DUST STORMS

Report

BY

Kern County Soil Conservation Committee

APRIL, 1949

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Kern County Chamber of Commerce

MAIN OFFICE: BAKERSFIELD

DUST STORMS

Report

of

Kern County Soil Conservation Committee

APRIL 1940

ORGANIZED BY

Kern County Chamber of Commerce

MAY 1940 — REVISED

REPORT
ON
WIND EROSION AND DUST STORMS

BY

KERN COUNTY SOIL CONSERVATION COMMITTEE

APRIL 1949

OUTLINE OF REPORT

By

Soil Conservation Committee

BANK OF AMERICA

East Bakersfield Branch

Bakersfield, California
March 3, 1949

Mr. Claude Botkin
P. O. Box 944
Arvin, California

Dear Mr. Botkin:

A committee is being appointed for study purposes on which you will act as Chairman and the following will assist you:

Jules Villard
Carl Carver
W. L. Smith
Carl Melcher
Loren Voth
Blake Hale
Frank Stockton
Phil O'Henneson
Glenn Moody

Your report of findings is to be made to the Board of Directors at a meeting to be called for this purpose.

Very truly yours,

F. E. Estribou
Chairman of the Kern County
Soil Conservation Council

FEE:iep

KERN COUNTY SOIL CONSERVATION COUNCIL PROGRESS REPORT

INTRODUCTION

The Kern County Chamber of Commerce, at the request of the Kern County Board of Supervisors, inaugurated and set into motion a county council to be known as the Kern County Soil Conservation Council. This council was established for the purpose of studying soil erosion and the dust storms resulting therefrom. The central council consists of six men from each of the five supervisorial districts. The council members were informed that "when it is formed, it will operate independently of the Kern County Chamber of Commerce."

The five district councils have held meetings for the purpose of studying the problems outlined by the Chamber of Commerce. They have held additional meetings for the purpose of studying not only the conditions in Kern County, but studying conditions of other counties and other areas where high winds result in dust storms. This council, after due consideration, study and analysis of this and other areas, has herewith compiled a report of its findings.

The Kern County Chamber of Commerce and the Board of Supervisors are to be commended for setting up an independent council to operate, study, and compile reports without the influence of any individual or individuals. The council has analyzed the problem under the foregoing outline in an attempt to secure as broad an analysis as possible.

The dust that has originated in Kern County has come from many areas, large and small. It has inconvenienced the housewives of both rural and urban population, industry, and agriculture. Dust has been found to originate in quantities large enough to cause discomfort to the above from the highways, streets, subdivisions, vacant city lots, vacant land adjacent to the city, untilled and unpastured lands, and fields that have been tilled. In general this dust has been caused by an extremely low rainfall during a period of three successive years. Any one of these places of origin, if eliminated would not cause the dust to be eliminated from the air. It is a problem upon which cooperation is needed by all of those concerned and which is outlined in the following pages of this report.

FACTUAL DATA

We have found it important that the council first establish as much factual information as possible. This section of the report contains factual data obtained from various individuals, subcommittees, public agencies, etc.

Rainfall:

We have compiled the precipitation of rainfall by years, the number of winds over 25 miles per hour by years, and the number of days with visibility of 6 miles or less by years. This information is primarily compiled from official U. S. Weather Bureau reports. The principal weather information is available from the U. S. Weather Bureau Station at the Kern County Airport. The rainfall as set forth by the weather bureau, on the average, is slightly more than 6 inches per year. Table 1 sets forth the rainfall in this county at the Bakersfield Airport station from the year 1889 to 1948, inclusive.

Table 1

Year	Inches in Precip. Rainfall	Year	Inches in Precip. Rainfall
1889	7.03	1919	3.79
1890	3.50	1920	6.50
1891	3.56	1921	8.47
1892	5.42	1922	8.14
1893	5.28	1923	4.70
1894	3.36	1924	3.99
1895	6.61	1925	5.06
1896	5.86	1926	5.73
1897	5.16	1927	6.79
1898	3.16	1928	4.63
1899	4.21	1929	2.74
1900	4.41	1930	6.15
1901	4.82	1931	8.28
1902	5.71	1932	7.51
1903	3.67	1933	6.08
1904	6.68	1934	4.63
1905	8.59	1935	6.08
1906	7.65	1936	7.34
1907	4.44	1937	6.94
1908	3.69	1938	11.17
1909	9.29	1939	6.07
1910	5.31	1940	9.55
1911	5.83	1941	10.96
1912	4.01	1942	4.26
1913	9.08	1943	9.38
1914	6.50	1944	6.08
1915	9.04	1945	7.33
1916	7.96	1946	5.95
1917	3.02	1947	2.68
1918	6.62	1948	4.32

It is evident that from 1890 to 1894 inclusive, there were five years when the rainfall did not exceed 5½ inches. There was a similar period from 1896 to 1903, a period of 8 years, that the rainfall did not exceed 5¾ inches. During the years 1923, 1924, 1925, and 1926, the rainfall was less than average. The last low rainfall period occurred in the periods 1946, 1947, and 1948 with the rainfall in 1947 as low as 2.68 inches.

The rainfall at Lost Hills has been secured on a seasonal basis since 1941 and the precipitation at this station is set forth in Table II.

Table II

Season	Rainfall in Inches
1941-42	6.20
1942-43	8.17
1943-44	4.29
1944-45	4.90
1945-46	4.30
1946-47	4.27
1947-48	3.18
1948-49	3.53—to March 24th

It is evident from this data that the rainfall from 1943-44 season to 1948-49 season up to and including March 24, was below the average rainfall of approximately 6 inches which has been established as the average rainfall at the Kern County Airport. With this low rainfall for a period of 6 years, the vegetative growth on the plains of the west side has been little as compared to previous years.

Wind Velocity and Visibility:

Table III sets forth the weather data pertaining to wind velocity from 1937 to 1948:

Table III

Years	NO. OF DAYS WITH WINDS 25 m.p.h. OR OVER
1937	7
1938	9
1939	3
1940	2
1941	13
1942	6
1943	10
1944	20
1945	13
1946	17
1947	18
1948	33

From the above table it is apparent that there has been a general increase in the number of days during the year when the wind velocity reached 25 miles per hour or more. In 1940, there were only two days when the wind velocity reached 25 miles per hour or over. In 1948, the year which has given many of us concern and dis-

comfort, the weather bureau reports 33 such high velocity winds. It is common knowledge that wind acts similar to streams and when they are of sufficient velocity, they will pick up dirt, thus causing considerable dust to be carried in the air. There is considerable evidence to this effect as indicated in the following table where the U. S. Weather Bureau shows that the visibility was less than 6 miles many days during the past two years.

Table IV sets forth the days of frequency with visibility of six miles or less caused by high winds. This table does not include low visibility caused by fog.

Table IV

Year	NO. OF DAYS WITH VISIBILITY OF 6 MILES OR LESS CAUSED BY HIGH WINDS
1937	1
1938	7
1939	2
1940	1
1941	9
1942	2
1943	6
1944	4
1945	6
1946	5
1947	10
1948	21

From the above table on visibility, it is apparent that during the period of 1937 to 1946, the number of days of low visibility were few while in 1947 and 1948, the visibility was decreased to 6 miles or less during many days of these two years.

From tables I, II, III and IV on rainfall, number of strong winds, and low visibility, we have prepared fig. 1, to show clearly the relationship of these three factors; that is, with decreased rainfall we get increased number of high velocity winds and increased numbers of dust storms.

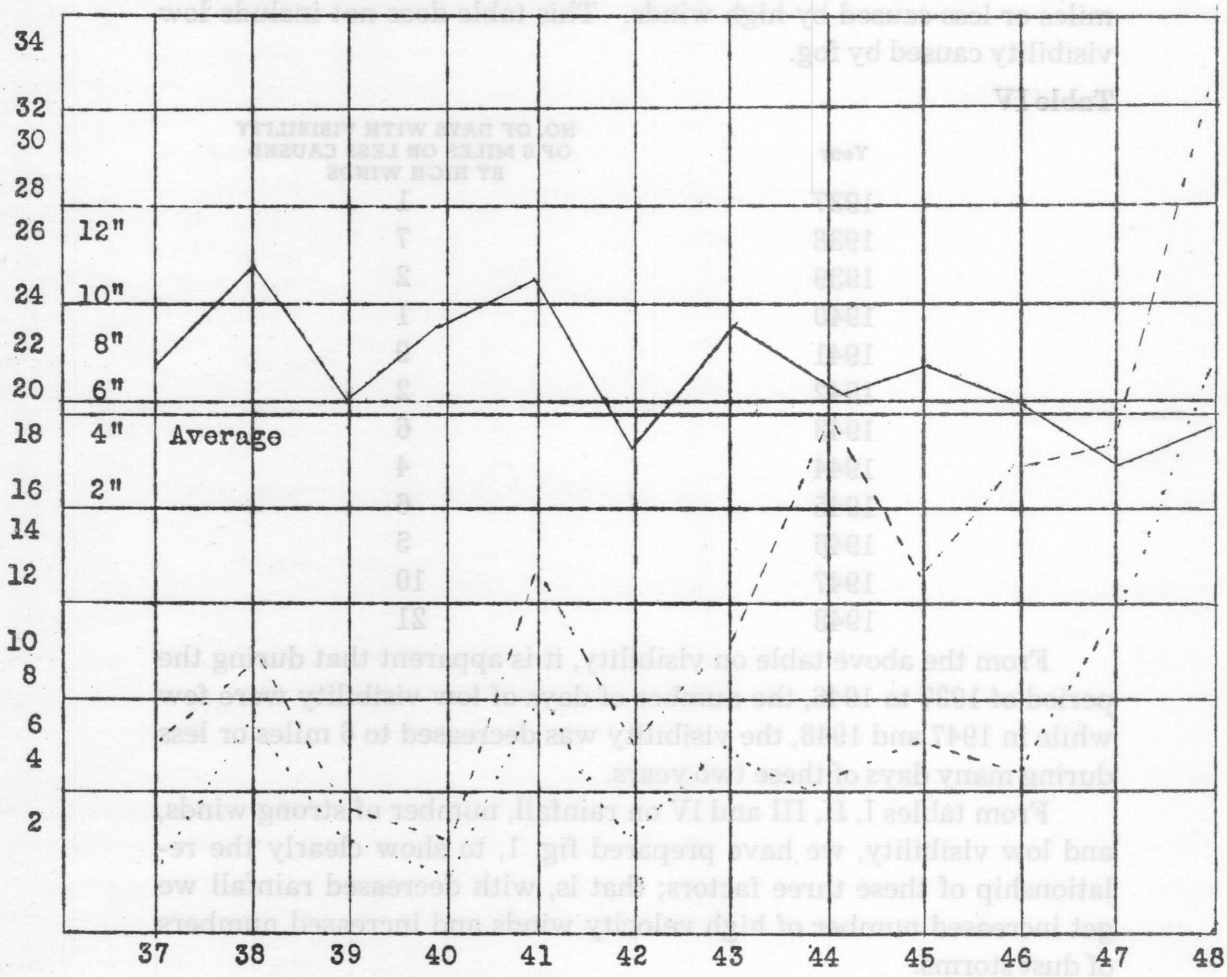
It can be seen from Fig. 1 that the rainfall has generally been in a downward trend during the past 11 years, the lowest rainfall being received in 1947. Fig. 1 also indicates that with the general downward trend in precipitation there is a general upward trend in the number of days of low visibility. These three weather conditions have been the cause of increased numbers of dust storms. A detained weather report from 1937 to 1948 is set forth in table V, as furnished by the U. S. Weather Bureau at Bakersfield by E. E. Wilson, Meteorologist.

Growth of County:

The growth of Kern County is an important factor that all citizens should recognize and we have set forth some of the factual information pertaining to the development of this county. Kern County

is one of the young agriculture counties in the United States. The population is an important factor in relation to agriculture.

Figure 1



(Calendar Year)

—— Rainfall (Calendar year total)

- - - - Days frequency/year of wind 25 mph or more

..... Days frequency/year of visibility 6 miles or less with wind.

Example: In 1940 there were 2 days in which wind reached or exceeded 25 mph., and one day with visibility reduced to 6 miles or less in connection with the strong wind; Rainfall—9.55 inches.

EXHIBIT No 1

Date		Wind		Visibility	Weather	Remarks
Year	Mo/Day	Dir.	Vel.	(Miles)*		
	2/13	NW	31	15	Rain	Dust preceding rain
	3/15	SSE	28	15		
	3/27	NW	31	5	Heavy Rain	Dust preceding rain
1937	4/15	NW	26	10		
	5/28	N	26	15		
	6/27	NE	30	¼	Dust	Dust lasted 20 minutes
	11/11	NW	27	10	Rain	Dust preceding rain
	2/9	SE	29	3	Dust	
	2/10	SE	29	30	-	Dust south; vsby. 5
	2/11	ESE	30	8	-	Dust west; vsby. 3
	3/18	NNW	37	5	Rain	Dust preceding rain
1938	3/20	NW	32	5	Rain	Dust preceding rain
	6/19	WNW	30	zero	Dust	Heavy dust for 1 hour
	11/6	SE	30	1	Dust	Dust lasted 5 hours
	11/23	SE	30	½	Dust	Dust lasted 8 hours
	12/14	SE	40	4	Dust	Vsby. occasionally ½
	3/9	SE	30	2	Dust	Dust lasted 5 hours
1939	3/21	ENE	25	1	Thunderstorm	Dust preceding rain
	5/22	NNW	28	20	-	
	3/27	NNE	30	10	Rain	
1940	12/15	ESE	36	½	Dust	16 hours dust preceding rain
	1/8	ESE	60	6	Dust	Followed rain
	1/9	ESE	60	10	-	Continuation of ⅛
	1/19	NNW	28	10	-	
	2/6	SE	32	5	Dust	3 hours dust, then rain
	2/11	SE	33	2	Dust	2 hours dust, then rain
	2/28	ESE	50	½	Dust	4 hours dust, then rain
1941	3/28	ESE	28	10	-	Dust over Bakersfield
	3/29	SSE	29	7	Dust	2 hours dust
	3/30	SSE	25	10	-	Occasional dust
	4/4	NW	35	2	Rain	Dust preceding rain
	6/25	NW	25	2	Dust	3 hours dust
	10/4	NW	25	1	Dust	3 hours dust
	12/16	WNW	28	5	Rain	Dust preceding rain
	1/20	ESE	36	4	Dust	7 hours dust
	2/24	W	30	8	Rain	
	3/14	WSW	34	10	Rain	Dust preceding rain
1942	4/5	W	25	10	Rain	Dust preceding rain
	5/1	NNW	26	10	Rain	
	11/3	NW	30	zero	Dust	1 hour dust, then rain

EXHIBIT No. 1 (Continued)

Date		Wind		Visibility	Weather	Remarks
Year	Mo/Day	Dir.	Vel.	(Miles)*		
	1/21	SSE	30	½	Dust	8 hours dust, then rain
	1/30	NNW	25	3	Rain	Dust preceding rain
	5/3	WSW	30	4	Dust	1 hour dust
	6/3	NW	25	6	Dust	2 hours dust
	10/26	SSE	27	3	Dust	2 hours dust
1943	11/7	SE	35	4	Dust	8 hours dust
	11/16	S	30	10	Rain	Some dust on airport
	11/20	NW	28	10	Rain	
	12/9	NE	28	10	---	Some dust on airport
	12/28	ESE	34	10	---	
	1/7	E	27	10	---	
	1/8	SE	30	10	---	
	1/13	SE	25	10	---	
	2/19	SE	30	10	---	
	2/20	SE	25	10	Rain	
	2/21	S	29	10	Rain	
	3/13	WNW	34	10	Rain	
	4/4	NW	28	10	---	
	4/8	NNW	60	⅛	Dust	2 hours dust, then rain
1944	4/11	NW	26	10	Rain	
	4/16	NW	27	10	---	
	4/20	NNW	28	10	Rain	
	4/26	NW	25	10	Rain	
	5/3	SE	29	10	---	
	5/15	WNW	26	10	Rain	
	6/3	NNW	26	10	Rain	
	6/8	NW	37	¾	Dust	10 hours dust
	6/20	NNW	27	10	---	
	6/23	NNW	32	6	Dust	Dust for 1 hour, then rain
	9/20	NW	28	zero	Dust	4 hours dust
	3/20	NNW	26	10	---	
	3/23	NNW	33	10	Rain	
	4/8	NNW	30	3	Dust	1 hour dust, then rain
	4/25	NW	37	4	Dust	1 hour dust
	5/14	NNW	26	10	---	
	5/18	NW	26	10	---	
1945	5/19	NNW	25	10	Rain	
	6/4	NNW	32	10	Rain	
	10/29	SSE	26	½	Dust	2 hours dust
	11/5	NNW	35	3	Dust	3 hours dust
	11/24	NNW	30	10	Rain	
	11/25	NE	26	10	Rain	
	12/4	SSW	32	1	Dust	7 hours dust
	12/19	SSE	26	5	Dust	1 hour dust

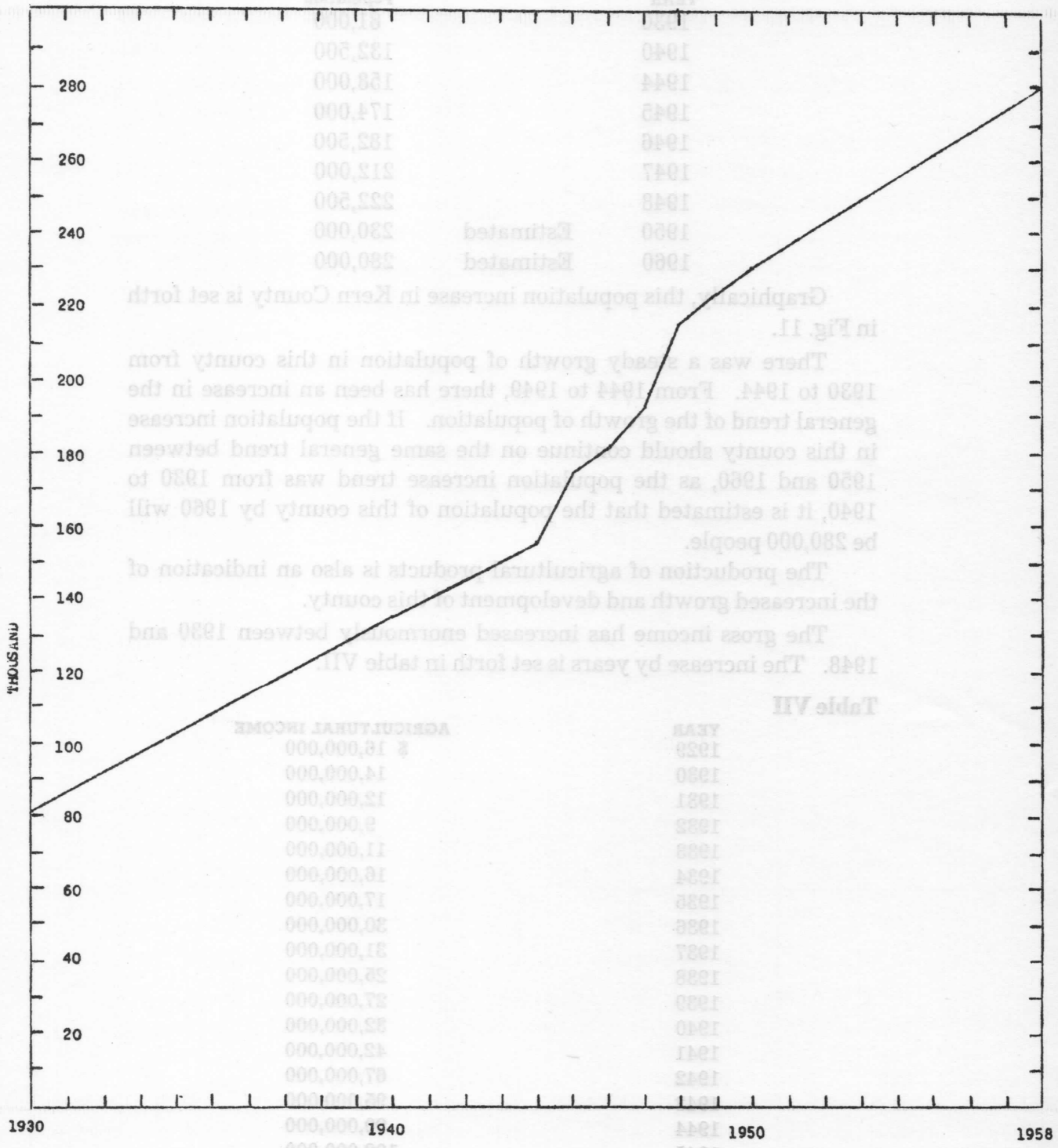
EXHIBIT No. 1 (Continued)

Date		Wind		Visibility	Weather	Remarks
Year	Mo/Day	Dir.	Vel.	(Miles)*		
	1/5	N	28	10	---	
	1/28	NNW	25	6	Dust	3 hours dust
	2/15	NW	28	10	Rain	
	3/3	NW	27	2½	Dust	4 hours dust
	3/10	NNW	29	15	---	
	3/13	WNW	31	10	Rain	
	3/29	S	35	3	Dust	6 hours dust, then rain
	3/31	WNW	25	10	Rain	
	5/13	NW	25	10	---	
1946	5/21	NW	31	2	Dust	2 hours dust
	5/26	NW	26	10	Rain	
	10/11	SSE	25	10	---	
	11/12	SE	25	10	---	
	11/13	E	35	1½	Dust	1 hour dust, then rain
	11/20	NNW	30	10	Rain	
	11/23	NNW	30	10	Rain	
	12/6	WNW	28	10	Rain	
	1/28	WNW	26	10	Rain	
	2/9	SSE	31	2½	Dust	3 hours dust, then rain
	3/3	NW	30	10	Rain	
	3/10	NNE	25	10	Rain	
	3/29	NW	32	15	---	
	5/26	NW	30	3	Dust	Dust followed by rain
	6/19	WNW	28	8	---	
	6/20	NNW	29	4	Dust	6 hours dust
	6/23	NW	25	15	---	
1947	8/19	N	25	2	Dust	11 hours dust
	9/16	WNW	28	2	Dust	1 hour dust
	9/17	NNW	32	2	Dust	8 hours dust
	10/6	NW	25	5	Dust	1 hour dust
	10/11	NW	25	10	---	
	10/20	NNW	30	3	Dust	4 hours dust, then rain
	11/1	WNW	45	⅛	Dust	1 hour dust, then rain
	12/17	WNW	33	¾	Dust	1 hour dust, then rain
	12/20	NNE	25	10	Rain	

EXHIBIT No. 1 (Continued)

Date		Wind		Visibility	Weather	Remarks
Year	Mo/Day	Dir.	Vel.	(Miles)*		
	1/25	NNW	27	1½	Dust	11 hours dust
	1/27	E	26	5	Dust	2 hours dust
	2/5	NW	25	10	Rain	
	2/10	NNW	26	2	Dust	6 hours dust, then rain
	2/28	NW	25	10	Rain	
	3/8	NNW	30	1½	Dust	4 hours dust, then rain
	3/12	SSE	25	3	Dust	3 hours dust, then rain
	3/13	WNW	30	2½	Dust	14 hours dust, then rain
	3/17	WNW	30	10	Rain	
	3/19	NW	25	10	Rain	
	3/24	WNW	30	10	Rain	
	3/28	N	25	8	---	
	4/9	N	25	5	Dust	1 hour dust, then rain
	4/28	SSE	40	zero	Dust	16 hours dust, then rain
	5/7	NNW	31	10	---	
1948	5/8	NNW	26	10	---	
	5/17	WNW	40	zero	Dust	4 hours dust
	5/18	W	30	1½	Dust	1 hour dust, then rain
	5/30	NW	25	10	---	
	6/2	NW	32	¼	Dust	12 hours dust
	6/6	SSE	26	Misg.	Misg.	
	6/8	NNW	30	1	Dust	13 hours dust
	6/20	NNW	25	10	---	
	6/21	NW	25	15	---	
	6/26	NW	25	½	Dust	7 hours dust
	7/4	NW	28	2	Dust	4 hours dust
	7/22	NW	28	1½	Dust	5 hours dust
	11/3	NNW	25	3	Dust	2 hours dust
	11/8	SE	30	⅛	Dust	10 hours dust
	12/3	NNW	32	2½	Dust	2 hours dust, then rain
	12/16	SSE	30	¼	Dust	5 hours dust, then rain
	12/26	SSE	40	⅛	Dust	14 hours dust, then rain

* 10 indicates a visibility of 10 miles OR MORE



KERN COUNTY
Population Data from Kern County Chamber of Commerce

Table VI indicates the population of Kern County.

Table VI

YEAR		Population
1930		81,000
1940		132,500
1944		158,000
1945		174,000
1946		182,500
1947		212,000
1948		222,500
1950	Estimated	230,000
1960	Estimated	280,000

Graphically, this population increase in Kern County is set forth in Fig. 11.

There was a steady growth of population in this county from 1930 to 1944. From 1944 to 1949, there has been an increase in the general trend of the growth of population. If the population increase in this county should continue on the same general trend between 1950 and 1960, as the population increase trend was from 1930 to 1940, it is estimated that the population of this county by 1960 will be 280,000 people.

The production of agricultural products is also an indication of the increased growth and development of this county.

The gross income has increased enormously between 1930 and 1948. The increase by years is set forth in table VII.

Table VII

YEAR	AGRICULTURAL INCOME
1929	$ 16,000,000
1930	14,000,000
1931	12,000,000
1932	9,000,000
1933	11,000,000
1934	16,000,000
1935	17,000,000
1936	30,000,000
1937	31,000,000
1938	25,000,000
1939	27,000,000
1940	32,000,000
1941	42,000,000
1942	67,000,000
1943	95,000,000
1944	90,000,000
1945	102,000,000
1946	143,000,000
1947	160,000,000
1948	166,000,000

During the depression years of 1930 to 1934, there was little change in the gross income. From a later table it can be seen that there was little change in the acres being farmed in the same period.

Between the years of 1935 and 1948, the total income to agriculture increased from roughly $16,000,000 to $166,000,000. It should be recognized also that the greater portion of this return to agriculture is spent within the boundaries of Kern County and is an important factor in the total development of the county.

The following graph in Fig. III indicates the enormous growth in agricultural income of Kern County.

It is true that during the period of 1929 to 1948 some of the increased return to agriculture was due to increase in prices. The greater portion of increase in income, however, was brought about by increased acres of land developed.

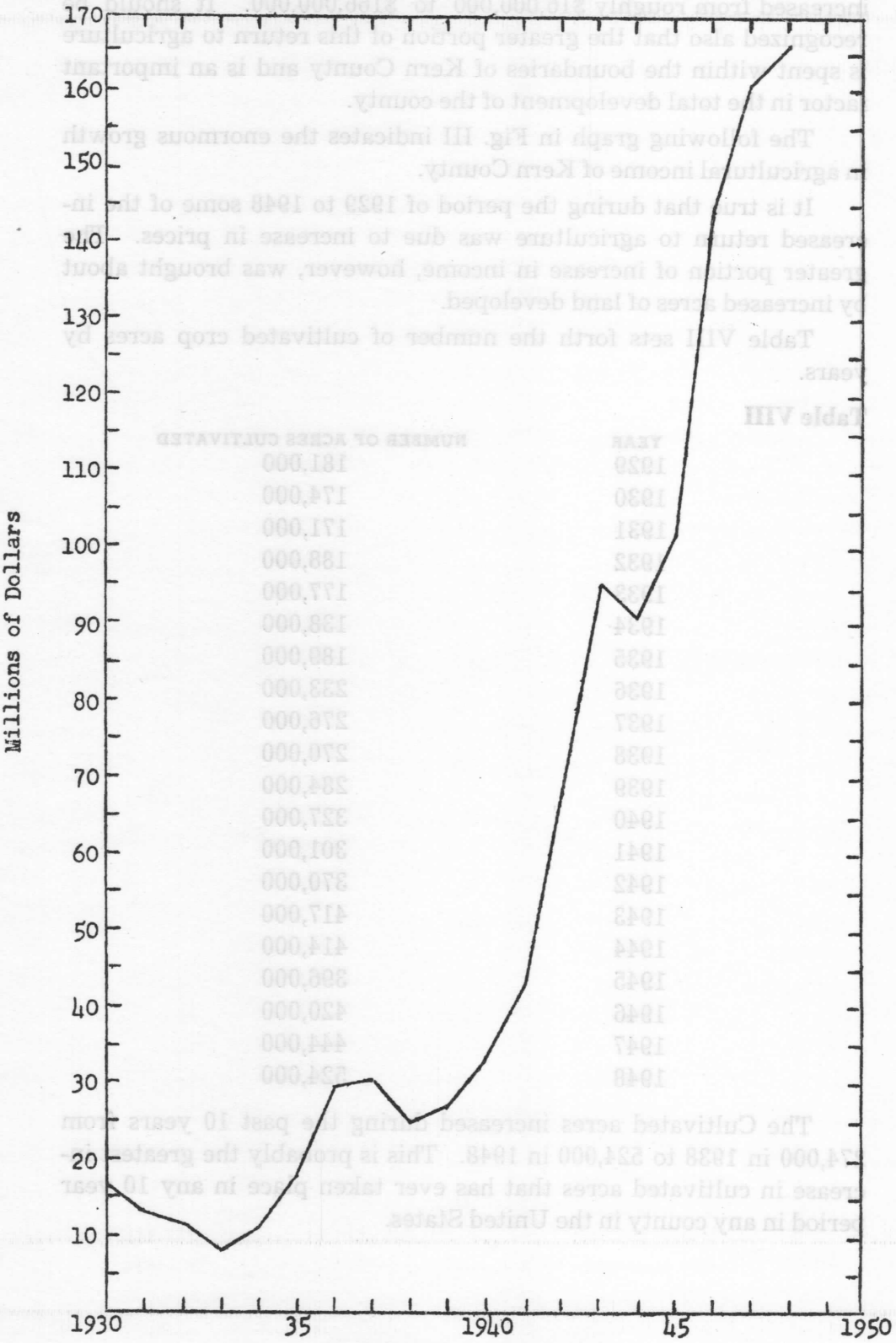
Table VIII sets forth the number of cultivated crop acres by years.

Table VIII

YEAR	NUMBER OF ACRES CULTIVATED
1929	181,000
1930	174,000
1931	171,000
1932	188,000
1933	177,000
1934	138,000
1935	189,000
1936	233,000
1937	276,000
1938	270,000
1939	284,000
1940	327,000
1941	301,000
1942	370,000
1943	417,000
1944	414,000
1945	396,000
1946	420,000
1947	444,000
1948	524,000

The Cultivated acres increased during the past 10 years from 274,000 in 1938 to 524,000 in 1948. This is probably the greatest increase in cultivated acres that has ever taken place in any 10 year period in any county in the United States.

Figure III



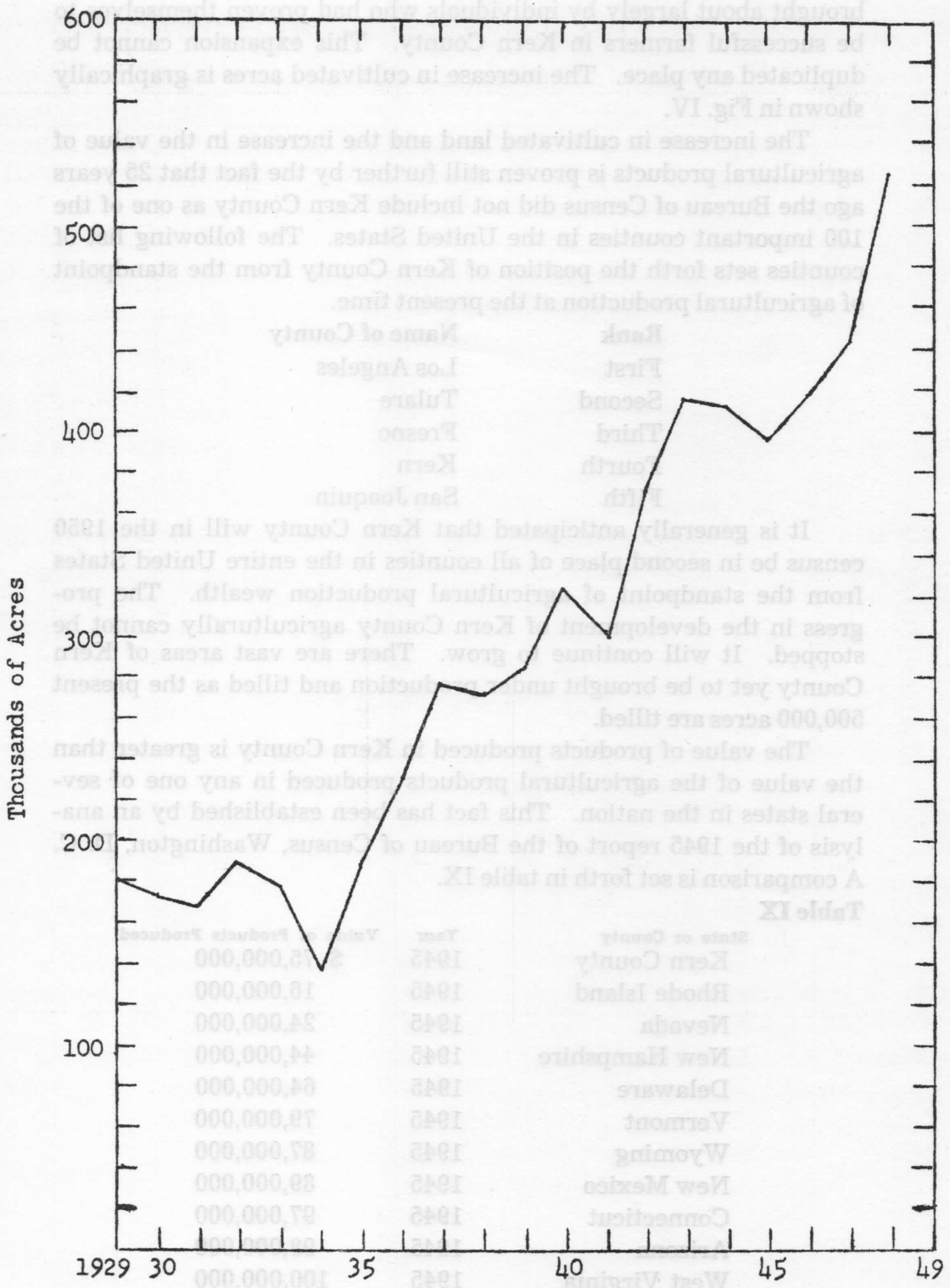
KERN COUNTY

Total Returns to Agriculture

1929 - 1949

Data From Agricultural Commissioner's Office

Figure IV



KERN COUNTY
Total Acres in Cultivation
1929 - 1949
Data from Agricultural Commissioner's Office

It should be noted at this point that this increase in acreage was brought about largely by individuals who had proven themselves to be successful farmers in Kern County. This expansion cannot be duplicated any place. The increase in cultivated acres is graphically shown in Fig. IV.

The increase in cultivated land and the increase in the value of agricultural products is proven still further by the fact that 25 years ago the Bureau of Census did not include Kern County as one of the 100 important counties in the United States. The following list of counties sets forth the position of Kern County from the standpoint of agricultural production at the present time.

Rank	Name of County
First	Los Angeles
Second	Tulare
Third	Fresno
Fourth	Kern
Fifth	San Joaquin

It is generally anticipated that Kern County will in the 1950 census be in second place of all counties in the entire United States from the standpoint of agricultural production wealth. The progress in the development of Kern County agriculturally cannot be stopped. It will continue to grow. There are vast areas of Kern County yet to be brought under production and tilled as the present 500,000 acres are tilled.

The value of products produced in Kern County is greater than the value of the agricultural products produced in any one of several states in the nation. This fact has been established by an analysis of the 1945 report of the Bureau of Census, Washington, D. C. A comparison is set forth in table IX.

Table IX

State or County	Year	Value of Products Produced
Kern County	1945	$ 75,000,000
Rhode Island	1945	16,000,000
Nevada	1945	24,000,000
New Hampshire	1945	44,000,000
Delaware	1945	64,000,000
Vermont	1945	79,000,000
Wyoming	1945	87,000,000
New Mexico	1945	89,000,000
Connecticut	1945	97,000,000
Arizona	1945	98,000,000
West Virginia	1945	100,000,000
KERN COUNTY	1946	166,000,000

*No census data is available for 1948 for the various states.
1948 data for Kern County in above table is from the Kern County Agricultural Commissioner's office.

From the above table, it can readily be seen that Kern County produced more agricultural wealth in 1945 than did the State of

Nevada and Rhode Island combined and more than the State of New Hampshire and Nevada combined, and almost as much as the agricultural wealth of Rhode Island, Nevada, and New Hampshire combined. It is not known what the value of the agricultural products was of the various states listed above in 1948, but we conservatively estimate that Kern County's agricultural production in terms of value now exceeds any one of the ten states listed above.

Livestock and Range Feed:

During the years of below normal rainfall little vegetative growth takes place on open land or cattle range. The recent dry years have produced so little livestock feed on the range that many livestock men (beef and sheep) have gone out of business with most of these individuals having exceedingly heavy financial losses. The breeding herds on these range lands have had to be reduced materially in size. In some cases the herds have been reduced as much as 75%. Some range land normally pastured has been lying idle with no livestock on it whatsoever for the past 3 years, all of this due to no vegetative growth of range grasses. In accordance with the Kern County Assessor's records, beef cattle assessed numbers in 1946-47 amounted to 79,463 head and in 1947-48, this had been reduced to only 62,881 head. Dairy cattle assessed numbers in 1946-47 was 26,550 and was decreased to 15,292 in 1947-48. In the case of sheep, the assessed number was reduced during this same period from 159,-920 to 107,726. These reduced numbers of livestock as indicated by the assessor's records are primarily due to low rainfall and thereby low production of range feed for livestock. The livestock men have reduced their numbers of livestock in order to conserve and maintain their range land vegetative covers. This is commonly called, among livestock men, deferred grazing. In order to maintain and conserve range lands, the livestock men have increased the permanent pasture acreage in Kern County in the past 12 months by more than 2500 acres, and it is expected that this increase probably will be more than 10,000 acres at the close of 1950. To conserve the feed that was produced, the livestock men have made thousands of miles of firebreaks in order to preserve the range. Since rodents destroy large amounts of range feed, the livestock men have spent untold time and money in the destruction of rodents so as to maintain the ranges for their cattle and sheep.

Wind Erosion Areas:

From the standpoint of soil erosion, there are two principal areas; one commonly known as the west side of which Blackwell's Corner is approximately the center, and the Wheeler Ridge-Comanche Point Area south of the City of Bakersfield. The west side area is known as open land area where livestock, during high rainfall years, are grazed. The Wheeler Ridge-Comanche Point area is a tilled area and farmed primarily under the irrigation method of farming. There is some dry farmed land in the area. These areas

were surveyed at the request of the farmers in 1947 and 1948 by the Agricultural Extension Service. It was determined that the Wheeler Ridge-Comanche Point erosion problem could, in due time, be largely controlled by proper farming practices. Much progress has been made in development of newer and sounder methods of tillage, which will undoubtedly minimize the dust in future seasons. In the west side area, it was determined that it was largely a case of low rainfall during a period of three years which completely destroyed the native cover, and erosion would continue to a greater or lesser degree until rainfall in the area again returned to normal.

There are windblown areas in Kern County definitely known not to have been grazed by livestock for periods of many years which have been completely denuded of all vegetation, and soil erosion has taken place. It is obvious under such conditions with exceedingly low rainfall that reseeding of these areas would be hopeless until seasons of normal rainfall again occur. There are areas in the open range where range management has been practiced and been found to produce excellent vegetative growth in a given year such as 1942-43 season. The following year in the same area when the rainfall was approximately one half, there was no livestock feed produced and therefore could not be pastured. The range man has no way of knowing what the rainfall will be twelve months in advance. If it were possible to predict rainfall twelve months in advance, a livestock man could then develop a better range management practice in these windblown areas that would probably be entirely satisfactory from the standpoint of wind erosion. In other words, the livestock man may have excellent feed in one season and have no feed the next season due entirely to lack of precipitation. This is particularly true in some of the west side areas as well as areas between Comanche Point and City of Maricopa.

The "'Reconnoissance Soil Survey of the Upper San Joaquin Valley, California," by J. W. Nelson and Walter C. Dean of the University of California and E. C. Eckmann of the U. S. Department of Agriculture, compiled in 1917 and published by the Government Printing Office in 1921, sets forth important data regarding the West Side area and the Comanche Point-Wheeler Ridge Area. This report describes the soils of the West Side windblow area as Panoche sandy loams. The report states, "The Panoche sandy loam group includes the fine sandy loam, gravelly sandy loam, and sandy loam types. The total area is 397.3 square miles, of which the fine sandy loam forms about 75% and the gravelly sandy loam about 15%. . . . The Panoche gravelly sandy loam consists of a medium textured sandy loam containing varying quantities of small flat shale gravel, . . . The soils in such places are more porous and droughty than the average, and in places appear **as barren spots on the slopes.** . . . Part of the group north and northwest of Lost Hills has an undulating surface due in part to the action of small streams and in part to deposi-

tion of the material by wind. The drainage of these soils is good to excessive . . . Shad scale and scant growth of grasses constitute the native vegetation, and from 10 to 20 acres are required to support one steer. Most of the land is held in large tracts and will be of little use to agriculture, except for pasture, for a long time to come. Underground water is practically unobtainable, and where available is commonly of poor quality. The remote situation of the soils from other sources of water supply makes it unlikely that gravity systems will be installed, especially as long as there is an insufficient supply for readily accessible lands. . . . The high phase of the Panoche sandy loams group includes high lying areas of the sandy loam types of the series. There are 45.1 square miles of soils of this kind in the area, the finer soil forming 85% of the total. . . . The admixture of organic matter is small. . Because of the low rainfall in part of the area where these soils occur and the practical impossibility of securing irrigation water, the soils are utilized only as pasture land. They carry a scant growth of grass and shad scale, so that it requires from 15 to 20 acres to support one steer.

This same reconnoissance soil survey of the Upper San Joaquin Valley report discusses the area now commonly called Comanche Point-Wheeler Ridge Area under the heading "WIND-LAID SOILS" Oakley Series. The report states on Page 104 that, "The soils of the Oakley Series . . . consist of wind-laid deposits which have been derived from a wide range of rocks. The material has been blown from the soils of other series and from exposed sandy deposits of lake and stream beds. The soils are generally uniform to 6 feet or more, except where the materials have accumulated as a shallow covering over older soils. They are low in content of organic matter and are **moved freely by wind.** The surface is irregular, ridgy, or undulating and in places somewhat dunelike. Drainage is good. . . .

The group Oakley sands includes the sand and fine sand of the series. The two are intimately associated, the sand ordinarily occurring upon the crests of the hummocks and ridges and the fine sand in the lower positions. The total area covered by the group is 24.8 square miles of which approximately 75% is included in the sand type. The surface soil of the Oakley sand consists of a . . . medium-textured loose, incoherent, slightly micaceous sand or loamy sand 6 feet or more deep. . . . The loose, porous structure enables the soil to absorb all the rainfall. . . . The surface is uneven and consists of rounded hillocks and semidune-like ridges, **the result of wind action.** The group occurs on the moderately sloping alluvial fan near the south end of the valley and has a deep water table. Drainage is good to excessive and the soils are inclined to be droughty. . . . Vegetation is sparse on the soils of this group, owing partly to the action of wind and to low rainfall and excessive drainage. A scant growth of brush and some grass afford a little pasturage during parts of the year. Water for irrigation is not available and can only be obtained

from outside sources, which fact retards agricultural progress for the pesent in this group of soils and keeps land values low.

RECOMMENDATIONS

The Central Soil Conservation Council and its subcommittees after having studied and compiled the factual information and having visited other areas where wind erosion and dust storms are problems, have the following list of recommendations to make. The recommendations include the cooperation of all the people of Kern County.

Political Subdivision:

A considerable part of the area within the City of Bakersfield and adjacent residential areas outside the City of Bakersfield are composed of vacant lots, new subdivisions, new streets and alleys, all contributing to the dust problem. It should be realized that high winds will definitely create soil movement within these residential areas as well as in rural areas. Accordingly, the problem in these large residential areas is considerable and complex. The city ordinance provides for cleaning of vacant lots to reduce fire hazards. This apparently is necessary. The city is constantly engaged in cleaning city streets with the equipment and men it has available, but it is understood that this is a job of large proportions. Our recommendations, therefore, regarding residential areas are as follows:

a. Vacant lots and subdivisions should be disced just previous to the development of fire hazards, but the surface left in as rough and trashy condition as possible to minimize the movement of soil yet still eliminate fire hazard.
b. Streets and alleys should be cleaned as regularly as possible and practicable.
c. Streets and alleys that are not oiled or surfaced should be oiled or surfaced as soon as practicable and the surfacing should be done the full width of the alley and the full width of the street from curb to curb.
d. Trenches opened for any construction work should be backfilled, materials consolidated, and resurfaced as soon as possible.
e. Where drifts of soil occur on highways in wind-blown areas, consideration should be given to resurfacing by raising the highway level with the dirt blown on to the road bed instead of grading the dirt to the sides of the road creating additional drifts in the next wind storm.
f. Experiment with deep furrowing at right angles to the direction of winds in open range areas.

Farmers:

After due consideration of the efforts of the farmers in following the well known soil erosion control practices, we feel that greater progress is being made in the Wheeler Ridge-Comanche Point area than in the other areas outside of Kern County where wind erosion

is a problem. Therefore, we recommend that these ranchers continue and expand the use of known practices that will control soil erosion. In general, these recommended practices are as follows:

a. The use of windbreaks should be expanded as rapidly as practicable. The windbreaks should be planted on all four sides of each quarter section, and under certain conditions might well be planted every quarter mile east and west.

b. The use of stubble mulch wherever possible should be practiced by leaving all vegetative growth possible on the surface of the soil to control the movement of soil.

c. The manner of tilling the soil in the Wheeler Ridge-Comanche Point area has been found to be an important factor in controlling the movement of soil. It is recommended that each grower determine how wet he need to till his soil to secure soil erosion control in each of his fields.

d. The type of equipment used in the tilling of soil in an erosion area is also an important factor. The use of the Cultipacker when the soil is dry should be eliminated. This is largely true also of the ordinary disc. The duckfoot type of plow and the springtooth harrow are both desirable types of tillage equipment.

e. The perennial crops have been found to be desirable crops to grow in wind blown areas. Therefore, it is recommended that alfalfa, irrigated pastures, orchards, and vineyards be increased in the wind blown area and that trees be planted around the farmstead.

f. The interplanting of each succeeding crop in the stubble of the old crop without the destruction of the old stubble has been found desirable in the control of soil erosion. Therefore it is recommended that this practice be used on each ranch where it is practicable.

g. The use of strip cropping under certain conditions will aid in the control of soil movement. The old method of wide strips under irrigated conditions is not desirable as narrow strips. The narrow strips should be the width of the rows of the crop to follow, leaving the stubble mulch or cover crop that may have been planted until the new crop has attained sufficient height to protect the soil.

h. At any time that a field is not being occupied by a marketable crop, the soil should be controlled in some manner. One method by which this can be secured is by the planting of a cover crop permitting the same to grow until the field is needed for the next marketable crop.

i. In leveling of land or releveling of land, as well as floating or land planing, it is recommended that the operator perform these functions in so far as possible during the three summer months of June, July and August. The reason for

this recommendation is that the weather bureau reports less high velocity winds during these months than during the six winter months. When land is planed or leveled, it should be immediately furrowed, irrigated, and planted to a cover crop or left in a roughed condition with many clods. This method will avoid in most cases the erosion of soil by wind following such operations.

It is recognized by the council that each and every recommendation when used must be applied to the individual ranch at the time of year when the operation is practicable in the production of farm crops. It is also recognized that not all of these practices can be used by every ranch.

Range Land Operators:

Proper management of range land has long been known to the livestock men of this county. In general this is practiced on lands owned and operated by the livestock industry. Therefore, it is only necessary to encourage livestock men to follow good range management practices which will produce the greatest amount of livestock feed and in so doing will control the movement of soil.

There is open land owned by non-residents and others, which is used for livestock range, and it is therefore recommended that the owners of this open range and the user of the open range follow the recommended range management practices which will also produce the greatest amount of forage and the least amount of soil erosion.

The council recognizes that during the past three years of exceedingly low rainfall there has been no vegetation or little vegetation produced in some of the open areas of the west side, and as a result there has been little or no range feed produced. Therefore, the large number of winds of high velocity has removed the vegetative cover and permitted the winds to cause soil erosion.

Oil Land Operators:

The petroleum industry of Kern County is recognized as one of the largest in the United States. Inasmuch as a large amount of oil development in the county is in the untilled areas, we recommend the following:

a. Open lands that are leased for livestock ranges should be managed in the same manner as any other livestock range in order that it will produce the greatest amount of feed and with the least amount of soil erosion, by constantly keeping in mind that vegetative coverage is a fire hazard to the petroleum industry. It would seem desirable that oil companies surface the areas surrounding all equipment and well locations by oiling an area sufficiently large to provide adequate fire protection.

b. Inasmuch as the Agricultural Extension Service of the University of California College of Agriculture maintains a staff of agricultural men in Kern County who have supplied

the recommendations to the farmers for soil erosion, it would seem desirable to recommend that the non-resident, prospective oil land area owners, as well as oil companies seek the cooperation of the Agricultural Extension Service in methods of controlling wind erosion on these lands in the west side area.

Agricultural Extension Service:

Inasmuch as the University of California College Agricultural Extension Service staff members have given their whole hearted support and untold time and effort to help the farmers in areas affected by high velocity winds by:

a. Quickly responding to requests for a survey and assistance in a wind protective program,
b. Making thorough studies of erosion control methods adaptable to Kern County farming conditions,
c. Supplying valuable information in the form of written suggestions to farmers for wind protective farming,
d. Furnishing men to assist and advise in practical methods of protecting land and crops from wind damage.

We recommend that the University of California and its Agricultural Extension Service staff members be complimented and thanked for their prompt help, and further be requested to continue in this work.

Weather Bureau:

The U. S. Weather Bureau located at the Kern County Airport has supplied untold valuable information to all of the agricultural industry of Kern County in its weather reports. The number of weather station locations does not seem to be adaquate to give sufficient information regarding wind and rainfall. It has been determined by the council that the U. S. Weather Bureau can handle additional weather stations provided the necessary equipment is made available to the weather bureau for its use. Therefore, we recommend that the Kern County Board of Supervisors, or some individuals or organizations provide the necessary weather instruments for the establishment of at least two additional weather stations in this county so that more accurate weather conditions can be provided the rural people.

Kern County Chamber of Commerce:

The council believes that since the Kern County Chamber of Commerce is in a position to print and publish this report, we recommend they print the same (not mimeographed) in pamphlet form including all graphs and tables, and see that the same is distributed as widely as possible throughout the county. The report should be distributed in quantities to all of Kern County's public libraries for distribution, as well as to all public schools if the cooperation of the school authorities can be secured, and we hereby request the fullest cooperation of the school authorities in the distribution of this report.

SUMMARY

The Soil Conservation Council of Kern County has studied all of the factual data compiled in this report as well as other data not compiled herewith. It has studied the conditions in Kern County. Members of the council have visited other wind erosion areas in California. We have placed in this report a large amount of factual data as well as recommendations, and in summing up this report, we feel it is important to emphasize the following points:

1. The agricultural industry in this county has developed from 181,000 acres in 1929 to 524,000 acres in 1948, and there are possibilities of developing an additional 500,000 acres of productive land in the future. The agricultural productive value has increased from $16,000,000 in 1929 to $166,000,000 in 1948. This productive value can also be materially increased in the future. Therefore, it is important that we recognize that the progress of the agricultural industry in this county must go ahead and not backwards.
2. In analyzing the methods of farming by the farmers of Kern County as compared to the methods of farming in other wind blown areas such as Cucamonga, we recognize and call to the public's attention, that the farmers of Kern County are far in advance in their methods of soil erosion control than those of like wind blown areas in other counties. We only commend the Kern County farmers to continue this excellent program.
3. The livestock industry has had one of the most severe setbacks during the past three years that it has witnessed in the past fifty years due to three consecutive dry or low rainfall years. It has caused little or no vegetation to be produced and has therefore materially reduced the income of the livestock industry due to a lack of vegetative growth on the range. At the same time it has created in some areas of Kern County a soil erosion problem that will again be controlled as soon as average or above average rainfall reoccurs.
4. All political subdivisions are faced with increased costs in order to function. Therefore, it is important that the public recognize that any and all recommendations made in this report cause additional expenditures of funds both for the individual and for the political subdivisions. We therefore urge that the public be tolerant of the conditions that exist and that all of us do our best in aiding and assisting in the control of dust regardless of where it may originate.

ACCOMPLISHMENTS

This council in its attempt to secure factual information has found that a large amount of work has already been accomplished with reference to soil erosion in Kern County. It is desirable that

the people of Kern County recognize that wind erosion is largely controlled by some form of plant growth either in the form of annual plant growth or perennial plant growth. It should also be recognized that in farming operations there is a practical time from the standpoint of crop production to perform soil conservation practices. From a financial or practical point of view, a farmer cannot be expected to continuously forego a commercial crop to plant a crop solely for the purpose of soil conservation because in the final analysis, it is the income from crops upon which the farmer must depend. We find the following accomplishments or experimental work well underway:

a. A survey of the areas has been completed with special reference to type and structure of soil that must be dealt with.
b. The approximate size of the various windblow areas has been surveyed and compiled.
c. The farmers of the Wheeler Ridge-Comanche Point area have completed approximately 100 miles of windbreak trees and are continuing to plant the same in a practical manner.
d. Interplanting of new crops with old crops is being practiced by approximately 10% of the operators in the Wheeler Ridge-Comanche Point area.
e. Tilling of the soil on the west side is one of the popular recommendations which approximately 70% of the growers are now following.
f. The trashy or stubble mulch method of preparing land for seeding is now a common practice and is being used by 70% of the farmers of this area.
g. The control of wind erosion with special reference to keeping sand dunes from occurring on highways is being dealt with in an experimental manner in several places in the west side area, including snow fences, drought resistant plants, windbreaks, and special types of furrowing.

Note: (Special mention should be made with reference to one Operator who is cooperating in an experimental manner in three different locations with the use of different types of furrows to control wind erosion and, if possible, concentrate the precipitation in the bottoms of the furrows to produce a greater amount of vegetative growth.)

h. Strip croping is being used by some growers where practical.
i. Deferred grazing is being practiced by the livestock industry. Some livestock men have gone to the extent of disposing of their entire herd because of no vegetative growth of range feed for their livestock.
j. Livestock men have planted 3500 acres of permanent pasture that provides a permanent soil cover.
k. A greater number of acres of alfalfa were planted this winter than last winter providing permanent soil cover.

l. Less than 10% as much land was leveled this winter as last winter, therefore there is less bare ground.

This council herewith submits this report to the Board of Supervisors of Kern County and to the City Council of the City of Bakersfield as well as to the Kern County Chamber of Commerce, and we cannot recommend too highly that this report be published and made available to the public of Kern County.

Respectfully submitted by the
Kern County Soil Conservation Council Members

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