

Economic Phases of Erosion
Control in Southern Iowa and
Northern Missouri

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EROSION—A PUBLIC ISSUE

Erosion means more than the mere washing away of the fertile top soil on farms.

It means, if it is not checked, the decline of communities with all their schools, churches and other institutions, in addition to the ruin of farms.

Erosion has become an important problem in the Corn Belt, for within the life of farmers now living, much of the rich top soil has been washed away in many areas.

The control of erosion is not a simple problem which is solely up to each farmer. Erosion control is affected by economic and social forces which are largely beyond the control of the individual farmer.

The following are the principal economic and social factors which, in general, tend to hinder or assist erosion control:

These Hinder Erosion Control

1. Small farms.
2. Corn-hog type of farming.
3. Farms operated by tenants.
4. Heavy debt burden and high interest rates.

These Assist Erosion Control

1. Large farms.
2. Dairy and beef cattle type of farming.
3. Farms operated by owners.
4. Small debt burden and low interest rates.

This bulletin attempts to show how these and other factors are related to erosion control.

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PREFACE

The Soil Erosion Service of the United States Department of Agriculture has 32 Erosion Control Projects under way in 31 states. More projects will be initiated in the near future. One of these demonstrational and experimental projects embraces about 152,000 acres of the Big Creek watershed area in Ringgold and Decatur counties, Iowa, and Harrison County, Missouri. The headquarters for this project of the Soil Erosion Service are at Bethany, Mo.

The government invites the farmers of this area to enter a cooperative agreement, under which the Soil Erosion Service agrees to assist the farmer in controlling erosion, and the farmer agrees to follow an erosion control program for 5 years. This program is worked out individually, for each cooperating farmer, by the farmer himself and the soil erosion experts. The government furnishes special equipment for terracing and gully control, as well as a portion of the seed, fertilizer and limestone necessary for an erosion control program.

The staff of the Soil Erosion Service includes experts in the fields of forestry, crops and soils, agricultural engineering and farm management. The Regional Director and his staff coordinate the activities of these experts so as to work out a balanced soil and crop management program for each farm. A definite crop rotation is outlined for each field on the farm, covering 5 years.

Inasmuch as the erosion control program requires changes in the crop system, subsequent changes in the livestock system and general farming organization are involved. The Soil Erosion Service in Bethany, Mo., therefore, asked the Agricultural Economics Section of the Iowa Agricultural Experiment Station to make a survey in the Big Creek watershed area in cooperation with the Agricultural Economics Department of the University of Missouri, for the purpose of analyzing the broader economic and social implications of the erosion control program. The present study is the result of this survey.

The authors wish to acknowledge the constructive suggestions and criticism given by Mr. R. E. Uhland, Regional Director of the Soil Erosion Service, by Prof. O. R. Johnson, Head of the Department of Agricultural Economics, University of Missouri, and by Dr. T. W. Schultz, Iowa State College, in planning the survey and preparing the manuscript.

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THE PROBLEM

EROSION, ITS CAUSES AND CONSEQUENCES

Soil erosion is caused primarily by rain water washing away the fertile surface soil and gradually exposing the less fertile subsoil.² Obviously, this type of soil deterioration occurs only on sloping land where the water run-off carries the soil particles away into creeks and rivers. The heavier the rainfall, the steeper the hill and the longer the slope, the greater are the soil losses from erosion on any given soil type. Erosion occurs mainly in two forms which are often associated: gully and sheet erosion. Under certain conditions of slope and soil, the water running off the field eats regular waterways into the ground which become deeper, broader and longer with every rainfall. This gully erosion is very noticeable, and the farmer is more apt to watch gullies than the more insidious sheet erosion which easily escapes attention. In the case of sheet erosion, the water with the suspended soil particles runs off in millions of miniature gullies and either deposits the soil along the bottom of the hillside or empties it into larger and more permanently established gullies.

The velocity of the water run-off largely determines the amount of soil carried away, that is, the rate of erosion. The velocity of the run-off, in turn, is determined by (1) the intensity of rainfall, (2) the degree of slope of the field, (3) the length of the slope, (4) certain soil characteristics,

¹Project No. 431 of the Iowa Agricultural Experiment Station.

²Wind erosion causes considerable soil losses in the more arid areas of the Great Plains States. It is of only minor importance in the Corn Belt states east of the Missouri River.

and (5) the type of the plant cover. Of these five factors, only the last three can be influenced by human efforts.

Two major soil characteristics influence the rate of erosion: infiltration capacity and water-holding capacity. They are dependent largely upon the texture and the organic matter content of the soil. The rate at which the water is absorbed and the extent to which it can be stored by the soil affect the water run-off and thereby erosion.

In southern Iowa and northern Missouri, the seasonal distribution and frequency of intense rainfalls and the rolling topography are highly conducive to erosion. Their effect on the rate of erosion has been and still is augmented by human practices facilitating erosion through improper soil management and crop systems.

The Influence of Plant Cover on Erosion

The plant cover protects the soil from erosion in several ways: It diminishes the impact of the rain water on the soil thereby retarding the run-off and permitting more absorption. Its root system holds the soil together and prevents soil particles from being washed away. The more complete the plant cover, and the denser its root system, the smaller is the soil loss from erosion.

Consequently, the various types of plant cover provide various degrees of protection from erosion. A dense *forest* cover affords the best protection. Permanent *pasture* with a dense grass sod holds the soil in place very effectively. *Alfalfa* which usually stays on the field for 3 to 8 years and develops a dense root system, also ranks high in preventing soil losses. Temporary pasture and mixed hay crops are not quite as effective soil protectors, since the soil is tilled and loosened in the preparation of the seedbed, and the root system is not as dense as that of a permanent pasture sod. The *small grains*, oats, barley and wheat, are still a little weaker in their protective quality. *Soybeans* offer very little protection, as they leave the land unprotected for a long period of the year and tend to loosen the soil, thereby permitting heavy soil losses through erosion. *Corn*, the most important crop in the

area, also requires a well prepared seedbed and several cultivations and thus exposes the soil to erosion. Fall-plowed fields and any fallow land lying bare of plant cover are most seriously subject to erosion.

Preliminary data of experiments carried on by the Soil Erosion Station near Bethany, Mo., and Clarinda, Iowa, indicate that the soil losses on plots of the same degree and length of slope are greatly influenced by the plant cover, and that the protective qualities of the various crops decrease about in the order in which they are listed in the preceding paragraph.

Effects of Soil Erosion

Annual soil losses through erosion in this area, under improper soil management, that is, under heavy cropping of rolling land to corn and soybeans, may well amount to over 60 tons per acre, or nearly $\frac{1}{2}$ inch of surface soil. The Soil Erosion Service, in cooperation with state colleges of agriculture, has estimated on the basis of a reconnaissance survey, that about 50 percent of the most fertile top surface soil in northern Missouri and southern Iowa has been washed away during the lifetime of pioneer farmers who are still living.

As long as there is plenty of surface soil left, even heavy soil losses from erosion will not directly affect the crop yields. But the surface soil becomes continually shallower until the subsoil is exposed. This is the stage where the productivity of the soil breaks down rapidly. Erosion goes on at an increasing rate because of the subsoil's deficiency in organic matter, its reduced infiltration capacity, and its decline in fertility which results in small crop yields. The thin plant cover, in turn, provides poor protection. Finally, the land must be abandoned. Brush, timber and thinly scattered grasses cover the ground where once high yields of corn were harvested.

Land which at present has just about reached this stage of forced abandonment is probably not worth saving for cultivation. It would take hundreds of years to build up only a few inches of fertile surface soil from the exposed

subsoil. Such land may best be reverted to timber or grasses. It is the land that still has some surface soil and some fertility left which must be saved. Most of the Shelby soils and practically all of the Grundy soils of the area fall in this class.

VARIOUS MEASURES FOR EROSION CONTROL

Timber and Pasture

There is a considerable area of land which is so badly eroded that it should be definitely withdrawn from cultivation. The decision whether it should be put into timber or permanent pasture probably should depend on whether it could support a dense grass sod under proper management. If it is dissected by many active gullies, or at places is too steep or too poor to develop a sod that withstands pasturing, timber is the only proper use for it. Also present pasture land showing these characteristics should be reforested. Some pastures, however, show serious marks of erosion, but could be restored to normal productivity by discontinuing overgrazing and practicing good pasture management. These pastures should, in general, be rehabilitated instead of reforested.

The Soil Erosion Service has prepared detailed soil maps of the Big Creek watershed area. The depth of the surface soil has been determined for practically all fields, and the number and size of the gullies have been mapped. On this basis, the Soil Erosion Service estimates that approximately 5 to 10 percent of the territory now in crops or pastures should be put into timber. A considerable part of the area now in crops, perhaps between 12 and 15 percent, should be seeded down to permanent pasture to check erosion.

The foregoing are necessarily tentative estimates, and as they are based on purely physical considerations regardless of the economic practicability, they do not represent actual recommendations. But they give a general picture of the extent to which land in this area, from the viewpoint of erosion control, should be withdrawn from agriculture by reforestation, or from cultivation by seeding down to pasture.

Adaptation of Crop Systems to Soil Conditions

It is obvious that retirement of land from strictly agricultural uses for the sake of preventing erosion will be limited to relatively small acreages of extremely eroded lands. Southern Iowa and northern Missouri are relatively densely populated agricultural regions and the efforts for erosion control must be concentrated on measures applicable within the agricultural enterprise.

At present, nearly half of the total crop land^a is in corn and soybeans, the two crops which are highly conducive to erosion, as has been pointed out before. The main problem of erosion control therefore is to reduce the acreage of these erosive crops and replace them by grasses, legumes (other than soybeans) and small grains, that is by crops offering a better protection from erosion.

Erosion can be greatly reduced by changing the crop rotation from, for instance, corn-corn-oats to corn-oats and 2 or 3 years meadow or rotation pasture; or to corn-oats and 4 to 5 years alfalfa. By and large, the more erosive a field is, the longer should be the interval between the corn-years. The Soil Erosion Station near Bethany, Mo., has found that on a type of land which loses more than 63 tons of soil per acre under continuous cropping to corn, the loss can be reduced to less than 12 tons under a 3-year rotation with one corn year.

Such changes in the crop rotations substantially reduce the corn acreage, a smaller percentage of the crop land is in corn (and soybeans), and a larger percentage in hay and pasture. Under 362 cooperative agreements between farmers and the Soil Erosion Service in the Big Creek area (as of September, 1934), the farmers agreed to reduce their corn acreage by about 31 percent and to increase their hay and pasture acreage by 19 and 45 percent, respectively, during the following 5 years.⁴ If similar changes were made

^aThe term crop land, as used in this study, includes all cultivated land from which crops are harvested (except wild hay), and all temporary pasture land that has been cultivated during the last 10 years.

⁴Since this survey was undertaken, the number of cooperative agreements has been increased to nearly 650 as of February, 1935. The average corn reduction under these agreements is now roughly estimated at 37 percent.

by all farmers in the Big Creek watershed area, the percentage of the total crop land in corn would be reduced from around 37 to 26, the percentage in meadow and rotation pasture would be increased from around 30 to 41.

This, obviously, implies a long series of economic readjustments within the individual farm as well as in its outside relationships. These economic readjustments will be discussed more fully later.

SOCIAL RESPONSIBILITY IN CONSERVING SOIL FERTILITY

Conservation of Soil Fertility—A Public Issue

In any region where the majority of the population depends directly or indirectly on agriculture, the perpetuation of soil productivity is of vital concern to the community as a whole. If conditions develop which threaten the perpetuation of the soil's producing power, therefore, they are threatening the future of the community at the same time. The once vigorous economic life of wide territories in the northern cut-over regions and the western ranges has been crippled for many decades or possibly forever because of a ruthless exploitation of the natural resources.

The Middle West has been settled for a relatively short time. Originally it seemed to offer an inexhaustible abundance of productive power in its fertile soils. Soon, however, ominous signs of rapid dissipation of its producing power began to appear in various sections. During the time of great industrial and agricultural expansion, neither individual nor community was much concerned about the consequences of destroying rich forests, grazing land and soil. There were plenty of opportunities and new regions to turn to after one had been exhausted and pauperized. Today this situation no longer prevails. The rate of industrial expansion has definitely slowed down, and no new land is available. If, today, a farmer exploits his soil so as to destroy its future productivity, his chances to find, tomorrow, satisfactory employment in industry or a fertile piece of new land are greatly reduced as compared with some 20 years ago. The same is true of the local communities. With their basic resources gone, their people have

no other place to go. Along with the soil, people, roads, schools, churches, hospitals and towns are bound to deteriorate.

Today the individual farmer as well as the community depends on the maintenance of the soil's producing power. Inasmuch as the individual farmer cannot, on his own account, prevent the dissipation of the soil resources, the community is obliged to assist him for the sake of its own survival.

The Powerlessness of the Individual

Many forces are compelling or inducing the individual farmer to exploit his soil. The over-capitalization of land values and the resulting heavy debt burdens cannot be blamed on any individual farmer. High debt burdens and low agricultural prices exert a strong financial pressure upon the farmer to get as much out of his soil as he can, regardless of how its future productivity is affected. In concrete terms, many a farmer, particularly the one on a relatively small acreage, had to plow up rolling pasture land and crop it to corn in order to make a living for his family and retain his farm.

Nor can an individual farmer be blamed for leases and landlord-tenant relationships which are detrimental to the conservation of soil fertility. These leases and landlord-tenant relationships were adequate at the time they originated many decades ago. A shifting tenancy and a cash-grain type of farming promoted the rapid and complete settlement of the Middle West, and the common crop-share lease is ideally suited to this type of land tenure and farming. But conditions have changed. The livestock enterprises, chiefly hogs, beef cattle, dairy cattle and poultry, have been expanding continuously. Farming involves more and more processing of crops into livestock products, and land tenure tends to become more stabilized. Yet, the lease system has not changed, at least not rapidly and efficiently enough to keep up with these changes in the farming enterprise.

Our lease system, our institution of land tenure, does not adequately reflect and recognize the growing necessity for

soil conservation and a more stable agriculture. One has only to compare our leases with those of the European countries in order to realize how inherently exploitive our system of land tenure is.⁶ In concrete terms, a one-year crop-share lease does not in the least safeguard soil conservation. To the contrary, it invites heavy cropping to corn, discourages the use of well balanced crop rotations and proper soil management, and hinders the development of livestock enterprises, particularly of cattle.

In the following pages, some of these broader economic and social forces which are standing in the way of practicing soil conservation will be discussed. Most of the material upon which the discussion is based is taken from the survey records of 148 farms in the Big Creek watershed area, and from records kept by the Soil Erosion Service in Bethany, Mo. Most of these broad economic forces which these data indicate, however, extend far beyond this particular area, and constitute a major problem in any soil conservation program in the Middle West.

ECONOMIC AND SOCIAL FORCES INFLUENCING EROSION CONTROL IN THE BIG CREEK WATERSHED OF SOUTHERN IOWA AND NORTHERN MISSOURI

Most of the data upon which the following discourse is based are obtained from a survey taken in September, 1934, covering 18.5 percent of the Big Creek watershed area in which the Soil Erosion Service carries on its control work. In order to get a sample of farms representative for the whole area, nine blocks of about four sections each were selected. (See fig. 1.) These blocks are scattered over the area, and their topography and soil conditions represent very nearly those of the entire region. All farmers in these nine blocks, 148 in number, have been visited, whether they had signed contracts with the Soil Erosion Service or not, whether their farms were large or small, whether they had severe or little erosion on their land. Thus, a sample of farms is obtained which, it is believed, pictures the farming con-

⁶In Germany, for instance, no farm can be rented for a period shorter than 7 years, and each lease has several provisions safeguarding soil productivity and prohibiting soil exploitation.

ditions representative for the area as a whole, at least in the more general and important features.

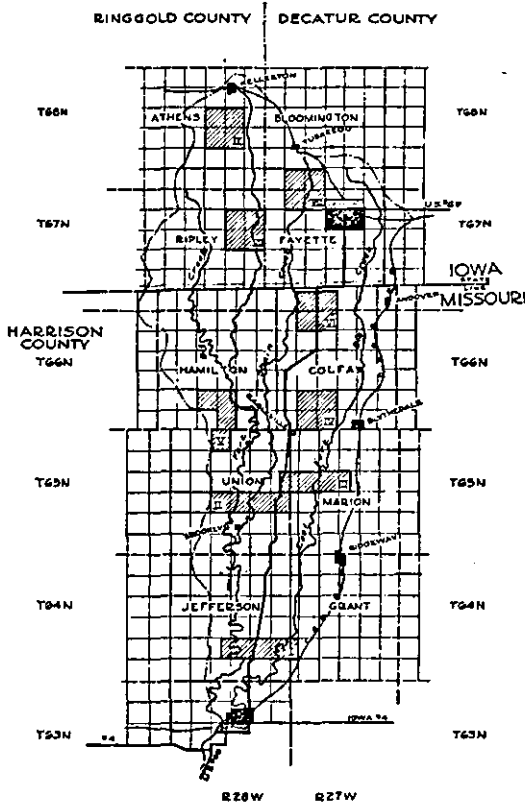


Figure 1. Soil erosion control area of the Big Creek watershed, and the 9 sample blocks covered by the survey.

Influence which these conditions have on erosion and its control, each farm has been given an "erosion rating," indicating the degree of erosion to which the crop land of each farm has been subject. The ratings range from (1) for little erosion to (7) for serious erosion, the average degree of erosion being represented by a rating of around (4).⁶

The schedule used in the survey made of these farms covers information on crop and pasture acreages, livestock normally on farm, annual sales of crops, livestock and livestock products, land tenure, mortgage indebtedness, value of buildings, years operator has been on farm, age, education and social activities of operators, and other items relevant to the complex situation of farming conditions. Since the main purpose of collecting this information is

⁶The unweighted average of the ratings of all farms falls between 3.7 and 3.8, which suggests a satisfactory accuracy in classifying the farms by their status with regard to erosion. These erosion rating numbers are composites of two different factors: topography and present apparent erosion, which have been determined separately for each farm as far as it was possible. The chief criteria used in appraising "present apparent erosion" are number and size of gullies, sheet deposits of soil on bottoms of hillsides, and outcroppings of subsoil. These ratings have been ascertained by inspection of the farms surveyed, independent from the soil survey of the Soil Erosion Service.

It has been pointed out that the type of plant cover greatly influences the rate of soil erosion, and that the problem of erosion control within agriculture centers around the readjustment of the crop system to soil conditions, so as to prevent the dissipation of the soil's producing power. The most important crop of the area, and at the same time the crop most conducive to erosion, is corn. Hence, the effect of a crop system on soil erosion depends largely on the proportion to which the cultivated land is cropped to corn. In the following, the percentage of the total crop land in corn will be used as the chief criterion of the crop system. It is true, soybeans are nearly as much, or even more conducive to soil erosion than corn, but they are much less important in total acreage, and are not grown on all farms. In fact, soybeans have gained in significance only during the last few years, largely as a result of the chinch bugs which damaged oats and corn crops for several successive years.

Table 1 strikingly reveals the decisive influence of the crop system on the degree of erosion. If the level farms with fields of less than about 3 percent slope where very

TABLE 1. PERCENTAGE OF CROP LAND IN CORN, FARM SIZE AND NUMBER OF FARMS ON ROLLING LAND, CLASSIFIED BY DEGREE OF EROSION.*

| Erosion rating | Percentage of crop land in corn | Average farm size in acres | Number of farms |
|----------------|---------------------------------|----------------------------|-----------------|
| 1 | 32 | 198 | 21 |
| 2 | 35 | 198 | 23 |
| 3 | 36 | 199 | 21 |
| 4 | 35 | 254 | 20 |
| 5 | 39 | 192 | 20 |
| 6 | 42 | 176 | 18 |
| 7 | 46 | 146 | 17 |

*Eight farms have been rated as level and are not included in this table (see text).

little erosion occurs no matter how heavily they are cropped, are eliminated, it is found that the degree of erosion increases closely along with the percentage of crop land in corn, from rating 1 with 32 percent in corn, to rating 7 with 46 percent in corn. This is particularly important in con-

sideration of the fact that in the first erosion group presumably half of the farms have less than 32 percent, and in the seventh group, half of the farms have more than 46 percent of the crop land in corn.

Logically, all factors which affect the prevailing crop systems have a direct bearing on the problem of erosion control. The prevailing crop system, however, is the result of broad economic and social forces, of general circumstances, many of which are outside the control of individual farmers. Unless these forces are faced squarely, and devices are found to deal with them effectively, there is very little chance for any soil conservation program to attain general adoption and yield permanent results.

FARM SIZE AND TYPE OF FARMING AS RELATED TO EROSION CONTROL

Effect of Farm Size on Crop System

When a farmer sets up his farming program, the size of his farm is a fixed factor, something he cannot change very well from year to year, certainly not within the year, something to which he definitely has to adjust his crop and livestock system. At the same time, he must make a living for himself and his family on his farm, whether he has 80 or 320 acres to handle. Similarly, his labor supply on the farm all the year round is a relatively fixed factor to which he has to adapt his farming program. Except for some outside labor hired for short rush periods, the labor is supplied chiefly by the farmer and his family, and his farming program is aimed at keeping him busy all the year round as profitably as possible.

CROP LAND AND PASTURE. The various uses to which a farmer can put his land absorb various amounts of labor. It is characteristic of the two major agricultural land uses, crops and pasture, that crops absorb relatively much, pasture relatively little labor. The smaller the farm size, the larger will be the proportion of the land put into uses requiring much labor and returning correspondingly higher values per acre. A farmer on 80 acres could hardly make

a living if he had only one-fourth, or 20 acres, in crops, while a farmer on 320 acres, with one-fourth, or 80 acres in crops, can fare very well. Moreover, on a large farm on rough and erosive land there is a much greater chance to confine crop production to level bottom soils and gentle slopes than there is on a small farm, which tends to render erosion control on small farms more difficult.

Of the farms surveyed in the Big Creek area, those below 100 acres have 66 percent of their land in crops; those above 300 acres have only 58 percent in crops. (See table 2.) The crop land on the small farms would undoubtedly constitute a higher proportion of the land were it not for the rough topography of the area which results in a relatively high proportion of untillable land. The fact that the percentage of farm land in crops on the small farms is not considerably greater than that on the large farms apparently supports the observation that small farms are often found in the rougher sections of the area where a smaller proportion of the land is tillable. This has a definite bearing on erosion control, because the small farmer is often forced to plow up land which is too steep for cultivation from the viewpoint of erosion control, in order to utilize his labor and to raise enough crops for his livestock.

Another indication of such maladjustment of farm size with respect to topography is revealed by comparing Block VII with Block VIII in table 3. Block VII has the roughest topography of all the sample blocks, and probably not more than 40 percent of the land should be cultivated. Yet 65 percent of the land is in crops, and the chief reason, very likely, is that the average farm in this block is only 155 acres in size. Consequently, this block has the highest erosion rating of 5.3. Block VIII, on the other hand, has a gently rolling to level topography, and a high proportion of tillable land, which is reflected by the lowest erosion rating, 2.4, coinciding with as much as 77 percent of the farm land in crops. This block, therefore, would be well suited to small farms. Yet, the average farm size in this block is as large as 257 acres.

From these facts the inference may be drawn that the farm size often is a limiting factor in erosion control. On small farms, crops tend to be pushed farther up on the steep hillsides than on large farms. If erosion control requires that certain fields be withdrawn from cultivation and seeded down to pasture, this will, in general, be more difficult, yet more often necessary, on small farms than on large ones.

CROP SYSTEM. The farm size influences not only the proportion to which the farm land is cropped, but also the proportion to which the cultivated land is used for specific crops. Here, again, the various crops have various labor requirements, and represent various values per acre. The pressure to grow as much high-valued crops as possible is naturally greater on small farms than on large ones, and the possibility is greater, too, as the high-valued crops generally require more labor, and more labor is available per acre on small farms.

Specifically, the percentage of crop land in corn and the degree of erosion tend to increase as the size of the farm decreases. According to our survey records, farms of more than 300 acres have only 33 percent of their crop land in corn and an erosion rating of 3.2, in contrast to the farms of less than 180 acres, which have over 40 percent in corn and have a considerably higher erosion rating. (See table 2.) This relation between farm size and percentage of crop land in corn and its effect on erosion is also substantiated by table 1, showing the smallest average farm size of 146 acres with the highest average percentage of crop land in corn (46 percent) for the groups of farms with the highest erosion rating of 7.

TABLE 2. DEGREE OF EROSION, CROP SYSTEM, AND NUMBER OF FARMS, CLASSIFIED BY FARM SIZE.

| Farm size (acres) | Erosion rating | Percentage of crop land in corn | Percentage of farm land in crops | Number of farms |
|-------------------|----------------|---------------------------------|----------------------------------|-----------------|
| 100 and below | 3.7 | 40 | 66 | 32 |
| 101 — 140 | 4.4 | 38 | 59 | 30 |
| 141 — 180 | 3.5 | 42 | 58 | 33 |
| 181 — 300 | 3.4 | 37 | 61 | 29 |
| 301 and above | 3.2 | 33 | 58 | 24 |

Again, the two blocks numbered VII and VIII furnish a good illustration. In block VII with the smallest average farm size of 155 acres, and the highest erosion rating of 5.3, the percentage of crop land in corn is 46, the highest of all blocks. In block VIII, with the largest average farm size of 257 acres, and the lowest erosion rating of 2.4, only 31 percent of the crop land is in corn, the lowest corn acreage of all blocks. (See table 3.)

TABLE 3. DEGREE OF EROSION, CROP SYSTEM AND FARM SIZE, IN SAMPLE BLOCKS.*

| | Block number | Erosion rating | Percentage of crop land in corn | Average farm size (acres) | Percentage of farm land in crops | Number of farms |
|--------------------------------|--------------|----------------|---------------------------------|---------------------------|----------------------------------|-----------------|
| High topography rating (rough) | VII | 5.3 | 46 | 155 | 65 | 16 |
| | II | 4.4 | 44 | 166 | 49 | 15 |
| Low topography rating (level) | VIII | 2.4 | 31 | 257 | 77 | 11 |
| | I | 2.7 | 34 | 177 | 44 | 20 |

*These four blocks represent both extremes regarding topography. The remaining five blocks (see fig. 1) fall in between, with reference to topography as well as to the other features presented in this table.

Even though several factors⁷ tend to disturb this inverse correlation between farm size and percentage of crop land in corn, erosion control, in many cases, definitely faces the difficulty that a greater reduction in corn acreage is required on small farms than on large ones, although this reduction is harder to bring about. According to 362 cooperative agreements between the Soil Erosion Service and the farmers, a corn reduction of about 36 percent seems to be necessary to handle the erosion problem on farms below 140 acres in size, while on farms above 140 acres a reduction of about 28 percent seems to be sufficient. (See table 4.) To be sure, these changes represent compromises between the ideal crop system from the soil conservation viewpoint and the crop system practically possible from the farmer's economic viewpoint. For instance, the farms in the 141-180

⁷The main factors are dairying and owner-operatorship, which, on small farms, tend to keep down the percentage of crop land in corn. They are discussed later.

TABLE 4. PERCENTAGE CHANGE IN ACREAGES OF CORN, HAY AND PASTURE, FROM THE 1932-1933 LEVEL, TO BE EFFECTED BY 1938, ACCORDING TO CONTRACTS, BY FARM SIZE.*

| Size groups (acres) | Corn | Timothy and clover | Pasture | Number of farms |
|---------------------|-------|--------------------|---------|-----------------|
| 60 — 100 | -37.6 | +12.8 | +53.0 | 109 |
| 101 — 140 | -31.6 | +22.4 | +29.9 | 56 |
| 141 — 180 | -23.3 | + 9.2 | +53.5 | 80 |
| 181 — 230 | -28.0 | +25.1 | +53.3 | 37 |
| 231 — 300 | -29.1 | +12.1 | +46.4 | 47 |
| 301 — 400 | -30.3 | +70.6 | +19.0 | 23 |
| above 400 | -39.5 | + 4.6 | +69.0 | 10 |
| Average | -30.8 | +19.3 | +45.5 | |

*Taken from 362 cooperative agreements between the Soil Erosion Service and the farmers. Up to March, 1935, about 650 agreements had been signed. The estimated average corn reduction provided for in these 650 agreements is around 37 percent.

acre group may well need a corn reduction of over 30 percent, but the respective farmers were not willing nor able to go farther than 27 percent. The degree of corn reduction eventually agreed upon is influenced not only by the impending dangers from erosion and by the farm size, but also by such factors as land tenure, financial pressure and opportunity for shifting to other enterprises, as will be discussed subsequently.

Moreover, it should be kept in mind that these changes agreed upon may be subject to modifications if they should prove economically impracticable, particularly in the smaller size groups. It is quite conceivable that several farmers may not be able, financially, to live up to their commitments regarding corn reduction, despite their best intentions and genuine understanding of the necessity of erosion control. Fortunately, the agreements are flexible enough to allow modifications of the planned crop systems as time goes on.

Effect of Type of Farming on Crop System

When a farmer sets up his farming program, he coordinates his crop system with his livestock system. In southern Iowa and northern Missouri, most of the crops are fed to livestock on the farm. Sales of cash grain or other crops are relatively insignificant. The various livestock enter-

prises are based on different kinds of feed. Hogs are primarily consumers of corn; beef and dairy cattle consumers of roughage and pasture. These three chief livestock enterprises of the region are combined in various proportions. On a farm where the hog enterprise is the main source of income, corn tends to predominate in the crop system. Where beef or dairy cattle represent the main source of income, hay gains in importance in the crop system, and more pasture must be available.

The survey records show that farms deriving more than 50 percent of their total gross income from hogs have 44 percent of their crop land in corn, and have the highest erosion rating, 4.2 (See table 5.). Farms receiving more than 30 percent of their income from dairying crop only 37 percent of their cultivated land to corn, and have an erosion rating of only 3.5. Farms getting more than 35

TABLE 5. CROP SYSTEM, FARM SIZE, DEGREE OF EROSION, AND INCOME STRUCTURE FOR THREE CHARACTERISTIC TYPES OF FARMING.

| Type of farming | Percentage of crop land in corn | Average farm size (acres) | Erosion rating | Percentage of gross income from | | | Number of farms |
|-----------------|---------------------------------|---------------------------|----------------|---------------------------------|-------|------|-----------------|
| | | | | Beef | Dairy | Hogs | |
| Beef Farms* | 31 | 307 | 2.7 | 55 | 2 | 29 | 23 |
| Dairy Farms** | 37 | 142 | 3.5 | 10 | 45 | 25 | 23 |
| Hog Farms*** | 44 | 160 | 4.2 | 11 | 12 | 64 | 40 |

*Farms deriving 35 percent or more of gross income from beef cattle.

**Farms deriving 30 percent or more of gross income from dairying.

***Farms deriving 50 percent or more of gross income from hogs.

These lines of division are so drawn that the classification is mutually exclusive, and that the respective enterprise has a key position in the farm organization.

percent of the income from beef cattle keep as little as 31 percent of their crop land in corn and show the lowest erosion rating, 2.7. Despite the fact that only farms deriving at least 50 percent of their gross income from hogs are classified as hog farms, almost twice as many hog farms are found as either beef or dairy farms. This indicates the predominance of the corn-hog enterprise in the area.

These data strikingly reveal the close correspondence of livestock system and crop system, and of farm type and degree of erosion. It should be noticed, that in the type

groups as classified in table 5, the relative importance of the key livestock enterprise varies. The hog farms derive, on the average, 64 percent of their income from hogs, the dairy farms only 45 percent from dairying, the beef cattle farms 55 percent from beef cattle. This means that the dairy farms are less strongly of the dairy type than hog and beef farms are of the hog and beef cattle type, respectively. If they were more predominantly of their type it could perhaps be assumed that the dairy farms had less crop land in corn and consequently a lower erosion rating. The relatively large production of manure in the dairying enterprise also tends to reduce soil losses from erosion, because application of manure increases the organic matter content and infiltration capacity of the soil.

The correspondence between a low percentage of crop land in corn and a strong dairy enterprise on small farms, and beef cattle enterprise on large farms, is very effectively illustrated by classifying farms into two groups of low and high corn acreage relative to crop land, and comparing the intensity of the two cattle enterprises in these crop system groups. (See table 6.) Of the farms less than 140 acres in size, those with a low percentage of crop land in corn (average 29 percent) sell 916 pounds of butterfat per 100 acres, while those with a high percentage of crop land in corn (average 54 percent) sell only 704 pounds of butterfat per 100 acres. The same holds true in the 141-180-acre size group. The intensity of the cattle enterprise is higher on farms with a low relative corn acreage in all three size groups of farms, most markedly so in the largest size group of 180 acres and above where the farms with a low relative corn acreage (29 percent of crop land) sell 92 head of cattle per 1,000 acres, as compared with a high relative corn acreage (49 percent of crop land) selling only 62 head per 1,000 acres. In this group, the intensity of dairying declines to around 300 pounds of butterfat.

These facts are of great concern to the erosion control problem. They definitely indicate that expansion of the dairy enterprise would greatly facilitate reduction of corn acreage through establishment of more balanced crop rotations with a larger proportion of the crop land in soil-pro-

tecting grasses and legumes. Yet, physical, economic and social conditions seem to limit the expansion of dairying which so effectively saved the northeastern section of Iowa from such devastating erosion as southern Iowa and northern Missouri are experiencing.

TABLE 6. INTENSITY OF THE DAIRY AND BEEF CATTLE ENTERPRISES AND NUMBER OF FARMS CLASSIFIED BY FARM SIZE AND PERCENTAGE OF CROP LAND IN CORN.

| | Percentage of crop land in corn | Pounds of butterfat sold per 100 acres | Number of cattle sold per 1000 acres | Number of farms |
|------------------------------|---------------------------------|--|--------------------------------------|-----------------|
| Farms below 140 acres: | | | | |
| Low relative corn acreage* | 29 | 916 | 36 | 38 |
| High relative corn acreage** | 54 | 704 | 32 | 24 |
| Farms of 141-180 acres: | | | | |
| Low relative corn acreage | 33 | 914 | 38 | 15 |
| High relative corn acreage | 50 | 627 | 29 | 18 |
| Farms above 180 acres: | | | | |
| Low relative corn acreage | 29 | 228 | 92 | 37 |
| High relative corn acreage | 49 | 451 | 62 | 16 |

*All farms with less than 40 percent of crop land in corn.

**All farms with more than 40 percent of crop land in corn.

Influence of Farm Size on Types of Farming

The various types of farming, representing various combinations of crop and livestock enterprises, have different labor requirements per acre and per livestock unit. By comparison, beef cattle rank lowest, hogs medium and dairy cattle highest in their labor requirements. This is reflected in the average farm sizes of the three definite type groups presented in table 5. The beef farms average 307 acres in size, the hog farms 160 acres, and the dairy farms 142 acres. A small farmer could not specialize in beef cattle raising, because neither beef cattle nor the corresponding pasture and hay crops, in the number and acreage associated with a small size farm, can profitably absorb enough labor. Hence, a large roughage and pasture acreage

and a large beef cattle herd are necessary if the farmer's labor is to be utilized effectively.

With regard to hog and dairy types of farming, the difference in total labor requirements per unit of final product is not quite as great, if the labor for growing the respective feed crops is included. The comparatively small difference between the average size of 142 acres for dairy and 160 acres for hog farms supports this contention.⁸ There is, however, a very important difference in the proportions to which the labor requirement is divided between crop and livestock enterprise. In the hog type of farm, the major portion of labor is applied to the crop system, specifically to a relatively high corn acreage; in the dairy type of farm the major portion of labor is applied to the livestock system, specifically to dairy cows and the handling of the dairy products and equipment. To the extent to which skim milk is utilized by hogs and poultry as supplementary enterprises, still more labor is diverted from crops to livestock. It often becomes necessary for the farmer to purchase additional concentrates, chiefly corn and small grains, instead of growing them himself.

The association of hogs and corn represents a combination of a labor-extensive livestock enterprise with a labor-intensive crop system. The association of dairying and roughage represents a combination of labor-intensive livestock enterprise and labor-extensive crop system. Both associations, or farm-types, are adapted to relatively small farm sizes, since both absorb profitably a high amount of labor per unit of the final product. In general, this holds for the dairy-type even more than for the hog-type.

The association of beef cattle⁹ and roughage represents a combination of a labor-extensive livestock enterprise and a labor-extensive crop system, that is a combination of two extensive enterprises. This farm type, therefore, requires a large acreage to utilize profitably the family's labor supply, and is not adapted to small farms.

⁸It should, however, be kept in mind that the hog enterprise on the "hog farms" as classified in table 5 is much more strongly developed than is the dairy enterprise on the "dairy farms."

⁹Sheep raising represents an even more extensive enterprise than beef cattle raising.

There are many data indicating the concentration of dairying on the smaller farms, of beef cattle on the larger farms. For instance, table 7 reveals that the intensity of dairying, measured in pounds of butterfat sold per 100 acres of farm land, is over 1,100 on farms of 60-100 acres as against 439 on farms of 181-300 acres and 176 on farms of over 300 acres. The intensity of the beef cattle enterprise, measured in head of cattle sold per 1,000 acres, changes in the opposite direction: around 35 on farms of below 180 acres, as against 80 on farms of above 180 acres.

In the smallest size-group of 60-100 acres, relatively the highest number of hogs (46) is sold and also the largest amount of butterfat. At the same time, this size group greatly outranks all others in the number of cases of eggs sold per 100 acres (40). This further illustrates the comparatively high intensity of livestock enterprises in general on the small farms, due to the fact that the small crop acreage cannot absorb as large a portion of the family labor as it does in the larger-size groups.

A good criterion for determining the type of farming is the percentage distribution of gross income from the various

TABLE 7. INTENSITY OF VARIOUS LIVESTOCK ENTERPRISES, CLASSIFIED BY FARM SIZE.

| Farm size (acres) | Pounds of butterfat sold per 100 acres | Number of cattle sold per 1,000 acres | Number of hogs sold per 100 acres | Cases of eggs sold per 100 acres |
|-------------------|--|---------------------------------------|-----------------------------------|----------------------------------|
| 60 — 100 | 1119 | 42 | 46 | 40 |
| 101 — 140 | 648 | 32 | 34 | 28 |
| 141 — 180 | 759 | 33 | 31 | 23 |
| 181 — 300 | 439 | 72 | 34 | 20 |
| 301 and above | 176 | 87 | 32 | 8 |

sources. Table 8 shows the income distribution for the five groups of farm sizes, and, again, the relative predominance of dairying in the smallest, and of beef cattle in the largest size groups is revealed. The farms of less than 100 acres derive 25 percent of their income from dairying and only 14 percent from beef cattle, in contrast to the farms of more than 300 acres which derive only 7 percent from dairying, but 40 from beef cattle. Hogs, however, represent

the most important source of income in all size groups, except in the largest, where the beef cattle enterprise is practically of equal importance.

These facts bear directly on the erosion problem. Reducing corn and replacing it by grasses and legumes implies replacing hogs by dairy and beef cattle and sheep. There is little opportunity to expand the beef cattle enterprise to a key position in the organization of a small farm. Here, an increase in cattle means chiefly an increase in dairying. As the possibilities for a substantial expansion of the dairy enterprise in this area seem rather limited, controlling erosion by reducing corn and shifting from hogs to dairy cattle will be possible only to a correspondingly limited extent. If, however, hogs are to be replaced by beef cattle or sheep, the average size of the former hog farm becomes inadequate; the acreage handled by one farmer has to be increased so that a less intensive crop system and a sufficiently large beef cattle herd or flock of sheep will absorb the farmer's labor profitably.

TABLE 8. FARM SIZE AND DISTRIBUTION OF INCOME FROM MAIN SOURCES.

| Farm size (acres) | Percentage of gross income from: | | |
|----------------------|----------------------------------|-------|------|
| | Hogs | Dairy | Beef |
| 100 and below | 36 | 25 | 14 |
| 101 — 140 | 40 | 17 | 15 |
| 141 — 180 | 41 | 22 | 13 |
| 181 — 300 | 38 | 10 | 29 |
| 301 and above | 38 | 7 | 40 |

It is interesting to note that this tendency toward larger farm sizes in this area has actually existed since about 1900. For the last 30 years the census figures show an increase in the average farm size of over 20 percent.

It is equally noteworthy that dairy production has increased significantly in more recent years,¹⁹ and indications

¹⁹Pounds of butterfat received by the cooperative creamery in Lamoni, Decatur County, increased from 287,000 in 1929 to 643,000 in 1934. Butterfat production increased by 97 percent between 1919 and 1929 in Ringgold County, and by 85 percent in Decatur County, Iowa. For Iowa as a whole, however, butterfat production increased by 89 percent during this period. The rate of increase in these southern Iowa counties, therefore, is only average.

are that this increase occurred on the smaller farms chiefly. Both tendencies facilitate adjustments in the crop system to the requirements of erosion control. This need for erosion control is becoming more urgent every year because these natural adjustments lag far behind, are slow and costly in many individual instances.

Adaptation of Farm Size and Type of Farming to Soil Conditions

The inference to be drawn from the preceding discussion is that a prerequisite for effective and permanent erosion control is the adaption of crop system, farm size and type of farming to soil conditions. This adaptation may take place in essentially three directions:

- (1) Shifting of emphasis from corn-hog to beef cattle on farms of around 200 acres or more in size perhaps with a slight increase in dairying, sheep, or other supplementary enterprises.
- (2) Shifting of emphasis from corn-hog to dairying or other labor-intensive enterprises on farms of around 160 acres and less in size.
- (3) Increasing the present size of farm of around 160 acres and less in order to facilitate the shift of emphasis from corn-hog to beef cattle and sheep.

It should be understood that these statements indicate general directions of adequate changes of farming systems in the area under consideration. They do not pretend to state quantitatively the extent of desirable shifts on any individual farm. Managerial ability and personal preferences of farmers, capital available, local market conditions, susceptibility of soil to erosion, are only a few of the many individual factors which determine the specific changes necessary to adapt the farming system to the soil conditions on a given farm.

An increase in the farm size (operating unit) may occur in various ways. A farmer on rough land may rent a nearby level field and transfer his corn from his steep hills to this level field, keeping his own land largely in grasses,

legumes and small grains. Another farmer may reduce his corn and increase his hay sufficiently to control erosion and rent additional pasture land to keep a beef cattle herd large enough to absorb his labor profitably.

Increasing the farm size by renting additional land may work very satisfactorily in some individual cases. As a general policy, however, it has serious shortcomings: first, it is self-defeating in the sense that if many small farmers were to adopt this policy, rents would shoot up and frustrate the adjustment; second, the farmer usually has no assurance of his use of the rented field for longer than 1 year. Yet his livestock adjustments depending on his renting additional land are of a long-time nature. This involves a dangerous element of risk.

Increasing the farm size by purchasing additional land avoids this risk and provides a secure basis for long-time readjustments. But it requires a considerable amount of capital, or the incurrence of new debts, which often is undesirable. A significant step toward such farm consolidation proper could perhaps be taken by the government buying land from corporate landholders, combining neighboring farms and selling them as a larger operating unit.¹⁴

The contention may be made that the type of farming could be adjusted to soil conditions on smaller farms by purchasing a greater part of the necessary corn instead of growing it. Again, this may work out satisfactorily on some individual farms. Its general adoption is liable to meet serious economic difficulties. First, the labor freed by reducing the corn acreage must find some profitable utilization elsewhere on the farm; second, it increases, especially if feeder steers are bought, the dependence of the farmer on the haphazards of the feed grain and livestock market and requires a commercial skill and a fund of liquid capital of which many farmers cannot readily avail themselves.

Alfalfa has been highly praised as a replacement crop for corn. It is true that alfalfa is the only alternative crop which yields approximately as high or higher feed value

¹⁴The Bankhead Tenancy Bill or similar legislation may possibly provide the machinery for such a policy.

per acre than corn, and at the same time reduces very effectively soil losses from erosion. Yet, it is equally true, that the possibilities of expansion of the alfalfa acreage in this area are rather limited, owing to physical as well as economic reasons. Only a relatively small part of the corn acreage reduction is likely to be profitably replaced by alfalfa. Lack of space forbids expanding on this question. Only a few major factors may be listed which definitely tend to limit the general expansion of the alfalfa acreage: (1) Alfalfa requires sweet soil, great depth of surface soil, and lack of intermittent frosts (winterkilling), in which respects this area is not particularly favored; (2) liming is in most cases indispensable, and alfalfa seed is relatively expensive, particularly in view of the uncertainty of getting a good stand; (3) the harvest accentuates the labor peaks in the period of the second corn cultivation and of the small grain harvest and threshing.

To the extent to which alfalfa can economically replace corn, however, it certainly is the most desirable alternative crop, from the viewpoint of erosion control as well as with regard to physical output per acre.

LAND TENURE

Attitude of Owner-Operator and Tenant Toward the Soil

Soil conservation requires a long-time planning of farming practices. A tenant farmer, who has no assurance from the landlord that he may stay on the farm for several years, who is ready to move to another farm at any given opportunity, naturally has a different attitude toward the soil than the owner-operator who builds up a permanent home for himself and his family and has a direct and persistent interest in keeping up the soil fertility, as well as the buildings and permanent improvements of his farm.

The length of time a farmer expects to stay on the same farm influences every major decision in the planning of his crop and livestock system, his farming practices and his living conditions. A good indication of how the length of time an operator stays on a farm affects his attitude towards the fixed, immovable assets of the farm, is obtained by comparing the value of buildings with the number of

years the operator has been on the farm. According to the survey records, the value of buildings on farms operated for 1 to 2 years by the same men is estimated at \$785 per farm, compared with \$1,477 on farms operated for 21 to 30 years by the same farmer.¹² In the first group, 79 percent of the operators are tenants; in the second group, not one operator is a tenant. (See table 9.)

Soil is another and a more important fixed asset of the farm. Yet a tenant usually has no incentive to practice good soil management in order to maintain fertility, unless he expects to own the farm sometime in the future, or at least to stay on the farm for a good number of years.

The average length of time a tenant who has no family relation to the landlord stays on the same farm is between 3 and 4 years, according to the survey records. Almost half of the tenants have been on their present farms not longer than between 1 and 2 years. This rapidly shifting tenancy

TABLE 9. CROP SYSTEM, DEGREE OF EROSION, VALUE OF BUILDINGS, SIZE AND NUMBER OF FARMS, AND TENANCY, CLASSIFIED BY OPERATOR'S YEARS ON FARM.

| Operator's years on farm | Percentage of crop land in corn | Erosion rating | Value of buildings per farm | Average farm size (acres) | Number of farms | Percentage tenant-operated farms |
|--------------------------|---------------------------------|----------------|-----------------------------|---------------------------|-----------------|----------------------------------|
| 1 — 2 | 42 | 4.3 | 785 | 166 | 33 | 79 |
| 3 — 5 | 40 | 4.2 | 917 | 158 | 29 | 62 |
| 6 — 10 | 39 | 4.2 | 836 | 168 | 11 | 73 |
| 11 — 20 | 36 | 2.7 | 1,414 | 212 | 21 | 24 |
| 21 — 30 | 36 | 3.9 | 1,447 | 178 | 27 | 0 |
| 31 and more | 30 | 2.8 | 1,368 | 234 | 27 | 0 |

has several strong advantages in certain aspects of social and individual developments. It offers a thrifty man a good opportunity, by allowing him to move quickly onto a better and still better farm, to accumulate savings and soon become a prosperous owner-operator of a farm or some other enterprise. Yet this opportunity is being paid for by future generations, out of the funds of the soil resource. Under certain conditions, for example under conditions of pro-

¹²The farm size of these two groups is 166 acres, and 178 acres, respectively; the great difference in value of buildings, therefore, cannot be attributed to differences in farm size.

gressive erosion, this price is apt to be ruinously high and may assume the dimensions of indefensible waste.

A program for erosion control should fully recognize this influence of the length of time an operator stays on the farm upon the management of the soil. Every means should be used to promote farm ownership by operators, and to adjust landlord-tenant relationships in the direction of longer leases, of developing a common interest of landlord and tenant in safeguarding the producing power of the soil. Soil conserving practices, such as longer rotations and the building up of cattle herds, involve immediate costs and investments, returns on which are distributed over many years to come. Unless tenants are given reasonable assurance of reaping benefits of such soil conserving practices, they cannot be expected to adopt them. Roughly 40 percent of the farms surveyed are tenant-operated. This percentage is highest, i. e. about 50 percent, in the middle-sized farms of between 101 and 180 acres, as can be seen in table 11. This indicates the importance of farm tenancy in this area, particularly as the farms of 100-180 acres show the most serious signs of erosion (see table 2).

Land Tenure Influencing Crop System and Type of Farming

The length of time an operator stays on one farm is reflected in the crop system. The shorter the operator's time on the farm, the higher the percentage of crop land in corn tends to be, and consequently the higher the degree of erosion. On farms operated for 1 to 2 years by the same man 42 percent of crop land in corn, and an erosion rating of 4.3 are found as compared with 30 percent in corn and an erosion rating of 2.8 on farms for 31 or more years under the same operator. (See table 9.) This illustrates the notorious relationship between a rapidly shifting tenancy and a highly exploitive farming system.

The length of farm occupancy is also reflected in the type of farming. The groups of 11 to 20, and of 31 and more operator's years on farm, both characterized by low degrees of erosion and large farm sizes, represent beef cattle farmers, deriving 43 and 48 percent, respectively, of their gross

TABLE 10. PERCENTAGE OF INCOME FROM HOGS, DAIRY AND BEEF, FARM SIZE, AND DEGREE OF EROSION, CLASSIFIED BY OPERATOR'S YEARS ON FARM.

| Operator's years on farm | Percentage of gross income from: | | | Average farm size (acres) | Erosion rating |
|--------------------------|----------------------------------|-------|------|---------------------------|----------------|
| | Hogs | Dairy | Beef | | |
| 1 — 2 | 37 | 17 | 15 | 166 | 4.3 |
| 3 — 5 | 41 | 21 | 11 | 158 | 4.2 |
| 6 — 10 | 49 | 14 | 17 | 168 | 4.2 |
| 11 — 20 | 35 | 9 | 43 | 212 | 2.7 |
| 21 — 30 | 44 | 13 | 22 | 178 | 3.9 |
| 31 and more | 33 | 6 | 48 | 234 | 2.8 |

income from beef cattle; the group of 21 to 30 operator's years on farm, characterized by a smaller average farm size and a higher degree of erosion, represents farms with a greater emphasis on hogs, receiving 44 percent of their income from hogs and only 22 percent from beef cattle. But even here the beef cattle enterprise is more important than in any of the three groups with less than 10 operator's years on farm, where hogs invariably represent the main source of income, and dairying is second in importance. The average farm size is smaller, the percentage of crop land in corn and the degree of erosion are considerably higher in these three groups of below 10 years, than in the other three groups of 10 and more operator's years on farm.

The crop systems of owner-operated farms and tenant-operated farms show the same tendencies. Owner-operators have, on the average, only 34 percent of their crop land in corn, as against 42 percent on tenant-operated farms. This holds for all size groups, but is particularly marked on the farms of below 140 acres, as shown in table 11. In this group, owner-operators tend much more toward the dairy type of farming than tenants. By far the most intensive dairy enterprise is found on the 60-100 acre farms operated by owners, with 1,312 lbs. of butterfat sold per 100 acres of farm land. If, in the case of a small over-cropped tenant farm, the lease could be adapted to dairy farming by providing for a longer term and a more equitable division of costs and returns, the way may be substantially cleared for establishing better crop rotations and other erosion control devices on that farm.

TABLE 11. CROP SYSTEM, INTENSITY OF LIVESTOCK ENTERPRISES, AND NUMBER OF FARMS, CLASSIFIED BY LAND TENURE AND FARM SIZE.*

| Farm size (acres) | Percent- age of crop land in corn | | Butter- fat sold per 100 acres | | Number of cattle sold per 1000 acres | | Number of hogs sold per 100 acres | | Number of farms | |
|----------------------|---|---------|--|---------|--|---------|---|---------|-----------------------|---------|
| | Owners | Tenants | Owners | Tenants | Owners | Tenants | Owners | Tenants | Owners | Tenants |
| All size groups | 34 | 42 | 447 | 679 | 88 | 36 | 35 | 34 | 83 | 57 |
| 60 — 100 | 39 | 54 | 1312 | 412 | 39 | 39 | 36 | 38 | 20 | 4 |
| 101 — 140 | 32 | 45 | 667 | 645 | 28 | 35 | 33 | 34 | 15 | 15 |
| 141 — 180 | 41 | 43 | 701 | 790 | 50 | 20 | 33 | 29 | 17 | 16 |
| 181 — 300 | 33 | 43 | 305 | 768 | 97 | 35 | 37 | 35 | 18 | 11 |
| 301 and above | 29 | 39 | 95 | 570 | 134 | 48 | 34 | 37 | 13 | 11 |

*The eight farms below 60 acres in size are not included in this table, because they do not represent independent farm operating units (full-time farms), and therefore would in some points obscure this refined analysis with their irrelevant data.

The fact that in the larger size groups dairying is less intensive on the owner-operated than on the tenant farms is partly explained by the increasing emphasis on beef cattle on the larger owner-operated farms (those above 140 acres). They sell two and three times as many head of cattle as do the tenant farms of similar size. The main reasons for this are probably that beef cattle raising is a long-time enterprise, owners can avail themselves more easily of credit than tenants, and cattle feeding involves a relatively large amount of capital, which is usually obtained on credit.

In interpreting the hog enterprises on tenant farms as compared with owner farms, one must keep in mind that the tenant usually delivers half his corn crop to the landlord. The considerably higher corn acreage on tenant farms shown in the preceding table, therefore, is not reflected in the number of hogs sold per 100 acres. If the landlord's share of the corn crop were fed on the tenant farms, one could expect an increase of roughly one-half or more in the hogs sold over the figures given in this table. Table 13, for example, shows that cash rent farms sell about twice as many hogs per 100 acres as crop share farms. This would, in all size groups, result in a much stronger hog enterprise on

tenant than on owner farms. From the viewpoint of erosion control, it is almost immaterial whether a farmer uses his corn for paying his rent or for feeding hogs. The effect of heavy cropping to corn on the soil is nearly the same in both cases.

Owner-operatorship definitely favors the development of dairying in the small size group of farms, and the beef cattle enterprise in the large size group. In order to segregate the influence of land tenure on these two enterprises, we can roughly eliminate the effect of farm size and crop system by classifying the farms into three size groups of 60 to 140, 141 to 180, and above 180 acres, and into two crop system groups of low and high percentage of crop land in corn. (See table 12.)

It is revealed that in the group of low relative corn acreage, the owners in the small size group sell more than twice as much butterfat per 100 acres (1,037 pounds) as the tenants do (473 pounds); and the owners in the large size group sell almost four times as many head of cattle per 1,000 acres (115 head) as the tenants do (32 head). Even in the groups of high relative corn acreage, owners in the small size group produce much more butterfat (926 pounds per 100 acres) than tenants do (611 pounds); and owners in the large size group produce many more beef cattle (98 head per 1,000 acres) than the tenants do (48 head).

This influence of owner-operatorship on the beef cattle enterprise prevails also in the medium size group, while its influence on the dairy enterprise in this size group is not apparent.

Table 12 also supports the previous statement that owner-operators tend to keep less of their crop land in corn and to conserve their soil better than tenants. In all three size classes, owner-operated farms strongly predominate in the groups with low relative corn acreage (percentage of crop land in corn), while tenant-operated farms predominate in the group with high relative corn acreage. In the small size class, 26 farms, or almost 80 percent of the 33 farms with a low relative corn acreage are owner-operated; only 8 farms, or about 38 percent of the 21 with a high relative corn acreage are owner-operated.

TABLE 12. INTENSITY OF DAIRY AND BEEF CATTLE ENTERPRISES, AND NUMBER OF FARMS, CLASSIFIED BY FARM SIZE, CROP SYSTEM AND LAND TENURE.

| | Percentage of crop land in corn | | Pounds of butterfat sold per 100 acres | | Number of cattle sold per 1000 acres | | Number of farms | |
|---|---------------------------------|---------|--|---------|--------------------------------------|---------|-----------------|---------|
| | Owners | Tenants | Owners | Tenants | Owners | Tenants | Owners | Tenants |
| Farms of 60-140 acres: ¹ | | | | | | | | |
| Low relative corn acreage ² | 29 | 32 | 1,037 | 473 | 32 | 41 | 26 | 7 |
| High relative corn acreage ² | 51 | 55 | 926 | 611 | 33 | 28 | 8 | 13 |
| Farms of 141-180 acres. | | | | | | | | |
| Low relative corn acreage ² | 34 | 31 | 848 | 1,007 | 53 | 15 | 9 | 6 |
| High relative corn acreage ² | 51 | 50 | 590 | 644 | 42 | 18 | 8 | 10 |
| Farms above 180 acres: | | | | | | | | |
| Low relative corn acreage ² | 29 | 31 | 130 | 487 | 115 | 32 | 27 | 10 |
| High relative corn acreage ² | 50 | 49 | 540 | 416 | 98 | 48 | 5 | 11 |

1. See footnote on table 11.

2. See footnotes on table 6 for explanation.

These facts illustrate that dairying tends to be associated with better crop rotations and owner-operatorship in the smaller farm sizes, and that the beef cattle enterprises tends to be associated with better crop rotation and owner-operatorship in the larger farm sizes.

Landlord-Tenant Relationship

In the preceding pages the effect of the two main types of land tenure, owner-operatorship and tenancy, on crop system and type of farming have been discussed. Within tenancy, however, the specific relationship between landlord and tenant greatly influences the attitude of the tenant-operator toward the soil and his farming program in general.

Length of Lease. Of the 59 tenant farms surveyed, 48 of them, or 81 percent, are leased under a 1-year contract,

without any provisions for extension or renewal. The remaining 11 farm leases contain some provision for a continuance of the contract, either by specifying a definite length of the lease, ranging from 2 to 5 years, or by extending the validity of the contract automatically over the first year for an indefinite period until notice is served by the landlord or tenant. This shows that more than four-fifths of the tenants can plan only from year to year, as they do not know whether or not the lease will be renewed.

Only one of the 48 tenants operating under a 1-year lease is related to the landlord. Seven of the eleven tenants operating under a longer-term lease, however, are related to the landlord. In general, it can be assumed that where tenant and landlord are related, the time provision of the lease will have little effect upon the farming program of the tenant, as he has reasonable assurance of staying on the farm as long as he so desires. Only 8 out of the 59 tenants are related to their landlords.

Definite long-term leases presuppose a mutual confidence between landlord and tenant, which is, of course, hard to establish previous to a longer personal acquaintance. Pains-taking information about character and ability of the other party should precede the signing of the contract. To the extent that such reliable information is not readily available to either party, the use of this type of contract will be limited. Indefinite farm leases, however, tend to give the tenant some assurance, particularly if an oral agreement has been reached on the continuation of the lease. To that extent, they are preferable to the strictly 1-year leases.

Type of Lease. An even more important phase of the landlord-tenant relationship is the division of costs and returns between the parties. There are three major types of leases: *crop share*, *stock share* and *cash rent*. The crop share lease is by far the most common. Forty-seven farms, or 80 percent of the 59 tenant farms, are leased on the crop share basis. The remaining 12 farm leases, or 20 percent, are equally distributed between stock share and cash rent leases. It seems that this frequency distribution of the lease types is fairly representative for the area.

Crop share tenants pay half of the corn crop and usually half of the small grain and hay crop to the landlord. Pasture rent is paid in cash. It was at the rate of about \$2.00 per acre in 1934. In some cases hay land, too, is rented for cash.

Such a division of returns inherently favors the cropping of the largest possible proportion of the farm land, and the planting of the highest possible corn acreage. The lease provides no safeguards against bad practices in soil management and exploitive crop systems. Nor does it generally contain adequate provisions regarding division of costs and returns connected with liming the soil, with perennial legumes (alfalfa) and with soil conserving crop rotations, which would recompense the tenant in case he leaves the farm before having reaped the benefit of his practices and the returns on his investments.

Even if such provisions were common, the crop share lease would still definitely discourage the development of longer crop rotations, more pasture, and the building up of cattle herds to utilize the increased supply of grasses and legumes, because the landlord is interested primarily in receiving a large amount of corn and the tenant must have enough corn left, after he delivers the landlord's share, to feed his livestock—primarily hogs. The tenant is loath to go far into long-time enterprises such as dairying or beef cattle raising, on the basis of a 1-year lease. Forty-two of the 47 crop share leases are strictly 1-year contracts. Four out of the remaining five crop share tenants operating under longer-term contracts are related to the landlord.

The few *stock share* leases encountered in the survey, provide for equal division of all current expenses and of the receipts from livestock and livestock production between landlord and tenant. For a dairy farmer, this division tends to be unfavorable because of the relatively great amount of labor involved in dairying. For a beef cattle farmer, it is more nearly adequate, and in the six cases of stock share leases recorded, the emphasis in the cattle enterprise is definitely on beef. Four of these six stock-share tenants have long-term leases, and two of them are related to the landlord.

It is quite conceivable that the more general adoption of improved stock share leases could effectively clear the way for soil conserving crop systems and other measures for erosion control.

The six *cash rent* leases recorded by the survey stipulate an average rental payment of \$2.95 per acre for 1934. Provided the rate of rental payment is in harmony with current prices this type of lease is almost neutral regarding soil management and crop system. It neither favors nor discourages directly any particular crop or enterprise. If the rent is too high relative to prices, it may exert a strong pressure on the tenant to crop his land as heavily as possible. Temporary sacrifices incurred by shifting from corn to grasses and legumes fall entirely on the tenant unless the landlord contributes by lowering the rent at least for the period of readjustments in the crop and livestock systems. A more equitable rent adjustment could perhaps be obtained if the rent were based on a sliding scale determined by the prices as well as the volume of the products sold. In principle, the cash rent lease may well be adapted to the requirements of soil conservation and erosion control.

The effect of the three types of leases on the crop and livestock system is indicated in table 13. Since the samples of cash rent and stock share farms are rather small, the data do not present a strong statistical evidence of these effects. Yet, it is believed that they suggest tendencies which logically may well be, at least in part, the result of

TABLE 13. CROP SYSTEM, INTENSITY OF LIVESTOCK ENTERPRISES, FARM SIZE, AND NUMBER OF FARMS, CLASSIFIED BY TYPE OF LEASE.

| Type of lease | Percent- age of farm land in crops | Percent- age of crop land in corn | Cattle sold per 1000 acres | Butter- fat sold per 100 acres | Hogs sold per 100 acres | Cases of eggs sold per 100 acres | Aver- age farm size (acres) | Num- ber of farms |
|------------------------------|--|---|--|--|-------------------------------------|--|---|----------------------------|
| Crop share, 1-year lease* | 67 | 44 | 40 | 543 | 31 | 15 | 193 | 42 |
| Stock share | 39 | 27 | 63 | 570 | 28 | 12 | 275 | 6 |
| Cash rent | 48 | 40 | 44 | 742 | 67 | 23 | 125 | 6 |

*Five farms with long-term crop share leases are not included in this table, because these leases do not represent the common type of crop share lease.

the landlord-tenant relationship as determined by the respective types of lease.

The farms leased under 1-year crop share contracts show the highest percentage of land in crops (67 percent), the highest percentage of crop land in corn (44 percent) and the lowest intensity of dairying (543 pounds of butterfat sold per 100 acres). Under cash rent and stock share leases, the percentage of farm land in crops drops to 48 and 39, respectively. The percentage of crop land in corn drops to 40 and 27, respectively. It is interesting to note that the average size of the cash rent farm is 115 acres and that of the stock share farm 275 acres. Correspondingly, the dairy enterprise is most highly developed on the cash rent farms (742 pounds of butterfat per 100 acres), and the beef cattle enterprise dominates on the stock share farms (63 cattle sold per 1,000 acres).

Type of Landlord. The type of landlord is, to a limited extent, also reflected in the way the farm is handled. In this regard, perhaps three types of landlords should be distinguished: (1) Private landlord, related to the tenant; (2) private landlord not related to the tenant; and (3) corporate landlord (banks and insurance companies). These types are listed in decreasing order of the interest the tenant is likely to have in the maintenance of soil fertility. A tenant who has family relationships to the landlord is apt to have very nearly the attitude of an owner-operator toward the farm. He often expects to own the farm sometime in the future. A private landlord unrelated to the tenant, in general, does not intend to sell the farm and is often interested in keeping a good tenant on the farm by offering him a long-term lease. In both cases, private ownership tends to insert an element of stability in the land tenure system, or at least allows such an element to develop.

Not so with corporate ownership. A corporate landlord is inherently a temporary owner, with primarily financial interests in the land, inserting an element of instability in the land tenure system. A corporation is ready to sell the farm any time, as soon as it can get a satisfactory price for it. Hence, it almost invariably rents under 1-year contracts. It is interested in the up-keep of the farm only to the extent

to which the present market value of the farm is affected. A soil conservation and erosion control program, in general, involves a longer time than a corporation expects to hold the farm. In recent years, to be sure, some banks and insurance companies seem to begin to realize the necessity of maintaining the soil productivity of their farms, because the market for farms has been so depressed for several years that they expect to hold the farms longer, with the hope for reviving land values. Even though this is as yet an exception, rather than a rule, a significant step toward erosion control could be achieved if corporate landlords became more interested in soil conservation and in using leases better adapted to soil conserving practices, since in many townships over one-third of the farm land is held by corporate owners.

About half of the tenant farms in the survey are owned by corporations. In some instances it was found that corporate landlords requested the tenant to put considerably more land in corn than the soil could stand, and more than the tenant would have done on his own judgment. Table 14 seems also to indicate a slight tendency towards heavier cropping to corn on corporate land than on privately-owned land. This tendency is most marked in the size group of 180 acres and above, namely 42 percent of crop land in corn on corporate compared with 32 on private land, and it is in this size group, too, where the highest percentage of tenant farms is corporately owned.

TABLE 14. CROP SYSTEM, NUMBER OF FARMS, AND INTENSITY OF LIVESTOCK ENTERPRISES, CLASSIFIED BY FARM SIZE AND TYPE OF LANDLORD.

| Farm size (acres) | Percentage of crop land in corn | | Number of farms | | Pounds of butterfat sold per 100 acres | | Number of cattle sold per 1000 acres | |
|----------------------|--|-----------------------|---------------------|-----------------------|---|-----------------------|---|-----------------------|
| | Private landlord | Corporate landlord | Private landlord | Corporate landlord | Private landlord | Corporate landlord | Private landlord | Corporate landlord |
| All size groups | 40 | 43 | 29 | 28 | 587 | 636 | 25 | 41 |
| Below 140 | 46 | 49 | 12 | 7 | 584 | 613 | 30 | 41 |
| 141 — 180 | 45 | 41 | 9 | 7 | 768 | 861 | 24 | 19 |
| Above 181 | 32 | 42 | 8 | 14 | 501 | 426 | 22 | 46 |

DEBT BURDEN AND SOIL CONSERVATION

The effects of farm size and land tenure on the crop system, and how they impinge on the problem of soil conservation and erosion control have been discussed. It seems desirable now to inquire into the effect of debt pressure on the problem of soil conservation.

Size of Mortgage and Crop System

A heavy debt burden tends to stimulate heavy cropping. This holds true particularly under the conditions of a falling price level which renders it more difficult to meet the payments of interest and amortization. Most of the mortgage debts on the farms surveyed were incurred or renewed before 1920 or after 1924, when land values were relatively high and agricultural prices on the upgrade. During that time the size of the mortgage did not seem excessive. After 1929, when prices fell rapidly, the debt burden grew in proportion, and the farmer had to sell double and triple the amount of products to meet his financial obligations. He had to squeeze out of his soil whatever he could in order to save his farm from foreclosure. The conspicuous increase in the corn acreage throughout Iowa and Missouri during 1930 to 1932 undoubtedly reflects, in part, this increased debt pressure.¹³

The survey records definitely suggest an influence of the debt burden on the crop system in this direction. (See table 15.) The percentage of crop land in corn increases from 32 percent on farms practically clear of debt to 43 percent on farms with a mortgage of \$51 or more per acre. The percentage of farm land in crops also increases from 51 to 72 percent with increasing size of mortgage per acre. These data are all the more indicative of the effect of debt pressure as the debt pressure overshadows the influence of farm size on the crop system. The average farm size increases steadily with the debt burden, from 129 acres in the \$10-25 per acre group to 203 acres in the \$51 or more per acre group.

¹³In Missouri, the corn acreage jumped from 5.6 million in 1929 to 6.5 million in 1932, an increase of 16.3 percent. In Ringgold County, Iowa, corn acreage soared from 77,000 to 89,000 in the same period, an increase of over 15 percent.

Yet, it has been shown previously, that the percentage of crop land in corn tends to decline with increasing farm size.

It should be kept in mind, that the size of mortgage per acre is only a rough measure of the debt burden. A mortgage of 50 dollars per acre on good level land valued at 100 dollars is only a light burden compared with the same mortgage size on less productive and more rolling land valued at 60 dollars per acre. Hence, level farms are able to obtain higher mortgages and can carry the load more easily than rolling farms.

Therefore, in order to eliminate roughly the influence of

TABLE 15. CROP SYSTEM, FARM SIZE, AND NUMBER OF FARMS,* CLASSIFIED BY SIZE OF MORTGAGE PER ACRE.

| Size of mortgage in dollars per acre | Percentage of crop land in corn | Percentage of farm land in crops | Average farm size (acres) | Number of farms |
|--------------------------------------|---------------------------------|----------------------------------|---------------------------|-----------------|
| 0 — 9 | 32 | 51 | 185 | 52 |
| 10 — 25 | 31 | 56 | 129 | 22 |
| 26 — 35 | 37 | 56 | 164 | 25 |
| 36 — 50 | 40 | 63 | 193 | 29 |
| 51 and above | 43 | 72 | 203 | 26 |

*Farms taken over by the mortgagee since 1930 are included. The number of farms refers to ownership-units, not operating-units.

the higher value of level land, and to segregate the influence of the debt burden on the degree of erosion, the level farms on good land are excluded in table 16 so as to make the size of mortgage per acre more representative of the debt burden they impose. Another reason for eliminating the level farms is that very little erosion occurs here, no matter how heavily they are cropped. Even if a high debt pressure results in heavier cropping on level farms—and table 15 indicates that it does—it would not be registered by the erosion rating.

All farms above 60 acres in size and on rolling land are grouped by their size of mortgage per acre.¹⁴ The relation between debt burden and erosion is strikingly revealed. The erosion rating increases steadily with increasing size of mortgage per acre, from 3.5 in the group of farms practi-

¹⁴Farms below 60 acres in size are excluded, because they do not constitute independent operating-units, and debt obligations are often met with outside income.

cally clear of debt to 4.6 in the group of farms with a debt load of over 50 dollars per acre. This relation is further substantiated by dividing the farms into two classes: one with a high erosion rating of 4.6 for the class average, the other with a low erosion rating of 2.1 for the class average. The distribution of the farms of each mortgage-group in these erosion-classes shows that the higher the debt burden, the greater is the percentage of farms with a high degree of erosion. Seventy percent of the farms with a heavy debt load of over 50 dollars per acre suffer from serious erosion; while only 43 to 44 percent of the farms clear of debt or with only a light debt burden show high erosion ratings.

TABLE 16. DEGREE OF EROSION AND NUMBER OF FARMS ON ROLLING LAND, CLASSIFIED BY SIZE OF MORTGAGE PER ACRE.*

| Size of mortgage (dollars per acre) | Erosion rating | Percentage distribution of farms with high and low degree of erosion | | Total number of farms |
|-------------------------------------|----------------|--|-----|-----------------------|
| | | High | Low | |
| 0 — 9 | 3.5 | 44 | 56 | 45 |
| 10 — 25 | 3.5 | 43 | 57 | 14 |
| 26 — 35 | 4.0 | 50 | 50 | 24 |
| 36 — 50 | 4.4 | 59 | 41 | 27 |
| 51 and above | 4.6 | 70 | 30 | 25 |

*Farms whose crop land, on the average, does not exceed a slope of about 3 per cent, and farms below 60 acres in size are excluded (see text for explanation).

Relieving the Soil from Financial Pressure

These facts impinge directly on the problem of erosion control. Heavy debt burdens tend to force crop land into corn and farm land in general into crops, whether the land can stand it or not. Wherever, and to the extent to which this holds true, the effectiveness of any soil conservation program could be substantially increased by relieving the soil from this financial pressure caused by an excessive mortgage indebtedness.

There may be several approaches to this problem which could possibly be used. Some suggestions may be ventured as to the direction in which a soil conservation program could proceed in its efforts to overcome the harmful effects of heavy debt burdens on the soil.

Debt adjustments may be achieved by mutual agreement between mortgagee and mortgagor. Negotiations for

such individual debt adjustments could be arranged on the initiative of erosion control agents, because their disinterested judgment is likely to carry more weight than that of the farmer when it comes to convincing the mortgagee of the necessity for an adjustment, for the sake of maintaining soil fertility as well as the security of the loan. Whether the adjustment takes the form of scaling down the principal, or of reducing the interest rate, or of granting a moratorium with a provision for later adjustments in the case land values and prices should fail to revive sufficiently, is relatively immaterial from the viewpoint of erosion control, as long as the debt adjustment actually relieves the soil from a disproportionate debt pressure and affords the farmer a breathing spell for adopting a long-time program.

Refinancing of excessively high mortgages may be undertaken by the Farm Credit Administration or any other federal or state institution by taking over the mortgage at a reduced rate of interest and amortization, and, in some cases, by scaling down the principal to a more nearly reasonable level. The cost involved in this refinancing of mortgages could be interpreted as a legitimate contribution of society to the conservation of its natural resources.

Subsidies for interest payments have been suggested, to be granted to the farmer by some government institution, at least during the time of readjustment in his farming program, after the need for such a subsidy has been verified. A specified part of the farmer's interest payments would be paid to enable him to carry out a soil conservation program. This method may be used advantageously in conjunction with the first method of individual debt adjustments between the farmer and his mortgagee referred to above.

New credit facilities may be offered and already existing sources made available to farmers willing to cooperate in a soil conservation program. A farmer shifting from the corn-hog to the dairy and beef cattle enterprise in consequence of a program of erosion control may often need credit to do so. Agents of private credit institutions tend to appraise the value of a farm higher the more land in cultivation and the more corn acres they see. Hence, by reducing his corn and increasing his pasture, the farmer

may decrease the security value of his land in the opinion of the appraisers, which would reduce the credit available to him. A soil conservation program may help farmers to obtain cheap credit for the specific purpose of enabling them to establish a farming program which will control erosion.

In all cases, the urgent need for erosion control on the respective farm and the discrepancy between the size of the mortgage and the long-time producing power of the farm should be certified by disinterested experts. The farmer should definitely pledge himself to follow a soil conservation program and to submit to a compliance check.

SUMMARY AND CONCLUSIONS

Insofar as erosion control calls for (a) contraction of the crop land by retiring land from cultivation and putting it into permanent pasture or timber, and (b) reduction in acreage of corn and other intertilled crops on the remaining crop land, a series of broader economic and social forces are brought into play, which are largely beyond the control of the individual farmer. A comprehensive program for soil conservation should recognize these economic factors and should deliberately plan to utilize those which are favorable to, and to overcome those which stand in the way of, the promotion of erosion control practices.

The main economic and social factors affecting erosion control work may be listed briefly as follows:

| OBSTRUCTIVE FACTORS | FACILITATIVE FACTORS |
|--|---|
| 1. Small farm size | 1. Large farm size |
| 2. Corn-hog type of farming | 2. Dairy and beef cattle type of farming |
| 3. Lack of supplementary enterprises | 3. Possibility of profitable supplementary enterprise |
| 4. Tenancy | 4. Owner-operatorship |
| 5. Short-term leases | 5. Long-term leases |
| 6. Crop-share leases | 6. Stock-share and cash-rent leases |
| 7. Tenant unrelated to landlord | 7. Tenant related to landlord |
| 8. Corporate landlord | 8. Private landlord |
| 9. Heavy debt burden and high interest rates | 9. Small debt burden and low interest rates |
| 10. Relatively low farm income level | 10. Relatively high farm income level |

Let us summarize the salient points from the previous discussion of these factors:

(1) A small farm tends to have the greatest possible acreage of its land in cultivation, and the greatest possible acreage in corn, in order to utilize fully the family labor supply and to obtain the highest possible output per acre; on a large farm, steep hillsides can be kept in pasture, and intertilled crops can be restricted to more level fields.

(2) In the corn-hog type of farming, there is not much use for pasture land and hay crops, because the cattle enterprise is not strongly developed, and the emphasis is placed on hogs fed primarily on corn; the dairy and beef cattle type of farming requires much pasture and hay and usually makes for a smaller percentage of crop land in corn, thereby facilitating the control of erosion. The type of farming is definitely related to the farm size. The beef cattle enterprise is concentrated in the large size groups, while the dairy enterprise, being labor-intensive, is especially adapted to small farms.

Soil conservation, in the final analysis, calls for a shift from corn-hogs to dairying in the small size groups, to beef cattle and sheep in the large size groups. To the extent to which this shift towards dairying on smaller farms is economically limited, the only alternative of general significance for permanent erosion control is to increase the farm size and to shift towards beef cattle and sheep.

(3) In some individual instances, supplementary enterprises may be developed which provide for profitable utilization of family labor on the farm without requiring a larger acreage of farm land. Poultry, vegetables and fruit, for example, may possibly supplement the major enterprises in the farm organization and contribute a significant part of the income, without preying upon the soil resources. In principle, a soil conservation program, particularly on small farms, must not allow the final aggregate output per farm, in terms of income, to decline.

Replacing corn by grasses and legumes sets labor free. Unless some other enterprises are developed to absorb this released labor profitably, the current net income is almost certain to decline and may force the farmer to discontinue his soil conserving rotations. The smaller the farm acreage

is per labor unit, the more complete and efficient must be the utilization of labor if a decent standard of living is to be attained. This higher labor utilization on the farm can be brought about by pushing the processing of the soil's products farther into higher-priced commodities, such as dairy products, eggs, vegetables, etc., as compared with hogs which represent a low degree of processing as far as labor requirements are concerned. The problem is to shift labor from erosive crops to other crops and enterprises which yield comparable returns per labor unit. The idea of saving for the future is workable only if there is something left to be saved in the present.

(4) A tenant operator, in general, has no specific interest in keeping up soil fertility, as he is ready to move to another farm any time he sees fit. An owner-operator inherently has a very definite interest in soil conservation, since his future independence and welfare rests upon the perpetuation of his soil's productivity. Tenancy, on the incline since 1920, is very likely stimulating the rate of erosion. Promoting operator-ownership tends to aid erosion control.

(5) Short-term leases accentuate the general tenant attitude toward the soil. The length of farm occupancy affects erosion control particularly because it involves immediate costs, the returns on which are distributed over many years; and involves changes in the crop and livestock system which are definitely of a long-time nature. Long-time leases, therefore, facilitate such changes.

(6) The crop share lease, by far the most common lease type, inherently encourages a large proportion of the farm land in crops, and a large percentage of crop land in corn, the most readily marketable cash-crop. Moreover, crop share leases usually run for only 1 year. Stock share leases, on the other hand, place the emphasis on livestock, on cattle particularly, and, subsequently, on pasture and hay crops. They commonly are long-term leases. The usual stock share lease is not well adapted to dairy farms. Promoting an improved stock share lease for dairy farms would be highly desirable from the viewpoint of erosion control. The

cash rent lease allows the tenant complete freedom in adjusting his farming program to soil conditions, provided the rent is adjusted to the price level. If it is not adequate, the tenant may resort to heavy cropping.

(7) A tenant who has family relationship to the landlord is apt to have an attitude toward the soil similar to that of an owner-operator. In many cases, he expects to own the farm later on. Under such circumstances, the length of the lease, and perhaps even the type of lease, may be rather immaterial to the problem of erosion control, because of the genuine community of interest of tenant and landlord with respect to soil fertility maintenance.

(8) Corporations are, by nature, temporary land owners. They are ready to sell the farm as soon as they can get a favorable offer. They have become landowners by accident, not by intention nor tradition. A tenant on corporate land has no assurance whatsoever of staying on the farm more than a year. As soil conservation requires a long-time farming program, the corporate landlord, in general, has little interest in it. Private landlords, on the other hand, usually do not own farms just to dispose of them as soon as possible, but rather as a permanent investment. Hence, they are vitally interested in conserving the producing power of the farm, and are often anxious to keep a good tenant on the farm. A high proportion of corporate land tends to cause instability in land tenure and to foster erosion, unless the majority of corporations can be induced to adopt definite soil conservation programs on their land.

(9) Heavy mortgage indebtedness exerts a specific financial pressure upon the soil by forcing the farmer to squeeze out of his soil whatever he can to meet his financial obligations. It would enhance erosion control work considerably if this pressure could be relieved by arranging for debt adjustments in connection with an erosion control program.

(10) The debt burden has become increasingly intolerable during the depression, which has left many farmers with incomes barely providing for their subsistence. Any policy which raises the general income level of farmers helps

to clear the way for soil conservation programs on the farms. The corn-hog program of the AAA doubtless tends to reduce soil losses through erosion, directly by reducing the corn acreage, and indirectly by increasing farm income and relieving farmers from tremendous financial pressure resulting in heavy cropping and subsequent soil losses.

There is another set of economic factors impinging upon the erosion problem which has not been dealt with at all in this study, but which, nevertheless, exerts a potent influence: price relationships between the various products concerned, and the absorptive capacity of local and national markets for these commodities replacing corn and hogs. For instance, high feed grain prices tend to obstruct, low grain prices to facilitate erosion control. High hog prices, relative to dairy products and beef cattle prices, tend to impede, low hog prices to foster erosion control. If erosion control practices became more generally adopted, the resulting reduction in hogs might drive hog prices so high, and the increase in beef and dairy production might force their prices so low that many farmers would be tempted to swing back to the soil exploitive corn-hog enterprise. From the viewpoint of soil conservation, however, it is a fortunate coincidence that the very commodities which prey most heavily upon the soil resources are those which have a weak competitive position in the foreign market, namely hogs, wheat and cotton. Hence, a reduction in their supply is likely to stimulate their prices less than it would if there were a strong demand for them. Granted that, regardless of what these price relationships are, erosion control is of vital concern to the future of many regions, they will set the pace, and determine the methods of erosion control.

Types of farming and farming practices are inherited and rooted in tradition. They may persist much longer than physical and economic conditions warrant. There is conclusive evidence that in the erosive sections of the Corn Belt soil conditions no longer warrant a highly specialized corn-hog type of farming. The urgent need for soil conservation is more and more realized by society as well as individual farmers.