

# WORKS PROGRESS ADMINISTRATION

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## RESEARCH BULLETIN

### AREAS OF INTENSE DROUGHT DISTRESS, 1930-1936

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**AREAS OF INTENSE DROUGHT DISTRESS, 1930-1936**

## INTRODUCTION

### The Problem of Drought

The incidence of drought in the Great Plains Region of the United States, with its fateful accompaniment of human distress, has been brought forcibly to the attention of the Nation by a succession of devastating visitations during the past few years. Evidence of suffering attendant upon these calamities has not been unheeded. Following initial programs of immediate relief, governmental resources have gradually been marshalled for a mass attack on the fundamental problems involved. It is hoped that from the wide range of coordinated research now under way will come an enlightened comprehension of all contributing factors. This in turn will serve as a reliable guide for future policy.

The necessity of adjusting economic and social organization to recurring periods of drought has resulted in the inauguration of a number of Government-sponsored measures for the correction of certain man-made conditions which tend to aggravate a situation made severe by the all too frequent niggardliness of nature. Efforts to restore an unwisely broken sod are known to all. It is now apparent that the draining of sloughs to increase wheat acreage was improvident, and the Nation patiently watches the development of the "little waters" campaign. Continuous over-grazing has more serious and far reaching effects than an immediate shortage of forage. Land utilization and soil conservation, reforestation, reclamation, and range preservation are all prominently to the fore in national thinking and national planning in the attempt to solve the basic physical problems presented.

Other questions arise, however, correlative to the physical problems but in many respects more insistent upon immediate attention, more pressing for early solution: questions which concern the human element involved—the men, women, and children who make their homes on the Plains. What is known of these people, their institutions, their society, and their culture? What has been the effect of the impact of persistent drought upon the pattern of their daily lives?

In an endeavor to examine the social aspects of the drought problem, the Division of Social Research of the Works Progress Administration, the Bureau of Agricultural Economics of the Department of Agriculture, and the Resettlement Administration

have combined their materials on human problems. The present bulletin is a preliminary effort to delineate areas of varying degrees of drought intensity and to select carefully defined sections as the basis for further study. It is the first of a series of three reports and will be followed shortly by one on the population of this midcontinent drought area, describing the population shifts caused by unpredictable natural forces, and by another giving a brief history of relief and rehabilitation, the public and private efforts to repair the damage to the social structure caused by periodic catastrophes.

### The Great Plains Region

The Great Plains Region includes a vast area bisecting the country from north to south and extending from the Rocky Mountains almost to the Mississippi River. Within this wide territory, and lying roughly between the 98th meridian and the Continental Divide, are the Central Great Plains, at once the heart of the Great Plains Region and the focal point of the present examination.

A comprehensive survey of cumulative effects of recurring droughts in the midcontinent, however, would extend beyond the Central Great Plains. An inspection of available data shows that, while the States of the Central Plains have borne the brunt of repeated droughts, neighboring States have not been left unscathed. The two most recent droughts, those of 1934 and 1936, covered large sections of adjoining country, but overlapped in an area blanketing the Great Plains and surrounding areas (figure 1).

To analyze carefully the effect of drought, it is essential to confine the project within geographic limits and to apply tests to the region so delimited. On the basis of the social and agricultural history of the Great Plains Region, an area has been selected for study which includes areas of intense drought distress. The area lies within the Great Plains Region, and covers the entire States of North and South Dakota, Nebraska, Kansas, Oklahoma, New Mexico, and Montana, together with parts of Wyoming, Colorado, Texas, Missouri, Iowa, and Minnesota.<sup>1</sup>

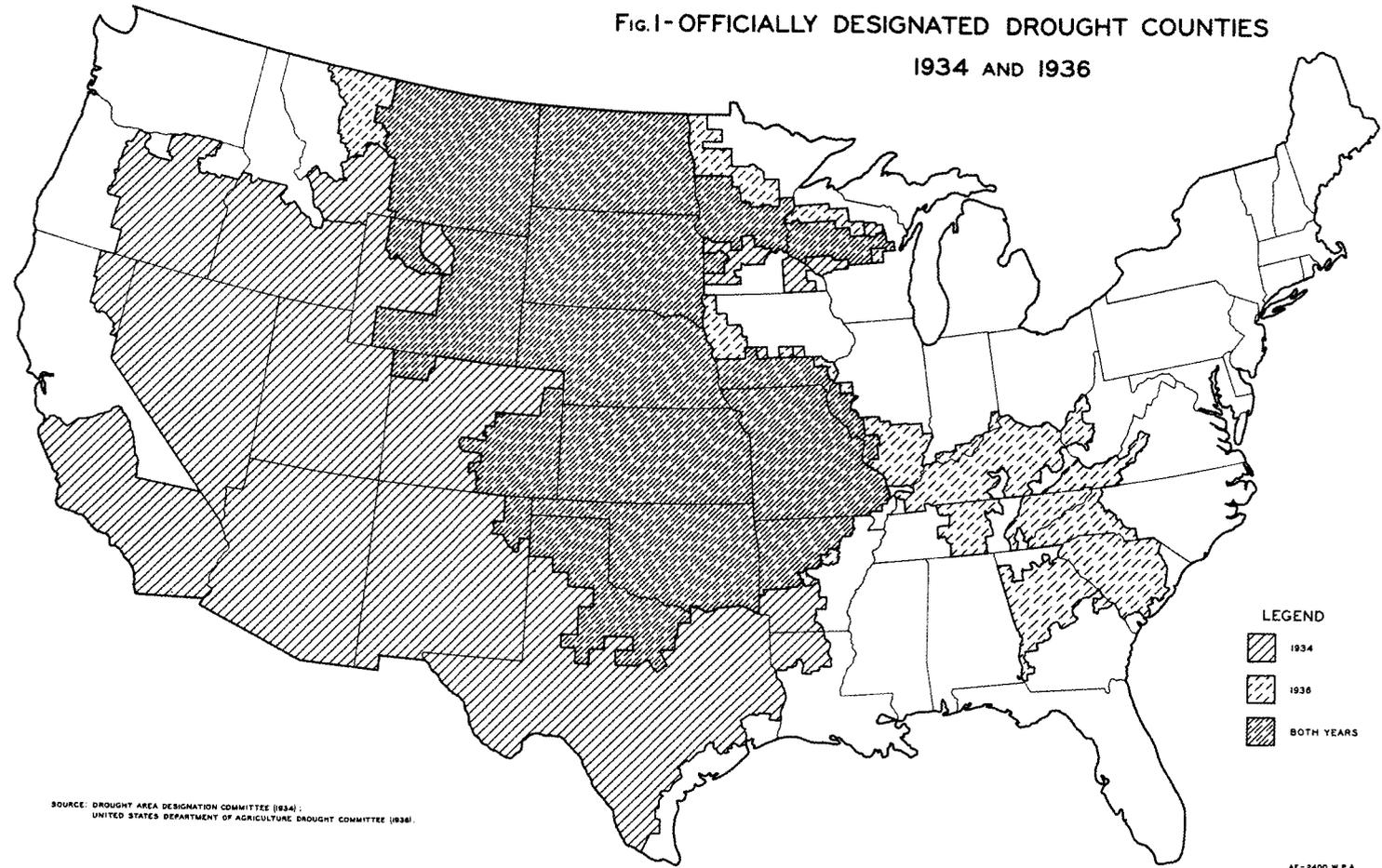
### Drought Incidence in the Great Plains Region

Drought is not unusual in the area selected for study. From earliest settlement, its development has been interrupted by the relentless plague of moisture deficiency. The greater part of the region lies in zones of 20-inch normal annual precipitation

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<sup>1</sup>See figures 2-8.

FIG. I - OFFICIALLY DESIGNATED DROUGHT COUNTIES  
1934 AND 1936



SOURCE: DROUGHT AREA DESIGNATION COMMITTEE (1934);  
UNITED STATES DEPARTMENT OF AGRICULTURE, DROUGHT COMMITTEE (1936)

LEGEND  
 1934  
 1936  
 BOTH YEARS

INTRODUCTION

or less. Even slight deviations downward on the scale of yearly rainfall may result in disaster, and the records of the Weather Bureau and the Geological Survey bear witness to the frequency of such occurrences.<sup>2</sup>

√In the 48-year period reaching back to 1889 the States of the Great Plains Region have experienced 11 severe droughts, averaging almost 1 drought year in every 4. These excessive dry periods occurred in 1889, 1890, 1894, 1901, 1910, 1917, 1930, 1931, 1933, 1934, and 1936. Not all of the Great Plains States were afflicted uniformly in each of these years, but all of them were stricken intermittently.

Forty years ago, the Chief Hydrographer of the United States Geological Survey described climatic conditions in the Great Plains Region in words so apt today that they are quoted here:<sup>3</sup>

Year after year the water supply may be ample, the forage plants cover the ground with a rank growth, the herds multiply, the settlers extend their fields, when, almost imperceptibly, the climate becomes less humid, the rain clouds forming day after day disappear upon the horizon, and weeks lengthen into months without a drop of moisture. The grasses wither, the herds wander wearily over the plains in search of water holes, the crops wilt and languish, yielding not even the seed for another year. Fall and winter come and go with occasional showers which scarcely seem to wet the earth, and the following spring opens with the soil so dry that it is blown about over the windy plains. Another and perhaps another season of drought occurs, the settlers depart with such of their household furniture as can be drawn away by the enfeebled draft animals, the herds disappear, and this beautiful land, once so fruitful, is now dry and brown, given over to the prairie wolf. Then comes a season of ample rains. The prairie grasses, dormant through several seasons, spring into life, and with these the hopes of new pioneers. Then recurs the flood of immigration, to be continued until the next long drought.

This tragic drama has frequently been repeated in the intervening years. Written at a time that may be considered as the

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<sup>2</sup>Eighty-five percent, or less, of the mean annual precipitation is ordinarily considered as constituting drought conditions in humid and semi-arid States. In the arid States, because of wide climatic differences, the establishment of limits is more hazardous. Any such yardstick is fallacious, however, in that it ignores seasonal variations in rainfall.

<sup>3</sup>Newell, Frederick H., "Irrigation on the Great Plains", *Yearbook*, U. S. Department of Agriculture, 1896, p. 168.

half-way mark in Great Plains history, the picture of conditions as they existed then is true of conditions today. The social process of learning by experience is slow.

#### Misdirected Agricultural Expansion

While the normal expectancy of dry years on the Plains is high, drought effect is not consistently distributed throughout the region. Severity of environmental conditions is relative; it can be measured only in terms of human activities, which in turn are limited and controlled by the prevailing elements. Thus, in the present examination, a serious shortage of water at a critical period in the growing season may be ruinous to a dry-land wheat farmer, but not necessarily troublesome to a neighboring rancher.

Man's agricultural partitioning of the West has not always followed the dictates of nature, with an inevitable result in social frustration and economic loss. Originally a rich, virgin range, the varied native forage plant types conformed to definite zones of soil and climatic conditions. The western bounds of the Tall Grass Country roughly follow the 20-inch rainfall line. Eastward roll the Prairie Plains, one of the most productive agricultural regions of the world. Favored by an annual precipitation ranging from 20 to 35 or more inches, which amply supported the deep-rooted, moisture-consuming native grasses, this region is admirably adapted to many forms of commercial agriculture. Drought conditions, while not unknown, certainly are not the usual order.

Extending westward to the Rockies is the Short Grass Area of the Central Plains. The many plants included among the short grasses, evolved and acclimated through the ages, thrive in this semi-arid region. Most of it has a scant 15 to 20 inches of rainfall each year, and in several sizable areas this is reduced to 10 to 15 inches. Where this can be augmented by irrigation from impounded mountain waters, agriculture flourishes; but the extent to which irrigation water may be apportioned under present methods is arbitrarily limited by the quantity and location of the water available. Throughout the vast domain of the Central Plains the sole reliance of the great majority of farmers will continue to be unreliable showers, supplemented by an occasional cloudburst.

The Short Grass Central Plains of America constitute an agricultural frontier which has withstood the onslaughts of determined men for three-quarters of a century. In yielding a livelihood in proportion to effort expended it is still inferior to other sections. Much of that effort has been dissipated in attempting to institute an ill-suited economy. Cultivated crops can be raised profitably throughout most of the region only in years

in which the most favorable conditions prevail. Since 1880 there have been but three such favorable periods, i.e., from 1880 to 1885, 1902 to 1906, and 1918 to 1923. Experience has shown that without the aid of irrigation, crop cultivation over the greater part of this territory is highly speculative and in the long run doomed to failure. Dry farming, as now practiced, cannot be sustained year in and year out. Its enormous expansion into natural grazing areas has created two evils: a marked destruction of excellent range, and a huge accumulation of marginal crop acres.

#### The Measure of Drought Effect

The cumulative effects of drought over a period are reflected in many ways, some of which may be measured and used to delimit areas of varying degrees of intensity.

The area selected for study included 803 counties. Within this area, a series of five tests have been applied in an effort to determine the relative effect of drought conditions in each county.<sup>4</sup>

Percent departure from normal annual rainfall, average crop and pasture conditions as percentages of the normal, percent of increase or decrease in numbers of cattle, and amount of Federal aid per capita were computed and mapped individually as indices of drought intensity on the basis of ranking the counties by grades of intensity.<sup>5</sup> A composite map (figure 7, page 30) depicts the average of the five separate ranks. The results are illuminating, not alone in the disclosures of each individual test, but in the impressive manner in which each one confirms and emphasizes the findings of the others. In the aggregate, the tests contribute their combined weight to the localization of specific trouble centers.

The years 1930-1936 were used, both because of the ready accessibility of current data, and because the period as a whole is fairly representative of the kaleidoscopic history of agriculture in the Great Plains. Feast and famine were both recorded. Generally unfavorable weather conditions culminated in the droughts of 1934 and 1936, while yields were high in 1932.

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<sup>4</sup>See Methodological Note.

<sup>5</sup>The counties were first ranked in respect to each index and the range divided into five groups, the first group denoting the best conditions, and the fifth group, the worst. For data by counties, see table B in Methodological Note.

## RAINFALL

In the development of the Great Plains Region, rainfall has ever been the determinant factor. Of the 13 States included wholly or in part in the selected area, 3 are commonly classed as humid (Minnesota, Iowa, and Missouri), 6 as semi-arid (North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas), and 4 as arid (Montana, Wyoming, Colorado, and New Mexico). The 50-year average annual precipitation for each of these States<sup>6</sup> follows:

✓ AVERAGE ANNUAL PRECIPITATION (50-year period, 1881-1930)	
	Inches
Humid States	
Minnesota	25.91
Iowa	31.48
Missouri	40.17
Semi-arid States	
North Dakota	17.70
South Dakota	20.77
Nebraska	23.50
Kansas	27.48
Oklahoma	32.63
Texas	30.84
Arid States	
Montana	15.21
Wyoming	14.05
Colorado	16.79
New Mexico	14.49

✓ Although aggregate annual precipitation is the most important climatic influence in determining agricultural productivity, several other conditions contribute markedly to the success or failure of farming operations in the midcontinent area. Distribution of rainfall in relation to the growing season, loss of moisture through run-off and evaporation, extremes of temperature, and wind velocity are almost equally worthy of consideration.

In 1934, when the area west of the Mississippi was experiencing a particularly disastrous drought, the effect of excessive heat and almost continuous high winds contributed perhaps as much to the severity of conditions as absence of rainfall. New

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<sup>6</sup> Averages for the entire State are given in the table, which shows two semi-arid States (Oklahoma and Texas) with more annual rainfall than Minnesota, classed as humid. Extreme rainfall differences in geographic subdivisions of States are considered in the above classification. Source: U. S. Weather Bureau.

maximum temperatures during June, July, and August of that year were established in three Plains States, while all through the region temperatures considerably above normal were registered. The increase in rate of evaporation accompanying high summer temperatures not only exhausts surface moisture, but also reduces the soil of cultivated areas to a powdery dryness which is readily susceptible to wind action.

The topographical outline of the midcontinent, in conjunction with climatic conditions, results in wind velocities similar to those experienced along the coast line in duration and intensity. Tremendous stretches of flat, treeless land offer no resistance to wind, and when water shortage and extreme heat have left the soil light and dry, wind erosion follows. Occasional heavy downpours of rain wash away top soil, previously dried out by heat and lack of moisture, resulting in some sections in severe sheet erosion.

Paradoxical as it may seem in a land where moisture deficiency is the chronic complaint, excessive rainfall not infrequently wreaks havoc with crops. Rust and smut must always be included in the farmer's worries and the unseasonable hail storm is a potentially destructive agent.

Deviations from normal rainfall form a basic index of drought intensity. For the purpose of this investigation, figures were obtained from the monthly and annual *Climatological Data* published by the United States Weather Bureau for the years 1930 through 1935, by counties. Percent departure from normal rainfall for this period was calculated for each weather reporting station in the test area for which complete records were available. Unfortunately, weather reporting stations, in some instances, have not been in existence long enough (10 years) for the establishment of a "normal" annual rainfall. Several were discontinued during the 1930-1935 period. As a result, uninterrupted climatological records, even for these few years, are not available for all counties. Most of the counties, however, have at least one station with complete records, while many have two or more. For counties without reporting stations, it was necessary to average the results of the nearest neighboring stations. In counties with more than one station reporting, an average of all of the figures was taken.

Table 1 shows the distribution of counties, by States, arranged in five groups on the basis of their average percent departure from normal annual rainfall for the 6-year period. It makes plain the necessity of careful demarcation along county lines, if reliable gradations of drought intensity are to be outlined. Conditions often vary radically within a State and within sections of a State. In Kansas, for example, 10 of the 105 counties received the normal, or more than the normal, amount of rain, while 17 were deficient 18.3 percent or more. Only 1

of North Dakota's 53 counties averaged approximately normal precipitation during the period; 26 were short 13.5 percent or more. The initial task is to determine where serious moisture deficiencies have occurred so that these sections may be examined in the light of other criteria.

Counties showing greatest departure from normal rainfall in the period studied are rather widely distributed throughout the region, although there are sections with considerable concentration (figure 2). Of the 167 counties that reported a decrease from normal of 18.3 percent or more, one-fourth (42 counties) are in the State of South Dakota, and neighboring Montana accounts for one-sixth, or 27 counties. In both instances the

Table 1—DISTRIBUTION OF COUNTIES IN THE DROUGHT AREA, BY AVERAGE PERCENT DEPARTURE FROM NORMAL RAINFALL, 1930-1935

State	Total Counties	Group I (Normal or Above to -2.5 Percent)	Group II (-2.5 to -8.5 Percent)	Group III (-8.5 to -13.5 Percent)	Group IV (-13.5 to -18.3 Percent)	Group V (-18.3 Percent or More)
Total:	803	130	167	175	164	167
Number	100	16	21	22	20	21
Percent						
Minnesota	77	2	24	24	18	9
Iowa	61	6	28	18	5	4
Missouri	14	6	7	1	-	-
North Dakota	53	1	8	18	20	6
South Dakota	69	1	1	5	20	42
Nebraska	93	4	19	38	19	13
Kansas	105	10	33	23	22	17
Oklahoma	77	32	18	13	9	5
Texas	101	41	13	13	10	24
Montana	56	3	2	6	18	27
Wyoming	19	2	2	4	6	5
Colorado	47	6	7	6	15	13
New Mexico	31	16	5	6	2	2

Source: Climatological Data, U. S. Weather Bureau.

proportion of counties in the worst group to the total number in each State is particularly high, 61 percent in South Dakota and 48 percent in Montana.

To the South, in the High Plains, a more marked concentration of counties in the lowest group is noticeable. Here in a region where 5 southwestern States abut, there is a grouping of some 61 counties represented by an almost solidly black area on the map. To this group Colorado contributes 13 counties; Kansas, 17; Oklahoma, 5; Texas, 24; and New Mexico, 2. Over one-third of all counties ranked in the lowest fifth are closely massed together in this center of comparative aridity.

One of the peculiarities disclosed in an examination of the rainfall map is the scattering of counties showing normal or better moisture conditions in the midst of those that reported greatest shortages. Conspicuous examples are Bowen County, North Dakota; Jackson County, South Dakota; and Meagher County, Montana. Local conditions in the vicinity of the weather stations, distinctly different from the surrounding country, are

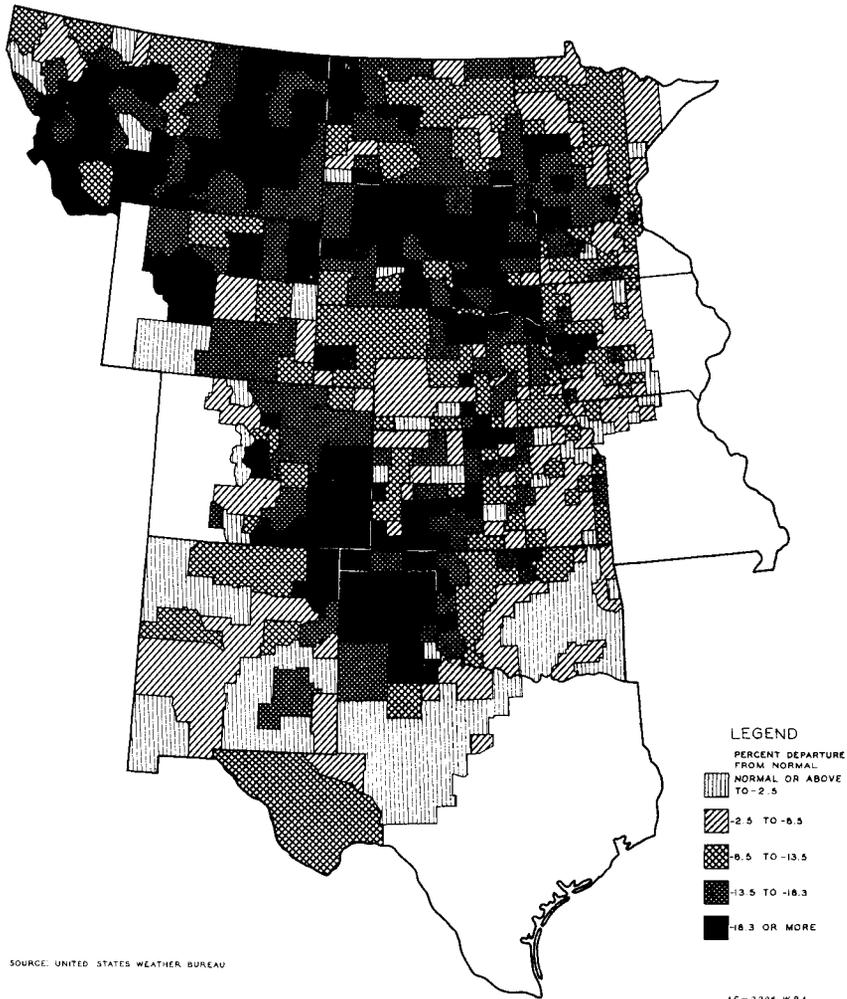
responsible for these occasional cases. One station in Meagher County (White Sulphur Springs) was found to have received an amount of rain 56.3 percent above normal during the period considered. This, of course, is in a mountainous region where wide variations are common.

Serious climatic fluctuations are characteristic of the entire area from the Rocky Mountains to the Mississippi River. Weather records in which the short-period variations have been smoothed show progressive wave-like upward and downward trends from normal. Thirteen of the first sixteen years of the century produced above normal rainfall in North Dakota, yet between 1930 and 1934 that State accumulated a deficiency of 16.5 inches.<sup>7</sup> In humid States this might be hardly noticeable, but on the Plains it acquires significance. Before effective programs of alleviation can be instituted, it is important that those areas which have been repeatedly subjected to water shortages and resultant acute suffering be analyzed in the light of their history of human misery.

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<sup>7</sup>From a paper presented before the American Meteorological Society at Pittsburgh, December 29, 1934, by J. B. Kincer, Chief, Division of Climate and Crop Weather, U. S. Weather Bureau.

FIG. 2 - RAINFALL IN THE DROUGHT AREA  
 AVERAGE PERCENT DEPARTURE  
 FROM NORMAL  
 1930 - 1935





## CROP CONDITIONS

The index of drought intensity based on average crop conditions was obtained from data for crop reporting districts established by the United States Department of Agriculture, rather than from data for separate counties.

Data covering the Spring Wheat, Winter Wheat, and Corn Areas were used in computing this index. Reported conditions of spring wheat, expressed as a percent of normal,<sup>8</sup> were obtained as of June 1, July 1, August 1, and September 1 for the years 1930-1936 from the eight States of North and South Dakota, Nebraska, Minnesota, Iowa, Missouri, Montana, and Wyoming. Winter wheat figures as of April 1, May 1, June 1, and July 1 were received for the same years from the six winter wheat States: Nebraska, Kansas, Oklahoma, Texas, New Mexico, and Colorado. Corn reports of July 1, August 1, September 1, and October 1 for the 6-year period were secured for seven States: Minnesota, Iowa, Missouri, South Dakota, Nebraska, Kansas, and Colorado. Crop reports for the irrigated regions of Montana, Wyoming, Colorado, and New Mexico were excluded. The average condition for the entire period was computed for each reporting district, and each county within the district was assigned that average (table 2).

Table 2—DISTRIBUTION OF COUNTIES IN THE DROUGHT AREA, BY AVERAGE PERCENT OF NORMAL CROP CONDITIONS, 1930-1936

State	Total Counties	Group I (66 Percent or More)	Group II (59 to 66 Percent)	Group III (54 to 59 Percent)	Group IV (51 to 54 Percent)	Group V (Less Than 51 Percent)
Total:	303	250	166	129	140	118
Number	100	31	21	16	17	15
Percent						
Minnesota	77	65	12	—	—	—
Iowa	61	43	18	—	—	—
Missouri	14	—	—	14	—	—
North Dakota	53	—	12	7	6	28
South Dakota	69	—	—	22	35	12
Nebraska	93	—	57	12	24	—
Kansas	105	27	19	11	23	25
Oklahoma	77	38	34	—	—	5
Texas	101	14	10	38	16	23
Montana	56	10	—	—	31	15
Wyoming	19	5	4	5	5	—
Colorado	47	17	—	20	—	10
New Mexico	31	31	—	—	—	—

Source: Division of Crop and Livestock Estimates, Bureau of Agricultural Economics, U. S. Department of Agriculture.

<sup>8</sup>As estimated in reports to the Division of Crop and Livestock Estimates, Bureau of Agricultural Economics, U. S. Department of Agriculture.

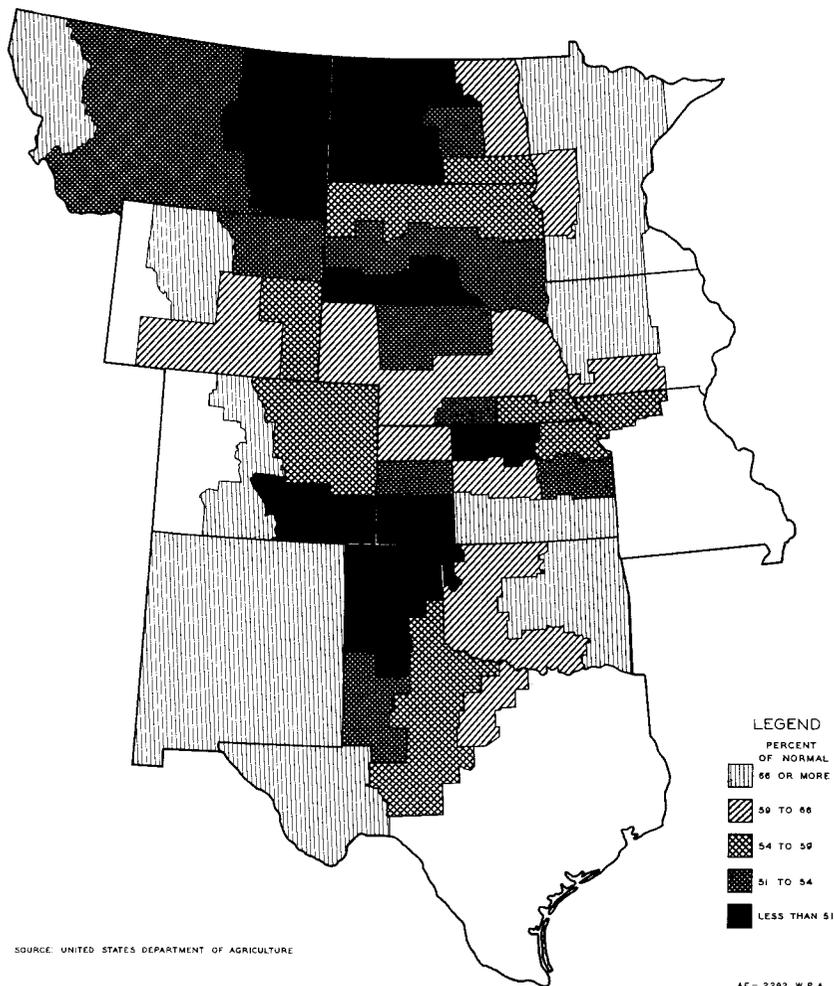
For favorable crop conditions, there must be not only an adequate total annual precipitation, but also a suitable distribution of rainfall throughout the year. The soil must have sufficient moisture at planting time to insure seed germination. From then until the plant reaches maturity, usually a period of some 3 months, depending upon the length of the growing season, a serious deficiency can cause damage to the extent of complete loss. Yield per acre depends largely upon the distribution of rainfall, and drought conditions result from slight variations.

Average crop conditions, over a period of time, are more than a measure of rainfall, because conditions other than moisture determine their growth. Climatic conditions generally, however, are the preponderant consideration; they are reflected on the accompanying map (figure 3).

Crop conditions over the 6-year period in almost one-third of the counties included in the test area (258 out of 803) averaged less than 54 percent of normal. The graphic presentation of drought effect as indicated by crop conditions shows a greater degree of concentration than is noted in the case of rainfall, partly due to the difference in units used as the basis of the map. Of the 118 counties in group V, showing the worst drought effects, 43 form a connected area in western North Dakota and eastern Montana. Most of the spring wheat country shows marked departure from normal crop conditions. The area of intensity on the Southern Plains, which includes a great number of winter wheat counties, coincides in a general way with a similar area of intensity on the rainfall map.

Thus, graphic presentation of average crop conditions shows that the areas of greatest drought effect are on the northern and southern portions of the Central Plains, with a border of counties of lighter shade, representing the more favorable gradations, almost completely enclosing them. All of New Mexico's 31 counties are in group I, the category reflecting lowest drought intensity. So also are a large proportion of the counties studied in Minnesota, Iowa, and Oklahoma. On the other hand, North and South Dakota and Nebraska have no counties in this group. It should be noted that counties included in group I on this scale of average crop conditions may still be as low as 66 percent of normal. About 70 percent of all of the counties averaged less than 66 percent of their normal condition for the 6-year period.

FIG. 3 - CROP CONDITIONS IN THE DROUGHT AREA  
AVERAGE PERCENT OF NORMAL  
1930-1936





## PASTURE CONDITIONS

Average pasture conditions, like crop conditions, were obtained for the Department of Agriculture crop reporting districts.<sup>9</sup> Figures representing percent of normal<sup>10</sup> for the months of June, July, August, and September, 1930-1936 (June and July only in 1936) were averaged for each district.

The distribution of the 803 counties by average pasture conditions is shown in table 3.

Table 3—DISTRIBUTION OF COUNTIES IN THE DROUGHT AREA, BY AVERAGE PERCENT OF NORMAL PASTURE CONDITIONS, 1930-1936

State	Total Counties	Group I (67 Percent or More)	Group II (63 to 67 Percent)	Group III (59 to 63 Percent)	Group IV (54 to 59 Percent)	Group V (Less Than 54 Percent)
Total: Number	803	154	167	194	168	120
Total: Percent	100	19	21	24	21	15
Minnesota	77	7	—	44	26	—
Iowa	61	8	21	32	—	—
Missouri	14	—	—	14	—	—
North Dakota	53	—	—	—	19	34
South Dakota	69	—	6	7	12	44
Nebraska	93	25	19	—	49	—
Kansas	105	28	—	54	9	14
Oklahoma	77	—	41	9	22	5
Texas	101	20	28	14	16	23
Montana	56	15	16	10	15	—
Wyoming	19	19	—	—	—	—
Colorado	47	24	13	10	—	—
New Mexico	31	8	23	—	—	—

Source: Division of Crop and Livestock Estimates, Bureau of Agricultural Economics, U. S. Department of Agriculture.

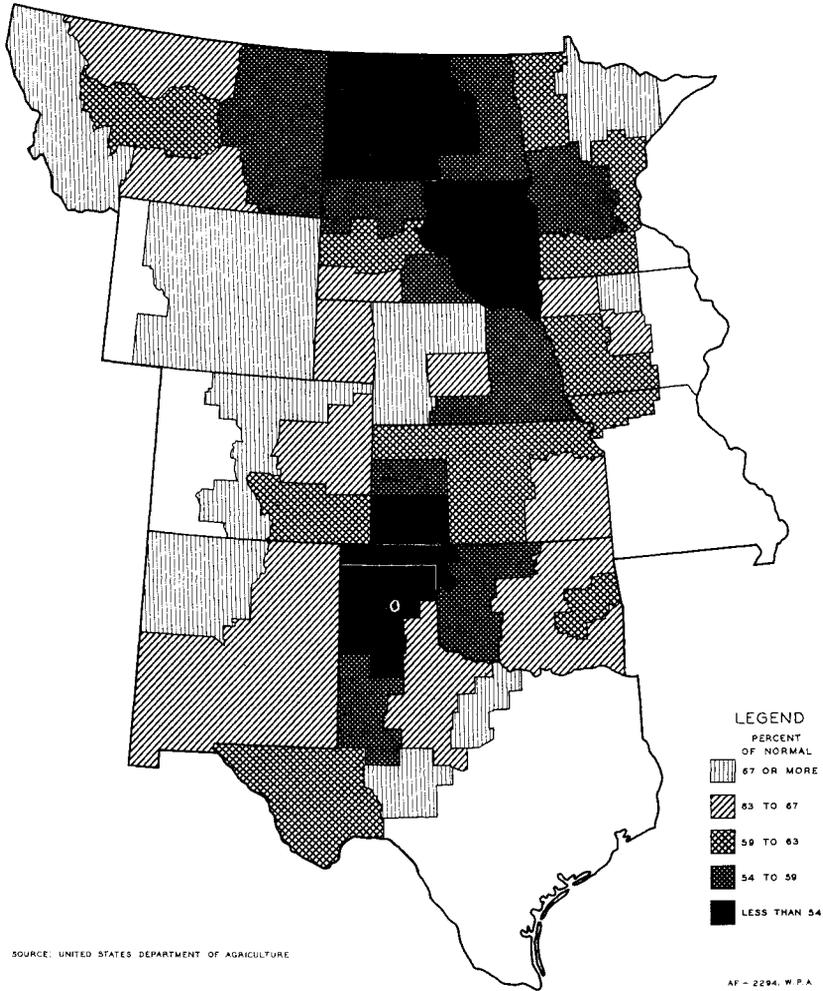
North and South Dakota together account for 78 of the 120 counties in group V, which reflects the worst pasture conditions. Under the Department of Agriculture classification, pasture conditions in the eastern third of North Dakota represented "severe drought", with those of the rest of the State representing "extreme drought." South Dakota has 56 counties, or 81 percent of its total of 69, in the 2 categories of highest drought intensity as an average condition for the 6 years.

A rather small, but highly concentrated, distress area is located on the Southern Plains, comprising 23 counties in Texas,

<sup>9</sup>In reporting pasture conditions, the U. S. Department of Agriculture uses the following scale: 80 percent and over, good to excellent; 65 to 80 percent, poor to fair; 50 to 65 percent, very poor; 35 to 50 percent, severe drought; and under 35 percent, extreme drought.

<sup>10</sup>As estimated in reports to the Division of Crop and Livestock Estimates, Bureau of Agricultural Economics, U. S. Department of Agriculture.

FIG. 4 - PASTURE CONDITIONS IN THE DROUGHT AREA  
AVERAGE PERCENT OF NORMAL  
1930 - 1936



5 in Oklahoma, and 14 in southwestern Kansas, where these 3 States adjoin (figure 4). The comparatively favorable conditions in Wyoming and western Nebraska, where tillage has not proceeded to the same extent as in the heavier shaded sections, are outstanding.

Average pasture conditions represent two different types of grazing: the open range, and improved pasture. The western range is composed of native grasses and other forage plants. It is never fertilized or cultivated. Made up of plant species which are naturally drought-resistant, over-grazing is a much more serious detriment than shortage of moisture. A regrettable combination of both factors, however, has resulted in considerable deterioration of the open range. Improved pastures, continuing eastward from the range border, receive a greater amount of rain. Often fertilized to increase production, they are made up of seeded grasses not native to the area and usually follow cultivation for other crops.

Native range and improved pasture naturally present different problems. The latter accompanies commercial agriculture. On the Plains it is developed where needed on land on which the original sod has been broken. It spreads farther and farther into range territory as successive spans of good years stimulate the plowing of additional acreage in the marginal productive zone between aridity and humidity. On the range, it is true, severe drought is equally as harsh as elsewhere. Dust was blowing on the Plains before the first plow ever turned sod. But the intensity of effect on national economy increases with the expansion of agriculture.

When crop and pasture conditions in the drought area are graphically compared (figures 3 and 4), it is seen that the extreme of intensity shifts slightly eastward of the center of the test area when gauged by pasture conditions, and westward when measured by crop conditions. In other words, it is apparent that crop conditions tend farther from normalcy as cultivation infringes on the natural range, with pasture conditions adversely affected along the eastern edges of the range country, which are already largely in cultivation.



## NUMBER OF CATTLE

The fourth index of drought effect—the percent of change in number of cattle between 1930 and 1935—presents a variegated pattern of changing cattle distribution throughout the entire Great Plains Region (figure 5).

With the exception of eastern Wyoming and several areas on the Southern Plains, most of the counties with an average pasture condition of 59 percent or more of normal reported increases in numbers of cattle. This is particularly noticeable in western Nebraska, western Montana, several tiers of counties in the adjoining sections of Kansas and Colorado, eastern Oklahoma, and western New Mexico.

Only the counties in group V represent a clear loss in cattle. The fourth category covers small deviations in both directions from the number in 1930. Approximately one-sixth of the 803 counties in the test area (129 counties) are included in group I which represents an increase of 60 percent or more in the number of cattle during the 5 years (table 4). More than 40 percent

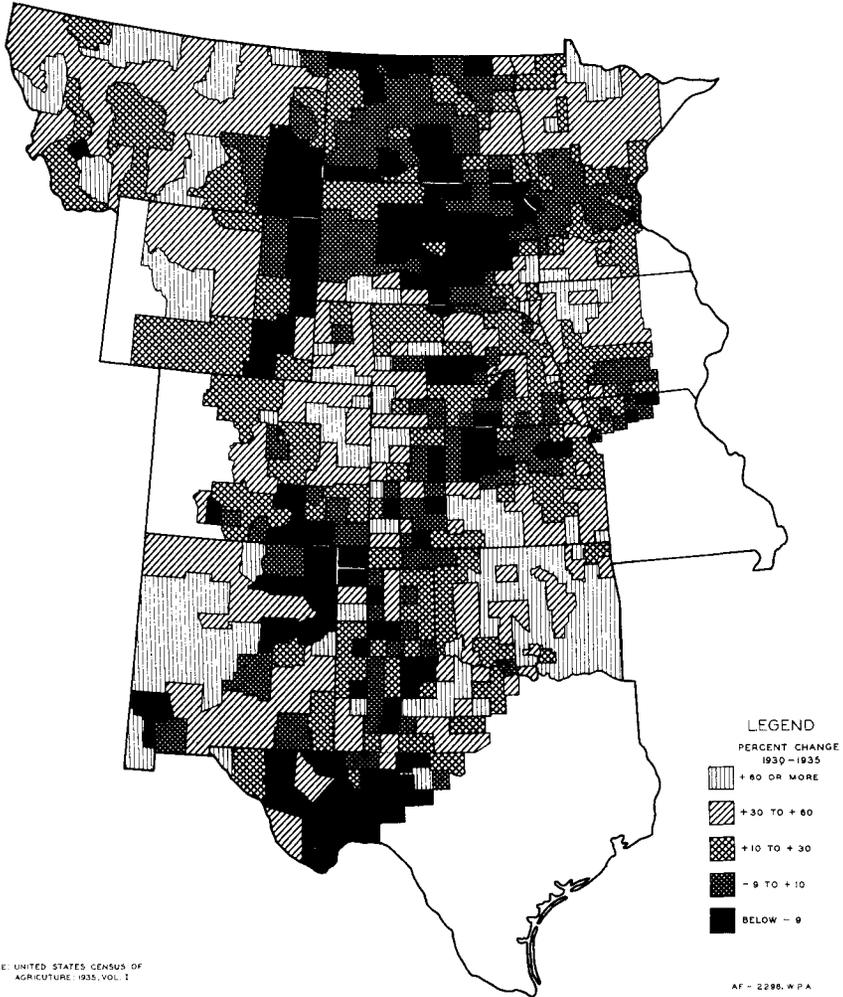
Table 4—DISTRIBUTION OF COUNTIES IN THE DROUGHT AREA, BY PERCENT CHANGE IN THE NUMBER OF CATTLE, 1930-1935

State	Total Counties	Group I (+60 Percent or More)	Group II (+30 to +60 Percent)	Group III (+10 to +30 Percent)	Group IV (-9 to +10 Percent)	Group V (Below -9 Percent)
Total: Number	803	129	204	202	149	119
Total: Percent	100	16	26	25	18	15
Minnesota	77	5	24	23	23	2
Iowa	61	10	24	17	10	-
Missouri	14	-	2	5	5	2
North Dakota	53	-	5	11	21	16
South Dakota	69	6	8	8	17	30
Nebraska	93	10	24	31	20	8
Kansas	105	19	27	26	20	13
Oklahoma	77	39	20	14	3	1
Texas	101	11	21	28	14	27
Montana	56	14	19	14	3	6
Wyoming	19	1	7	5	2	4
Colorado	47	5	13	18	7	4
New Mexico	31	9	10	2	4	6

Source: *United States Census of Agriculture: 1935*, vol. 1.

of all the counties (333 counties) gained 30 percent or more in the number of cattle during that period. Oklahoma had the greatest increases in cattle, over half of the 77 counties in the State gaining 60 percent or more in number of cattle.

FIG. 5 - PERCENT CHANGE IN THE NUMBER OF CATTLE  
IN THE DROUGHT AREA  
1930-1935



Counties reporting from 30 to 60 percent increase in the 5-year period are found in the midst of others that lost 9 percent or more. Reeves County, in the southwestern corner of Texas, is an example of this situation. In central South Dakota, Hughes County shows a gain of from 10 to 30 percent, yet it is completely surrounded by counties in group V which lost 9 percent or more. In contrast, Silver Bow County, Montana, experienced a decrease in cattle while its neighboring counties on all sides were gaining from one-third to two-thirds in numbers.

The spotty appearance of the graphic representation of cattle changes by counties is due, in most instances, to local conditions which are not always representative of the entire district. Supplies of stored feed and access to water for stock, in times of general distress, often vary greatly within short distances, and the ease with which cattle can be moved from one locality to another, when necessity arises, accounts in some measure for a seeming lack of consistency in the distribution of counties disclosing severest drought effect, as measured by gain or loss in cattle numbers.

As in each of the preceding tests, South Dakota presents the most distressing picture. Out of 69 counties in the State, 30 lost more than 9 percent of their cattle during the 5-year period. Forty-seven counties, two-thirds of the total, are in the two lowest groups, with from very slight gains to heavy losses. North Dakota ranks second in point of cattle losses by counties, with 37, or 70 percent of all of the counties, in the 2 lowest classifications.

Of the 101 Texas counties included in the survey, 27 lost more than 9 percent of their cattle. The greater portion of these decreases, however, occurred not in the Panhandle Counties but in the southwestern corner of the State. The area in which five States come together, consistently black in other tests, displays a certain incongruity in this one. Oldham County, Texas, in the lowest category in every other measure of drought effect, shows a gain of more than 60 percent in cattle between 1930 and 1935; yet in its immediate vicinity are a dozen counties which lost in numbers. The explanation lies in those strictly local variations in supply of feed and water which cannot be computed on a county basis.



## FEDERAL AID

As an index for gauging the gravity of human distress resulting from moisture deficiency, crop failure, pasture damage, and depletion of livestock, and for localizing the areas of varying intensity, the amount of money expended per capita by Federal agencies dealing directly with the drought problem presents the most impressive, as well as the most accurate, criterion of the situation. In this series of tests, distribution of Federal assistance is the only measure of the direct effect of drought upon the peoples of drought areas, yet in itself it is a remarkably reliable guide in the delineation of trouble areas. It is the end result of all contributing conditions, expressed in terms of human want. Combined with the four indices previously described, it contributes equally with them in the composition of an aggregate index (figure 7, page 30),<sup>11</sup> but the latter appears to be almost a duplication of the index of Federal aid, so closely do they conform in gradation.

Figure 6 depicts the extent to which Federal funds were expended in the drought States during the 3-year period from April 1933 to June 1936. The amounts given include total expenditures in this region by the Federal Emergency Relief Administration from April 1933 to the close of its operations in 1936;<sup>12</sup> those of the Civil Works Administration from November 1933 to July 1934; the Agricultural Adjustment Administration rental and benefit payments, and amounts spent in the cattle, sheep, and goat purchasing activities, operative from May 1933 to May 1936; expenditures for the rural rehabilitation program of the Resettlement Administration, July 1935 through June 1936; and Works Progress Administration expenditures through June 1936. To obtain per capita expenditures, total amounts in dollars were obtained by counties and related to total county population, as reported in the 1930 Census.<sup>13</sup>

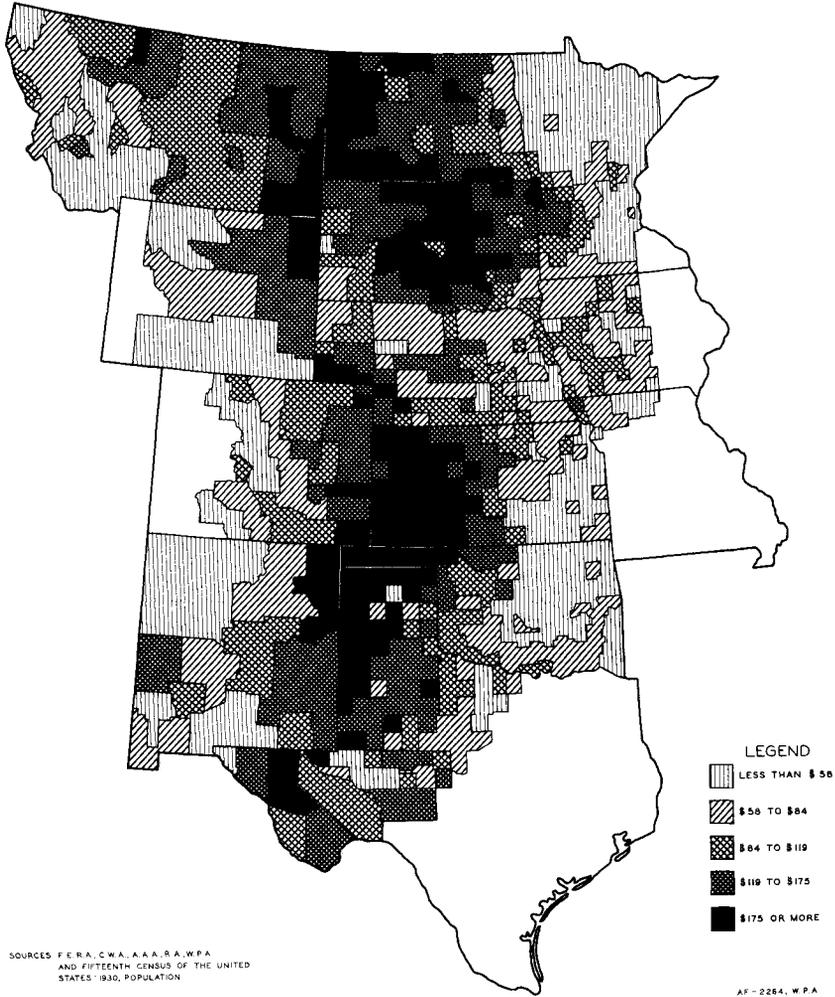
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<sup>11</sup>See following section, Combined Indices of Drought Intensity.

<sup>12</sup>Including expenditures for rural rehabilitation.

<sup>13</sup>This procedure may have resulted in slight inaccuracies in individual counties, and even in wider areas, due to population changes since 1930. Available data on recent changes in population would indicate that in most counties of high drought intensity per capita expenditures based on 1936 population would be greater than those shown, due to migration from the worst areas, while in the more favorable sections they would be less, due to movement into the areas.

FIG. 6 - FEDERAL AID PER CAPITA IN  
THE DROUGHT AREA  
1933 - 1936



What bearing, if any, administrative policy in any of these programs may have had on the distribution of Federal aid is difficult to ascertain. Differences in public attitude toward the whole question of relief, in a territory so large and with so many diverse elements, may also be reflected. The agencies included were not the only ones operating with Government funds throughout this territory during the years mentioned, but an attempt was made to distinguish between those engaged primarily in efforts to relieve distress and others which were of a "pump priming" nature. The rental and benefit payments of the Agricultural Adjustment Administration account in many instances for a much higher per capita figure than would be shown with these funds excluded. Yet if these payments had not been made, the expenditures of strictly relief agencies in those counties undoubtedly would have increased.

Table 5 shows the relative ranking of the 803 counties, by States, based on amount of Federal aid received per capita.

Table 5—DISTRIBUTION OF COUNTIES IN THE DROUGHT AREA, BY FEDERAL AID PER CAPITA, 1933-1936

State	Total Counties	Group I (Less Than \$58)	Group II (\$58 to \$84)	Group III (\$84 to \$119)	Group IV (\$119 to \$175)	Group V (\$175 and Over)
Total:	Number 803	179	190	149	148	137
	Percent 100	22	24	19	18	17
Minnesota	77	43	17	10	5	2
Iowa	61	8	37	16	-	-
Missouri	14	6	6	1	1	-
North Dakota	53	-	5	8	21	19
South Dakota	69	1	6	12	23	27
Nebraska	93	11	34	28	14	6
Kansas	105	26	19	8	15	37
Oklahoma	77	33	21	13	6	4
Texas	101	12	16	18	28	27
Montana	56	9	8	18	14	7
Wyoming	19	7	3	-	7	2
Colorado	47	13	11	12	8	3
New Mexico	31	10	7	5	6	3

Sources: Federal Emergency Relief Administration; Civil Works Administration; Agricultural Adjustment Administration; Resettlement Administration; Works Progress Administration; and Fifteenth Census of the United States: 1930, Population.

There are 137 counties in which the per capita Federal aid for the period 1933-1936 was \$175 and over, and 148 in which it ranged from \$119 to \$175. On the basis of an average family of four members, this means that in more than a third of all the counties studied, a sum was expended sufficient to provide at least \$476 for every family.

In the North, where the counties receiving the highest per capita Federal aid are loosely centered in the Dakotas and eastern Montana and Wyoming, there are some breaks in the concentration of black sections (figure 6). South Dakota, however, has 50 counties, or almost three-quarters of the entire State, in the 2 highest Federal aid groups. Three-fourths of North Dakota's counties were in the same two classifications.

Kansas, with 37 counties receiving per capita amounts of \$175 and over, had the largest number of counties in group V. A little more than a third of the entire State appears solidly black on the map.

Figure 6 graphically shows the intensity of Federal aid in a large part of the Southern Plains, with 4 counties in Oklahoma, 27 in Texas, 3 in New Mexico, and 3 in Colorado in the group of counties receiving per capita amounts of \$175 and over.

## COMBINED INDICES OF DROUGHT INTENSITY

When the counties of the Great Plains and the surrounding territory are considered in the light of the combined indices of drought effect, it is seen that there are two distinct centers of acute distress (figure 7). One is on the Northern Plains, extending to the Canadian border, the other is on the Southern or High Plains. Of the 125 counties in group V, showing the highest degree of drought intensity (table 6), all but 6 are closely grouped in one or the other of the 2 centers: 75 in the northern region, and 44 in the southern.

Table 6—COMBINED INDICES OF DROUGHT INTENSITY, 1930-1936<sup>a</sup>

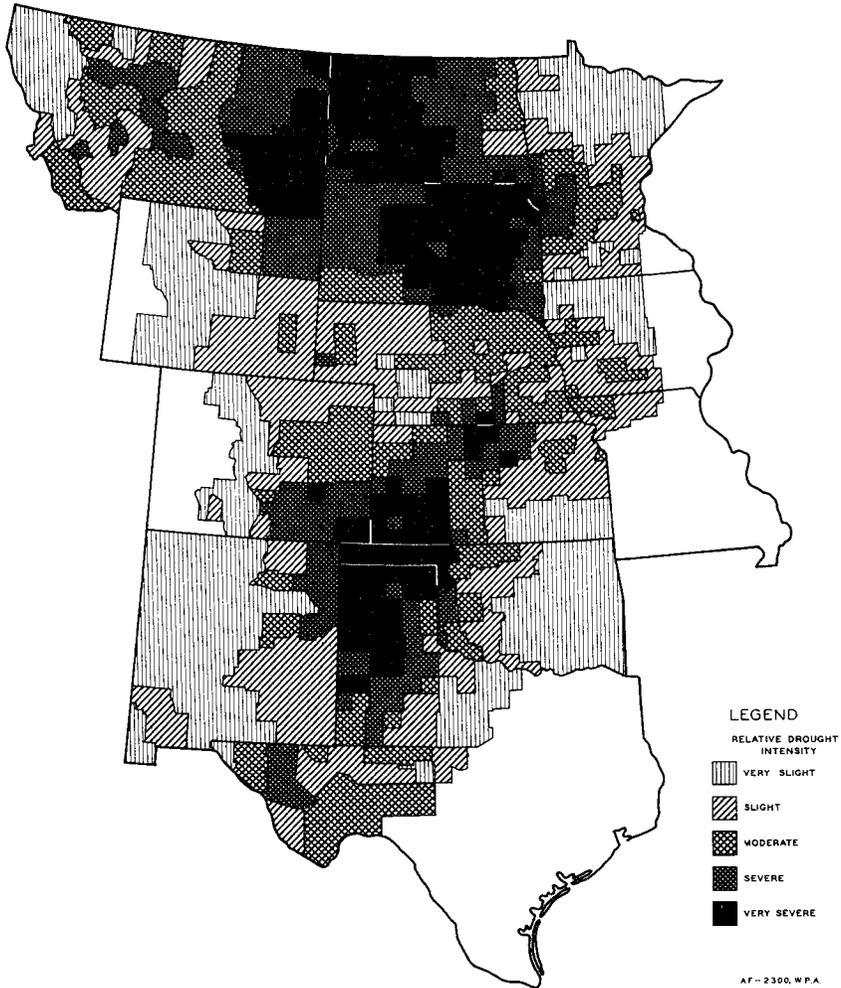
State	Total Counties	Group I (Very Slight)	Group II (Slight)	Group III (Moderate)	Group IV (Severe)	Group V (Very Severe)
Total: Number	803	177	208	166	127	125
Total: Percent	100	22	26	20	16	16
Minnesota	77	20	32	15	9	1
Iowa	61	26	24	11	-	-
Missouri	14	-	10	4	-	-
North Dakota	53	-	2	6	22	23
South Dakota	69	-	-	7	21	41
Nebraska	93	5	32	46	9	1
Kansas	105	17	31	19	19	19
Oklahoma	77	47	13	9	3	5
Texas	101	17	24	19	18	23
Montana	56	8	10	15	13	10
Wyoming	19	6	8	2	3	-
Colorado	47	15	12	11	7	2
New Mexico	31	16	10	2	3	-

<sup>a</sup>For procedure followed in ranking counties, see Methodological Note.

When the fourth and fifth classifications, reflecting the highest drought intensity groups, are considered together, 2 very definite problem areas, including a total of 252 counties, stand out. The northern problem area embraces 137 contiguous counties, comprising almost the entire States of North and South Dakota, the eastern third of Montana, northeastern Wyoming, west central Minnesota, and 1 county in northern Nebraska. The southern problem area is made up of 105 adjoining counties in an irregularly shaped area centered in the Texas-Oklahoma Panhandle Region, and including parts of the 6 States of Nebraska, Kansas, Oklahoma, Texas, New Mexico, and Colorado.

This method of grouping excludes 10 counties in the fourth category of drought distress: 7 in the mountainous section of western Montana, 2 in the southwest corner of Texas, and 1 in

Fig. 7 - COMBINED INDEX OF DROUGHT INTENSITY  
AVERAGE OF FIVE INDICES  
1930-1936



western Nebraska. None of these 10 counties is adjacent to the 2 high intensity areas outlined above, being surrounded in each instance by sections with comparatively better conditions.

The extent of drought distress in these two problem areas, based on the comparative intensity of the five drought indices, is shown in table 7.

Table 7—FIVE INDICES OF DROUGHT EFFECT IN TWO HIGH INTENSITY AREAS\*

Area and Index	Total Counties		Group I		Group II		Group III		Group IV		Group V	
	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent
Northern Plains												
Rainfall	137	100	2	2	6	4	17	12	45	33	67	49
Crop conditions	137	100	1	1	4	3	19	14	57	41	56	41
Pasture conditions	137	100	-	-	14	10	29	21	45	33	49	36
Number of cattle	137	100	4	3	1	1	7	5	48	35	77	56
Federal aid	137	100	3	2	10	7	21	15	49	36	54	40
Southern Plains												
Rainfall	104	100	5	5	6	6	10	9	30	29	53	51
Crop conditions	104	100	1	1	6	6	16	15	24	23	57	55
Pasture conditions	104	100	4	4	8	8	9	18	22	21	61	59
Number of cattle	104	100	-	-	10	10	24	23	28	27	42	40
Federal aid	104	100	4	4	10	10	30	30	30	30	30	28

\*For definitions of groups by indices, see tables 1-5.

Between the two regions on the Northern and Southern Plains in which cumulative drought effect is shown to have been most severely felt is a wide belt of demarcation, in which only one county (Banner County, Nebraska) is in either of the two groups representing highest drought intensity. This dividing strip extends across Nebraska, continuing in broadening lines through Colorado and Wyoming to the west and Iowa and Missouri to the east. Much of eastern Nebraska falls into the third classification of drought intensity, providing a connecting link of counties with only average drought distress between the northern and southern high intensity areas (figure 7).



## TYPE OF FARMING AREAS

Throughout the Great Plains Region, farming in one form or another is the predominant industry and upon farming the social and economic welfare of the people is entirely dependent. Considerable variation in type of farming has developed, however, and it is considered desirable to point out the effect of drought as related to the major crops. A study of the combined index of drought effect by types of farming (table 8)<sup>14</sup> shows that practically the entire Spring Wheat Area of eastern Montana and the Dakotas (figure 8) is a region of high drought intensity. To the west, a number of ranching counties in South Dakota, Montana, and Wyoming are in areas of high intensity, while the high intensity area of southeastern South Dakota and western Minnesota protrudes slightly into the Corn Belt.

On the High Plains to the south, the boundary lines of the high intensity area cut through the Winter Wheat Area, dividing it into two nearly equal parts. Thirty-six wheat counties in western Kansas and the Oklahoma-Texas Panhandle are within this high intensity area. In Colorado, New Mexico, and Texas, 17 range livestock counties are included, as well as 8 corn-growing counties in north central Kansas, 15 western cotton counties in Texas and Oklahoma, and approximately 18 scattered counties where a varied agriculture has developed.

The conclusion that agriculture has over-stepped its bounds in its westward march is inescapable. The line now recognized by the Forest Service as marking the boundary of the western range, running north and south from the Canadian to the Mexican borders, which has been continuously pushed westward before agricultural expansion, cuts through the heart of the northern region of greatest drought intensity and forms an eastern boundary to the southern problem area.

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<sup>14</sup>The type of farming areas were defined as follows: *Spring Wheat*—counties in which at least 30 percent of the total acreage of crop land and plowable pasture was planted in wheat in 1929; *Winter Wheat*—same as for Spring Wheat; *Western Corn*—counties in which at least 29 percent of the total acreage of crop land and plowable pasture was planted in corn in 1929; *Western Cotton*—counties in which at least 40 percent of the value of all farm products sold, traded, or used was derived from cotton farms; *Ranching*—counties in which at least 40 percent of the total farm land was classed as "stock-ranch" in 1930; *Mixed Farming*—counties in which none of the above requirements for the other areas is fulfilled or in which at least two types of crops are important.

## AREAS OF INTENSE DROUGHT DISTRESS

Under the stimulus of occasional and irregular periods of high prices, notably during and immediately following the World War, and without the guidance and restraint of a well-planned

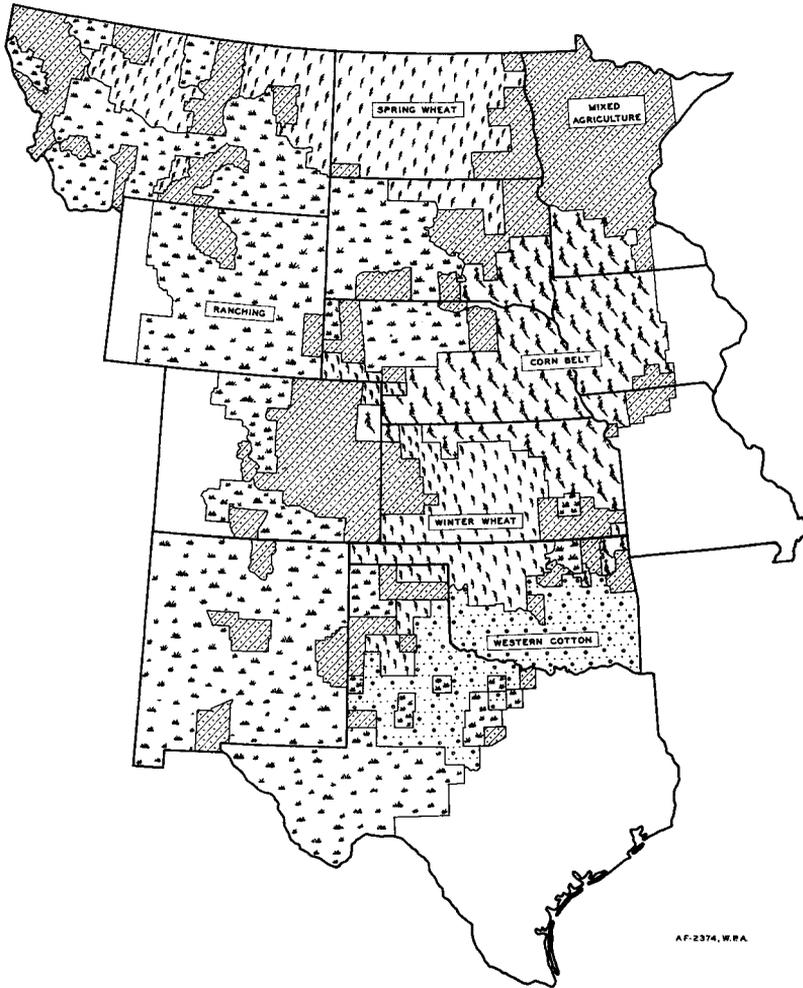
Table 8—INDICES OF DROUGHT INTENSITY IN TYPE OF FARMING AREAS<sup>a</sup>

Index	Total Counties		Group I		Group II		Group III		Group IV		Group V	
	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent	Num-ber	Per-cent
					<i>Spring Wheat</i>							
Rainfall	66	100.0	-	-	7	10.6	17	25.8	24	36.3	18	27.3
Crop conditions	66	100.0	-	-	6	9.1	9	13.6	14	21.2	37	56.1
Pasture conditions	66	100.0	-	-	5	7.6	3	4.5	19	28.8	39	59.1
Number of cattle	66	100.0	3	4.5	8	12.1	12	18.2	23	34.9	20	30.3
Federal aid	66	100.0	-	-	2	3.0	8	12.1	30	45.5	26	39.4
Average	66	100.0	2	3.0	-	-	5	7.6	25	37.9	34	51.5
					<i>Winter Wheat</i>							
Rainfall	82	100.0	3	3.7	13	15.9	20	24.4	21	25.6	25	30.4
Crop conditions	82	100.0	16	19.5	30	36.6	3	3.6	4	4.9	29	35.4
Pasture conditions	82	100.0	3	3.6	8	9.8	31	37.8	15	18.3	25	30.5
Number of cattle	82	100.0	26	31.7	18	22.0	15	18.3	12	14.6	11	13.4
Federal aid	82	100.0	5	6.1	8	9.8	7	8.5	19	23.2	43	52.4
Average	82	100.0	5	6.1	22	26.8	16	19.5	13	15.9	26	31.7
					<i>Western Corn</i>							
Rainfall	213	100.0	21	9.8	66	31.0	57	26.8	39	18.3	30	14.1
Crop conditions	213	100.0	66	31.0	65	30.5	31	14.6	43	20.2	8	3.7
Pasture conditions	213	100.0	32	15.0	34	16.0	73	34.3	54	25.3	20	9.4
Number of cattle	213	100.0	20	9.4	64	30.0	71	33.3	43	20.2	15	7.1
Federal aid	213	100.0	39	18.3	89	41.8	57	26.8	20	9.4	8	3.7
Average	213	100.0	41	19.2	72	33.8	62	29.1	24	11.3	14	6.6
					<i>Mixed Farming</i>							
Rainfall	207	100.0	22	10.6	46	22.2	43	20.8	46	22.2	50	24.2
Crop conditions	207	100.0	90	43.5	27	13.0	39	18.9	29	14.0	22	10.6
Pasture conditions	207	100.0	51	24.6	36	17.4	50	24.2	42	20.3	28	13.5
Number of cattle	207	100.0	30	14.5	61	29.5	47	22.7	41	19.8	28	13.5
Federal aid	207	100.0	75	36.3	36	17.4	30	14.5	33	15.9	33	15.9
Average	207	100.0	56	27.1	53	25.6	41	19.8	27	13.0	30	14.5
					<i>Western Cotton</i>							
Rainfall	82	100.0	45	54.9	16	19.5	7	8.5	9	11.0	5	6.1
Crop conditions	82	100.0	23	28.0	25	30.5	24	29.3	9	11.0	1	1.2
Pasture conditions	82	100.0	2	2.4	51	62.2	8	9.8	20	24.4	1	1.2
Number of cattle	82	100.0	34	41.5	18	21.9	18	21.9	8	9.8	4	4.9
Federal aid	82	100.0	20	24.4	25	30.5	21	25.6	14	17.1	2	2.4
Average	82	100.0	40	48.8	20	24.4	7	8.5	13	15.9	2	2.4
					<i>Ranching</i>							
Rainfall	153	100.0	39	25.5	19	12.4	31	20.3	25	16.3	39	25.5
Crop conditions	153	100.0	55	36.0	13	8.5	23	15.0	41	26.8	21	13.7
Pasture conditions	153	100.0	66	43.0	33	21.6	29	19.0	18	11.8	7	4.6
Number of cattle	153	100.0	16	10.5	35	22.9	39	25.5	22	14.4	41	26.7
Federal aid	153	100.0	40	26.2	30	19.6	26	17.0	32	20.9	25	16.3
Average	153	100.0	41	26.8	35	22.9	34	22.2	24*	15.7	19	12.4

<sup>a</sup> For definitions of groups by indices, see tables 1-5.

national policy, cash grain farming not only increased tremendously in scope but penetrated deeply into regions ill-suited climatically to its sustenance. One measure of the result is presented here. Areas of varying degree of drought effect are described. Certain focal points of intensity, surrounded by sections of lesser severity, are outlined on the basis of the criteria employed.

FIG. 8 - TYPES OF FARMING IN THE DROUGHT AREA  
1934 AND 1936



On the basis of these delimitations of graded areas, it is apparent that serious study must be undertaken in an effort to solve the problems of agriculture in the regions where farming practices have been proved to be unsound. Moderate changes, or complete abandonment of present practices, are indicated in many instances. No sweeping program applicable to the entire area can be applied successfully because of the variations in conditions encountered within comparatively short distances. Only by segregating the smallest workable units having like conditions and treating each group separately can the way to complete rehabilitation of the drought regions be accomplished.

The problems are essentially national. Therefore, only those measures which consider the national welfare as well as that of the areas involved will be thoroughly effective. Desirable changes in farming methods, if instituted immediately in the drought regions, would undoubtedly necessitate some readjustment in other sections of the country. To determine the end desired and by direction and restraint to attain its lasting accomplishment without disruption elsewhere are pressing questions.

**Appendix**

**METHODOLOGICAL NOTE**



## METHODOLOGICAL NOTE

Localized droughts, often of great intensity but not expansive in nature, occur frequently and are entirely of local concern. The cumulative effect of drought over large areas, however, is a national problem, and as such is the basis of the present report.

The Plains States form the nucleus of the present analysis. Original delineation for the purpose of the survey was quite arbitrary. The Continental Divide in Montana, Wyoming, and Colorado was accepted as a western boundary, with the whole State of New Mexico included. The tier of States immediately to the east — North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and the northern one-third of Texas—completed the area of survey as at first selected. This comprised 636 counties in 10 States.

Five indices — average percent departure from normal rainfall, 1930-1935; average percent of normal crop conditions, 1930-1936; average percent of normal pasture conditions, 1930-1936; percent change in the number of cattle, 1930-1935; and Federal aid per capita, 1933-1936 — were selected for study because measurable data were available and because they were apropos of drought conditions. The 636 counties of the "trial area" were ranked according to each index separately and divided into 5 equal groups<sup>1</sup> for mapping purposes. Each group contained a numerical range, according to the index used (see tables 1-5 and figures 2-6). After the rankings by indices were determined for each county, the five rankings were averaged. These county averages, ranging from one to five, furnished the basis for a map of combined indices.

The map of combined indices for the original trial area disclosed the fact that regions of high intensity apparently extended beyond the eastern boundaries set up and in the west reached into western Montana. Hence, the counties on the periphery of the trial area were measured on the scales set up for the original 636 counties in order to determine drought intensity in the marginal areas. Such borderline testing was extended until in most cases counties of least drought intensity bordered the trial area. As a result, 167 counties in western

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<sup>1</sup>Group I indicated "very slight" drought intensity; group V, "very severe" drought intensity.

Minnesota, Iowa, Missouri, and Montana were added to the original list, making a total of 803 counties in the final test area.<sup>2</sup> Their distribution was as follows:

Table A—DISTRIBUTION OF COUNTIES STUDIED IN DROUGHT AREA

State	Number of Counties Studied
Total	803
Minnesota	77
Iowa	61
Missouri	14
North Dakota	53
South Dakota	69
Nebraska	93
Kansas	105
Oklahoma	77
Texas	101
Montana	56
Wyoming	19
Colorado	47
New Mexico	31

In adding the 167 counties, the same scale was utilized as for the 636 counties. As a result, the distribution of counties into groups for any single index or for the combined indices was no longer on a basis of fifths. The additional counties fell primarily into groups I and II which had "very slight" or "slight" drought intensity although a few scattered counties with moderate to severe conditions were also included (table 6).

<sup>2</sup>See table B.

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
MINNESOTA						
Aitkin	2	-12	70	61	42	\$ 50
Anoka	2	-9	70	61	17	48
Becker	2	-20	70	62	31	40
Beltrami	1	-9	73	72	46	51
Benton	3	-16	67	58	3	56
Big Stone	5	-21	61	55	-14	197
Blue Earth	2	-9	75	62	30	54
Brown	1	-1	75	62	34	51
Carlton	1	1	70	61	23	25
Carver	2	-7	67	58	1	30
Cass	1	-12	73	72	35	53
Chippewa	4	-21	61	55	8	143
Chisago	2	-3	70	61	-1	27
Clay	2	-30	71	62	47	42
Clearwater	1	-5	71	62	29	35
Cottonwood	2	-10	69	60	53	79
Crow Wing	2	-8	70	61	35	65
Dakota	2	-11	76	62	16	39
Douglas	4	-22	61	55	3	68
Faribault	2	-18	75	62	42	76
Freeborn	2	-13	75	62	28	61
Grant	3	-17	61	55	26	93
Hennepin	2	-13	70	61	-6	49
Hubbard	1	-5	73	72	48	48
Isanti	2	-9	70	61	2	29
Itasca	1	-12	73	72	47	36
Jackson	2	-11	69	60	52	75
Kanabec	2	-8	70	61	-3	79
Kandiyohi	3	-15	67	58	11	85
Kittson	2	-14	71	62	39	54
Koochiching	1	-11	73	72	71	34
Lac qui Parle	4	-21	61	55	1	142
Lake of the Woods	1	-4	75	72	69	46
Le Sueur	2	-6	75	62	16	44
Lincoln	3	-11	74	60	1	119
Lyon	3	-18	69	60	26	89
McLeod	2	-7	67	58	5	42
Mahnomen	1	-7	71	62	71	71
Marshall	2	-12	71	62	24	45
Martin	2	-14	75	62	36	60
Meeker	3	-15	67	58	9	71
Mille Lacs	3	-11	70	61	2	85
Morrison	2	-8	67	58	17	71
Murray	2	-10	69	60	50	90
Nicollet	1	-8	75	62	33	53
Nobles	1	-8	69	60	64	64
Norman	2	-11	71	62	48	45
Otter Tail	3	-17	61	55	8	49
Pennington	1	-5	71	62	31	24
Pine	2	-8	70	61	15	37
Pipestone	2	-4	69	60	51	72
Polk	1	-5	71	62	37	40
Pope	4	-18	61	55	-4	106
Ramsey	3	-14	70	61	15	65
Red Lake	1	-5	71	62	36	24
Redwood	3	-16	70	60	33	87
Renville	3	-9	67	58	24	100
Rice	2	-9	75	62	13	35
Rock	2	-6	69	60	68	70
Roseau	1	-7	71	62	25	19

## AREAS OF INTENSE DROUGHT DISTRESS

Table 8—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION—Continued

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
MINNESOTA—Continued						
St. Louis	1	-7	81	71	31	\$ 53
Scott	2	-11	67	58	17	36
Sherburne	3	-21	67	58	15	57
Sibley	2	-4	67	58	15	51
Stearns	3	-18	67	58	4	66
Steele	1	-6	75	62	25	30
Stevens	4	-14	61	55	7	151
Swift	4	-20	61	55	3	142
Todd	3	-15	67	58	2	52
Traverse	4	-14	61	55	7	177
Wadena	2	-9	67	58	24	51
Waseca	1	-3	75	62	23	57
Washington	2	-9	70	61	5	34
Watsonwan	1	-10	75	62	42	64
Wilkin	4	-26	61	55	27	101
Wright	3	-15	67	58	-3	55
Yellow Medicine	4	-17	61	55	3	123
IOWA						
Adair	3	-9	65	61	8	104
Adams	2	-4	65	61	2	99
Appanoose	2	-1	64	62	13	51
Audubon	2	-10	67	60	26	113
Boone	1	-7	73	65	39	45
Buena Vista	1	-8	73	65	62	80
Calhoun	2	-11	67	60	55	75
Carrroll	3	-19	67	60	38	73
Cass	2	-6	65	61	24	89
Cerro Gordo	1	-7	77	67	37	39
Cherokee	2	-16	73	65	68	82
Clarke	3	-6	64	62	-1	90
Clay	1	-4	73	65	-55	82
Crawford	3	-20	67	60	19	101
Dallas	2	-16	73	65	19	69
Decatur	2	-10	64	62	10	64
Dickinson	1	-6	73	65	67	70
Emmet	1	-6	73	65	65	66
Franklin	1	-8	77	67	43	93
Fremont	3	-18	65	61	27	104
Greene	2	-6	67	60	53	77
Guthrie	2	-12	67	60	12	82
Hamilton	1	-7	73	65	48	74
Hancock	1	1	77	67	43	84
Hardin	1	-4	73	65	43	69
Harrison	2	-17	67	60	31	82
Humboldt	1	-7	77	67	53	80
Ida	3	-11	67	60	23	105
Jasper	1	-7	75	65	21	60
Kossuth	1	-3	77	67	63	86
Lucas	3	-10	64	62	2	74
Lyon	1	-10	73	65	70	73
Madison	3	-9	64	62	-6	114
Marion	2	-2	64	62	-2	67
Marshall	1	-7	73	65	44	52
Mills	2	-3	65	61	20	79
Monona	3	-22	67	60	48	110
Monroe	2	-2	64	62	10	82
Montgomery	2	-4	80	61	20	82
O'Brien	1	-9	73	65	64	72
Osceola	1	-6	73	65	76	75
Page	2	-6	65	61	24	69

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION—Continued

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
IOWA—Continued						
Palo Alto	1	-5	73	65	59	\$ 77
Plymouth	1	-13	73	65	43	78
Pocahontas	1	-4	73	65	71	87
Polk	2	-12	73	65	17	48
Pottawattamie	2	-11	80	61	23	68
Ringgold	2	-6	64	62	15	80
Sac	2	-11	67	60	63	89
Shelby	1	-20	67	60	26	104
Sioux	1	-13	73	65	49	66
Story	1	-5	73	65	39	53
Taylor	2	-3	65	61	32	90
Union	3	-12	64	62	1	70
Warren	2	*	64	62	-2	84
Wayne	2	-4	64	62	16	72
Webster	1	-8	73	65	52	50
Winnebago	1	4	77	67	41	73
Woodbury	2	-18	67	60	49	45
Worth	1	-10	77	67	44	68
Wright	1	-12	77	67	44	77
MISSOURI						
Andrew	2	4 <sup>*</sup>	58	60	18	79
Atchison	3	-3	58	60	33	122
Buchanan	2	-2	58	60	1	41
Daviess	2	-3	58	60	4	62
De Kalb	2	-1	58	60	18	76
Gentry	3	-7	58	60	4	65
Grundy	2	-1	57	59	-11	37
Harrison	2	-3	58	60	14	55
Holt	2	2	58	60	40	90
Mercer	2	-3	57	59	*	51
Nodaway	3	-10	58	60	20	80
Putnam	2	-2	57	59	-12	33
Sullivan	2	-7	57	59	-6	38
Worth	3	-7	58	60	17	77
NORTH DAKOTA						
Adams	5	-39	50	51	-10	186
Barnes	2	-6	62	57	40	110
Benson	4	-10	50	51	19	176
Billings	5	-9	50	51	7	243
Bottineau	5	-17	50	51	-23	179
Bowman	4	9	50	51	-10	187
Burke	5	-15	46	46	-34	171
Burleigh	5	-15	50	53	-11	109
Cass	2	-14	62	57	48	63
Cavalier	4	-16	61	54	-10	126
Dickey	4	-17	55	54	5	175
Divide	5	-30	46	46	-12	206
Dunn	5	-15	49	53	-4	180
Eddy	4	-12	51	52	11	151
Emmons	5	-15	50	53	-19	186
Foster	4	-3	51	52	10	149
Golden Valley	4	-13	50	51	23	210
Grand Forks	3	-9	61	54	12	75
Grant	5	-12	50	53	-26	200
Griggs	3	-8	62	57	18	113
Hettinger	5	-15	50	51	-8	199
Kidder	5	-16	51	52	-12	163
La Moure	4	-12	55	54	15	149
Logan	4	-7	55	54	-9	149
McHenry	4	-9	50	51	-3	143

## AREAS OF INTENSE DROUGHT DISTRESS

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION—Continued

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
NORTH DAKOTA—Continued						
McIntosh	4	-16	55	54	-23	\$ 168
McKenzie	5	-19	49	53	15	237
McLean	5	-19	49	53	5	150
Mercer	5	-15	49	53	-2	124
Morton	5	-13	50	53	-3	163
Mountrail	5	-15	46	46	-34	175
Nelson	4	-12	61	54	7	116
Oliver	5	-15	49	53	12	154
Pembina	3	-16	61	54	32	75
Pierce	4	-9	50	51	12	164
Ramsey	4	-11	61	54	1	133
Ransom	4	-16	55	54	-3	108
Renville	5	-16	46	46	-25	187
Richland	4	-18	55	54	12	95
Rolette	4	-7	50	51	-4	145
Sargent	5	-20	55	54	-18	197
Sheridan	4	-10	51	52	6	170
Sioux	5	-16	50	53	14	194
Slope	5	-7	50	51	-9	225
Stark	4	-7	50	51	-6	150
Steele	3	-9	62	57	33	120
Stutsman	4	-12	51	52	7	116
Towner	4	-6	61	54	*	161
Trail	3	-16	62	57	38	61
Walsh	3	-11	61	54	1	77
Ward	5	-13	46	46	-7	105
Wells	4	-12	51	52	4	163
Williams	5	-23	46	46	-26	189
SOUTH DAKOTA						
Armstrong	5	-27	52	59	-78	2,844
Aurora	5	-21	53	47	-52	244
Beadle	5	-27	53	47	-41	129
Bennett	3	-15	50	64	66	160
Bon Homme	5	-31	51	50	2	92
Brookings	4	-21	51	48	24	93
Brown	5	-27	54	49	-4	136
Brule	5	-23	53	47	43	206
Buffalo	5	-16	53	47	-47	182
Butte	4	-18	54	57	4	104
Campbell	5	-23	54	49	-46	250
Charles Mix	5	-15	51	50	3	138
Clark	5	-25	54	49	-38	167
Clay	4	-25	51	50	63	91
Codington	4	-14	54	49	-11	108
Corson	4	-31	54	57	12	177
Custer	3	-11	50	64	9	74
Davison	5	-22	51	48	9	92
Day	5	-20	54	49	-5	157
Deuel	4	-14	54	49	6	121
Dewey	5	-22	54	57	-54	163
Douglas	5	-15	51	50	-3	175
Edmunds	5	-17	54	49	-9	206
Fall River	3	-13	50	64	36	78
Faulk	5	-27	54	49	-35	212
Grant	5	-19	54	49	-13	139
Gregory	5	-22	50	57	-2	159
Haakon	5	-40	52	59	-20	211
Hamlin	5	-18	54	49	-8	143
Hand	5	-23	53	47	-34	225
Hanson	5	-27	51	48	33	154

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION—Continued •

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
SOUTH DAKOTA—Continued						
Harding	4	-15	54	57	29	\$167
Hughes	4	-20	53	47	22	102
Hutchinson	5	-23	51	50	23	108
Hyde	5	-19	53	47	-26	220
Jackson	4	12	52	59	*	201
Jerauld	5	-22	53	47	-53	217
Jones	5	-19	50	57	-5	262
Kingsbury	5	-29	51	48	-30	152
Lake	4	-14	51	48	51	123
Lawrence	4	-24	52	59	2	34
Lincoln	4	-27	51	50	27	78
Lyman	5	-13	50	57	-20	198
McCook	4	-10	51	48	33	129
McPherson	5	-17	54	49	-35	188
Marshall	5	-20	54	49	-11	186
Meade	4	-21	52	59	-2	142
Mellette	5	-23	50	57	-35	186
Miner	5	-15	51	48	-16	179
Minnehaha	3	-5	51	48	65	58
Moody	4	-17	51	48	68	129
Pennington	4	-15	52	59	-6	95
Perkins	4	-20	54	57	17	169
Potter	5	-25	54	49	-60	252
Roberts	5	-14	54	49	-12	143
Sanborn	5	-23	51	48	-29	189
Shannon	3	-15	50	64	140	87
Spink	5	-28	54	49	-39	203
Stanley	5	-16	52	59	-10	235
Sully	5	-30	53	47	-14	285
Todd	4	-20	50	57	34	146
Tripp	5	-17	50	57	-40	185
Turner	4	-19	51	50	39	82
Union	4	-21	51	50	52	97
Walworth	5	-31	54	49	-46	192
Washabaugh	3	-10	50	64	57	164
Washington	3	-14	50	64	307	103
Yankton	4	-31	51	50	19	79
Ziebach	5	-32	54	57	-9	174
NEBRASKA						
Adams	3	-11	52	58	8	53
Antelope	3	-16	62	58	34	63
Arthur	1	-3	53	70	63	71
Banner	4	-29	61	66	40	351
Blaine	2	-18	53	70	81	80
Boone	3	-16	62	58	11	84
Rox Butte	3	10	61	66	10	104
Boyd	3	-12	53	70	3	98
Brown	3	-	53	70	23	82
Buffalo	2	-5	60	65	19	71
Burt	3	-11	62	58	29	86
Butler	3	-13	61	58	34	70
Cass	2	-5	61	58	27	53
Cedar	3	-17	62	58	25	76
Chase	1	-4	65	68	103	163
Cherry	2	-13	53	70	12	84
Cheyenne	2	-10	61	66	78	192
Clay	4	-14	55	58	-6	96
Colfax	2	-11	61	58	35	76
Cuming	3	-15	62	58	17	77
Custer	3	-13	60	65	-15	123

## AREAS OF INTENSE DROUGHT DISTRESS

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
 \* IN THE GREAT PLAINS REGION—Continued

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
NEBRASKA—Continued						
Dakota	3	-21	62	58	37	\$ 84
Dawes	2	-13	61	66	70	70
Dawson	2	-4	60	65	23	78
Deuel	2	-11	61	66	84	206
Dixon	3	-20	62	58	10	66
Dodge	3	-18	61	58	4	49
Douglas	2	-13	61	58	32	57
Dundy	2	-11	65	68	50	140
Fillmore	3	-7	55	58	15	87
Franklin	4	-15	52	58	1	99
Frontier	2	-4	65	68	9	99
Furnas	4	-9	52	58	6	87
Gage	3	-10	55	58	15	65
Garden	2	-11	61	66	48	145
Garfield	3	-13	53	70	23	125
Gosper	3	1	52	58	5	102
Grant	2	-13	53	70	22	50
Greeley	3	-16	60	65	-21	101
Hall	2	-9	60	65	19	49
Hamilton	4	-15	61	58	-16	99
Harlan	3	-9	52	58	23	85
Hayes	2	-5	65	68	20	189
Hitchcock	1	2	65	68	56	117
Holt	3	-22	53	70	33	71
Hooker	2	-13	53	70	58	55
Howard	3	-13	60	65	9	92
Jefferson	3	-10	55	58	7	93
Johnson	3	-11	55	58	-8	72
Kearney	4	-24	52	58	28	119
Keith	2	-3	65	68	57	134
Keyapaha	4	-23	53	70	-20	120
Kimball	2	-5	61	66	90	202
Knox	3	-21	62	58	13	77
Lancaster	2	-9	61	58	13	48
Lincoln	1	-4	65	68	48	62
Logan	3	-7	53	70	7	128
Loup	3	-16	53	70	19	139
McPherson	3	-4	53	70	10	120
Madison	3	-12	62	58	19	61
Merrick	2	-6	61	58	17	70
Morrill	3	-24	61	66	47	120
Nance	3	-17	61	58	33	88
Nemaha	3	-9	55	58	12	74
Nuckolls	4	-12	55	58	-16	91
Otoe	3	-9	55	58	1	55
Pawnee	3	-12	55	58	-7	79
Perkins	2	-4	65	68	82	246
Phelps	3	-1	52	58	23	96
Pierce	3	-16	62	58	30	65
Platte	2	-9	61	58	39	69
Polk	3	-14	61	58	3	88
Redwillow	1	11	65	68	44	64
Richardson	2	-6	55	58	23	76
Rock	3	-20	53	70	39	91
Saline	3	-10	55	58	18	74
Sarpy	2	-13	61	58	77	45
Saunders	3	-16	61	58	29	58
Scotts Bluff	2	-23	61	66	109	98
Seward	2	-3	61	58	30	56
Sheridan	2	-10	61	66	42	102

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION—Continued

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
NEBRASKA—Continued						
Sherman	4	-19	60	65	-13	\$122
Sioux	2	-13	61	66	33	73
Stanton	3	-13	62	58	24	102
Thayer	2	-5	55	58	23	84
Thomas	2	-13	53	70	100	67
Thurston	3	-22	62	58	58	90
Valley	3	-11	60	65	-33	101
Washington	3	-15	61	58	34	91
Wayne	3	-17	62	58	12	78
Webster	5	-25	52	58	-27	108
Wheeler	2	-8	53	70	39	123
York	3	-15	61	58	3	64
KANSAS						
Allen	1	-6	74	69	41	35
Anderson	2	-5	52	67	35	47
Atchison	2	-3	54	62	16	40
Barber	3	-9	66	59	17	150
Barton	3	-20	64	62	39	133
Bourbon	1	-9	74	69	45	46
Brown	2	-9	54	62	38	66
Butler	1	-3	74	69	31	33
Chase	2	-4	52	67	20	62
Chautauqua	1	-6	74	69	58	57
Cherokee	1	-11	74	69	65	88
Cheyenne	2	-8	61	61	136	182
Clark	5	-20	45	50	24	315
Clay	4	-16	44	61	5	107
Cloud	4	-7	44	61	-5	93
Coffey	2	-10	52	67	30	42
Comanche	4	-15	66	59	18	268
Cowley	1	-11	74	69	51	43
Crawford	1	-12	74	69	50	74
Decatur	3	-6	61	61	26	193
Dickinson	2	-11	64	62	28	84
Doniphan	2	-6	54	62	54	45
Douglas	2	-7	52	67	36	38
Edwards	3	-14	66	59	90	271
Elk	1	-6	74	69	49	45
Ellis	3	*	64	62	*	156
Ellsworth	3	-12	64	62	-7	124
Finney	5	-19	45	50	4	186
Ford	5	-16	45	50	-8	180
Franklin	2	-12	52	67	21	41
Geary	2	-5	52	67	7	68
Gove	4	-3	53	56	-3	240
Graham	4	-16	61	61	-25	239
Grant	4	-5	45	50	278	446
Gray	5	-27	45	50	1	420
Greeley	4	-21	53	56	65	417
Greenwood	1	-4	74	69	26	50
Hamilton	5	-11	45	50	21	254
Harper	2	-13	66	59	64	136
Harvey	2	-14	56	59	48	48
Haskell	5	-28	45	50	44	609
Hodgeman	5	-21	45	50	-38	446
Jackson	3	-1	54	62	-14	88
Jefferson	2	1	54	62	11	71
Jewell	5	-19	44	61	-15	115
Johnson	2	-9	52	67	21	41
Kearny	5	-13	45	50	-16	253

## AREAS OF INTENSE DROUGHT DISTRESS

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION—Continued

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
KANSAS—Continued						
Kingman	2	-7	66	59	63	\$156
Kiowa	3	-14	66	59	32	283
Labette	1	1	74	69	49	67
Lane	4	-16	53	56	32	395
Leavenworth	2	14	54	62	22	27
Lincoln	4	-17	64	62	-44	169
Linn	2	-17	52	67	42	59
Logan	4	-9	53	56	23	184
Lyon	2	-6	52	67	12	41
McPherson	2	-9	64	62	25	78
Marion	2	-14	64	62	30	67
Marshall	2	-1	54	62	8	80
Meade	5	-22	45	50	-23	305
Miami	2	-17	52	67	28	51
Mitchell	4	-9	44	61	-25	153
Montgomery	1	-5	74	69	61	47
Morris	2	*	52	67	15	70
Morton	5	-28	45	50	31	260
Nemaha	2	-3	54	62	16	69
Neosho	1	-7	74	69	47	42
Ness	5	-14	53	56	-3	261
Norton	3	-16	61	61	12	138
Osage	2	-8	52	67	29	48
Osborne	5	14	44	61	-33	166
Ottawa	5	-14	44	61	-11	169
Pawnee	3	-19	66	59	82	226
Phillips	4	-4	44	61	1	119
Pottawatomie	3	-8	54	62	-13	81
Pratt	3	-16	66	59	136	169
Rawlins	2	-5	61	61	76	240
Reno	1	-1	66	59	78	88
Republic	4	-23	44	61	17	83
Rice	2	-13	64	62	81	117
Riley	2	-4	54	62	2	55
Rooks	4	-3	44	61	-9	195
Rush	3	-13	64	62	30	259
Russell	4	-14	64	62	-23	197
Saline	2	-4	64	62	6	74
Scott	4	-4	53	56	59	226
Sedgwick	1	-9	66	59	66	51
Seward	5	-25	45	50	-7	199
Shawnee	2	-8	52	67	22	48
Sheridan	4	-14	61	61	-8	268
Sherman	3	-14	61	61	95	176
Smith	5	-25	44	61	-10	124
Stafford	3	-19	66	59	102	196
Stanton	5	-21	45	50	61	532
Stevens	5	-23	45	50	54	288
Sumner	1	-3	66	59	115	86
Thomas	3	-13	61	61	57	255
Trego	4	3	53	56	-15	264
Wabaunsee	3	-10	52	67	*	68
Wallace	3	-1	53	56	59	165
Washington	4	-14	44	61	3	94
Wichita	5	-12	53	56	-3	259
Wilson	1	-5	74	69	80	43
Woodson	1	-6	74	69	26	61
Wyandotte	3	-17	54	62	12	51

METHODOLOGICAL NOTE

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION—Continued

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
OKLAHOMA						
Adair	1	1	70	62	79	\$ 38
Alfalfa	3	-13	65	58	79	149
Atoka	1	3	65	66	74	74
Beaver	5	-23	49	50	3	260
Beckham	4	-23	63	54	17	87
Blaine	2	-13	63	54	79	91
Bryan	1	-4	65	66	99	65
Caddo	2	-4	62	56	75	67
Canadian	1	-6	66	63	57	57
Carter	1	3	65	66	61	71
Cherokee	1	-4	70	62	78	54
Choctaw	1	*	66	64	98	74
Cimarron	5	-34	49	50	-32	352
Cleveland	1	2	66	63	35	46
Coal	1	*	65	66	66	77
Comanche	2	-7	62	56	17	59
Cotton	2	-3	62	56	28	87
Craig	1	3	67	64	28	43
Creek	1	4	66	63	51	43
Custer	3	-11	63	54	37	72
Delaware	1	-8	67	64	43	48
Dewey	2	-10	63	54	51	98
Ellis	5	-26	49	50	20	155
Garfield	2	-10	65	58	56	62
Garvin	1	3	65	66	76	45
Grady	1	8	66	63	58	51
Grant	3	-17	65	58	81	141
Greer	3	-17	62	56	16	85
Harmon	4	-16	62	56	13	108
Harper	5	-18	49	50	-5	238
Haskell	1	4	70	62	85	75
Hughes	1	6	70	62	38	49
Jackson	3	-16	62	56	71	86
Jefferson	2	-6	65	66	5	73
Johnston	1	3	65	66	24	82
Kay	2	-20	65	58	91	39
Kingfisher	2	-8	66	63	71	119
Kiowa	2	-12	62	56	53	82
Latimer	1	3	66	64	64	78
LeFlore	1	1	66	64	97	57
Lincoln	1	7	66	63	73	42
Logan	1	-4	66	63	74	45
Love	2	3	65	66	40	101
McClain	1	-1	66	63	62	58
McCurtain	1	5	66	64	153	52
McIntosh	1	4	70	62	91	58
Major	2	-13	65	58	71	94
Marshall	1	3	65	66	66	85
Mayes	1	-2	67	64	64	59
Murray	1	7	65	66	42	68
Muskogee	1	4	70	62	66	46
Noble	2	-14	65	58	68	57
Nowata	1	-3	67	64	64	43
Okfuskee	1	4	66	63	33	52
Oklahoma	1	5	66	63	47	39
Okmulgee	1	4	70	62	37	41
Osage	1	-9	67	64	76	36
Ottawa	1	-8	67	64	24	48
Pawnee	1	-10	67	64	41	39
Payne	1	-3	66	63	63	40

## AREAS OF INTENSE DROUGHT DISTRESS

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION—Continued

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
OKLAHOMA—Continued						
Pittsburg	1	-3	70	62	80	\$ 58
Pontotoc	1	*	65	66	65	37
Pottawatomie	1	9	66	63	71	29
Pushmataha	1	-5	66	64	106	68
Roger Mills	4	-16	63	54	13	121
Rogers	1	-1	67	64	60	53
Seminole	1	6	66	63	89	25
Sequoyah	1	-4	70	62	96	63
Stephens	1	-4	65	66	26	60
Texas	5	-16	49	50	29	243
Tjilman	3	-10	62	56	57	114
Tulsa	1	-1	67	64	61	29
Wagoner	1	4	67	64	74	56
Washington	1	-9	67	64	36	29
Washita	3	-13	63	54	35	97
Woods	3	-13	65	58	26	123
Woodward	3	-18	65	58	19	93
TEXAS						
Andrews	3	9	51	56	31	201
Archer	1	-6	59	68	21	40
Armstrong	5	-21	39	52	-31	256
Bailey	4	-14	51	56	17	208
Baylor	2	-6	56	64	80	90
Borden	3	2	56	64	-25	276
Brewster	3	-11	75	59	-43	126
Briscoe	5	-20	39	52	-8	158
Callahan	1	1	59	68	54	77
Carson	5	-21	39	52	38	189
Castro	5	-14	39	52	-11	269
Childress	2	3	56	64	10	102
Clay	1	6	59	68	29	92
Cochran	5	-18	51	56	28	310
Coke	3	21	54	68	-23	144
Coleman	2	21	56	64	19	82
Collingsworth	3	-17	56	64	19	135
Concho	2	21	54	68	-5	138
Cottle	4	-20	56	64	-18	145
Crane	2	-5	75	59	14	46
Crockett	3	5	54	68	-47	169
Crosby	4	-13	51	56	25	172
Culberson	4	-9	75	59	-34	207
Dallam	5	-20	39	52	-57	183
Dawson	4	9	51	56	3	125
Deaf Smith	5	-22	39	52	24	277
Dickens	4	-13	56	64	-29	121
Donley	4	-21	56	64	9	107
Eastland	1	-3	59	68	51	66
Ector	2	-5	75	59	7	53
El Paso	1	-9	75	59	82	47
Fisher	2	2	56	64	38	124
Floyd	5	-20	39	52	23	125
Foard	2	-6	56	64	48	115
Gaines	3	9	51	56	45	142
Garza	4	-13	56	64	-14	141
Glasscock	3	13	51	56	36	152
Gray	4	-21	39	52	14	74
Hale	5	-14	39	52	-3	123
Hall	4	-20	56	64	11	120
Hansford	5	-18	39	52	52	372
Hardeman	2	-6	66	64	55	94

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION—Continued

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
TEXAS—Continued						
Hartley	5	-20	39	52	53	\$339
Haskell	1	16	56	64	106	101
Hemphill	5	-30	39	52	12	169
Hockley	5	-18	51	56	-34	219
Howard	2	1	51	56	47	67
Hudspeth	3	-9	75	59	17	123
Hutchinson	4	-30	39	52	37	50
Irion	2	21	54	68	-21	112
Jack	1	8	59	68	15	51
Jeff Davis	4	-11	75	59	-13	182
Jones	1	16	56	64	45	83
Kent	2	-13	56	64	120	145
King	3	-4	56	64	16	217
Knox	1	6	56	64	95	97
Lamb	4	-14	51	56	13	187
Lipscomb	5	-18	39	52	12	274
Loving	3	-5	75	59	-22	264
Lubbock	4	-18	51	56	3	81
Lynn	4	9	51	56	10	144
Martin	4	1	51	56	18	134
Midland	3	13	51	56	-2	89
Mitchell	2	4	56	64	12	106
Montague	1	8	59	68	33	64
Moore	5	-20	39	52	-25	370
Motley	4	-20	56	64	12	131
Nolan	2	4	56	64	28	74
Ochiltree	5	-18	39	52	26	354
Oldham	5	-22	39	52	80	382
Palmer	5	-14	39	52	19	188
Pecos	3	-11	75	59	-12	85
Potter	5	-22	39	52	7	72
Presidio	2	-11	75	59	54	85
Randall	5	-22	39	52	-39	198
Reagan	2	13	54	68	-33	49
Reeves	2	-9	75	59	34	108
Roberts	5	-30	39	52	-9	315
Runnels	2	21	56	64	15	103
Schleicher	3	15	54	68	-11	143
Scurry	2	2	56	64	4	111
Shackelford	1	16	59	68	29	63
Sherman	5	-20	39	52	1	508
Stephens	1	16	59	68	29	40
Sterling	3	21	54	68	-19	158
Stonewall	2	9	56	64	65	144
Sutton	3	15	54	68	-38	145
Swisher	5	-14	39	52	13	246
Taylor	1	7	56	64	40	65
Terrell	3	-11	75	59	-28	101
Terry	3	9	51	56	86	167
Throckmorton	1	10	59	68	44	61
Tom Green	1	21	54	68	70	77
Upton	2	13	54	68	-60	45
Ward	2	-5	75	59	-19	67
Wheeler	3	-21	56	64	22	91
Wichita	1	-6	56	64	54	40
Wilbarger	2	-6	56	64	189	76
Winkler	2	-5	75	59	-21	19
Yoakum	4	9	51	56	37	232
Young	1	10	59	68	64	47

## AREAS OF INTENSE DROUGHT DISTRESS

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION—Continued

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
MONTANA						
Beaverhead	3	-26	53	68	12	\$ 50
Big Horn	3	-16	53	65	25	106
Blaine	2	-13	53	65	82	97
Broadwater	4	-16	51	62	29	85
Carbon	3	-19	53	65	63	101
Carter	5	-17	45	58	-24	217
Cascade	3	-15	51	62	24	66
Chouteau	4	-24	53	65	47	169
Custer	5	-22	45	58	-52	162
Daniels	4	-23	48	57	72	167
Dawson	5	-25	48	57	-5	134
Deer Lodge	2	-26	71	74	29	101
Fallon	5	-17	45	58	-31	202
Fergus	3	-11	51	62	55	103
Flathead	1	-6	71	74	53	60
Gallatin	2	-19	53	68	38	53
Garfield	4	-20	48	57	35	125
Glacier	3	-13	53	65	25	107
Golden Valley	4	-17	51	62	33	117
Granite	1	-16	71	74	53	27
Hill	3	-13	53	65	70	169
Jefferson	2	-25	53	68	46	49
Judith Basin	4	-14	51	62	20	104
Lake	1	-17	71	74	88	60
Lewis and Clark	3	-32	51	62	42	43
Liberty	2	-6	53	65	80	186
Lincoln	1	-12	71	74	57	24
McCone	4	-18	48	57	38	196
Madison	2	-13	53	68	70	45
Meagher	2	17	51	62	21	65
Mineral	1	-14	71	74	83	112
Missoula	1	-26	71	74	92	60
Musselshell	3	-22	51	62	61	102
Park	3	-33	53	65	25	49
Petroleum	3	-14	51	62	54	108
Phillips	3	-17	53	65	73	97
Pondera	2	-14	53	65	80	107
Powder River	5	-15	45	58	-28	262
Powell	2	-23	71	74	29	71
Prairie	5	-29	45	58	-42	189
Ravalli	2	-18	71	74	41	62
Richland	5	-27	48	57	29	148
Roosevelt	4	-16	48	57	49	167
Rosebud	5	-35	45	58	2	106
Sanders	1	-1	71	74	59	60
Sheridan	5	-40	48	57	8	167
Silver Bow	4	-33	53	68	12	146
Stillwater	3	-16	53	65	56	123
Sweet Grass	3	-19	53	65	39	51
Teton	4	-24	53	65	56	154
Toole	1	10	53	65	81	93
Treasure	4	-38	53	65	23	166
Valley	4	-24	48	57	47	167
Wheatland	4	-22	51	62	25	85
Wibaux	5	-18	45	58	18	210
Yellowstone	3	-23	53	65	101	106
WYOMING						
Albany	2	-17	59	76	-12	58
Big Horn	1	-12	80	81	37	49
Campbell	4	-14	52	73	-1	170

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION—Continued

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
WYOMING—Continued						
Carbon	2	-16	59	76	17	\$ 56
Converse	2	-10	57	73	17	120
Crook	4	-26	52	73	-37	193
Fremont	1	-20	80	81	86	65
Goshen	2	-6	57	73	59	160
Hot Springs	1	-24	80	81	58	44
Johnson	3	-25	52	73	30	121
Laramie	2	-9	57	73	24	52
Natrona	1	-5	59	76	52	59
Niobrara	2	-1	57	73	-17	144
Park	1	-17	80	81	54	56
Platte	3	-17	57	73	-15	132
Sheridan	2	-9	52	73	13	80
Sweetwater	1	8	59	76	12	37
Washakie	2	-17	80	81	33	120
Weston	4	-26	52	73	-8	191
COLORADO						
Adams	3	-16	54	65	23	100
Alamosa	1	-9	80	75	20	63
Arapahoe	3	-18	54	65	29	87
Baca	5	-23	50	61	-7	230
Bent	4	-27	50	61	-2	101
Boulder	2	-19	55	67	72	68
Chaffee	1	-2	78	79	42	95
Cheyenne	3	-26	54	65	51	157
Clear Creek	1	-13	78	79	40	51
Conejos	1	8	80	75	14	54
Costilla	2	-21	80	75	-3	60
Crowley	5	-29	50	61	-6	156
Custer	3	-7	50	61	24	97
Denver	3	-18	54	65	-34	65
Douglas	3	-18	54	65	4	70
Elbert	3	-18	54	65	12	129
El Paso	2	-9	54	65	16	70
Fremont	2	-7	50	61	37	54
Gilpin	1	-9	78	79	35	37
Grand	1	-7	78	79	21	18
Hinsdale	1	-16	77	72	47	47
Huerfano	4	-15	50	61	13	108
Jackson	1	11	78	79	23	85
Jefferson	2	-9	55	67	9	60
Kiowa	4	-25	54	65	13	190
Kit Carson	3	-28	54	65	66	165
Lake	1	14	78	79	42	45
Larimer	2	-18	55	67	24	78
Las Animas	4	-20	50	61	-14	96
Lincoln	3	-25	54	65	32	112
Logan	2	-9	55	67	31	102
Mineral	2	-16	80	75	-16	31
Morgan	2	-14	55	67	64	109
Otero	4	-24	50	61	13	82
Park	1	-28	78	79	54	53
Phillips	2	-8	54	65	74	183
Prowers	4	-20	50	61	25	139
Pueblo	4	-15	50	61	-26	79
Rio Grande	1	1	80	75	1	47
Routt	1	-4	78	79	25	35
Saguache	1	-3	80	75	13	59
Sedgwick	2	-7	55	67	51	165
Summit	1	-1	78	79	20	40

## AREAS OF INTENSE DROUGHT DISTRESS

Table B—FIVE INDICES OF DROUGHT INTENSITY IN 803 COUNTIES  
IN THE GREAT PLAINS REGION—Continued

State and County	Average Rank	Average Percent Departure From Normal Rainfall, 1930-1935	Average Percent of Normal Crop Conditions, 1930-1936	Average Percent of Normal Pasture Conditions, 1930-1936	Percent Change in Number of Cattle, 1930-1935	Per Capita Federal Aid, <sup>a</sup> 1933-1936
COLORADO—Continued						
Teller	1	-15	78	79	27	\$ 31
Washington	3	-18	54	65	62	131
Weld	2	-17	55	67	36	99
Yuma	3	-17	54	65	50	130
NEW MEXICO						
Bernalillo	1	15	72	73	35	40
Catron	1	*	69	64	162	149
Chaves	2	-18	89	66	34	122
Colfax	2	-9	68	63	-3	58
Curry	2	-6	68	63	73	126
De Baca	2	1	68	63	20	162
Dona Ana	1	-1	89	66	47	55
Eddy	2	-1	89	66	-6	91
Grant	2	2	69	64	-18	47
Guadalupe	3	-9	68	63	-23	106
Harding	4	-22	68	63	-19	254
Hidalgo	1	2	69	64	88	76
Lea	2	-3	89	66	19	143
Lincoln	2	25	89	66	-5	93
Luna	2	1	69	64	10	68
McKinley	1	1	72	73	97	23
Mora	3	-11	68	63	-44	74
Otero	1	4	89	66	54	56
Quay	4	-17	68	63	-13	179
Rio Arriba	1	-9	72	73	46	26
Roosevelt	2	2	68	63	31	124
Sandoval	1	3	72	73	117	41
San Juan	1	-1	72	73	56	31
San Miguel	1	-2	73	73	31	66
Santa Fe	1	-5	68	63	49	77
Sierra	1	3	69	64	33	87
Socorro	1	-6	69	64	125	75
Taos	1	-9	72	73	83	43
Torrance	1	-5	68	63	78	109
Union	4	-27	68	63	-54	211
Valencia	1	-12	72	73	87	45

\* Less than 0.5 percent.

<sup>a</sup> Population changes since 1930 in many of the counties included would tend to increase per capita expenditures in counties of higher drought intensity and reduce the figures in others.