

REPORT ON
LAND RESOURCES OF THE
GREAT PLAINS AREA OF COLORADO

COLORADO STATE PLANNING COMMISSION

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Denver, Colorado.
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I GENERAL CONDITIONS

Definition of the Area

The Great Plains Area of Colorado considered in the present study embraces about 44,340 square miles or 42 percent of the area of the entire state. The plains extend from the Wyoming state line on the north to the New Mexico and Oklahoma state lines on the south, a distance of 276 miles, and from the Kansas and Nebraska lines westward a distance averaging about 161 miles to the base of the Rocky Mountains. Twenty entire counties are included, and parts of eight counties. These vary in size from Denver County with 37,000 acres, to Las Animas County which includes nearly 3 million acres in the plains in addition to its mountainous section.

In this part of Colorado are found 80 percent of the state's population, all the cities over 10,000 population except one, two thirds of the farms, and nearly all the manufacturing. Denver, the capital city, with about 300,000 population, is by far the largest urban center in this part of the west. While the plains area presents physical and climatic aspects in sharp contrast with the adjacent mountain area it is closely bound to the mountains, particularly in the matter of its surface water supplies. These mountain streams are used to their full capacity in providing most of the water required for domestic and irrigation purposes.

Population Growth, Characteristics and Distribution.

Permanent settlements in eastern Colorado date back 78 years to the discoveries of gold near Denver in 1858 and 1859. For a decade or more thereafter the populated areas were largely confined to the mining districts, the city of Denver, and to the stream valleys where water could easily be diverted for irrigation. Many of the gold-seekers were more experienced in farming than in mining and failing to find gold, settled down to farming as a means of livelihood.

A strong incentive to attempt farming came from the fact that it had been necessary to haul food supplies for the mining camps about six hundred miles by wagon from Missouri River points. Another impetus came from the desire on the part of cooperative farming enthusiasts in the east to see their theories tried out in a new country, among them Horace Greeley. This resulted in the founding in 1870 of the Union Colony including the townsite of Greeley, in the South Platte River valley 50 miles below Denver. The 600 colonists went through the usual hardships of pioneering, built irrigation canals at much greater cost than anticipated, and developed a successful community. Several other colonies were organized shortly afterward. These settlers were drawn largely from the north-central and New England states and Illinois and Missouri. They were citizens of exceptionally high type, able to meet new problems and solve them successfully. The interest in farm lands was further stimulated by the two land-grant railroads, anxious not only to sell their land but to encourage settlement along their lines.

Development of irrigation in the Arkansas Valley came somewhat later, and the new population has come more largely from the southern and southwestern states, including a considerable number of Spanish-American descent. In thinking of the people who have been attracted to Colorado one should not fail to note the large numbers of health-seekers, particularly those suffering from pulmonary diseases. Frequently the illness of one member would involve the moving of the whole family.

Robert Louis Stevenson, himself a lifelong invalid, in referring to his journey in 1879 across the country, wrote: "Anyone who has travelled westward by the great transcontinental railroad of America must remember the joy with which he perceived, after the tedious prairies of Nebraska and across the vast and dismal moorlands of Wyoming, a few snowy mountain summits along the southern sky. It is among these mountains, in the new State of Colorado, that

the sick man may find, not merely an alleviation of his ailments, but the possibility of an active life and an honest livelihood. There as a working farmer, sweating at his work, he may prolong and begin anew his life."

Figure 1 shows the birthplace of the population living in Colorado in 1930 who were not born in this state, and the proportion of the population born in Colorado, in other states, and in other countries, who were residents of the state at census years since 1900.

Except for the relatively small irrigated areas in early days, the plains region was first used as an open free range for livestock. Construction of the first railroads in the late sixties and early seventies, by providing shipping facilities gave a great impetus to the livestock industry. Between 1866 and 1884 large numbers of cattle were trailed into the state, principally from Texas, for summer grazing. General farming then was not extensive, it being supposed that crops could not be grown except by irrigation.

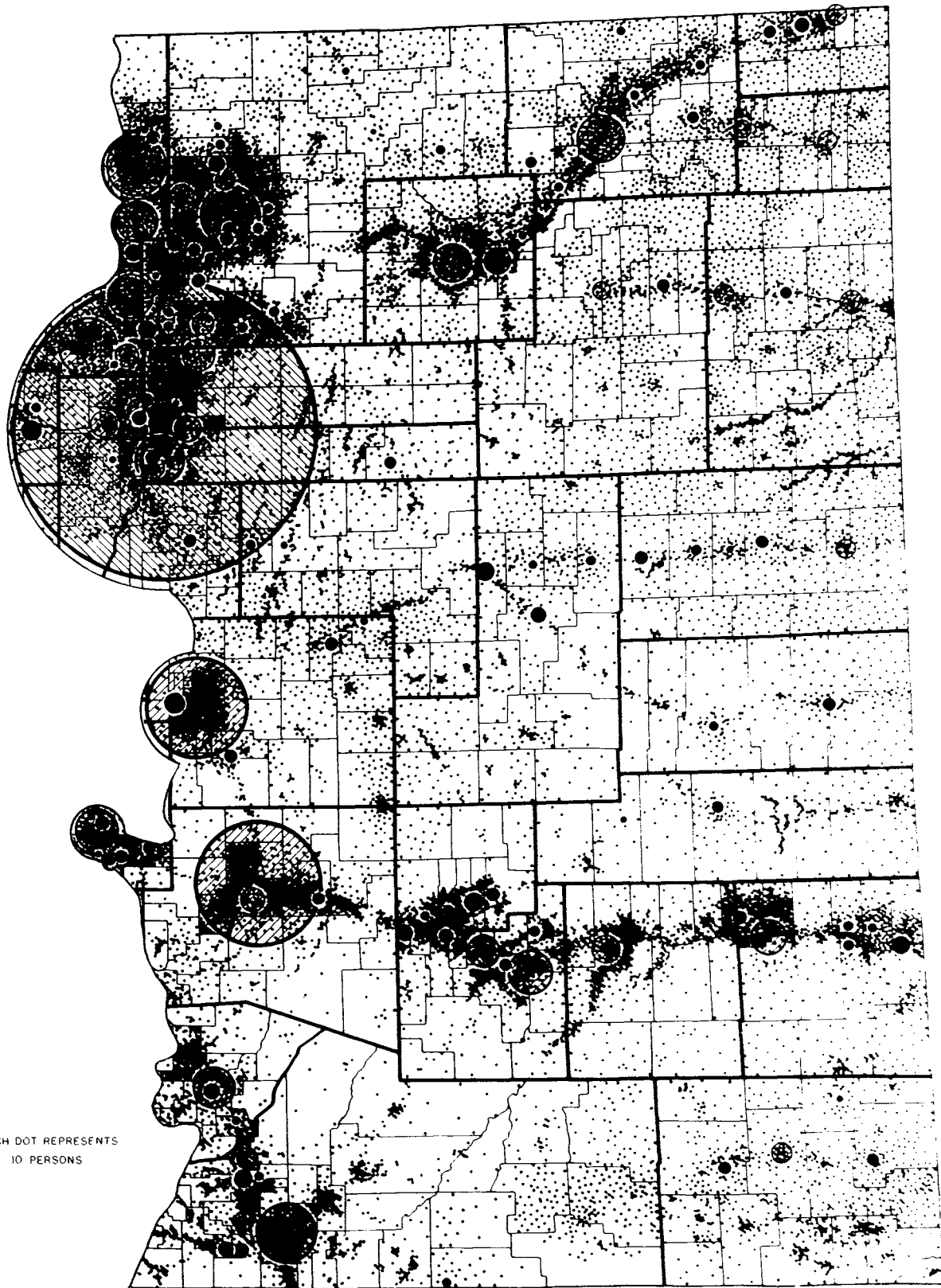
A notable inrush of people took place between 1866 and 1890, largely an overflow of the landseekers who had come to Kansas in immediately preceding years. These homesteaders on the dry lands seriously interfered with the business of the free-range livestock men. Many succeeded fairly well until 1892 when a series of dry years occurred, there being a complete crop failure in 1894. By 1895 practically all the settlers had left. Following this recession in land settlement there was a gradual recovery, as the rainfall increased. After 1900 there was much experimenting with improved farm practises to conserve soil moisture and before 1910 a definite boom was under way not only in dry lands, but in over expansion of irrigation. Many promotions and projects based upon uncertain flood-water supplies from the intermittent streams were doomed to failure.

The last stimulus to crop farming, as is well known, was the result of high prices for agricultural products during and immediately following the World War. Speculators seized the opportunity to get settlers on the land, much land changed hands at exorbitant prices, tractors were introduced, and grain farming was undertaken on a relatively large scale. The number of farms in Colorado increased from about 10,000 in 1890 to about 60,000 in 1920, since which time the number has not increased greatly.

In 1930, of the population in the plains counties, 57.6 percent were urban residents, and 42.4 percent rural. If the city of Denver were excluded, the rural population would predominate. Table I shows the urban-rural distribution by counties in 1930. During the decade 1920-1930 the urban population had gained 14.1 percent as compared to the rural gain of 9.3 percent. Percentage of rural gain was highest in the area near Denver, amounting to 53%, 51%, and 44% in the three surrounding counties. Rural gain was also shown in the counties in which the other principal cities are located, Pueblo and Colorado Springs. All of the 7 counties in northeastern Colorado showed a gain in rural population, and all 8 counties in southeastern Colorado showed a loss except for Baca and Pueblo counties. In the east central counties, practically all dry-land territory, 6 showed a loss as compared to only 3 which had gained, leaving out of consideration three counties in which the cities of Denver and Colorado Springs had an influence in stimulating suburban rural growth.

The Agricultural Census of 1935 shows a decline in the farm population of the Plains Area since 1930 amounting to 4.5 percent, as compared to a gain in the remainder of the state. The land-use survey of the Resettlement Administration in 1936 appears to show a much more serious decline in farm population in the dry-land counties than the foregoing. Based on various sources of information it seems probable that several counties have lost as much as 20 percent of their population since 1930.

GREAT PLAINS AREA OF COLORADO
DISTRIBUTION OF POPULATION IN 1930



EACH DOT REPRESENTS
10 PERSONS

SCALE FOR CIRCLE DIAMETERS
NUMERICAL EQUIVALENT

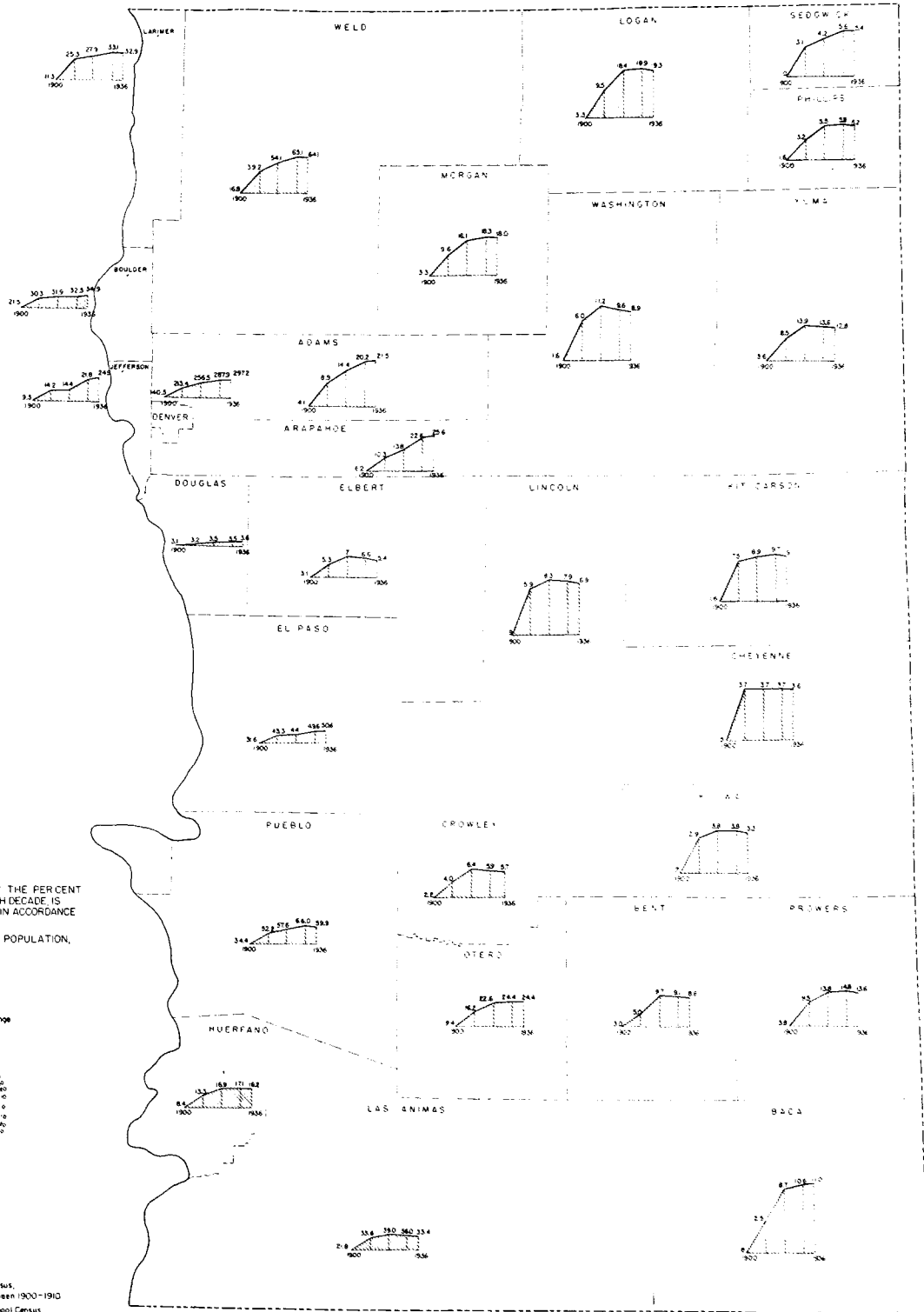
0 10 25 50 100 150 200 250 300 THOUSAND

REPRODUCED FROM MAP BY BUREAU OF AGRICULTURAL ECONOMICS
SHOWING POPULATION OF COLORADO BY MINOR CIVIL DIVISIONS

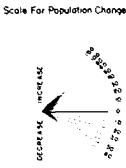
COLORADO STATE PLANNING COMMISSION

Fig. 2

GREAT PLAINS AREA OF COLORADO POPULATION TRENDS BY COUNTIES 1900-1936



NOTE
 IN THE CURVE FOR EACH COUNTY THE PERCENT OF GROWTH OR DECREASE FOR EACH DECADE IS INDICATED BY THE SLOPE OF LINE IN ACCORDANCE WITH THE SCALE BELOW.
 NUMERALS ABOVE CURVE INDICATE POPULATION, IN THOUSANDS.



Data From 1910 to 1930 Based on U.S. Census.
 Adjusted For Changes in County Lines Between 1900-1910
 Estimated Population in 1936 Based on School Census

Fig. 3

The rural population has always been predominately native white. When the sugar industry began after 1900, German-Russian beet-field laborers were brought into northern Colorado, and many of these later became tenants or farm owners. In southern Colorado, Spanish-American labor has been employed since early days in coal mining and on farms. In more recent years many of these have been hired for beet work on northern Colorado farms. In the Denver area a moderate number of truck farms are operated by Japanese.

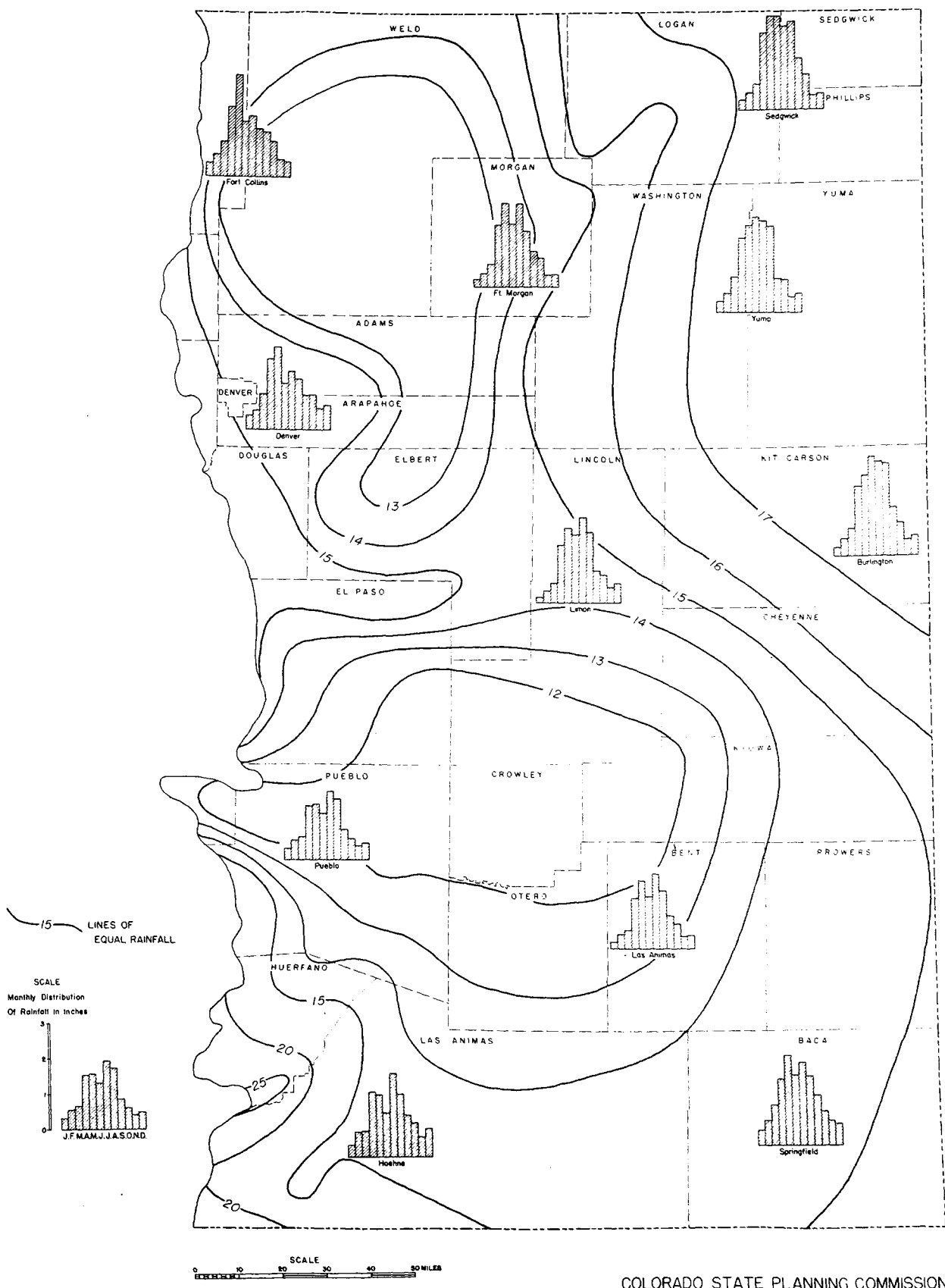
While we are accustomed to thinking of the farm population as being much less mobile than the urban population, the 1955 Agricultural Census shows that one-sixth of all farm operators had been on the farm less than one year and one-fourth less than two years. Figure 2 shows the distribution of the population as of 1930. The concentration of people in the cities and along the irrigated valleys of the Platte and Arkansas rivers is noted. Population density ranges from Cheyenne and Kiowa counties, typical dry-land counties, where the density is but 2.1 persons per square mile to Denver County, wholly urban, with 5,000 persons per square mile. Population trends from 1900 to 1936 are shown in Figure 3. With few exceptions, the curves representing rate of growth flatten out or show a decline for the periods since 1920.

Climate.

Colorado has a climate which has been influential in drawing many of its residents from other parts of the country, particularly such features as the high percentage of sunlight, low humidity, cool summer nights, freedom from hurricanes and tornadoes and from protracted periods of extremely cold weather.

From the standpoint of crop production the principal climatic conditions are: (1) Mountain snowfall supplying most of the irrigation water, (2) Rainfall during the growing season, (3) late spring and early fall frosts and freezes which at times cause injury, (4) hail storms particularly in areas near the mountains, and (5) torrential rains which cause damage to irrigation ditches

GREAT PLAINS AREA OF COLORADO AVERAGE ANNUAL PRECIPITATION AND MONTHLY DISTRIBUTION



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Fig. 4

and fields. To the above may be added dry air and strong winds, factors both in soil development and crop production. A high rate of evaporation means much moisture is required to produce a crop, and blowing of sandy soils may injure young plants.

A prime factor is the variability of the climate. On this account averages of precipitation, length of growing season, temperatures, etc., are unreliable guides without an understanding of possible deviations as shown by the weather records. In the present study it was deemed necessary to explore this matter a little in order to analyze local conditions, though a much more complete analysis has presumably been made for the entire area of the Great Plains.

Figure 4 shows the average annual precipitation over the Great Plains, including the recent dry years. Except in the foothill country at the extreme southwest corner of the area, there is no place now where the average precipitation is as high as 18 inches. Two considerable areas have less than 12 and 13 inches respectively. Monthly distribution is shown for 11 representative stations, most of the precipitation occurring between April 1st and October 1st. Table 2 shows the proportion of the annual precipitation occurring in this season, ranging from 69% at Denver to 82% at Sedgwick in the northeast corner of the state. The same table indicates the number of years with less than the average annual amounts, and the proportion of years when the April to October precipitation was less than 75 percent of the average for this period. While setting 75 percent as a danger limit may seem arbitrary, this is probably quite conservative in view of the small base to which it applies. Roughly it may be said that at least one year in four is liable to result in draught for crops grown without irrigation, particularly when accompanied by higher than average temperature.

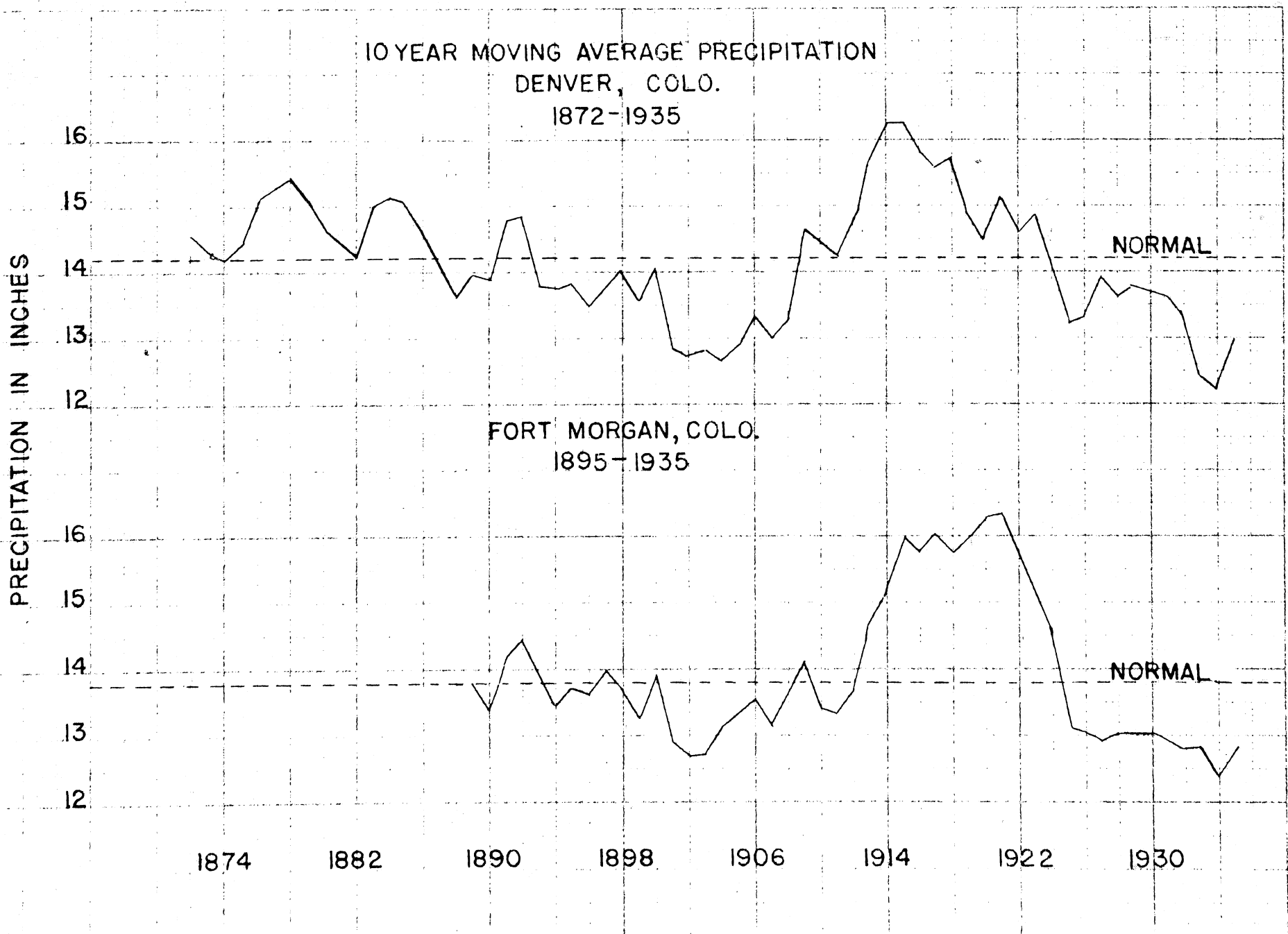


Fig. 5

ARKANSAS RIVER BASIN

Variations From Average Precipitation, In Inches.

AT
LAS ANIMAS,
COLO.

Average
Precipitation
12.41 Inches

AT
ROCKY FORD,
COLO

Average
Precipitation
12.45 Inches

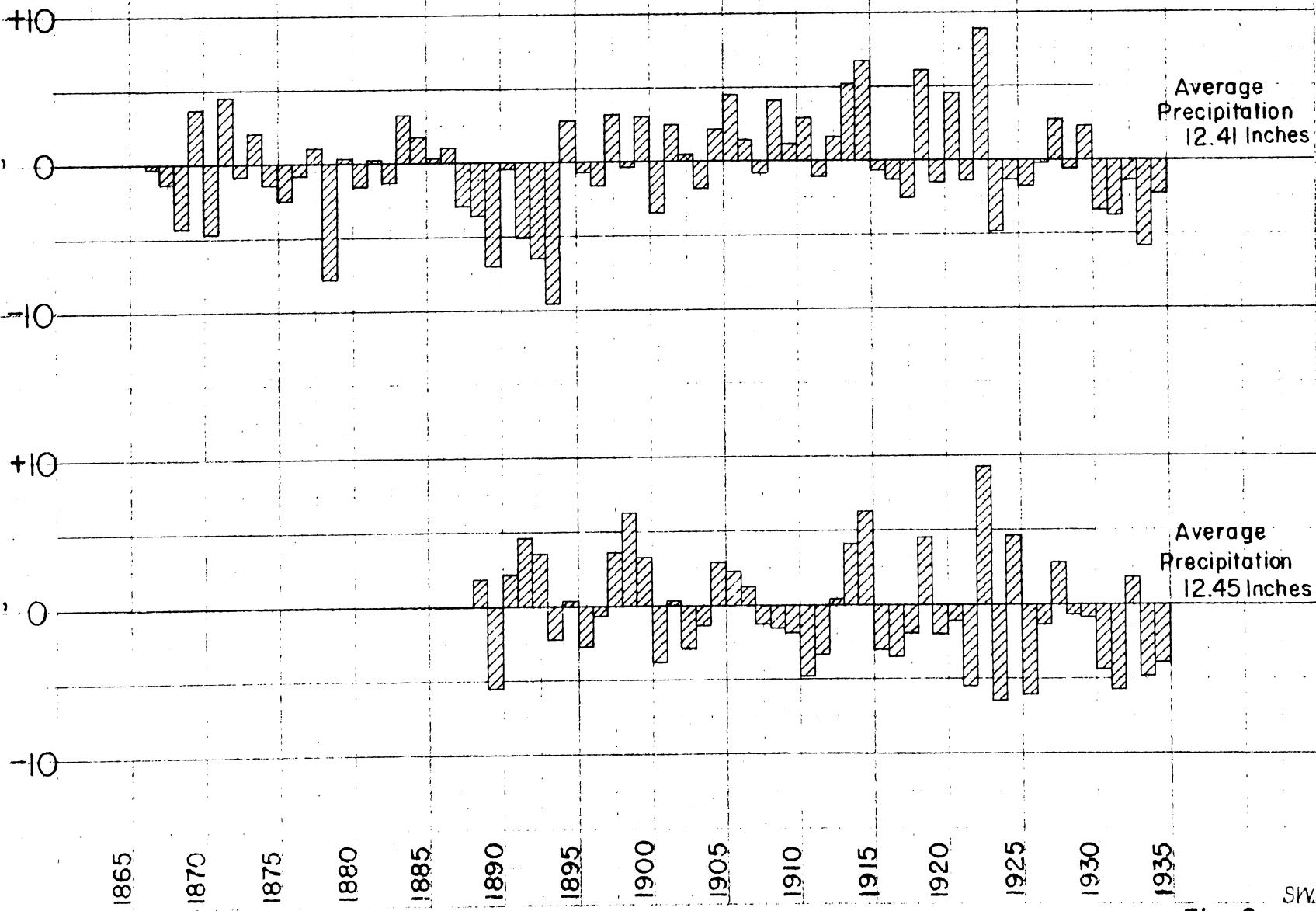


Fig. 6

SW.

REPUBLICAN RIVER BASIN

Variations From Average Precipitation, In Inches

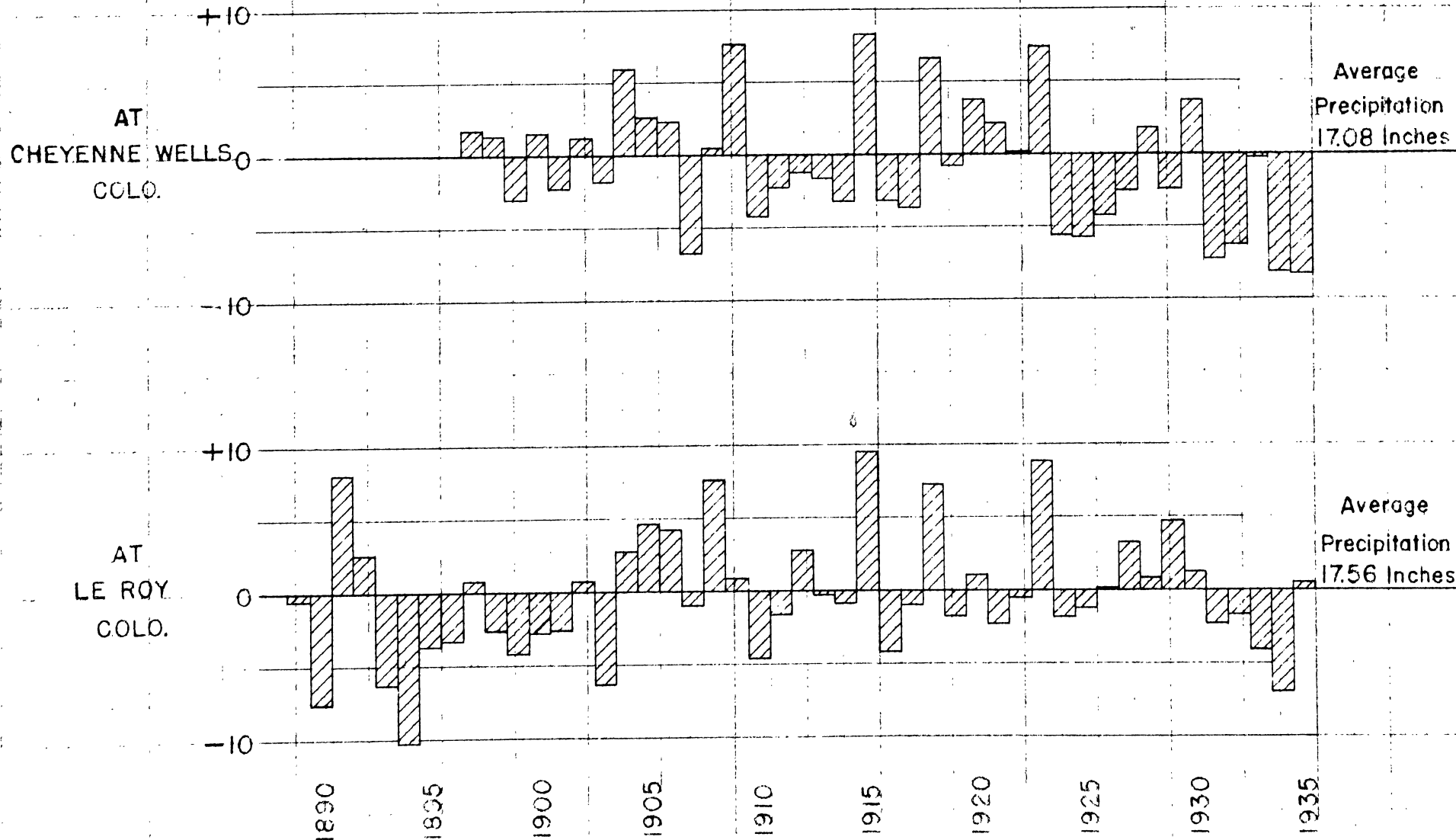
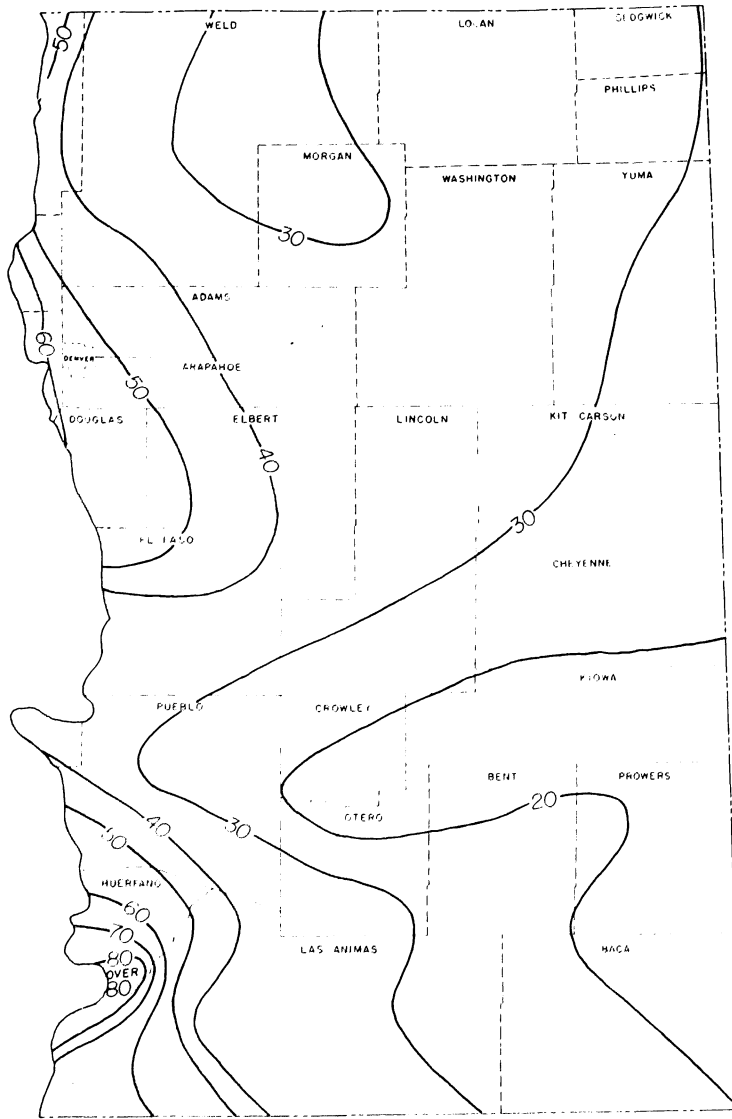


Fig. 7

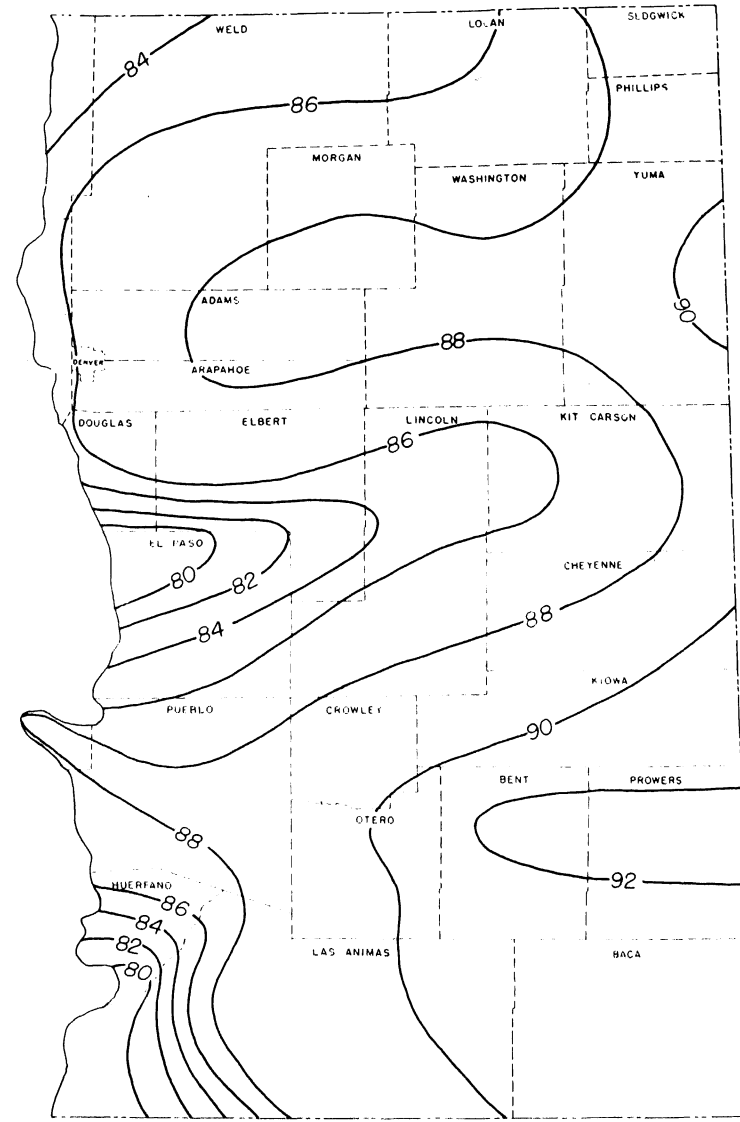
GREAT PLAINS AREA OF COLORADO
AVERAGE ANNUAL SNOWFALL



SCALE
0 10 20 30 40 50 MILES

— 30 — LINES CONNECTING POINTS WITH EQUAL SNOWFALL, IN INCHES

GREAT PLAINS AREA OF COLORADO
MAXIMUM DAILY TEMPERATURE
JULY AVERAGE



— 80 — LINES CONNECTING POINTS WITH EQUAL TEMPERATURE

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Fig. 8

The situation becomes far more serious when a series of dry years occur, as in the period since 1930. Figure 5 represents 10-year moving averages of precipitation at Denver and Fort Morgan, and Figures 6 and 7 show the deviations from the average precipitation at four stations. At Cheyenne Wells in 10 of the past 12 years precipitation has been below the average, and in the past five years alone there was an accumulated deficiency of more than 30 inches, or nearly the average amount of two entire years. Under such conditions the climate is that of a desert rather than a semi-arid country. The extremes in low precipitation appear to have been 2.5 inches at Kit Carson in 1879, and 2.8 inches at Las Animas in 1894.

Further study would show what proportion of the precipitation during the growing season is of value for crop production or of benefit to grasslands. Light rains of less than one-half inch are of little value to crops, due to high surface evaporation, and the runoff from typical summer rains is usually heavy. A high runoff, however, where only a small portion of the rainfall is absorbed locally, is generally utilized somewhere lower in the valley as irrigation water from a main stream.

Average annual snowfall is shown in Figure 8. In the southeast corner of the state the snowfall reaches a minimum of 14 inches and probably 40 percent of the entire area has less than 30 inches.

The average annual temperature ranges from 44.2° on the Platte-Arkansas divide near the mountains at an elevation of about 7,000 feet, to 54.4° at Lamar, in the lower Arkansas River Valley. At points near the mountains extremes of temperature are much less pronounced than farther out on the plains, as shown in a comparison between Denver and Las Animas. The annual temperature at Las Animas is but 1.7° higher than at Denver, but the average maximum temperature during July is 7.3° higher, and the average minimum in January is 7.3° lower.

More important in considering drought factors is the summer temperature. Figure 8 shows the average daily maximum temperatures for the month of July. These change both with the altitude and latitude, being highest in the eastern and southeastern parts of the state. In connection with this data should be considered the great daily range in temperature, the nights at this altitude being considerably cooler than at lower elevations where the daytime temperature may be no greater than here.

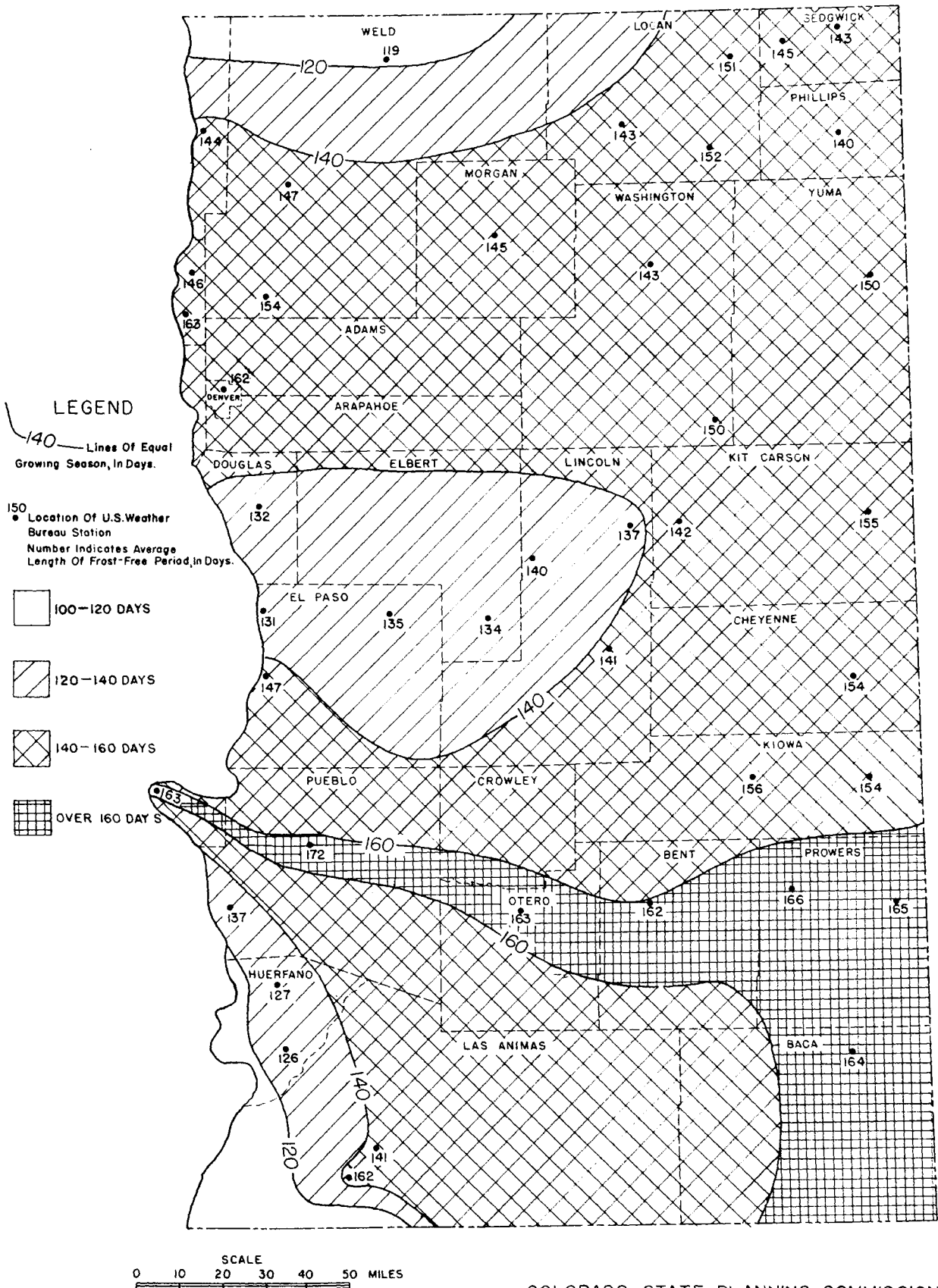
In Table 3 is shown the average number of days with temperatures of 100° or more, together with the record for the past five years in comparison with the long time average. The great variation areally is clearly indicated as well as the great increase for the recent period at Two Buttes and Las Animas in southeastern Colorado, and at Sedgwick in the lower Platte River valley.

Wind movement is rather moderate at points near the mountains, becoming considerably higher farther east. Unfortunately information is lacking for large areas where wind is a critical factor. Wind velocity is highest during the winter and spring months, April being the maximum month for Colorado stations. It is during this season, from February to May that winds do their greatest damage, the ground tending to excessive dryness during late winter and early spring.

In the fall and early spring the soil-eroding winds blow from a generally westward direction. Later in the spring such winds may also come from the south, southeast, or southwest in the proportion of about two to every four or five. However, winds with soil-eroding velocities may come from any quarter.

In the following table Cheyenne, Wyoming has been included, it being within a few miles of the Colorado state line and no wind records are available in this part of Colorado.

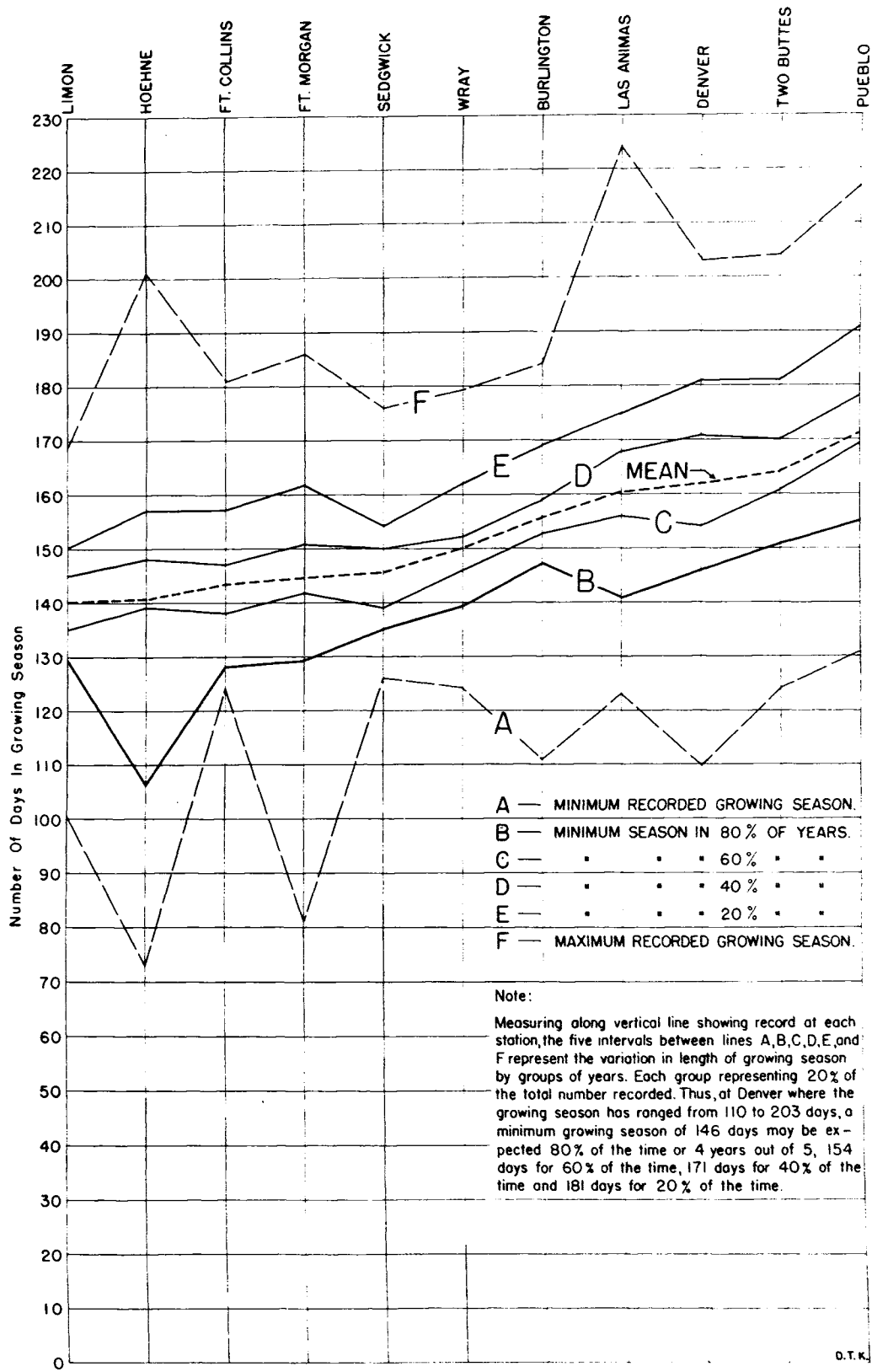
GREAT PLAINS AREA OF COLORADO AVERAGE LENGTH OF GROWING SEASON



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Fig. 9

VARIABILITY IN LENGTH OF GROWING SEASON AT ELEVEN STATIONS IN EASTERN COLORADO



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NOVEMBER 1936

Fig. 10

	<u>Wind Velocity in Miles Per Hour</u>		
	<u>Annual Average</u>	<u>Highest Monthly Average</u>	<u>Highest Month</u>
Denver	8.0	8.8	April
Fort Collins	6.1	7.8	April
Pueblo	7.6	8.8	April
Las Animas	8.5	10.6	April
Cheyenne	11.0	13.1	Jan.

The annual average velocity at stations nearest Colorado in adjacent states are: North Platte, 9.2 miles; Dodge City, 12.9 miles; Amarillo, 12.5 miles.

A few records are available relative to the amount of evaporation from a free water surface. At the Colorado Experiment Station in Fort Collins at elevation of 4,998 feet a 40-year record shows the average annual evaporation from a 3-foot pan to be 42.19 inches, 72 percent of which occurred between April 1st and October 1st. At the station maintained by the Bureau of Plant Industry at Akron, elevation 4,650 feet, the evaporation amounts to 53.95 inches, 74.4 percent of which occurs between April and October, and a record from a beet sugar company at Rocky Fork (Arkansas Valley) shows the evaporation there to be 63.8 inches.

Most of the area has an average growing season or frost-free period of from 140 to 160 days, exceeded only in the southeastern part of the state and at some sheltered points close to the foothills. This period is sufficient for growing the crops commonly produced in the area. A shorter season is found on the Arkansas-Platte divide in the west-central portion, where elevations up to 7,200 feet are attained. It may be noted that crop growth in Colorado is very rapid and many crops mature in less time than required in some regions with a longer growing season. The length of the average growing season is shown in Figure 9, and the probability of variation from these averages at representative locations in Figure 10. From this diagram the variability at one station

may be compared with another. From an agricultural viewpoint perhaps the most important consideration is the probable shortness of the season one year out of five, as marked by line "B".

Lack of normal snowfall in the mountains has a serious effect on irrigation water supply unless there is ample carryover of stored water from the previous season. In a series of dry years this is of course impossible. The discharge of the Arkansas River at Pueblo in 1934 was but 29.6 percent of the long-time mean, and the average discharge for the four years 1931-34 was but 51.4 percent of the mean. Water in storage reservoirs supplying the Arkansas Valley on May 1st was but 63,000 acre feet or 31.7 percent of the average. In this year of high temperatures the precipitation was 6.20 inches or 51 percent of normal (average of Pueblo and Las Animas stations).

While the situation in the irrigated districts of the Platte River Valley was not quite so serious as in the Arkansas valley, only a partial crop was produced in 1934. Ordinarily in the irrigated districts the principal crop hazard is hail. A single hail storm covers a small area in a strip from 1 to 4 miles wide.

Geology and Topography

Almost the entire area is underlain by Tertiary and Upper Cretaceous formations. Oldest of the Cretaceous is the Dakota sandstone, exposed over considerable areas south of the Arkansas River, and upturned along the foothills at the extreme western edge of the plains. Most extensive of the Cretaceous are the Niobrara group (shale and limestone), Pierre shale, Fox Hills sandstone, and Laramie. The principal Tertiary formations are the Denver, Arickaree and Ogallala. Near the southern state border are limited

areas of extrusive igneous rocks consisting of andesite and basalt, lava flows as found in the Raton Mesa and Mesa de Mays. These are of late Tertiary and Quarternary (?) Age.

Since the formation of the plains, erosion has been at work in the degradation and removal of the outwash material from the mountain area to the west, producing small rounded hills and low ridges, bluffs and terrace lines, small valleys and occasional deep arrayos. The principal streams have formed shallow valleys, and are bordered by narrow flood plains and wider old flood plains. Away from the river valleys the uplands consist of broad expanses of gently undulating to rolling plains. The effect of geologic wind erosion is seen in numerous shallow basins which have been scooped out. Such formations are well marked in areas north of the Arkansas River, and in numerous places have been developed for use as irrigation reservoirs at minimum expense.

The Great Plains in Colorado are subdivided into three sections, the High Plains which are located in the southeastern and easternmost parts of the state, with a narrow strip along the northern edge, the Raton Section in the extreme southwest, lying south of the Arkansas River, and the Colorado Piedmont, extending eastward from the mountains.

The general slope is toward the east, the lowest elevations being about 3,400 feet where the Arkansas and Platte Rivers leave the state and the average elevation at the western extremities and along part of the line between Colorado and Wyoming being around 6,000 feet. At the extreme southwest corner in the rough country beyond Trinidad, elevations of more than 9,000 feet are attained.

The area is drained by three important river systems, the South Platte, Arkansas, and Kansas Rivers, the latter being represented by its tributaries including the Republican, Arickaree and Smoky Hill Rivers. While the streams

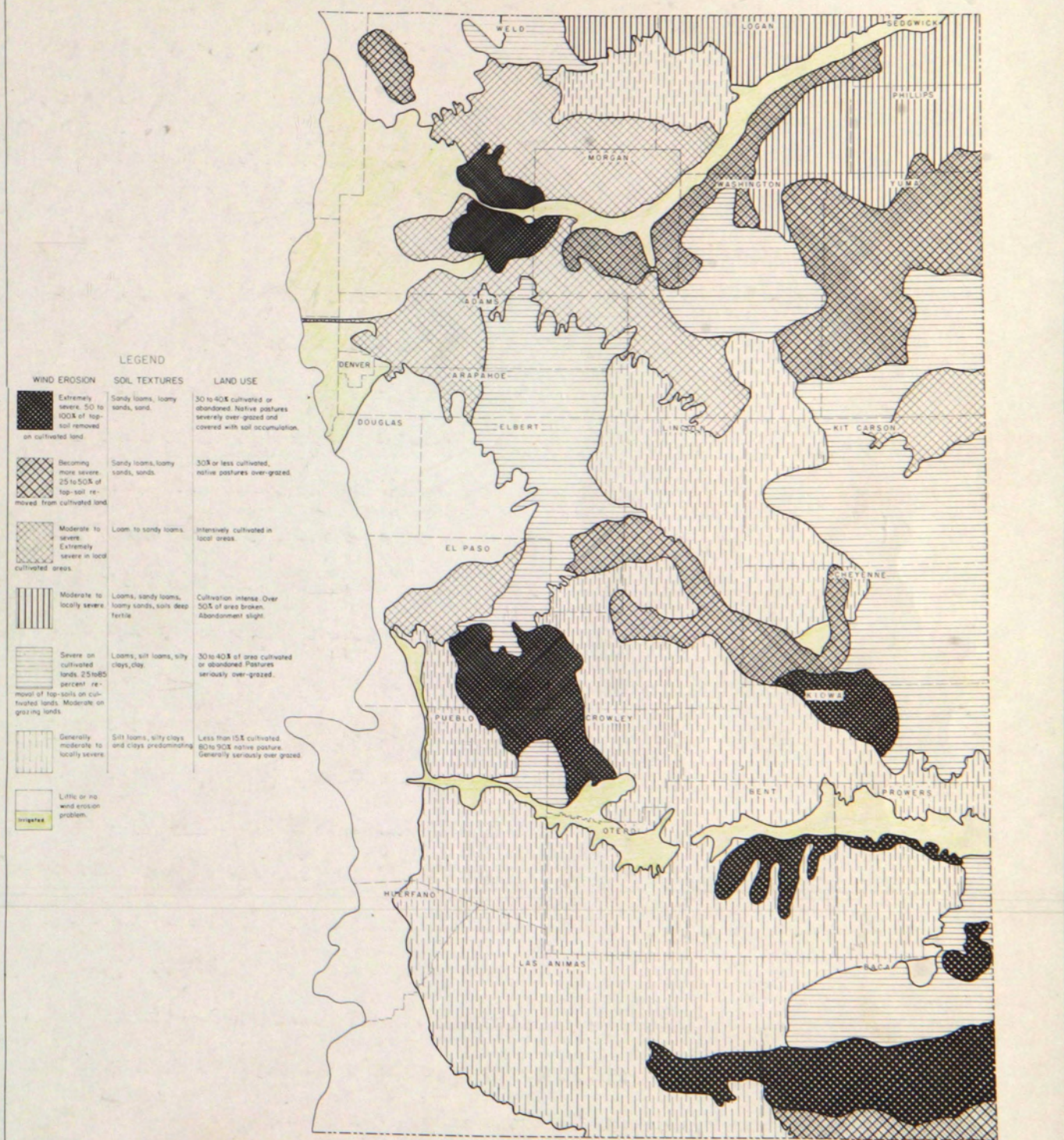
of the Republican and Smoky Hill river basins rise on the Colorado plains, the headwaters of the South Platte and Arkansas lie within the mountains. Many intermittent streams draining the plains discharge into the Platte and Arkansas.

Soils and Land Classification

Soils in the Colorado plains vary from almost pure sand as found in the sand hills to tight hard adobe. The greater proportion is made up of clay loams, silt loams, and sand loams which in their natural state are covered with typical short-grass vegetation, principally grama and buffalo grass. Wheat grass is a characteristic plant of the heavier soils. The sandiest soils support a semi-tall native vegetation. The soils are amply supplied with lime, and practically none are deficient in minerals required for plant growth, but are generally deficient in organic matter. In general the soils are fertile and of good depth. Due to the great variation in texture, soils vary greatly in their ability to absorb and retain moisture. Detailed soil surveys have been made only for the irrigated districts, though such surveys are now in progress in a program which will include the remainder of the plains. In the discussion of types of farming areas brief mention is made of typical soils as found in the various areas. The map showing soil erosion conditions (Figure 11) indicates predominating types of soils in large areas and the land classification map (Figure 12) shows the area of sand hills.

Native tree growth is not extensive and practically confined to groves of cottonwoods along the streams, a scattered growth of pinon-juniper on the mesas in the south and southwestern parts of the area, and the ponderosa pines on the divide between the Platte and Arkansas Rivers.

GREAT PLAINS AREA OF COLORADO WIND EROSION CONDITIONS



LEGEND

WIND EROSION	SOIL TEXTURES	LAND USE
	Sandy loams, loamy sands, sand.	30 to 40% cultivated or abandoned. Native pastures severely over-grazed and covered with soil accumulation.
	Sandy loams, loamy sands, sands.	30% or less cultivated, native pastures over-grazed.
	Loam to sandy loams.	Intensively cultivated in local areas.
	Loams, sandy loams, loamy sands, soils deep texture.	Cultivation intense. Over 50% of area broken. Abandonment slight.
	Loams, silt loams, silty clays, clay.	30 to 40% of area cultivated or abandoned. Pastures seriously over-grazed.
	Silt loams, silty clays and clays predominating.	Less than 15% cultivated. 80 to 90% native pastures. Generally seriously over grazed.
	Little or no wind erosion problem.	
	Irrigated	

SCALE
0 10 20 30 40 50 MILES

SOURCE: SOIL CONSERVATION RECONNAISSANCE SURVEY

COLORADO STATE PLANNING COMMISSION

Fig. 11

Erosion

A large part of Eastern Colorado has been subject to wind erosion, the intensity in various districts varying with the character of soil, amount of land in cultivation or abandoned, and degree of overgrazing. The worst conditions are found in six districts with a total area of about 2.1 million acres where 30 to 40 percent of the land is cultivated or abandoned, and on which from 50 to 100 percent of topsoil has been removed from cultivated lands. Soil accumulations have injured the native pastures. On other large areas totaling about 4.3 million acres with heavier soils and with about the same proportionate area cultivated or abandoned, topsoil removal from cultivated lands is from 25 to 85 percent. In certain sandy areas comprising about 2.5 million acres where less than 30 percent of the land is cultivated, erosion is becoming more severe, and 25 to 50 percent of topsoil on cultivated land has been removed.

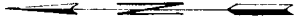
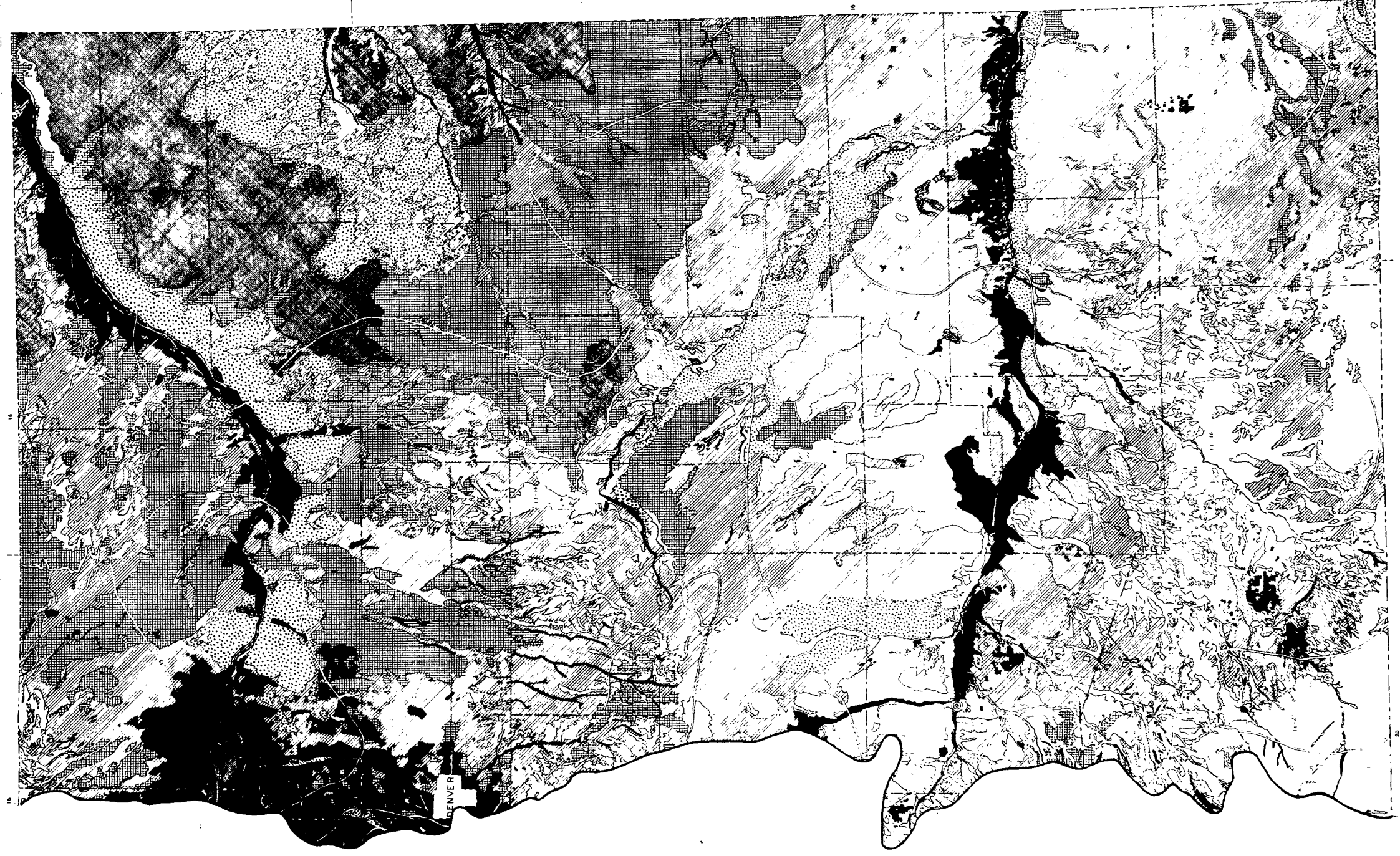
On three other types of areas comprising 13.7 million acres, erosion is generally moderate, though often locally severe. Included are about 9.6 million acres with generally heavy soils where less than 15 percent of the land is cultivated, and from 80 to 90 percent of native pastures are generally overgrazed.

The comparatively small areas where there is little or no wind erosion problem include the irrigated lands and a strip east of the mountains.

Water erosion has not been such a widespread problem on the plains as wind erosion, though the soil destruction caused by water is very evident in certain localities. Rains of high intensity are common over all the plains, and on any sloping land where the natural cover is depleted, erosion will occur with the more rapid run-off. Farming on the slopes and overgrazing has resulted in ever-widening gullies. Some of the most serious

conditions are found on the watersheds above Denver and Colorado Springs, though the entire foothill area at the edge of the plains as far north as Denver is affected. Erosion is serious for some distance east of the foothills on the rolling lands of the South Platte-Arkansas divide, and also on considerable areas among the mesas south of the Arkansas River.

GREAT PLAINS AREA OF COLORADO LAND CLASSIFICATION



- IRRIGATED LAND
- ▨ 1st CLASS DRY FARM LAND
- ▩ 2nd CLASS DRY FARM LAND
- ▧ 3rd CLASS DRY FARM LAND
- GRAZING LAND
- ▨ PHYSICALLY TILLABLE
- ▤ SAND HILLS



COLORADO STATE PLANNING COMMISSION
ADAPTED FROM U.S. GEOLOGICAL SURVEY LAND CLASSIFICATION
MAP OF THE CENTRAL GREAT PLAINS

In the land classification of eastern Colorado made by the U. S. Geological Survey in cooperation with the Department of Agriculture, the land was classified as to its utility, based on a combination of factors including topography, precipitation, soil characteristics and vegetative cover. The distribution of the areas is shown by Figure 12, and the estimated acreage in each class is as follows:

Irrigated Land	2,171,400
First-Grade Dry Farming Land	1,872,800
Second- " " " "	4,852,900
Third- " " " "	10,956,700
Grazing Land	5,570,800
Sand Hills	2,135,000
	<u>27,559,600</u>

About sixty percent of the total area is classified as third-grade dry-farm or grazing land. These lands are largely concentrated in the southern part of the plains area, whereas the first-grade dry-farming lands are confined almost exclusively to the northeastern section. The second-grade dry-farming lands in general are considered only slightly less suited for crop production than the first-grade land. In the light of recent conditions of drought, it is apparent that most of the third-grade dry-farming areas should be utilized only for grazing.

Present Land Uses

In 1934 in the counties which are wholly or partially in the Plains Area there were about 42,100 farms occupying about 21,279,000 acres, or about 80 percent of the entire area. In the north-central and northeastern counties 44 percent of the farm land is crop land, in the east-central counties 30 percent, and in the southeastern counties 27 percent. Crop land here includes harvested crops, crop failure and idle or fallow land.

Nearly all the remaining farm land is in pasture, the total are of which is about 13 million acres. The total amount of woodland not used as pasture and all other land in farms is only about 1/2 million acres. The proportion of crop land harvested in northeast Colorado in 1929 was 81% as compared to 53% in the drought year of 1934; in the east-central counties, 78% as compared to 30%; and in the southeastern counties 77% as compared to 27%.

There is but little land used for forestry or recreational purposes. Among the mountains to the west lie the extensive national forests comprising over 13 million acres, Rocky Mountain National Park, and at least 20 thousand acres in municipally-owned recreational areas in the foothills.

Irrigation

According to the 1930 census the irrigated area in Eastern Colorado was 1,784,900 acres, including the Arkansas, South Platte, Republican and Smoky Hills river basins. Of this amount it is estimated that about 1,661,200 acres lie within the Great Plains Area, the remainder being in mountain valleys. The distribution of this acreage is as follows:

South Platte River Basin	1,175,100 acres
Arkansas River Basin	482,700 "
Republican and Smoky Hills Basin	3,400 "

It will be noted that this area is less by 500,000 acres than the area classified as irrigated land in the U. S. G. S. land classification, due to the fact that the latter includes townsites, farmsteads, railroads, highways, and dry areas within the exterior boundaries of irrigated districts.

Most of the water used for irrigation is supplied from direct stream flow or from storage. Pumping of ground water, however, is on the increase and has become much more extensive since 1930.

The principal irrigated districts have been in existence many years, and there has been little new development since 1910.

Plant Diseases, Noxious Weeds, Animal and Insect Pests.

Plant diseases and insect pests in general have not been serious enough to seriously affect crop production though there are problems which warrant mention. Leaf spot has affected sugar beets and in certain areas has been serious enough to influence growers to grow larger proportions of other irrigated crops. In beet production infestations of nematodes has caused condemnation of some fields until other crops have been grown sufficiently long to eradicate the pest. Alfalfa diseases, principally wilt, have shortened the life of hay meadows to about three years. Corn smut has been quite serious in the dry-farming areas. The bean beetle has been an influence in restricting bean production. Grasshoppers are by far the most serious of the insect pests, and at times have been very destructive over wide areas.

Small areas on individual farms have been abandoned because of perennial weeds such as bindweed, pepper grass, Canadian thistle, saw thistle, and Russian knapweed. Much the worst of these has been bindweed (wild morning glory) in some irrigated districts. It is very costly and difficult to eradicate, and greater efforts must be made for its control. Whorled milkweed, found in the southern part of the state, is poisonous to cattle whether the plant is green or dry.

Among the rodents which enter into competition with livestock for forage are jack rabbits and prairie dogs. In periods of drought this competition becomes a very serious matter. Prairie dogs will consume 80 percent of the forage where prevalent, and 12 rabbits will consume as much feed as a 120 pound sheep.

Transportation

Seven railway systems serve Eastern Colorado. The east-west lines connecting with Missouri River and eastern markets extend across the area to the principal cities which are located near the western edge of the plains.

North-south routes link up these cities and extend south into New Mexico, Texas and Oklahoma, and north into Montana and Wyoming. Rail and highway facilities are good, particularly through the more densely populated irrigated agricultural areas. Farm to market roads are good in the irrigated districts, and from poor to good in other areas. The condition of local roads shows lack of system in carrying out improvements, though it is doubtful if an extensive program should be undertaken until land-use adjustments are made which will eliminate most of the need for local roads in areas devoted to grazing.

Markets

The Great Plains Area of Colorado is at the eastern edge of a vast territory of mountains, plateaux and deserts which is very thinly populated and is also at considerable distance from the more densely populated areas of the Middle West and the East. Agriculture has necessarily developed along lines tending to overcome this handicap, such as by:

1. The concentration of crop products before shipment; sugar beets being reduced to sugar, and alfalfa hay, barley and corn being used in fattening lambs and cattle in transit to eastern markets.
2. Growing of products of exceptional quality which command a premium in distant markets such as potatoes, celery, lettuce and other vegetables, melons and pure seeds.
3. Adjustment of production to meet local market requirements. Thus; truck, poultry, and dairy farms are heavily concentrated in the area about Denver which contains about one-third of the state's population.
4. Production of crops which may be shipped long distances without damage, such as wheat, corn, and dry beans.

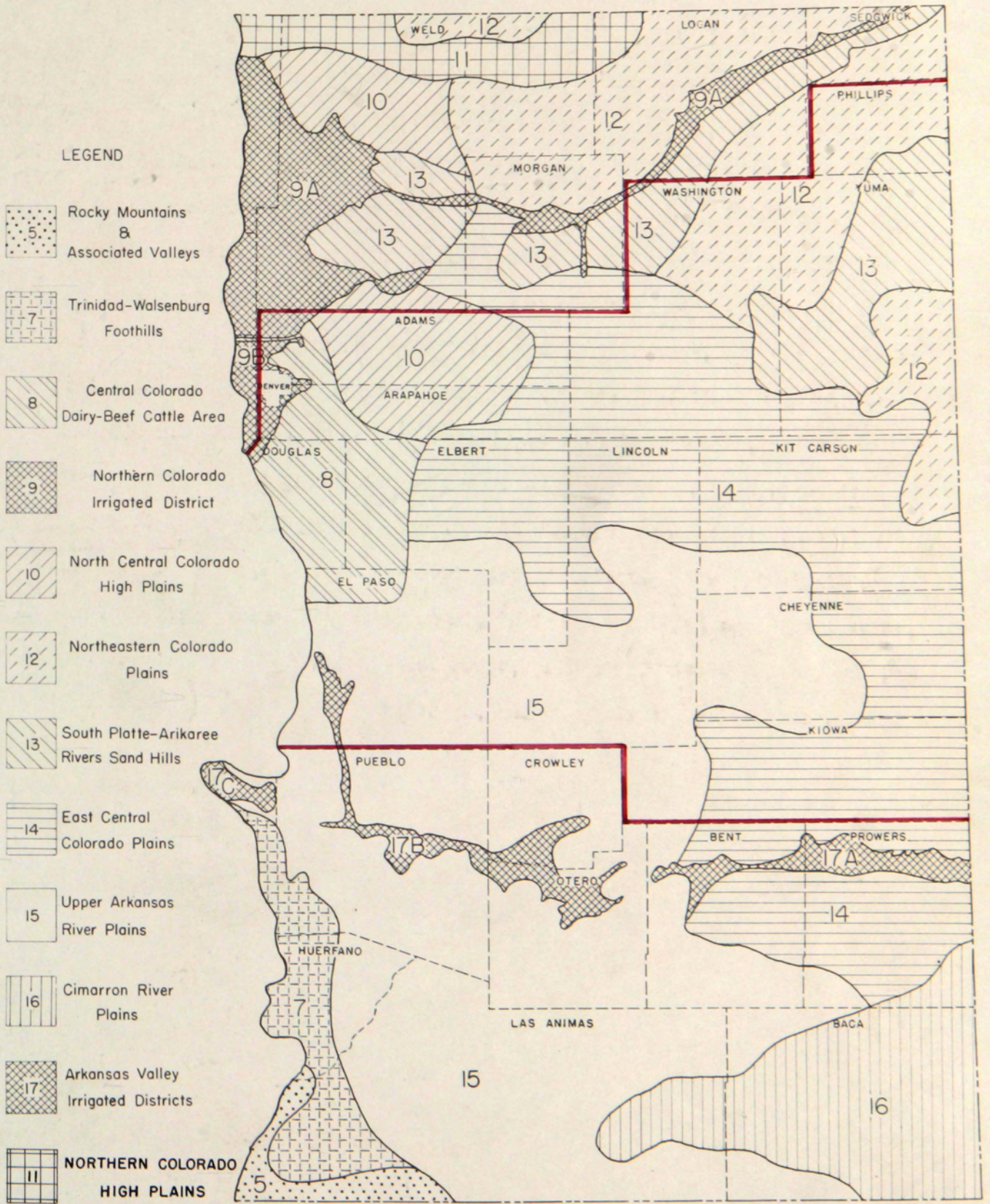
5. Growing of products which have high values in relation to bulk, such as seed crops of alfalfa clover, cantaloupe, melon, cucumbers and flowers.

It is estimated that about 60 percent of the cattle produced are shipped east and 40 percent go to Denver or to the west, including the Pacific Coast. Probably 90 to 95 percent of the sheep which are shipped go to the river markets. About 80 percent of the potatoes from the Greeley and Sedgwick areas are shipped out of the state. There are heavy shipments of mixed vegetables almost all of which are first concentrated at Denver. Melons and onions are shipped east in quantity.

Of the total production of the dry-farming areas, 90 percent is marketed in the form of livestock. All the corn grown is consumed locally or used in the feedlots in the irrigated districts. The principal dry-land products other than the foregoing which are shipped are wheat, beans, and broomcorn. In the irrigated areas, probably 60 to 65 percent of production is represented by cash crops, and the balance by livestock.

GREAT PLAINS AREA OF COLORADO

TYPE-OF-FARMING AREAS



SOURCE: BULLETIN 418, COLORADO EXPERIMENT STATION
COLORADO STATE PLANNING COMMISSION

Fig. 13

TYPES OF FARMING*

In the 1930 Census of Agriculture Colorado farms were classified as to 10 principal types, the primary basis of classification being source of income. These types and their characteristic products are as follows:

General: Principally farms having less than 40 percent of the total value of all products from any one source.

Cash-grain: Corn, wheat, barley, oats, rye, and grain sorghum.

Crop-specialty: Sugar beets, potatoes, dry beans, ripe peas, hay, broomcorn, and seeds.

Fruit: Tree fruit, small fruit, and grapes.

Truck: All vegetables harvested for sale.

Dairy: Milk, cream, butterfat, butter, dairy cows and calves.

Stock Farm and Ranch: Beef cattle, sheep, hogs, horses, mules, goats, and wool. A stock farm has less than 10 acres, and a stock ranch has 10 acres or more, of pasture land to each acre in crops.

Poultry: Chickens, ducks, geese, turkeys, and chicken eggs.

Self-sufficing: Farms having 50 percent or more of the total value of all products used by the operator's family.

Abnormal: Includes in Eastern Colorado institutional and country-estate farms, part-time farms, feedlot farms, etc.

In the plains area the number of farms of each of the above types is as follows:

<u>Type of Farm</u>	<u>Number</u>	<u>Percent of Total</u>
General Farms	5,433	13.7
Cash-grain	8,130	20.5
Crop-specialty	9,063	22.8
Fruit	362	1.0
Truck	1,517	3.8
Dairy	2,447	6.2
Animal-specialty and Stock-ranch	6,050	15.2
Poultry	1,259	3.2
Self-sufficing	794	2.0
Abnormal	2,208	5.5
Unclassified	2,439	6.1
Total - - -	<u>39,722</u>	<u>100.0%</u>

* This discussion is largely based on Colorado Experiment Station Bulletin 418, "Type of Farming Areas in Colorado", September 1935.

More than two-thirds of the farms of the state being in the Great Plains Area, the following figures which apply to the entire state may be taken as being fairly representative of the average gross value of all receipts per farm in 1929, for each of the several types of farm. These figures include the value of products used by the farm families and receipts from crops, livestock, livestock products and a small item of forest products.

Type of Farm	Average Gross Income per Farm in 1929
Animal-specialty and stock ranch	\$ 6,891
Crop-specialty	3,634
Dairy	2,619
Cash-grain	2,584
Fruit	2,512
Truck	2,500
Abnormal	1,845
General	1,722
Poultry	1,643
Self-sufficing	309
ALL TYPES	3,333

For all ten types of farms the total gross income was derived proportionately from these sources: crops, 43.9%; livestock, 37.0%; livestock products, 13.3%; forest products, 0.2%; products used by operator's family, 5.6%.

Figure 13 shows the type-of-farming areas in the Great Plains. Of the 17 types into which the state has been divided, 10 are wholly on the plains, and 2 are partly in this section. The following summary describes the principal characteristics of each area.

Area 5. Rock Mountains and Associated Valleys.

A small strip only of this large area is included in the part of the state here considered, and is found along the New Mexico border. The land is rough, and useful principally for grazing sheep and cattle.

Area 7. Trinidad-Walsenburg Foothills.

The surface varies from gently rolling mesas to rough foothills, and the altitude from about 5,500 to 7,500 feet. Winters are comparatively open and the grazing season is long. About 86 percent of the farm land is in pasture, and animal specialty farms and stock ranches predominate. Many of the beef cattle are pastured in the adjoining national forests during summer. Most of the crop land is used for hay and feed crops. A small acreage along the narrow valleys is irrigated.

Area 8. Central Colorado Dairy and Range Cattle Area.

This area lies southeast of Denver, extending to and beyond the crest of the semi-timbered divide separating the Platte and Arkansas river basins. Elevations range from 5,000 to 7,500 feet. The surface of the plain is relieved by breaks along the streams and by extensive areas of low rolling hills. Flow of several small streams is extremely variable. They are frequently dry, but damaging floods are not uncommon.

There is a very limited amount of irrigated land. The soils of the second-grade dry farming land are of good depth, and with an increased water supply from proposed transmountain diversions to the Platte river, a considerable development of irrigation is practicable, and particularly desirable in view of the nearness to Denver.

Dairy farms and stock ranches predominate, comprising respectively 29 percent and 26 percent of all farms. Whole milk is supplied in quantity to both Denver and Colorado Springs.

Of dry farm crops, corn, wheat, barley, etc., much the largest acreage is in corn. Much of the lower grade land now in cultivation should be in grass, and at the higher elevations reforestation should be undertaken.

Areas 9-a and 9-b. Northern Colorado Irrigated District.

The largest and most important irrigated area in Colorado lies in the Platte River valley and extends from a few miles above Denver to the Nebraska line. The altitude ranges from about 3,400 feet to about 6,000 feet and the surface is smooth to gently undulating. The land is well drained, and soils are productive and easily cultivated. In 1929 the irrigated acreage was 1,223,423 acres, and the investment in irrigation works over 36 million dollars. In the existing irrigation enterprises the additional irrigable area was about 278,000 acres.

Due to return flow to the stream the amount of water used for irrigation is much greater than the natural stream flow. The plains contribute but little to the flow of the Platte and tributaries, the source of supply being largely snowfall on the mountain ranges to the west. There is a very considerable shortage of water even in average years which can be remedied only by trans-basin diversions from the Colorado River.

The principal types of farms are: Crop-specialty, 50 percent of the total number; stock farms and ranches, 16 percent; general, 8 percent; cash-grain and dairy, 6 percent each. The special crops which occupy about 60 percent of the acreage include hay, sugar beets, potatoes and dry beans. Vegetables are extensively grown and shipped out of the state as well as supplying the Denver market. Large quantities of feeder lambs and cattle are bought for feeding during the winter and shipped during the spring. The sugar beet has for years been the principal cash crop, this area being the most important sugar beet producing district of the United States.

It will be noted from the map that Area 9 is divided into sub-areas 9-a and 9-b. Area 9-b surrounding Denver has been influenced by the needs of this city, and shows a concentration of poultry, dairy, part-time, fruit and truck farms.

Area 10. North Central Colorado High Plains.

This area flanks Area 9 on either side, and is situated on the plains above the valleys of the South Platte river and its tributary, the Cache la Poudre. The surface is gently rolling, rainfall is scant and variable, averaging from 12 to 15 inches, and wind movement comparatively high. The area has been classified as second-grade and third-grade dry-farming land in nearly equal proportions, based on texture and depth of soil. Practically all crops are produced without irrigation, but under hazardous conditions of the climate. Principal cash crops are winter wheat, dry beans and corn, and barley and corn are principal feed crops.

The number of cash-grain farms comprised 36% of the total; crop-specialty, 21%; general, 15%; stock farms and ranches, 13%. Beef cattle is the dominant type of livestock.

Area 11. Northern Colorado High Plains.

Extending to the Wyoming line, this area ranges from 5,000 to 6,500 feet in elevation. The surface is generally rolling or undulating with a few hills and ridges, and bluffs are found along the intermittent streams. The growing season varies from 115 to 140 days. High winds are prevalent in late winter and spring. A large proportion of the land has been classified as third-grade dry farming, but actually better adapted to grazing, for the lighter soils when cultivated are subject to severe wind erosion. There is evidence of serious overgrazing. The principal cash crops have been wheat and dry beans.

Cattle and sheep ranches dominate, followed by cash-grain farms.

Area 12. Northeastern Colorado High Plains Cash-Grain Area.

Four separated bodies of land in the northeastern part of the state make up this area, the most highly developed dry-farming district of the state. The elevation is from 3,500 to 4,500 feet and the surface generally smooth. About 89 percent of the land is on farms and of the farmed areas 73 percent was crop land in 1929. A high proportion is classified as first-grade dry-farming land having deep, friable silt and sandy silt soils suited to grain-crop production. Average precipitation is around 17 inches, with considerable annual variation. High winds prevalent in spring and early summer are a factor in evaporation of surface moisture.

Three-fourths of the farms are cash-grain, average size being about 500 acres. The principal crops are winter wheat, corn, barley and oats. In a normal season winter wheat is grown on from 40 to 50 percent of the harvested acreage, corn from 25 to 30 percent, barley from 10 to 12 percent. Representative of average yields in the area are those of Phillips County: winter wheat, 12.1 bushels; corn, 14.9 bushels; barley, 17.8 bushels; oats, 19.0 bushels. The livestock enterprises are devoted to swine and cattle, the latter principally kept for milking.

Area 13. South-Platte-Arickaree Rivers Sand Hills.

This area which includes four districts bordering the Platte Valley and one north of the Arickaree River consists principally of sand hills elevated from 25 to 50 feet above the surface of the plain, interspersed with small valleys suitable for crop production. The sand dunes are held in place by highly nutritious grasses. About 90 percent of the land area is farmed, with about 65 percent in pasture and 30 percent in crop land. The sandier third-grade dry-farming lands among the sand hills near the Arickaree are subject to serious wind erosion. In this district about 40 percent of the farms were cash-grain, with stock farms and ranches comprising

30 percent. In the districts near the Platte River stock farms and ranches predominate. The principal feed crops are corn and sorghums, corn being also the principal cash crop.

Area 14. East Central Colorado Plains.

Over this large area lying in three major river basins of the South Platte, Republican-Smoky Hill and Arkansas rivers, the elevation ranges from 3,300 to 6,000 feet. Much of the surface is level to slightly undulating, with other portions more rolling and small areas of rough land on the ridges and along the margins of the stream valleys. Average precipitation is from about 13 to 17 inches, with wide variations in single years and series of years. Accumulated deficiency at Cheyenne Wells for the period 1931-1935 was 30.5 inches, or more than two years annual rainfall. A considerable proportion of precipitation is in the form of torrential rain, which combined with a tight soil over much of the area, results in heavy-runoff. Crops are subject to damage from hot winds and hail storms.

Classified as to utility, much the largest portion of the area is second or third-grade dry-farming land, with small amounts of grazing land and first-grade dry-farming land. In the second-grade land the dominant type of soil is a silt loam. Third-grade lands lie in the lowest rainfall areas and have soils too shallow, too sandy or too heavy for consistent crop production. In 1929 about 67 percent was pasture and 34 percent crop land. Principal cash crops are corn and winter wheat; feed crops include corn, grain sorghums, barley, oats, millet. When winter wheat fails, corn is frequently planted in the spring. The farms are classed as follows: cash-grain, 39%; general, 23%; stock farms and ranches, 20%. The principal kind of livestock produced is beef cattle.

Most of this low rainfall area is third-grade land unsuited to crop production and adapted only to grazing. In shifting from cash-grain to livestock farming two principal problems must be solved: To re-grass cultivated land and increase the size of farms sufficiently to operate as a livestock enterprise. Present average size of stock farms (animal-specialty) is but 730 acres; the stock ranches average 3,230 acres.

Area 15. Upper Arkansas River Plains.

This extensive area lies on either side of the irrigated lands of the Arkansas River Valley, and includes parts of 15 counties. The altitude ranges from 4,000 to 6,000 feet. The major portion consists of smooth to gently rolling plains, with broken mesas and buttes toward the southwest. Average annual precipitation varies from less than 12 inches to about 16 inches. Most of the streams are intermittent and flood flows from cloudbursts are common. Most of the area is classified as grazing and third-grade dry-farming, with rather extensive sand-hills north of the Arkansas. The grazing land generally has heavy soils, frequently shallow, and unsuited to farming. Third-grade land varies from clay and clay loam to sandy soils, the latter being subject to blowing. There is a relatively small amount of irrigated land, including districts watered from the Purgatoire River, and from Fountain Creek near Colorado Springs. Alfalfa hay is the principal irrigated crop.

The most important dry-land crops are corn, dry beans and sorghums. The leading industry is the production of beef cattle, and the open winters permit much winter grazing. Outside the irrigated sections stock farms and ranches constituted 34 percent of all farms, general farms, 17 percent; crop-specialty, 10 percent.

A serious problem is the wind erosion on beanland, beans having been most extensively grown on a large area with sandy soil east of Colorado Springs. Water erosion is also a serious problem in various parts of the area, accentuated by the deterioration of vegetative cover on overgrazed pasture land.

Area 16. Cimarron River High Plains.

Located in the southeastern corner of the state, this district lies near the center of the "Dust-bowl". The surface is generally smooth, and includes some sand hills. Elevation ranges from 3,500 to 5,000 feet. The average annual precipitation is from 15 to about 18 inches, and growing season from 140 to 160 days. The area is subject to torrential rains, high winds, and high evaporation during late spring and summer. In the land classification third-grade and second-grade dry-farming land predominate with at least 80 percent of the area in the former. Soil of the third-grade land is generally a shallow black silt loam, often underlain with gypsum, and with texture too compact to readily absorb moisture, whereas second-grade lands, somewhat sandier, are well capable of absorbing and retaining moisture.

In 1929 approximately 69 percent of the area was in farms, of which 35 percent was crop land and 62 percent pasture. Cash-grain occupied 41 percent of the crop land, other cash crops, principally broom-corn, 27 percent, and feed crops, 32 percent.

High prices for wheat and a surface adapted to large-scale use of machinery were factors in bringing much land under plow since the World War. "Suit-case" farming by absentee owners has been prevalent. The dominant type of farm is cash-grain, followed by crop-specialty and general farms. Cattle are the principal livestock.

Area 17. Arkansas Valley Irrigated Area.

Extending a distance of 185 miles from the mountains to the Kansas state line one of the principal irrigated districts of the state is located along the valley of the Arkansas River, at an elevation of from 3,400 to 5,300 feet. The area occupies about 375,000 acres on the valley floor and the lower terraces. The precipitation increases toward the east, most of the area having but little over 12 inches annually. The entire valley enjoys a comparatively long frost-free period. A large variety of soils, from sand and sandy loams near the river, to silt loams and clay loams on the benchlands has been conducive to a wide variety of crops. In general soils are well supplied with nitrogen and lime, but deficient in organic matter. Following the development of irrigation, drainage works were found necessary including both open ditches and tiling.

In addition to the development for crop production, livestock feeding enterprises are very important, the average number on feed in recent winters being about 253,000 sheep and 9,000 cattle.

The area has been divided into sub-districts to conform with differences in types of farming. Sub-Area A includes the lower part of the valley, where on a total area of 175,000 acres, about 83 percent was in crops, principally hay and grain, and the remainder in irrigated pasture. Crop-specialty is the predominating type of farm, concentrating on alfalfa hay, sugar beets, alfalfa and clover seed. In addition to hay used for feeding, much is shipped to midwestern markets either as hay or alfalfa meal. Most of the stock farms are only partially irrigated, the farms including grazing land lying above the irrigated land.

Sub-Area 17-B extends below Pueblo and differs considerably from the previously described area in the crops produced. Less hay and grain and more sugar beets are grown. A large variety of vegetables are grown, cantaloupes being the principal item. Seed crops are an important product. Crop-specialty farms in 1929 made up 43 percent of the total. Animal-specialty farms (stock farms) predominate greatly over stock ranches.

Sub-Area 17-C is a relatively small area lying near the foothills characterized by many fruit, poultry and part-time farms. Though not adjacent to any large city, this is one of the few areas of the state where part-time farms lead other types in number.

Irrigation has long been established in this valley, but development, as in the Platte River valley of northern Colorado, has outstripped the water supply. Even in years of average stream flow, shortages in the supply occur with resulting damage to crops, and during a series of dry years, the situation becomes extremely serious.

II ECONOMIC AND SOCIAL CONDITIONS

Value of Farms.

Table #6 shows for three divisions of Eastern Colorado the value of farm lands and buildings as reported by the census in 1925, 1930 and 1935. It will be noted that in 1935 the average value per farm in north-central and notheastern Colorado was \$8,547 as compared with \$5,905 in the south-eastern part of the state and \$7,124 for the entire area. For individual counties the average value ranges from \$4,225 in Huerfano County to \$12,204 in Sedgwick County. The more intense development in northeastern Colorado is reflected in the average value of \$25.70 per acre, as compared with \$11.19 in the east-central district and \$9.42 in the southeastern district. In a recent economic study of the northern Colorado irrigated district, the average value per farm of land, water, and improvements is estimated at \$10,477, or \$108 per acre of irrigated land.

Crop Yields and Livestock.

In Tables 7 and 8 are shown the acreage and yield of principal harvested crops in 1924, 1929, and 1934 for the same districts, and for the entire plains area. The effect of the 1934 drought is plainly seen in both harvested acreage and yield, including those crops grown almost wholly by irrigation; hay, sugar beets and potatoes. Livestock are the mainstay of eastern Colorado and in 1935 the area had 66 percent of the horses, 59 percent of the cattle, 53 percent of the sheep, and 75 percent of the swine in the state. In spite of the effect of the drought and other factors tending to reduce the numbers of livestock, the number of cattle was 15 percent greater than in 1925, the gain being greatest in the east-central (dry-land) counties.

Farm Income.

In the discussion of types of farming areas the average gross income of farms in 1929 is given for the state as a whole. Like information for 1934 is not yet available. In a detailed study of 151 dry-land farms made in 1922, average farm receipts were reported as \$2,368, including income from part-time work done off the farm. In a recent study of the northern Colorado irrigated district the average gross production value of irrigated land is estimated at \$49.90 per acre.

Size of Farms.

Irrigated farms in the Platte Valley have on the average about 96 acres of irrigated land. In typical dry-land counties the average size of farm is from 600 to 800 acres, but the predominant size is generally well below this, there being many farms of 160 and 320 acres. In Baca County, where the total number of farms in 1936 is 1,036, it is found that 656 farms have 640 acres or less. For stock ranch operations, in many parts of Eastern Colorado, the economic sized unit is thought to be not less than 2,500 acres and in certain areas not less than 10 sections. In districts where conditions are reasonably favorable for dry farming, the economic size of unit is around 640 to 960 acres.

Farm Tenancy.

There has been a large increase in the number of farms operated by tenants, the percentage of tenants among all farm operators having increased from 34.7 percent in 1925 to 44.4 percent in 1935. While the number of farms in the Plains Area increased but 912 in this period, the number of tenant operators increased 4,406, as reported by the census. In seven counties more than 50 percent of all operators were tenants. Table 9 shows the tenure of farm operators for three divisions of Eastern Colorado in 1925, 1930, and 1935.

Farm Mortgages.

In a recent W. P. A. research project, a survey of farm mortgages has been made which includes ten counties in Eastern Colorado. The data secured are not completely tabulated but the following items for two counties afford some idea of the relative amounts in private, corporate and federal loans. In Prowers County it is found that federal first mortgage loans represent about one-half the total, amounting to about \$1,440,000 compared to private loans of \$840,000 and corporation loans of \$652,000. In Otero County, federal loans represent about one-third of all first mortgages. In Prowers County the average interest rate on first mortgages is as follows: Federal, 5.59%; corporation, 6.52%; private 6.96%. In Otero County the average rates are: Federal, 5.46%; corporation, 6.88%; Private 7.17%.

Governmental Services - Schools and Roads.

In the more densely populated sections school facilities are excellent and compare favorably with those in any part of the country. In the sparsely settled country districts are many small schools which are operated at a high cost per pupil. In 1934 for 71 schools in Eastern Colorado which had less than 5 pupils each and which served a total of about 270 pupils, the cost of operation in some cases ran over \$500 per pupil.

The Land-Use Survey being made by the State Extension Service in cooperation with the Resettlement Administration, and the road survey of the State Highway Department will afford more complete information on the type and condition of local roads than has heretofore been available. It appears that in some rural districts trails, third-class and second-class dirt roads comprise as much as 85 percent of the total road mileage. Some thinly settled townships have no roads other than unimproved trails.

In the recent land-use survey of Baca County the condition of 946 occupied farmsteads was rated as follows: good, 12.8%; fair, 30.3%; poor 56.9%. There were found to be 782 unoccupied farmsteads of which 368 were in ruins and 414 not in ruins, and in addition 437 places where farm homes had stood at some time. In this county the proportion of farmers having specified facilities or equipment was as follows: automobile, 82.8%; tractor, 53.7%; truck, 22.6%, and combine, 13.3%; while but 9.3% have water piped to dwelling, 5.8% have telephone, and 2.0% have electricity in the home.

III. DISCUSSION OF PROBLEMS IN GENERAL.

The reports of the State Land Planning Consultant made in 1954 and 1935 to the State Planning Commission and National Resources Board delineated problem areas of four types in Eastern Colorado, of which the most extensive were (1) areas in which 20 percent or more of the number of farms were on land where arable farming is uneconomic and undesirable, and which should be replaced by some other major use, such as stock ranching or grazing districts, and (2) areas in which 20 percent or more of the number of farms are too small for efficient operation and on which an adequate family living is not possible. In the first classification about 9.3 million acres were included and in the second classification about 7.4 million acres. To effect the needed adjustment would involve the removal of about 3,350 farm families in areas of the first type and about 1,250 families in areas of the second type. While these estimates as to number of families may have been somewhat higher than justified, they were based on the number of farm families as reported by the census, and a considerable amount of voluntary removal has since taken place. It may be noted that whereas the 1935 Census of Agriculture reports over 1,800 operating farms in Baca County, the survey of the Resettlement Administration in 1936 shows 1,036 operating farms in the county including farms of non-residents.

In all the problem areas studied are many small farm holdings, entirely inadequate for successful operation under the conditions which obtain in this part of the Great Plains Area. There would seem to be three alternatives for such farmers, either that they remove to some other part of the country, obtain more land where they are now located, or be supported at public expense whenever a dry year occurs.

The Arkansas Valley irrigated district is recognized as a problem area because of insufficient water supply in years of average or low stream flow. The situation here has been studied in some detail in connection with the Drainage Basin Studies for the National Resources Committee. Tax allinquency has been about as great in these irrigated districts as on dry-land farms in adjacent areas. There are several hundred irrigation enterprises and while some of the water is used uneconomically on less productive soils to the exclusion of water for more productive soils in other parts of the district, the primary need is an increased water supply.

The fourth type of problem area involves watersheds where existing land uses tend to affect water supplies through irregular stream flow, silting of reservoirs, ditches, etc. It is now well recognized that depletion of natural vegetative cover either through overgrazing and timber cutting, or arable farming on slopes, is a contributing factor in the floods which have occurred in the foothill country at the edge of the plains, on the headwaters of those tributaries of the Platte and Arkansas which rise on the plains, and in the rough mesa lands south of the Arkansas. A particular area with a distinctive problem is the Black Forest comprising about 100,000 acres on rolling land northeast of Colorado Springs. Owing to the peculiar type of soil, this land when cleared is useful for crop production for only a very short period, it has little value for grazing, and it is easily eroded. Its greatest value is undoubtedly for recreational uses and watershed protection.

There seems to be ample evidence that dry farming should be carried on only by farmers who have ample resources to carry through the frequent years of partial or nearly complete crop failure. Dry farming is more successful on soils which hold moisture well and at the same time have less tendency to be blown, and in those areas which have more rainfall. The many abandoned farm homes are evidence of the failure of farmers whose means were too limited or who had

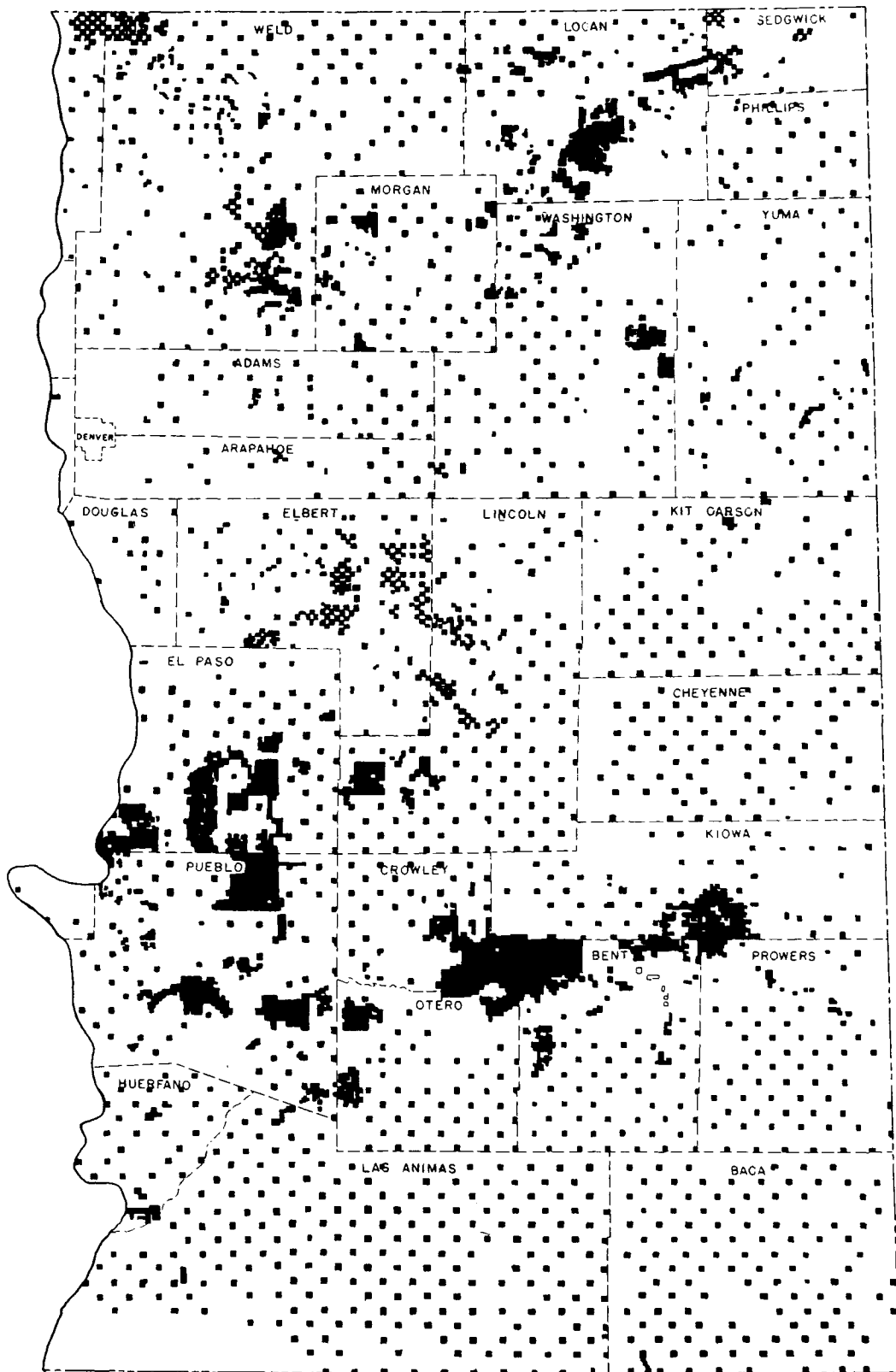
little knowledge of the requirements for successful operation. In the northern part of the state conditions in general have been more favorable than farther south where summer temperatures and evaporation are higher. Fortunately a great deal more is known today than fifteen or twenty years ago in regard to the natural hazards of farming on the plains, and farm practices which make for success in crop production and conserving soil fertility.

The use of ground water supplies has been very limited except along the main stream valleys. It is very probable that considerable development of ground water in favorable locations is practicable in connection with dry farming and that here is a means of providing emergency water for feed crops at critical periods during the growing season. To determine where supplemental irrigation by pumping is feasible and the safe limits of draft within various areas will require an extension of investigations which have so far been made.

The problem of increasing the size of a farm so as to round out an economic unit involves the extension of credit at low rates of interest. There are doubtless many farmers who have been handicapped by lack of capital required to increase their holding and who have accordingly been unable to turn from cash-grain production to a type of farming centered more on stock raising.

The amount of federal land remaining in the public domain is negligible and consists of remnants too small for homesteads. Figure 14 shows the distribution of state land in Eastern Colorado, amounting to about 2 million acres, or about 7.1 of total area. In a few counties as much as 14 or 15 percent of the area is state land. Conservation measures for the state land is of equal importance with private land. The State Land Board has evidenced

GREAT PLAINS AREA OF COLORADO
DISTRIBUTION OF STATE LAND



SCALE
0 10 20 30 40 50 MILES

COLORADO STATE PLANNING COMMISSION

Fig. 14

its willingness to cooperate in plans for conservation and has filed application for a W.P.A. project for range improvement.

The opportunities for attractive recreational developments on the short-grass plains are limited as compared with timbered lands and areas supplied with natural bodies of water. There has been some recreational use made of irrigation reservoirs, particularly for fishing. While the larger part of the population are in close proximity to the mountains, where recreation is a major land use, the recreational needs of those living at a greater distance should be recognized. Construction of proposed reservoirs such as the Apishapa, Caddoa and Purgatoire would bring about new opportunities for recreation. In the southern part of the plains adjoining a land purchase project of the Resettlement Administration lie the rough timbered lands drained by the Purgatoire River, suitable as a site for a large-scale reservation having much historic and geologic interest.

IV. EMERGENCY PROGRAMS

The number of employable persons on relief in June, 1935, in proportion to total population of each county of Eastern Colorado, is shown in Table 1. At this time, when 22.3 percent of the state's population were on relief, the relief load in six plains counties represented from 40 to 50 percent of the county population. While the proportion of farm operators on relief in the state as a whole was less than that of the urban and rural non-farm populations, it was found that in October 1935 only four states had a higher proportion of farmers on relief than Colorado. Crop failure was the reason for going on relief given by most farmers.

In the 14 counties of southeastern Colorado the sum of nearly 37 million dollars has been furnished since 1933 by the federal government in the form of A.A.A. benefit payments, A.A.A. drought livestock purchases, Federal Land Bank and Commissioner loans, Regional Agricultural Credit Corporation, Rural Rehabilitation, Emergency Crop Loans, Drought Loans, Production Credit Association, C.W.A., and E.R.A. through October 1935. In Baca County \$4,102,675 has been furnished through these agencies, equivalent to more than \$4,000 per farm for all operating farms in the county.

The Soil Conservation Service has carried on extensive operations with excellent results in controlling erosion in 9 areas with varying conditions of climate, soil, topography and land use. The work has included structures of many types designed to prevent runoff and store moisture, seeding, and tree and shrub planting. The educational value of such work during the short period of two years has been very great.

The Resettlement Administration has undertaken three purchase projects of submarginal land, on which options have been closed for about 235,000 acres. This land is to be restored to grazing use under suitable range management.

The principal operations of this agency in establishing new farms for re-settlement are in western Colorado.

The foregoing indicates in part the activities of emergency administrations and others which evidence the necessity of or contribute toward a long-time program. The partially completed land-use surveys of the Resettlement Administration are of particular value in planning for land adjustment. Detailed maps of existing conditions and analysis of data now in process will provide the requisite background on which to base definite plans for adjustments of land use. Up to the present time such detailed information has not been available, particularly on such items as the location of crop and pasture land, abandoned land, condition of farm dwellings amount of land blown, and crops records of the individual farm.

V. CONTRIBUTIONS OF RESEARCH AND EDUCATIONAL AGENCIES TO A
LONG-TIME PROGRAM.

In the Appendix of this report are memoranda prepared by the Director of the Colorado Agricultural Experiment Station, the Director of the U. S. Dry Land Field Station, and the Director of Extension at Colorado Agricultural College. These agencies and others including the Resettlement Administration, Soil Conservation Service, Forest Service and Biological Survey are engaged in research and educational work of the greatest value in arriving at a better understanding of the land problems of the state and developing long-term plans for improving conditions. Closely associated are surveys and investigations being made by the Bureau of Reclamation in regard to projects for flood control and irrigation in Eastern Colorado.

An organization has been formed with representatives of all federal and state agencies concerned with land and water problems, known as the State Agricultural Clearing Committee. This Committee has worked effectively during the past year in coordinating programs of research and action, and through sub-committees is now engaged in formulating recommendations for action of the problem. It is the intention that the information developed by a survey conducted by any agency be made available to all other agencies.

VI. RECOMMENDATIONS FOR REMEDIAL MEASURES

A. 1. Approved practises for soil and water conservation in individual farms and ranches should be continued, and where governmental aid is extended it should be on the basis of compliance with terms designed to insure the maintenance of constructed works. Among such practises and structures are listing, pasture contouring, terracing, water spreading, check dams, small dams for stock water, development of ground water, revegetation, and wind-break planting.

2. Demonstration projects of the Soil Conservation Service having proved to be of great value, a wider distribution of such projects on a smaller scale would be beneficial in order that more farmers may observe the methods employed and the results obtained.

3. Educational work should be intensified so as to obtain fuller adoption of tillage and cropping practises which assist in preventing erosion.

B. 1. Major enterprises for water development to relieve shortages of irrigation water should be undertaken, including reservoirs for impounding flood water and transmountain diversions with adequate compensatory storage for the river basin from which water is drawn. These will include projects for which investigations have been entirely or nearly completed such as the Caddoa dam on the Arkansas River, and the Colorado-Big Thompson diversion for the Platte Valley.

2. Other projects under investigation, such as the Blue River transmountain diversion to provide supplemental irrigation water for the upper Platte Valley, and a group of smaller projects for flood control and irrigation, have a definite place in the long-range plan for the region.

C. 1. Enabling legislation should be enacted permitting the formation of local grazing associations with authority to lease private, federal, state and county lands, make needed range improvements, and administer such land with advise and assistance from a State board. Such grazing districts would be practicable in areas wherever much of the land is still in grass or where persistent failure of crop farming has resulted in extensive land abandonment. Several years of experience with such grazing districts in Montana should point the way for their successful operation in this state.

2. Enabling legislation should be enacted for the creation of soil conservation districts. In the case of land owner unwilling to cooperate in control work for soil erosion, authority would be granted to enter upon such land, perform the work necessary to prevent damage to neighboring lands from erosion, and assess the cost against the land.

3. The present law in regard to tax delinquent land, whereby it is optional for the county to take title after three years' delinquency should be amended to make it mandatory for the county to take such action. The county then should have authority to exchange the land in order to permit blocking into larger units or to lease or sell it to an established grazing association.

D. For taxing purposes, farm land should be classified on the basis of productiveness at the time of assessment. Adherence to such a policy should distribute the tax burden more equitably and result in less land abandonment.

E. Governmental loaning agencies in furnishing credit should give full consideration to the suitability of land for particular uses under a long-term program so as to avoid the perpetuation of existing mis-use of land. While there has probably been an over-extension of credit in general,

it is believed that loans on easy terms are the most practicable means whereby deserving farm operators with small uneconomic units, can increase their holdings and be rehabilitated in place. A greater flexibility in repaying loans would be desirable, offering a discount for repayment during years when farm income is high, with a reasonable relaxing of conditions during years of drought.

F. Public acquisition of land will probably be necessary in clearing up occasional tracts within grazing district so as to obtain proper distribution of water holes and effect economies in local service. Acquisition also will be necessary in providing recreational facilities and in certain areas where watershed protection is essential.

G. Surveys and research work should be continued, requisite for a more complete understanding of the many problems involved, and should include the following:

1. Completion of topographic mapping.
2. Establishment of additional stream gaging stations and weather bureau stations.
3. Completion of soil surveys.
4. Institution of adequate surveys of ground water.
5. Intensive study of climatic factors and development of long-range weather forecasting.
6. Completion of land-use surveys.
7. Investigation of transmountain diversion to Arkansas River.

APPENDIX

MEMORANDA ON RESEARCH AND EXTENSION WORK

Memorandum on Research Prepared by M. P. Sandsten,
Dean and Director Agricultural Experiment Station,
Colorado State College, Fort Collins, Colorado.
L. A. Moorhouse, Professor of Economics and Soci-
ology, and others of the college faculty.

IMPROVED VARIETIES OF CROPS, PARTICULARLY THOSE THAT ARE DROUGHT RESISTANT

Winter wheat:

Our most generally grown and improved variety is Kanred, brought into the state by the institution, bred at Kansas Experiment Station. Turkey Red was imported but strains improved at the Experiment Station.

Spring wheat:

Komar, a spring wheat, does rather well on the dryland. Experimental work indicates that Komar will outyield all other spring wheats around 30 percent. Introduced, original hybridization made in North Dakota. Ceres, second best spring wheat adapted for dryland. Same original hybrid parents as Komar. Also introduced from North Dakota.

Barley:

Two best sorts are Club Mariout and Flynn. Original Club Mariout was imported from California. Flynn is a hybrid of Club Mariout and Lion made by Harlan, U. S. D. A. Particular strains adapted at the Akron Experiment Station. These two strains are about equal in productive capacity and outyield all other dryland barleys so far tried. Flynn has an advantage over Club Mariout in that it has smooth beards or awns so that the straw can be fed without causing sore mouth in cattle or other farm animals. Club Mariout in rather large fieldtests on farms away from Akron has yielded from 8 to 20 bushels per acre when the best previous variety, Trebi, was a total failure. Flynn does equally well under the same conditions. We are more largely recommending Flynn at the present time because of its obvious advantage in the smooth awns. There is not yet enough seed for general planting.

It can be said of Flynn and Club Mariout barleys that they produced fairly good yields when properly planted everywhere on our plains every season except 1934. Other dry years which completely killed off other barley varieties were not so severe as to prevent Flynn and Club Mariout from producing fairly good yields.

Oats:

The best single variety is Bruncker produced by breeding at the Akron Station by F. A. Coffman and others, including J. F. Brandon, now Superintendent at Akron. Next to Bruncker the best dryland oats is Kanota, a Kansas bred variety.

Sorghums:

All sorghums in our work were originally brought into the state but due to our higher altitude and shorter seasons the types that we are now growing have to be adapted for northeastern Colorado conditions. Such work has been done under Mr. J. F. Brandon at the Akron Station and has produced improved strains of Amber, Orange and some new things such as Coes and others not yet named, all of which promise very great improvement in this field.

Sudan:

Considerable breeding work is under way which has produced a number of new and very promising strains as yet unnamed. This is the best annual pasture and one of the best hay plants for much of the dryland.

Corn:

Colorado No. 13 corn was bred up using Minnesota No. 13 for original stock. This is now the most widely adapted Dent corn of the state. It was bred by private individuals under complete direction of Experiment Station and Extension men. The Station worked out the best planting date of corn, showing that for most of the northern Colorado region the best planting date was from May 1 to 10; further south April 25 to May 10. Planting at these

dates increased yields and increased the amount of mature corn. Planting this early occasionally the corn was frosted but recovered to make an earlier crop and higher yield than later plantings.

INTRODUCTION OF NEW CROPS THAT ARE BETTER ADAPTED TO THE REGION.

Many of our best adapted dryland crops are introductions. Some of these introductions have been subjected to definite breeding work and have been changed into new things. Among the introductions are Kanred and Turkey Red winter wheats, Komar and Ceres spring wheats, the better of the Durum wheat varieties, Club Mariout and Flynn barleys, Kanota oats, all of the millets including the better varieties of grain millet and hay millet, all of the sorghums, the better adapted sorts, however, have been brought to their present state of perfection by crop improvement methods; pinto beans, soybeans.

FARMING METHODS AND PRACTICES WHICH AID IN THE CONSERVATION OF SOIL MOISTURE.

The methods which have been worked out for the conservation of soil and moisture consist in surface treatment to keep down weeds and to more readily permit penetration of precipitation. It has been worked out that leaving a roughened cloddy surface not only saves moisture but catches moisture better so that there is a smaller loss and a larger soak-in. Also the cloddy surface protects from loss of moisture by evaporation more thoroly. The use of a lister, the use of the field cultivator or duckfoot have been pretty well proved experimentally. Contouring, contour listing and terracing have been tried but not long enough experimentally. Contour farming was first done on the Cheyenne Wells farm, beginning in 1914. This is the longest single piece of work and has demonstrated thoroly the value of contours for getting a larger amount of water into the soil, thus reducing run-off.

Practices and methods to conserve moisture consist of two parts; First - Surface treatments or soil treatments which permit a greater catchment. Second - Surface treatments which prevent loss of water caught. Experiments indicate that the greatest loss of water caught is thru transpiration from growing plants. Consequently, clean cultivation of the proper sort is one of the greatest aids in conserving the moisture in the soil. The experimental work has gone far enough to show that the clean cultivation should leave a cloddy surface somewhat roughened, which will reduce the danger of blowing and the danger of erosion by water.

IMPROVEMENTS AND CONSTRUCTIONS WHICH FACILITATE THE CONSERVATION OF SOIL MOISTURE AND THE IMPOUNDING OF SURFACE RUN-OFF.

Considerable demonstration has been done in construction of contours and terraces. No direct experimental work has been done except the one piece of work started on the Cheyenne Wells farm in 1914. Demonstration practices along this line started in the spring of 1936 will be described by the Extension Agronomist.

LIVESTOCK PRODUCTION PRACTICES WHICH CONTRIBUTE TO A LONG-TIME PROGRAM.

By livestock production practices we understand, first, the production or raising of livestock on the farm or range. Second, the fattening of livestock in certain irrigated and sugar beet producing areas in the state, where by-products are cheap and available.

The raising of livestock on the farm or range is a rather specialized type of farming. It is limited by two factors; available range or pasture, and sufficient hay or feed for winter feeding. The number of livestock carried per unit depends upon the carrying capacity of the range. Drought and overstocking or overgrazing have greatly reduced the carrying capacity of the range, especially in the Plains area, and on the public domain in the western part of the state.

The public domain has not been protected until recently, and has suffered greatly from overgrazing and drought. With a closer regulation of the public range and a better understanding of proper range management, the production of livestock on the range should attain stability in quantity production.

In the strictly range country, the growing of various farm crops is not practised, livestock production being almost the sole source of income. In other sections, particularly in the Plains Area, livestock occupies the position of one of the crops that is produced on the land. This is particularly true where dairy herds are kept. In most instances farmers in the eastern Plains Area have little or no livestock, or at least nothing but milk cows to supply the family need. This condition makes for unbalanced farming, and such farming can not be permanent since it does not consider the keeping up of soil fertility by the addition of animal manures. The main farm crops have been grain, corn and beans, and the return from these has been irregular and often uncertain, due to the vagaries of rainfall. There is little doubt that with proper sized farm unit and a balanced farming, including livestock, this would make farming less hazardous and hence more secure. After all, security is what everyone should look for, and this can only be obtained by balanced agriculture. The old days of unlimited public range are gone, and cattle production must meet the new conditions. The livestock man must look after his range; whether it be personally owned or leased, the obligations should be the same. Regulations by state and federal agencies in the matter of range management are the result of the inability or unwillingness of the livestock industry to look after its own business.

Both state and federal agencies are interested in the range and range management. The Soil Conservation Service is doing praiseworthy work in the

matter of erosion and water distribution. The studies of the Forestry Division in range management from various angles are progressing rapidly. The Experiment Station of the Agricultural College has inaugurated several projects on which work was started last summer to study the grazing problems in the Plains area. These lines of work are being actively pursued, and much valuable information will soon be available to the livestock industry and others interested.

ECONOMIC AND SOCIAL STUDIES HAVING A BEARING ON THE PROBLEM.

From the standpoint of our work in farm and ranch organization and management at least two observations may be made. In general our studies have shown that on the most profitable farms well balanced systems have been followed. These systems or types have been built around stable enterprises adapted to the area. Crops and livestock have been selected in such a manner that they have constituted a definite pattern and they have contributed to each other. Non-marketable products such as straw, beet tops and pasturage, have in the main been utilized to good advantage. Good field and feeding practices have been followed. All of these things have made for economical production. The operators of the most profitable farms were generally regarded as good buyers and sellers; they possessed a knowledge of values; they were informed as to conditions likely to result in favorable prices for some products and unfavorable prices for others. Moreover, the planning of the system of farming is a forward-looking undertaking and the results of the past should always be interpreted in the light of new conditions. Production and price relationships likely to prevail during the years just ahead constitute the basis for decisions. On the one hand judgments are formed as to the amounts of the various products that may reasonably be expected with one system or another and, on the other, decisions are reached as to probable costs and prices which may be expected for farm products.

In the study of irrigated farms we have found that some farmers have been able to take a given set of resources and make good returns while other farmers, using similar resources, were sustaining large losses. The following factors appear therefore to be essential in explaining the causes for variations in returns; (a) the selection of enterprises; (b) crop yields and crop practices; (c) the cost and utilization of man labor and horse work; (d) feeding practices; (e) knowledge of values in buying and selling; (f) adjustments in farm plans due to price changes; (g) size of business; and (h) the managerial ability of the farm operator.

There are a few factors in ranch operation and organization that have a very direct bearing upon the annual returns from the business. These factors may be considered as measures of efficiency. It has been found that ranch profits are modified and controlled by such items as (a) the size of the ranch, (b) efficiency in the use of labor, (c) care of herds in order to secure good wintering, (d) taking necessary precautions to obtain a good calf crop, (e) economy of operation with persistent work on the part of the owner or manager.

Considerable attention has been given to the analysis of cost data relating not only to the production of crops but also to the feeding of livestock. The value of such information will be found in its application by the individual farm operator as he attempts to become more familiar with the details of his own program. The hours of man and horse labor can be used in planning the work of the farm for the year. Labor requirements may vary quite widely between farms and in different years. Usually the reasons can be given for such variations. Low labor requirements are generally associated with the managerial ability of the farmer, able and skillful employees, large sized units both in machinery and power, and a tentative but carefully laid out farm program. The value of cost

figures is not so much a matter of their accuracy as it is a source of records likely to challenge the customary methods employed in farming. If they do no more than cause the individual to examine his own practices and to seek for better ways they have done their part toward improving and raising the general scale of farm management.

Our study of type of farming areas in Colorado, reported in Station Bulletin 418, was undertaken in order to acquire a more comprehensive understanding of the agriculture of the state as a whole; to locate and delimit the different type-of-farming areas within the state; to determine the general character of the farming carried on in each area; and to identify and evaluate the relative importance of the various sources and conditions which have been and are now shaping the type of farming in the various parts of the state. This study has provided background material which may be used in dealing with the agricultural problems of the state, in teaching agriculture and related subjects in colleges and public schools, in making recommendations to farmers in placing a limit on the application of such recommendations and in formulating land-use policies. This report contains a graphic presentation of the distribution of crop and livestock enterprises as well as the types of farming which have been developed in this state. It also includes a detailed description of the seventeen type-of-farming areas which were outlined as a result of this analysis.

From the point of view of studies in the field of public finance and taxation I am going to confine my remarks largely to the recommendations which grew out of our initial project in this field. This summary will be found in Station Bulletin 346, "Some Colorado Tax Problems with Special Reference to Their effect on Agriculture."

This analysis appeared to indicate that we should broaden our tax system so as to take advantage of the sources of ability to pay taxes which now make little or no contribution to the cost of government. Although we have within the past two years added the sales tax to this list, nevertheless in distributing its tax burden Colorado uses a relatively small number of indications of ability to pay taxes. The possession and use of tangible property, including automobiles, constitutes the basis for collecting almost all of the tax revenue for state and local uses. Taxes on an insignificant amount of tangible property, levies on inheritance and business, and other so-called license taxes, account for most that is collected from other sources. Thus, much Colorado wealth makes no direct contribution to the support of state and local government. It was therefore suggested in this report that intangible property might be made to pay some part of the cost of government and income might be used as a basis for a part of the tax system.

The first method of broadening the tax base, namely, the classification of property for tax purposes, and the use of a lower rate on intangibles, involves a change in the general property tax. Other changes in the general property tax have to do with changes in principle or in administration. It is believed by many that there may be a possibility of working out a system of assessment which will make some closer reflections of the income-yielding ability of property than sales value, the measure of tax-paying liability.

The state income tax is no longer an experiment. The Federal government collects a vast amount of revenue through this means. More than twenty states now tax individuals on the basis of income. Such a tax properly administered will bring a fair amount of revenue into the public treasury and will secure some of this revenue from many who at present make slight or no direct contributions to the support of government. Too much, however, should not be expected from an income tax in Colorado.

It was further suggested that certain activities of government could be carried on more economically and more equitably if the governmental units maintaining them were to be altered. Roads and schools form excellent illustrations of possibilities in this direction. A wider use of state funds and supervision in the construction and maintenance of roads is certainly justified by the use to which roads are put. The responsibility of the state toward the education of its children will be denied by few. The fact that without state assistance there could be no such thing as equality of educational opportunity is not open to doubt.

Finally, no one doubts that there is an excellent chance for a reduction in many of the costs of government without curtailing the services that the government supplies to its people. Duplications caused by county governments which were planned in the day of the horse and buggy rather than the motor car, and inefficiency arising from the maintenance of an excessive number of small school units, are typical of many that may be cited.

Furthermore, a study of counties or even school districts will reveal opportunities for better buying, for the consolidation of functions, and for the lopping off of unnecessary extravagances.

Memorandum on Research Prepared by
J. S. Brandon, Superintendent U. S. Dry Land
Field Station, Akron, Colo.

IMPROVED VARIETY OF CROPS, PARTICULARLY THOSE THAT ARE DROUGHT RESISTANT.
INTRODUCTION OF NEW CROPS THAT ARE BETTER ADAPTED TO THE REGION.

This station conducts extensive tests of winter and spring wheat, barley, oat, bean, proso, foxtail millet, grain and forage sorghum, forest and wind break trees and shrub, and fruit garden varieties to fix their relative value to the region. This is important work to continue, for new, and possibly better varieties, are constantly being bred and introduced. It also does extensive breeding work with whatever of these crop varieties its funds and scientific staff will enable. This station was very early instrumental in bringing about a change in the wheat variety from Durum or Macaroni to the hard red winter by finding the hardiness and value of the latter and by introducing pure seed to picked growers in the various sections. It more recently bred, proved, and introduced Brunner, an outstanding oat variety for this entire high altitude portion of the West Central Great Plains.

It quite recently proved the worth of Club Mariout and Flynn barleys in its variety experiments and introduced seed to widely scattered, picked seed growers. Club Mariout is outstanding in its adaptation to this same general region, and in Colorado alone it is conservatively worth \$250,000 per year to the plains section barley industry. Flynn is equally valuable to those who want a smooth awned barley. It still more recently proved the worth of Kansas spring wheat and introduced it to growers.

In later years the station has been aided in widely disseminating these better adapted varieties by the Seed Registration Service of the Colorado Agricultural College.

This variety work has been valuable even when we have not been able to ferret out and introduce better adapted varieties to the region, by being a source of pure strains of the varieties, and by proving a check on the unscrupulous crop variety promoter, who springs up occasionally and, who would work freely, were it not that his variety has been, or is being checked in our varietal evaluating experiments. This latter type of value can only be estimated.

FARMING METHODS AND PRACTICES WHICH AID IN THE CONSERVATION OF SOIL MOISTURE. IMPROVEMENTS AND CONSTRUCTIONS WHICH FACILITATE THE CONSERVATION OF SOIL MOISTURE AND THE IMPOUNDING OF SURFACE RUN-OFF.

The cultural work at this station has served to throw light on some of the early theories of proposed successful plains farming, such as green manuring, time of plowing, dynamiting, and depth of plowing. This, and other similar experiments about the Plains, has stopped the wild theorizing in farm magazine articles intended for plains farmer consumption. This more rational teaching is being furthered by county extension agents. It is finding its way into text books that are being used by Smith-Hughes agricultural teachers in the high schools. The rotation studies have fixed the place of the crops in sequence, and this information is being disseminated through the same sources.

This cultural and rotation work has thrown valuable light on all the cultural and crop sequence problems of the region, and has shown definitely that the plains soils are naturally outstandingly fertile, and that the limiting factor in production is in the amount of moisture received as precipitation, and the amount that can be made to enter the soil.

The storing and conserving of the precipitation is wholly a surface soil problem. Stirring the soil deeply merely opens a greater mass to the drying influence of the air. In some ways of working, such as the chisel, this deep cultivation may facilitate penetration, but if this can be accomplished without the drying out, the operator is ahead. Recently damming implements, and still more recently, surface pock-marking implements, offer to facilitate the storing of moisture without unduly stirring and aerating the surface six to eight inches. This trend in implement building has been urged long before the actual building.

This trend in implement building promises to make a profound impression on plains agriculture. We operators here on the stations have often bemoaned the fact that we had to take implements designed for other regions and do the best cultural jobs our experience indicated should be done.

Soil blowing is a natural crop hazard here on the plains. A bulletin has been recently published, which covers this subject in a very popular manner.

LIVESTOCK PRODUCTION PRACTICES WHICH CONTRIBUTE TO A LONG-TIME PROGRAM.

Livestock and mixed farming have always been advocated by the plains experiment station. This is because the forage feeds which in themselves have no readily ~~saleable~~ market value are the most certain producing crops we have. While very certain, these carbonaceous feeds furnish 80 percent of the livestock producer's feed necessities. This 80 percent of the necessary live stock feed is produced more cheaply than at any other place in the country. Livestock and the diversification it entails will tend to cushion the shock of a low price on one product, and will enable one to practise strip cropping.

ECONOMIC AND SOCIAL STUDIES HAVING A BEARING ON THE PROBLEM.

Studies of successful farmers, and there are many over the plains, show that the diversified farmer with livestock is farming better in the way of diversification, is having less soil blowing trouble by having annually better cover on his soil, and was happy and contented during the depression period.

OTHER PROBLEMS.

A problem at this station is in not being able to lead in livestock promotion work. A livestock unit is needed in connection with our agronomic work.

We see corn smut take great toll in plains corn production, yet we have no trained scientist, nor can hire one, to tackle this great economic waste right in our midst. We need a trained scientist to breed better adapted varieties of proso, which is a very economic carbonaceous grain feed in this region. We need a similarly trained man to take hold of and expedite our breeding work with grain sorghums which can be made to yield and become adapted this far away from the grain sorghum belt. We need a similarly trained man to take charge of our forestry and shrubbery work and to oversee the demonstration of their adaptation into a plains landscape plan.

We need that this station should at last realize its place as the Central Great Plains Field Station, and its work expanded to really serve the great section it really represents. Hays, Kansas, is too far east today, to be a Great Plains Station. We need a sizable, important institution to work out problems, originating right out on the western edge.

The Soil Conservation Service is needed for factual information in furthering their campaigns here on the western edge of the Central Great Plains. We need, and here is an excellent place for establishing such a unit, a comprehensive research unit, on the problems incident to better trapping and storing the rainfall.

Memorandum Prepared by F. A. Anderson,
Director of Extension, Colorado State Agricultural
College, Fort Collins, Colo.

EXTENSION SERVICE ACTIVITIES IN MEETING THE DROUGHT PROBLEMS OF THE GREAT
PLAINS AREA IN EASTERN COLORADO.

After experiment stations prove a new crop or improved practice it becomes an activity of the Extension Service to encourage farmers to adopt the new crop or variety or practice. Extension workers attempt to introduce the new variety or practice by some educational procedure, such as field demonstrations, meetings, publicity or circular letter. Every farmer who tries the new variety or practice becomes a demonstrator for his community. Farmers may see for themselves the results of the demonstration or they may be told of the results and, slowly, the new crop or practice is generally adopted by farmers in the community. It is difficult to get an accurate measure of the adoption of practices without an expensive survey.

Experiment stations have introduced improved and better adapted varieties of wheat, including Kanred and Turkey winter wheats and after about twelve years of educational effort, these varieties are grown by, perhaps, 95% of the wheat growers in Eastern Colorado. Komar, a new spring wheat, is rapidly replacing Ceres and Marquis in areas where spring wheat is grown, as a result of well placed demonstrations and the creation of a seed supply.

In hundreds of demonstrations Club Mariout barley has produced a satisfactory yield while other varieties planted alongside have entirely failed or produced only a small yield. Flynn barley, a new smooth-awn variety, is about ready to compete with Club Mariout for top honors as a dry land variety. A drought enduring variety of oats, called Bunker, has been quickly adopted by farmers interested in this crop. Proso or hog millet has been a new crop.

Introduced by the experiment station as, perhaps, one of the most drought enduring crops in the region. This grain millet has been proved to be an excellent feed grain as well as bread grain for humans. The development of a seed supply of selected varieties of hog millet has been carried on by the Extension Service in cooperation with the Experiment Station. Sudan grass and sorghums are, perhaps, the surest of all crops grown in the dry land region. Experiment stations have released improved varieties, which have quickly moved to many farms throughout the area.

Corn is a major crop throughout the area. Intensive effort on the part of extension workers has resulted in improved selections, better able to stand the difficult growing conditions in Eastern Colorado. A carefully-planned seed improvement program under the direction of Extension workers insures a supply of seed of improved variety each year. Effort on the part of extension workers aiming at feed conservation has resulted in the construction of some 8000 trench silos for the storing of mature or immature feed. The feed value of Russian thistles and other weeds has been demonstrated at the suggestion of Extension workers.

During the 28 years that the Experiment Station has been in operation at Akron, Colorado, there has been only one total crop failure. The practices proven by the Akron Station have been adopted by the more progressive farmers of the dry belt. The adoption of these improved methods of preparing land in order to save the soil and store moisture is the reason that all farmers in the area are not on the relief roll.

The Agricultural Conservation Act, under the supervision of the Extension Service, has encouraged thousands of farmers to follow an improved farming practice. As a result of this Act, the adoption of improved practices

Will be speeded up because the Act will help to finance these improved practices. More farmers have planted winter wheat on fallow this fall, as a result of the A.A.A., than ever before.

Farmers are more soil and moisture conservation minded than ever before because of the drought; therefore, educational programs along these lines have been more effective during the past three years. The emergency dust control program of 1936 administered by the Extension Service resulted in the listing of 1,377,111 acres of land on 8,396 farms in 21 counties; 276,602 acres were listed on the contour. The long-time educational effect of this program will be considerable toward future efforts in the education of farmers in the control of soil erosion and moisture conservation.

New labor saving and moisture saving machines such as the duck foot cultivator and the damming lister have been demonstrated. Terracing machines and contouring machines have been demonstrated in cooperation with the Soil Conservation Service. The general adoption of these practices will depend upon further experimental work to prove their value under different soil and moisture conditions.

A long-time program aimed at permanent drought relief or rehabilitation in Eastern Colorado must take into consideration the following:

1. The need for experimental data or further research to determine methods of reseeding to grass thousands of acres of plowed land; tillage methods on different soil types, moisture conservation under different conditions; feed crop varieties and methods of production on marginal lands; an economic farming or ranching unit; methods of preventing soil erosion on various soil types and methods of developing water supplies.

2. Land use and the type of farming on first, second and third grade plow land.

3. Financing farmers to change from their present uneconomic set-up to an improved set-up including, perhaps, more land, improved machinery and other equipment, and foundation livestock.

4. Farmers will be successful only when they grow a large proportion of their living at home; when they grow a greater diversity of crops with emphasis on feed crops rather than market crops; point their agriculture toward livestock production because feed crops and grazing crops are surer than cash crops; control sufficient land in order that they may carry on improved tillage methods and grazing; produce and carry over feed reserves and generally become tied to the land by ownership.

TABLES 1 - 9.

TABLE 1

GREAT PLAINS AREA OF COLORADO
URBAN-RURAL DISTRIBUTION OF POPULATION BY COUNTIES IN 1930
AND EMPLOYABLE PERSONS ON RELIEF - JUNE, 1935

COUNTY	URBAN - RURAL DISTRIBUTION OF COUNTY POPULATION		PERCENT OF COUNTY POPULATION ON RELIEF-JUNE, 1935
	% URBAN	% RURAL	
<u>N. CENTRAL & N. E. COLO.</u>			
Boulder	53.2	46.8	22.6*
Jefferson	0.0	100.0	18.0
Larimer	51.3	48.7	23.7*
Logan	36.6	63.4	10.2
Morgan	24.2	75.8	20.0
Sedgwick	0.0	100.0	16.3
Weld	18.7	81.3	22.1
<u>EAST CENTRAL COLORADO</u>			
Adams	16.8	83.2	17.0
Arapahoe	35.2	64.8	27.6*
Cheyenne	0.0	100.0	25.0*
Denver	100.0	0.0	17.5
Douglas	0.0	100.0	12.1
Elbert	0.0	100.0	25.2*
El Paso	67.0	33.0	26.4*
Kiowa	0.0	100.0	42.3*
Kit Carson	0.0	100.0	40.1*
Lincoln	0.0	100.0	19.2
Phillips	0.0	100.0	13.3
Washington	0.0	100.0	20.9
Yuma	0.0	100.0	22.8
<u>SOUTHEAST COLORADO</u>			
Baca	0.0	100.0	49.3*
Bent	27.6	72.4	23.9*
Crowley	0.0	100.0	47.1*
Huerfano	32.3	67.7	42.7*
Las Animas	32.6	67.4	37.2*
Otero	43.5	56.5	23.3*
Prowers	28.7	71.3	43.4*
Pueblo	75.9	24.1	28.7*
ENTIRE STATE	50.7	49.3	22.3

* Above State Average.

Compiled from Data Furnished by
Colorado State Relief Administration.

TABLE 2

PRECIPITATION AT REPRESENTATIVE STATIONS IN PLAINS AREA OF EASTERN COLORADO

Station	Years of Record	Average Annual Precipitation		Average Precipitation from Apr. 1 to Oct. 1.		
		Inches	Proportion of Years with less than average	Inches	Percent of Annual	Proportion of years with less than 75% of seasonal average
Ft. Collins	38	15.16	55%	10.98	73%	26%
Denver	64	14.07	52%	9.71	69%	23%
Pueblo	61	11.84	52%	8.79	74%	15%
Hoehne	20	14.13	56%	10.15	72%	22%
Yuma	46	17.09	48%	13.30	78%	22%
Limon	25	14.06	40%	11.42	81%	24%
Las Animas	69	12.12	55%	9.61	79%	23%
Sedgwick	26	17.24	58%	14.12	82%	19%
Burlington	45	17.70	49%	13.71	80%	24%
Springfield	29	16.78	48%	11.77	70%	28%
Fort Morgan	47	13.80	53%	11.06	80%	17%

Source: U. S. Weather Bureau

TABLE 3

GREAT PLAINS AREA OF COLORADO

NUMBER OF DAYS WITH TEMPERATURES OF 100° AND OVER AT 10 SELECTED STATIONS

STATION	ENTIRE PERIOD OF RECORD					TOTAL	LENGTH OF RECORD IN YEARS	AVERAGE PER YEAR :	PERIOD 1931-1935	
	MAY	JUNE	JULY	AUG.	SEPT.				TOTAL NUMBER OF DAYS	AVERAGE PER YEAR
Las Animas	15	154	254	152	16	591	43	13.74 :	262	52.40
Ft. Collins	0	0	2	0	0	2	43	.05 :	1	.20
Denver	0	0	3	8	0	11	64	.17 :	1	.20
Pueblo	0	5	27	2	1	35	23	1.52 :	16	3.20
Sedgwick	0	24	87	34	9	154	28	5.50 :	78	15.60
Hoehne	0	9	17	7	0	33	21	1.57 :	10	2.00
Burlington	0	15	56	17	0	88	25	3.14 :	25	5.00
Limon	0	1	5	0	0	6	27	.22 :	6	1.20
Ft. Morgan	1	9	46	13	1	70	37	1.89 :	7	1.40
Two Buttes	2	75	171	133	15	396	43	9.21 :	76	15.20

High temperatures are of more frequent occurrence at lower altitudes, as shown for Las Animas, Two Buttes, Sedgwick and Burlington.

At every station except Ft. Morgan the average number of hot days for the years 1931 to 1935 was greater than the long time average. Notably Las Animas with approximately FOUR times as many and Sedgwick with nearly THREE times as many.

TABLE 4

SUMMARYFARMS, FARM ACRES AND CROPS HARVESTED

				7 COUNTIES OF DISTRICT NO. 2 N. CENTRAL & N. E. COLORADO		
				<u>1924</u>	<u>1929</u>	<u>1934</u>
Number of Farms			15,109	14,559	15,353	
All Land in Farms (Thousand Acres)			4,196	5,040	5,100	
Crops Harvested	"	"	1,589	1,786	1,193	
Crop Failure	"	"	189	209	719	
Idle or Fallow	"	"	105	197	338	
Total Pasture	"	"	1,936	2,638	2,649	
Woodland Not Used as Pasture & All Other Land "	"	"	369	211	201	

				13 COUNTIES OF DISTRICT NO. 6 EAST CENTRAL COLORADO		
				<u>1924</u>	<u>1929</u>	<u>1934</u>
Number of Farms			15,842	15,234	16,357	
All Land in Farms (Thousands Acres)			8,467	9,503	9,603	
Crops Harvested	"	"	2,432	2,737	1,112	
Crop Failure	"	"	342	528	1,759	
Idle or Fallow	"	"	140	315	765	
Total Pasture	"	"	5,248	5,684	5,689	
Woodland not Used as Pasture & All Other Land "	"	"	306	241	278	

				8 COUNTIES OF DISTRICT NO. 9 SOUTHEAST COLORADO		
				<u>1924</u>	<u>1929</u>	<u>1934</u>
Number of Farms			10,321	9,929	10,494	
All Land in Farms (Thousand Acres)			5,157	6,697	6,576	
Crops Harvested	"	"	702	888	398	
Crop Failure	"	"	224	80	691	
Idle or Fallow	"	"	59	187	361	
Total Pasture	"	"	3,832	5,403	5,007	
Woodland Not Used as Pasture & All Other Land "	"	"	339	138	120	

				TOTALS - GREAT PLAINS AREA OF COLORADO		
				<u>1924</u>	<u>1929</u>	<u>1934</u>
Number of Farms			41,272	39,722	42,184	
All Land in Farms (Thousands Acres)			17,820	21,240	21,279	
Crops Harvested	"	"	4,723	5,411	2,703	
Crop Failure	"	"	764	817	3,169	
Idle or Fallow	"	"	304	699	1,464	
Total Pasture	"	"	11,016	13,725	13,345	
Woodland Not Used as Pasture & All Other Land "	"	"	1,014	590	599	

TABLE 5

SUMMARYTYPE OF FARMSGREAT PLAINS AREA OF EASTERN COLORADO1930

	7 COUNTIES OF DIST. #2 N. CENTRAL & N.E. COLO.	13 COUNTIES OF DIST. #6 EAST CENTRAL COLO.	8 COUNTIES OF DIST #9 SOUTHEAST COLO.	TOTAL GREAT PLAINS
Number of Farms	14,559	15,234	9,929	39,722
General Farms	1,533	2,579	1,321	5,433
Cash-grain	2,548	4,690	892	8,130
Crop-specialty	4,620	1,725	2,718	9,063
Fruit	351	15	16	382
Truck	380	514	623	1,517
Dairy	889	1,044	514	2,447
Animal-specialty & Stock-ranch	1,901	2,557	1,592	6,050
Poultry	493	523	243	1,259
Self-sufficing	197	213	384	794
Abnormal	905	636	667	2,208
Unclassified	742	738	959	2,439

Source: U. S. Agricultural Census

TABLE 6

VALUE OF FARMS, LAND AND BUILDINGS

GREAT PLAINS AREA OF COLORADO

7 COUNTIES OF DISTRICT NO. 2 - N. CENTRAL & N. E. COLORADO

YEAR	VALUE OF FARMS, LAND & BUILDINGS (THOUSAND DOLLARS)	AVERAGE VALUE PER FARM (DOLLARS)	AVERAGE VALUE PER ACRE (DOLLARS)
1925	191,531	12,677.00	45.65
1930	202,001	13,875.00	40.08
1935	131,057	8,547.00	25.70

13 COUNTIES OF DISTRICT NO. 6 - EAST CENTRAL COLORADO

1925	181,752	11,473.00	21.47
1930	170,664	11,203.00	17.96
1935	107,484	6,571.00	11.19

8 COUNTIES OF DISTRICT NO. 9 - SOUTHEAST COLORADO

1925	78,938	7,648.00	15.31
1930	94,800	9,548.00	14.16
1935	61,962	5,905.00	9.42

TOTALS - GREAT PLAINS AREA OF COLORADO

1925	452,221	10,957.00	25.38
1930	467,465	11,768.00	22.01
1935	300,503	7,124.00	14.12

SELECTED CROPS

GREAT PLAINS AREA OF COLORADO

TABLE 7

7 COUNTIES OF DISTRICT NO. 2 - N. CENTRAL & N. E. COLORADO

	1924			1929			1934		
	Acres	Quantity	Yield	Acres	Quantity	Yield	Acres	Quantity	Yield
Corn (bushels)	250,186	2,146,949	8.58	243,856	3,614,505	14.82	85,193	538,388	6.32
Wheat (bushels)	341,397	4,465,816	13.08	511,327	6,663,838	13.05	285,213	2,851,303	10.00
Oats (bushels)	67,124	2,066,044	30.78	43,101	1,413,938	32.81	36,781	1,037,461	28.21
Barley (bushels)	97,987	2,170,049	22.15	235,305	5,754,165	24.45	114,253	2,729,229	23.89
Rye (bushels)	20,783	172,044	8.28	17,146	150,514	8.78	10,681	66,477	6.22
Hay (tons)	404,932	671,784	1.66	354,088	636,451	1.80	316,942	435,043	1.37
Sugar Beets (tons)	148,431	1,825,108	12.30	152,929	1,935,123	12.65	125,432	1,238,594	9.87
Potatoes (bushels)	18,331	3,259,171	177.80	26,876	3,122,574	116.18	23,041	2,246,157	97.49
Sorghums (bushels)	280	4,248	15.17	582	4,955	8.51	1,223	6,467	5.29
Beans (pounds)	*	*	*	87,864	36,277,920	412.89	68,970	11,600,650	166.75
Broom Corn (pounds)	*	*	*	0	0	0	30	4,050	135.00

13 COUNTIES OF DISTRICT NO. 6 - EAST CENTRAL COLORADO

Corn (bushels)	686,534	6,155,406	8.97	814,556	10,839,281	13.31	126,307	381,878	3.02
Wheat (bushels)	764,263	7,600,507	9.94	794,826	6,897,079	8.68	284,144	1,620,445	5.70
Oats (bushels)	53,375	749,667	14.05	42,864	693,127	16.17	7,458	99,189	13.30
Barley (bushels)	162,817	1,765,997	10.85	278,059	2,728,087	9.88	34,601	256,974	7.43
Rye (bushels)	51,372	384,733	7.49	43,564	309,267	7.10	19,619	96,714	4.93
Hay (tons)	327,054	447,432	1.37	350,308	375,953	1.07	308,016	174,971	.57
Sugar Beets (tons)	10,396	108,063	10.39	14,230	182,221	12.81	10,093	95,615	9.47
Potatoes (bushels)	2,984	115,166	38.59	3,651	216,401	59.27	1,018	20,296	19.94
Sorghums (bushels)	5,564	43,140	7.75	7,239	61,311	8.47	8,084	32,188	3.98
Beans (pounds)	*	*	*	207,879	58,319,560	280.55	91,210	7,602,200	83.35
Broom Corn (pounds)	*	*	*	718	221,800	308.91	2,970	340,670	114.70

* Records not available.

SELECTED CROPS
GREAT PLAINS AREA OF COLORADO

8 COUNTIES OF DISTRICT NO. 9 - SOUTHEAST COLORADO

	1924			1929			1954		
	Acres	Quantity	Yield	Acres	Quantity	Yield	Acres	Quantity	Yield
Corn (Bushels)	109,676	1,415,257	12.90	180,972	3,411,455	18.85	11,022	104,027	9.44
Wheat (Bushels)	126,655	1,270,867	10.04	135,473	1,752,218	12.93	52,805	384,587	7.28
Oats (Bushels)	12,313	411,161	33.39	9,566	319,589	33.41	5,655	128,067	22.73
Barley (Bushels)	17,631	304,576	17.28	45,034	909,427	20.19	16,344	249,860	15.29
Rye (Bushels)	1,368	12,319	9.01	1,034	11,666	11.28	387	3,395	8.77
Hay (Tons)	244,261	457,208	1.87	256,074	474,581	1.85	178,121	186,540	1.05
Sugar Beets (Tons)	31,733	330,015	10.40	34,823	413,392	11.87	24,382	157,325	6.45
Potatoes (Bushels)	153	4,574	29.90	333	23,963	71.96	225	1,722	7.72
Sorghums (Bushels)	31,111	270,259	8.69	28,070	321,224	11.44	6,844	29,576	4.32
Beans (Pounds)	*	*	*	65,027	24,352,440	374.50	12,210	3,515,000	287.88
Broom Corn (Pounds)	*	*	*	63,527	18,175,603	286.11	49,000	5,455,280	111.33

TABLE 8

SUMMARY - SELECTED CROPS
THREE DISTRICTS
GREAT PLAINS AREA OF COLORADO

	1924			1929			1934		
	Acres	Quantity	Yield	Acres	Quantity	Yield	Acres	Quantity	Yield
Corn (bushels)	1,046,396	9,717,612	9.29	1,239,384	17,865,241	14.41	222,522	1,024,293	4.60
Wheat (bushels)	1,232,295	13,337,190	10.82	1,441,626	15,313,135	10.62	622,162	4,856,335	7.81
Oats (bushels)	132,812	3,226,872	24.30	95,531	2,426,654	25.40	49,874	1,264,717	25.35
Barley (bushels)	278,435	4,240,622	15.23	556,398	9,391,679	16.87	165,198	3,256,063	19.58
Rye (bushels)	73,523	569,096	7.74	61,744	471,447	7.63	50,687	166,586	5.42
Hay (tons)	976,247	1,576,424	1.61	960,470	1,486,985	1.55	803,079	796,554	.99
Sugar Beets (tons)	190,560	2,263,186	11.88	201,982	2,550,756	12.53	159,907	1,491,534	9.33
Potatoes (bushels)	21,468	3,378,911	157.39	30,860	3,362,938	108.97	24,282	2,268,175	93.40
Sorghums (bushels)	36,955	317,627	8.59	35,891	387,490	11.80	16,151	68,231	4.22
Beans (pounds)	*	*	*	360,770	118,949,920	329.71	172,390	22,617,850	131.20
Broom Corn (pounds)	*	*	*	64,245	18,397,403	286.34	52,000	5,800,000	111.53

* Records not available.

TABLE 9

SUMMARYTENURE OF FARM OPERATORGREAT PLAINS AREA OF COLORADO7 COUNTIES OF DISTRICT NO. 2
N. CENTRAL & N. E. COLORADO

	<u>1925</u>	<u>1930</u>	<u>1935</u>
Number of Farms	15,109	14,559	15,333
Full Owner	6,634	5,648	5,647
Part Owner	2,019	2,586	2,244
Manager	176	146	112
Tenant	6,280	6,179	7,330

13 COUNTIES OF DISTRICT NO. 6
EAST CENTRAL COLORADO

	<u>1925</u>	<u>1930</u>	<u>1935</u>
Number of Farms	15,842	15,234	16,357
Full Owner	6,424	5,093	5,301
Part Owner	4,117	4,195	3,801
Manager	152	172	134
Tenant	5,149	5,774	7,121

8 COUNTIES OF DISTRICT NO. 9
SOUTHEAST COLORADO

	<u>1925</u>	<u>1930</u>	<u>1935</u>
Number of Farms	10,321	9,929	10,494
Full Owner	5,504	4,265	4,324
Part Owner	1,851	1,965	1,859
Manager	84	113	45
Tenant	2,882	3,586	4,266

TOTALS -GREAT PLAINS AREA OF COLORADO

	<u>1925</u>	<u>1930</u>	<u>1935</u>
Number of Farms	41,272	39,722	42,184
Full Owner	18,562	15,006	15,272
Part Owner	7,987	8,746	7,904
Manager	412	431	291
Tenant	14,311	15,539	18,717