ABSTRACT OF THESIS

by

William L. Friesen

DEMONSTRATION FARMS AND AGRICULTURAL EDUCATION

ABSTRACT OF THESIS

The problem of soil erosion is international in importance. Great nations have deteriorated as a result of the loss of soil and soil fertility. The collapse of the ancient Mayan civilization, and the difficult situation that China is facing, are but two of the many examples that may be cited.

History of Kansas agriculture follows the same trend as that of other states and nations. Lands that were too steep, too shallow, or too sandy for safe cultivation without serious depletion and erosion, were plowed and have been cultivated for some time, but many of these lands do not now yield profitable returns.

The writer, for some time, has been aware of the need for developing a management and teaching program in soil and water conservation at Bethel College, North Newton, Kansas. This interest led to a study of the problem during the winter and spring of 1947-48.

The problem

How shall the Bethel College farms be managed, so that they will serve as demonstration farms for teaching soil and water conservation?

Problem analysis.--Answers to the following questions have been sought for a solution to the problem:

1. How is the land of these farms used at present?
2. What land types are found on each of the various farms?
3. What soil erosion is taking place?
4. What land capability classes are found on each of these farms?
5. What practices can be recommended that will help to conserve soil and water in the area where these farms are located?

Methods and procedure

Five farms owned by Bethel College, North Newton, Kansas, typical of the farms in the area surrounding Newton, were selected for use in this study. The present use of the land of these farms was determined from field observations and personal interviews with the tenants operating these farms. The data for each farm were recorded on an aerial photograph of that farm.

With the assistance of soil technicians, the land of these farms was carefully surveyed as to the kind of soil, the parent materials from which they had developed, the percent of slope for a given area, and the amount of soil loss as a result of erosion. These data were re-

corded on aerial photographs in terms of composite symbols. The symbols used conform to the standards determined by the Soil Conservation Service. Areas of land were delineated and individually described upon the basis of the four factors named above.

Each delineated area of land was then classified upon the basis of the climate of the area, what the land can do, and what it needs.

Findings

For the sake of clarity and understanding, a short summary of the findings concerning each farm is presented.

Campus farm.--Most of the land of the west half of this farm was designated as class II land. However, a small tract of land adjoining the north boundary was designated as class III land. The area along the creek near the east boundary was found to be class VI land.

The east half of this farm had a small tract of land designated as class VI, and a small tract designated as class IV. Most of the land, however, was designated as class III. The class VI land was in pasture, and the remainder of it in cropland.

Kirkpatrick farm.--Land capability classes II, III, and VI were designated on this farm. The class VI land was in pasture, as was part of the class III land.

The rest of the land was used as cropland with most of it in wheat.

Becker farm.--This farm comprising about 200 acres had over 70 acres of pasture. An intermittent stream crossed almost the entire length of the farm. A large amount of topsoil had been lost as a result of erosion. Land capability classes III, IV, and VI were identified.

Kirschner farm.--More class II land was found on this farm than on any of the other four farms. Consequently, this farm presented less of a problem, as far as soil and water conservation were concerned, than any of the other farms that were included in this study. This was the only one of the five farms with some class V land. There was also a small amount of class IV land.

Kliewer farm.--Most of the land of this farm was designated as class III. However, there was also some class II and some class IV land. Of the 240 acres in this farm, about 40 acres were in pasture. Wheat was the major cash crop.

The findings revealed by the field surveys of the five farms can be further summarized as follows:

1. All five farms had lost an appreciable amount of soil as a result of erosion.
2. Some areas of land were being cultivated that were eroding badly.

3. Much of the land of these farms had a clay-pan subsoil which contributed to the erosion of the topsoil.
4. Very few acres of land on these farms were producing legume crops.
5. Tenants of these five farms had made very few provisions for conserving soil and water.
6. The following five classes of land were identified: II, III, IV, V, and VI.
7. No class I land was identified.

Recommendations

An analysis of the findings together with a review of literature in Chapter II sustain the following recommendations:

1. Class II land should be contour tilled and fertilized where necessary, pending further study. Crop residues should not be burned and legume crops should be a part of the planned crop rotation.
2. Class III land should receive the same treatment as class II land, but in addition, it should be terraced.
3. Class IV land should be used only for occasional or limited cultivation. Grasses should generally be sown on this kind of land.

4. Class V land should not be cultivated. It may be used for pasture, meadow, or woodland.

5. Class VI land is not suitable for cultivation, but may be used for pasture, meadow, or woodland. Care should be exercised in making certain that it is not overgrazed.

Recommendations for future land use were made upon the basis of the above land-capability classifications and upon the basis of the economic needs of Bethel College and its farms. If these recommendations are carried out, the farms should become excellent demonstrations for use in teaching soil and water conservation.

T H E S I S

DEMONSTRATION FARMS AND AGRICULTURAL EDUCATION

Submitted by

Wm. L. Friesen

In partial fulfillment of the requirements

for the Degree of Master of Education

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COLORADO AGRICULTURAL AND MECHANICAL COLLEGE

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I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY WM. L. FRIESEN

ENTITLED DEMONSTRATION FARMS AND AGRICULTURAL EDUCATION

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INTRODUCTION

The value of the soil as a life giving natural resource is being recognized more and more, not only by those actively engaged in the tillage of the soil, by educators, business men, and public officials, but by the general public and by society as a whole. Nor is this true only in the United States. Great Britain's recent inauguration of a plan and law whereby farm land may be confiscated, when improperly cared for, is an indication of the realization of one foreign country that farm land is a source of present and future livelihood.

The rise and fall of past civilizations may often be closely associated with the agricultural productivity that nurtured them. Perhaps the outstanding example of this is the ancient Mayan civilization which once flourished in Central America.

Nature provides for the conservation of soil and water, and man might well learn from her the secrets of this plan. Too often, however, the farmer exploits the land with utter disregard for nature's method of conserving it, only to find out too late that the soil is

gone. As long as there were new frontiers to which farmers could move, where they could find virgin soils to till, there seemed little immediate need for special care to conserve the soil. With the last land frontier gone in the United States, we must become more and more aware of the deplorable condition of the land in areas where it is seriously eroded, and begin to safeguard those soils which are still relatively fertile and productive. Moreover, any method used to keep the soil from washing away will keep the water where it falls and thus increase crop yields.

History of Kansas agriculture follows the same trend as that of other states and other nations. Land resources seemed to be unlimited and the native sod was broken without thought of the future. Lands too shallow, too sandy, or too steep for safe cultivation without serious depletion were broken and cultivated until their producing capacity naturally declined. Some of these depleted lands are still under cultivation, but do not yield profitable returns. Others have been sown to grass pasture, and still others have been abandoned and left for nature to provide a protective cover. Much of Central Kansas is so well adapted to wheat and other small grain crops that farmers have too often sown wheat on the same piece of land year after year until the soil has become very much depleted in certain essential elements.

Mechanization in farming has certainly contributed to the depletion of Kansas soils. During and shortly after World War I, much land, especially in the western part of the state, was brought under the plow that during the early thirties contributed to the immense dust bowls of that time. With the increase in rainfall, the demands of World War II, and the use of more efficient power equipment, even more land in that area has been brought under cultivation. Farmers with the latest equipment can cultivate far more land than formerly. Many of these large-scale operators live in town during the winter months and their only interest is growing more wheat. They have no livestock which would contribute fertility to the soil. Nor do these farmers follow a crop rotation program which would help to conserve the soil.

It is a well-recognized fact that a good program of soil and water conservation will increase the present and future productivity of the land. If we manage our farms properly, we will not be robbing the future generations of a means for providing their livelihood.

Planning a program of soil management, of course, is a problem for the soil technician, but he cannot help a farmer plan a farming program in soil conservation until that farmer seeks his services. Proving to farmers the need for improved conservation practices is often the task of the man who specializes in agricultural education, be

he county extension agent or an instructor of vocational agriculture in some high school.

Farmers generally are slow to accept recommendations regarding new methods in farming procedures, but once they see the practical value of some new method or idea on a neighbor's farm, it will become highly endorsed and will be used on their own farms. The writer then, with the facilities of some demonstration farms at hand, can use these farms as aids in teaching tenants on Bethel College farms, and other farmers, the value of improved practices in soil and water conservation.

This possibility then, presents the following problem:

The problem

How shall the Bethel College farms be managed so that they will serve as demonstration farms for teaching soil and water conservation?

Problem analysis.--The following sub-questions will aid in answering the problem question:

1. How is the land of these farms used at present?
2. What land types are found on each of the various farms?
3. What soil erosion is taking place?

4. What land capability classes are found on each of these farms?
5. What practices can be recommended that will help to conserve soil and water in the area where these farms are located?

Delimitations.--This study has been limited to five farms owned by Bethel College, North Newton, Kansas. North Newton is located in central Kansas, about one mile north of Newton, Kansas.

Definitions.--Land types. A group of soils closely related in surface and subsoil characteristics, depth, position, color, and general mode of development.

Land capability.--A term used in describing (1) the suitability of land for cropping or other use, and (2) the degree or intensity of special practices required for such use.

The setting for the study

The writer is employed by Bethel College, North Newton, Kansas, as Farms Manager and Instructor in agriculture. Most of this school's endowment money is invested in farm land. All of this land is located in central Kansas in the following five counties: Butler, Harvey, Marion, McPherson, and Sedgewick.

Chapter II

REVIEW OF LITERATURE

Part of the solution to the problem being dealt with in this study can undoubtedly come from a review of literature. Some of the reviews, although not related directly to the study, are included since the information in these articles served as an aid in forming a foundation for the study.

Education plays a very important role in soil and water conservation. Very little has been published, however, regarding the use of farms themselves in demonstrating various farm practices, especially those practices which deal with soil and water conservation.

Farms as teaching aids

H. M. Wilson (11), in his special study in 1939, surveyed five typical farms near Forest Lake, Minnesota, as to soil erosion and its control. Soils maps of the five farms were made, information assembled, and plans for equipment and procedures for class use were formulated and used in the local agriculture classes.

R. A. Benton (1), in 1940, surveyed the soil types and soil conditions on 20 well-distributed farms

within the patronage area of Malvern High School in Iowa. An extended study of ownership, cropping history, and weather bureau records was made. Approved practices recommended by the federal soil and moisture technicians were listed. A series of problems and lessons for a high school unit in soil conservation was set up. Each lesson was based on need for instruction as shown by the land survey.

That it is possible to use the land itself as a teaching aid is indicated in an article written by Burdett (2) entitled "Classrooms Expand in Alabama." In this article the following was said:

> On the rolling red hills of Clay County, 40 Alabama teachers and school officials last summer found a new textbook - the land itself. By now the group of 40 has grown to 820, all of them teaching right out on the land the way to a better living through the wiser use of soil and water.
>
> It now looks as if every Alabama school one day will be carrying soil conservation to its students without adding a single new course to the already crowded curriculum. Instead better land use and soil conservation methods will be established as an integral part of the other courses. (12:160-161)

Perhaps no better example of the use of farms as "demonstration farms" can be found than is indicated by Johnson (6), who wrote in the April, 1947 issue of the Agricultural Education Magazine, an article, "School Farms and Plots in the Pacific Region." A part of the article reads as follows:

> Approximately 40% of the departments of vocational agriculture in the Pacific Region operate and manage land or some other major instructional device as a department or F.F.A. chapter educational activity. (6:67)

The above author lists the following as one of the purposes of school farms:

> To assist in demonstrating and determining the feasibility of new and improved farm practices in the enterprises of the community. When developing a testing program for observation purposes, plans for the project should be carefully worked out with colleges and experiment stations. (6:68)

Conserving soil and water

Not many writers have formulated a complete plan regarding the management of a farm for the purpose of conserving soil and water. There are many articles in magazines and elsewhere dealing with certain aspects of the problem of soil and water conservation, but it is hardly necessary or possible to review all of this literature in a study of this kind.

Perhaps the most outstanding publication concerning a planned program for conserving farm lands is that published cooperatively by the United States Department of the Interior, Office of Education and the United States Department of Agriculture, Soil Conservation Service. This publication entitled "Conserving Farm Lands", was prepared by Dale and Ross (3), and published in 1939. By way of introduction they said in part,

> Each of the 6,500,000 farms in the United States is a unit with distinctive differences and specific problems of its own. A practical soil conservation program must, of necessity, be based upon existing conditions which involve primarily the land, the people, and the climate. Each tract or parcel of land has certain characteristics. A sound program of soil conservation must provide for the use and management of each tract of land according to its adaptabilities and capabilities. If, however, the program is to be feasible it must also meet the economic and social demands of the farm of which the tract is a part and of the farmer who operates the farm. (3:1)

They further stated that,

> Most farmers and landowners, given a limited amount of guidance, are prepared and qualified to institute the conservation measures needed on their farms. They are usually not sufficiently informed, however, on recent developments in techniques to evaluate properly all factors concerned in planning the conservation practices and devices to be carried out on a given tract of land. Also lacking in many instances is the ability on the part of farmers and landowners to visualize and formulate a completely coordinated program for the farm as a whole. (3:2)

The above publication includes: (1) analyses of the training content on type jobs involved in planning a soil conservation program for a farm; (2) statements of interpretive science and related information of importance in connection with the jobs; (3) illustrations; (4) definitions of soil conservation terms; and (5) lists of references and visual materials. This publication then, presents a complete plan for the proper analysis of a farm concerning soil and water conservation.

One of the outstanding reports of the Soil

Conservation Service of the United States Department of Agriculture in regard to soil and water conservation planning is that written by Mortlock (7), in telling about the Box Elder Creek Project of Nebraska. This report was published in September 1941. Part of this report reads as follows:

> A detailed soil conservation survey was made in 1935 and 1936 covering the Box Elder Creek project, an area of 15,331 acres, just west of Millard, Nebraska. The Southern boundary of the project is formed by the boundary line between Douglas and Sarpy counties. The area is 6 miles across from east to west and 4 miles from north to south. It is representative of the climatic, soil, agricultural and erosion conditions along the Missouri River and its tributaries in eastern Nebraska, western Iowa, and northwestern Missouri. (7:1)

The authors further state that,

> Five classes of land according to use capability were recognized in the Box Elder project.....
>
> This classification of land according to its use capability furnishes a guide to the kind of cropping practices that may safely be followed and to the intensity and variety of the measures best suited to its protection. The selection of the crops to be grown depends on the nature of the soil, its relationship to drainage features, the rate and regularity of the slope of the land, the degree to which it has already been eroded, and the climatic factors, especially the amount, intensity, and distribution of rainfall. (7:1)

Hockensmith and Steele (4) in U.S.D.A. Farmers' Bulletin No. 1853 published in February of 1943, say the following about land use:

> Misuse of land costs money. If it makes the soil liable to erosion by water and wind, the loss is immediate and permanent although sometimes so gradual it is scarcely noticed ..... Such waste can be prevented by farming according to land capability, using practices that have been tested and proved by practical farmers and by experiment stations. (4:3)

A review of the literature on demonstration farms as teaching aids, and definite plans of procedure in analyzing farms for the purpose of soil and water conservation, brought to light the need for more study and writing on these topics.

Chapter III

METHODS AND MATERIALS

This study was undertaken to develop a plan for the management of five typical farms owned by Bethel College to serve as demonstrational units in teaching soil and water conservation. Not only are the students of the writer to benefit from these demonstrational units, but also tenants on other farm land owned by the College which is not included in this study. With such a program in conservation, the vocational agriculture instructors and county extension agents will find these farms valuable as teaching devices. It is also hoped that these farms will, in the future, serve to encourage farmers of the several adjoining communities to alter their individual farming practices in such a way as to better cope with the perplexing problem of conserving the soil and water.

In making this study, it was possible to secure substantial information concerning certain aspects of the problem through a careful review and study of available literature. This review of literature concerning the use of demonstration farms as an aid in agricultural education and the work of the Soil Conservation Service and other

agencies regarding the conservation of soil and water was presented in the previous chapter. The latter provided a basis for the techniques and procedures used in conducting this study.

The problem as previously outlined, reads as follows: How shall the Bethel College farms be managed, so that they will serve as demonstration farms for teaching soil and water conservation?

To systematically approach this study, the problem was broken down into the following secondary problems. The investigations were organized around these several problems and the analysis of findings and discussion will be segregated under the sub-divisions representing the several aspects of the problem.

Sub-questions.--1. How is the land of these farms used at present?

2. What land types are found on each of the various farms?
3. What soil erosion is taking place?
4. What land capability classes are found on each of these farms?
5. What practices can be recommended that will help to conserve soil and water in the area where these farms are located?

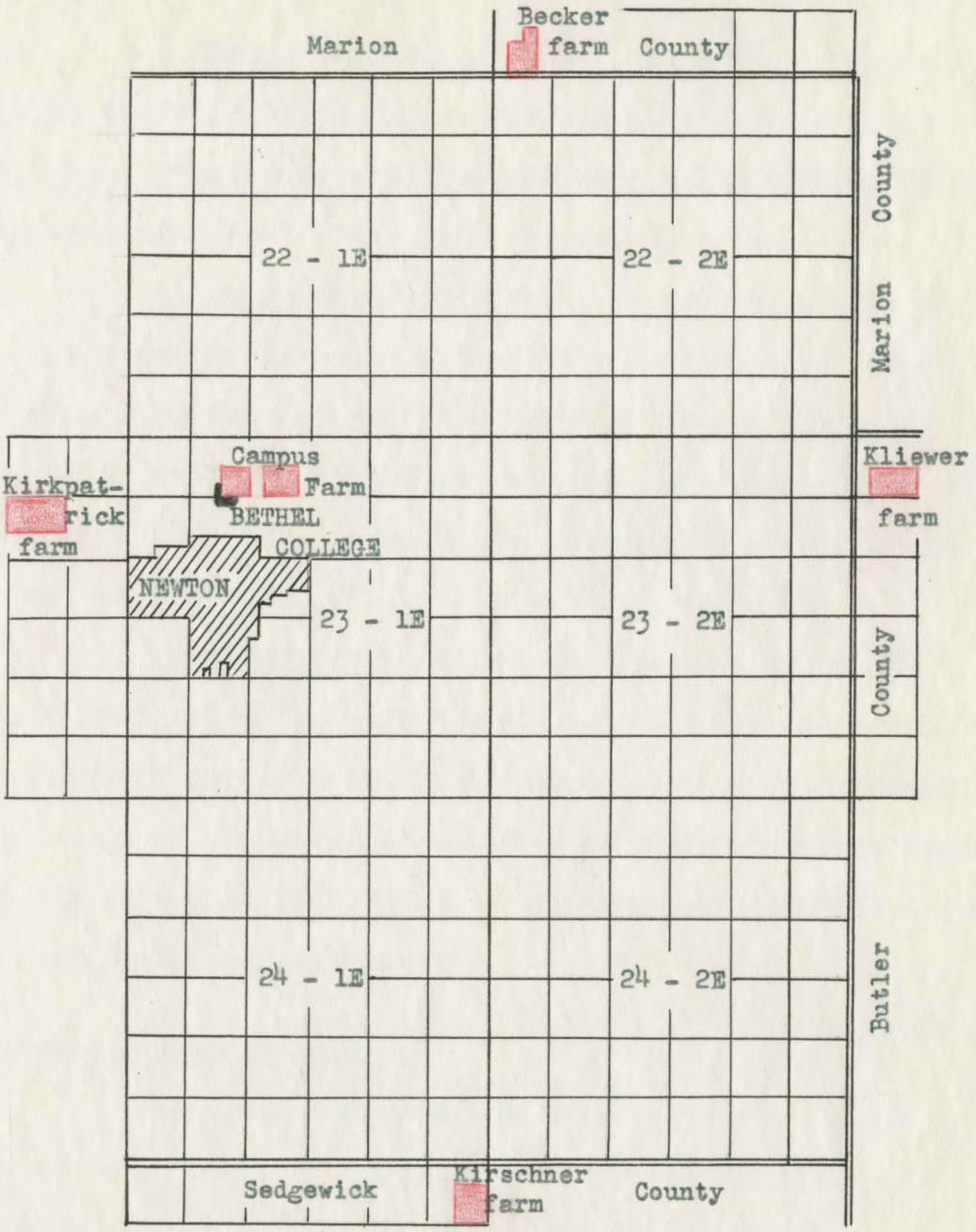
Selecting sample farms

Most of the land owned by Bethel College is located in Harvey County of Kansas. However, the College also owns at least one farm in each of the following counties: Butler, Marion, and Sedgewick. In order that this study might cover as large an area as possible, thereby introducing a greater number of soil and water conservation problems, it was decided to use one farm from each of Butler, Marion, and Sedgewick counties and two from Harvey County. All of these counties are organized into Soil Conservation Service Districts.

For the sake of convenience and simplicity, these farms carry the names in this manuscript by which they are commonly known in the local community. Figure 1 shows the location of the five farms in relation to Bethel College and Newton. A brief description of each of the five farms is given to further familiarize the reader in a general way with the study.

Campus farm.--This farm is located adjacent to the Bethel College campus about one mile north of Newton. The area of this farm is about 255 acres. It is a diversified farm with special emphasis being placed on purebred dairy cattle and hogs.

Kirkpatrick farm.--This farm is located about three miles west of the College campus. It is a diversified farm of about 320 acres. Many of its products are



MAP OF NEWTON AND ENVIRONS SHOWING
IDENTIFICATION AND LOCATION OF THE FIVE
FARMS USED IN THIS STUDY

0 2 4 6

Scale of Miles

Figure.--1

used in the College dining hall since it is so near the campus.

Becker farm.--This farm is located in Marion County about five miles east and seven miles north of the College. It is a diversified farm of about 200 acres with a substantial part of it in permanent pasture.

Kliewer farm.--This farm is in Butler County, about twelve miles east of the College. Most of the buildings have been removed from this farm. There are about 240 acres in this farm and all but about 40 acres of native pasture, is used for the production of cash grain crops, mostly wheat.

Kirschner farm.--This farm is in Sedgewick County and is twelve miles south and three miles east of the College campus. It is at present composed of about 152 acres of cropland and 8 acres of native pasture land. The buildings on this farm are in very poor condition and are now being torn down.

Techniques and procedures

The Soil Conservation Service of the United States Department of Agriculture provides farmers with technical help in solving their soil and water conservation problems wherever and whenever these farmers are organized into conservation districts. In Kansas these districts are usually county-wide organizations. Trained soil technicians work directly with the farmers in

developing plans with them for conserving soil and water on their farms. The technicians from the four counties concerned volunteered their services in assisting the writer to make a soil survey of the five farms.

The War Food Administration, Agricultural Adjustment Agency had in its files aerial photographs of all farms and farm land. Each photograph covers an entire township and is printed to a scale of eight inches equals one mile, or 160 acres in a 4 x 4 inch area. After the selection of the five farms included in this study was made, the writer obtained aerial photographs of those townships which contain the farms to be used in the study. He then photographed, with his own equipment, the five tracts from the above mentioned aerial photographs and made several prints of each farm using the same scale as the original photograph. These prints were used in the field study by the writer as a means of recording necessary information for the solution of the problem.

On one such photograph of each farm the present use of the land and other pertinent details such as fences, field boundaries, and lanes were plotted by the writer. This map was prepared to preserve the data gathered in the field for further analysis. One such map of each of the farms in chapter IV will be clearly identified later.

The writer then enlisted the help and cooperation of the Soil Conservation Service Technicians from the

counties in which the five farms are located and proceeded to make a careful survey of the soils of the five farms selected. This survey included a study of the type of soil, its origin, depth, extent of erosion, the topography, something about the cropping history of the farm, and other factors that might influence the plans for conservation farming.

These data were recorded on a second set of photographs. These photographs on which were recorded the field data, now become land capability maps and are referred to as such in the following discussions. These land capability maps show the type of soil, the kind of material from which the soil was developed, the percent of slope, the degree of erosion for each delineated area, and a capability classification for each area. All of these items except capability classification are shown in each delineated area on the capability map by a composite symbol. Each part of the composite symbol represents a particular soil characteristic. The capability classification for each delineated area is identified by a Roman numeral and designated color. The completed land capability maps also show extensive gullies, streams, the farm boundary, fences, and other pertinent details which did not appear on the original photograph.

In making the land capability maps for the five farms, a standardized legend developed for Kansas by the

Soil Conservation Service was used. The composite symbol as used by the Soil Conservation Service is arranged in the following way:

Soil Group - Dominant Parent Soil Material

Percent of Slope - Erosion Group

By the use of symbols for each of the characteristics represented in the above illustration, the soils of each of the delineated areas is described. To illustrate the application of the use of a composite symbol, let us use a hypothetical case. For instance, the symbol $\frac{5 - 0}{A - 1}$ has the following meaning:

5 - describes a deep soil (30" or deeper to partially weathered parent soil material), dark in color, and has a tight clay or clay-pan subsoil.

0 - indicates that the above soil has developed from older alluvium (sands, silts, and clays, chiefly unconsolidated) (Commonly called "plains outwash").

A - indicates that the land in the area slopes less than one percent.

1 - shows that the land has lost less than 25% of its topsoil as a result of erosion.

Any composite symbol containing other symbols than the example given above can be deciphered by the use of the Soil Conservation Service's Guide for Preparing

Soil Conservation Survey Legends in Kansas. (8)

The report of the Kansas State Board of Agriculture (9) proved very valuable in securing an over-all picture of the nature of soils, crop rotations, and soil conservation practices for Kansas. This report was used frequently in connection with the five field surveys, an analysis of the data, findings of the study, and a proposed program of conservation of soil and water.

The types of soil on each farm were determined by digging down through the soil profile with a spade or a soil auger at points on the land wherever surface characteristics indicated a variation from the previous soil profile studied. In many cases, road cuts or deep gullies had exposed the soil profile so that little digging was necessary. The extent of erosion for each area was determined by comparing the depth of the topsoil, and in some cases the depth of the subsoil, with areas found nearby which were known to have lost no soil from erosion. The percent of slope for a given area was determined by the use of an engineers' level or a hand level. Any one of the above mentioned characteristics could determine the extent of a delineated area.

Each delineated area was assigned to a land capability class on the basis of the factors represented in the composite symbol and upon a knowledge of the climate factors. Eight capability classes are recognized

in the United States by the Soil Conservation Service. All lands, therefore, in the United States may be placed in any one of the eight classes according to its capability and use. For instance, Land Capability Class II includes good land that can be cultivated safely with easily applied practices. These practices include such measures as contouring, protective cover crops, and simple water-management operations. Common requirements are crop rotations and fertilization. Moderate erosion is common. Class II land is somewhat limited in its use as compared to Class I land.

With the use of the techniques described in this chapter, data were secured for a soil survey map. The data were recorded on copies of the photographs giving a complete picture of the type of soil, parent material, slope, and erosion. The land was classified as to its capability for production and its limitations. The data on these maps will be analyzed in the next chapter.

Chapter IV

ANALYSIS OF DATA

It is the writer's purpose in this chapter to present the findings of the investigations related to this study. This will include an analysis of the survey of the five farms as to the present use of the land and an analysis of the soil surveys of each of the farms. These analysis of surveys will answer the first four of the sub-questions proposed for study in relation to the main problem. The last of the sub-questions, which involves a recommended plan for conserving soil and water on the farms studied, will be answered upon the basis of the analysis of findings and the review of literature in the following chapter.

The farms used in this study are all located in an area commonly referred to as the Claypan Section of Kansas. Deep and fertile soils are characteristic of this section wherever erosion has not been too severe. These soils absorb moisture slowly and have a high water-storage capacity. With this kind of soil, heavy rains cause much run-off and consequent erosion.

In revealing the present use of the land, the crops and their approximate acreages are given for the 1948 growing season.

The Land-Capability Classifications for the delineated areas of the farms were not determined by the writer alone. Soil Conservation Service authorities assisted in determining the proper classification for each area. The classification is quite largely determined by the kind of soil, its parent material, slope, and erosion. Climatic factors and intermittent ponds and streams have some bearing upon this classification.

For the sake of clarity and organization the findings on each farm are presented separately.

Campus farm

Present land use.--An examination of figure 2 reveals that the land of the Campus farm was used in the following manner: Alfalfa 44 acres, brome grass 5 acres, fallow 21 acres, native pasture 25 acres, rye pasture 14 acres, mixed oats and sweet clover 19 acres, and wheat 69 acres. About 5 acres were in woodland and 13 acres in the farmstead.

Soil survey.--Figure 7 reveals that most of the land of the west portion of the Campus farm is identified by the symbol $\frac{5 - 0}{A - 1}$. This symbol describes a deep soil (30) inches or deeper to partially weathered parent soil

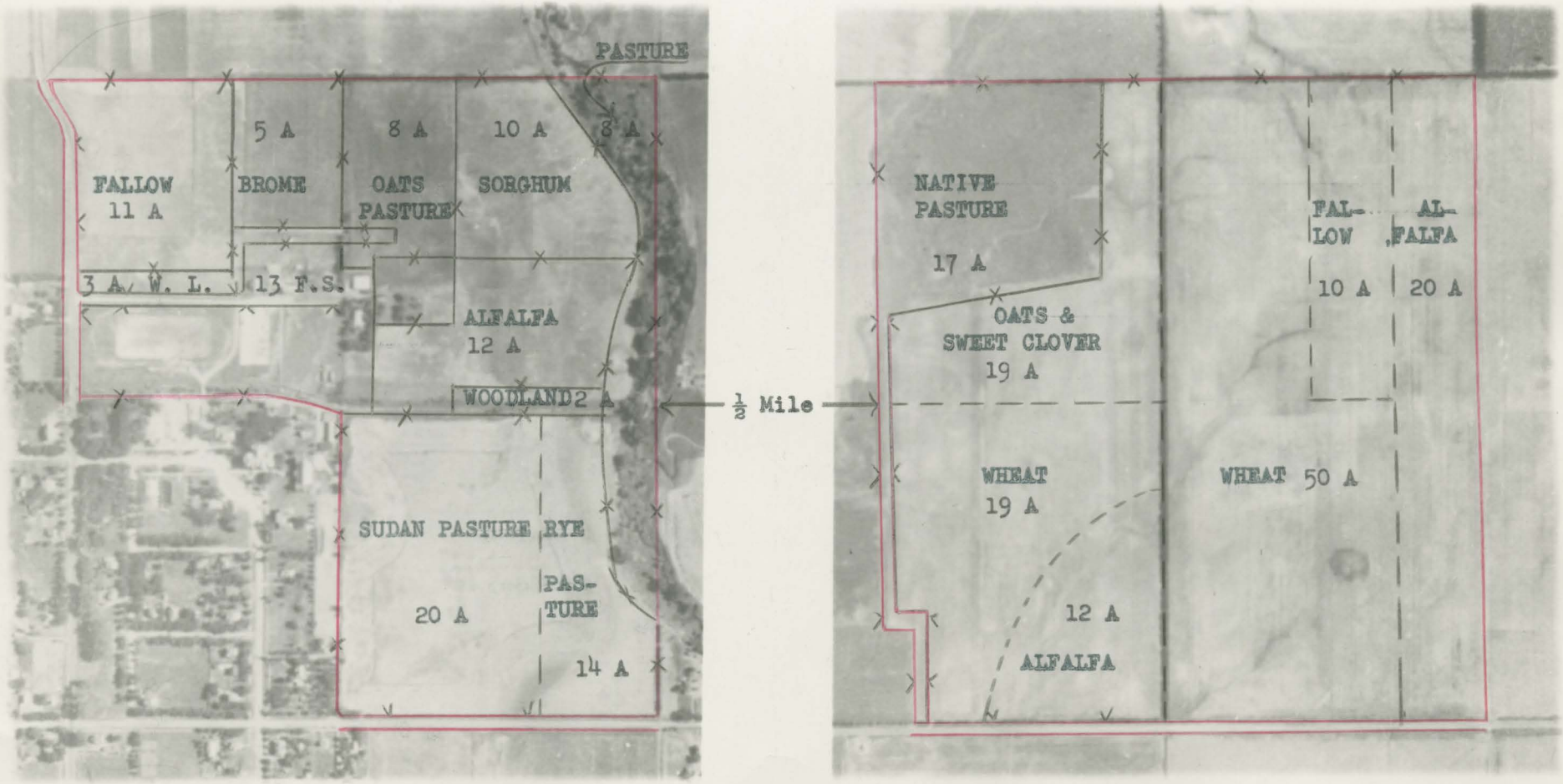


Figure 2.--Campus farm showing present land use.

Legend

Farm boundary

Fence existing

Field boundary; no fence

Fence along highway

materials), that is dark in color, has a claypan subsoil, and has developed from older alluvium. The entire area slopes less than 1 percent and has suffered a loss of less than 25 percent of its topsoil as a result of erosion. The land of this area is classified in Land-Capability Class II and is designated on the map by a yellow color.

> Class II land is suitable for permanent cultivation with simple practices. The chief types of practices needed are likely to be (1) erosion control, (2) water conservation, (3) simple drainage, (4) simple irrigation, (5) removal of stones or other obstacles, or (6) correction of moderately low fertility by fertilizers or soil amendments. The erosion-control and moisture-conservation practices most commonly used on class II land are contour tillage, strip cropping, cover crops, crop rotations that include grasses or legumes, simple terrace systems, rough tillage, stubble mulch, or basin listing. It is impossible, however, to classify these or any other single practice as simple or intensive, since the intensity or the difficulty of application may be fully as important as the nature of the practice. The application of strip cropping and suitable crop rotations may be judged a simple set of practices on a 7-percent slope and an intensive set of practices on a 12-percent slope. Terracing and establishing suitable outlets are usually considered intensive practices, but some land needing terracing is classified as II. Local determination must be made of what are simple and intensive practices, or sets of practices, and the classification that is arrived at must always be one that is practicable and useful (4:14).

The small area near the north boundary of the farm with the symbol $\frac{5 - 0}{B - 2}$, is similar to the above described area except that the slope varies between 1 and 5 percent, and from 25 to 75 percent of its topsoil has been lost as a result of erosion. Because of the greater slope

and erosion, the land is classified in class III and is designated on the map by a red color.

> Class III land is suitable for permanent cultivation with intensive practices. It is land requiring careful and intensive application of the best possible practices for soil-erosion control or soil management. The types of practices needed, some of which are the same as those for class II land, are (1) erosion control, (2) water conservation, (3) drainage, (4) intensive irrigation practices, (5) removal of especially large or numerous stones, (6) correction of low fertility by fertilizers or soil amendments. If the soil is workable and productive but on slopes so steep that erosion control is imperative, several practices will be needed. These may include long crop rotations, strip cropping in narrow strips, terraces and outlets, buffer strips, mulch, rough tillage, or basin listing. Drainage systems or irrigation systems needed may be more difficult to install or may require more active maintenance than on class II land, or the land when drained or irrigated may also require additional soil treatments to give moderate or high yields.
>
> Usually a combination of several practices is required for safe and permanent cultivation of class III land. A higher degree of skill in management is needed than on class II land. (4:18)

The narrow strip of land bordering Sand Creek on the east boundary of this portion of the farm with the symbol $\frac{82}{B-3}$, has a soil composed of mixed, generally non-arable, alluvial soils. The slope of this area varies between 2 and 6 percent, and little topsoil has been lost as a result of erosion. The land is classified as class VI land, which is designated on the map by an orange color.

> Class VI land is suitable for permanent vegetation that can be used for grazing or for woodland, with moderate restrictions. It is not suitable for cultivation. Most of it either is moderately sloping and therefore subject to water erosion or is subject to wind erosion. The restrictions commonly needed on range land are chiefly limitation of grazing to the carrying capacity, deferred grazing to permit growth of grass in the spring, and rotation of grazing to permit the grass to recover and form seed. Fencing, distribution of water ponds, salting and herding are some of the practices necessary to bring about these limitations. Contour furrows, ridges, and water spreaders may be useful to check or divert water and thereby increase the growth of grass.
>
> Land of class VI, capable of producing moderate yields of forage or of woodland products under moderate restrictions, might have the vegetation depleted by mismanagement and therefore might require severe restrictions in use for a few years to permit recovery of vegetation. An example of such temporary severe restrictions would be total exclusion of livestock from overgrazed class VI range land.
>
> Class VI land as a rule is either steeper or more subject to wind erosion than class IV land. It must not be too severely eroded, however, to prevent safe use with moderate restrictions. Not much of it is poorly drained. (4:28).

The east portion of the farm, as revealed in figure 7, is divided into five delineated areas. An area in the northwest corner of this part of the farm, identified by the composite symbol $\frac{82}{B - 3}$, is similar to the area last described and is also class VI land. Just east of this tract is an area with the symbol $\frac{25 - Sh}{B - 2}$. This soil is moderately deep, dark or very dark, with tight or moderately tight clay subsoils. The parent material is chalk and chalky shale. The slope varies from 1 to 5 percent

and the land has lost from 25 to 75 percent of its topsoil as a result of erosion. The land in this area is class III, which is designated by a red color on the map and has been described previously.

The two delineated areas described by the composite symbol $\frac{25 - Sh}{B - 3}$ are similar to the area just described, except that at least 75 percent of the topsoil has been lost as a result of erosion. Since so much of the topsoil is gone, the land is class IV and is designated by a blue color on the map.

> Class IV land is suitable for only occasional or limited cultivation. It may be steeper than class III, more severely eroded, more susceptible to erosion, more difficult to drain or irrigate, less fertile, more open and porous and so give excessive permeability, or otherwise less suitable for cultivation than class III land. It is not good land for row crops and is best used for permanent vegetation. Much class IV land in the humid regions may be cultivated occasionally by using a long rotation of a grain crop every 5 or 6 years, followed by several years of hay or pasture. More intensive cultivation is justified only if the farm does not have enough better cropland and then only for a temporary period until other adjustments can be made, or in time of emergency when a large acreage of crops is needed for a few years. Some of the nearly level imperfectly drained land classified as IV is not subject to erosion but is unsuitable for intertilled crops because of the time required for the soil to dry out in the spring and because of its low productivity when in these crops. In semi-arid regions some of the land classified as IV is suitable for cultivation that is limited to the growing of feed crops, provided not more than 320 acres is cultivated in one tract and the surrounding land remains in grass. Such land is not suitable for growing wheat but can be used effectively for livestock ranches. (4:24)

The remaining area of this part of the farm with the symbol $\frac{5 - 0}{B - 0}$ has a deep soil (30 inches or more to parent material), is dark in color, and has a tight claypan subsoil. The area slopes between 1 and 5 percent and has suffered a loss of from 25 to 75 percent of its topsoil. The land is classified as class III and is designated by a red color on the map. Class III land has been described previously.

Four classes of land were recognized on the Campus farm as revealed in the previous paragraphs. Most of the land is suitable for cultivation and may be continued as cropland. Some of the land should be seeded to pasture grasses.

Kirkpatrick farm

Present land use.-- The crops being produced by this farm during the 1948 growing season and the approximate acreages of each may be summarized as follows from figure 3: Barley 15 acres, brome grass 25 acres, oats 30 acres, rye 19 acres, sorghum 20 acres, wheat 150 acres, native pasture 56 acres, and farmstead 4 acres.

Soil survey.--An examination of figure 8 reveals that at the east end of this farm is an area of land which is designated by the symbol $\frac{5 - 0}{A - 1}$. This describes a deep soil (30 inches or deeper to partially weathered parent

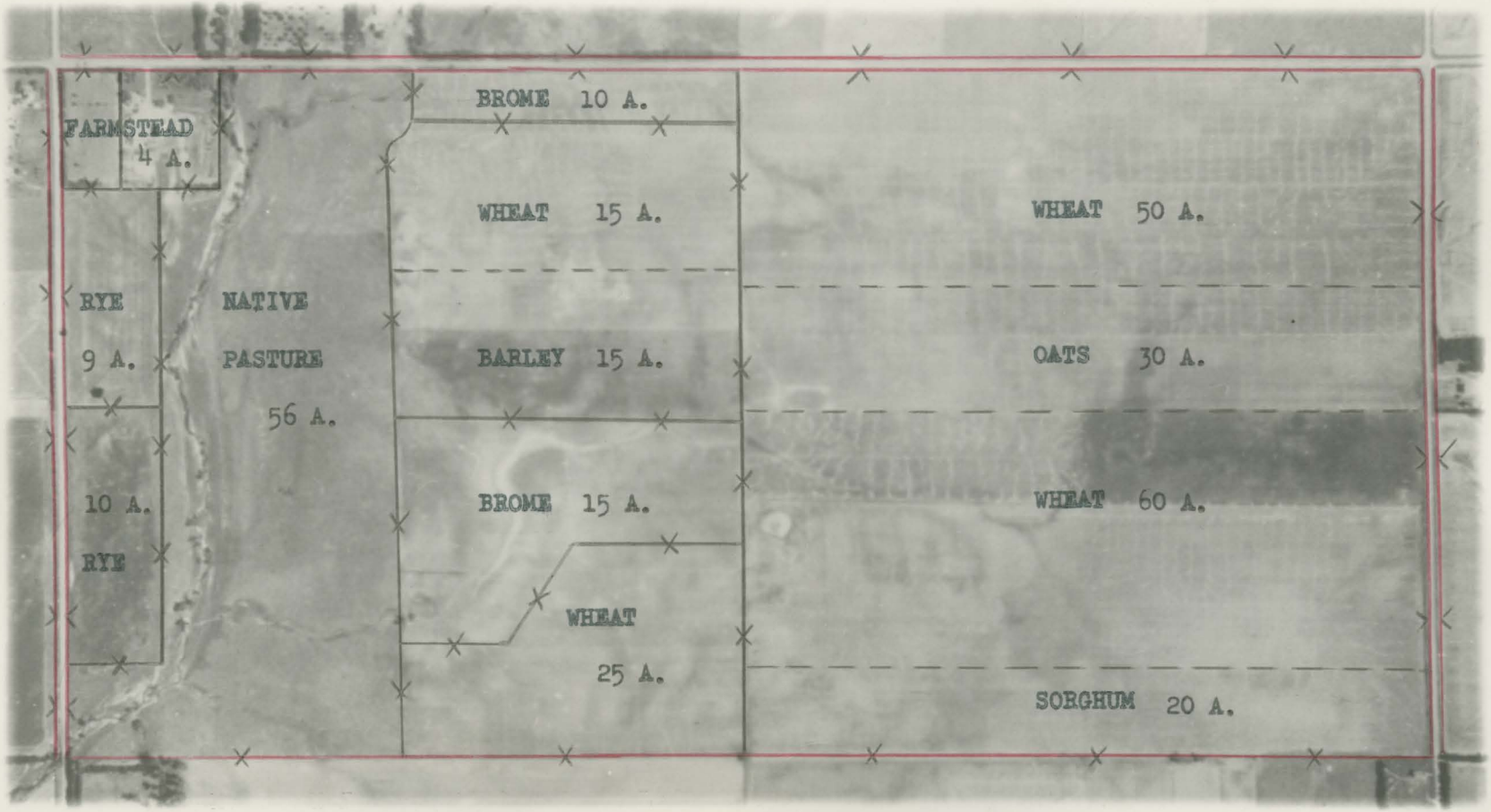


Figure 3.--Kirkpatrick farm showing present land use.

Legend

Farm boundary
Fence existing
Field boundary; no fence
Fence along highway

soil materials), one that is dark in color and has a clay-pan subsoil. It has developed from older alluvium, slopes less than 1 percent and has lost less than 25 percent of its topsoil as a result of erosion. This area was classified as class II land and is designated by a yellow color on the map. Class II has been described previously.

Next to the above described area is a large plot of land designated by the symbol $\frac{5 - 0}{B - 2}$. The land of this area is similar to that just described except that it slopes between 1 and 5 percent and has lost from 25 to 75 percent of its topsoil. Because of the greater slope and erosion evidence, this land was classified in class III.

The next delineated area, with the symbol $\frac{17 - 0}{B - 3}$, has a deep, dark reddish soil with a friable or moderately friable, silty to clayey subsoil. The slope of this area varies from 2 to 6 percent, and from 25 to 75 percent of the topsoil has been lost as a result of erosion. This is class III land and is designated by a red color on the map.

The area along the creek is designated by the symbol $\frac{82}{B - 3}$. The land is composed of mixed, generally nonarable, alluvial soils. The slope varies from 2 to 6 percent and little soil has been lost as a result of erosion. An intermittent stream crosses this area, and because of this, mainly, the land is Class VI.

The area bordering the west boundary of this

farm is designated by the symbol $\frac{17 - 0}{B - 2}$. The soils of this area are deep, dark reddish in color, friable or moderately friable, and have silty to clayey subsoils. The slope of this area varies between 2 and 6 percent, and from 25 to 75 percent of the topsoil has been lost as a result of erosion. This land is class II.

It will be observed that most of the land of the Kirkpatrick farm is class III. A carefully planned soil and water conservation program is definitely needed.

Becker farm

Present land use.-- Figure 4 reveals the following use of land on the Becker farm: Alfalfa 9.8 acres, native pasture 79.5 acres, oats 8.7 acres, sorghum 35.4 acres, wheat 60 acres, and farmstead 6.7 acres.

Soil survey.--Three areas of land on this farm are designated by the symbol $\frac{24 - Sh}{B - 2}$. This describes a deep, very dark, soil with moderately tight clay or semi-claypan subsoil. This soil has developed from chalk and chalky shale, and the general area slopes from 1 to 5 percent. From 25 to 75 percent of the topsoil has been lost as a result of erosion on the cultivated land. Moderate erosion is evident in the area that is in native pasture. The land is classified as III, which has been described previously.

The two areas designated by the symbol $\frac{25 - Sh}{B - 2}$ are similar to the areas just described, except that the

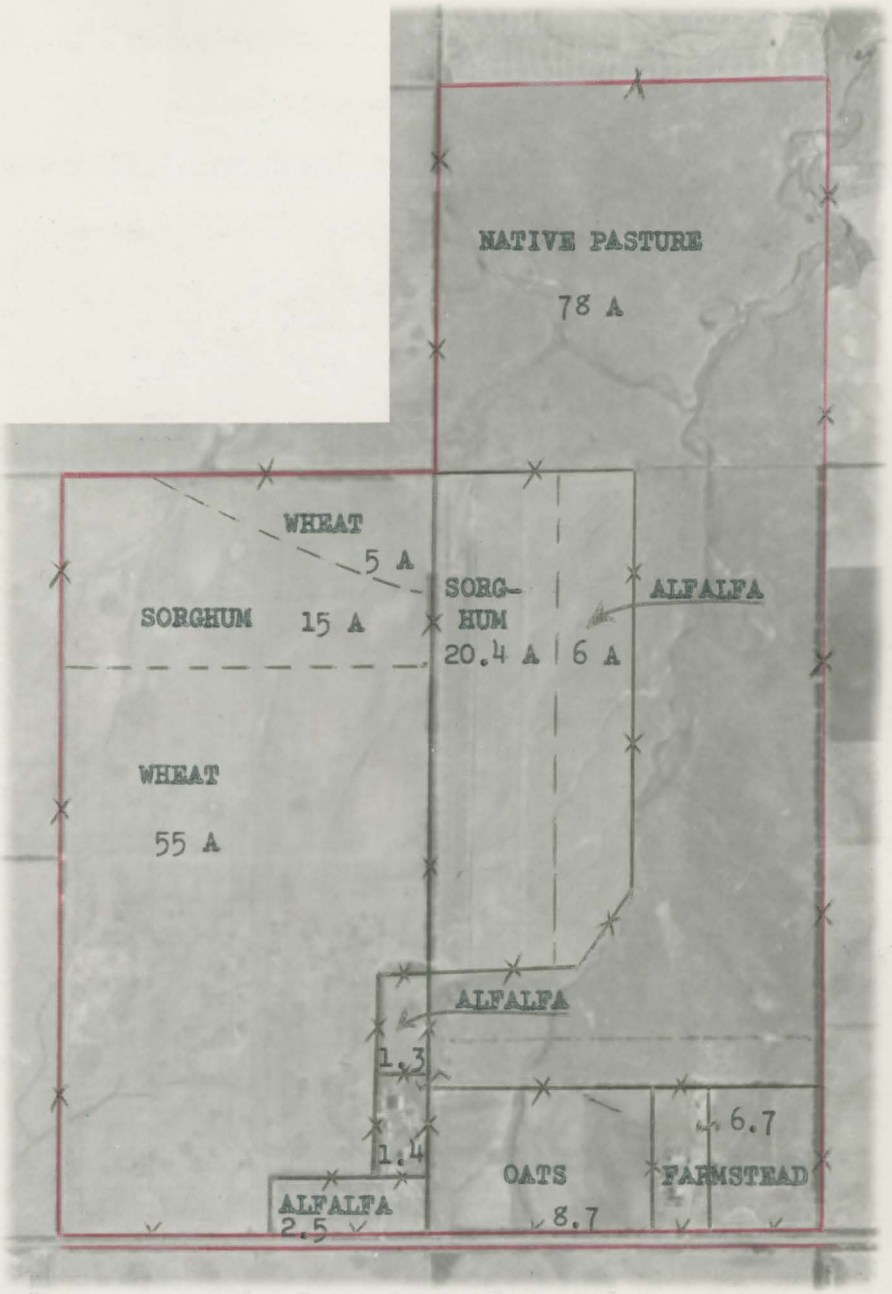


Figure 4.--Becker farm showing present land use.

Legend

Farm boundary ——— Field boundary; no fence - - -

Fence existing —X— Fence along highway =====

Connected areas —/—

soil is only moderately deep with tight or moderately tight clay subsoils. These areas are also classified as III.

The area of land designated by the symbol $\frac{25 - Sh}{B - 3}$ is similar to that described above, except that over 75 percent of the topsoil has been lost as a result of erosion and is classified as IV.

The small delineated area designated by the symbol $\frac{6 - O}{B - 2}$ describes a deep, very dark soil, with a friable or moderately friable silty to clayey subsoil. This soil has developed from older alluvium, and the area slopes between 2 and 6 percent. Between 25 and 75 percent of the topsoil has been lost as a result of erosion. This land is classified as III.

The area of land adjoining the east boundary of the farm, which is designated by the symbol $\frac{7 - L}{B - 2}$, has a moderately deep, dark or very dark soil, with a friable or moderately, silty to clayey subsoil. This soil has developed from limestone and interbedded limy shales. The slope of the area varies between 2 and 6 percent, and since this land is in native pasture, only a small amount of topsoil has been lost as a result of erosion. This is class III land.

The area of land with the intermittent stream and which is further identified by the symbol $\frac{82}{X - 3}$, has a mixed generally nonarable, alluvial soil. No definite

percent of slope could be assigned to the area. A moderate amount of soil loss from erosion is evident. This in class VI land.

It should be observed that there is no land on this farm which is classified above III.

Kirschner farm

Present land use.--Figure 5 reveals the following use of land on the above named farm: Alfalfa 6 acres, sorghum 7 acres, oats 10 acres, oats and sweet clover mixed 10 acres, wheat 128 acres, and native pasture 8 acres.

Soil survey.--Practically all of the land of this farm is designated by the symbol $\frac{5 - 0}{A - 2}$. This describes a deep, dark or very dark soil with a tight clay or claypan subsoil. It has developed from older alluvium, and the area slopes less than one percent. From 25 to 75 percent of the topsoil has been lost as a result of erosion. This is class II land.

The delineated area designated by the symbol $\frac{82}{B - 2}$ is made up of mixed, generally nonarable, alluvial soils. The slope varies between 2 and 6 percent and the land has lost from 25 to 75 percent of its topsoil. This is class IV land.

The area of land designated by the symbol $\frac{82}{B - 2}$ is similar to the area just described except that an intermittent stream crosses this land. The soil, topography, and climatic conditions identify this as class V land.

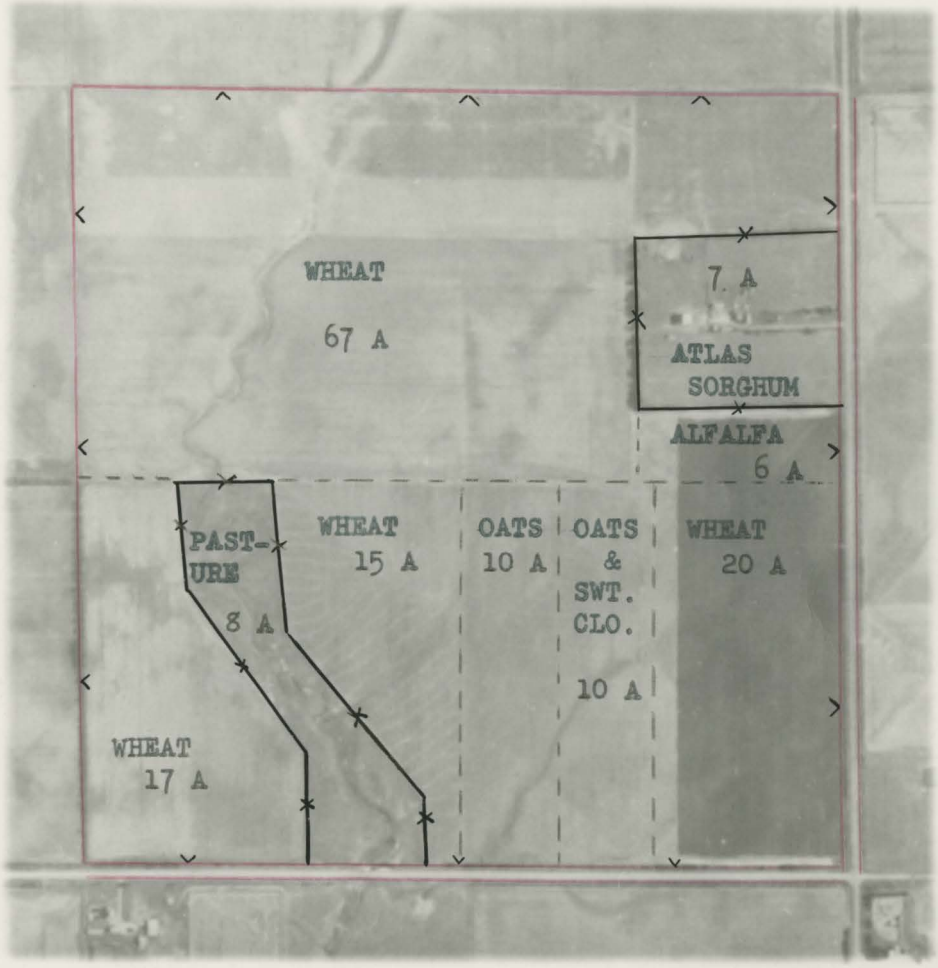


Figure 5.--Kirschner farm showing present land use.

Legend

Farm boundary —————— Field boundary; no fence — — —

Fence existing ——×—— Fence along highway ═══

Class V land is not suitable for cultivation but is suitable for permanent vegetation that may be used for grazing or for woodland without any special restrictions. It must be nearly level and not subject to either water or wind erosion, even if the cover should be removed. If the cover is in good condition now, the land requires no special restrictions or special practices for its protection, although certain range-management or woodland-management practices such as stocking within carrying capacity and prevention of burning are always needed to obtain satisfactory production. Land on which vegetation has become temporarily depleted through misuse may require moderate or even severe restrictions for a period of time. If these are solely to permit recovery of vegetation, if the land is not subject to erosion, and if it is capable of producing moderate to high yields of forage or of woodland products, the land would be classified as V regardless of the present kind, amount or condition of vegetation.

No special restrictions or special practices are needed to protect the land, although some restrictions of grazing or timber harvesting may be worthwhile to improve the yield. (4:26,28)

Kliewer farm

Present land use.--An examination of figure 6, reveals the following land use: Oats 24 acres, sorghum 41 acres, wheat 138 acres, and native pasture 38 acres.

Soil survey.--Two large areas of this farm are designated by the composite symbol $\frac{5 - 0}{B - 2}$. This describes a deep, dark or very dark soil with a tight clay or clay-pan subsoil. This soil has developed from older alluvium and the area slopes between 1 and 5 percent. From 25 to 75 percent of the topsoil has been lost as a result of erosion. This is class III land.

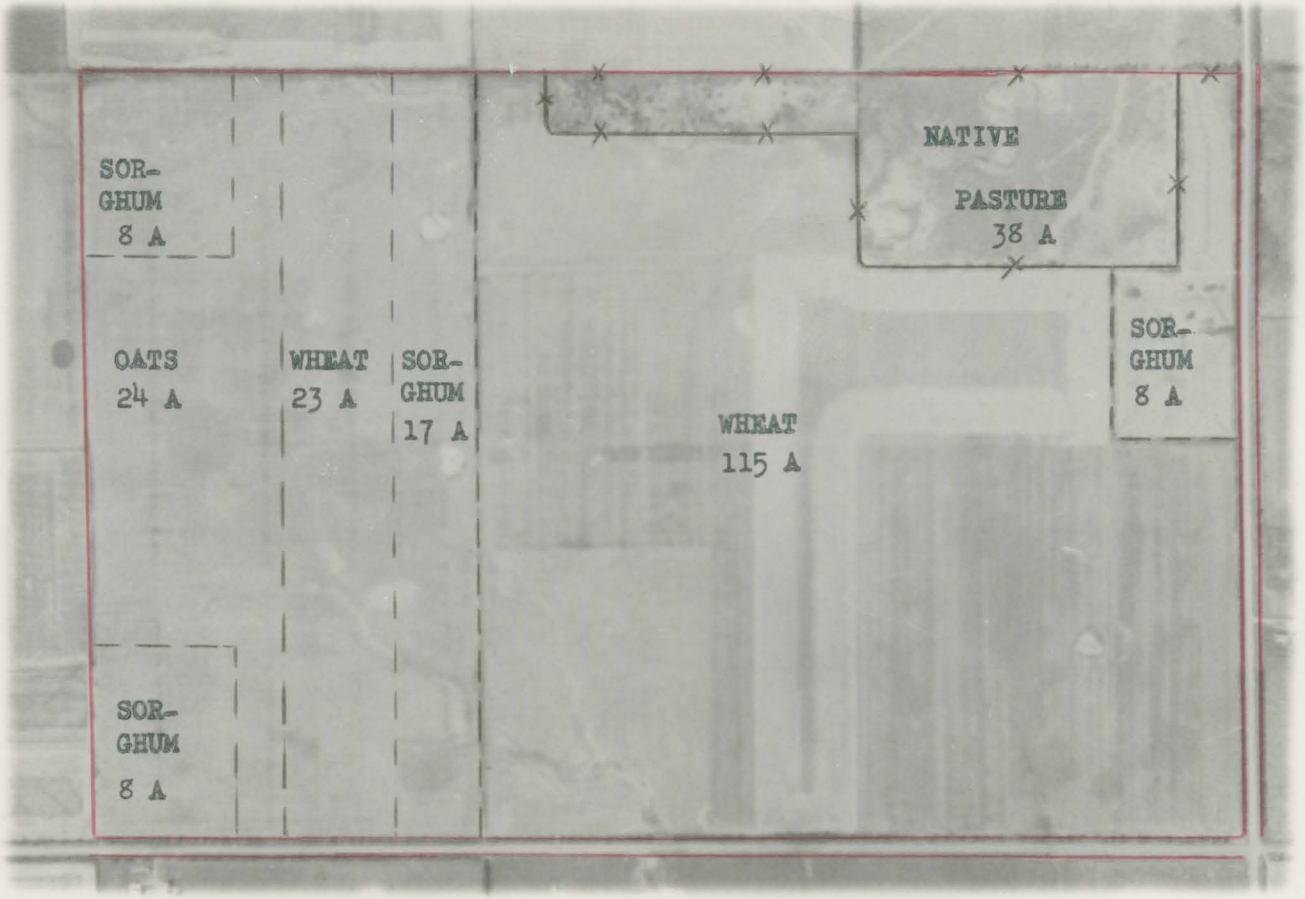


Figure 6.--Kliewer farm showing present land use.

Legend

Farm boundary

Fence existing

Field boundary; no fence

Public road

The small area near the north boundary with the symbol $\frac{5 - 0}{B - 1}$ is similar to that just described except that the erosion loss is less severe. It is also class III land.

The narrow strip of land crossing the center of the farm and designated by the symbol $\frac{5 - 0}{A - 1}$ is similar to the two areas described above as far as soil and parent material are concerned. This land slopes less than one percent and less than 25 percent of the topsoil has been lost as a result of erosion. This is class II land.

The two areas of land designated by the composite symbol $\frac{82}{B - 2}$ are described as mixed, generally non-arable, alluvial soils. The slope of the areas varies between 2 and 6 percent, and between 25 and 75 percent of the topsoil has been lost from the cropland as a result of erosion. The loss from the pasture land in these areas is much less severe. This is class IV land.

The two areas with the designated symbol $\frac{5 - 0}{B - 3}$ have soils similar to those first described on this farm, but have lost more than 75 percent of the topsoil as a result of erosion. This is also class IV land.

Summary

Five land-capability classes were observed on the farms used in this study. It is obvious that much soil has been lost as the result of erosion. This emphasizes the need for conservation farming.

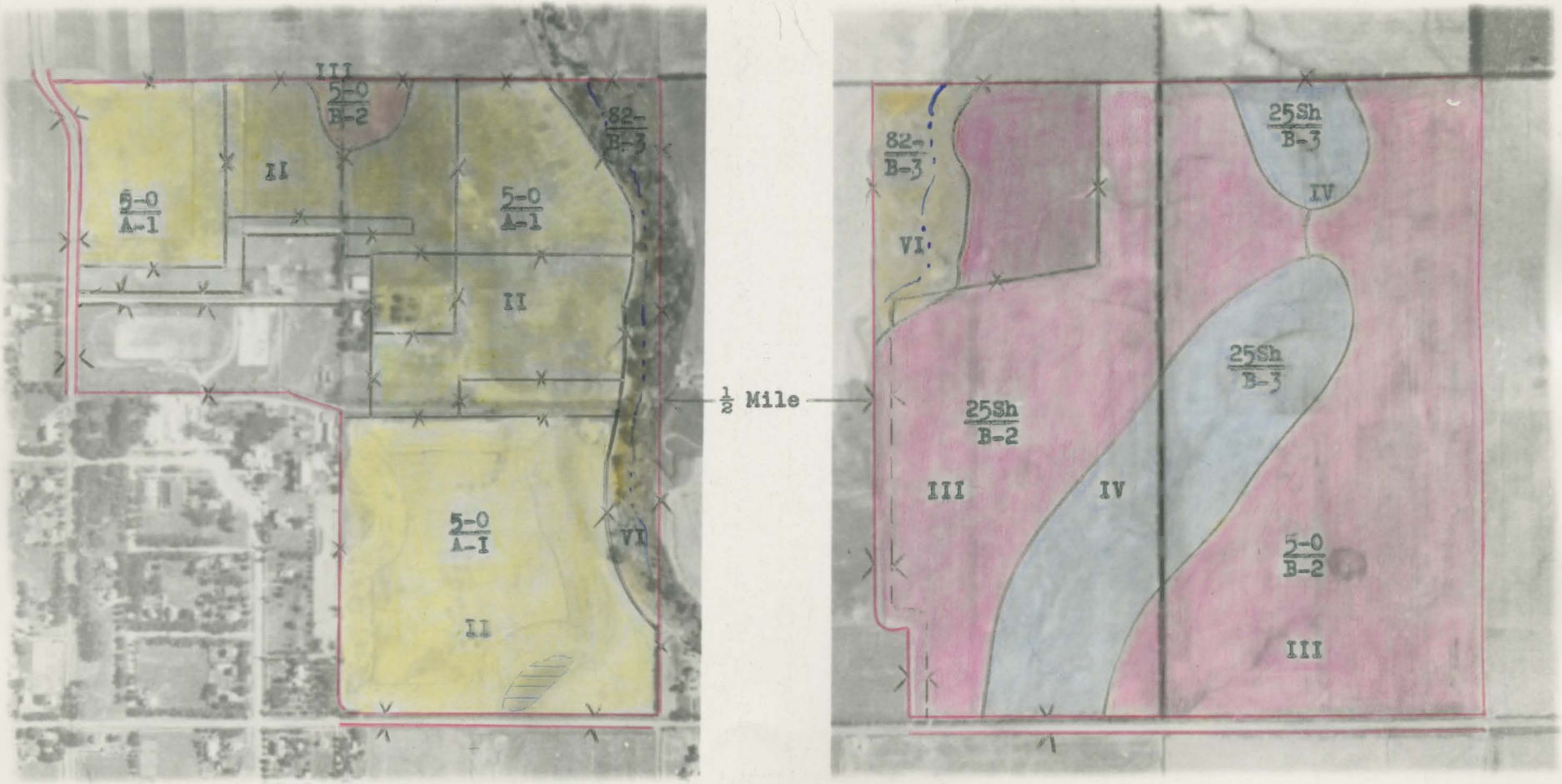


Figure 7.--Land capability map of the Campus farm.

Legend

Conservation survey boundary — Intermittent stream — Intermittent pond

Farm boundary — Fence existing — Fence along highway — Public road

Land capability class II

Land capability class III

Land capability class IV

Land capability class VI

Figure 8.--Land capability map of the Kirkpatrick farm.

Legend

Conservation survey boundary
Farm boundary
Land capability class II
Land capability class VI
Fence existing
Fence along highway
Land capability class III
Intermittent stream
Gully
Public road

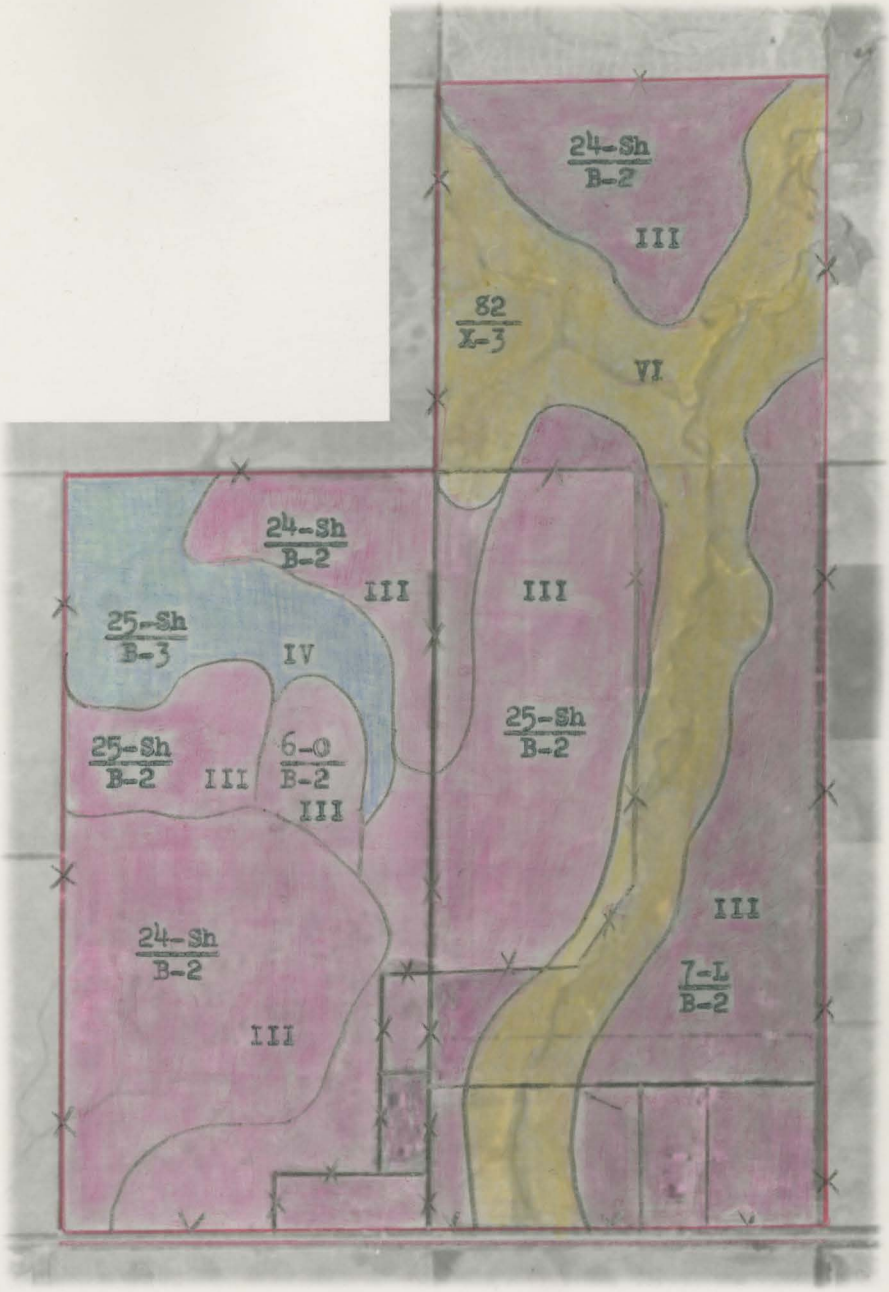


Figure 9.--Land capability map of the Becker farm.

Legend

Farm boundary ——— Fence existing —X— Public road ═══

Conservation survey boundary ~~ Intermittent stream

Land capability class III

Land capability class VI

Land capability class IV

Figure 10.--Land capability map of the Kirschner farm.

Legend

Conservation survey boundary
Public road
Intermittent stream
Fence existing
Farm boundary
Fence along highway
Land capability class II
Land capability class IV
Land capability class V

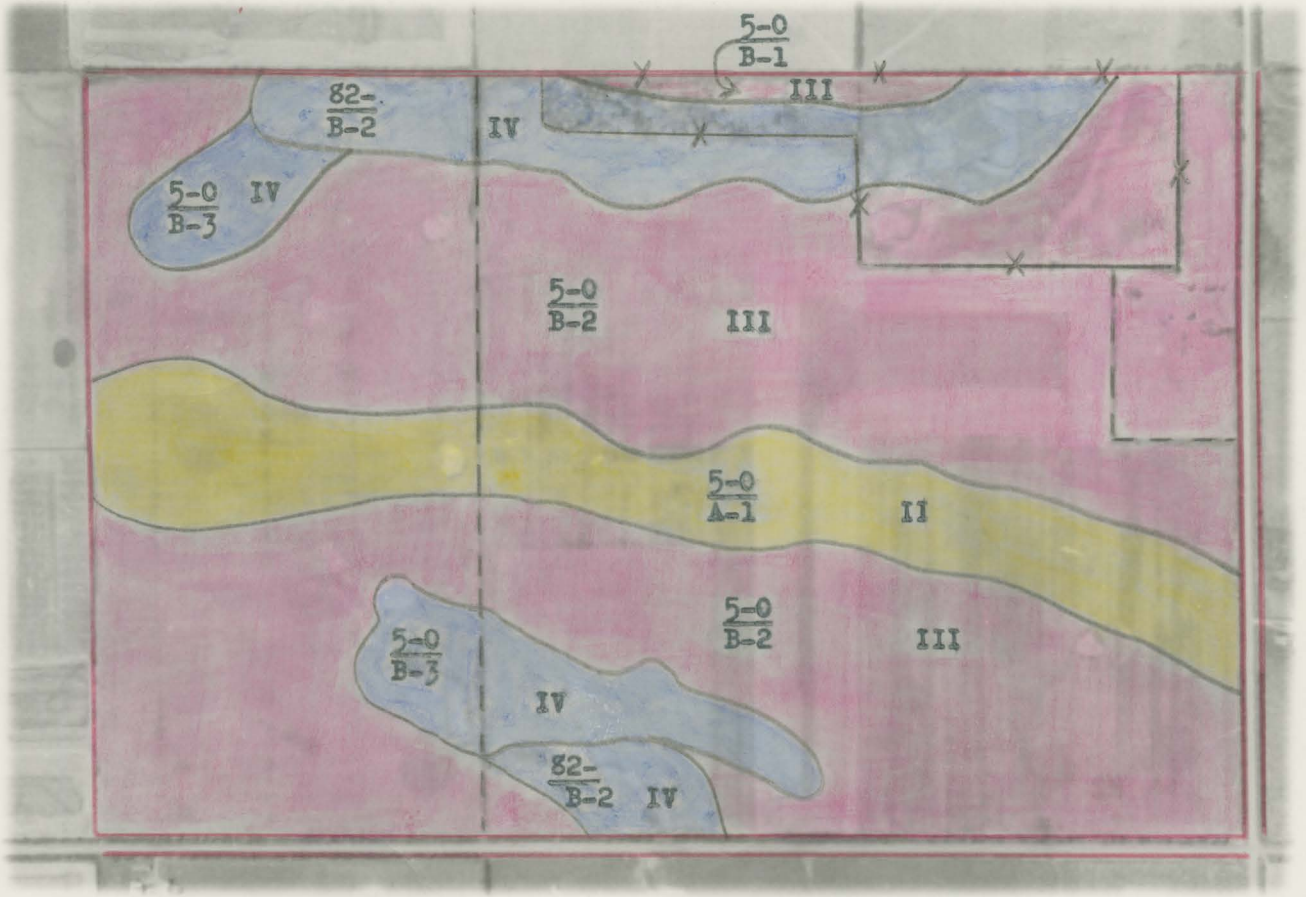


Figure 11.--Land capability map of the Kliewer farm.

Legend

Farm boundary ——— Conservation survey boundary ~~~ Public road ═══

Fence existing —X—X—

Land capability class II

Land capability class III

Land capability class IV

Chapter V

DISCUSSION

In the previous chapter the writer presented, by the use of maps and technical soil formulae, a description of the various farms included in this survey. The land of these farms was classified as to what it can do and what it needs.

Upon the basis of these findings in Chapter IV and a rather comprehensive knowledge of the literature reviewed it is now proposed to bring the major findings into the open for discussion. The writer plans by the use of the findings in Chapter IV, and in the light of the needs of Bethel College, to make specific recommendations for use in the management of the five farms for teaching soil and water conservation.

In developing individual plans for these five farms, it would be desirable from a strictly conservation standpoint, to use the Land Capability Class boundaries designated on the Land Capability Maps, as boundaries for future land use. This is not always possible from a practical standpoint. To illustrate, a fence following the boundary line between two different land capability

classes would be a meandering division line and would result in too great a loss of efficiency in the use of labor and machinery.

It is well to keep in mind that land may be used less intensively than its capability classification indicates, but that it should never be used more intensively. For instance, if the capability classification for a given area indicates that the land may be used as cropland, the area could also be used for pasture. But, if a capability classification indicates that the land in the area should be used for permanent pasture, it would be a destructive practice to try to produce cultivated crops on such a tract. This fundamental principle is generally recognized as self evident by soil conservation authorities.

It is evident that each farm studied presents some problems that are not common to the other farms. Dale and Ross (3:1) reviewed in Chapter II, stated, "Each of the 6,500,000 farms in the United States is a unit with distinctive differences and specific problems of its own."

Recommended plan of conservation operations

In order to present a clear picture of the recommended future use of the land of the five farms studied, the writer presents in this chapter another aerial photograph of each farm. On these photographs, the writer has plotted such features as fences, field boundaries, and farm lanes, that are to remain where they are

at present. Designated symbols have been used to indicate where new fences are to be constructed, where soil saving dams are to be built, and other changes recommended for the future land use that can be indicated on a photograph of this kind. These recommendations are based upon the results of the analysis of the soil surveys, a review of literature, discussions with soils authorities, economic needs of the farms, climatic factors, and the needs for an instruction program in soil and water conservation.

Each individual field on these maps is identified by a number by which it is known in the discussion that follows. The reader will find it helpful to refer to the maps presented in this chapter and also to the Land Capability Maps of the previous chapter as he follows this discussion. For the purposes of discussion and the development of the recommendations, each of the farms will be considered separately. In the background the writer has given consideration to the over-all management program for teaching soil and water conservation.

Campus farm.--(Refer to figure 14). The land that is to be used as cropland includes fields 4, 8, 10, and 14. Fields 4, 8, and 10, being class II, will require relatively simple conservation treatment. Erosion-control practices usually recommended by soil technicians on class II land in the area in which this farm is located, consist of contour tillage, cover crops, and rotations that in-

clude legumes (9:22,23). The soil should be fertilized if chemical analyses and test plots indicate a need for fertilization. Barnyard manure, of course, should be spread as available. The small intermittent pond in field 10 should be drained. Field 14, being in class III, will require more intensive treatment than the fields just mentioned. In addition to the practices recommended for the above designated areas, field 14 should be terraced as soon as grass has been established in the field adjoining it on the west, so that the terraces will have proper outlets.

Figure 12.--A wide open type drainage ditch.

Fields 1, 2, and 3, which are composed of class II land, could be used for the production of cultivated crops or pasture. However, since the demands for more pasture on this farm are high, because of a large dairy herd, it is recommended that the land be sown to pasture. Fields 5 and 11, being classified as VI, should remain in native pasture (9:28). Since much of fields 12 and 13 is class IV land, and since the farm demands more pasture, all of this land should be retired to native grass. It is understood, of course, that a part of field 13 is class III land and could be used for cropland if it were terraced.

There is no source of water for livestock on field 11, now in pasture. Consequently, if further study reveals that it is feasible, a farm pond should be built on this pasture to provide water for the livestock. Fences should be constructed between fields 12 and 13 and between fields 12 and 14.

It will be observed that in making soil and water conservation plans for this farm, several alternate practices provided in the capability classifications have been used to meet the requirements of the dairy herd, which offer additional opportunities for instruction in soil and water conservation.

This farm and conservation plan will provide students with the opportunity of observing land classes II, III, IV, and VI.

Figure 13.--A farm pond on one of the College farms.

Kirkpatrick farm.--(Refer to figure 15). Since fields 5, 6, 7, 9, and a part of 4 are class III land, they may continue to be used as cropland. That part of field 4 which is class III land should be terraced. Gradient terraces may be more desirable than level terraces. Further study is required before a recommendation can be made as to the type of terrace to be used. The gully of this field should be filled in and grassed. This will then serve as a grassed waterway for terrace outlets. That part of field 4 which is class II land should be farmed on the contour but need not be terraced (4:14,18).

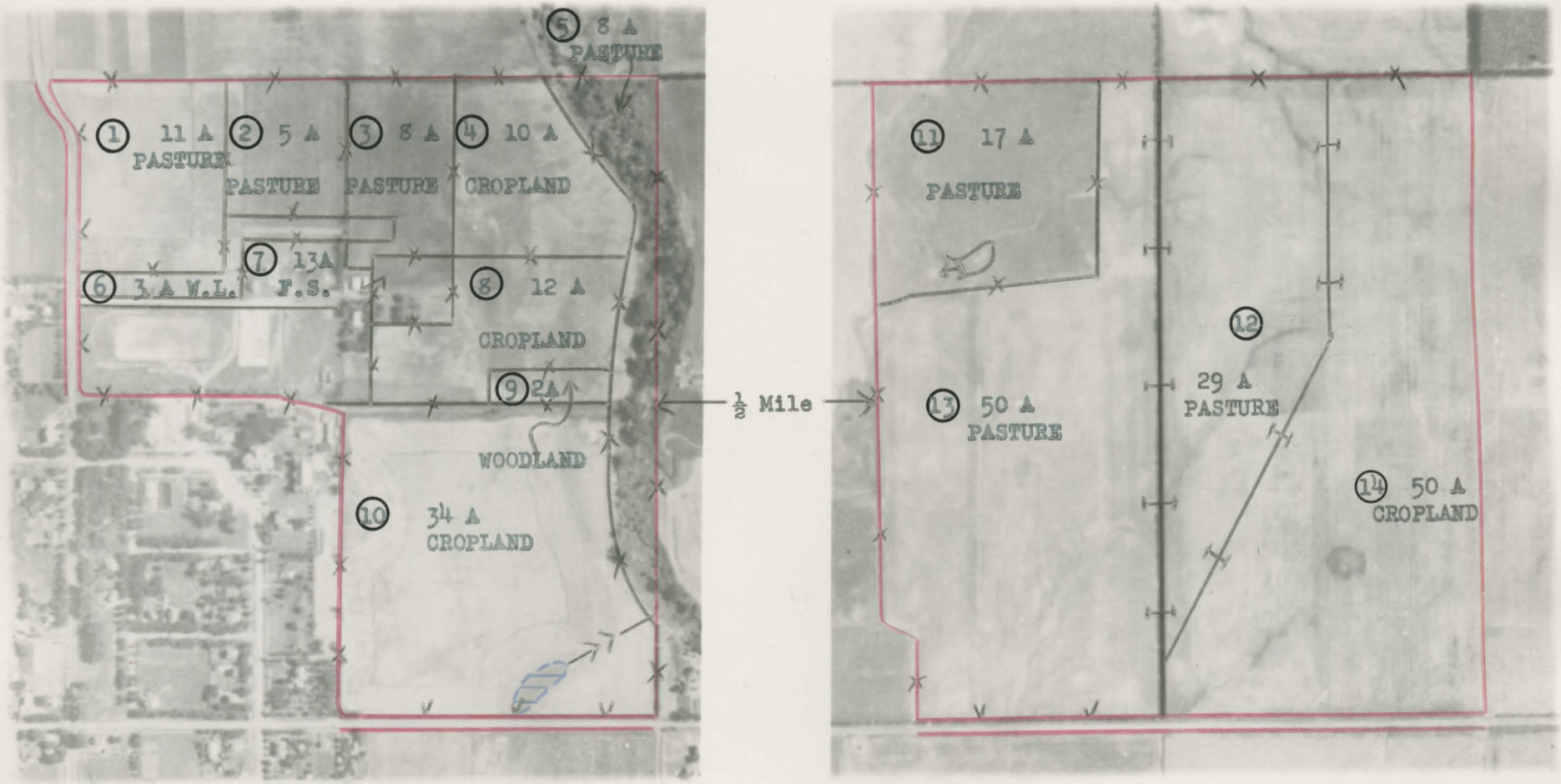


Figure 14.--Campus farm showing recommended land use

Legend

Farm boundary
Fence existing
Fence to be built
Drainage ditch
Farm pond
Field boundary; no fence
Fence along highway
Connected areas

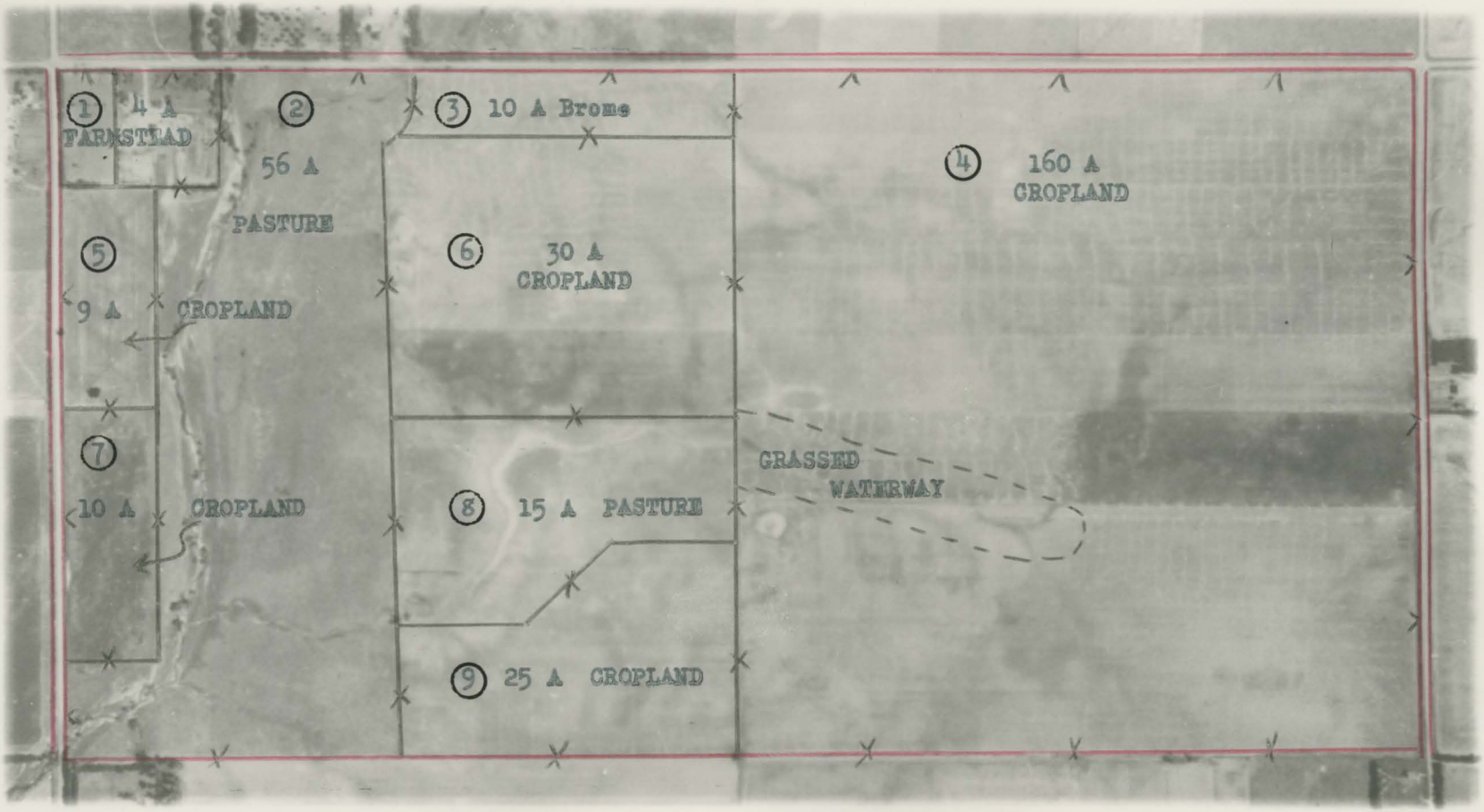


Figure 15.--Kirkpatrick farm showing recommended land use.

Legend

Farm boundary

Fence existing

Field boundary; no fence

Fence along highway

Fields 6 and 9 should be terraced since they are composed of class III land. Terraces may safely empty into fields 2, 3, and 8.

Fields 1, 5, and 9 need not be terraced but should be contour farmed since they are class II land.

Practices that will apply to all of the cropland on this farm are as follows: (1) Crop residues should not be burned; to do so hastens soil depletion (9:15). (2) To increase the amount of nitrogen in the soil and help maintain organic matter, it is recommended that a legume should be used in a planned rotation program (9:22,23). (3) Chemical analyses of soils and test plots should be used to determine the need for the application of commercial fertilizers. (4) Barnyard manure should be spread as available.

Field 2 should remain in native pasture. Grazing should be limited to the normal carrying capacity of such pasture. A part of this field could be used as cropland, since it is class III land. However, the tenant on this farm maintains a sizeable herd of cattle and needs the pasture. All pasture land should be mowed before weeds reach the blossoming or seeding stage.

Fields 3 and 8 should continue to be used for pasture or hay crops because of the tendency for gullies to form.

This farm has two types of soils not found on

the Campus farm. The writer's students will have an opportunity to observe a relatively big variation in soils on this farm.

Becker farm.--(Refer to figure 17). Parts of field 1 could be used as cultivated cropland, being class III land. However, the field boundaries would be very irregular, and a number of new fences would have to be constructed, making it quite impractical.

Fields 3, 4, 5, 6, 7, 8, part of 9, and 10 may continue to be used as cropland. All of these fields are composed of class III land and should be terraced (4:18). Grassed waterways should be seeded where indicated on the map. The need for commercial fertilizers should be determined on the basis of soil sample analyses and test plots. No crop residues should be burned, but they should be incorporated into the soil with regular tillage operations (9:15). Legumes, such as alfalfa and sweet clover, should be used in the rotation in order to help maintain organic matter and increase the nitrogen content of the soil (9:22,23). All tillage operations should be performed on the contour. As a result, more water will be absorbed into the soil, thereby reducing soil erosion and increasing crop yields (9:37).

Figure 16.--Class III land on the Becker farm.

Field 2 should be retired to native grasses. This is class IV land and has suffered great losses as a result of erosion. This field should be extended south beyond the class IV land boundary, so that if the area is used as pasture, livestock may be able to get to water. New fences will need to be constructed between fields 2 and 5 and between fields 2 and 3.

This farm presents an economic problem in that so much of it is pasture land. A strong livestock program will need to be developed by the tenant to conform to the proposed plans.

Kirschner farm.--(Refer to figure 18). Since most of the land of this farm is class II, the management

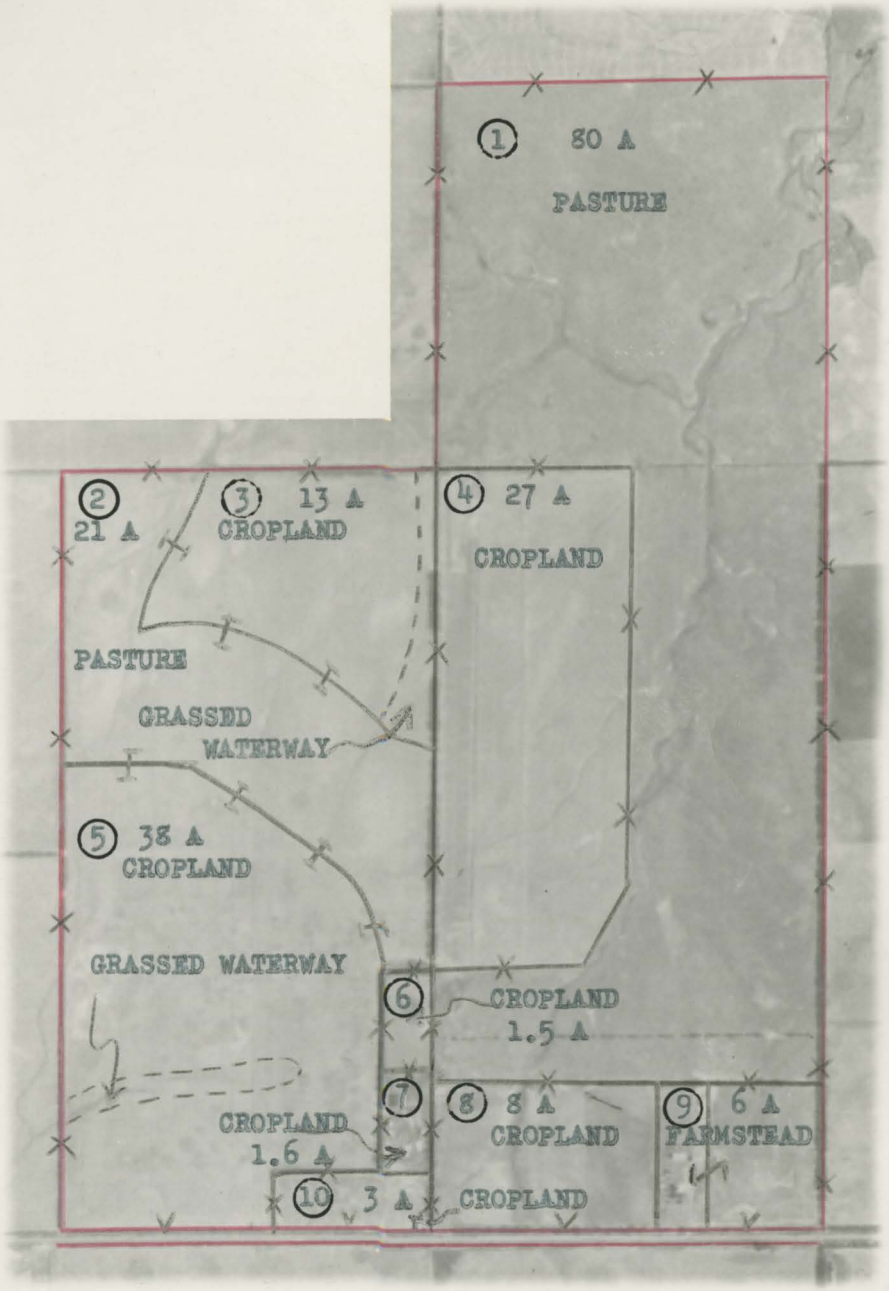


Figure 17.--Becker farm showing recommended land use.

Legend

Farm boundary
Fence existing
Fence to be built
Field boundary; no fence
Fence along highway
Connected areas

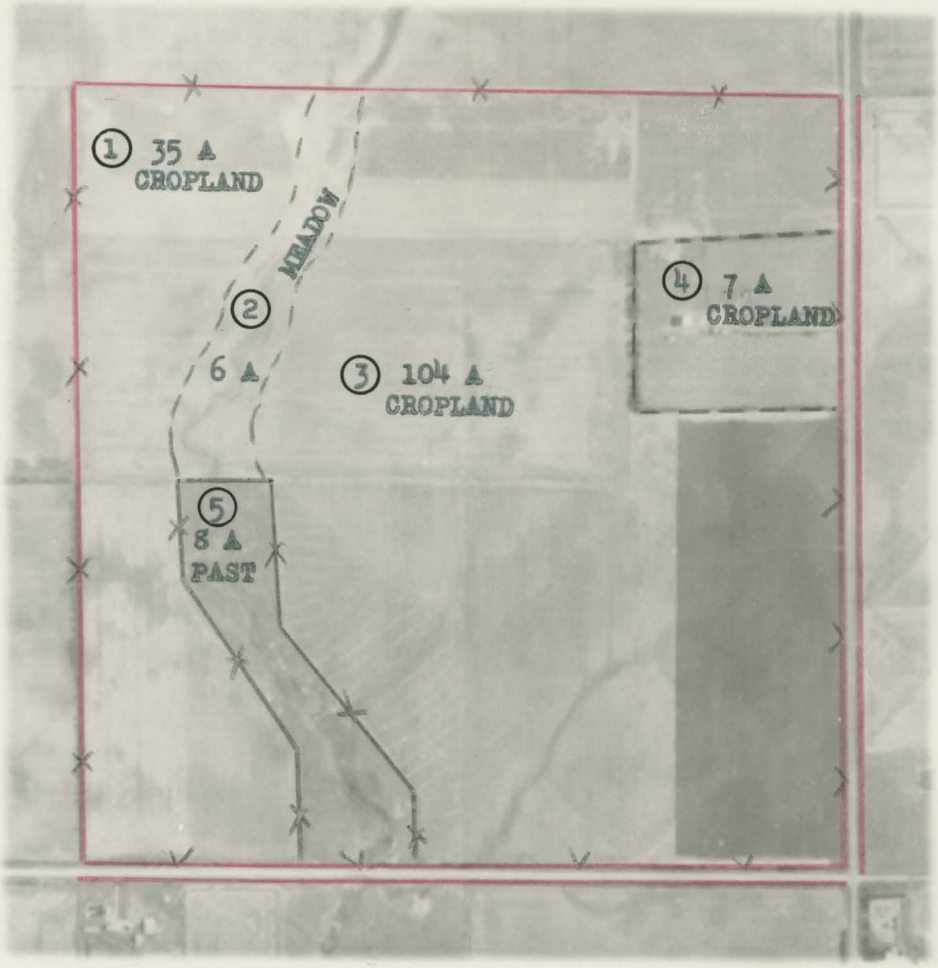


Figure 18.--Kirschner farm showing recommended land use.

Legend

Farm boundary
Fence existing
Field boundary; no fence
Fence along highway

problem is relatively simple. All tillage operations on fields 1, 3, and 4 should be performed on the contour (9:37). It is quite likely that commercial fertilizers would be beneficial on this land; however, chemical soil analyses and test plots should be used to determine the feasibility of their use. Legume crops should constitute a part of the rotation program (9:22,23).

Field 2 is designated as class IV land and should be seeded to grass. Water from the land adjoining this farm on the north often causes some gullying in this field. This conclusion is confirmed by the aerial map. Since field 5 is only 8 acres, it may be advisable to combine fields 2 and 5 later, thereby increasing the size of the pasture.

Field 5, class V land, should remain in native pasture. No special recommendation concerning conservation practices need be made except that over-grazing should be avoided (4:26). Since there is no water available to livestock in this pasture, it will be necessary to construct a farm pond if further investigation shows that it is feasible.

The Kirschner farm is the only one of the five farms with some class V land. This farm also has more class II land than any of the five farms studied. The agricultural students of Bethel College will have an opportunity to study the feasibility of constructing a

farm pond on this land.

Kliewer farm.--(Refer to figure 20). That part of field 1 which is not now in native pasture, and which is class IV land, should be seeded to grass (4:24). It may be incorporated with the present pasture if further study reveals the need for doing so. That part of the pasture which is class III land could be broken up and cultivated. However, the photograph indicates that the pasture is surrounded by hedge trees, and since the area which could be cultivated is small, it would be impractical to recommend taking it out of pasture. The pasture should be mowed annually before the weeds begin to blossom.

Figure 19.--Typical class IV land.

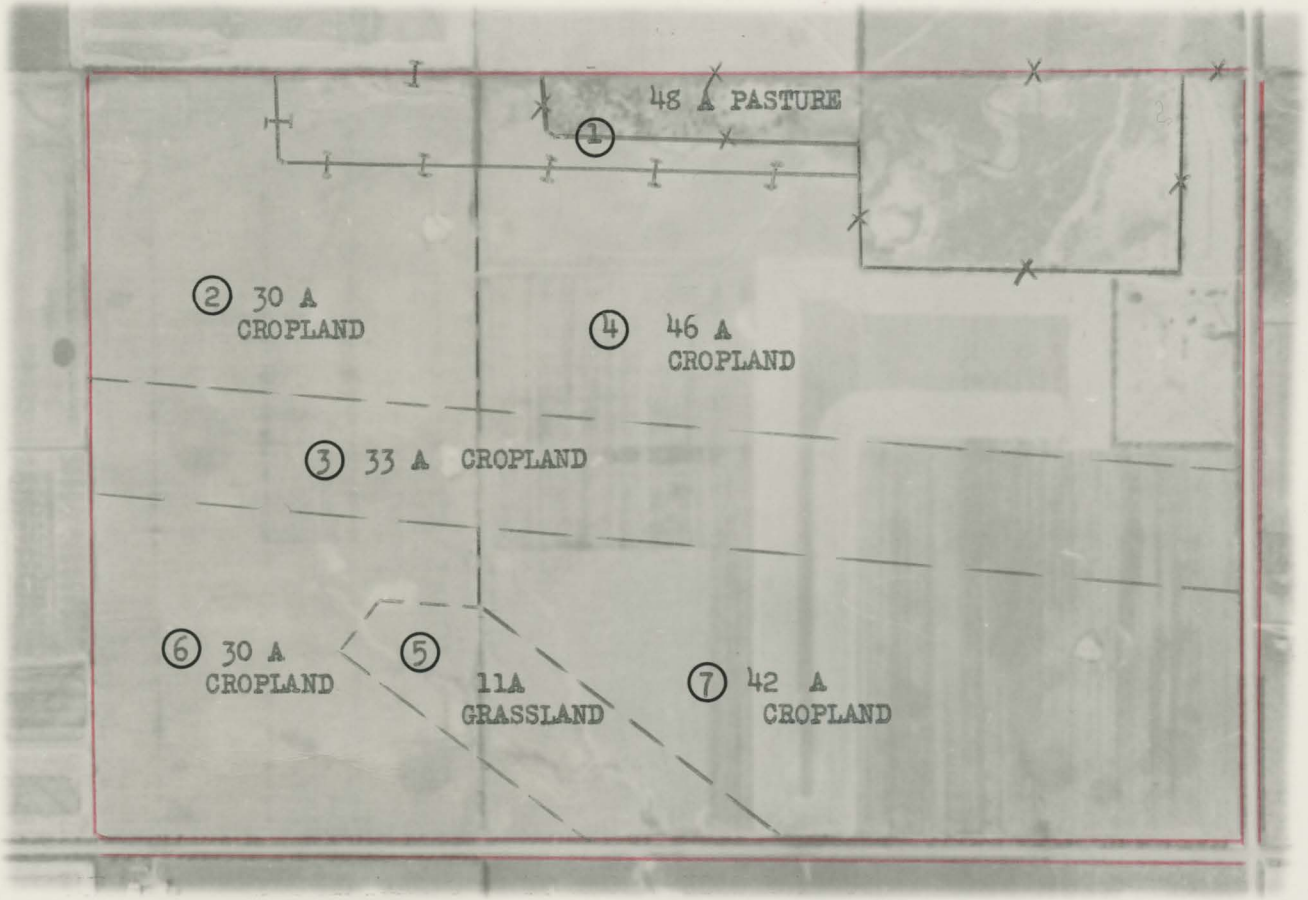


Figure 20.-- Kliewer farm showing recommended land use.

Legend

Farm boundary ——— Field boundary; no fence — — Public road ═══

Fence existing —X—X— Fence to be built —I—I—

Fields 2, 4, 6, and 7 should be terraced (4:18). All tillage operations should be performed on the contour. Legumes should be a part of the planned rotation program. The need for commercial fertilizers should be determined on the basis of further study. In the interest of conservation, no crop residues should be burned.

Field 3, class II land, should be handled in the same way as those just mentioned, except that it need not be terraced (4:14).

Since field 5 is class IV land it should be seeded to grass, though it may be cultivated occasionally. (4:24).

This farm presents a unique problem in that there are no buildings on it, consequently, there is no livestock program on the farm, but there is a large pasture on it.

Summary

In the preceding paragraphs of this chapter, specific recommendations have been made as to the land use for the several tracts in each of the five farms. These recommendations are based on analyses of specific data gathered on the farms which were transferred to specially prepared aerial photographs of the individual farms. The analysis of the data gathered on each farm helped determine the Land Capability classification for each delineated area.

The prescribed land use practices recommended by the United States Soil Conservation Service for each class of land allow for some interpretation as to which ones should be used in a specific situation. The writer, therefore, in making his final recommendations took into consideration the following factors: Possible uses under land classification requirements, economic needs of the over-all college program, and instructional requirements for a soil and water conservation program.

Very few studies have been made in soil and water conservation for the purpose of providing teaching aids. Wilson (11) surveyed five farms near Forest Lake, Minnesota, as to soil erosion and its control. Plans for equipment and procedures for class use were formulated and used in the agricultural classes.

Benton (1) also surveyed a number of farms near Malvern High School in Iowa for the purpose of setting up a teaching program in soil and water conservation.

California has taken the lead, as far as vocational agriculture is concerned, in making use of demonstration farms in its teaching program. Johnson (6) states,

> Approximately 40% of the departments of vocational agriculture in the Pacific Region operate and manage land or some other major instructional device as department or F.F.A. chapter educational activity. (6:67)

The sum total of the recommendations for the five farms above enumerated provides an opportunity for an instructional program in soil and water conservation in the following area:

1. Opportunity to observe and study different types of soils.
2. Opportunity to make determinations as to the slope of land.
3. Opportunity to make determinations as to the extent of soil erosion in the various areas and in the various stages.
4. Opportunity to observe five of the eight Land-Capability classifications of soil recognized by the United States Soil Conservation Service.
5. Students will get practical experience in "running" contour lines and in "staking out" terraces.
6. Students will have an opportunity to analyze soils and determine fertilization requirements on that basis.

If the recommendations for soil and water conservation made in this chapter are followed for the five farms involved in this study, an excellent opportunity for a rather comprehensive program in teaching soil and water conservation will be provided.

Chapter VI

SUMMARY

People everywhere are concerned about the apparent great losses of soil from our American farms. We are becoming aware of the fact that our last land-frontier in the United States is gone and that we will need to revise our farming practices if our children are to inherit land that will support them.

The Soil Conservation Service of the United States Department of Agriculture has, in recent years, developed scientific methods in coping with the ever-present problem of soil and water losses from our farms. However, many more trained soil technicians are needed to educate farmers in the use of these improved methods. Soil erosion is a problem that is national in scope and one that should challenge every citizen into action.

Need for study

There is no satisfactory method of classroom teaching that will train students in the use of technical procedures in dealing with soil and water conservation. A knowledge of these procedures and their use can best be

acquired in the field. This being true, the writer decided on the following problem: How shall the Bethel College farms be managed so that they will serve as demonstration farms for teaching soil and water conservation?

Methods and procedure

Five typical farms owned by Bethel College, North Newton, Kansas, were selected for use in this study. The present use of the land of these farms was determined from field observations and personal interviews with the tenants who operate them. These data were recorded on an aerial photograph of each farm.

With the assistance of soil technicians, the soils of the five farms were carefully surveyed as to the kind of soil, the parent material from which they had developed, the percent of slope for a given area, and the amount of soil loss as a result of erosion. These data were recorded on a second aerial photograph of each farm.

The land of each farm was then classified upon the basis of its needs and capabilities.

Findings

1. All five farms had lost an appreciable amount of soil as a result of erosion.
2. Some areas of land were being cultivated that were eroding badly.

3. Much of the land of these farms had a clay-pan subsoil, which contributed to the erosion of the topsoil.
4. There were very few acres of land that were producing legume crops.
5. There were very few provisions for conserving soil and water.
6. No land-capability class I land was identified.
7. The following five classes of land were recognized: II, III, IV, V, and VI.

Recommendations

An analysis of findings together with data contained in Chapter II resulted in the following recommendations:

1. Class II land should be contour tilled and fertilized where necessary, pending further study. Crop residues should not be burned and legume crops should be a part of the planned crop rotation.

2. Class III land should receive the same treatment as class II, but in addition, it should be terraced.

3. Class IV land should be used only for occasional or limited cultivation. Grasses should generally be sown on this kind of land.

4. Class V land should not be cultivated. It may be used for pasture, meadow or woodland.

5. Class VI land is not suitable for cultivation, but may be used for pasture, meadow, or woodland. Care should be exercised in making certain that it is not overgrazed.

Recommendations for future land use were made upon the basis of the above land-capability classifications and upon the basis of the economic needs of Bethel College and its farms. If these recommendations are carried out, soil and water losses should be reduced greatly on these farms, and an opportunity will be provided for organizing an instructional program in soil and water conservation.

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