Soil and moisture conservation practices in Montana
by Phillip T Allen

A THESIS Submitted to the Graduate Committee In partial fulfillment of the requirements for the Degree of Master of Science in Agricultural Economics at Montana State College
Montana State University

Abstract:
The principal purpose of this study were to determine the farmers' opinion of the conservation practices used on his farm, and the changes In farm organisation and management that resulted from the use of the practices. These conservation practices represent an effort to better adapt the agriculture in the Great Plains to the limitations of the region.

The forms studied were located in the Power-Dutton Soil conservation Service Project; and the Soil Conservation Service Project in the Froid area. Schedules were filled out by about 22 farmers in each area. The two projects were different In some respects and emphasized the necessity of careful study before a set of conservation practises should be recommended for an area.

The Power-Dutton area, located In the "Triangle", will continue to be predominately a wheat growing section, since water shortage eliminates livestock development. Since the advent of conservation programs, farmers had more generally adopted a one-half fallow-one-half crop type of rotation. The restriction In wheat acreage caused by the Agricultural Adjustment Administration program was accompanied by superior methods of production—namely, the use of more summer fallowed acres, so that the curtailment in wheat acreage could not be expected to reduce production proportionately. Farmers were using strip fallow and trashy cover to control wind erosion. Although operation costs were somewhat higher because of the stripped fields, farmers believed wind erosion was definitely curbed and crop yields stabilized.

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"Their plight has been stated in this way: east of the Mississippi civilization stood on three legs--land, water, and timber; west of the Mississippi not one but two of these legs were withdrawn--water and timber,--and civilization was left on one leg--land." 1/

1/ Webb, Walter Prescott. "The Great Plains." Houghton Mifflin Company, New York. 1936. p. 9.

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ABSTRACT

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The Froid area, in northeastern Montana, had sufficient water for livestock, and a diversified agriculture was being established. Land retired to grass was providing hay and some pasture, and feed reserves were accumulating. Stock dams were aiding in livestock production, and over one-half of the farms had increased livestock because of conservation programs.

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PART I. INTRODUCTION

The Problem

Dust storms of the past several years have focused on public attention a serious problem resulting from misuse of land. A combination of drought years and unadapted farming practices have resulted in large acreages of cropped land being severely damaged by wind erosion. 2/

It has been suggested that the soils in the Great Plains are of such a nature that growing grain will produce conditions favorable to wind and water erosion. Conservation is possible under a cover of grass, but this means low returns. The two alternatives given are grass and a low return, or grain farming and eventual soil depletion. The soils are considered as similar to a mine, which, if used, will eventually become useless. 3/

The question which is brought up is this: Are the Great Plains to be ruined by wind erosion until farmers are forced to move out, with the land finally reverting to desert? Such an occurrence would of course have tremendous social costs.

Since the time of settlement of the Great Plains, efforts have been made to adapt the agriculture to the physical limitations of the region. The problem of conservation has become more acute because of the dry years of the past decade. It is because of this fact that there have been developed

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2/ The term wind erosion refers to the loss of soil by wind action. Conservation is defined as the maintenance or the increasing of the ability of the soil to produce plant life.

3/ Cf. Wilcox, Walter W. "Economic Aspects of Soil Conservation." Journal of Political Economy. Vol. XLVI. No. 5. Oct., 1938, pp. 707-709.

in the last few years, many new practices to meet the problem of wind erosion. These practices are making changes necessary in land use and in methods of operating machinery. The development of these practices bring up many questions. Can the soil in the Great Plains be farmed in a manner that will maintain the fertility of the soil? Will these practices which have been developed be of a nature to control wind erosion and at the same time not cause sufficient increases in operating costs or losses through reduction in acreages to make their use uneconomical?

Beginning in 1935 the Soil Conservation Service 4/ of the United States Department of Agriculture has established demonstration projects in Montana to experiment with and demonstrate the use of practices and methods of farming to prevent erosion and to conserve moisture. Since 1936 the Agricultural Adjustment Administration 5/ has been making payments for certain soil conserving practices, as well as making payments for reduction in acreages of some crops. There is little doubt that these conservation programs have caused considerable changes in farm organization and management on those farms on which the programs have been in effect.

The principal purpose of this study is to determine whether these practices which are being used to conserve soil and moisture are accomplishing their objectives and whether they are acceptable and economic from the point of view of the individual farmer. How well does the farmer believe each of these practices has worked out on his farm, does he consider the practices economical, and what changes in farm organization and management

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4/ In the remainder of this study, SCS will designate the Soil Conservation Service.

5/ AAA will designate the Agricultural Adjustment Administration.

have been caused by these practices--these were the important questions to which answers were sought. The importance of the farmer's opinion can scarcely be over-emphasized since he is the one who decides whether to use, or to continue to use, the practices on his farm.

The three purposes of this study are as follows:

1. To determine the value of soil conservation practices from the point of view of the individual farmer.

2. To determine the changes in land use that have occurred on the farms studied since the establishment of the conservation programs.

3. To trace the development and to determine the extent to which conservation practices are used on the farms studied.

Method of Procedure

This study was carried out in two demonstration areas of the SCS in Montana. The two areas are the Power-Dutton area located in Teton and Cascade counties; and the Froid area located in Roosevelt County. (Refer to figure 1.)

Twenty-two farms were studied in the Power-Dutton area. Farmers cooperating with the SCS who were interviewed were those living on their farms during the period of the study and who were at home when the interviewer called. A list of farms in the area that was considered representative was made, and the list was the basis of the sample. 6/ Approximately equal

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6/ In several cases roads were blocked with snow so that a farm could not be reached, or the operator was not at home at the time of the call. In these cases, another farm was selected.

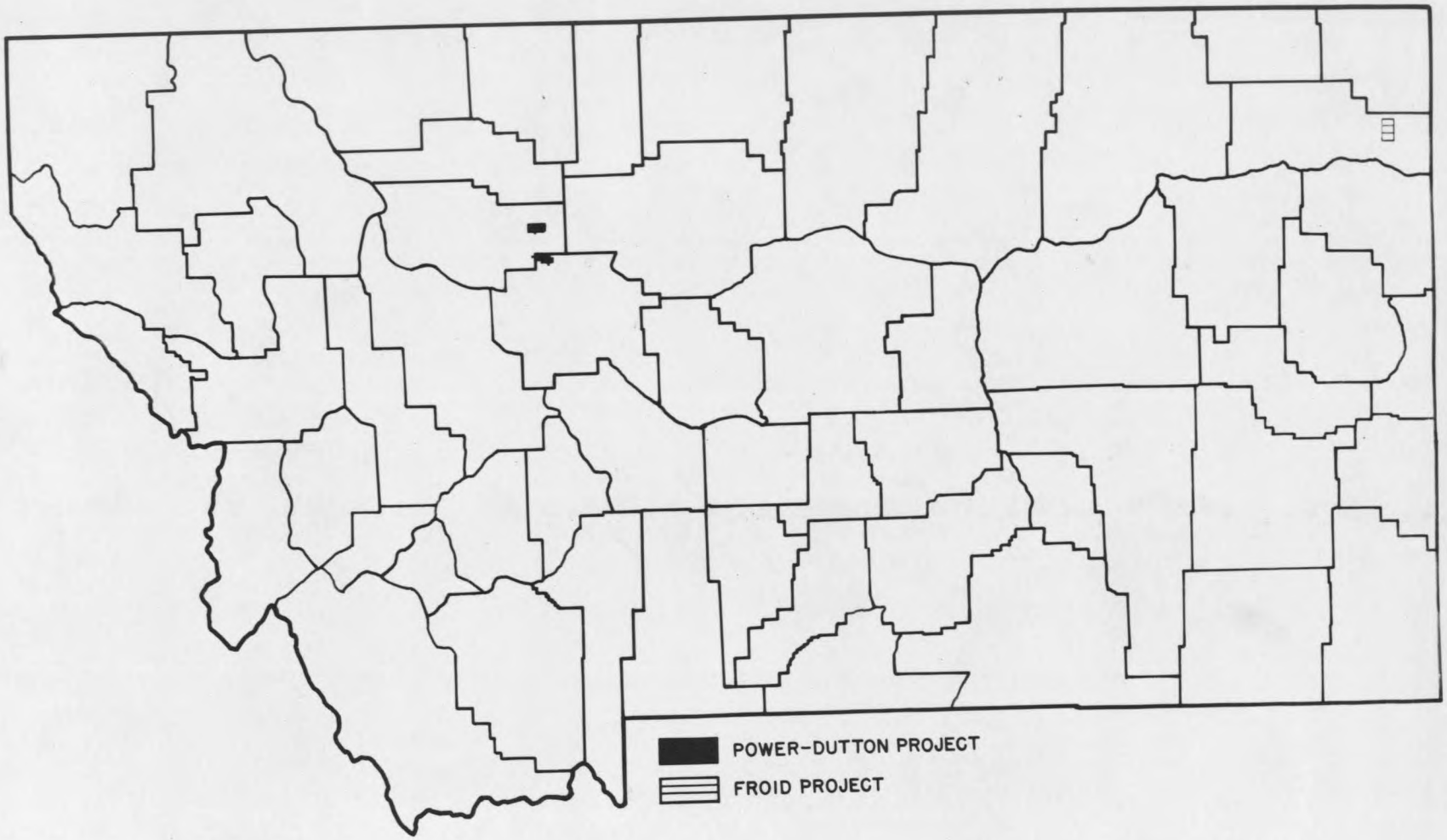

Figure 1.--Location of the Power-Dutton and the Froid Soil Conservation Service projects where this study was made.

numbers of operators were interviewed in the Power and in the Dutton areas. Seventeen operators out of 42 cooperating with the SCS were interviewed. Five out of a total of about 30 operators not cooperating with the SCS were contacted. The grouping of the 22 farms according to Government programs is shown in table I.

TABLE I.--FARMS STUDIED IN THE POWER-DUTTON AREA, JANUARY, 1940.

Program	SCS & AAA	SCS	AAA	No Program	Total
No. of Farms	15	2	3	2	22

Twenty-three farms were studied in the Froid area. Farmers cooperating with the SCS were selected on the basis of practices used and location in the area. This selection was made with the help of SCS technicians at Culbertson, the headquarters for the Froid area. Eighteen cooperators were interviewed out of a total of 45 on the project.

A selection of the operators in the area not cooperating with the SCS was made on a basis of location in the area, and an effort made to interview all those selected. Of a total of 26 operators in the area who do not cooperate with the SCS, five were interviewed.

TABLE II.--FARMS STUDIED IN THE FROID AREA, MARCH, 1940.

Program	SCS & AAA	AAA	Total
No. of farms	18	5	23

A schedule was filled out by the writer and each operator interviewed. This schedule was for the purpose of determining the farmer's opinion of the importance of erosion in the area, his opinion of the different conservation practices, and the changes in organization and management resulting from the use of these practices. A copy of the schedule is in the appendix, page 146.

Limitations of Data

The material presented in this study is largely based on farmers' opinions of practices which have been used for only a short period of time, and under adverse conditions.

The Power-Dutton Project was begun in 1935, while the Froid Project was started in the fall of 1936. Even the early cooperators had no more than three or four years to observe the results of conservation practices. For some of the practices that have been tried, no analysis can be made. It takes several years to get some practices effectively established, as, for example, field hedges.

In the Power-Dutton area, precipitation considerably below normal 1/ was received in 1936, in 1937, and in 1938. 2/ The following statements were taken from a Power-Dutton Project report. "Two years (1936-37) of the worst drought and insect pestilence experienced to date by farmers on

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1/ Normal refers to the use of the term as defined by the Weather Bureau.

2/ Refer to appendix, p. 138.

this project have largely nullified work of the Soil Conservation Service. Crested Wheat Grass has been planted for the third year. Sweet clover was seeded twice. Caragana, which started well in 1935, died because of drought and insects." 9/

In the Froid area, 1936 and 1937 were years of below normal precipitation. In 1937 "...this year was notable for the coldest winter and the driest spring in the history of the state, as well as for the most devastating drought conditions ever known in the extreme northeastern counties." 10/ The years 1938 and 1939 could not be considered normal since June rainfall in each year was nearly twice the usual June rainfall. 11/ The success shown in establishing Crested Wheat plantings in the Froid area may have been greater than would have been the case during more normal years. In 1938 precipitation in Culbertson was more than six inches above normal.

Rust and grasshoppers in the summer of 1938 largely nullified the influence of the favorable rainfall, and made impossible the evaluation of the effect on yield of soil and moisture conserving practices. 12/

In many instances persons tend to rationalize their participation in activities, and for this reason farmers' statements may be biased in

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9/ Soil Conservation Service. Power-Dutton Project (A Report). Montana No. 1. Great Falls, Montana. Typewritten. p. 4.

10/ U.S.D.A. Weather Bureau. Climatological data. 1937.

11/ Refer to appendix, p. 139.

12/ Soil Conservation Service. Culbertson, Montana. Montana Project No. 2. Region 9. "Annual Report, 1938-1939". Typewritten. p. 1.

favor of certain practices. On the other hand, some farmers are prejudiced against any change in their usual methods of operation, and their answers may not indicate the true worth of the practices.

For these reasons it is desirable that a study similar to this one be carried on for a period of years to provide adequate information of the value of soil and moisture conservation practices

A History of Soil Conserving Practices

Most of the present day conservation problems in the Great Plains developed from the use of a type of agriculture not adapted to the area. The Great Plains were different, particularly in rainfall and soils, from any other agricultural region in the country. The effort to use on the Great Plains a type of agriculture adapted to humid conditions caused many serious problems of the present. Dust storms of the last few years are an example of man's failure to adapt the type of farming to the physical characteristics of the Great Plains.

The period of heaviest settlement into the Plains region coincided with the period of highest rainfall ever recorded in the area. This high rainfall period gave rise to the belief that such an amount of moisture could be expected. A type of agriculture was established which proved to be unadapted in periods of less rainfall.

The Homestead Law did not comply with the conditions of the Great Plains because of a lack of knowledge of the new environment on the part of the lawmakers. The area of the homestead "was originally fixed at 160

acres on the theory that this area was sufficient on which to maintain a family comfortably, and in the regions where the Homestead Law first applied this was true." 13/ In the Great Plains, however, this was not the case, and homesteaders were forced to limit their holdings to an area considerably smaller than a more desirable policy would have allowed. Partly as a result of this policy the land owner farmed more intensively than was desirable from the standpoint of good land use.

The settlers brought with them to the Great Plains their ideas and farming tools developed in a different environment. Plows, disks, and harrows, all humid region tools, were brought to this new country. Disks and harrows pulverize the soil into a condition very susceptible to damage by wind erosion. Such tillage methods and farming practices arising from the use of these tools were factors in causing soil blowing and other problems of conservation.

Because of war time needs, wheat prices were high during the period of settlement of the Great Plains. The effort was made to plant the largest possible acreages of wheat in order to reap large profits. The extension of wheat growing led to the use of lands not suited to cultivation, and to poorly prepared seed beds.

The early publicity that was distributed by Governmental and private agencies was designed to draw settlers to the state. The amount of the publicity was large, and adjectives were not spared in picturing Montana as

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13/ House Report. 58th Congress, 1st and 2d Session. No. 2452. p. 2. Quoted in Hibbard, Benjamin Horace. "A History of the Public Land Policies." Peter Smith, New York. 1939. p. 392.

the land of great opportunity. An example that might be cited was the discussion at the Dry Farming Congress held in Billings in 1909. The Congress met for the purpose of discussing dry farming problems but much of the time was given to an elaboration of the agricultural possibilities of the state. "Montana...the land of opportunity...millions of acres of fertile agricultural land waiting the rough carass of the plow to transform them into productive fields." 14/ Such publicity as this caused many persons not adapted to farming to be drawn to the state. It led to a get-rich-quick psychology. It is probable that many of the settlers drawn to this new region did not intend to make a home, but came with the idea of making large profits and leaving the area. This type of settler was interested in converting the large acreages of grass into wheat. Permanent agriculture could not be established on this basis.

Because of the belief in a prosperous future as a result of high wheat yields and prices, land values rose. Borrowing was encouraged. Farmers went into debt to buy farm machinery and land to extend their farming operations. The period was one of speculation with little attention given to establishing a permanent agriculture. When the period was ended by several years of drought, farmers were considerably in debt, and many were not able to keep their holdings.

While the conditions that have been described were a reasonable development and probably justified by the lack of knowledge and other conditions

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14/ Montana Board of Control. "The Fourth Dry Farming Congress and International Dry Farming Exposition." Billings, Montana. October 25-29, 1909. p. 21.

of the time, it is nevertheless true that the problems of soil and moisture conservation of today are in a large part due to these early influences. A change to soil and moisture conserving methods of farming is difficult because it involves not only the discovery of the methods of farming, but in addition the making of these methods acceptable to the farmers through education and other means. This often means the breaking of prejudices or habits that are deeply set.

Soon after the settlement of the state, Governmental and private agencies began experiments in farming practices. Among the early publications, some space was devoted to summer fallowing. As early as 1894 summer fallowing was recommended to increase the supply of plant food, and to free the land from weeds. 15/ Mention was made of summer fallowing in later publications, being recommended as a method of holding water from one year until the next crop year.

Discussion was given to crop rotations which included alfalfa. 16/ It was believed that alfalfa or other legume could be used to replace fallow in dry land farming. Continuous cropping with wheat was believed to take phosphoric acid from the soil and crop rotations were recommended to supply the deficiency. Small farms were believed to hold the key to the State's future by permitting the settlement of a large agricultural population.

15/ Press Bulletin No. 2. Montana Agricultural Experiment Station. Bozeman, Montana. 1894.

16/ Crop rotations, of particular importance in maintaining soil fertility in regions of greater rainfall, were assumed to serve the same function here. Later, it will be observed, the value of crop rotations in dry land farming was questioned.

Some experiments were done by the Experiment Station 17/ in methods of constructing reservoirs for the dry farm. A 1904 publication mentioned water reservoirs. "A small reservoir in a small coulee afforded opportunity to illustrate the possibility and method of constructing a small farmer's reservoir to store the flood waters. 18/ Early efforts were thus made to provide a supply of water for stock and home use.

In 1903 the Experiment Station began tests to determine the type of crops and methods of cultivation best adapted to dry land farming. The importance of moisture to farming was emphasized to a large extent. A description was given of methods which were thought to prevent loss of water by evaporation. "...never for a single minute during the entire year permit the surface of a field to give off water in evaporation... keeping always on every field a dust mulch of three to four inches of loose surface soil." 19/ It was recommended to stir this dust frequently thereby preventing the formation of a crust. A soil with a dusty, pulverized surface is extremely likely to be damaged by wind erosion.

The desirability of fall plowing to keep the land in a condition to absorb water was pointed out. However, it was also noted that in a windy country fall plowing might not be advisable since the snow would often be blown away and much of the soil lost. "Under these circumstances leave

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17/ Experiment Station as used in this study refers to the Montana Agricultural Experiment Station.

18/ Bureau of Agriculture, Labor and Industry. "Ninth Report" For the year ending November 30, 1904. p. 74.

19/ Bureau of Agriculture, Labor and Industry. "Eighth Report" For the year ending November 30, 1902. Independent Publishing Co. Helena, Montana. p. 90.

all the grass and stubble possible on the land to catch and hold the snow." 20/ It should be observed that mention was made of wind damage to soil at an early date, and that the use of stubble to hold snow and protect the land from blowing was recommended.

Surface cultivation to prevent evaporation continued to be emphasized. The use of such tools as the harrow and disk was recommended to provide a dust mulch and thus prevent evaporation. "The harrow is the best implement for the conservation of moisture...the disk also is valuable in the preliminary work for forming mulches." 21/ Frequent cultivations to break crusts formed by rains continued to be suggested. Such tillage implements as the harrow and the disk tend to break up the soil aggregates and leave the soil in a condition susceptible to wind erosion.

Alfalfa was recommended to keep up the productivity of the dry land soil. "...some nitrogen gathering crop must be grown. Under a system of dry land agriculture, alfalfa is the most promising of the leguminous crops for this purpose." 22/ It had not been shown that dry land soils were depleted by cropping and that a crop rotation was necessary.

By 1910 the recommended tillage implements were, "a good mould board

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20/ Linfield, F. B. "Dry Land Farming." In the Second Annual Report of the Montana Farmers' Institute for the year ending November 30, 1903. Independent Publishing Company, Helena. p. 17.

21/ Montana Farmers' Institute. "Fifth Annual Report". Independent Publishing Co., Helena. For the year ending June 30, 1907. pp. 111-112.

22/ Linfield, F. B. "Dry Farming in Montana". Mont. Agri. Expt. Sta. Bul. 63. Bozeman, Montana. 1907. p. 31.

breaking plow adapted to the size of the area to be farmed, a disk harrow, a set of drag harrows, and a single or double disk seed drill." 23/

There were some warnings issued during this time which showed that agriculture might need adjustment. "Many hard working farmers have totally failed this year (1908) to mature crops on dry farms." 24/ The first evidence to be found that many farmers were realizing that the type of agriculture was not adapted to the area was in a publication of 1911. Many farmers were convinced of the "necessity of a different agricultural system from that in vogue in humid or semi-humid regions." 25/ It was suggested that it would be desirable to increase the size of holding from 160 acres to a half or entire section. This was a recognition of the fact that small dry land farms were not as desirable as was formerly believed.

A bulletin published in 1911 gave the results of experiments which showed summer fallowing to be more profitable than continuous cropping. 26/

Alfalfa was still recommended as necessary to improve the soil, and the Canadian Field Pea was suggested as an addition to the rotation.

Trees and shrubs were thought to be adapted to growth on dry land. "Trees and shrubs may be successfully grown on dry lands if the principles of

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23/ Atkinson, Alfred, and F. S. Cooley. "Dry Farming Practices in Montana". Mont. Agri. Expt. Sta. Cir. 3. 1910. p. 3.

24/ Bureau of Agriculture, Labor, and Industry of the State of Montana. "Eleventh Report" For the year ending November 30, 1908. p. 2.

25/ Montana Farmers' Institute. "Ninth Annual Report". For the year ending February 28, 1911. p. 5.

26/ Atkinson, Alfred and J. B. Nelson. "Dry Farming Investigations in Montana." Mont. Agri. Expt. Sta. Bul. 83. 1911. p. 184.

moisture conservation are observed and practiced." 27/ A bulletin published by the Experiment Station in 1912 described the value of trees and shrubs on the dry farm and gave methods of growing and caring for them.

The value of the dust mulch began to be questioned at this time. "The most effective soil mulch is granular rather than a fine dust. If pulverized too finely, soil runs together again and capilliary action becomes re-established or it blows away..." 28/ The cloddy mulch was beginning to be recognized as giving greater protection against wind erosion than the dust mulch. Another method suggested to prevent blowing was the use of the corrugated roller to leave the soil rough.

Alfalfa continued to be considered as necessary in the rotation, being recommended as best grown in cultivated rows in the dry area. "... every successful dry-land farmer will ultimately grow considerable of it, both for pasture and for winter feeding for all kinds of growing stock." 29/ However, a few years later some doubt was laid on the value of the crop rotation. "Either three or four year rotations containing a green manure crop have been less profitable than similar rotations where clean fallow replaced the green manuring." 30/ In some parts of the state corn received

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27/ Atkinson, Alfred, and F. S. Cooley. op. cit. p. 19.

28/ Cooley, F. S., editor. "Suggestions to the Dry Farmer". Mont. Agri. Expt. Sta. Cir. 19. 1912. p. 14.

29/ Atkinson, Alfred and M. L. Wilson. "Suggestions to Alfalfa Growers." Mont. Agri. Expt. Sta. Cir. 49. 1915. p. 23.

30/ Atkinson, Alfred, et. al. "Dry Farm Crop Rotations and Cultural Methods." Mont. Agri. Expt. Sta. Bul. 116. 1917. p. 53.

considerable attention and the use of corn to replace fallow was believed profitable in some cases. 31/

The effect of burning was discussed in a publication of 1918. "Burning straw...is a practice that should be strongly condemned. Some method should be found for getting this organic material back into the soil." 32/

The dry years of 1918 and 1919 caused more stress to be placed on livestock for the dry farm. "...another deduction from this dry period, based on the promising crop rotation, is that livestock must enter more largely into the work of the dry farm." 33/

Soil drifting was receiving considerable mention at this time. "...a serious problem on the dry-land farm and one that is likely to become more and more troublesome as time goes on is soil drifting...(it) may be materially reduced by proper methods of cultivation and cropping." 34/ In 1921 an important publication titled "The Use and Construction of Home Made Implements" discouraged the use of dust mulch since it tended to cause puddling and to prevent absorption of water. The use of the duckfoot cultivator was recommended to leave a ridged, lumpy surface, and the rod

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31/ Atkinson, Alfred, et. al. op. cit.

32/ Currier, E. L. "The Cost of Growing Wheat on Typical Non-Irrigated Areas in Montana." Mont. Agri. Expt. Sta. Bul. 122. 1918. p. 143.

33/ Mont. Agri. Expt. Sta. "Twenty-Sixth Annual Report". Year ending June 30, 1919. p. 8

34/ Mont. Agri. Expt. Sta. "Twenty-Seventh Annual Report". Year ending June 30, 1920. pp. 7-8.

weeder was described for use in light soils. Soil blowing was considered, and control suggested by keeping stubble and clods on the surface by use of the new tillage implements. Ridging the soil at right angles to the prevailing wind was recommended. The bulletin described construction of several home-made types of weeders. 35/ In a later publication the use of the harrow on soils likely to blow was discouraged and implements such as the duckfoot cultivator and rod weeder recommended to maintain a clod mulch. Ridges at right angles to the wind, 15 to 20 rods apart, continued to be mentioned for use in control of blowing. 36/ Reservoirs and dams were discussed and methods for their construction given.

The cloddy surface was recommended and the use of the spike tooth harrow discouraged in publications of 1926. The duckfoot received mention as the "outstanding tillage implement for general purposes and average Montana conditions." 37/ It was used in connection with the plowless fallow to maintain a clod mulch and to establish ridges for the lessening of soil blowing.

The 1927 results of experiments showed that plowing under green manure crops of peas and winter rye had no beneficial effect on the yield of spring wheat. Experiments also indicated that phosphorous fertilizer did not increase

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35/ Ogaard, A. J. and H. E. Murdock. "The Use and Construction of Home Made Implements". Mont. Ext. Service Bul. 47. 1921.

36/ McKee, Clyde. "Summer Tillage in Montana". Mont. Agri. Expt. Sta. Cir. 102. 1922.

37/ Ogaard, A. J. "Summer Tillage Implements". Mont. Ext. Serv. Bul. 79. 1926. p. 9.

yields. 38/ The Thirty-Fourth Annual Report of the Experiment Station also showed that turning under winter rye, field peas, sweet clover, or barnyard manure for fertilizer had not increased yields of small grains.

The burning of stubble was discussed in an Extension Bulletin published in 1929. The conclusions reached were that burning gave higher immediate yields but the ultimate effect was not known. 39/

This history of soil conserving practices has considered State and Experiment Station publications issued in Montana before 1930. It will be noted that ideas from humid regions are much in evidence. This is necessarily true when a new environment is settled. While problems of blowing were recognized in early studies, methods of preventing blowing had not been practiced to a large extent by 1930. Strip cropping had not received mention up to this time.

The need for a type of agriculture in harmony with the climate and soil conditions of the Great Plains was realized by some persons early in the century. The change in agriculture to a more adapted type was slow in developing, the development being retarded by favorable crop conditions in the years of settlement. The dry years of 1918, 1919, and 1920 were followed by the development of power farming and the introduction of implements better adapted to the Great Plains. Other developments have come since. There

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38/ Osenbrug, A. "Cultural Methods for Winter Wheat and Spring Wheat in the Judith Basin." Mont. Agri. Expt. Sta. Bul. 205. 1927. pp. 3-4.

39/ Starch, Elmer and L. D. Kurtz. "Stubble Burning". Mont. Agri. Ext. Service Bul. 99. 1929.

were, of course, many detours, some probably leading opposite to the desired direction, but this is to be expected when people come into a new and different environment.

The dry years of 1934, 1935, and 1936 brought dust storms of high intensity; soil drifted around houses and fences; and in some cases entire wheat fields were blown from the earth. Again has come the realization that if agriculture is to function under conditions of low rainfall, farming practices must be changed.

Federal Government help became more and more important as action was taken to protect farm prices, to help prevent wind and water erosion, and to encourage wise land use. Many new practices have been developed in efforts to conserve soil and moisture. Some of these practices will probably not be successful, just as earlier practices which were believed to be adapted, later proved to be unwise.

One of the purposes of this study is to consider the usefulness of practices that have been recommended in recent years.

THE POWER-DUTTON PROJECT

Description of the Area 40/

The Power-Dutton wind erosion area is located in Cascade and Teton counties near the southern tip of the portion of Montana known as the

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40/ Taken largely from: Handbook. Power-Dutton Project. Montana 1. SCS. Typewritten, 7 pp. with supplementary material.

"Triangle." The area, when laid out, was divided into two parts, the Power Project of 14,080 acres, and the Dutton Project of 17,920 acres. This division was necessary in order to include the various types of soils subject to wind erosion in this section of the state. The Power Project begins east of the town of Power; the Dutton Project is immediately east of the town of Dutton.

Physical Characteristics

Rainfall.--The climate for this part of the State is described as semi-arid with low rainfall. 41/ The mean precipitation for Great Falls, 18 miles southeast of the project, from 1892 to 1930, was 15.41 inches, nearly 55 per cent or 8.37 inches of which comes in the four months of May, June, July, and August. 42/ Observations of the SCS technicians indicate that the precipitation on the project is about two inches under that of Great Falls. 43/ It is probable that the rainfall at Choteau, Montana, 22 miles west of the project in Cascade County would more nearly approach that on the project. The mean precipitation for Choteau from 1890 to 1930 was 13.48 inches of which approximately 58 per cent or 7.80 inches

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41/ "Semi-arid means that half of the years are dry and the other half are wet, rather than that there is fifteen inches of rainfall every year as over against thirty inches in humid areas. Furthermore, the wet and dry years do not come in series nor alternately, but are unpredictable in their succession." From Starch, E. A. "Type of Farming Modifications Needed in the Great Plains." Journal of Farm Economics. Vol. XXI, No. 1. February 1939. p. 114.

42/ Climatic Summary of the United States. U.S.D.A. Weather Bureau. Section 8. North Central Montana. Date to 1930. p. 12.

43/ Compare the table on the following page, table III, with appendix, p. 138.

fell during the four months of May, June, July, and August. 44/ June is the month of highest rainfall. Precipitation for the last ten years is shown in table III for Great Falls, Montana.

TABLE III. PRECIPITATION AT GREAT FALLS, MONTANA, 1930 TO 1939

	Years									
	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939
Precip-itation in inches	11.61	11.24	19.38	16.25	14.03	7.45	9.16	9.66	14.44	9.87

The year the project was started, 1935, it will be noted was a year of extremely low rainfall.

The lowest precipitation ever recorded in Great Falls was 6.68 inches in 1904. The year of highest precipitation was in 1917 with 22.38 inches recorded. These figures illustrate well the extreme variations in rainfall which are characteristic of the Great Plains. This fact is of special importance since the average amount of moisture is small.

The method in which rainfall comes may be, depending on slope and soil conditions, of importance in making control of runoff and water erosion necessary. "Sixty-five to seventy-five per cent of the total annual rainfall is received largely in small local torrential showers, and in the more rolling sections the runoff is large." 45/ The records on the project seem to

44/ Climatic Summary of the United States. loc. cit. p. 10.

45/ Gieseker, L. F. "Soils of Teton County." Mont. Agri. Expt. Sta. Bul. 332. 1937. p. 18.

show that rainfall does not come in the form of cloudbursts which is explained by the fact that the area is located immediately east of the Rocky Mountains. 46/

In summary, the rainfall is small in amount, with a favorable seasonal distribution, and extremes in moisture may be expected from year to year.

Temperature.--The temperature factors considered in this study are the length of the growing season, the average summer and winter temperatures, and the temperature extremes.

The average frost free period for Great Falls for 40 years of records ending in 1930 was 136 days. 47/ It is probable that the Power-Dutton growing season more nearly approximates that of Choteau with an average of 110 days. 48/

The average annual temperature, average winter and summer temperatures, and lowest and highest recorded temperatures are shown in Table IV. This

TABLE IV. CHARACTERISTICS OF THE TEMPERATURE AT CHOTEAU AND GREAT FALLS, MONTANA

Location	Average Annual	Average Winter	Average Summer	Absolute Maximum	Absolute Minimum
Choteau	42.7	22.6	62.6	101	-42
Great Falls	44.4	25.5	65.7	106	-44

Source: Gieseker, L. F. "Soils of Teton County" op. cit. p. 15, and Gieseker, L. F. "Soils of Cascade County". Mont. Agri. Expt. Sta. Bul. 337. 1937. p. 17

46/ Power-Dutton Project. Montana No. 1. SCS. Great Falls, Montana. Typewritten. p. 2.

47/ Reitz, L. P. "Crop Regions in Montana as Related to Environmental Factors". Mont. Agri. Expt. Sta. Bul. 340. 1937. Chart 2, p. 81.

48/ Ibid. (For 24 years ending in 1930.)

table shows that extremes in temperatures are great, that winter temperatures are low, and that summer temperatures are quite high.

Chinook winds sometimes occur in the area.

Wind.--Winds of sufficient strength to cause soil damage have been experienced in the area. High wind velocities are a general characteristic of the Plains region. "In no other section of the interior of the United States are prevailing wind velocities as high as in the Great Plains...this high rate of air movement increases evaporation, intensified drought caused by rainfall deficiencies and high temperatures, and promotes dust blowing on cultivated fields." 49/

Topography. The topography of the Power Project is level to slightly rolling. Slopes are long and gradual. Slopes of cultivated land run from less than one per cent, to six per cent, with only a few locations sloping as much as 12 per cent. Eighty per cent of all cultivated land is on slopes of less than three per cent.

The Dutton area is more sloping than the Power area, being described as rolling. Cultivated slopes run from one per cent to 10 per cent. Slopes are short with 80 per cent of the cultivated land on slopes of less than five per cent. Since slopes are not steep and the rainfall does not come in the form of torrential showers, water erosion is not an important problem on the project.

Soils.--The soils of the Power Project consist largely of Morton loams and Morton silt loams with some Pierre clay loams, and Marias clay

49/ Report of the Great Plains Committee. "The Future of the Great Plains." U.S. Govt. Printing Office, Washington, D. C. 1936. p. 32.

loams. The soils of the Morton series overlie sandstones and shales. Drainage is good, water holding capacity is high, and these soils are adapted to raising small grains.

The Marias series is a heavy soil, which, when drying during the winter, frequently breaks into small granules and is susceptible to blowing. The Pierre clay loams are also heavy soils, difficult to work, and usually not farmed.

Soils in the Dutton Project consist largely of the Scobey series, including loams, silt loams, and silty clay loams. The Scobey series developed on glaciated material. This series consists of dark colored soils, one of the most productive soils for wheat in Teton County. The soils have good water holding capacity, and are of favorable tilth.

Generally speaking, the soils in the Power area are shallower and less productive than those in the Dutton area.

The soils of the Power-Dutton project are productive for raising wheat. The characteristics of these soils, especially when the soils are not correctly handled, make them susceptible to considerable erosion by wind. If correctly worked, and with sufficient rainfall, these soils will usually produce a cloddy mulch resistant to blowing.

Economic Characteristics of the Area

The average size of farm on the project is something over 600 acres, though definite data are not available. Approximately one-half of the operators own their farms, the remainder being tenants.

Income from crops constitutes the principal source of income for the operators. "Wheat is the most important crop and provides 95 per cent to 99 per cent of the farm income." 50/ Especially high quality, high protein wheat is raised in the area. At least one year the best wheat in the world was grown near Dutton. Wheat is the principal crop produced, spring wheat being grown most commonly for the last few years due to lack of protection for the soil during the winter months if winter wheat is grown. At the time the project was started about 15 per cent of the cultivated land was planted to mustard, most of the remainder being in wheat. Only a very small acreage of feed crops was produced.

Land use for the 32,000 acres in the entire project is shown in table V below. These figures are for the time the project was started.

TABLE V. LAND USE ON THE POWER-DUTTON PROJECT, 1935. a/

Area	Cultivated land	Grass	Total
Power	13,580	500	14,080
Dutton	15,920	2,000	17,920
Total	29,500	2,500	32,000

a/ Source: Handbook. Loc. Cit.

The farming system is usually one-half fallow and one-half crop. Farmers in the area, generally speaking, are well supplied with modern

50/ Summary. Project Analysis. Power-Dutton Project. Montana 1. Region 9. SCS. p. 2.

tillage equipment. Practically all farming is done with tractors, most farms being equipped with tractors, duckfoot cultivators, and other adapted equipment.

The amount of livestock in the area is small and lack of water apparently eliminates the possibility of much future development. "This part of the state is peculiar in that there is no ground water. Farmers haul water for domestic and livestock use from an artesian well in the Sun River Valley drilled by the Northern Pacific Railroad. (Another well has recently been secured north of Dutton.) This precludes the use of livestock in developing a program. There is no use for grass. Row crops cannot be grown successfully." 51/

Wheat yields per seeded acre in Teton County for the period 1919 to 1934 were 15.12 bushels; the figure for Cascade County for the same period was 11.98 bushels. 52/

In summarization, one-half of the farmers are tenants, the principal source of income is crops, and the principal crop is wheat. Incomes of farmers in the area are high compared to other dry land areas in the state. There is little livestock on the farms, and probably the area will continue to be predominately a wheat growing section. The problem then is to find the most economical method of growing wheat and to conserve the soil at the same time.

51/ Power-Dutton Project. Montana No. 1. Handbook. Loc. Cit. p. 3.

52/ Starch, E. A. "Readjusting Montana's Agriculture. VII. Montana's Dry-Land Agriculture". Mont. Agri. Expt. Sta. Bul. 318. 1936. Table 2, p. 8. (From AAA data.)

Work Program of the Power-Dutton Area 53/

The location for the project was decided by the SCS, the Extension Agronomist, and the staff members of the Montana Experiment Station. Among the reasons given for the selection of this area were the following:

1. Wind erosion had just begun to be a serious problem.

2. The proposed project was the best dry land wheat area in the United States.

3. The farmers on the project were not on relief and, therefore, were in a position to carry on cooperative relationships to the best advantage.

The Power-Dutton project was believed to represent a variety of soil and topographic conditions characteristic of some five or six million acres of good wheat producing land. 54/

The principal attention in the Power-Dutton area was on the establishment of straight line strips of crop alternating with fallow in a direction perpendicular to the prevailing wind. 55/ The strips were not to exceed 20 rods in width, and a considerable portion of the strips were laid out narrower.

Attention was also directed to the maintenance of a trashy cover

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53/ Taken quite largely from Power-Dutton Project. Montana No. 1. Region 9. Great Falls, Montana. SCS Typewritten. 5 pp with attached charts.

54/ Summary. Project Analysis. Power-Dutton Project. Montana-1. Region 9. Typewritten. p. 1.

55/ The prevailing wind in this area is from the southwest.

and clod mulch to be used in connection with stripping to reduce wind erosion and to conserve moisture. The ground was to be stirred the minimum amount necessary to control weeds and to reduce soil blowing. The disk and the harrow were not to be used, and the burning of stubble was prohibited. Experiments in rotations for dry land farming were to be carried out.

In a further effort to reduce wind erosion, experiments were to be made with five rod windbreaks planted on the west side of the farms. Caraganas in rows 20 rods apart were to be established north and south between the strips. Stock dams were to be built on some farms.

Soil drifts were to be smoothed down to make seeding possible. Contour stripping was to be experimented with in some cases, though terracing was not believed necessary on the project. Contour furrows were to be established on pasture lands. 56/

General Consideration of Erosion in the Power-Dutton Area

The farmers' opinion of the seriousness of erosion is an important factor in determining whether farmers will use practices to control erosion. If the farmer believes soil losses on his farm are important, and that these losses are having a deleterious effect on crop yields and on land values, the farmer is likely to adopt measures to prevent the soil losses.

Most of the farmers in the group interviewed believed erosion was a serious problem. Of the group of 22 interviewed, only four operators stated that erosion was not a serious problem on their farms.

56/ Refer to the appendix, p. 140, for a complete list of SCS accomplishments to date.

The group was practically unanimous in their belief that wind erosion was their serious problem. Only one operator believed water erosion was a problem. The group as a whole believed the land was sufficiently level and rainfall low enough to minimize the water erosion hazard.

Damage from wind erosion was a large problem in the area. Several operators spoke of dust storms of such intensity that it was impossible to see more than a few feet. Some had observed gravel spots beginning to show in the fields where damage had been severe.

Farmers' replied to the question, do you think much soil has been lost from your farm? are shown below:

Reply	Yes	No	No reply	Total replies
No. of ans.	13	6	3	22

The majority of the group was of the opinion that a considerable amount of soil had been blown from their farms. Farmers had observed soil drifts piled around fences and buildings, severe dust storms, and gravel spots in fields to justify this conclusion.

Farmers stated that soil blowing has been in evidence for a considerable length of time. One member of the group interviewed said he had noticed blowing on his farm as early as 1914, while over one-half of the group had seen soil blowing before 1925. The data indicated that some wind erosion has been occurring in the area for many years. Some of the farmers were of the opinion that soil blowing began after the plant fibers were worked out of the soil. Wind erosion was not evident when