to the range livestock industry. In most cases a considerable part of the gross income of these farms is derived from the sale of livestock and livestock products. Furthermore, most of the hay and considerable of the grain produced and sold on these farms is usually purchased by ranchmen, who, in turn, feed it to livestock. Thus they form an important part of the livestock industry as a whole. The abnormal farms as mentioned above consisted of six boarder-lodger farms, one country estate or institutional farm, two farms that received 40 per cent or more of their gross income from the sale of forest products, and two horse or fed lot farms.

The Dominant Type.—The production of range cattle and sheep is the predominating agricultural enterprise in Area 6. The stock ranches formed 75 per cent of the dominant type and the stock farms 25 per cent. The dominant type may be further divided into cattle ranches, sheep ranches, and ranches that handle both sheep and cattle.
The beef cattle of this area are handled in much the same way as are the cattle of Area 3. The bulk of them are summer grazed on the Big Horn National Forest for about 120 to 125 days. Around the first of October they are returned to the foothill and plains portion of the area where they graze until in December. The winter feeding season usually begins about the 25th of December and closes around April 1, at which time the cattle go to the spring range. Considerable winter grazing can be done during most winters. The average amount of hay required to winter a mature cow varies from about \( \frac{1}{2} \) to 1 ton. In this area it is necessary for each ranchman to own or control by lease practically all of the land he uses. The cattle marketed usually consists of yearling steers and heifers, two-year old steers and dry and culled cows.

The sheep belonging in this area are handled in much the same manner as those of Area 1. They are summer grazed in the Big Horn Mountains and are trailed to the winter range in the eastern part of the area or into Area 1. The supplementary winter and early spring feeding and the management of the flocks corresponds closely to the practices and methods followed in Area 1.

AREA 7. THE GREEN AND FERRIS MOUNTAINS CATTLE RANGE

Description

Area 7 is situated in southcentral Wyoming. More specifically it is located in the southeastern part of Fremont County, the southwestern part of Natrona County, and the northwestern part of Carbon County. It is completely surrounded by type of farming Area 1. (Figure 37.) As its name implies, it embraces both the Green and Ferris mountains which extend from west to east parallel to and just south of Sweetwater River. It also includes a belt of the plain surrounding the mountains and which varies in width from 5 to 10 or 12 miles. This belt includes the Sweetwater River valley to the north of the mountains where most of the ranch headquarters are located and where the bulk of the hay is grown for wintering the beef cattle of the area.

The mountains rise to a maximum height of about 9,500 feet or some 1,500 to 2,500 feet above the surrounding plain. The mountains constitute the chief part of the summer range of the area, and the belt of the plain and foothills surrounding the mountains and the irrigated and sub-irrigated meadow and pasture lands along the Sweetwater River are used for late fall and early spring grazing and, to a limited extent also, for summer grazing. The summer grazing of the plain is essentially limited by the distance that cattle can go for water.
The surface features of the plains portion of Area 7 are very similar, in general, to those of Area 1 except that near the mountains the plain rapidly blends into foothills, which are not extensive. The mountains, in most places and especially on their north side, rise quite abruptly from the plain. These mountains are only partly timbered.

The description of the climate given for Area 1 will suffice for that of Area 7 with the exception that the mountainous portion generally receives sufficient snow to prevent winter grazing. The mountain type of soils prevail in the higher elevations. The plains portion of the area has soils that are similar to the surrounding plain as a whole. (See soil description for Area 1.) The soils of the irrigated land along Sweetwater River and its tributaries having their source in the Green and Ferris mountains vary from alluvial sand and sandy loam to clay loam and clay. In places granitic gravel is quite prevalent.

Crops

The crops grown in Area 7 consist almost entirely of hay which is used mostly to carry beef cattle through the winter. Approximately 85 per cent of the hay crop is alfalfa and 15 per cent wild hay. These two were the only crops with sufficient harvested acreage in 1929 to justify the placing of dots within Area 7 in making figures 13 to 23 inclusive.

Livestock

Beef cattle strongly predominated in 1929. However, there were some sheep. The dairy cattle, poultry and hogs were restricted almost entirely to the needs of the local farms and ranches.

Types of Farming

Out of 84 farms located in Area 7, in 1929, 60 were classified as stock farms and ranches. The Census schedules of 11 farms were so incomplete that they could not be classified. Of the total number of farms, 5 were part-time, 3 were general, 2 were crop-specialty, 2 were self-sufficing, and 1 was cash-grain. Thus, it is seen, the stock farms and ranches were the dominant type in 1929, making up 72 per cent of the total number. The stock ranches of this area may be considered as a combination of the prairie ranches of areas 4 and 8 and the mountain ranches of areas 2, 3, and 5. The crop-specialty farms may be considered as farms having sufficient surplus hay to sell to give them 40 per cent or more of their gross income from that crop. In this area the farmers and ranchmen very generally own or lease all the land they use except the summer mountain range, which, for the most part, is public domain.
AREA 8. NORTHEASTERN WYOMING GREAT PLAINS

Description

Area 8 is situated in the northeastern part of Wyoming. It includes all of Campbell County and parts of Sheridan, Johnson, Converse, Niobrara, Weston, and Crook counties. (Figure 37.) It is the second largest of the 17 type of farming areas into which the State has been divided in this study and lies entirely within the Great Plains province.

In general the area may be described as a high undulating to rough upland plateau that, in places, is deeply dissected into rough breaks. The general slope is to the north, to the northeast and to the east. The area is mostly drained by four rivers and their tributaries: namely, the Powder River which flows to the north, the Little Missouri and the Belle Fourche rivers which flow to the northeast, and the Cheyenne River which flows eastwardly. In the spring of the year or after heavy rains the flow of these streams may be considerable. During the late summer, however, some of them become quite shallow and near their sources may be dry for short periods. In this respect they are quite different from the streams which have their source in the high mountains and which are fed by springs and melting snow throughout the summer.

The surface features of the area are very characteristic of other portions of the western Great Plains. The elevation varies from 3125 feet in the northeastern part of Crook County, where the Belle Fourche River crosses the State line into South Dakota, to around 6000 feet at the summits of Pumpkin Buttes in southwestern Campbell County. The surface of the plain along the western border of the area has been dissected into rough breaks by Powder River and its tributaries. In places, especially in the eastern part of Sheridan County, these breaks have the appearance of badlands. The undulating surface of the general plain is interrupted in the eastern part of Campbell County by a number of conspicuous sandstone escarpments which extend in a north-south direction. The four flat-topped Pumpkin Buttes which rise several hundred feet above the surrounding country, as well as numerous red cone-shaped hills (remnants of burned coal beds) in various parts of the area also break the monotony of the plain. That part of the area lying in Converse County consists mostly of a rolling plain broken more or less by sandstone hills and ridges; that part occupying the northern part of Niobrara County consists largely of a succession of ridges separated by rather wide valleys along the streams; and much of the area within Crook County is a high plateau that is deeply carved by narrow drainage channels.
After the Indians were placed on reservations about 1877, Area 8 was rapidly occupied by range livestock producers. Cattle were introduced first and sheep a few years later and for some thirty years the livestock industry held undisputed sway throughout the area. An influx of homesteaders began about 1912 and continued until 1925. Land settlement was given a considerable impetus by the passage of the 320 and 640 acre homestead acts and by the high prices of wheat that prevailed during and following the World War.

While some dry farming had been carried on prior to 1920, it began to expand about that time, reaching its culmination during the late twenties. This expansion was greatly stimulated by the introduction of the tractor, the combine harvester-thresher, the one-way Wheatland disk plow and the furrow drill. A slump in dry farming in Area 8 came during the early thirties as a result of the extremely low prices that prevailed at that time and also as a result of several drouthy years.

**Climate**

The climate of Area 8 is typical of the western part of the western Great Plains. As a rule there is a large amount of sunshine; a wide variation between day and night temperatures; fairly constant winds; a relatively low humidity; and a relatively high evaporation. The mean annual precipitation within the area varies from a low of about 11 inches along Powder River in Johnson County to a maximum of 18 to 20 inches in the northeastern corner of Crook County. That of southwestern part of the area is around 12 inches. (Figure 6.) The seasonal precipitation, that falling from April to September inclusive, averages from 64 to 74 per cent of the annual in different parts of the area. (Table 5.) The annual precipitation is quite variable from year to year and two or more drouthy years or two or more good rainfall years may occur in succession from time to time. (Figure 7.)

The effect of drouthy seasons on the use of land and on the production and yield of crops is illustrated by data for Campbell County presented in table 10. The year 1929 was a fairly normal crop year whereas a very severe drouth occurred in 1934. The acreage of crop land harvested in Campbell County in 1934 was less than one-third of that harvested in 1929; the acreage of crop failure was more than seven times as great in 1934 as in 1929; and the crop land that was fallowed or that lay idle in 1934 was 2.4 times as large as in 1929. Table 10 further indicates that approximately 10,000 acres of crop land were allowed to revert back to pasture and grazing between 1929 and 1934. All land in farms in Campbell County increased about 447,000 acres during the 5-year Census period 1929-1934 while at the same time crop land decreased within the county about 10,000 acres.
TABLE 10
Classification of land in farms, crop land harvested and yield per acre, Campbell County, Wyoming, 1929 and 1934. 
Classification of land in farms

<table>
<thead>
<tr>
<th>Item</th>
<th>1929</th>
<th>1934</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acres</td>
<td>Acres</td>
</tr>
<tr>
<td>Crop land:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crop land harvested</td>
<td>157,546</td>
<td>45,025</td>
</tr>
<tr>
<td>Crop failure</td>
<td>11,714</td>
<td>82,337</td>
</tr>
<tr>
<td>Idle or fallow land</td>
<td>22,538</td>
<td>55,082</td>
</tr>
<tr>
<td>Total crop land</td>
<td>192,098</td>
<td>182,344</td>
</tr>
<tr>
<td>Pasture grazing land</td>
<td>2,342,305</td>
<td>2,706,276</td>
</tr>
<tr>
<td>All other land in farms</td>
<td>26,552</td>
<td>18,880</td>
</tr>
<tr>
<td>All land in farms</td>
<td>2,560,755</td>
<td>2,907,500</td>
</tr>
</tbody>
</table>

Crop land harvested and yield per acre

<table>
<thead>
<tr>
<th>Crops</th>
<th>Harvested acreage</th>
<th>Yield per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1929</td>
<td>1934</td>
</tr>
<tr>
<td></td>
<td>Acres</td>
<td>Acres</td>
</tr>
<tr>
<td>Grain Crops:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winter Wheat</td>
<td>5,566</td>
<td>5,567</td>
</tr>
<tr>
<td>Spring Wheat</td>
<td>36,096</td>
<td>3,801</td>
</tr>
<tr>
<td>Oats</td>
<td>11,714</td>
<td>730</td>
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<tr>
<td>Barley</td>
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<tr>
<td>Rye</td>
<td>1,382</td>
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<tr>
<td>Corn for grain</td>
<td>9,369</td>
<td>1,577</td>
</tr>
<tr>
<td>Corn for all other purposes</td>
<td>18,833</td>
<td>3,757</td>
</tr>
<tr>
<td>Mixed Grains</td>
<td>982</td>
<td>20</td>
</tr>
<tr>
<td>Flax</td>
<td>7,307</td>
<td></td>
</tr>
<tr>
<td>Emmer</td>
<td>1,956</td>
<td></td>
</tr>
<tr>
<td>Total grain harvested</td>
<td>101,111</td>
<td>17,021</td>
</tr>
<tr>
<td>All hay and forage:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alfalfa</td>
<td>18,673</td>
<td>5,984</td>
</tr>
<tr>
<td>Timothy and clover</td>
<td>1,372</td>
<td></td>
</tr>
<tr>
<td>Other tame and wild grasses</td>
<td>20,830</td>
<td>12,491</td>
</tr>
<tr>
<td>Sweet and grain sorghums</td>
<td>89</td>
<td>138</td>
</tr>
<tr>
<td>Small grains</td>
<td>5,670</td>
<td>7,766</td>
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<tr>
<td>Sweet clover</td>
<td>60</td>
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</tr>
<tr>
<td>Total all hay and forage</td>
<td>46,640</td>
<td>26,439</td>
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<tr>
<td>Other crops:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potatoes</td>
<td>371</td>
<td>293</td>
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<tr>
<td>Alfalfa Seed</td>
<td>2,959</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous¹</td>
<td>6,465</td>
<td>1,372</td>
</tr>
<tr>
<td>Total all crops harvested</td>
<td>157,546</td>
<td>45,025</td>
</tr>
</tbody>
</table>

¹In relatively small acreages and not available for 1934.
Compiled from United States Census of Agriculture, 1930 and 1935.
Soils

The lands of Area 8 fall into four classes: Irrigated land, second-grade dry farming land, third-grade dry farming land, and grazing land. (Figure 9 and table 6.) The relative importance of the four classes of land can not be given for the area as a whole because the data are on a county basis and also because the area contains parts of six counties. The comparison is made, however, for Campbell County since it lies wholly within and is fairly typical of the area as a whole.

Of the total area of Campbell County (2,990,600 acres), only 600 acres were listed as irrigated; 83,000 acres were classified as second-grade dry farming land; 1,088,000 acres as third-grade dry farming land; and 1,819,000 as grazing land. In other words, about two-tenths of one per cent of the total area of the county was classified as irrigated land; less than 3 per cent as second-grade dry farming land; 36 per cent as third-grade land; and 61 per cent as grazing land.

The United States Census of Agriculture, 1930, gives 192,000 acres as the acreage of crop land in Campbell County in 1929. If it be assumed that all of the second-grade land was being used as crop land in 1929, it then follows that at least 108,000 acres of crop land that year consisted of either third-grade dry farming land or grazing land, or of the two grades together. It is probable that Campbell County will average a little better adapted to dry farming than will the area as a whole.

The soils of the area consist mainly of loams, sandy loams, clay loams, heavy clay and gumbo. The second-grade land is generally comparatively level or undulating and consists mostly of loams and sandy loams. The surface features of the third-grade land are usually rougher and less favorable to crop production than are those of the second-grade land. While the soils of the third-grade land may be of good texture, they are generally shallow, or they receive an average rainfall that is considered too scant for successful cash-crop farming. The soils of the grazing land, for the most part, consist of clay or gumbo or they may be stony. In general the soils of the area are low in organic matter. The content of alkali salts also is low. Some of the low and poorly drained flats, however, may contain considerable alkali.

Vegetation

The native vegetation on the loamy textured soils consists mostly of grama grass and western wheat grass intermixed more or less with June grass, needle grass, and other species. Sagebrush and western wheat grass are the dominant species on the clay soils. In some parts of the area at the present time (1937) cheat grass
(Bromus tectorum) has become quite prevalent. It is an annual, matures early and has but little forage value except during the early part of the grazing season, largely because of the stiff awns on the spikelets. The creek bottoms and other areas that are sub-irrigated usually produce timothy (Phleum pratense), red top (Agrostis alba), brome grass, (Bromus inermis) and clover (Trifolium sp.). Soils that are highly impregnated with alkali generally support a growth of greasewood. On the whole, very little forage is obtained from the salt sages. Cactus is quite prevalent in some local areas.

Crops

While crops are produced in Area 8 primarily to provide feed for livestock, the production of crops for sale has had an important place in the agriculture of some parts of the area during past years, particularly during the late twenties. The relative importance of the more important crops, the variation in the harvested acreage and the average yield per acre of each are indicated by the data given in table 10. While the information presented pertains specifically to Campbell County, it applies remarkably well to the several localities of the area where dry farming is practiced.

The crop data presented in table 10 are for two census years, 1929 and 1934. The former may be considered as a fairly good or average crop year, whereas the production of non-irrigated crops and range forage was seriously hampered during 1934 by a very severe drouth. Perhaps the most striking thing presented in the table is the greatly reduced harvested acreage and yield per acre of each of the several crops in 1934 as compared with production and yields in 1929. The reduction may be attributed almost entirely to the drouth of 1934. Winter wheat, spring wheat, and flax are the principal crops grown for sale. The other crops are mostly grown for feed. The feed crops, however, are sometimes sold.

It appears that dry farming has not been carried on long enough in Area 8 for the cultural practices to have become well stabilized. Hence, no very definite crop rotations or cropping systems are followed. Where corn is grown it is generally followed by a small grain crop. During comparatively late years there has been a tendency to increase the acreage of winter wheat and to decrease that of spring wheat. Likewise there has been some tendency to increase the acreage summer fallowed, the summer fallow land being planted to winter wheat. However, there is considerable wind in the dry farming districts of Area 8 and wind erosion is likely to occur where the surface of the ground is left bare for periods of considerable length. Corn may be harvested for grain, cut with a mower and used as fodder, or grazed off by
livestock, the latter method being followed when the crop is a near failure. In like manner each of the small grain crops may be harvested for grain, cut for hay or harvested by turning cattle or sheep into the field. It is frequently necessary during drouthy years for farmers having livestock to harvest all crops for forage. Alfalfa is planted very thinly and sometimes in very wide rows and then cultivated. The second crop of alfalfa is sometimes harvested for seed. The tame and wild grass hay is generally grown along the water courses and on lower lying areas that receive some surface runoff and are therefore more moist than the uplands.

Livestock

Beef cattle and sheep are about equal in importance in Area 8. In some parts of the area cattle predominate and sheep in other parts. After cattle numbers were reduced in 1934, sheep were increased. The tendency at the present time (1938) is for sheep to replace cattle, especially on the smaller ranches and general farms. While Hereford cattle predominate, there are a few of Shorthorns. There are some range horses in this area and some fairly good stallions have been purchased recently and placed with the range mares. Dairy cattle are of minor importance. About 78 per cent of the cows milked in 1929 were of beef or dual-purpose breeding and an average of about 4.7 cows were milked per farm reporting the milking of cows. The chickens consist of small farm and ranch flocks, the average being around 40 to 45 chickens per farm reporting chickens. Turkeys in 1929 averaged 87 per farm reporting turkeys. Turkeys usually increase numerically following the harvest of a good grain crop and decrease, likewise, the year after there has been a near grain crop failure.

Types of Farming

A classification of 2,998 farms and ranches located in Area 8 shows clearly that the area is quite strongly dominated by livestock production. Of the total number of farms in 1929, the stock farms and ranches formed 43 per cent; the general farms, 19 per cent; cash-grain, 15; unclassified, 6; self-sufficing, 6; part-time, 5; crop-specialty, 4; and poultry and dairy, 1 per cent each. Of the total gross receipts of all farms in 1929, nearly 70 per cent was received by the stock farms and ranches. The cash-grain farms received about 16 per cent, the general farms 10 per cent and the crop-specialty farms 1.5 per cent. The general and the cash-grain farms each carry considerable livestock. On the general farms, for example, approximately 14 per cent of the gross income came from the sale of grain and 11 per cent from livestock and livestock products. Thus it is seen livestock is the dominating enterprise in this area.
The Dominant Type.—The farms of the dominant type (stock farms and ranches) may carry either cattle or sheep or both cattle and sheep. During former years it was believed that the passing of a flock of sheep over a range ruined the forage for cattle. That prejudice is now passing and a goodly number of ranchmen now prefer to have both sheep and cattle. The sheep eat a considerable amount of weeds, wild flowers, and browse that the cattle refuse, especially if other forage is plentiful. The sheep and cattle may be placed on a range together, or the sheep may be passed over a range rather hurriedly with the cattle following or vice versa. Sometimes a range that is summer grazed with cattle is winter grazed with sheep.

In this area ranchmen must own or lease all of the land they use, since there is very little land left in the public domain. The general plan on the larger ranches is to reserve a portion of the range for winter use and to feed cottonseed cake and little or no hay to either cattle or sheep. This plan works nicely during normal or good rainfall years. When a severe drouth season occurs, however, the forage on the summer range becomes exhausted and the ranchmen are forced to use the winter range during the late summer and fall. In this event one of three things must happen: Feed may be shipped in, the livestock may be shipped out, or the livestock may be sent to market or otherwise disposed of. During former years cattle were marketed mostly as aged steers. The drouth years of 1934 and 1936 forced the selling of a large number of stock cattle (calves, yearlings, and 2-year olds), and in some cases part of the breeding herd. On the smaller ranches and farms more hay and roughage is fed during the winter. On the average from one-fourth to one-half ton of hay are required to winter a cow. In addition to the hay, from one to five pounds of cottonseed cake are fed per cow per day from December until May.

AREA 9. THE BLACK HILLS AREA

Description

Area 9 is situated in the northeastern part of Wyoming in Crook and Weston counties. Its maximum length from north to south is approximately 86 miles and its greatest width about 36 miles. Its total area is around 1,150,000 acres. The Bear Lodge Mountains extend from near the northern extremity of the area in a southerly direction for some 25 to 30 miles. This range is rough and in places precipitous and the slope on either side of the divide is generally quite abrupt. These mountains have a maximum elevation of 6700 feet and rise above the surrounding plain from 1000 to 3000 feet. The eastcentral part of the area is occupied by the rugged Wyoming portion of the Black Hills which
have a maximum elevation in Wyoming of about 7000 feet. The higher parts of the Black Hills in Area 9 also rise from 1000 to 3000 feet above the general level of the surrounding plain. The Black Hills National Forest includes the major portion of the Bear Lodge Range and the Wyoming part of the Black Hills.

The Belle Fourche River parallels the northern and northwestern boundary line of Area 9. This river and its tributaries drain practically all of the area lying within Crook County whereas that lying within Weston County drains to the south into Cheyenne River. Practically all of the streams draining Area 9 have a more or less intermittent flow and for that reason they are not very dependable as sources of irrigation water. More land would be under irrigation in this area, however, if prior rights on the flow of the Belle Fourche River and its tributaries were not held in South Dakota.

The area slopes from the summit of the Bear Lodge Range to the east, to the north and to the northwest; and to the northeast, to the west and to the south from the Black Hills. That part of the area not included in the Black Hills and in the Bear Lodge Mountains consists, for the most part, of a series of ridges or divides with valleys between that have been carved out of a former high plain. In places the ridges are flat-topped which indicates the general level of the former plain. While the valleys are generally rather narrow, some of them widen out to as much as a half mile to a mile. Many of the slopes leading down from the divides to the valleys and drainage channels present evidence that considerable sheet and gully erosion has taken place during comparatively recent years. The dry farm land of the area may be found in the valleys, on the more gentle slopes, on the terraces and on the tops of the more or less flat-top ridges.

**Climate**

The mean annual precipitation of the major portion of Area 9 is considerably above that of any other part of the Wyoming portion of the Great Plains province. This is due, no doubt, to the obstruction of the general plain by the Bear Lodge Mountains and the Black Hills. The mean annual precipitation within Area 9 varies from about 16 inches along the western and southwestern borders to about 24 or 25 inches at the higher elevations in the Black Hills and the Bear Lodge Mountains. At Sundance near the center of the area the mean is 20.7 inches and at the Knowles Ranch near the northern extremity of the Bear Lodge Range it is 21.7 inches.

Of the mean annual precipitation about 70 to 75 per cent is seasonal, i.e., falls between April and September inclusive. As a rule the winter precipitation falls as dry snow. Due to the action
of the wind a snow mantle covers the surface of the ground in the prairie parts of the area but a few days at a time. In the timbered areas, especially at the higher elevations, the surface may be covered with snow during much of the winter. A snow mantle, especially if crusted, interferes with winter grazing. Torrential showers and hail storms are not uncommon during the summer. There is a wide variation between summer day and night temperatures. The sun shines and the wind blows a relatively large proportion of the time. The relative humidity is low and evaporation high.

**Soil**

As classified by the Geological Survey of the Department of the Interior, the lands of Area 9 consist of irrigated land, second- and third-grade dry farming lands, grazing land, and land lying within the Black Hills National Forest. When the classification was made approximately 1000 acres were under irrigation and only one irrigated tract was mapped. It lies in the Belle Fourche River Valley in the northern part of the area and is irrigated with water diverted from Beaver Creek. Several other tracts under irrigation were considered too small to map separately. The Black Hills National Forest includes 179,000 acres of Area 9. The acreages of second-grade land, third-grade land, and grazing land cannot be given because the data are on a county basis.

The second-grade land consists mostly of friable dark-red loams and sandy loams located in the stream valleys leading down from the Bear Lodge Mountains and the Black Hills and on the gently sloping benches and terraces. Included with the second-grade land are numerous tracts of first-grade dry farming land which also were too small to map separately. The third-grade lands are mostly located to the south, east, and north of the Bear Lodge Mountains on benches and slopes having shallow surface soils. In some localities the third-grade land contains outcroppings of gypsum.

An outcropping of the “Red Beds” encircles the Bear Lodge Mountains and lies to the west of the Black Hills. The soils derived from this formation are generally friable red loams and sandy loams. Those soils are productive, are easily eroded and wash badly under torrential showers. The soils of the Black Hills and the Bear Lodge Mountains are mainly sandy loams and sandy clay loams with gravel and stone intermixed.

**Vegetation**

The vegetative cover of Area 9 may be said to consist, in general, of two types—grassland and forest. The dominant vegetation of grassland type usually consists of grama grass, western
wheat grass, pine grass, needle grass, some buffalo grass, and with sagebrush on the heavier soils. A very high percentage of the Black Hills and also of the Bear Lodge Mountains is timbered, the western yellow pine (Pinus ponderosa), being the dominant timber species. The stand of pine timber is usually quite dense. There are also dense thickets of aspen on the moist slopes and in the draws. There is much underbrush consisting mostly of dwarf oak (Quercus macrocarpa), aspen, hawthorn (Crataegus sp.), etc. On the western side of the Bear Lodge Mountains the pine timber extends well down the ridges, in places to the Belle Fourche River, the timber being thin and dwarfed on the rocky ridges. On the treeless slopes and level lands of the Black Hills and the Bear Lodge Mountains the vegetation is similar to the grassland type.

Crops

Practically all crops produced in Area 9 are grown without irrigation. Of the total harvested acreage of non-irrigated crops in 1929, the hay crops constituted approximately 51 per cent, the grain crops 47 per cent, and miscellaneous crops 2 per cent. Alfalfa formed 51 per cent of the harvested area of hay, wild grasses 26, the small grains 12, and the tame grasses and clovers 11 per cent. Wheat, in 1929, was the leading grain crop, accounting for about 38 per cent of the area harvested. Oats made up around 19 per cent, barley 18, corn 15, flax 6, and rye, emmer and other grains 4 per cent. The miscellaneous crops consisted of seed crops, mostly alfalfa seed, potatoes, and dry beans. The acreage of crop failures in 1929 was not great, 3117 acres for Crook County as a whole as compared with 67,278 acres in 1934. Idle fallow land in 1929 was 11,816 acres for the whole county as compared with 30,816 acres in 1934. These differences between the two census years may be attributed mostly to the drouth of 1934.

Livestock

The livestock of Area 9 consists mostly of beef cattle. While the Herefords predominate, the Shorthorns are of considerable importance. The sheep belonging within the area are owned and run in comparatively small flocks. The dairy cattle consist mostly of grade Holsteins, Jerseys, Guernseys, and Milking Shorthorns. The cows are milked mainly to supply local and farm and ranch needs. The production of swine and horses is mostly for local needs. Turkeys are becoming an important sideline enterprise. The average size of flocks is about 100 birds, with some flocks containing as many as 500 head. The chickens consist almost entirely of small farm and ranch flocks.
Types of Farming

The 748 farms located in Area 9 in 1929 have been grouped into 11 types. Stock farms and ranches that year made up 39 per cent of the total number; general farms, 22 per cent; cash-grain, 20; self-sufficing, 7; unclassified, 4; dairy, crop-specialty, and part-time, 2 per cent each. In addition there were 2 poultry and 7 forest products farms.

The general farms, as the term indicates, had receipts from several sources. An average of about 26 per cent of the gross amount came from livestock, 23 per cent from livestock products, 22 per cent from crops, close to 2 per cent from forest products and about 27 per cent consisted of farm products used by the farm family. The gross income of the general farms in 1929 was not large and averaged but $1320. The cash-grain farms are larger than the general farms and had average gross receipts of $2875. Of this amount, approximately 68 per cent came from crops (mostly wheat), 15 per cent from livestock, 6 per cent from livestock products, and 11 per cent consisted of farm family used products.

The Dominant Type.—Stock farms and ranches, as indicated by the data presented above and by figure 38 were the dominant type in 1929. Of the total number in this type, about three-fourths were stock ranches and one-fourth stock farms, the former having 10 acres or more of grazing land per acre in crops while the latter had less than 10 acres. The dominant type is made up of both cattle and sheep farms and ranches with the cattle strongly predominating. The sheep and cattle, in most cases, are summer grazed on the Black Hills National Forest from about June 1 to October 1. The sheep are generally wintered on the range and fed supplementary feeds at critical times during storms. The cattle, on the other hand, are wintered at the home ranches, the winter feeding season being from 3 to 4 months each winter. In this area each ranchman must own or lease all of the land he uses outside the National Forest for his autumn and spring grazing and the production of his winter feed. During past years the cattle have been marketed mostly as aged steers and dry and cull cows. Severe drouth years force the selling of calves and yearlings as well as older steers.

AREA 10. SOUTHEASTERN WYOMING GREAT PLAINS

Description

Type-of-farming Area 10 is situated in southeastern Wyoming and embraces approximately 3,200,000 acres. It includes the southern part of Niobrara County, the southeastern corner of Converse County, the eastern parts of Platte and Laramie coun-
ties and all of Goshen County except the land lying within the North Platte reclamation project which is designated in figure 37 as type-of-farming Area 11-A. Area 10 and Area 4 together occupy the western portion of the High Plains in southeastern Wyoming. The Laramie Mountains lie immediately to the west of these two areas.

The surface features vary from the characteristic level high plains to rough and rolling hills. The rolling to rough hills are to be found mostly in the north central part of the area in Goshen, Platte, and Niobrara counties. A series of more or less broken and rolling hills which extend along the southern boundary of Goshen County practically divide Area 10 into two parts. Elevations vary from about 4,000 feet where the North Platte River crosses the Wyoming-Nebraska state line to 6,000 feet or more in the vicinity of Cheyenne. The general slope is to the east. The northern part of the area is drained by the Niobrara River, the central part by the North Platte River and its tributaries, and the southern part by Crow and Lodgepole creeks which flow into the South Platte River. Most of the drainage streams flow the year round in comparatively narrow, shallow valleys. Considerable irrigated and sub-irrigated hay is produced along the streams.

A very conspicuous feature of Area 10 is what is known as Goshen Hole which starts near Fort Laramie on the Platte River, extends in a southerly direction for some 20 miles and then swings to the southeast in a gentle curve to near the southeastern corner of Goshen County. Thus the hole is about 50 miles long and some 7 to 35 miles wide. The floor of the hole lies considerably below the table lands to the east and the west and its western border is marked by an escarpment that rises somewhat abruptly 200 feet or more. Due to the general lowering of the high plain from west to east, the difference between the elevation of the floor of the hole and the table land to the east is not so great as it is on the west. Within the hole the surface is fairly level to gently rolling.

Climate

The climate of Area 10 is semi-arid. It has wide extremes of temperature between night and day and between winter and summer, considerable variations in the annual precipitation from year to year and in the monthly distribution of the annual precipitation, much sunshine, a dry atmosphere, and considerable wind. The mean annual precipitation increases within the area from west to east and varies from about 14 inches in the northwestern portion as indicated by the weather record for Douglas to some 16 or 17 inches along the eastern border. (Figure 6.) Approximately 75 per cent of the annual precipitation falls between April and September inclusive. Much of the scant winter precipitation
falls as snow. The variation in the annual precipitation from year to year is indicated by the data presented in figure 7 for Kirtley and for Cheyenne. The small charts superimposed on figure 6 show the average distribution of the annual precipitation by months. The relatively high day temperature and wind movements tend quickly to dissipate light summer showers by evaporation and much of the summer rainfall that occurs as violent local showers is lost as run-off. Hail storms, while relatively infrequent, occasionally occur with sufficient force to cause damage. The growing season as measured by the average frost-free period varies in different parts of the area from about 105 to 127 days.

Soils

The lands lying within the borders of Area 10 have been studied and classified on the basis of their fitness for different agricultural purposes into the following six classes: First-, second-, and third-grade dry-farming land, grazing land, irrigated land, and sand hills. (Figure 9.)

The first-grade dry-farming land lies in a single body in the eastern part of Laramie County. It is all smooth or gently rolling, generally consists of fine-grained loam to clay loam and is fertile and well adapted to absorb and retain moisture. It is considered the best grade of land within the area and upon it has developed a substantial dry-farming community. The second-grade land, for the most part, lies in three large tracts. One of these occupies the bulk of the eastern part of Laramie County, a second is situated in southern Niobrara and northeastern Goshen counties and the third is located east of Chugwater Creek in southeastern Platte and southwestern Goshen counties. The second-grade land varies from sandy loams to clay loams and is less productive than the soils of the first-grade. This is usually due to less favorable rainfall, topography, soil texture, or depth of soil.

While the third grade land is rather widely distributed over the area, the largest single body lies in Goshen County south of the North Platte River. Conditions for crop production are less favorable on the third-grade land than on the second-grade. That is, the surface may be rougher, the texture of the soil either coarser or tighter, the soil more shallow, or the rainfall less adequate. In Goshen Hole, which is mostly occupied by third-grade dry-farming land, the soil is generally a heavy clay. In some local areas the clay is modified by admixtures of sand while a few areas consist of nearly pure sand. Considerable damage has been done by wind erosion where these sandy areas have been dry-farmed and left bare during the winter.

In general, the grazing land occupies the areas that are too rough, or where the rainfall is to scant, or the soil too thin, tight,
or stony to permit of crop production by dry-farming methods. The small amount of irrigated land within the area is widely scattered in small tracts along the many streams that cross the area from west to east. The irrigated land within the stream valleys is generally fertile and composed of fine-grained silt and clay alluvial material.

The land classified as sand hills, some 35,390 acres, lies north of the North Platte River in Goshen County. The sand hills are composed of nearly pure sand that has been blown into dunes or mounds varying in height from 20 to 60 feet and separated by narrow valley like depressions. The dunes are generally held in place by a growth of native deep rooted vegetation but when the vegetative cover is seriously weakened a shifting of the dunes is likely to begin. Some of the depressions between the dunes are sufficiently sub-irrigated to produce hay and other crops. The sand hills proper are chiefly used for grazing.

Vegetation

The native vegetation, in general, is a short-grass type that is composed, for the most part, of low growing shallow-rooted grasses. During the early summer there is usually an abundance of flowering plants. After midsummer when the grasses have matured and the flowering plants have disappeared, the area appears parched and even desert like during years of scant summer rainfall. During seasons of abnormal rainfall the characteristic short-grass vegetation is modified in places by the vigorous growth of tall grasses. A considerable part of the vegetative cover consists of a few species of shrubs. Especially is this the case where areas have been overgrazed, over run with fires year after year, or abandoned after the sod has been broken.

Of all the grasses that occur within the area, grama grass is by far the most important and in places it forms almost a pure sod. The more important of the plants associated with grama grass are the western and slender wheat grasses, needle grass, three awn-grass, nigger wool, sand grass (Calamovilba longifolia), sand dropseed and sand sage (Artemisia frigida). Cottonwoods, box elders, and willows occur along the perennial streams. Several sedges, wire grass, foxtail (Hordeum jubatum), and salt grass grow on the wet land in the stream valleys.

The most usual vegetative cover on the first and second grade dry farming land is a rather dense growth of grama grass mixed mostly with wheat grass and June grass. On the deep soils needle grass is plentiful and in the southeastern part of the area a limited amount of buffalo grass occurs. On the heavy textured soils of the third-grade dry farming land the most common vegetative type is composed of grama grass and wheat grass with more or
less common sage brush. On the heavy textured soils of Goshen Hole, the dominant species are wheat grass and common sagebrush with some June grass and grama. The sandy soils of the Hole, on the other hand, produce grama grass, big and little blue-stem, needle grass, three awn grass, nigger wool, sand grass and sand sage. On the Goshen Hole escarpment, squaw brush, skunk brush, and soapweed are the more important of the brushy species to be found while stunted growths of yellow pine and juniper occur in places.

Crops

Of the total acreage of non-irrigated crop land in Area 10, crops were harvested from approximately 81 per cent in 1929, about 12 per cent lay idle or was summer fallowed and crops failed on some 7 per cent. During the operation of the wheat, corn and hog adjustment programs, the area summer fallowed materially increased. Crops are produced quite extensively in this

<table>
<thead>
<tr>
<th>Crop</th>
<th>Laramie County</th>
<th>Goshen County</th>
<th>Platte County</th>
<th>Converse County</th>
<th>Niobrara County</th>
<th>Total for five counties</th>
<th>Per cent 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvested acres—total.</td>
<td>187,001</td>
<td>166,135</td>
<td>96,186</td>
<td>50,879</td>
<td>95,532</td>
<td>595,733</td>
<td>354,695</td>
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<tr>
<td>W. wheat</td>
<td>29,112</td>
<td>52,159</td>
<td>18,205</td>
<td>2,649</td>
<td>2,660</td>
<td>104,785</td>
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<td>Spring wheat</td>
<td>4,382</td>
<td>13,146</td>
<td>20,065</td>
<td>9,321</td>
<td>8,232</td>
<td>55,176</td>
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<td>Durum wheat</td>
<td>25,256</td>
<td>3,495</td>
<td>7,032</td>
<td>2,133</td>
<td>5,713</td>
<td>44,909</td>
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<tr>
<td>Oats</td>
<td>16,726</td>
<td>12,905</td>
<td>8,478</td>
<td>7,335</td>
<td>11,624</td>
<td>56,468</td>
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<td>Barley</td>
<td>21,880</td>
<td>18,027</td>
<td>8,468</td>
<td>3,265</td>
<td>5,652</td>
<td>57,502</td>
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<tr>
<td>Rye</td>
<td>17,794</td>
<td>3,437</td>
<td>828</td>
<td>334</td>
<td>3,263</td>
<td>25,656</td>
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<tr>
<td>Flax</td>
<td>1,244</td>
<td>572</td>
<td>871</td>
<td>540</td>
<td>1,532</td>
<td>4,759</td>
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<td>Other (mixed)</td>
<td>932</td>
<td>1,762</td>
<td>2,006</td>
<td>452</td>
<td>888</td>
<td>6,040</td>
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<td>Row tilled Crops:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>44,222</td>
<td>35,747</td>
<td>14,219</td>
<td>10,163</td>
<td>11,148</td>
<td>115,499</td>
<td>19.4</td>
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<tr>
<td>Corn</td>
<td>37,674</td>
<td>29,728</td>
<td>12,422</td>
<td>9,046</td>
<td>9,467</td>
<td>98,637</td>
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<tr>
<td>Potatoes</td>
<td>3,603</td>
<td>3,618</td>
<td>828</td>
<td>656</td>
<td>1,499</td>
<td>10,204</td>
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<tr>
<td>Dry beans</td>
<td>1,511</td>
<td>2,674</td>
<td>265</td>
<td>246</td>
<td>21</td>
<td>4,747</td>
<td>8</td>
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<td>Other</td>
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<td>327</td>
<td>74</td>
<td>215</td>
<td>161</td>
<td>1,911</td>
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<td>23,944</td>
<td>15,221</td>
<td>14,401</td>
<td>41,846</td>
<td>119,406</td>
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<td>Alfalfa</td>
<td>2,733</td>
<td>5,068</td>
<td>3,378</td>
<td>3,335</td>
<td>16,234</td>
<td>30,748</td>
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<tr>
<td>Tame grass and clover</td>
<td>4,529</td>
<td>2,256</td>
<td>811</td>
<td>1,763</td>
<td>3,857</td>
<td>13,246</td>
<td>2.2</td>
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<tr>
<td>Wild grasses</td>
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<td>12,966</td>
<td>7,021</td>
<td>6,182</td>
<td>16,349</td>
<td>48,031</td>
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<tr>
<td>Small grains</td>
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<td>3,955</td>
<td>3,981</td>
<td>3,121</td>
<td>7,391</td>
<td>27,337</td>
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<tr>
<td>Other</td>
<td>15</td>
<td>29</td>
<td>15</td>
<td>15</td>
<td>44</td>
<td>149</td>
<td>.0</td>
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<tr>
<td>Seed crops</td>
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<td>293</td>
<td>207</td>
<td>3,535</td>
<td>4,964</td>
<td>.8</td>
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<tr>
<td>All other crops</td>
<td>527</td>
<td>364</td>
<td>260</td>
<td>49</td>
<td>39</td>
<td>1,269</td>
<td>.3</td>
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</table>

Compiled from U. S. Census of Agriculture, 1930.
area by dry farming methods and in a limited way also under irrigation. The irrigated crops, for the most part, are fed to livestock as hay and consist mostly of alfalfa, tame grasses, clovers, and wild grasses. The irrigated crops are quite widely distributed over the area and are very generally grown in relatively small tracts on the bottom land along the streams. A few sugar beets and dry beans are produced under irrigation.

The dry land crops of this area made up about one-half of the total acreage of all non-irrigated crops harvested within the State in 1929. A fairly accurate indication of the variety of dryland crops grown and their relative importance when measured in acres harvested are presented in table 11. While Area 10 does not include all of the five counties covered in the table, it does include the major part of the land that is dry farmed in the five counties.

While the small grains are generally sown with the intention of threshing them for grain, they are frequently cut for hay during drouthy seasons. While some barley is occasionally sold to feeders of livestock on nearby irrigated farms, as a rule it is fed on the farms where produced and is not an important source of cash income. Corn and oats also seldom enter commercial channels. During severe drouth years corn may be used mostly as fodder. The small grains, row-tilled crops and alfalfa generally occupy the uplands whereas the tame grasses, clovers, and wild grasses are grown on the low lying areas.

TABLE 12
Ten-year weighted average yield per acre of non-irrigated crops in four counties, Wyoming.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Unit</th>
<th>Laramie County</th>
<th>Goshen County</th>
<th>Platte County</th>
<th>Niobrara County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter wheat</td>
<td>Bushels</td>
<td>12.6</td>
<td>12.4</td>
<td>10.7</td>
<td>9.4</td>
</tr>
<tr>
<td></td>
<td>&quot;</td>
<td>9.0</td>
<td>10.3</td>
<td>9.6</td>
<td>9.3</td>
</tr>
<tr>
<td>Oats</td>
<td>&quot;</td>
<td>17.5</td>
<td>18.8</td>
<td>18.2</td>
<td>17.6</td>
</tr>
<tr>
<td>Barley</td>
<td>&quot;</td>
<td>11.9</td>
<td>14.8</td>
<td>16.9</td>
<td>12.6</td>
</tr>
<tr>
<td>Corn</td>
<td>&quot;</td>
<td>12.8</td>
<td>12.4</td>
<td>12.5</td>
<td>12.4</td>
</tr>
<tr>
<td>Rye</td>
<td>&quot;</td>
<td>6.8</td>
<td>7.9</td>
<td>7.4</td>
<td>8.2</td>
</tr>
<tr>
<td>Flax</td>
<td>&quot;</td>
<td>5.2</td>
<td>5.1</td>
<td>5.3</td>
<td>4.3</td>
</tr>
<tr>
<td>Potatoes</td>
<td>&quot;</td>
<td>68.0</td>
<td>71.1</td>
<td>51.0</td>
<td>66.6</td>
</tr>
<tr>
<td>Beans</td>
<td>Pounds</td>
<td>390</td>
<td>398</td>
<td>454</td>
<td>400</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>Tons</td>
<td>1.0</td>
<td>1.5</td>
<td>1.3</td>
<td>.8</td>
</tr>
<tr>
<td>Wild hay</td>
<td>&quot;</td>
<td>.8</td>
<td>.8</td>
<td>.7</td>
<td>.7</td>
</tr>
</tbody>
</table>

Compiled from Crop Estimate Records, Bureau of Agricultural Economics.
The harvested acreage of the respective crops is not always a reliable measure of their relative importance. Potatoes, for example, have become an important cash crop in parts of this area. They are grown both for certified seed and for table use and generally sell for several times as much per acre as any other dry land crop. The acreage of certified potatoes increased from approximately 3207 acres in 1929 to 7472 acres in 1935, an increase of 130 per cent. Due to the severe drought of 1936 and the low prices received in 1935, the acreage of certified seed potatoes dropped to 4356 acres in 1936.

Owing to the variations in the annual precipitation and in its monthly distribution from year to year, there is much variation in the yield of crops. Table 12 presents the estimated ten-year average yields of the various crops for four southeastern Wyoming counties, the yields being based on the harvested acreage.

Livestock

The livestock enterprises associated with Area 10 are beef cattle, sheep, dairy cattle, swine, and poultry. The beef cattle are of first importance and the sheep second. The beef cattle and sheep are mostly grazed in fenced pastures that are controlled by farm and ranch operators either by ownership or by lease. The few strictly dairy herds to be found within the area are generally located in the vicinity of towns which supply a limited demand for fluid market milk. A few cows are milked on practically all farms and ranches. Poultry consists mostly of farm and ranch flocks. A limited amount of turkeys are produced on a commercial scale. Hogs are of more importance than in any other type of farming area of the State, due, chiefly, to the prominent place which both corn and barley occupy in the cropping system of the dry land farms.

Types of Farming

About a dozen types of farming are carried on in Area 10. Of the total number of farms located within the area in 1929, the cash-grain farms formed approximately 29 per cent; stock farms and ranches, 25; general, 23; crop-specialty, 10; part-time and unclassified, 4 each; dairy and self-sufficing, 2 each; and poultry, forest products, and horse and feed lot farms, less than 1 per cent each. While the cash-grain farms are slightly ahead numerically, the stock farms and ranches are the more important because of their larger size and greater net income. Since the general farms are almost as numerous as either the cash-grain or the stock farms and ranches and since the crop-specialty farms are of considerable importance, no one type of farm stands out as the dominant type. Area 10 may be said, therefore, to present a mixed type of farming.
As usual considerable variation occurs in the stock farms and ranches in this area. Of the total number about 60 per cent are stock ranches and 40 per cent are stock farms, the former having 10 acres or more of grazing land to each acre in crops while the latter have less than 10 acres. In size they range from less than 260 to over 10,000 acres. Some of the farms and ranches carry only beef cattle, others only sheep, and still others produce both cattle and sheep. On a number of the non-irrigated stock farms, hogs are of considerable importance. While an occasional ranch operator along the western boundary of the area may find summer range for his cattle or sheep in the Laramie Mountains in Area 3, most of the livestock are kept within Area 10 until sent to market. Since there remains but very little public domain in Area 10, it is necessary for each ranch operator to own or lease substantially all the land he uses for crop production and for grazing.

The calf crop is generally larger in this area where the cattle are grazed in fenced pastures than it is on the open range. Furthermore, hay forms a much greater proportion of the total feed and forage used than in most of the other grazing areas of the State. In other words, there is less winter grazing and more reliance is placed in the feeding of hay and fodder to supplement the grazing forage and to carry the breeding herd of cows through the winter. Under the conditions prevailing in Area 10 the selling of calves has become a more common practice than in former years.

The sheep ranches of this area are organized and operated in a very similar manner to those described for Areas 1 and 3. In this area, however, practically all of the grazing land used by each ranch operator must be owned or leased and most of the flocks are kept within the area throughout the year. While the lamb crop is relatively large, due mostly to closer supervision, smaller flocks, and lower death loss caused by straying, predatory animals, and poisonous plants, the lambs usually average lighter in weight when marketed than do the lambs summer grazed in the mountainous areas. Consequently most of the lambs produced in this area go to the feed lots to be finished for slaughter.

The cash-grain farms of Area 10, although more numerous in 1929 than any other type, ranked second in economic importance. This was due to their smaller size and lower net income as compared with the size and income of the stock ranches. In size they average around 800 acres and vary from less than 250 to over 1,000 acres.

The land that is dry farmed in Area 10 is comparatively level or gently rolling and well adapted to the use of tractors, combine harvesters, and large size tillage implements. The cropping prac-
tices of the cash-grain farms center around the production of winter wheat. A systematic and definite crop rotation is seldom followed. In the first place dry farming has not been carried on long enough in most communities for cultural practices to have become well standardized. In the second place the annual precipitation and its monthly distribution vary so greatly that no definite cropping system and set of cultural practices can be followed satisfactorily year after year.

It is generally the aim of each cash-grain farmer to make winter wheat the chief cash crop. During the early years of cash-grain farming in this area considerable spring wheat was grown. Of late years, however, the tendency has been increasing to use spring wheat as a catch crop on land intended for winter wheat. That is, spring wheat is generally seeded when weather and soil conditions have been too unfavorable for seeding of wheat in the fall or on land where winter wheat has winter killed. Winter wheat may follow wheat, oats, barley or corn, or it may be grown on land that has been summer fallowed. That better paying crops can be obtained by summer fallowing seems to be a growing opinion.

Since many of the cash-grain farms of this area are located on sandy soil that is more or less subject to blowing, it is necessary to resort to cultural practices that will reduce wind erosion to a minimum. Accordingly implements and cultural operations are adopted with the view of pulverizing the soil as little as possible, leaving the top soil cloddy and the stubble and other trash on or mixed with the surface soil.

Strip farming is one of the most important means employed in this area for reducing wind erosion. During past years the strips have usually extended north and south or at right angles to the direction of the prevailing wind. The strips vary from about 4 to 20 rods, the width depending on the degree to which the particular field is liable to blow. At the present time (1938) the trend has been narrower strips on contour levels. On the cash-grain farms there may be alternate strips in winter wheat and summer fallow; or either wheat, oats, or barley may alternate with corn, potatoes or dry beans. On some farms fallow strips may be cultivated with the duckfoot cultivator and the revolving weeder; or they may be kept well ridged by using the lister plow. The small grains are generally planted with a furrow drill. Under the strip system of crop production fairly large scale implements and machinery may be used quite economically.

The general farms rank third in importance in Area 10. In size they average approximately 700 acres and vary from less than 200 to more than 1,000 acres. This type is intermediate between the cash-grain farms and the stock farms and ranches. An
average of 32 per cent of the gross income of these farms came from crops in 1929, 27 per cent from livestock, 25 per cent from livestock products and about 16 per cent was farm products used by the farm family.

The crop-specialty farms are of considerable importance in this area. The special crops grown are potatoes, hay, sugar beets, and dry beans, the sugar beets and the beans being of minor importance. The sugar beets and part of the dry beans are grown under irrigation. About one-third of the potato crop is grown as certified seed. The potatoes are planted thinly in wide rows.

AREAS II. THE TORRINGTON-WHEATLAND-DOUGLAS IRRIGATED DISTRICTS

Description

Area II includes three separate and distinct irrigated districts in southeastern Wyoming in each of which cash-crop and general farming predominate over livestock production. (Figures 37, 38, and 39.) The three districts are referred to in this discussion as Sub-areas II-A, II-B, and II-C. Sub-area II-A is situated in the eastcentral part of Goshen County just west of the Nebraska-Wyoming state line; II-B near the center of Platte County; and II-C a little south of the central part of Converse County. The agriculture carried on in the three sub-areas is very similar. Much the same crops are grown though not in the same proportions. Sub-area II-C is more closely related to the production of range livestock than are II-A and II-B. However, much less yard feeding of lambs and cattle is done in II-C than in the other two sub-areas.

Area II is well provided with transportation facilities. Sub-area II-A is served by the Chicago, Burlington and Quincy and by the Union Pacific railroads; II-B by the Colorado and Southern Railroad; and II-C by the Chicago & North Western and by the Chicago, Burlington and Quincy railroads. Each of the sub-areas may be reached also by one or more hard surfaced highways. Creameries are operated at Douglas, Wheatland, and Torrington and sugar factories at Wheatland and Torrington.

Climate

The climate of Area II as a whole is semi-arid and subject to rather wide variations in both temperatures and precipitation. The summers are medium in length. The frost-free growing season averages about 112 days at Douglas in Sub-area II-C, 127 days at Torrington in II-A, and 134 days at Wheatland in II-B. The variation in the length of the frost-free period in the three sub-areas is due, in part, to differences in elevation, in surface
features and in air drainage. The summer months are characterized by relatively warm days and cool nights. Extremely high and low temperatures occur infrequently and during but short periods at a time. The relative humidity is low and evaporation is high. Prevailing winds are from the west and northwest. Due to their nearness to the mountains, II-B and II-C are less subject to strong winds than is II-A. Some wind erosion occurs, especially in II-A, when fine sandy soils are left bare and unprotected.

The annual precipitation averaged 13.9 inches at Fort Laramie in the northwestern part of II-A during a 45-year period, 14.0 inches at Douglas in II-C during 21 years, and 14.4 inches at Wheatland in II-B during 26 years. In the eastern part of II-A the precipitation is much greater, averaging 17 inches or more along the Nebraska-Wyoming state line. The variation in the annual precipitation from year to year may be illustrated by the extremes that occurred at Fort Laramie between 1900 and 1933 inclusive. The low during that period was 6.4 inches in 1910 and the high 27.1 inches in 1915. Figure 7 illustrates deviations that may be expected in the annual precipitation from the long-time average.

The seasonal precipitation, that falling between April and September inclusive, averages from 70 to 78 per cent of the annual in the three sub-areas. (See the data presented in table 5 for southeastern and eastcentral Wyoming.) Thus the seasonal precipitation averages about 10.5 inches when the annual is 14 inches. In irrigated districts like II-B and parts of II-C where the supply of irrigation water is variable and frequently inadequate, a seasonal rainfall of 10.5 inches is looked upon as a very substantial supplement to the supply of irrigation water. In other districts having an ample supply of water as is usually the case in most of II-A, a heavy seasonal rainfall may seriously interfere with the harvesting of crops, especially the hay crops. In such cases it becomes a handicap.

Sub-area II-A

Sub-area II-A forms part of the Nebraska-Wyoming-North Platte Irrigation Project. It lies at elevations ranging from about 4050 feet where the North Platte River crosses the Nebraska-Wyoming state line to about 4700 feet near Fort Laramie. It is situated mostly within the Goshen Hole lowland erosion plain described in the discussion of Area 10. Across the northern part of this plain the North Platte River has cut a stream valley that varies in width from about one-half to two miles. This valley which forms part of II-A is comparatively level and slopes with the fall of the North Platte River. The first bottom lands of the valley lie from 4 to 12 feet above the channel of the river and are
subject to being flooded from time to time. The surface of the Goshen Hole lowland plain, in general, is gently rolling to rolling, there being considerable land with a moderate slope, some that is flat and some that is quite steep.

Irrigation water for II-A is obtained by impounding the flood waters of the North Platte River in the Pathfinder and Guernsey reservoirs. These two reservoirs have a combined storage capacity of 1,141,060 acre feet. The supply of water is generally ample except during the very driest seasons when the flow of the river is low. A relatively small part of II-A is irrigated with water diverted from Horse Creek.

The soils of II-A vary from fine dune sand to clay. Silt loam soils occupy around 26 per cent of the sub-area; very fine sandy loams about 23 per cent; loamy fine sand, 17; fine sandy loams, 9; silty clay loams, 6; clay, 6; fine sand, 6; broken land, 4; clay loam, 2; and dune sand less than 1 per cent. The proportional distribution of the soil types given above is based on a detailed soil survey covering 362,240 acres of which II-A is a part. Therefore, the proportional distribution of the soil types given above must be considered only as fairly close approximations. In their virgin state the soils of II-A were generally low in their organic matter content and very seldom did they contain enough alkali salts to be injurious to crop production. The application of irrigation water, however, has changed this condition. The water-table has been raised to near the surface over considerable of the low lying areas for which it has become necessary to provide artificial drainage. Some seeped land is now used only for pasture.

Sub-area II-B

Sub-area II-B, locally known as the Wheatland Irrigated District, is situated near the central part of Platte County about the town of Wheatland. It includes the irrigated bench lands lying between Sibycle and Chugwater creeks, the former stream skirting the area on the west and the latter on the east. It also includes the valley lands of these two streams lying adjacent to the irrigated bench lands. About 50,000 acres of irrigated land are embraced within its borders. Of that amount approximately 40,000 acres are crop land and 10,000 acres in pasture land.

The soils consist mostly of loams and gravelly loams with some fine sandy loams, silty clay loams, fine sand and broken and stony land. The loamy soils strongly prevail and make up some 65 to 75 per cent of the irrigated acreage. The soils are light

1Soil Survey of the Fort Laramie Area, Wyoming-Nebraska. (Advance Sheets Field Operations of the Bureau of Soils, 1917.)

A detailed description of the soils of the area is given in “Soil Survey of the Wheatland Area, Wyoming, Number 13, Series 1926.”
colored, low in organic matter and calcareous, the carbonates and other soluble compounds which have been removed from the surface layer are abundant in the subsoils. The accumulation of alkali in the surface soils in injurious quantities to crop production has occurred in only a few places. Because of seepage it has been necessary to drain about 3800 acres of bench land. Practically all crops respond to the application of feed lot fertilizer. Phosphate has given good results in growing alfalfa and sugar beets on soils low in available phosphate.

Sub-area II-B is irrigated by diverting water from the Laramie River and from Sibylee Creek. The water of the Laramie River is first stored in the Wheatland Reservoir in Albany County and then diverted across the Laramie Mountains through a tunnel to Sibylee Creek. Maximum crop yields per acre cannot be obtained, during drouthy years with the available supply of water. An attempt is being made (1937) to provide a more dependable supply of water by materially increasing the capacity of the Wheatland Reservoir.

Sub-area II-C

Sub-area II-C, the Douglas Irrigated District, is the smallest of the three sub-areas making up Area II. It is situated in the southcentral part of Converse County in the vicinity of the town of Douglas. It may be considered as consisting of two parts: First, that irrigated from the North Platte River and, second, that from La Prele Creek. The North Platte portion lies in the stream valley of the river and is comparatively flat and level. The La Prele portion, on the other hand, is generally undulating to rolling. The narrow stream valley of La Prele Creek, which flows northeast from the mountains to the North Platte River, is paralleled by several smaller valleys that are separated by narrow ridges. The soils of the irrigated lands which lie mostly in the wider of these valleys are largely residual and derived from soft sandstones. The ridges and knolls are generally capped with a heavy conglomerate, the weathering of which has resulted in high percentage of steep stony land that is used only for grazing purposes. Thus the irrigated part of the La Prele portion of II-C is quite spotted, lying more or less in streaks along the floors of the narrow valleys mentioned above. Furthermore practically every irrigated farm carries a high proportion of rough land that is not used for producing crops. The rolling surface and the ease with which the soft sandstone soils are eroded have resulted in the formation of numerous gullies that are too deep to be filled, causing considerable inconvenience in the distribution of irrigation water and the arrangement of fields. Some of the low lying bottom lands along the streams are subject to flooding during periods of high water and a considerable acreage of level land having heavy textured
soils has become more or less impregnated with alkali salts. This sub-area has a variety of soils that consist mostly of fine sandy loams, loams, silt loams, clay loams, clay, gravelly clay, and rough stony land.

That part of II-C that is irrigated from the North Platte River has a very dependable supply of water. While the water is diverted direct from the Platte River, the flow of that stream is well stabilized by the storage facilities provided by the Pathfinder Reservoir. Only during the severest drought seasons is there a serious deficiency of irrigation water. That part of II-C that is irrigated from La Prele Creek, on the other hand, has an inadequate supply of water. The irrigated acreage has been extended beyond that for which there is sufficient water. Since approximately 20,000 acres of land fairly well adapted to irrigated farming lies under the canals and since only some 12,000 to 13,000 acres have been placed under irrigation, the irrigated acreage could be still further extended were there sufficient water available.

It is said that approximately 20,000 acre feet of water can be impounded in the La Prele Creek reservoir when it is filled to capacity. The amount of water available, therefore, for irrigation purposes, consists of the water impounded in the reservoir and that which can be diverted from the natural flow of La Prele Creek during the irrigating season. While the supply of water is occasionally ample for the land now under irrigation, it is generally scant and has averaged less than 1.0 acre foot per acre during some drouth seasons and has been as low as .6 of an acre foot per acre on some individual farms. The shortage of water materially reduces crop yields and makes it difficult to grow crops like sugar beets that require water late in the season. Perhaps the most striking readjustment problem confronting the farmers of II-C is the development of ample storage facilities for impounding the waters of La Prele Creek that are now allowed to pass down the stream unused.

**Crops**

Crop production in Area II is confined almost entirely to the growing of the ordinary field crops. For example, the United States Census of Agriculture, 1930, reports only 52 acres of irrigated vegetables harvested for sale in 1929, 113 acres of orchard fruits and grapes, and 8 acres of small fruits in Goshen, Platte and Converse counties combined, i.e., in the three counties in which the three sub-areas of Area II are located.

The field crops grown in Area II rank approximately as follows when measured in terms of their average harvested acreage in 1929: Alfalfa easily leads, especially in sub-areas II-B and
II-C; sugar beets are the next most important crop, especially in II-A; barley, oats, corn, wheat, wild grass hay, tame grass and clover hay, potatoes, and dry beans then follow in approximately the order named. It must be understood, however, that the relative acreages devoted to the respective crops change considerably from year to year and that the crops are not grown in the same proportions in the three sub-areas. For example sugar beets form a much higher percentage of the total harvested acreage in II-A where there is generally an ample supply of irrigation water than in II-B and in the La Prele Creek portion of II-C where the supply of water is generally scant and where alfalfa is of far greater importance than it is in II-A. The relative importance of dry beans increased materially in sub-area II-A from 1929 to 1936.

Livestock

The livestock enterprises associated with the agriculture of Area II consist of range cattle and range sheep, feeder cattle and feeder lambs, a few farm flocks of sheep, dairy cattle, horses, swine, and poultry. A few stockmen having their home ranches and headquarters within Area II, especially within II-C and II-B run their cattle and sheep on the range during the grazing season. The lot feeding of lambs and cattle, however, is of more importance than is the grazing of stock on the range. Dairy farming has not been extensively developed in this area and is confined mostly to the local needs of the town and farm population. The number of horses within the area has declined during recent years, much of the farm work being done now with tractors. Swine production is restricted largely to local farm needs. While the chickens of the area consist mostly of relatively small farm flocks, the production of turkeys has increased materially during recent years.

Types of Farming

A classification of the farms and ranches located within the three sub-areas composing Area II shows very clearly that cash-crop farming predominates in sub-areas II-A and II-B while in sub-area II-C three types (stock farms and ranches, crop-specialty, and general) are quite evenly balanced numerically. The proportional distribution of the farms within each of the three sub-areas in 1929 is approximately as follows:

In sub-area II-A that year, crop-specialty made up about 52 per cent of all farms; cash-grain, 17; general, 11; stock farms and ranches together, 9; part-time and unclassified, 3 each; dairy and poultry, 2 each; and self-sufficing, 1 per cent.

In sub-area II-B crop-specialty farms formed 65 per cent of all farms; general, 10; stock farms and ranches, 9; part-time, 5;
cash-grain, 4; poultry and horse or feed lot farms, 2 each; and dairy, self-sufficing, and unclassified, 1 per cent each.

In sub-area II-C stock farms and ranches constituted 24 per cent of the total number; crop-specialty, 23; general, 22; part-time, 9; dairy, 8; cash-grain, 6; poultry and unclassified, 3 each; self-sufficing and horse or feed lot farms, 1 per cent each.

From the data presented above it is seen that crop-specialty farms strongly predominate in sub-areas II-A and II-B, while in II-C there is a mixture of types with no one of them making up as much as 25 per cent of the total number of farms. The cash-grain farms show up much stronger in the tabulation for II-A than for the other two sub-areas. This may be explained in part, by saying that considerable dry land cash-grain farming is carried on within the minor civil divisions used in making up the data for II-A that really belong in Area 10. The data given above, therefore, must be regarded as only fairly close approximations.

The stock farms and ranches lead numerically in sub-area II-C. This may be attributed mostly to the distance that sugar beets have to be shipped to the sugar factory and to the extensive grazing lands that surround II-C. Of 39 stock farms and ranches in the tabulation for II-C, 30 were stock ranches and 9 were stock farms. The stock ranches, it is to be remembered, have 10 acres or more of grazing land to each acre in crops whereas the stock farms have less than 10. The stock ranches of II-C are somewhat intermediate between those described for Area 3 and Area 8.

Out of 75 stock farms and ranches in II-A in 1929, 56 were stock farms and 9 were stock ranches. In like manner, out of 28 in II-B that year, 20 were stock farms. For the most part the stock farms on these two irrigated sub-areas are farms on which range produced lambs or cattle are finished for slaughter by lot feeding for 60 days or more during the fall and winter. The lambs and cattle fed are generally purchased from range ranchmen and placed on feed shortly after sugar beet harvest. The feeds consumed in the feeding operations are mostly home grown, namely, alfalfa hay, barley, oats, corn, and sugar beet tops. Wet sugar beet pulp is purchased from the two sugar factories located, respectively, at Torrington in II-A and at Wheatland in II-B. Cottonseed cake and also some barley and corn are shipped into the area to be fed. Feeder cattle and lambs, as a rule, move into the area during October. A large proportion of the lambs usually leave the feed lots by the end of February. The finishing of the calves and young steers requires a much longer time and occasionally they remain in the feed lot until May or even later, depending on their age and the time they were placed on feed during the fall or winter.
The farms on which the lambs and cattle are fed very generally produce alfalfa hay, barley, oats, corn, sugar beets and also potatoes in some cases. The growing of the alfalfa and the fertilizer obtained from the feed lots are very important factors in maintaining the productivity of the soil and in obtaining satisfactory sugar beet and other crop yields, the sugar beets being the principal cash crop. Thus it is seen the feeding of lambs and cattle is but one of several enterprises in a well balanced farming system that is intended to maintain a permanent agriculture. However, the gross receipts from the sale of the finished lambs or cattle (when the classification is based on gross income from different sources) is usually sufficient to cause these farms to fall into the stock-farm or animal-specialty type due to the fact that the cost of the lambs and steers is not deducted from the gross sales receipts. Such a classification is likely to give the reader a very erroneous conception of the enterprises carried and the organization of these farms. Most of them might more properly be designated as general farms.

The Dominant Type.—Crop-specialty, it has been shown, is the dominant type of farm in sub-areas II-A and II-B. The principal special crops grown are sugar beets, hay (mostly alfalfa), potatoes, and beans. Farms were classified as crop-specialty if 40 per cent of the gross receipts came from one or all of the special crops, provided however, that no other source of income contributed 40 per cent of the gross receipts.

The crop-specialty farms vary considerably in their organization, in the enterprises carried and in the relative magnitude of these enterprises. They may derive 40 per cent of their gross income from the sale of the special crops and yet be very similar in organization to many of the general farms or to the stock farms, i.e., the farms on which lambs or cattle are fed and which derive 40 per cent of their gross receipts from the sale of fattened lambs or cattle. Or they may lean quite strongly to the production of one or more of the special crops.

No well established cropping system or crop rotation is in general use in Area II although the trend is now in that direction. It is quite generally agreed that sugar beets should not be grown more than two years in succession on the same land and under the most favorable conditions not over three years. Practically the whole area is now infected with alfalfa bacterial wilt which shortens the profitable producing life of that crop to 4 or 5 years. This situation makes the rotation of crops practically imperative. Where it is desirable to keep the sugar beet acreage at a maximum a cropping program consisting of 1 year of small grain with which alfalfa is seeded, 3 years of alfalfa and 2 years of sugar beets has
been followed quite successfully where there is an ample supply of irrigation water, especially on some of the smaller crop-specialty farms. On this basis one-sixth of the crop land is in small grain, one-half is in alfalfa and one-third is in sugar beets. Where more sugar beets and less hay are desirable, sweetclover is sometimes substituted for the alfalfa and the length of the rotation reduced to four years in which case half of the land is in sugar beets. It must be remembered that an ample supply of water and organic matter are essential in order to obtain maximum yields of sugar beets and that the application of the water must continue throughout the season.

AREA 12. THE SHERIDAN IRRIGATED AREA

Description

Area 12 is situated in the northcentral part of Wyoming and consists of two sub-areas designated in figure 37 as 12-A and 12-B. Area 12 lies at elevations varying from about 3,700 to 4,500 feet. Sub-area 12-A is located near the central part of Sheridan County and is completely surrounded by Area 6. Sub-area 12-B is located in the southeastern part of Sheridan County and the northeastern part of Johnson County and borders on both Area 6 and Area 8. These two sub-areas are drained by Tongue River, Big and Little Goose creeks, Prairie-dog Creek, Clear Creek and the tributaries of these streams all of which have their source in the Big Horn Mountains lying to the southwest. In general these streams flow in a northeasterly direction and empty into the Yellowstone River in Montana.

The surface features within the borders of Area 12 consist of comparatively smooth bottom lands along the streams, gradual to steep slopes above the valleys, relatively flat terraces and ridges or divides between the streams. In general, irrigation is confined to the alluvial terraces and stream valleys, the surface of which is usually sufficiently flat for easy irrigation and which, on the other hand, slopes enough to prevent the accumulation of excessive amounts of ground water. There is also a limited amount of rolling land under irrigation within the area. Relatively small tracts of land above the irrigating ditches and on the ridges are dry farmed. The remainder of the non-irrigated land lying within the borders of the area is used for grazing.

Much of Area 12 has been farmed for 30 to 40 years, alfalfa being the principal crop grown. Experience has shown that the harvesting of alfalfa year after year from the same piece of land materially reduces the yield, the reduction being principally due, it would seem, to the poor physical condition of the soil, to excessive flooding, and to little or no cultivation.
The Chicago, Burlington and Quincy Railroad and U. S. Highways Nos. 14 and 87 each pass through the area, all parts of which can be reached over fairly good earth and gravelled country roads. The city of Sheridan with a population of around 9000 and the industries of the area—sugar manufacturing, meat packing, flour milling, the operation of creameries, the railroad shops, round house, a tie treating plant, and the production of coal—create a considerable demand for local products.

**Climate**

The climate of the area may be designated as cool temperate and semi-arid. The frost-free growing season at Sheridan during a 28-year period averaged 125 days. The last killing frost in the spring occurs, on the average, about May 18 and the first in the fall about September 20. A maximum high temperature of 105 degrees F., and a minimum of -45 degrees have been recorded. Temperatures which approach these extremes occur rather infrequently and for but short periods at a time. The mean day and night temperatures for the year are approximately 57 and 29 degrees F., respectively. The average velocity of the wind is relatively low in this area due to its proximity to the Big Horn Mountains.

The annual precipitation at Sheridan over the 40-year period 1894 to 1934 averaged 15.2 inches. Of this amount 53.9 per cent fell between April and September inclusive. The low during this period was 8 inches in 1902 and the high 29.8 inches in 1923. During each of 10 years of the 40-year period the annual precipitation was less than 12 inches, while for each of another 9 years it was more than 18 inches. The small chart superimposed on figure 6 in Sheridan County shows the average monthly precipitation at Sheridan, April, May, and June being the heavy rainfall months. During the summer a portion of the rainfall comes as thunder showers and considerable loss occasionally occurs through surface run-off. In parts of the area the present available water supply is not sufficient to give the best results in growing sugar beets and the construction of ample storage facilities would aid materially in stabilizing crop production.

The irrigation water used in Area 12 is largely derived from the melting of snow in the Big Horn Mountains to the southwest. The snowfall is quite variable from year to year. A heavy accumulation of snow, especially if it falls mostly during the early part of winter, generally provides an abundance of irrigation water even though a severe drought occurs the following summer. Likewise there may be a rather scant supply of irrigation water during summers of excessive rainfall when the accumulation of snow in the mountains is scant.
Soils

The soil types of the irrigated lands of Area 12 are quite variable and fall mainly within two series—the Big Horn and the Wolf. These two series have been described as follows:

"Soils of the Big Horn series have from 3 to 8 inches of dark grayish brown surface soils, very heavy 'gumbo' upper subsoils from 6 to 15 inches thick and a thick accumulation of silty lime in the alluvial substratum. Alluvial gravels of varying compositions sometimes occur at depths of four feet or more. Soils of the Wolf series resemble those of the Big Horn series except that both surface and subsoils are shallower and gravel always occurs within three feet. Surface soils of both of these series vary from neutral to alkaline in reaction and hence little benefit from lime application can be expected on most of the areas. Other conditions being equal, the Big Horn soils are more productive than the Wolf soils. This is because the latter are more leachy and do not hold moisture so well. A few small areas and spots of both of these soil series contain harmful amounts of soluble salts. The heavy gumbo upper subsoil of these soils is very intractable and where exposed to the surface materially reduces crop yields. It is highly important, therefore, to reduce erosion to a minimum to prevent this gumbo from coming to the surface."

Crops

Although considerable cash-crop farming is done in Area 12, the crops grown are quite closely related to the production of range beef cattle and to a less extent also to the production of sheep. That is to say, a lot of the crops grown in Area 12 is fed to range livestock during the winter.

The hay crops in 1929 occupied around 55 to 60 per cent of the total harvested acreage of all irrigated crops and the grain crops about 34 per cent. The remainder was made up of such miscellaneous crops as sugar beets, seed crops (mostly alfalfa seed), ripe peas, dry beans, and potatoes, named in the order of their harvested acreage. Sugar beets are by far, the most important of the miscellaneous crops. Alfalfa made up about 70 per cent of the harvested acreage of hay, tame grasses and clover 25 per cent, wild or native grasses 3 per cent, and the small grains 2 per cent. Wheat formed about 42 per cent of the acreage in grain crops, oats 24, barley 21, and corn 2 per cent. There seems to be no definite crop rotation or cropping system in general use. Alfalfa, being the leading crop, usually occupies the land for several years or until the stand becomes thin. It is then plowed up and from one to two crops of grain raised before seeding the land back to alfalfa.

Livestock

The livestock connected with Area 12 consist of range beef cattle, range sheep, a few farm flocks, dairy cattle, horses, poultry, and swine. The beef cattle consist mostly of Herefords. A few ranchmen, however, prefer Shorthorns. While the beef cattle are outside of Area 12 during the grazing season, most of their winter feed is produced within its boundaries. The sheep owned by residents of the area, except the relatively few farm flocks, are generally wintered on the range to the east. The dairy cattle are, for the most part, dual purpose Shorthorns, Holsteins, and Jerseys. Horses are chiefly used to provide farm power and as saddle horses. The tractor has replaced a lot of the farm horses in this area. The poultry consists mostly of farm flocks with a few commercial flocks. Turkey production has been increasing during late years and in 1935 about 15 car loads were shipped from the area to outside markets. Hogs are of very minor importance.

Types of Farming

In delimiting Area 12 an attempt was made to locate its border lines where livestock ranching ceases to be the dominant type of farming and where other types begin to prevail. In certain places it was necessary to locate the lines more or less arbitrarily. The proportional distribution of the types of farming to be found in the two sub-areas differ considerably. In sub-area 12-A the general farms made up approximately 27 per cent of the total number of farms in 1929; stock farms and ranches and part-time, 13 per cent each; dairy, 11; cash-grain, 10; crop-specialty, 9; self-sufficing, 6; unclassified, 5; truck, 4; and poultry, 2 per cent. In sub-area 12-B, on the other hand, the stock farms and ranches formed 34 per cent of the total number in 1929; crop-specialty, 30 per cent; general, 17; cash-grain, 11; unclassified, 4; dairy, 2; and part-time and self-sufficing, approximately 1 per cent each. Thus it is seen that in 12-A the general farms lead numerically with the part-time and the stock farms and ranches tied for second place while in 12-B the stock farms and ranches formed the largest type with crop-specialty second and the general farms third, (Figures 38 and 39.)

The difference in the relative importance of the types of farms to be found in the two sub-areas may be explained, in large part, as follows: Within 12-A are the city of Sheridan with a population of some 9000, and a number of industrial enterprises. This city and these industries create a demand for local farm products and make it possible for a limited amount of part-time, dairy, truck, and poultry farming to be carried on. Sub-area 12-B, on the other hand, is situated in the midst of grazing lands and is very sparcely populated, the production of livestock and
the growing of crops being the chief industries. Hay and sugar beets are the principal crop-speciality crops, the sugar beets being shipped to the sugar factory at Sheridan in sub-area 12-A.

**AREA 13. THE BIG HORN BASIN IRRIGATED DISTRICTS**

*Description*

Type of farming Area 13 consists of five more or less separate irrigated sub-areas situated in the northwestern part of Wyoming. The five sub-areas are designated in figure 37 as 13-A, 13-B, 13-C, 13-D, and 13-E, four of which lie in the floor of the Big Horn Basin. Sub-area 13-A is situated along the Shoshone River and Sage Creek in the northwestern part of Big Horn County and the northeastern part of Park County; 13-B extends from north to south along the Big Horn River in Washakie and Big Horn counties; 13-C is situated in the Greybull River Valley west of the towns of Basin and Greybull; 13-D lies along Shell Creek in the eastern part of Big Horn County; and 13-E is located on Clark Fork of the Yellowstone River in the northcentral Park County. Sub-area 13-E is a part of an irrigated district, the major portion of which lies in Montana. The five sub-areas of Area 13 all lie within type-of-farming Area 2. They include the major portion of the irrigated lands of Park, Big Horn, and Washakie counties where other types of farming predominated over stock farms and ranches. The total number of farms located in each of the five sub-areas should be a fairly reliable measure of their relative importance in 1929. That year there were approximately 817 farms in 13-A; 428 in 13-B; 195 in 13-C; 48 in 13-D; and 33 in 13-E.

The minimum elevation of the area as a whole is about 3640 feet near Kane on the Big Horn River. The maximum elevations within the five districts are approximately as follows: On the Big Horn River near Neiber, 4180 feet; on Shell Creek near Shell, 4200 feet; in the Greybull Valley near Emblem, 4400 feet; on Clark Fork of the Yellowstone River near Clark, 4500 feet; and 4500 feet also on the Shoshone River near Ralston. The area has the lowest average elevation of any of the irrigated districts in the State where irrigated farming is extensively practiced.

**Climate**

The climate of the area is both arid and seasonal. The mean annual precipitation of the four sub-areas varies at the different weather stations from less than 6 inches at Denver near the Montana State line to about 10 inches at Neiber in Washakie County, while that of the district on Clark Fork of the Yellowstone River is less than 12 inches. Over a 25-year period the annual precipi-
tation varied between a minimum of 2.6 inches and a maximum of 11.1 inches at Basin and between 1.7 inches and 12.0 at Powell. The seasonal precipitation, that falling between April and September inclusive, averages about 70 per cent of the annual. The scant precipitation makes it necessary to produce all crops under irrigation. The mountains surrounding the Big Horn Basin are high, especially the Absaroka Range lying to the west and the Big Horn Range to the east, and they generally receive a heavy snowfall. The accumulation of snow in the mountains during the winter and early spring generally maintains a fairly good flow of water in the streams from which the irrigation water for Area 13 is diverted.

The summer days are generally warm and the nights relatively cool. Temperatures above 100 degrees F. occur occasionally during periods of comparatively short duration. The relative humidity of the atmosphere is very low and evaporation is high. The somewhat violent thunder-showers which occur occasionally during the summer wet the soil to a depth of but a few inches and much of this moisture is rapidly dissipated. While hail storms occur occasionally, they are rarely of sufficient force to severely damage crops. The average frost-free season in different parts of the area varies from about 117 to 150 days.

Soils

The irrigated lands very generally occupy the river and creek valleys and the alluvial terraces and fans. The topographical features, for the most part, are well adapted to the application of irrigation water. The soil types\(^1\) are quite variable and consist mostly of loams, sandy loams, fine sandy loams, loamy fine sands, and clay loams. In places the sub-soil is gravelly. As a rule the soils are low in organic matter content and high in soluble plant food.

Drainage and Water Supply

The surface drainage of practically the whole of the five districts making up Area 13 was good before irrigation operations were begun. It was soon discovered, however, that the underdrainage was not capable of taking care of the surplus water that was being used. The water table raised to or near the surface over large tracts of land and alkali began to accumulate on the surface as the result of the evaporation of the soil moisture. Thus it has become necessary to provide artificial drainage for much of the flat lying irrigated lands.

\(^1\)Soil surveys have been made that cover all of the land in Area 13 except that on the Clark Fork of the Yellowstone River to which the reader is referred for further information. Soil Survey of the Shoshone Area, Wyoming, Series 1927, No. 38, and Soil Survey of The Basin Area, Wyoming, Series, 1928, No. 27.
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The water supply for the irrigation of crop and pasture lands is very good in four of the five districts composing the area. The irrigated lands lying along the Big Horn River, Shell Creek, and Clark Fork of the Yellowstone River have water supplies that are fairly dependable although the water is diverted direct from the streams. The Shoshone Reservoir located a few miles above Cody on the Shoshone River provides ample storage facilities for the land now under irrigation along that stream. In the Greybull Valley, however, the area under irrigation has been extended until a shortage of water sometimes occurs during the summer months when the flow of the river is at its minimum. Especially is there likely to be a shortage of water in the valley during dry years like 1934 and 1936. It is claimed, however, that the flow of the Greybull River is ample to irrigate all of the land now under cultivation were there sufficient storage facilities for impounding the flood water and the flow of the river outside of the irrigating season. Arrangements for providing storage facilities on the Greybull River are now under way.

Transportation and Industries

The area is served by the Chicago, Burlington and Quincy Railroad which follows down the Big Horn River to the junction of the Big Horn and Shoshone rivers and thence up the Shoshone River and Sage Creek to Frannie near the Montana State line. A branch of the Chicago, Burlington and Quincy Railroad extending from Frannie up the Shoshone River to Cody serves a part of the area. Each of the five districts composing Area 13 is also served by excellent highways except the Clark Fork of the Yellowstone River district, the chief outlet of which is into Montana.

The area has sugar factories at Lovell and at Worland. There is a vegetable canning factory at Cowley and creameries are operated at Powell, Greybull, Basin, and Worland, with cream shipping stations at various points. There is a Bean Growers Association with headquarters at Basin.

Crops

Definite crop statistics for Area 13 cannot be given because the area forms parts of three counties and the available data are on a county basis. However, the major portion of the crops grown in the three counties is produced within the area. For these reasons the data presented are to be considered as close approximations. The crops grown may be divided into three groups: Grain crops, hay and forage crops, and other crops. The grain crops make up about 25 to 26 per cent of the total harvested acreage, the hay and forage crops around 48 to 50 per cent and
other crops from 24 to 27 per cent. These proportions change quite materially from year to year. Oats generally occupy the largest acreage of any of the grain crops followed by either wheat or barley, some years wheat being the more important and other years barley. Corn and all other grain crops are of minor importance. Alfalfa is the leading hay crop and makes up from about 75 to 95 per cent of the harvested acreage of hay. Sweet-clover and the small grains form part of the hay crop. The other crops consist mostly of sugar beets, dry beans, and potatoes. Beans generally make up from 12 to 15 per cent of the total harvested acreage and sugar beets from 10 to 11 per cent. Potatoes are of much less importance than the beans or the sugar beets, except in the vicinity of Powell. Beans, potatoes, and corn are generally grown on the sandy and sandy loam soils, while the heavier soils are preferred for sugar beets, alfalfa, and the small grains. A limited amount of truck crops are produced. The truck crops are marketed in the local towns of the area and are shipped also to Casper, Thermopolis, Cody, the Yellowstone National Park and other outside points.

**Livestock**

Area 13 is completely surrounded by grazing lands and its agriculture is quite closely related to the range livestock industry. The wintering of range cattle within the area and the feeding of lambs and cattle each fall and winter make sheep and beef cattle the leading livestock enterprises. While there are sufficient dairy cattle to provide for local needs and to maintain the four creameries of the area, dairy cattle are not a highly important enterprise. The chickens of the area consist mostly of relatively small farm flocks. There are some commercial flocks of turkeys. Hogs are of minor importance and many horses have been replaced by tractors.

**Types of Farming**

The proportional distribution of the types of farms in the five sub-areas varied considerably in 1929. That year the distribution was approximately as follows:

Crop-specialty farms made up 63 per cent of the total number of farms in 13-A; general, 13 per cent; stock farms and ranches, 6; unclassified, 5; part-time, 4; cash-grain, 3; dairy and poultry, 2 each; and self-sufficing 1 per cent. The other one per cent was made up of truck, fruit, and horse or feed lot farms.

In 13-B crop-specialty farms formed 62 per cent of the total number; stock farms and ranches, 14; general, 8; part-time, 5; dairy and unclassified, 4 each; and cash-grain and poultry, 1 per cent each. Truck, fruit, horse or feed lot and institution or country estate farms made up the other one per cent.
Of the total number of farms in 13-C, crop-specialty constituted 60 per cent; general, 19; stock farms and ranches, 8; unclassified, 6; poultry, 3; and dairy, 2 per cent. In addition to the above there was one farm each of the following types; cash-grain, part-time, boarder and lodger, and horse or feed lot.

In 13-D crop-specialty formed 38 per cent of the total number in 1929; stock farms and ranches, 31; general, 17; unclassified, 6; poultry, 4; and dairy and part-time, 2 per cent each.

Crop-specialty farms made up 52 per cent of the total number of farms in 13-E; cash-grain, 18 per cent; stock farms and ranches, 15; and general, 15 per cent.

Thus, it is seen, the crop-specialty farms strongly predominated in four of the five sub-areas and were the most numerous in the fifth. Figures 29 and 35 present the approximate distribution of the more important types within each of the sub-area. In like manner, figures 38 and 39 show the first and second dominant type in each sub-area.

Since the census enumerators credited the voting precinct in which a farmer lives with livestock and the land he owned, it is probable that some of the stock ranches credited to Area 13 are situated outside of the area. That is, the ranchmen live within Area 13 and their ranches may be located elsewhere. It is also probable that the farms classified as stock farms (animal-specialty farms as classified by the United States Bureau of the Census) may give the reader an incorrect conception of their nature and organization. For the most part they are farms on which cattle or lambs are fed for 60 days or more during the fall and winter. The crop land is devoted to the production of cash crops and feed crops. Feeder lambs and feeder cattle are purchased and brought to the farms in the autumn where they are finished for slaughter. Sugar beets are generally the principal cash crop on these farms and alfalfa and one or more of the small grains are the feed crops. The alfalfa and manure associated with the feeding operation play their parts in maintaining satisfactory yields of the sugar beets. The whole is a well rounded type of farming. The gross returns from the sale of the finished lambs or cattle on these farms amount to 40 per cent or more of the total gross receipts with less than 40 per cent derived from any other single source. This situation puts these farms in the stock farm (animal-specialty) type, whereas the feeding operation is only a part of a well balanced organization that is intended to maintain the productivity of the farm land.

The Dominant Type.—The crop-specialty farms (the dominant type) show a decided concentration in Area 13. (Figure 31.) The special crops grown on these farms are hay, sugar beets, dry beans and potatoes, with some clover and alfalfa seed. If the
total gross receipts from any one or from all of these crops equaled 40 per cent or more of the total gross receipts from all sources, the farms were placed in the crop-specialty type provided, of course, no other source contributed 40 per cent, in which event they were classified as general farms. These farms leaned very strongly to cash crop farming in 1929, their gross receipts being derived from the different sources approximately as follows: All crops contributed an average of about 77 per cent; livestock, 8 per cent; livestock products, 8 per cent; and farm products used by the farm family, 7 per cent.

The crop rotations and cropping systems followed on the crop-specialty farm vary considerably. This is due largely to the varied conditions to be found from farm to farm. Formerly alfalfa, when well established with a good stand, often occupied the same tract of land for as much as 10, 15 or even 20 years. The spreading of alfalfa bacterial wilt over the area during recent years has shortened the profitable life of alfalfa in some cases to about 4 or 5 years. Likewise beans have been grown continuously on the same land for several years, and by a few growers for as many as 12 to 15 years. Especially has the continuous growing of beans on the same land been practiced in the Shell Creek district. However, bean bacterial blight has made its appearance and it is likely the bean crop will be forced into a crop rotation in that district.

Both sugar beets and beans are generally grown in very flexible rotations or cropping systems in which alfalfa and sweetclover are the soil improving crops. The following will illustrate the sequence of the crops in these rotations.

Rotation No. 1
Small grain 1 year (alfalfa seeded)
Alfalfa 3-5 years
Sugar beets 2 years

Rotation No. 2
Small grain (alfalfa seeded)
Alfalfa 3 years
Sugar beets 1 year
Beans 1 year

Rotation No. 3
Small grain (sweet clover seeded)
Sweet clover 1 year
Beans or beets 2 years

In general sugar beets and beans are interchangeable in the crop rotations and their relative importance, as measured by the acreage devoted to each crop, depends (1) on the prospective profitableness of the two crops at planting time; (2) on the adaptability of the two crops to the texture of the soil to be planted; (3) on the distance the crop must be hauled to the shipping point; and (4) on the prospective supply of irrigation water during the latter part of the growing season. Although beans are best adapted to the sandy loam soils excellent yields are obtained also
on the heavy soils by preventing the surface of the ground from crusting until the young plants are up and well established. This is done with a harrow or other suitable implement. While the beets are best adapted to the heavy and medium textured soils, they may be grown on most of the soil types of the area. Beets are bulky and are generally grown within 6 to 10 miles of the railroad while beans may be transported long distances. The sugar beet matures late in the fall and requires water throughout the irrigation season whereas beans mature during late August and early September and require much less irrigation water. For these reasons few beets are grown in the Greybull Valley.

AREA 14. THE LANDER-FORT WASHAKIE-RIVERTON IRRIGATED AREAS

Description

Area 14 is located near the center of Fremont County in the westcentral part of Wyoming. It may be described as an undulating to fairly level plain that slopes away from the foothills of the Wind River Mountains toward the northeast, first at the rate of 50 to 75 feet per mile and then more gradually. In the central and northeastern parts of the area, the general slope is to the east and numerous stretches of comparatively level land occur here and there.

The area lies at elevations varying from about 4900 to 6000 feet, Riverton having an elevation of 4950 feet, Lander 5337 feet, and Pavillion 5690 feet. The area is chiefly drained by three streams and their tributaries: The Big Wind, Little Wind, and Popo Agie rivers. These three streams unite in the lower part of the area and become the Big Horn River, which flows north through the Owl Creek Mountains in a deep narrow canyon into the Big Horn Basin.

Numerous streams (mostly tributaries of the Popo Agie and Little Wind rivers) have cut channels and from narrow to broad stream valleys through the plain from southwest to northeast. Between these channels and valleys are ridges, flat-topped mesas, benches and terraces, all of which flatten out gradually toward the northeast.

Area 14, as its title implies, may be divided into three sub-areas: the Lander, the Fort Washakie, and the Riverton.

The Lander sub-area lies to the southwest and is drained by the Big and Little Popo Agie rivers and their tributaries. The first settlement was made in 1869 and that year Fort Augur, a military post, was established. The name of the fort was changed to Camp Brown in 1870. In 1878 Camp Brown was moved to the northwest about 15 miles onto the Shoshone Indian Reservation.
and renamed Fort Washakie. Lander, the county seat of Fremont County and the western terminal of the Chicago and North Western Railroad, was laid out in 1883. This sub-area has a fairly stable water supply. No material increase in the irrigated area is likely to take place in the near future.

The Fort Washakie sub-area is triangular in shape and lies between the North Fork of the Popo Agie and the Big Wind rivers. It constitutes a part of the "diminished" portion of the Shoshone Indian Reservation. It is chiefly watered and drained by Little Wind River and its tributaries. In surface features, it is more nearly level than is the Lander sub-area.

A part of the Fort Washakie sub-area has been allotted to the Indians. A considerable portion, however, is held as tribal grazing lands. Of the irrigated land allotted to individual Indians, some is farmed by the Indian owners, while some is farmed by white men who have either bought or leased the land. While not as good farmers as the white men, the Indians get along fairly well. They are, as a race, more suited to a pastoral type of agriculture. The irrigation system of this sub-area is under the supervision of the Indian Agency.

The Riverton sub-area lies north of the Big Wind River in the northeastern part of Area 14. It is a part of the "ceded" portion of the Shoshone Indian Reservation. It is made up of two parts. One of these consists of about 18,000 acres of irrigated land lying in a long narrow strip in the bend of Big Wind River above and below the town of Riverton. This unit is irrigated from two privately owned ditches, the Le Clair and the Wyoming No. 2. The area irrigated from these two ditches is gradually increasing from year to year.

The other part is known as the Riverton Federal Irrigation Project. This project is being developed under the U. S. Bureau of Reclamation. When completed the system will furnish water for approximately 100,000 acres. Water was distributed to 20 farm units in 1926. Approximately 18,700 acres were irrigated in 1936. Under this project raw land may be acquired either by homesteading or by the purchase of land now held in private ownership.

**Climate**

The climate is semi-arid to arid; the relative humidity is low; the summers are comparatively short with fairly high day temperatures and cool nights; the winters are long and cold; frequent and fairly strong southwestern winds predominate during each month of the year; the mean annual precipitation varies from about 10 inches in the northern part of the area to around 14 inches in its upper part near the Wind River Mountains. The
average length of the frost-free period varies from 123 days at Lander to 140 days at Riverton.

Soils
The lands of Area 14 have been classified as grazing and irrigated. The irrigated lands lie mostly in the stream valleys and on the lower benches, terraces and level areas to which water can be diverted for irrigation. Practically all lands not irrigated are used for grazing purposes. The area irrigated is likely to increase gradually for several years to come.

The irrigated soils vary in texture all the way from fine sand to heavy clay; in depth from shallow to deep; in porosity from open to compact; in alkalinity from neutral to a high impregnation of alkaline salts. The soils are generally basic and low in organic matter and available nitrogen. A horizon of high lime concentration generally occurs at 18 to 30 inches below the surface. The productivity and tilth of all virgin soils are greatly improved by the growing of sweetclover and alfalfa. In the older farmed parts of the area, crops show a marked response to the application of phosphate fertilizers. Seepage has developed in many of the low and poorly drained areas. Some wind erosion takes place on irrigated, sandy soils when left bare during the winter after such crops as sugar beets and beans have been harvested. There is also a limited amount of gully erosion where too much irrigation water is applied and especially where excessive amounts of water are turned into the waste channels.

Crops
All crops produced in Area 14 are grown under irrigation and most of them are closely related to the livestock industry. Of the total harvested acreage in both 1929 and 1934, the hay crops roughly estimated made up about 70 per cent; the grain crops 25; the sugar beets, dry beans, potatoes, and a few other crops the remaining 5 per cent. In 1934 oats constituted approximately 48 per cent of the harvested acreage of all grain crops, wheat 28, barley 16, and corn and mixed grains 8 per cent.

The harvested acreage of sugar beets increased from 763 acres in 1924 to 1798 acres in 1934. The lack of satisfactory marketing facilities is largely responsible for the slow increase in the acreage devoted to sugar beets. While the beets yield well, can be grown successfully and are needed as a row-tilled crop in the cropping system, the crop must be shipped to the sugar factory at Worland, a distance of more than 200 miles. This entails an expense to the beet growers of some 50 cents per ton.

Of late years dry beans have been in favor as a cash crop and the acreage has steadily increased. A limited amount of po-
potatoes is grown each year and sweetclover is becoming an important soil improving, pasture, and seed crop. In some parts of the area, seed crops of alfalfa are harvested. Much of the irrigated land of the area has been brought under cultivation during recent years and but few farmers of the area have adopted definite crop rotations or cropping systems.

Livestock

The kinds of livestock associated with Area 14 are sheep, beef cattle, dairy cattle, swine, poultry and horses. Range sheep and cattle are of primary and all other kinds of livestock of secondary importance. In addition to the range sheep a limited number of comparatively small flocks are kept on some of the irrigated farms the year round. Most of the range sheep and cattle are summer grazed outside of Area 14 and wintered within it. Probably one-fourth of the cows milked are of beef or dual purpose breeding. Hogs are produced only for local use, and the poultry is mainly made up of farm flocks. The horses are chiefly kept to provide farm power.

Types of Farming

Of the dozen or more types of farming to be found in Area 14 in 1929, three types stood out quite prominently, namely, stock farms and ranches, general farms and crop-specialty farms. The stock farms and ranches that year made up approximately 24 per cent of the total number; general, 21; crop-specialty, 20; cash-grain and self-sufficing, 8 each; unclassified, 6; part-time and dairy, 4 each; poultry, 2; and truck 1 per cent. The other 2 per cent was made up of institutional farms or country estates, boarder and lodger farms, and horse or feed lot farms.

An idea of the relative importance of the several types may be obtained by a consideration of the distribution of the gross income. Of the total gross receipts of all farms in 1929, the stock farms and ranches received approximately 72 per cent; general and crop-specialty, 9 each; dairy and abnormal, 3 each; cash-grain, 2; and poultry, truck and self-sufficing, less than 1 per cent each. That year the average gross receipts per farm for the several types were about as follows: Stock farms and ranches, $6308; dairy, $3010; truck, $1902; crop-specialty, $1642; general, $1573; poultry, $1472; abnormal, $1198; cash-grain, $787; and self-sufficing, $260.1

The crop-specialty farms are very closely related to the livestock industry. The special crops of Area 14 which put farms into that type are hay, sugar beets, dry beans, and potatoes. Hay is

1The data given above on the distribution of gross income are based on gross receipts for all farms of Fremont County as a whole.
of far more importance than the other three crops combined, and practically all hay produced is consumed by livestock within the area. Where farms are crop-specialty farms because of the hay sold, the hay is generally bought by stock-ranch operators who need more hay than they produce. The area supports two creameries, one at Lander and one at Riverton, and some 25 farms may be classified as dairy farms.

The Dominant Type.—It is quite evident from what has been said above that the stock farms and ranches combined are easily the dominant type of farm in Area 14. Of the total number of farms in the dominant type in 1929, about 67 per cent were stock farms (animal specialty) while around 23 per cent were bona fide stock ranches. That is to say, that 67 per cent had less than 10 acres of grazing land to each acre in crops whereas the 23 per cent had 10 acres or more of grazing land per acre in crops.

Area 14 lies in close proximity to the grazing lands of both the Washakie National Forest and the Shoshone Indian Reservation, where stockmen of Area 14 obtain permits to summer graze their sheep and cattle. The foothills and the meadows and irrigated pastures furnish the spring and autumn grazing. The necessary feed for wintering the livestock and supplementing the range, in large part at least, is produced in Area 14. Some of the ranchmen with headquarters in the area, winter graze their sheep in Area 1. The stock farms and ranches of Area 14 are organized, operated, and managed in much the same way as those described for Areas 3 and 5.

AREA 15. EDEN VALLEY IRRIGATION DISTRICT

Description

Area 15, the Eden Valley Irrigation District, is located in the northwestern part of Sweetwater County. The area lies at elevations between 6580 and 6700 feet. Its surface in general is smooth and the slope is gradual and to the south. The irrigated land lies in two separate tracts: One is located between the Big and Little Sandy creeks about Farson Postoffice while the other is situated some three miles south of the junction of these two streams. The nearest railroad shipping is Rock Springs, Wyoming, the distance being 35 and 40 miles respectively from the two irrigated tracts. The area is traversed by U. S. Highway No. 187, which runs from Rock Springs to Yellowstone Park.

Area 15 was developed under the Carey Act and the irrigation system is privately owned and managed. Irrigation water was first available in 1908. At that time it was planned to irrigate approximately 21,000 acres and title has passed to the State of Wyoming on that acreage. Title to about 12,000 acres has been
conveyed to the settlers by the State. At the present time (1938) approximately 8000 acres are being irrigated. While crop production has been seriously curtailed during past years because of shortage of water, it is said that the present storage facilities and canal system, under efficient management, would deliver ample water for the present acreage being irrigated except during severe drouth years such as 1934. The irrigation company, through foreclosure proceedings on water rights, has taken over a considerable portion of the land that has been brought under irrigation. Some of the perennial weeds (white top, Canada thistle, Russian knapweed and quack grass) are quite well established in the northern part of the area.

Climate

The climate of the area is arid, the mean annual precipitation being between 6 and 7 inches. From 60 to 65 per cent of the annual precipitation falls between April and September. Most of the winter precipitation falls as snow. The winters are relatively long and temperatures of −30 degrees F. for rather short periods are not uncommon. The winter grazing of sheep on the ranges surrounding Area 15 is more hazardous than it is in the Red Desert Country to the south. This is because the snow mantle covers the surface more continuously and because also of the lack of natural shelter. This makes it necessary for the ranchmen of this area to do more winter feeding. The growing season is short, the frost-free season averaging 82 days for a 19-year period.

Soils

Soil and topographical surveys have been made and it was found “that the top soil is generally a sandy loam, although there are scattered areas of clay loam which are exceedingly difficult to farm. Where the top soil is a sandy loam the subsoil and the sub-strata are found to be first coarse sand, then fine sand and at depths of from 5 to 12 feet a hard pan. Where the top soil is clay loam the substrata are clay and hard pan.”

“The clay loam top soil shows a much higher concentration of salts than does the sandy loam. It is also on the clay knolls and patches where the so-called alkali first puts in its appearance. One or two seasons after the alkali has shown up on the knolls the land produces an unusually large crop for that locality and the next year will grow nothing at all.”

The need for a complete drainage system is far more urgent for the northern irrigated tract, or Farson Area which lies between the Big and Little Sandy creeks and to the east of the Little Sandy, than it is for the other tract lying to the south.

Crops

The crops produced in Area 15 are largely confined to hay and grain crops. In acreage, alfalfa leads all other crops. It is cut twice each season and yields around 2 tons per acre. The stand of alfalfa usually lasts 5 or 6 years. When there is but little snow, alfalfa may winter kill. When the stand becomes thin and the yield reduced, the land is usually plowed and devoted to grain for one or two years and then seeded back to alfalfa. Oats are the leading grain crop with barley second and wheat third. During past years there has been a better demand for oats as a cash crop than there has for barley or wheat. Barley is mostly used in feeding lambs and the wheat is chiefly fed to chickens. Sweet-clover is used both for hay and pasture. Hay and a limited amount of potatoes are grown as cash crops.

Livestock

Range sheep, beef cattle, and dairy cattle are the principal kinds of livestock associated with Area 15. A number of ranchmen produce feed and make their headquarters within the area and graze their sheep and cattle in areas 1 and 5. There are, however, a few farm flocks of sheep. During very recent years there has been an increase in the number of dairy cattle. Except for a few flocks of from 200 to 500 hens and also a few flocks of turkeys the poultry of the area consists of farm flocks. Hogs are produced only for local use.

Types of Farming

The agriculture of Area 15 is closely related to the production of range sheep and beef cattle. This is largely due to its isolation and its being surrounded by extensive grazing lands. Of the total number of farms in 1929, the crop-specialty farms constituted 22 per cent; cash-grain, 21; stock ranches, 18; general, 12; dairy, 10; part-time, 8; and self-sufficing, 3 per cent. In addition there were 2 institutional or country estate farms, 1 boarder-lodger farm, 1 horse or feed lot farm, and 1 unclassified farm. While not the largest numerically, the stock ranches are the most important type.

The special crops produced on the crop-specialty farms are hay and potatoes, the latter being of very minor importance. The hay is mostly sold to sheep and cattle ranchmen who in turn feed it. Likewise, practically all of the grain produced for sale on the cash-grain farms is bought to be fed to livestock. Much of the oat crop is used for horse feed, while considerable of the barley is fed to underweight lambs. Hence the close relationship between the crop-specialty and cash-grain farms to the range sheep and beef cattle enterprises.
The dairy enterprise has been increasing of late years. The dairy herds are made up mostly of grade cattle and vary from around 6 to 45 cows per herd. The milk is marketed through the Eden Valley Dairy Association which operates trucks for picking up the milk and also a whole milk distributing and manufacturing plant in Rock Springs, which has a population of about 8500. In addition to Rock Springs as a market, the coal mines within the vicinity of that city have an additional population of some 8000. Under efficient management of the marketing phase of the industry, dairy farming is likely to increase.

AREA 16. BRIDGER VALLEY IRRIGATED AREA

Description

Type-of-farming Area 16, the Bridger Valley Irrigated District, is situated in the southwestern part of Uinta County. The southern and western limits of the area are some 12 and 36 miles, respectively, from the southern and western boundaries of Wyoming. The sharp Uinta Mountains lie to the south, the Bear River Divide to the west and northwest and the Red Desert winter grazing country to the east and northeast. The area lies at elevations ranging from approximately 6600 feet at its lower extremity where irrigation ceases on Black's Fork and Smith's Fork of Green River to about 7300 feet in its upper portion near the town of Robertson. The area is drained by these two streams and from them the water used in irrigating the area is diverted direct without storage. Both of these streams have their source in the Uinta Mountains in Utah.

Climate

The climate of Area 16 is arid to semi-arid. The mean annual precipitation for the area as a whole is around 12 to 14 inches. At Lyman during a 7-year period, it averaged 11.92 inches. Approximately 60 per cent of the annual precipitation falls between April and September inclusive. Since much of the seasonal precipitation falls as somewhat heavy, violent showers, considerable moisture may be lost by surface run-off. The winter precipitation generally falls as dry snow. The entire surface of the ground is seldom covered with a mantle of snow for more than a few days at a time because of the drifting of the snow.

The annual precipitation varies greatly from year to year. (See the data presented for Evanston in Figure 7.) This in turn causes a corresponding variation in the flow of the streams during the irrigating season. Since the irrigation water for this area is

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1This area as described here does not include the Carey Act Project known as the Uinta Development Project, which proposes to irrigate some 50,000 acres lying north of Black's Fork of Green River by the construction of storage reservoirs.
diverted direct from the streams without storage, the supply of water may be greatly reduced and the production of crops and grazing forage materially curtailed during severe drouth years. For example, the harvested acreage of all crops in Uinta County in 1934 (a severe drouth year) was but 24,640 acres as compared with 52,840 acres in 1929, a fairly normal year. This handicap (the fluctuation in the flow of the streams during the irrigating season) might be overcome by the construction of reservoirs to impound flood water and the flow of the streams during the non-irrigating season.

The winters are rather long and relatively cold. Temperatures as low as —30 degrees F. may be expected almost any winter. The summers are correspondingly short. At Lyman, for example, the frost-free growing season averaged 78 days for a 7-year period. The winter feeding season for beef cattle brought to the area from the range, usually extends from about November 1 to May 1. Dairy cows that are milking are usually fed a little more than 6 months.

Soils

The land under irrigation consists mostly of the sloping benches lying between Black's Fork and Smith's Fork and of the bottom lands along and adjacent to those two streams. The benches make up the major portion of the area irrigated and consist mostly of Uinta Gravelly Sandy Loam, a "light grayish brown gravelly sandy loam over a light gray to light grayish brown very gravelly subsoil. The subsoil contains a very high percentage of water worn gravel and stones which are cemented together with lime."1 The major portion of the irrigated bottom land consists mainly of Yellow Creek clay loam, a "dark grayish brown calcareous clay loam surface over a lighter grayish brown to gray sub-soil."1 In addition to these two types of soil there are also limited areas of loam, silt loam, and clay loam soils under irrigation.

The Bridger Valley was opened to homestead entry in 1890, many filings were made in 1891 and irrigation got well under way by the close of 1892. Some 40 years or more have elapsed, therefore, since water was first applied to some parts of the valley. Irrigation water was applied lavishly, it is said, during the early years when the acreage irrigated was relatively small and the water supply abundant. In the course of time, however, the water table rose to near the surface on much of the bottom and low lying bench lands which, in the beginning, produced the best crop yields. The accumulation of alkali on the surface then followed and

1From an unpublished characterization of the soils of Uinta County, Wyoming, in a soil survey made by the University of Wyoming and the Bureau of Chemistry and Soils, U. S. Department of Agriculture.
finally large acreages were allowed to lie idle because of the alkalinity of the surface soil. On some of the abandoned land, a thrifty growth of greasewood appeared within a few years while on other areas practically nothing grew. During recent years, however, a considerable portion of the abandoned, seeped areas have been reclaimed sufficiently to permit the production of pasture and hay consisting of the wild grasses and alkaline resistant tame grasses. This has been accomplished by flushing the surface of the ground in the early spring each year with the surplus flood waters taken direct from the mountain streams. Several years have been required because the flushing can be done only in the early spring when there is a surplus of water. At the present time (1938) a portion of the land that became seeped and alkaline still supports a growth of greasewood while on some of it the greasewood has been removed and the alkali reduced sufficiently by flushing the surface to permit the reestablishment of hay meadows and pastures. In general it may be said also that much of the irrigated land of the whole area is affected by high water table and the accumulation of alkali salts. From 30 to 40 per cent of the irrigated land is so impregnated with alkali as to materially reduce crop yields and impede natural drainage.

Crops

No crop census data are available which apply specifically to Area 16. However, the crop data for Uinta County as a whole should serve fairly well for this purpose since Area 16 makes up fully half of the crop acreage harvested in the whole county. The total acreage of all crops harvested in the county in 1929 was 52,840 acres. Of this amount, 92.2 per cent was in hay crops, 6.5 per cent in grain crops and 1.3 per cent consisted of ripe peas, sweetclover (pasture), potatoes, seed crops, vegetables, and fruits. Oats made up 53 per cent of the 3444 acres of small grains harvested, wheat 23 per cent, barley 22 per cent, and rye and mixed grains 2 per cent. Of the 48,828 acres of hay harvested that year, the tame grasses and clovers formed 57 per cent, alfalfa 22 per cent, and the wild grasses 21 per cent. It is believed, however, that the grain crops make up a slightly greater proportion of the total harvested acreage in the Bridger Valley than they do for the county as a whole and that the hay crops constitute a correspondingly smaller proportion. All crops produced within the area are irrigated and it is estimated that about 15,000 acres of pasture land are also irrigated. Practically all grain and forage crops produced are fed to livestock within the area.
Livestock

Range beef cattle, range sheep, and dairy cattle are each closely related to the agriculture of Area 16. There are a few farm flocks of sheep kept within the area the year around. A few hogs are grown for farm use and poultry consists almost entirely of small farm flocks.

Types of Farming

The agriculture of Area 16 is more closely related to the range livestock industry than is that of Area 15. The stock ranches and stock farms formed approximately 36 per cent of the total number of farms in 1929; the dairy farms, 21 per cent; general, 16; crop-specialty, 10; part-time, 8; poultry and unclassified, 3 each; self-sufficing, 2; and cash-grain, 1 per cent.

The dominant type is made up of both cattle and sheep ranches. The cattle ranches, in general, are more closely related to the agriculture of the area than are the sheep ranches. The sheep ranches are managed in much the same way as those described in detail for Area 1, while the description of the cattle ranches in Area 3 will give the essential features of the operation of the cattle ranches.

The range sheep belonging to the ranchmen of the area consist of relatively small bands ranging in size from 500 to 2500 head. They are mostly summer grazed in the Ashly and Wasatch national forests to the south in Utah and winter grazed in Area 1 to the west. The lambs are sometimes brought to Area 16 and grazed on the irrigated meadows and fields for a short period before being shipped. The lambs go mostly as feeders. In addition to the range sheep, there are quite a number of farm flocks kept on the irrigated pastures during the summer.

The beef cattle are summer grazed also in the Ashly and Wasatch national forests and in the Bear River Divide country to the west. The steers and other cattle to be marketed are rounded up soon after the hay harvest has been finished, brought to the valley and grazed on the meadows and irrigated pastures until About October 1, when they are marketed mostly as feeder cattle. A small percentage of the cattle may go for immediate slaughter as grass fat. The stock cattle are brought to home ranches of the area soon after the market cattle have been shipped out. They are grazed on the meadows during the late fall and fed hay for a period of 5 to 6 months. The feeding usually begins sometime during November and closes about May 1.

The general farms, as has been shown, are second in importance numerically. As the name implies, the income of these farms is derived from a number of sources with no one contributing 40
per cent. Thus, the gross income may come from the sale of hay, dairy products, poultry products, grain, a few beef cattle or from a farm flock of sheep.

Dairy farming has been increasing of late years. Most of the cattle milked are of Holstein breeding. The area maintains two cheese factories and around 50 per cent of the milk produced is shipped via truck to Green River and to Rock Springs, distances of 55 and 70 miles respectively. The dairy cattle are summer grazed on irrigated pastures. Dairy cows in milk are usually winter fed for fully 6 months. Alfalfa hay is the basis of the winter ration.

The crop-specialty farms were fourth in importance. Hay and a very few potatoes are the special crops grown. These farms may be very similar to the general farms although having at least 40 per cent of the gross income derived from hay or hay and potatoes.

**AREA 17. THE STAR VALLEY AREA**

**Description**

Star Valley is located in the extreme westcentral part of Wyoming along the Idaho-Wyoming state line. It is drained by Salt River and its tributaries and the irrigated lands lie on either side of the river for some 40 to 45 miles. The irrigated area has a maximum width of about 6 miles near the town of Grover. The rugged Salt River Range of mountains parallels the valley on the east and the Caribou Range and the less rugged Gannett Hills lie just to the west in Idaho. The elevation of the upper part of the valley where irrigation begins is around 6900 feet, while at its lower extremity where Salt River empties into Snake River it is approximately 5600 feet. Highway No. 91 traverses the valley from north to south and the distance to the nearest railroad shipping point varies from about 50 to 70 miles. The distance to market was a serious handicap to the early settlers before the days of improved highways and truck and automobile transportation.

Area 17 consists of two valleys, the upper or southern and the lower or northern, which are approximately of the same length. The two valleys are formed by the pinching in of the foothills from either side, thus causing the river to flow through a narrow canyon for a short distance. The floor of the two valleys slopes to the north and also toward the river from either side. The river flows in a very shallow channel through both valleys. Numerous small streams put in from either side which also flow in shallow channels. The river and its tributaries furnish an abundance of water for irrigating practically all of the land now under irrigation, the water being taken direct from the streams.
Wyoming Farming and Ranching Areas

Area 17 has been settled for some 50 years or more. While a few families came to the Valley about 1880, the chief influx of settlers occurred during 1885-86. At that time the land had not been surveyed and the settlers held their claims by the so-called “squatters’ rights.” Each settler staked off the boundaries of the land he claimed, usually about 160 acres, built his home and waited for the land to be surveyed. The survey was completed about 1890, a land office was opened at Evanston in 1891 and the settlers began making filings during May of that year. The filings were made under the 160-acre homestead act.

Climate

Area 17 has a semi-arid climate. The mean annual precipitation is around 17 inches for most of the area. The seasonal precipitation, that falling between April and September inclusive, is a trifle less than 50 per cent of the annual. (See the small chart superimposed on figure 6 which shows the average monthly distribution of the mean annual precipitation at Bedford.) January and May are the heaviest rainfall months of the year. Much of the summer precipitation falls as thunder showers, while that of the winter generally comes as dry snow.

The growing season is short. At Afton the frost-free period averaged 49 days for a period of 24 years, and at Bedford 64 days for 31 years. The winters are generally long and fairly cold. Temperatures of around —30 degrees F. for short periods may be expected to occur sometime during the winter months of any year. The short growing season and the length of the winters give the area a fairly long winter feeding season.

Soils

The surface soils of the irrigated part of the area, for the most part, are shallow, the depth varying from a few inches to as much as 2 or 3 feet with the thin phase predominating. The subsoil contains a very high percentage of water worn gravel and stones. The surface soils are usually dark brown in color and consist of gravelly sandy loam to clay loam with the gravelly sandy loam predominating. At places along the river the lateral slope is very scant and the water table is so near the surface that the land is used only for pasture or for producing native or wild grass hay. Star Valley is one of the very few irrigated districts that has no alkali problems. On the low foothills bordering the valley where small grain crops are grown without irrigation, the predominating soil type is a silt loam.
Crops

Practically all crops grown in Area 17 are fed to livestock. Roughly estimated, hay forms about 75 per cent of the harvested acreage of all crops and the small grain crops 25 per cent. About four-fifths of the hay acreage is in alfalfa and one-fifth consists of wild and tame grasses and clover. Alfalfa is cut twice during the season and yields, on the average, about 1½ tons per acre. The wild and tame grasses and clovers are cut but once each year and also yield about 1½ tons per acre.

The grain crops consist of barley, oats and wheat, mentioned in the order of their importance when measured in terms of acres harvested. A considerable portion of the grain crops is produced by dry farming methods on the foothill lands above the irrigation canals. Under irrigation no definite crop rotation is followed. However, alfalfa generally occupies the land for 6 or 7 years. After the alfalfa has been plowed up 2 or 3 crops of grain are usually grown before alfalfa is again seeded. About 50 per cent of the alfalfa is seeded alone and 50 per cent with a grain nurse crop. In addition to the irrigated crop land, about 10,000 acres of pasture land are either irrigated or sub-irrigated.

Livestock

The livestock consists of dairy cattle, beef cattle, sheep, a few hogs for local use, and farm flocks of poultry. The area maintains about 10,000 dairy cows and 5,000 dairy heifers. During 1936, between 20 and 25 car loads of cows were shipped to the Los Angeles market. Sufficient heifers are raised to replace both the wornout cows and those that are shipped out. The dairy cattle are mostly of Holstein breeding, ten of the herds being purebred. Some of the dairy herds contain as many as 40 cows. About 60 per cent of the young dairy cattle is summer grazed in the nearby foothills.

Types of Farming

While the agriculture of Area 17 is dominated by dairying, a half-dozen or more other types are to be found within its borders. In 1929 the dairy farms made up 47 per cent of the total number of farms; stock farms and ranches, 21 per cent; part-time, 12; crop-specialty, 9; general, 7; cash-grain, 2; and self-sufficing and horse and feed lot farms, 1 per cent each.

Stock farms and ranches, it is seen from figure 39, were the second dominant type in 1929. Of their total number 84 per cent were stock farms and 16 per cent stock ranches. The beef cattle are generally sent to the foothills about May 15 and a little later to the national forests. They are returned to the valley around October 1, where they graze on the meadows and irrigated pas-
tutes. The winter feeding season for beef cattle extends from about December 1 to May 15. From $1\frac{1}{2}$ to 2 tons of hay are required to winter a mature cow. In general, steers are sold when 2 to 3 years old. Thus, it is seen, the beef cattle of this area are handled in much the same way as in Area 3.

Around 40,000 sheep belong in Star Valley. Of this number about two-thirds are summer grazed on the nearby national forests from approximately July 1 to September 15. The other third remains on the farms of the valley during the summer. The sheep sent to the national forests are returned to the foothills in September and from there to the irrigated pastures and meadows of the valley. The lambs are marketed from September to November, some going for immediate slaughter as grass fat. The most of them, however, are shipped as feeders. The breeding flock is wintered on hay, about 4 pounds per ewe per day being required. Thus it is seen more winter feeding of the breeding flock is done in Area 17 than in other areas of the State.

It has been noted that the part-time farms made up 12 per cent of all the farms in the area in 1929. The farms of this type are generally small and they contribute but a small part of the gross income of all farms. The crop-specialty farms, however, are larger and of considerable importance in the area. While hay is the principal source of income of the crop-specialty farms, they generally receive some income from other sources such as dairy products, dairy cattle, beef cattle, sheep or grain.

**The Dominant Type.**—It has been shown that the dairy farm is the dominant type in Area 17. Dairy farming got under way rather early in the development of Star Valley. This was largely due to isolation. All products shipped out had to be transported for distances of 50 to 70 miles over a mountainous wagon road in order to reach the nearest railroad shipping points and during the winter the roads were often impassable, the area being snow bound at times. This made it expedient that the products to be disposed of in distant markets be in concentrated form in order to reduce freight charges as much as possible. Another factor that probably had much to do with developing the dairy industry was the necessity for a rather intensive type of farming. The population of the area, a family on practically each 160 acres, was greater than could find full employment in the production of range livestock. Finally a few of the settlers were dairy minded and about 1900 a creamery was built and a little later an experienced cheese maker was imported from Wisconsin.

From this small beginning a cheese making type of dairy farming gradually grew until it dominated the agriculture of the valley. For many years American cheese was the chief product
produced. Of late years, however, Swiss cheese has been the predominating product. At the present time (1937) six cheese factories and a casein-butter manufacturing plant are being operated. Four of the cheese factories are cooperative concerns. Approximately 80 per cent of the cheese manufactured is Swiss and 20 per cent American. About 98 per cent of all the cheese made goes to the west coast, 50 per cent of it direct to Los Angeles by truck and about 40 per cent to a processing plant at Pocatello, Idaho. The production of cows for the Los Angeles market has also become an important phase of the dairy industry of the area.

The milking cows, in general, are on pasture from about May 20 to October 1 to 15. In the main the pasture consists of Kentucky Blue Grass, White Clover, and Alsike Clover. Wheat grass and orchard grass form part of the pasture mixture on a few farms. Very few dairymen do any feeding while the cows are on good pasture. During the winter feeding season alfalfa hay constitutes about 90 per cent and meadow hay 20 per cent of the roughage. About 20 per cent of the milking cows are fed grain, much of which is sheaf oats.