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Soil Conservation: An Elementary Discussion for Use in Grade School

Ralph E. Hansen

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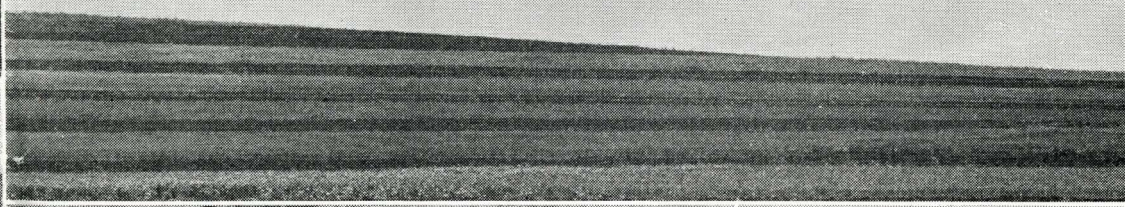
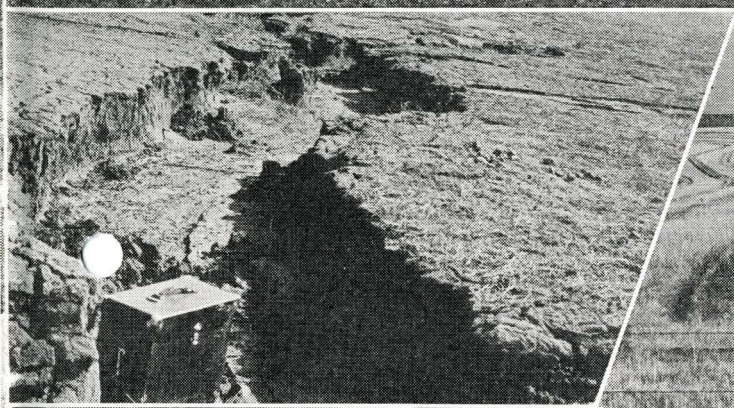
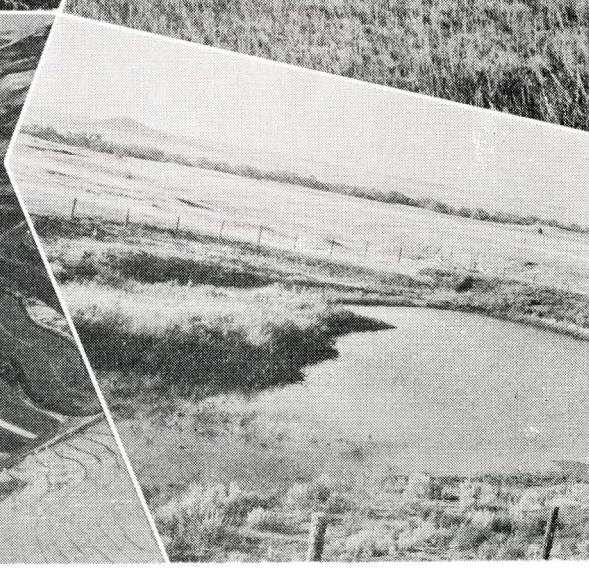
Soil Conservation

An Elementary Discussion for Use in Grade Schools

South Dakota State College Extension Service ❖ Brookings







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Soil Conservation

An Elementary Discussion for Use in Grade Schools

by

Ralph E. Hansen

Extension Soil Conservationist

I. PROBLEM:

Soil erosion and water losses in various places in South Dakota have become a serious handicap in growing crops and producing livestock.

Dust storms and swollen streams have represented a great loss of water and soil in this state during the past few years. Although South Dakota is a comparatively new state in agriculture, much of its land already is rapidly losing its productivity, and many acres of land have been injured by erosion.

This condition creates a problem that faces the boys and girls, as well as their elders, in this state today. The problem is to save the soil, in order that it may be farmed with a profit for years and years to come by future generations.

II. OBJECTIVES:

The objectives in presenting this material to the grade pupils of South Dakota are:

1. To impress upon them the meaning of erosion and conservation.
2. To show the extent and effects of erosion in South Dakota.
3. To explain the causes of erosion and to make the children aware of their local erosion problems.
4. To explain some of the methods of conserving soil and moisture and to create a desire for knowledge of erosion control.
5. To stimulate action in conservation and to impress the pupils with their responsibility in the battle against erosion.
6. To report the progress of erosion control and to present to the students erosion control activities that they may undertake.

III. APPROACHES:

1. Have pupils write compositions or tell about dust storms or floods that they have seen.
2. Ask each student to draw a map of his farm, showing the fields that have been blowing or the fields that have gullies in them.
3. Encourage pupils to ask questions and to become interested in knowing why some fields show erosion and others do not.
4. Have the pupils discuss means and methods that they have seen used to prevent erosion.
5. Relate what happens to the water that falls during a heavy rain, with special notice given to just where it goes (into the soil, run-off, etc.)

IV. DIVISION WITH ACTIVITIES:

1. What Soil Erosion Is

(a) GENERAL DEFINITION:

Soil erosion is the wearing away of the land by the action of running water or winds. For countless ages wind, rain, running water, and other natural forces have been wearing away the land. Great valleys have been formed in the earth's surface, and streams and rivers have carried away tons of rich, fertile topsoil. This is natural, or geologic, erosion.

On the other hand, fields have been stripped bare of their topsoil and have become unfit for further crop production. This is more often man-made, or accelerated, erosion. Sometimes the process may go on slowly, but over a period of years the loss is very great. It is the man-made erosion that concerns South Dakota farmers.

Removal of only a cubic yard of soil each week from an acre of land would hardly be noticed, but if continued for thirty years, the loss would amount to more than 11 inches taken from the entire surface. Only the topsoil, is suitable for cultivation, as it contains the food necessary for the production of plants. This layer of topsoil is itself but a few inches deep; hence the destructive result of allowing such erosion to continue is easily seen.

(b) GEOLOGIC EROSION:

Geologic erosion is the breaking up of rocks by wind, water, freezing, thawing, snow and rain into fine particles called soil, so that it will grow grass and trees. Looking into the past, we can see the effects of geologic erosion. It has worn away and sculptured the earth and is the process of nature that has formed the landscape as it is known today. This process works so slowly that ages are required for it to make any noticeable difference in the earth's surface.

The Grand Canyon of the Colorado River is so beautiful that is has been set aside as a National Park. Early in its history, it was little different from hundreds of other small valleys in the same region. Erosion by the Colorado River for ages has carved this large gorge, by carrying out a little rock and soil from the valley each day and each year. This valley will become larger, for rock and soil are washing away all the time. It can even be imagined that some day this canyon may be five times as wide as it is today.

South Dakota's Badlands are another example of geologic erosion, and are a type of land that has been formed by rain and running water. The sand and clay that is washed or eroded from the Badlands is carried into the White River. More and more of this once high-plains area is being carried away in this fashion as these great natural gullies continue to grow larger. The Badlands attract many tourists each year and are of scenic value only. Geologic or natural erosion has been going on since the world began and will continue, because man can do little or nothing to stop this type of erosion. It should be remembered, however, that in most parts of this state, geologic erosion has destroyed the soil no faster than new soil has been formed.

ACTIVITIES

1. Find pictures of the Grand Canyon and of the Badlands and notice the results of geologic erosion.
2. If any of the class have seen the Badlands, report on what they observed.

3. A more detailed account of the Badlands formation and history could be discussed and a theme could be written on the formation of South Dakota's Badlands.

(c) MAN-MADE EROSION:

As soon as South Dakota lands were plowed, soil erosion began to take its toll. Most ofthe soil erosion seen in the state today on farm and range lands is not a natural form of erosion but is man-made erosion. This kind of erosion of the soil is gradually becoming worse; and unless it is recognized and controlled, it well may result in reducing the chances for a prosperous agriculture.

The erosion that has been seen in South Dakota in recent years can be described best by dividing it into two types: Erosion caused by wind, and that caused by water.

(1) Wind Erosion: Wind erosion is the wearing away of the soil by the action of the winds. It is a form of erosion that is common in South Dakota.

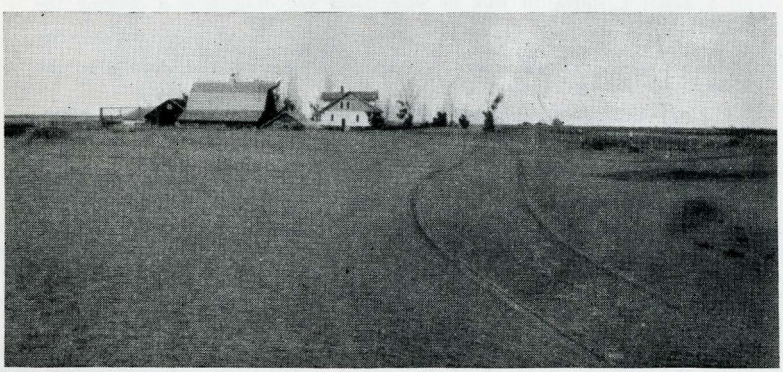
Bare fields may start blowing in winds of only 7 or 8 miles an hour. The blowing usually starts from some very bare spot where the soil is loose, and spreads in fan-like shape with the wind. The moving soil gains speed and becomes more harmful as it moves along. Wind erosion not only injures the field from which the soil is removed, but it may cause damage to nearby fields and farms, by covering up crops and grass, fences and buildings, and cutting off crops. The blowing soil, or dust, also may be unhealthful for people and livestock.

Soil drifting, which is caused by wind erosion, may be considered in three forms:

1. THE FINEST SOIL PARTICLES, that may be lifted miles into the air and carried as dust clouds for greater distances. This is the most fertile topsoil that is lost.

2. SLIGHTLY HEAVIER PARTICLES, that may be lifted from 5 to 50 feet above the ground, and which fall as soon as the speed of the wind decreases.

3. HEAVIEST PARTICLES AND VEGATIVE MATTER, that are blown along the surface of the ground, cutting off young plants and loosening more soil. This is the most destructive type of soil drifting.



Example of a badly wind eroded field.

ACTIVITIES

1. Locate the drifted fences in your neighborhood.
2. Write to a Weather Bureau station, in Huron or Rapid City, mailing the best letter written, and find out what the average speed of the wind is for the locality, with other wind information.
3. If there is no evidence of wind erosion, state your reasons for the fact that the soil does not blow.
4. Measure the depth of soil deposits found in this locality.

(2) Water Erosion: Water erosion is the removal of soil by moving water. Whenever rain falls at a rate fast enough that the soil can not absorb it all immediately, the rest of the water is called "run-off." This run-off water very often carries large quantities of soil with it, that is dropped as silt in streams, ponds and elsewhere.

Generally speaking, one-third of our rainfall evaporates, one-third stays in the soil for crop production, and the other third runs away. The one-third that runs away is lost for crop production and causes soil erosion and floods.

Water erosion may be divided into two general classes:

1. SHEET EROSION, which is the removal of a more or less uniform layer of soil from an entire field. This type of erosion may go on for a long time before it is noticed, as it is a slow, even and gradual process. Run-off water hurrying across a field will pick up soil particles and carry off thin layers of soil from the whole field. Sooner or later the tops of the hills lose their rich top soil, and the crops become poorer in those parts of the field. The soil washed away is lost forever to the field from which it came, and the "thin" spots grow larger and larger, until the whole field may be ruined.

2. GULLY EROSION is the removal of soil by water in a furrow, channel, or small valley cut by running water, but through which water runs only after and during rains or when snow is melting. Smaller gullies are sometimes called rills or "shoestrings." Starting with a channel across which a man may step, a gully may increase in size until it is large enough to hide a cow,—or a house. Rills are small enough that they can be farmed over, but gullies grow so big that special measures are required to control them.

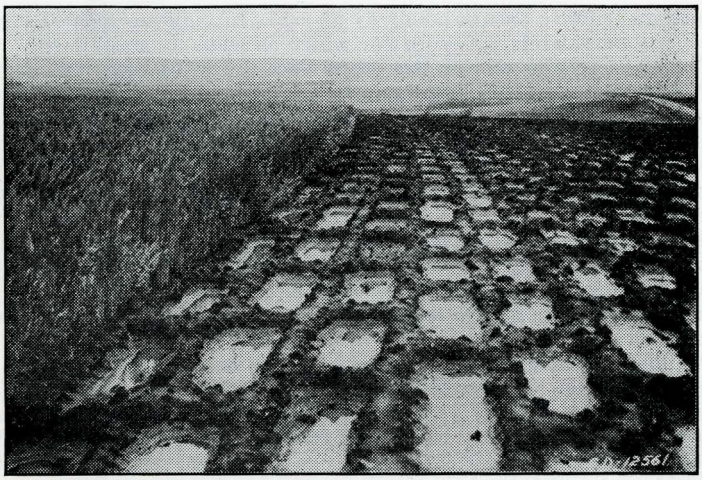
ACTIVITIES

1. Select a cultivated field on your farm and draw a map showing the gullies and rills.
2. Find a field that shows the effects of sheet erosion and measure the depth of the soil that has been deposited at the lower side of the field.
3. If there is no water erosion evident in the neighborhood, give the reasons for not finding any.

(d) RELATIONSHIP BETWEEN SOIL EROSION AND WATER LOSS:

Many farmers believe they have enough topsoil that they do not have to worry about soil erosion. They say they can afford to lose a little topsoil and still produce good crops. It is true that in some localities, where the topsoil is very deep, the effects of soil erosion may not be evident at once, and farmers may believe for a while that they still have a rich, fertile soil. The erosion process is going on, however, though it is not so apparent.

Moisture is a very important factor to be considered in the growing of crops. In certain areas of South Dakota where the rainfall is low it is most important to conserve the moisture. If this moisture can be kept



Farming to hold the rain where it falls reduces soil loss and increases soil moisture.

where it falls and be used by crops, it may increase the yields, and will do away with the danger of water erosion.

Generally where there is water loss, there also is soil erosion from washing. If farming methods can be planned to hold the rain where it falls, that not only will reduce this soil loss but will also increase the soil moisture, which is so important in producing vegetation and in keeping the soil in the best condition to resist wind erosion.

Wind and water erosion and water loss are discussed as three separate elements in the conservation problem, but they are tied together so closely that they can not be considered strictly as separate units. When we save the water, we save the soil; and when we save the soil, we save all.

ACTIVITIES

1. Compare moisture penetration after a rain on different soil types and slopes.
2. Figure the amount of moisture in drifted snow as compared with newly fallen snow.
3. Discuss whether or not the water table has been lowered in the community. If so, how much and why?

2. The History, Extent, and Effects of Soil Erosion and Water Loss

(a) IN SOUTH DAKOTA:

The droughts, dust storms and crop failures of the past few years have made the people of South Dakota realize the importance of conserving soil and holding down water losses. The annual loss to the American farmer from erosion alone is estimated at $400,000,000 a year. On an equal state basis, this would mean a loss of nearly $8,500,000 a year for South Dakota farmers and ranchers.

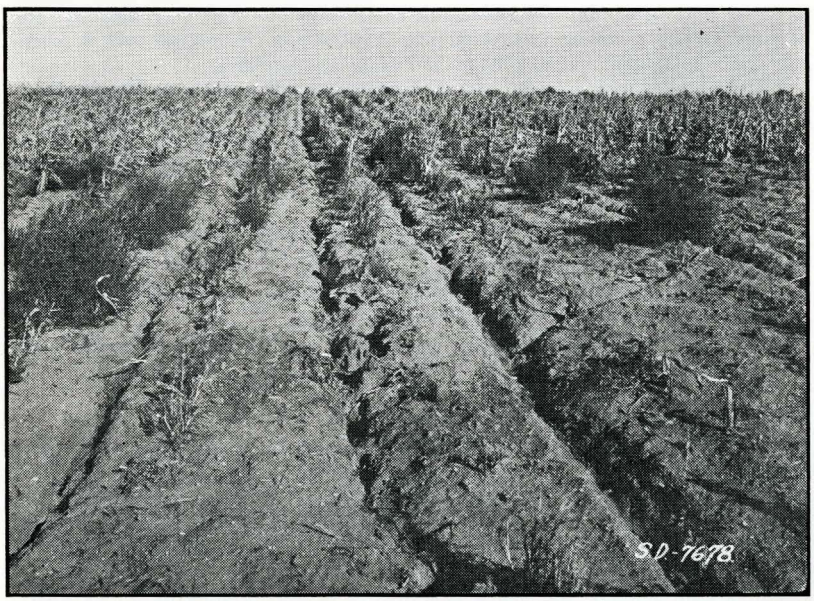
It is well known that when the topsoil either washes or blows away, the most valuable supply of plant food is gone. In many places in South Dakota, where the topsoil already is gone, the remaining subsoil is non-

productive. It takes nature hundreds of years to build an inch of topsoil, but only a short while is needed for water or wind to carry it away.

There has been erosion in this state since the white man first came in and broke up the prairies. The homesteaders found the land covered with a good growth of grass which protected the soil from high winds and kept it in condition to absorb the rainfall. Plowing the prairies, burning crop stubble, leaving the fields bare, farming up and down hill, and following soil depleting rotations have been some of the causes of erosion.

Water erosion goes on year after year, but becomes noticeable only as large gullies appear or as the soil becomes less productive. Wind erosion is present all the time on certain soil types. The severe dust storms of recent years have made most South Dakota farmers well aware of the wind erosion problem.

The losses by wind erosion are not confined to any one area. A soil erosion survey made in South Dakota in 1934 showed approximately 4,000,000 acres of land had been seriously injured by wind erosion. Almost every community in the state shows the effects of erosion. Many fields have been practically destroyed and can no longer be cropped. Range land and pastures have been overgrazed and show the effects of wind and water erosion. In South Dakota, gullying to some degree, in combination with sheet erosion is present on about 16.5 percent of the land. Wind, however, is the most active erosion agent being present to some degree on fully 93 percent of the land.



The bad effects of up and down hill farming are clearly shown by the water erosion evidence in this picture.

Soil and moisture losses mean reduced crop yields. Smaller crop yields mean less money for the farm family. Less money for the farm family means that the living costs must be reduced and that the standard of living will not remain as high. Abandoned farms, unpaid taxes, increased indebtedness and unsatisfactory rural economic conditoins all have resulted, at least partially, from soil erosion and water loss in South Dakota.

ACTIVITIES

1. Ask early settlers about dust storms during South Dakota pioneer days.
2. Let each student make a list of the dust storms, showing the approximate dates of the past few years.
3. Write an account of any flood damage that the pupil or his parents may have observed in his locality.

(b) IN THE UNITED STATES:

Estimates indicate that approximately 50 million acres of land in the United States have been nearly ruined for agricultural purposes by erosion. Another 50 million are in almost as bad condition; 100 million acres have been seriously injured, and erosion has begun on still another 100 million acres.

It is said that no nation in the history of the world has destroyed its soil as rapidly as has the United States. Until not so many years ago a man could wear out a farm and then move farther west and take up a new farm. When that was worn out, he could move west and do the same thing again. Now, there are no new lands to homestead, and it is necessary to conserve the soil that is in use. Therefore, boys and girls who will live on farms will have to consider the need for conservation. Soil erosion and water loss is a national problem.

At the present time in the United States there is great concern over the spread of this unnatural form of erosion. Many areas already are beyond recovery. Other areas are severly damaged, but these can be saved and started on a slow recovery if proper care and treatment are given. Prevention of soil erosion and prompt checking of it is worth more than any amount of attempts to replace soil that has been lost, because hundreds of years are needed by nature to replace even a single inch of eroded topsoil.

ACTIVITIES

1. Figure what percentage of the cultivated land area of the United States is represented by the three hundrd million acres showing erosion.
2. Find out from your parents erosion conditions that they are familiar with in other parts of the United States.
3. Ask each pupil to write to relatives in other states and find out what damage erosion has done there.
4. You are encouraged to write to the County Agent and the Soil Conservation Service at Washington, D. C., for bulletins on erosion conditions in other regions of the United States.

(c) IN THE WORLD:

To see a good example of the effects of erosion through the centuries, we need but look to China. There erosion has destroyed so much of the uplands that the people have been driven into the river valleys. The population has become overcrowded. Flood waters drive families out and destroy their homes and crops, and cause sickness and death. It is hoped that this country will not allow erosion to continue to the point that it has in China.

Many countries have taken steps to control erosion. Italy, Japan, France, England and others have been practicing conservation of the

soil and water for many years. England has really set the example for conservation. It is said that through the use of grass and pastures for livestock, the soils of England are more fertile now than when the Romans landed on the Island.

These countries, because of dense populations and small areas have found it necessary to conserve their soil in order to continue in existence.

ACTIVITIES

1. Interview a foreign-born farmer who lives in the neighborhood, to find out how soil was conserved in his country.
2. Discuss whether the area in which the sphinx and the pyramids were built always was a desert.

3. Causes of Soil Erosion

(a) NATURAL CAUSES:

(1) Soil Types: Before anyone can understand soil erosion and its causes, he must be acquainted with soils and soil types. Thus sandy

The top soil on this field has been removed as deep as the field was plowed.

soils are more subject to blowing than are others. A clay soil will not absorb water as easily as will a silty or sandy soil.

The crops to plant, the type of machinery to use, and the best use for the land all may be determined by the soil type in the fields. Serious water erosion has occurred in areas of tight clay soils, and severe wind erosion and sand dunes have appeared in South Dakota in areas of sandy soil. The type of soil is a large factor affecting erosion and should be considered in adopting control measures for both wind and water erosion.

Soil is a mixture of two main ingredients. They are finely ground rock, or minerals, and organic matter. About 95 percent of most soils consists of mineral matter and the remaining 5 percent of organic matter, which is decayed plant and animal material. Most of the important characteristics of the soil, such as water holding ability, water absorbing capacity and erodibility, are determined by the mineral portion. Soils are composed of mineral particles of different sizes, varying from gravel to those which are so small that they are not visible even when examined through the microscope.

The different sizes of soil particles are classified as SAND, SILT and CLAY. A fairly good estimate of the amount of sand, silt or clay in a soil may be determined by feeling the soil between the fingers, if a person is familiar with the size of the different soil separates.

Sand particles vary from 2.0 to 0.05 mm in diameter.

Silt particles vary from 0.05 to 0.005 mm in diameter.

Clay particles vary from 0.005 to 0.000 mm in diameter.

There are 25 millimeters (mm) in one inch. If a sand particle were .10 mm, there would be 250 grains in one inch; if a silt grain were .05 mm, there would be 500 grains in one inch, and if a clay particle were .005 mm, there would be 5000 grains in one inch.

If a soil is made up of a mixture of sand, silt and clay, it is called a LOAM, if none of the three predominate.

A soil class is a group of soils that contain the same amounts of sand, silt and clay. The six most important soil classes are:

Sand Sandy Loam Loam Silt Loam Clay Loam Clay

Before any person begins to plan a conservation program for his farm, he must know what kind of soil he has, in order that the control practice will fit the soil type.

We have now considered only the mineral part of the soil, and have not discussed the organic matter which makes the soil a living, breathing thing. The science unit for Grade Eight, on Soils, Gardening and Preservation of Food, discusses this topic in detail. A collection of soil particles held together by humus is called a soil aggregate. Humus is decomposing organic matter, leaves, stems, roots and dead bacteria. When some soils have been farmed too long without a rest, the aggregates may be broken to bits; and the land should be planted to grass, to allow it to build up again.

ACTIVITIES

1. Bring samples of the soils on the different fields of your farm to school and try to identify it as to class.
2. Bring a sample of soil that has been farmed for many years and a sample of the same soil that has been in grass; notice the difference in feel, color and structure. Pour water on these samples and see which one absorbs the most water.
3. Students should gather samples of the six soil classes and keep them in bottles.
4. If clay, sand and silt are available, put a like amount in each of three bottles (about one-tenth of the bottle full), fill the balance with water, and then shake well. Which one settles out first? Why?
5. Write a theme on what the soil class has to do with wind and water erosion.
6. Study a roadside or railroad ditch to get a picture of a soil profile.
7. Each pupil should draw a map of his farm, showing the soil classes.

(2) Slope or Topography: Generally speaking, the slope or topography of land in South Dakota west of the Missouri river slopes to the east, and that east of the Missouri river slopes to the south. Due to this

fact, all the rivers in the western part of the state flow to the east, and the rivers in the eastern part of the state flow to the south.

The slope, or topography, of any field has a great deal to do with the amount of erosion. If the field is in a level country where the wind gets a long sweep at it, we are likely to see more wind erosion. If the country is rough, rolling and hilly, the hazard from wind erosion is reduced greatly. Water erosion, however, is more dependent upon slope than is wind erosion.

A large part of the farm area in South Dakota is on sloping land, although in some cases the percentage of slope is very slight. If the ground slopes, the free water will begin to run down hill. The longer it keeps in motion, the faster it will flow; and the faster it flows, the more soil it carries with it. Double the speed of a stream of water just able to move a rock weighing one pound, and it can move a 64-pound rock with equal ease. Slopes usually are divided into the following classes: level, undulating, rolling, hilly, and steep. There should be no cultivation of crops on hilly or steep land unless proper methods are used to prevent run-off. Rolling fields likewise will need to be farmed so as to control run-off, if the soil type is one that does not absorb water readily.

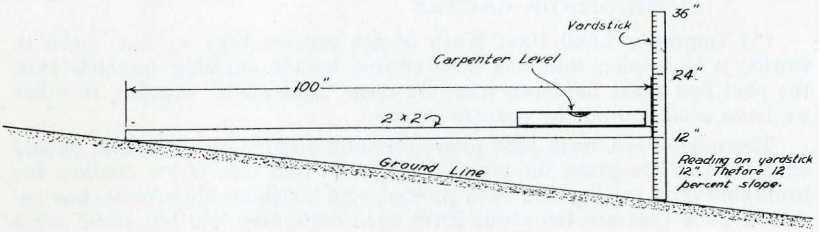
To measure the percentage of slope on any field, take a straight stick 100 inches long, a yardstick, and a carpenter's level. On the field whose slope you wish to measure, rest one end of the 100-inch stick on the ground. Raise the other end until it is level with the resting end, using the carpenter's level. Measure the distance between the raised end and the ground with the yard stick. If it is 6 inches, the slope is a 6-percent slope. The percentage of slope and the inches from the ground are always the same when this equipment is used.

ACTIVITIES

1. Find the percentage of slope on a number of fields on your farm. (It may be well to take six or eight different figures on each field and then average them for the field average.)
2. Locate the steepest slope that is farmed in the locality and find out what percent it is.
3. Each student should draw a map of his farm, showing the percentage of slope of the different fields.
4. The teacher may suggest that the pupils practice estimating slopes.

(3) Climatic Conditions: In South Dakota, the surface soil is frozen for about four months of the year. While the soil is frozen, if sufficient moisture is present, it cannot be washed nor blown away. We do not have as serious a problems in this state, then, as exists in the states in the southern parts of the country, where the soil may be moved most of the year. The disadvantages of having the soil frozen for this long time, however, is that little water can enter the soil.

The amount of rainfall that an area receives and the rate, or intensity, of this rainfall are important factors in soil erosion. A slow rain may have time to soak into the soil, but a fast, dashing rain may run off. If rains come too close together and find the soil well soaked up, there also is a greater chance that much of the rainfall will be lost and run into the streams. The soil type and slope just discussed are also important in determining the amount of moisture that the soil will absorb. Areas of heavy rainfall are more subject to sheet erosion, and there are more evidences of gullies. An area that has less rainfall may be more subject to wind erosion.



A homemade device to measure the percentage of slope.

ACTIVITIES

1. What is the average rainfall for South Dakota? For this county? The weather station can give this information.
2. Discuss the rainfall rate for the county in comparison with that in some other state.
3. Ask each pupil to write an essay on the semi-arid regions of the United States, and whether or not he thinks his county is in this area.
4. Point out examples in this area of serious erosion that has been caused by too much rain in too short a period of time.

(4) **Lack of Vegetative Cover:** If the soil has a good cover of vegetation to protect it, erosion may not occur on the land, even though it is a heavy soil, with considerable slope and the rain is a flash or dashing one. The plants that grow in the soil do much to hold it in place, and absence of this cover exposes the soil to wind and water erosion. Plants resist the action of wind and water, and they help hold the water that falls, for the use of crops. Forests and grasslands are very good in controlling erosion.

Weed patches in which the plants are separated by bare soil offer too little protection against erosion. A typical neglected or overgrazed pasture in South Dakota consists of pepper grass, pull-up grass, wild onions, sage and other weeds. As little as ten per cent of the surface may be covered with vegetation. Erosion continues under these circumstances, as most of the rain is lost by run-off. This fact is largely responsible for burned up pastures during summer months.

The soil type and small amount of rainfall that appears to be normal in parts of South Dakota were the cause of erosion for many years before the fields were cultivated. A thin, or sparse, vegetative cover was responsible for much of the natural erosion which occurred before man broke up the prairies of this state.

To determne the percentage of vegetative cover or density of any field, the so called "square foot" method may be used. Take a piece of wire 4 feet long and bend it into a one foot square. Place this square on the ground and with a knife cut off all the vegetation, inside the square, just below the surface of the soil. Place all this vegetation in one end of the square in a natural upright position, close together but not crowded. The percentage of the square that is filled will be the percentage of cover. Several samples should be taken in order to obtain the average for the field or pasture.

ACTIVITIES

1. Estimate the percentage of vegetative cover on each of your fields.
2. Discuss the percentage of cover on native pastures in this area.
3. Determine how much of the time during the year the fields have a protective vegetative cover.

(b) MAN-MADE CAUSES

(1) Improper Land Use: Much of the erosion that we have seen in words, it is erosion that has been caused by the farming methods that the past few years has been what we term "man-made" erosion. In other we have used and not by natural causes.

There has been much land plowed up and planted to crops that should have been left in grass for grazing purposes. Soil that is too shallow for profitable crop raising has been plowed, and considerable erosion has resulted. Soils that are too sandy have been cultivated and left bare; wind erosion, with dust storms and drifted fences, were among the results.

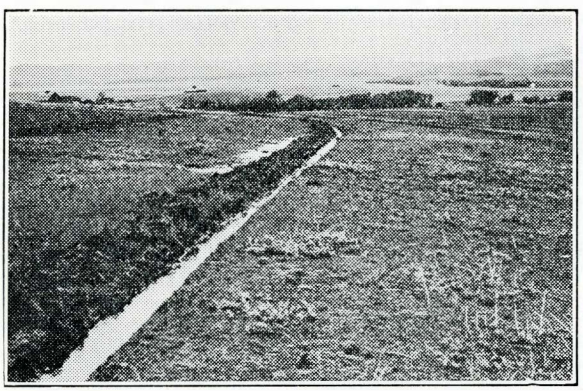
Many fields where the slope is too great have been farmed, and water erosion has taken its toll. Livestock have been permitted to graze too closely on pastures; the result has been that erosion has reduced the value of the grassland. Many areas have been cultivated where the average yearly rainfall is so small that crop failures are the rule rather than the exception.

Not only on land that should not be farmed do we see improper land use, but also on much of our best crop land, where the production of crops should be a profitable venture. Fields are left bare over the winter months and given an opportunity to blow. Stubble is cut so short that there is very little protection for the soil against either wind or water damage. Fields are plowed and cultivated up and down the slope, helping the water to rush down hill and carry with it some of the richest soil of the topsoil. Improper crop rotations are used, until the structure of the soil is broken down and the land becomes more erosible.

Good pastures are so badly overstocked that the grass is destroyed and weeds take over the pasture. Large fields of corn and other crops are planted without regard to the fact that they are erosion hazards.

Water is allowed to run off from the fields and to be carried down into the streams and rivers to increase the floods along the Mississippi. Man surely has been guilty of improper land use in South Dakota.

(2) Economic Causes: There is no thought here of giving the impression that the farmers and ranchers in South Dakota have destroyed



Contour pasture furrows are one means of helping to re-establish pastures and bring about proper land use.— Courtesy of Dakota Farmer, Aberdeen, S. D.

their soil willfully or with utter disregard for the future generations. As a general rule, some of the soil erosion which has gone on in this state has been the result of an economic or financial necessity which has forced the farmers and ranchers to till the soil and pasture the grassland in the manner they have.

When the homesteaders came into South Dakota, they were given a quarter section of land. In many cases this was not enough. In some of the western counties, the farm or ranch should have been from four to ten times that size.

When a homesteader received 160 acres of rough or hilly land, he was forced to farm it in order to make a living. If he drew sandy soil, infertile soil, shallow soil, or soil that washed or blew easily, he still found it necessary to try to grow crops and make a living. Many times droughts and grasshoppers and hot winds destroyed his crops and made it necessary for him to break up more of the grassland and put in into cultivated crops in an effort to increase his income.

The farmers of South Dakota have been as careful of their soil as the farmers of any other state, but the wastage of soil and water has gone on; and the time has come when definite action must be taken to conserve our greatest resource, which is the soil.

ACTIVITIES

1. How many of the people of your neighborhood homesteaded here?
2. Learn whether there are as many people in the locality now as there were during homestead days and why there has been any change.
3. Count how many of the families are still living on the old homesteads, how many farmers are still farming only their original homestead, and how many have taken on additional land.
4. How large should a farm be in this area for a family to make a comfortable living?

(3) Social or Inherited Causes: When people first began to farm in the United States, they believed that it was necessary to clear away the forests and to farm the land where the trees had once grown. For a long time, farmers did not believe they could grow good crops on the prairies, because there were no trees growing there. Most of the farmers who settled in South Dakota came from Eastern states, where the rainfall was much greater than it is in this state.

Farmers coming into South Dakota quite naturally began to farm with the same methods that they had used in the state where they lived before. The soil was tilled the same and planted the same. All rows were planted in a straight line, and some of them were a mile long.

It was to be expected that the farming methods that had proved to be successful elsewhere would be tried in the new country. These methods may have enabled the farmers to produce good crops for many years, even in South Dakota; but these same methods characterizing "good farming" in the East, were constantly causing soil wastage in South Dakota. We have improved seeds, better machinery and better farmers today than we had fifty years ago. Still we are not getting better crop yields. The reason must be that the soil is not as productive as it once was.

It must be necessary, then, for us to change our methods of farming so that we can conserve the soil and keep the water where is falls. We also must farm in such a manner that we keep the fertile top soil from blowing away. Because our grandfathers allowed the soil to be wasted is no reason why we must do the same thing.

ACTIVITIES

1. How long has the farm on which you live been farmed?
2. From what state did the people come who first owned the farm?
3. State how the crop yields today compare with those when the farm was first cultivated.

4. How to Control Erosion

(a) PROPER LAND USE AND PROPER SIZED FARM UNITS.

Before we can expect to control erosion in South Dakota we must have all land being put to its proper use, and the farms and ranches must be of a size that will permit the operator to do this. A farm in southeastern South Dakota, of course, does not have to be nearly as large as one in the northwestern part of the state. Each locality will have to determine for itself just how large a farm unit should be in order to be profitable and at the same time control erosion.

Many farms in South Dakota should include in the crop rotation soil-holding crops such as grass to prevent soil-blowing. These crops, of course, will not return any immediate cash income. Therefore the farm must be large enough to allow for raising these crops without reducing the acreage of income-producing crops.

The farm must be large enough to have sufficient crop land without using lands that erode too easily. It must also have enough pasture land to take care of the livestock that should be raised on the farm.

Proper use of the land should help determine the type of farming on that land. Markets, personal desires of the operator and other factors also help determine the type of farming. Regardless of these factors, however, land that is obviously best suited for grazing because of the type of soil, shortage of moisture, or tendency to erode easily by wind or water, should positively not be put into cash crop production. Yet, that very mistake in type of farming has been made over and over again in South Dakota.

In some areas of the state, it takes only two or three acres of pasture for each cow or horse; in other parts of the state, it may take 30 or 40 acres per animal. Certain parts of the state are ideal for corn production, but in other areas, corn can not be grown profitably. The average yield of small grain over the state varies considerably. All these things must be taken into consideration when deciding how large a farm should be, or what type of farming should be followed, in order to insure the operator a fair standard of living under normal conditions.

After a farmer or rancher has enough land to carry on his operations, he must be certain that the land is being used for the best purpose so that erosion will be controlled. If the fields are not too rough or hilly, and if the soil is good and he can expect enough rainfall, then the land can be used for crop production. Lands that are rough, steep, badly eroded or subject to erosion should be used for pasture.

A permanent cover should be established on all steep and badly eroded land. Erosion resistant crops, instead of clean tilled crops, should be planted on highly erodible land. More detailed and specific recommendations for land use on crop and pasture land will be discussed with the vegetative, cultural and mechanical control practices explained in the next pages of this bulletin.

The matter of proper land use has been well summarized by Ralph E. Johnston, who is agronomist for the South Dakota State College Extension Service. Mr. Johnston points out that there is no such thing as "poor land." Man's use of the land is poor—in altogether too many cases—but every bit of land is good for something, if man will put it to its best use. The best use for some land may be scenery or recreation purposes, or it may be grazing, cash crop production or something else—the important thing is not to make poor use of the land.

ACTIVITIES

1. Have pupils find out how large the farms are in their locality.
2. See if any of them think that any of the farms are too small or too large.
3. Do you know of any fields that are being farmed that should go back to grass?
4. How many acres of grass land does it take in the locality for one cow or horse?
5. Draw a map of the farm that you would like to own, showing the size, the amount of crop land and the amount of grass land.
6. Discuss each others ideal farm and decide on one that would be the best for their neighborhood.
7. Discuss the farming types best suited to your community.
8. Decide if the wrong farming type is being practiced on many of the farms in this community.

(b) PROPER VEGETATIVE AND CULTURAL CONTROL MEASURES.

The conservation of the soil is not always a difficult problem. Sometimes there are simple practices which can be followed that will assist in preventing erosion. If we will just till our crops properly, leave a high stubble, keep the soil covered or follow a good crop rotation, we may be able to retard the erosion of our soil and the loss of moisture. In the next few pages different vegetative and cultural practices which conserve soil are discussed.

(1) Crop Rotations Help in Conserving Soil: A careully planned crop rotation may prove to be the cheapest way of keeping the soil fertile and of controlling erosion. A complete rotation is one that includes the planting of a legume or permanent grass, followed by cultivated crops, and then returned to a forage planting again. Each crop rotation must be planned to fit the individual farm.

It is impractical, or impossible, to set up one for the entire state or other large area. In deciding upon the rotation to be used, we must consider the following factors: soil classes, kind and degree of erosion, slope, type of farming, climatic conditions, weed problem, kind and number of livestock, size of the farm, and the individual farmer himself. A good crop rotation will do the following things:

Build and maintain soil fertility.
Supply a good acreage of erosion-resistant crops.
Leave a cover on the soil a large percentage of the time.
Supply a cash crop income.
Furnish an adequate feed supply.
Aid in erosion and weed control.

In spite of the fact that it is difficult to try to establish a crop rotation that will be suited to the entire state, long-time grass legume rotation, can be generally recommended. This rotation includes the use of grass, or a legume on 25 per cent of the cultivated land on the farm, remaining in grass for a period of not less than five years. Then, as grass

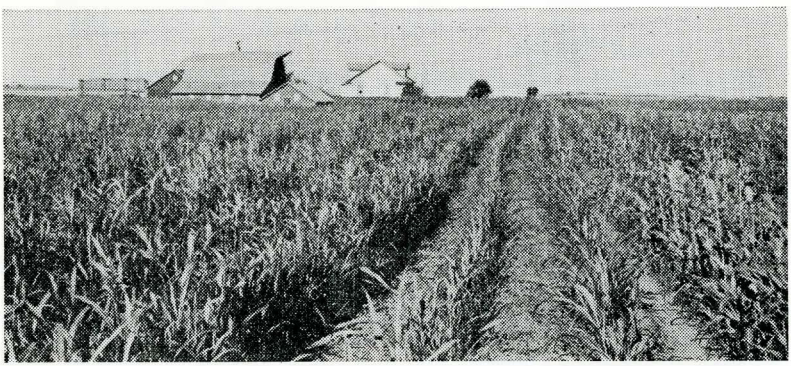
is established on another 25 per cent, the first area seeded to grass is returned to crop production. This process rotates over the entire cultivated acrage so that once in twenty years, all of the cultivated land will be in grass or a legume.

The general trend of rotations should be to decrease unprotected summer fallow acreage, increase the use of drought resistant crops, increasing grass land acreage, and to increase the acreage of feed crops.

ACTIVITIES

1. Make a list of the crop rotations used in the locality.
2. Do you think that these rotations help to control erosion?
3. After a discussion, decide on an ideal rotation for the pupils' farms.
4. Have crop rotations in your area changed within the past few years from what they used to be?
5. If you can find a farm that has followed no systematic rotation, compare crop yields and erosion conditions with those on a farm on which a good rotation has been followed.
6. Find out from your county agent some of the crop rotations which are best suited to this community.

(2) Use of Extra Seasonal Cover Crops: The majority of the crops in South Dakota are planted in the spring. The harvested fields are left in a barren condition during the fall and winter months, and, therefore,



A late seeding of sorghums left standing is a good protection against wind erosion.

are subject to erosion. In some areas of the state, winter wheat and winter rye are seeded and provide a cover for the ground during the period that the land otherwise would be bare.

High winds that cause wind erosion occur at different times of the year, but they are especially bad during the driest part of the year, from October to March. During the summer the winds do not blow so hard; and, at the same time, the soil usually has a very good cover and does not move, or drift.

It, therefore, is necessary to provide extra seasonal cover crops to protect the soil during the period of high wind velocity.

If there are fields that blow when they are bare and unprotected, then it is necessary to keep a cover on them as much of the time as possible. This cover may be a seeding of winter wheat or winter rye, or a fall seeding of grass. A late seeding of oats or of sorghum also may be used and the crop left standing over the winter as a protection against wind erosion.

ACTIVITIES

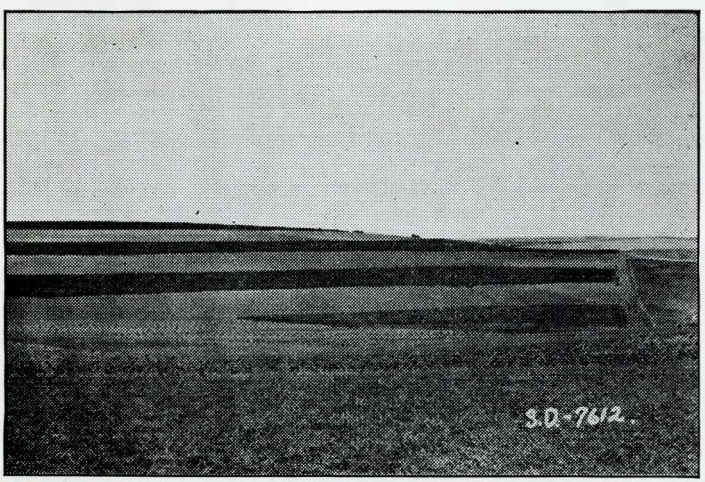
1. Make a list of the cover crops that are planted in the fall in this area.
2. What percentage of the fields in this area are planted in the fall?
3. Bring out a discussion as to whether there is much fall plowing done in this community and how it affects the erosion situation.

(3) Strip Cropping: Strip cropping is the practice of planting in narrow fields with bands, or strips, of close-growing crops such as wheat or oats between similar strips of cultivated or row crops such as corn or potatoes. Strip cropping has been used in the northern United States and in the Prairie Provinces of Canada by alternating strips of grain with strips of fallow or corn, and has proved successful.

Wind strip cropping is the growng of the regular farm crops in long, fairly narrow, parallel strips, placed crosswise to the direction of the prevailing wind without regard to the contour or slopes of the land. Wind stripping helps to control erosion, because the stubble on the grain fields offers some protection to the more open row crop field. The strips also gather more snow in the winter than do large open fields.

The weather record station at Huron has figures on the speed of the wind, and also on the direction from which the wind blows. From these, we learn that most of the high speed winds in South Dakota come from the northwest or the west. It is, therefore, best to have the strips running north and south or northeast and southwest. If the strips run in these directions, they will be crosswise to the prevailing winds and will offer the most protection.

Some demonstration work has been done in South Dakota on the width of the strips in a program of strip cropping. At first, it was felt that strips of 30 or 40 rods would be narrow enough to prevent erosion and at the same time be easy to farm. The drought and wind has shown that this still left too wide an area of fallow or row crop unprotected between the grain strips. The strips have been cut down to 15, 12, or 10 rods, or even less, and are proving more effective. The type of soil, the



This field has been strip cropped to protect it against erosion.

amount of erosion, and the size and shape of the field will all have to be taken into consideration when planning the width of the strips.

It is also a good idea, when plannng to farm by using crop strips, to grow crops that will remain on the ground for a number of years between those that will not stay in for more than a single year. In this way, if we grow strips of corn next to alfalfa, or sweet clover, the legume will generally keep the soil surface protected from the sweep of the wind so that the corn will not get the full force of the wind and soil blowing is not likely to occur. The strips always should be kept narrow, so as to keep the wind from getting at any large stretch of bare soil.

We also must consider the slope of the land and the soil type when planning to use strip cropping. If the slope of the field is not more than 2 per cent on the heavy soils, or more than 3 per cent on the sandy soils, strip cropping may be used and good results expected. When the slope becomes greater than that, then it may become necessary to use contour strip cropping, discussed in detail later.

ACTIVITIES

1. Map your own farm, with each field laid out in strips, showing the width of the strips and the crops to be planted.
2. Ask your local AAA committeeman what the payment would be on this amount of strip cropping under the farm program.
3. Bring out in discussion what the ideal width of strips would be for the community.

(4) **Crop Residue Management:** Not only must the proper land use be practiced and the proper crops planted, but the problem of what to do with the stubble and stalks after the crops have been harvested, also must be considered. Soil conservation is a year around job, and too much can not be said for the practice of handling crop residues properly. In considering the management of the crop residues, we should remember the following points:

We should not burn trash, weeds or stubble, unless it is absolutely necessary for farming operations. By leaving this stubble or weeds on the soil, we have a cover to last over the winter, when the soil is usually bare.

When harvesting small grain crops, we should leave a high stubble. This will act as a protection against winds that might otherwise cause blowing.

We should prevent livestock grazing on stubble fields to the extent that the cover will be removed to the point where soil blowing may start.

We should leave a few rows of corn or sorghum standing to furnish a protective cover. These rows should be left every few rods, so that the wind can not get a full sweep at unprotected fields.

We should till the soil in such a manner so as to leave most of the vegetative cover on or near the surface.

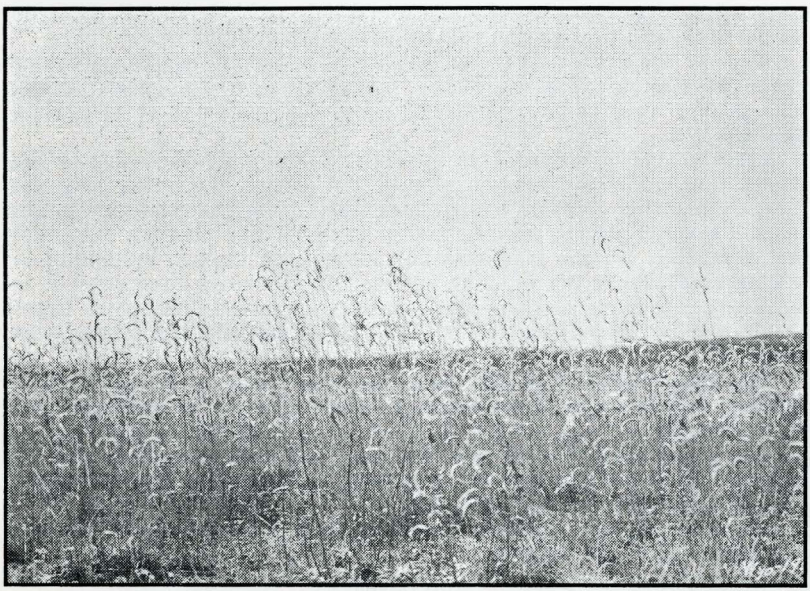
Stubble or stalks left on the field aid in holding the soil from blowing. Above ground, the stubble helps to break up wind currents and to catch and hold in place the soil that has started to move. Underground, the root system ties the soil to the plant and the plant to the soil. If crop residues are destroyed by burning or overgrazing, the soil has less protection. Some of the worst examples of wind erosion in South Dakota may be traced directly to these two destructive practices.

Severe trampling of stubble or stalk fields may cause a field to blow that otherwise would not move. The action of hoofs tends to powder the

soil and make it ready to move with the first strong wind. The best arrangement is to have a reserve supply of feed that makes it unnecessary to turn livestock into stubble or stalks. If it is necessary to pasture these fields, it should be done under close supervision; and the livestock should be taken out before the soil has been trampled to the extent that it will blow.

ACTIVITIES

1. Each pupil should make a report on the good or bad practices used in his locality, in handling crop residue.
2. Do the pupils believe that burning stubble is a good thing to do?
3. Can they give any examples of soil blowing that were caused by grazing stubble too heavily?



A good stand of grass is one of nature's methods of protecting against wind and water erosion.

(5) Regrassing: Grass is highly important in erosion control. It should be used in the long-time grass rotation already discussed. There are also a number of fields that are now being plowed and planted to crops that should be planted to grass and left in grass. If the soil type or climatic conditions are such that the raising of crops is not very sure, then the land should be retired to grass. There are many abandoned farms and idle fields in South Dakota that at one time were used for growing crops. If these fields are growing up to grass, and not all to weeds, they should not be reseeded. If the fields, however, are growing all to weeds, grass should be seeded, in order that the land will be more valuable and can be used for pasture.

When we think of grass, we usually think of that part which appears above the ground, but in erosion control, some of the grasses have more

benefit below the soil surface than on top. In studies made in Canada, the pounds per acre of root fibre in the top six inches of soil in 3-year old grass was found to be 1,795 pounds for western rye grass, 3,733 pounds for brome grass, and 5,079 pounds for crested wheat grass. The western rye roots went into the soil 64 inches, the brome grass roots were 65 inches long, and the crested wheat grass roots went 96 inches below the surface.

Another study of grass roots made in Canada dealt with the length of the roots of each plant. When the root systems of well spaced, three-year-old plants were dug up, the length of the main and secondary branches from a single plant totaled 9.8 miles for western rye, 63 miles for brome, and 319 miles for crested wheat grass. It is easy to understand why such a large quantity of roots would help to bind the soil, build up the fertility, and prevent the soil from blowing or washing.

Some of the grasses that can be planted in South Dakota are brome grass, western wheat grass, slender wheat grass, crested wheat grass, blue grama, reed canary, and others that are suited best to certain localities.

Grass should be seeded very carefully. If the grass is seeded at the wrong time, or if the seed is planted too deeply, the grass may not grow. In planting grass on badly blown soils, it may be necessary to get the soil covered first by seeding rye or sorghum and planting the grass in the stubble. On the land that has never been broken, reseeding, or sowing seed, should not be done unless it is absolutely necessary. It is much better to leave pastures idle and let them reseed themselves. Grass should not be seeded unless the following conditions and preparation exists:

The grass seed must be planted at the proper time of the year, either between August 1 and September 15 (if there is plenty of moisture), between November 1 and January 1, or in the early spring, before April 1.

Grass seed should be put in a firm seed bed (firm enough to walk on the soil without sinking over the shoe soles), planted with a drill, and not covered more than one-half inch deep.

All grass planted should be protected from grazing until it has had a chance to get well started.

ACTIVITIES

1. The pupils should bring as many different grasses to school as they can find in their locality.
2. Report on what is the most common native grass found in your pastures.
3. If there are any idle fields in the community, inspect them and find out if there is mostly grass or mostly weeds.
4. Each pupil pick out a field on his farm which he thinks should be planted to grass and give reasons for its selection.

(6) Controlled Grazing: Sometimes we find pastures where all of the grass has been eaten off and the soil left in a bare condition that may may start blowing. To let livestock eat the grass too closely on pastures is called overgrazing. This destroys the grass. Overgrazing may be caused by having too many head of livestock on a pasture, by leaving livestock in a pasture too long, or by starting to graze too early in the spring.

The first thing to consider to prevent the destroying of grass is that the pastures must be used only during the proper season. If the grass is eaten off at the wrong time, it may be killed out; and the pastures will become bare and subject to blowing. It is a good thing to divide a pasture

into more than one part, so that a pasture rotation system may be worked out. The AAA program has been paying farmers and ranchers for leaving 25 per cent of their grassland idle, during part of the season. This system is called "deferred grazing" and lets the grass reseed naturally. Limited grazing also permits natural reseeding of grass.

When we are talking about overgrazing, the first thing to consider is whether or not too many head of livestock are allowed on the pasture. The farmer or rancher can figure out from his own past experience just how many acres of grassland it takes for each head of livestock. Figuring the number of livestock that can be grazed on a pasture is called "establishing the carrying capacity." In other words, we want to find out just how many cattle or horses or sheep can be kept on the pastures and still not injure the stand of grass.

It sometimes may be necessary to change the fences or to put up new fences in order to be sure that grazing may be controlled. Salt is necessary, and if it is placed in different parts of the pasture, it will help cause the cattle or sheep to use all parts of the pasture to the best advantage. Water also is necessary, and in large pastures there should be enough water located at different points so that the livestock can use the entire pasture.

Overgrazing of pastures is a practice that never has been found to be economical. Continued overgrazing reduces the carrying capacity and makes the pastures subject to both wind and water erosion. In comparing a properly grazed pasture and an overgrazed pasture, the first thing that we notice is that the grass has been killed out in the overgrazed pasture, and that weeds make up most of the forage. Sometimes it may be necessary to rent more pasture land, or even to sell off some of the livestock, in order to do away with overstocking.

ACTIVITIES

1. The students should ask their AAA Committeemen how many acres of grassland it takes in their locality for one animal unit. (An animal unit is one horse, one cow or five sheep.)
2. Inspect the pastures in the community and, by the growth of weeds or grass, determine which pastures have been overgrazed.
3. Let each pupil estimate, using the carrying capacity figure, how many animal units can be kept on his farm or ranch.
4. Discuss the practice of controlling grazing and cite examples in their own neighborhoods where farmers or ranchers are rotating their pastures.
5. Figure the percentage of grass cover left on your pasture over the winter.

(7) Pasture Management: In the small-farm areas of South Dakota where the pastures also are small, it is necessary to grow additional pasture crops. Crops grown for pasture are called supplemental pastures. In many parts of eastern and central South Dakota, farmers find it necessary to keep several head of work stock and dairy cattle on a very small pasture. If no supplemental pasture is grown, the grass kills out, and the pasture becomes a stamping ground subject to wind and water erosion.

The crops that are best to be used as additional or supplementary pasture are Sudan grass, sweet clover, winter wheat and winter rye. The small grains and second-year clover furnish early grazing in the spring, before grass is big enough to pasture. Sudan grass gives excellent summer and early fall grazing but sweet clover often dries up after mid July.

Any supplemental pasture not needed for grazing may be cut for hay and stored for reserve feed supply. By using these pasture crops, the farmer's total pasture carrying capacity is greatly increased, and his

Supplementary pasture not needed for grazing may be cut and stored for reserve feed.

native pastures are protected. Grass is one of South Dakota's best crops; and a good cover of grass, even on small pastures, is a great help in conserving the soil.

It is easy to see that in the years when the grass pastures will be poor, because of drouth or grasshoppers, the supplementary pasture crops also may be poor. Therefore, it is better to have a good supply of reserve feed on hand to be used during the years when the pastures are poor. Overgrazing of pastures should be prohibited, and the use of extra pasture crops should be a regular practice on every farm.

ACTIVITIES

1. List the supplemental pasture crops that have been grown in this locality the last few years.
2. Give the acreage in your pastures, the number of head of livestock you have, and the acreage of supplemental pasture crop.
3. Inspect the pastures in the neighborhood and and find out if any of them have been overgrazed to the extent that erosion has become a problem.
4. Determine how long farmers and ranches keep over their reserve feed supplies.
5. Discuss how grass is injured by too early grazing.

(8) **Insect Control:** In the last few years grasshopper damage has become a serious problem in South Dakota, and it appears that it will be necessary to continue plans to fight them.

Entire fields have been destroyed by the 'hoppers, and crop yields have been decreased over the entire state. There are means and methods of controlling these insects.

One of the best control methods is to destroy their eggs by plowing them under. The method that is used more often is that of spreading poison bait early in the spring and summer, after the 'hoppers have

hatched but while they are still small. The mechanical bait spreader is used widely. The control of grasshoppers has proved successful through both of these methods.

Fields on which vegetation is destroyed by grasshoppers are an erosion hazard. On many of the sandier soils in South Dakota, soil blowing and drifting have started as soon as the insects have eaten the crops. Although a farmer may have tried to conserve his soil for many years, if the field is made bare by 'hoppers, wind erosion may become serious. Water erosion also increases when the cover is destroyed. It is necessary, therefore, to control grasshoppers in order to prevent erosion.

One of the best methods found for controlling grasshoppers has been to plow or till the land in the fall, in order to destroy the eggs. But, as we have already learned that the soil should not be bare, and that crop residue should be left on the field, it would be contrary to good conservation practice to leave large barren fields in the fall, even for 'hopper control. Therefore, if the insects are to be coverd or exposed by plowing or other tillage methods, precaution should be taken to prevent the soil from blowing.

The use of a duck-foot cultivator, or some other implement that will keep the trash near the surface, is recommended. Though it is most necessary to destroy grasshoppers, it also is necessary that the soil be protected. Any tillage method that will leave the stubble or trash near the surface, and leave the sod in a rough or cloddy condition, will destroy 'hopper eggs and also prevent erosion.

ACTIVITIES

1. Relate instances of grasshopper damage in your neighborhood.
2. Discuss the grasshopper poisoning methods used in this locality.
3. Do you know of any examples of drifted fences or eroded fields that have resulted from grasshopper damage?

(9) Use of Idle Land: In many South Dakota localities, there are fields that once were cultivated but that have been abandoned and left idle. These fields often are used for pastures, and very often are not well protected against erosion.

If these fields have a good cover of grass, they could be used as a part of the regular farm pasture or for hay land. If they contain only a small percentage of grass, all livestock should be kept out until the grass has time to reseed. If the idle field has only a cover of weeds, it may be necessary to reseed it to grass, using the methods discussed under re-grassing.

Very often these fields have been left idle because they were not very productive, or because wind and water erosion had taken away much of the rich topsoil. In order to prevent further erosion and make the land of more value, every effort should be made to grow a good stand of grass on these areas.

In other sections of the state, entire farms have been abondoned, and the owners or operators have moved away. The causes for abandoning these farms have included drouth, crop failures, too small farm units, grasshopper damage, low prices and erosion. These units that are now idle are used for livestock grazing; and, in some cases, the more productive of these fields are cropped by other farmers in the area.

The badly eroded areas on these farms, fields having little value for raising crops, and all fields that are too steep or in which the soil is too shallow for cultivation, should be left out of production and just the

better parts be farmed. The fact that in many cases farmers should be operating larger units has been discussed earlier. The presence of many idle or abandoned farms in an area gives other farmers there a better opportunity to secure the proper size farm or ranch units, by adding to their operating units from the idle land.

ACTIVITIES

1. Make a map of your township or community, showing the idle farms.
2. Give the reasons why you believe these farms were abandoned.
3. If there are any idle or abandoned fields on your farm, discuss the reasons why these fields are not used.
4. Draw a map of one idle farm and show on each field what should be done to control erosion.

(10) Trees and Erosion Protection: Trees and shrubs are important in soil conservation. Trees may be used in South Dakota in an erosion control program for the following purposes:

1. To protect valuable land from erosion on steep slopes, or to check the movement of sand dunes and shifting soils.
2. To reclaim lands ruined by erosion, such as slopes that are badly washed, or other areas unfit for cultivation in their present condition.
3. To establish shelterbelts, or windbreaks, for the protection of soil, crops, livestock, and farm buildings from both hot summer and cold winter winds.

During the winter, a house protected by a good belt of trees is not only a more comfortable place in which to live, but requires less fuel. Livestock sheltered by the right kind of a tree belt keeps in better condition and requires less feed.

The speed of winds over the surface of the ground is reduced by a tree planting. It may be observed that the dust does not rise as freely from a field near a tree windbreak.

In establishing a tree planting, the young trees must be cultivated for several years to keep out the weeds and grass that use up moisture the trees need in their growth. The success of the tree planting will depend very much on whether the trees receive this proper cultivation. Many fine plantings of trees likewise have been ruined because livestock has been permitted to graze among them. The animals destroy the small trees through browsing and breaking them down, and also pack the soil around them. It is advisable, therefore, to fence shelterbelt planting against livestock.

Growing trees in the drier areas of the state is not an easy task. Careful attention must be given to the nature of the soil, the slope, and the possibility of making use of extra run-off water for the trees. The ground usually must be planted to a row crop or summer fallowed a year before the planting, in order to hold as much moisture as possible for the first year's growth.

Great care must be used in selecting the trees to be planted. As a good windbreak will protect soil from blowing, and also will protect field crops from hot winds, considerable time and effort may well be spent in obtaining the right kind of trees for shelterbelt plantings. The following trees have proven general satisfactory for windbreaks in South Dakota:

Broadleaf Trees—

Green ash
Hackberry
American elm
Russian olive
Dwarf Asiatic elm (the hardy species of "Chinese elm")
Honey locust
Bur oak
Cottonwood
[1]Willow (European white or Russion golden)
Box elder
[2]Russian mulberry

Shrubs—

Caragana
Chokecherry
Wild plum
Buffaloberry
Honeysuckle
Lilac
Golden flowering currant
Aromatic sumac
Nannyberry or Black Haw
Hawthorn, red and yellow
Juneberry or Service berry

Evergreens—

Red cedar
Ponderosa pine
[3]Colorado blue spruce
[3]Black Hills spruce

1. Suitable for use in the eastern part of the state and on sandy soils where there is high ground water.
2. Suitable in the southern part of the state.
3. Spruce not adapted to severe, dry conditions.

Tree plantings heal gulfies, provide soil protecting field windbreaks, and furnish wildlife food and cover.

In selecting trees and shrubs to plant care should be taken to see they have been grown from seed from adapted trees, that is, trees grown successfully in or near the state under average, or even trying conditions. Trees raised from seed grown in the South, or in areas with higher rainfall, cannot be considered well adapted stock for South Dakota.

ACTIVITIES

1. If possible, the students should visit a shelterbelt planting, if there is one in the locality.
2. Identify the different kinds of trees growing in the neighborhood.
3. Discuss the proper way to plant and take care of trees.

(11) Conservation of Wildlife: The term "wildlife" means animal and bird life other than domestic birds and mammals, such as game birds, song birds, fur bearing animals and fish.

Wildlife is a product of the land, much the same as are timber, livestock or agricultural crops. It has been estimated that the economic value of birds as destroyers of harmful insects amounts to $350,000,000 a year. The true function of birds is not to destroy any particular species of insect, but to reduce the insect population as a whole.

With the increase of the human population, and with the large amount of farm machinery in use and the expansion of the cattle and sheep industries, conditions have become less favorable, not only to game birds but also to desirable forms of wildlife generally.

Wildlife should be given every advantage on each farm. Many farmers are already interested enough to set aside small waste areas and odd corners not fit for crop production. These can be made into excellent homes for wildlife. Thicket plantings of shrubs and vines in gullies or on stream banks have two purposes: To control erosion and furnish wildlife food and cover.

In following such practices, the farmer gives the birds that nest on the ground a protected place to build without danger of trampling by livestock, and provides food and shelter close to the nest.

Throughout South Dakota wildlife is limited most through the lack of enough vegetation. The first step, then, in wildlife improvement is to provide surroundings that will fill the needs of the different birds and animals. Vegetation supplies the two great essentials of food and cover. It must be remembered that birds living and nesting on the ground do not make their homes in a dense, heavy growth of trees and shrubs but prefer the edge of such patches.

Many more homes can be provided on the farm by fencing out the woodlot, by planting food-producing shrubs around the woods, and by using thick-growing shrubs in the outside rows of tree windbreaks. Fence rows also offer a wonderful opportunity for planting low-growing shrubs and vines to furnish food and protection.

When planting to encourage wildlife, food must be made available for the late winter and spring. Much of this food may be obtained from waste grain, grass and weed seeds growing close to winter shelter, which itself will furnish some food if such trees, shrubs and vines as hackberry, mulberry, cedars, oaks, sumac, Virginia creeper and wild grape are used in the planting.

Ponds and lakes can be made into homes for waterfowl and fish, though water alone will not make the home. If the dam and a part of the pond, or reservoir, are fenced to keep out livestock, nesting places are

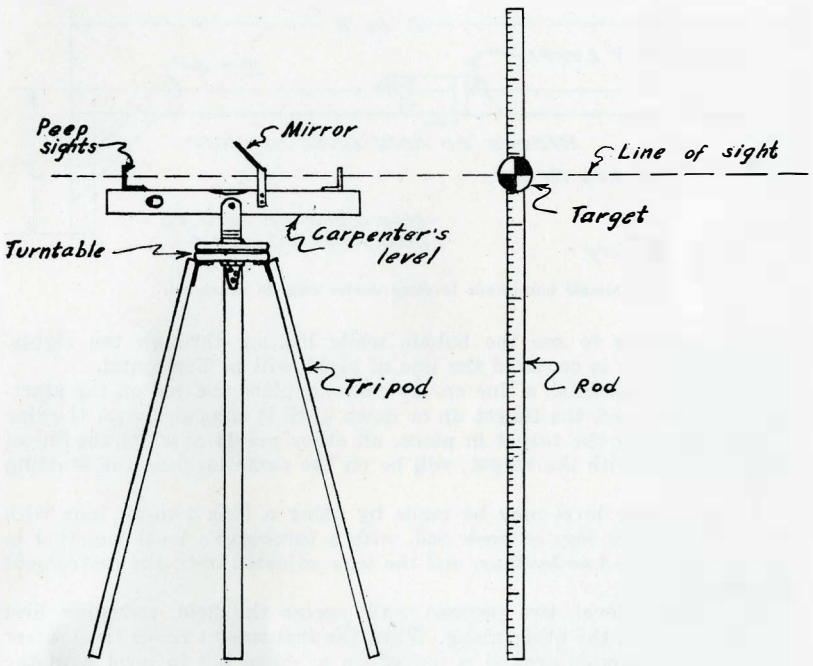
furnished for ducks and wading birds. Planting water plants in the shallow portion around the edge of the pond will increase the food supply for both waterfowl and fish, and will furnish a place for the small fish to hide until they are large enough to take care of themselves among the larger fish in the pond.

ACTIVITIES

1. The students should visit both protected and unprotected reservoirs during the nesting season and compare their value for wildlife.
2. Identify the ducks and birds using a reservoir during the migration or nesting season.
3. Visit thickets in gullies or along stream banks, observing how they are holding the soil in place and their value as wildlife homes.
4. Report on different forms of wildlife observed in the community for each month of the school year and describe the food and cover conditions.

(c) HOW TO CONTROL EROSION BY MECHANICAL CONTROL PRACTICES

So far in discussing the methods of controlling erosion, we have been talking about simple practices that in most cases, could be put into effect very easily. The discussion has dealt entirely with vegetative control. We have reveiwed different methods of planting and growing crops, and of keeping a cover on the soil, before turning to mechanical control practices.



HOME-MADE LEVEL

An illustration of one of the homemade leveling devises.

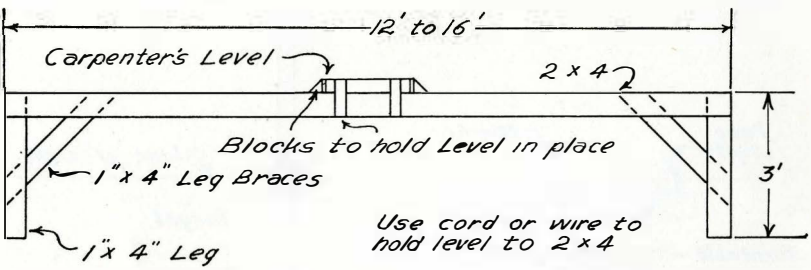
Mechanical control means the use of man-built structures to control erosion and conserve water. These devices include terraces, dams, spreader ditches, diversions, and furrows, which are in contrast to the vegetative control methods but which are sometimes necessary aids.

(1) Use of the Farm Level: In mechanical control of erosion, the first thing to consider is that it is necessary to farm on the contour, or on the level. A contour is an imaginary line on the surface of the soil which connects points of the same elevation, or level.

In order to lay out these contour, or level lines, some type of leveling device must be used. A regular farm level is the most satisfactory. If a farm level is not available, there are some more or less crude home-made leveling devices that may be made from material available on most farms or ranches.

A home-made level may be constructed by using an ordinary carpenter's level equipped with peep-sights and mounted on a tripod. To permit tilting, the carpenter's level is pivoted on a bolt. A turn-table made of two pipe flanges permits rotating the level. The tripod legs are attached to the lower plate of the turntable with "T" hinges.

The rod may be made by nailing three yardsticks to a one-by-two. The target can be made of a piece of innertube. A small mirror will per-



A simple homemade leveling device easy to construct.

mit the operator to see the bubble while looking through the sights. When the bubble is centered the line of sight will be horizontal.

In order to establish a line on the contour, place the rod on the starting point and move the target up or down until it coincides with the line of sight. Leaving the target in place, all other points at which the line of sight coincides with the target, will be on the same level as the starting point.

A home-made level may be made by using a long two-by four with two- or three-foot legs at each end, with a carpenter's level mounted in the middle of the two-by-four, and the legs adjusted until the instrument is perfectly level.

To use this level, two persons walk across the field, swinging first one end and then the other along. When the instrument reads level, after the end being carried around is moved up or down hill to level with the still end, the point is marked with a stake or spadeful of dirt so that the line can be followed. Starting at the upper side of the field, the level operators proceed back and forth across the field until the contour lines are finished.

As the purpose of laying a contour line is to mark the course of a furrow or ridge that will hold water on a level, these contour lines must be accurate. It is, therefore, more accurate to use a farm level than to attempt to use any home-made device.

ACTIVITIES

1. Draw plans of the home-made leveling devices described above and construct one, either in actual size or in minature.
2. Lay out some contour lines with the home-made leveling device.
3. Invite an engineer to assist the students in laying out level lines and explain the use of the farm level.

(2) Contour Farming: Contour farming is simply plowing or cultivating sloping fields on the level; all tillage operations are on the level, crosswise of the slope.

Most farmers in South Dakota today farm in straight rows, either north and south, or east and west. These rows may be straight in regard to direction, but they likely will not be level rows.

In up and downhill farming, each furrow mark of the cultivator or other implement acts as a trough or drain that carries off soil and water when it rains. In some cases, the cause of severe erosion is the fact that slopes of the field are long, and a great volume of run-off water carries soil from the field.

The main problem in water erosion is to control the run-off. In order to do this, we must keep the water where it falls until it has time to sink into the soil and be stored for future crop use. In South Dakota areas, a lack of enough soil moisture often is the reason for crop failures. The entire purpose, then, of contour farming is to hold the water where it falls, in order to decrease water erosion and increase crop production.

Whether a field should be farmed on the contour depends on the slope of the land, the type of the soil, and the amount and heaviness of rainfall. For example, the amount of water that runs off a long, steep slope will, of course, be much greater than that running off a gentle slope; and the amount of run-off on clay soil will be much greater than that on sandier, more porous soil.

In contour farming, the first thing to do is to see whether water has been running off the cultivated field. Generally speaking, if the slope is more than 2 percent, or 2 feet of drop in 100 feet, on a clay soil, or 3 percent on a sandy soil, run-off does occur. After it has been found that water is being lost from the field, it is time to lay out the field on the contour.

It is necessary to use a level in doing this work. A level, or contour line can be run every 100 feet or so in the field; and all tillage, planting and harvesting operations then can follow these lines. Every wheel mark, ridge, or furrow becomes a dam to hold back the run-off water.

Contour strip cropping is one of the best ways to control water erosion. By this method, the strips are laid out on the contour, or level line that has been staked out. Half the width of the strip is above the level line, and the other half is below.

These strips are laid out in such a way that they come close together on the steepest slope, and then, because of the decreasing slope on the rest of the field, they gradually become farther apart. A series of these strips is continued from the top of the slope to the lower edge of the field. In order to work in a proper rotation and assist in conserving water,

one strip is planted to small grain, a legume or grass, and the next strip to row crops.

To develop contour strip cropping still further, the row crops may be planted with a lister, this will aid a great deal toward holding all of the water that falls on the land.

Contour farming has been used a long time in some sections of the South, where one may drive for miles without seeing a straight row of cotton or corn. Because farming operations in South Dakota always have been in straight lines following the fences or section lines, many farmers may think at first it is hard to change over to contour farming in curved rows. Those farmers in South Dakota who have tried contour farming say, however, that there are many advantages besides the fact that it conserves water and soil.

In addition to saving the soil, it saves power because the machinery always is pulled on the level with no up-hill drags to take extra fuel. Then there is not so much turning, because, generally speaking, the rows are much longer. The increased moisture held on the land by contour farming has also increased the yield of crops.

In contour strip cropping, there often will be small, irregularily shaped fields left between the regular strips, resulting from the differences in slope. These areas are called buffer strips, and should be seeded to grass, alfalfa or some feed crop.

It should be kept in mind that the same number of acres of row crops, grain, and hay crops may be kept under contour strip cropping that were had under the old square field system. The arrangement of these crops in the fields has changed, but the acreage need not be changed.

ACTIVITIES

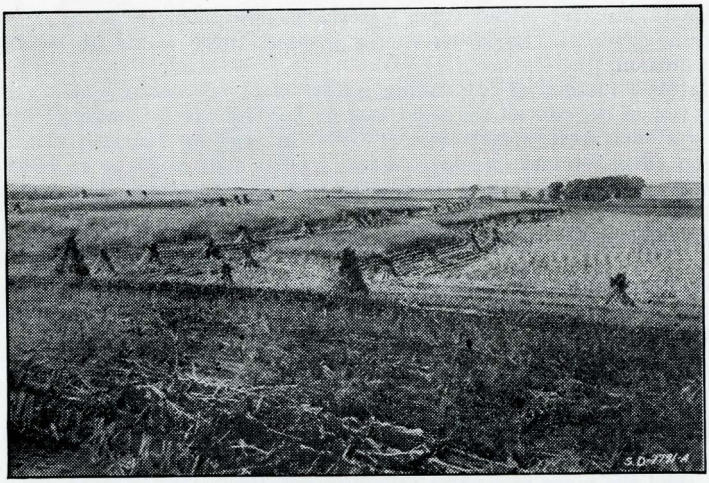
1. Each pupil should draw a map of his farm, showing the fields that he thinks could be farmed on the contour.
2. If there is any contour farming in the neighborhood, interview the farmer, asking him what he thinks of this method.
3. Let the students, by inspecting the number of rills or gullies on the fields, determine what fields near the schoolhouse should be farmed on the contour.
4. Write a theme on the difference between straight farming and level farming.

(3) Terracing: In some parts of South Dakota, where the slopes are steep, the soil is heavy, or the rains come rapidly, contour farming may not be enough to hold the water where it falls. If the land has enough slope, and the rain falls so rapidly that all of it cannot soak into the soil, the water may break over the contour ridges and run off from the fields causing sheet erosion or making gullies.

When contour farming is not enough to control water erosion, it may be necessary to add terraces.

A terrace is a long, low embankment and shallow ditch, combined, built on the contour to control water run-off. The distance between terraces will depend upon the steepness of the slope and the soil type. Terraces usually are laid out according to the slope, or the up-and-down distance between the levels at which it is decided to build them. A terrace can follow the same contour, or level, line that is laid out for contour farming.

A terrace should be laid out with a slight grade, or drop toward one end so as to allow any surplus water that cannot sink into the soil to run off from the field very slowly, without any washing. Terraces are rather



Terraces like this are necessary when contour farming is not enough to control water erosion.

expensive as compared with other control measures; therefore, they should be built with the greatest care. The farm level should be used in laying them out.

After the contour line has been laid out, the land should be plowed where the terrace is to be built. The ridge can be built with a plow, road grader or other machine that moves the loosened earth into an embankment, or terrace, forming a channel on the up-hill side.

ACTIVITIES

1. The students should visit terraced fields, if there are any in the locality.
2. Report on what kind of machines are available in the community for building terraces.
3. Decide whether the fields slope enough, and if there is enough rainfall in the neighborhood to make terraces necessary.
4. Watch the daily newspapers and farm magazines for stories about terraces and report any of these stories in school.

(4) **Gully Control:** Gullies have been defined as being the result of water erosion that has gone on for a long time. There are gullies in every county in the state of South Dakota. In some places in the southeastern part of the state, gullies are large enough that farm buildings could be hidden in them. In other areas, the gullies are small and still can be farmed across.

The most serious damage caused by gullying, of course, is the washing away of the fertile topsoil. Then, too, gullies cannot be easily crossed by teams and farm equipment. Gullies also have undermined buildings, cut into roads, and lowered the market value of farms. One fact very often overlooked in talking about gullies is that they are largely responsible for filling up dams and streams with silt, and for covering bottom lands with deposits of soil washed down from fields above.

Gullies may be very small, such as those between rows of corn planted up and down hill, or they may be large and extend for back into a pasture or into crop land. Gullies would not be formed if steps were taken to check them in the beginning. If the land all were farmed on the con-

tour with terraces added when necessary, and if there always were a sufficient cover of vegetation on the ground, there would be much less gully erosion.

Nature's method of controlling gullies is to prevent erosion by keeping cover on the soil all the time, and by holding the soil together by the root systems. Gullies may be controlled by seeding them to grass and fencing them against livestock. These gullies will continue to show up, however, unless the land is farmed so that water erosion will no longer continue.

Another means of controlling gullies is to plant shrubs or trees in them.

An important preventative against gullying in cultivated fields is to leave a wide sod strip along the draw through the field, by leaving it unplowed.

The best results for controlling gullies are obtained where some kind of a dam is built across the gully to catch and hold any of the soil that otherwise would be carried away. Brush dams have been used for this purpose, as well as those made of straw and manure, sod and woven wire, logs, or loose rock,—none of these being more than one to two feet high—and the more expensive concrete structures. These dams catch the soil and gradually fill in the gully so that it can be farmed again.

The best method of all for controlling gullies is to keep them from starting in the first place. After a gully has eaten into the soil, it cannot be filled again unless further erosion continues to carry in enough soil to fill it. By farming the fields so that the run-off water is very slight, gullies may be prevented.

ACTIVITIES

1. Each pupil should draw a map of his farm, showing the locations of the gullies, and of rills in the cultivated fields.
2. What methods could be used to fill in these gullies and to prevent others from starting?
3. If there are any gullies on pasture land in the neighborhood, why have they formed?

(5) Contour Pasture Furrows: In this country 800,000,000 acres, or about 40 per cent of the entire United States, is used for grazing. About 200,000,000 other acres of cut-over land and forests are used partially for grazing. In some of these pastures, there has been much water erosion, soil loss, and gullying. Wind erosion also has damaged pastures in some parts of this state.

On pastures where the soil is removed faster than nature can build it up, and where the vegetation is almost gone, some mechanical means should be employed to help hold and spread the water. If a pasture has a good cover of grass, there is, of course, less need for this type of mechanical control.

Contour pasture furrows have been used as a means of holding water on pastures and, in that way, increasing the growth of grass. Pasture furrows may be laid out with any home-made or farm level. On a 3 per cent slope, they should be spaced about 25 feet apart. As the slope increases, the furrows should be closer together, by approximately 3 feet for every one per cent of slope.

Pasture furrows may be plowed in with an ordinary breaking plow, lister, or any other implement that makes furrows. Properly built pasture furrows will assist in stopping the run-off by holding the water on the grassland. A grass mixture may be seeded in the furrow.

The furrows are plowed on the level around a slope; for if they ran up and down the hill, they would let water run off faster than ever. Pasture furrows need to be only about 4 inches deep and 8 inches wide or less. They should be plowed only where the slope is not steep, and where the soil is of a type that does not easily absorb water. Wherever there is a good cover on soil that absorbs water, furrows may not be necessary.

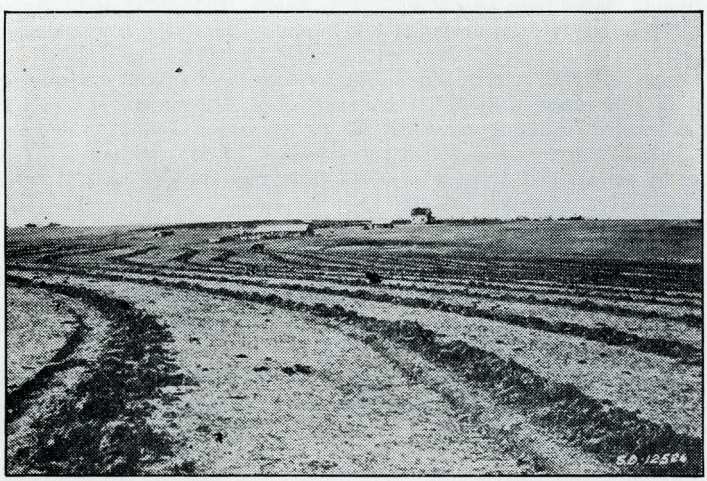
It might be concluded on first thought that pastures could not be improved upon, because we know that grass is one of the best soil conservation plants. But, if water is held on the soil long enough for it to sink into the ground, almost double the grass and grazing may be obtained. Results from pasture furrows may not show up for two or three years.

ACTIVITIES

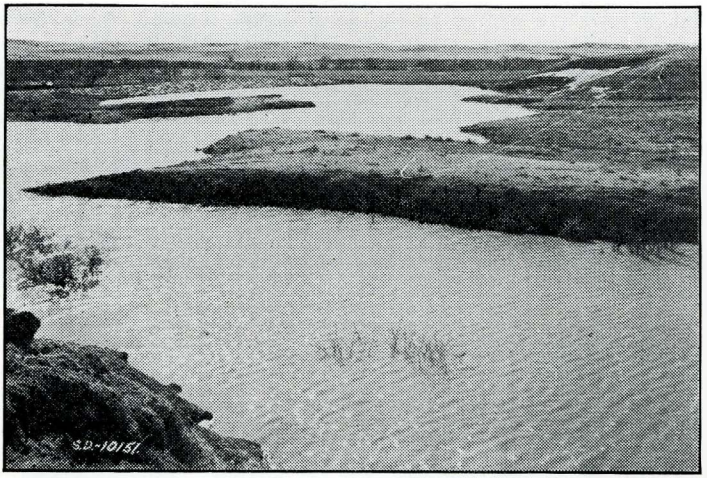
1. If there have been any pasture furrows plowed in the neighborhood, the pupils should visit the pasture and find out what benefit has come from this practice.
2. Figure how many gallons of water could be held in a pasture furrow 4 inches deep, 8 inches wide and 1000 feet long.
3. Each pupil should write a theme on the reasons why he would plow pasture furrows on part of his own pasture.
4. List any reasons why you think pasture furrows should not be used.
5. Observe old trails and cow paths and notice the better grass growth along those that wind around hills, and the gullies in those going up and down hill.

(6) Water Spreading: In the areas of the state where the slope of the land and the soil type give a large amount of run-off on grass land, water spreading devices are of much value in saving additional water.

When a dam is built, special attention should be given to locating it so that the water which runs over the spillway may be used by spreading it over nearby pasture lands. A water spreading system should not be placed on a slope of more than 3 per cent, because to do so may cause gullying.



Contour pasture furrows are one means of holding water on pasture and increasing the growth of grass.



A typical South Dakota stock water dam with an earth fill and a natural vegetable spillway.

Water diversion and spreading on hay land or pasture will make use of the run-off water and will increase the livestock feed supply. Water diversion with not more than one per cent slope onto cultivated land, to develop feed such as alfalfa, is also a good practice.

As a general rule, it requires at least 30 acres of drainage area for each acre of agricultural land to be flooded. A water flooding system on cultivated fields easily can be a failure if the supply ditch is not made large enough. All spreader ditches must have an extra spillway to let the surplus water pass by during heavy floods. It is difficult to lay out a water spreading system on cultivated lands without the assistance of an engineer.

Water spreading is a practice that has not been followed to any great extent in this state, although small spreader ditches may be plowed in with a regular breaking plow at not too great an expense. The benefit from the additional water which can be used for the production of grass or supplemental feed crops will more than pay for the cost of building the inexpensive spreader system.

ACTIVITIES

1. Does the AAA farm program pay for building spreader ditches? What is the rate of payment?
2. If there are any water spreading systems in the neighborhood, the pupils should visit them.
3. Let each pupil select an area on his own farm where he believes that a simple water spreading system could be built.

(7) Dams or Stock Ponds: It often is necessary to construct dams, reservoirs or stock ponds for storing water. In many areas of the state, dams are used as the only source of water supply for livestock. There also are diversion dams, which are not used for storing water but are used in connection with water spreading.

In locating a dam, careful attention should be given to having enough drainage area to provide sufficient water for the dam. The soil also must

be considered before building a dam. It has happened in some cases when dams were built in sandy soil that they did not hold water.

Dams may be constructed for the following purposes: flood control, irrigation, stock water, human water supply, improved fishing, and for other recreational purposes. Most of the dams built in South Dakota are for stock water or recreation.

In the open range country, wherever possible, dams should be located not more than three miles apart. Most of these dams should be earth dams, and rock rip rap may be used to protect the spillway on the face of the dam from washing and wave action. Such a dam should have a three-to-one slope on the upstream side, and at least a two-to-one slope downstream. That means five feet through the base of the dam for every foot of height. Generally speaking, the dams should be large enough so that the water collected will be from eight to 10 feet deep. This ordinarily gives a sure water supply through the dry season.

It is a good plan to fence the spillway and the dam fill, so that livestock do not tear them down by trampling. Silt accumulating in the pond is often a problem. This is especially true if there are cultivated fields in the drainage area. It may be necessary to build silt traps, or catchers, of woven wire, shrubs or brush, up the drainage. These help keep the reservoir from filling with soil.

In areas in which it is difficult to find a place where a dam can be built cheaply, it is sometimes necessary to construct dugouts. A dugout is a water hole which is made by digging a deep hole at a point where water usually gathers, but where there is no place to construct a dam. A large, shallow pot-hole might be made into a dugout, collecting enough water to create a good stock water supply that will not evaporate quickly in hot weather because the dugout is deep and the exposed water surface small.

In 1934, in South Dakota it was necessary for many ranchers and cattle men to sell half or more of their livestock. This was due, in many cases, to the fact that they did not have a good supply of water. If dams are built in large pastures, they also assist in preventing overgrazing. Where there is only one dam in a large pasture, livestock tend to stay close to this dam and will, therefore, overgraze the area close to the watering place. By placing more dams in the pastures, the livestock are encouraged to graze more evenly over it and thus avoid overgrazing that helps cause erosion.

ACTIVITIES

1. Draw a map of your township, showing the number of dams and their location.
2. What is the age of the oldest dam in the territory?
3. Measure the slope on the upstream and downstream parts of a dam fill.
4. Select a location in your pasture where you think a dam could be built.
5. Find out from your AAA community committeeman if there is any payment being made for dam building, and if so, how much.
6. If there are any dams in the neighborhood that have washed out, interview the farmer to find out just what was wrong with the construction of the dam.

(8) **Improved Tillage:** One of the best ways to control erosion is to use proper tillage methods.

At the present time, many farmers do not own the best tillage implements for erosion control. Some of the new machines that help to conserve soil and water are the basin lister, the duckfoot cultivator, and the deep furrow drill. Tilling of the soil wears it away and breaks down the

structure as fast as do growing crops. Yet tillage is most necessary, to destroy weeds, to loosen the soil, to allow plant roots and soil moisture to go into the ground, to prepare the seedbed, to decrease run-off, and to put organic matter into the soil.

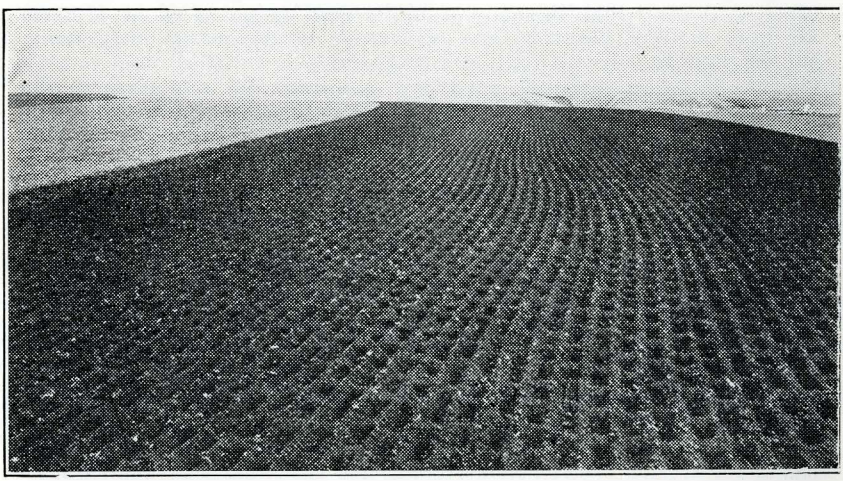
From an erosion viewpoint, we know that a vegetative cover on the soil is highly important. The kind of tillage implement determines to some extent the amount of vegetative cover that will remain on the soil.

It is easy to understand that the tillage operations in one part of the state will not necessarily apply to the entire state. In light blow soils, for example, the amount and number of tillage operations should be decreased, if possible. Rotations should be planned so that the soil will not have to be plowed each year. In wind erosion areas, spring plowing is better than fall plowing.

Generally speaking, the moldboard plow is not the most desirable implement to leave the crop residue, stubble and trash on or near the surface where it can help protect the soil. In many areas, the duckfoot cultivator can be used in its place. The one-way, or Wheatland plow, if properly used, is also a good implement in wind erosion areas.

The disc and spike tooth harrow, or drag, should be avoided in wind erosion areas since they will powder and loosen the top soil. The lister is a good implement to use, but on steep slopes or heavy soils it should be used only on the contour. The new deep-furrow drill is proving to be a very good machine in the heavy soil types of the state, but should be used on the contour wherever possible. The basin lister, which builds dams in the furrow every few feet, has been found to be a good implement in some soils for summer fallow or for planting row crops, such as corn or sorghum.

Generally speaking, in South Dakota the following tillage program is recommended:



The basin lister builds dams in the furrow and helps to hold the water where it falls.
Courtesy of Dakota Farmer, Aberdeen, South Dakota.

(a) Till in a manner to keep a vegetative cover on the soil as much of the time as possible.
(b) Keep the soil roughly tilled, to prevent blowing, and use the basin lister on the contour.
(c) Encourage the use of the deep-furrow drill on the heavier soil types.
(d) Use the one-way disc only where there is a vegetative cover.
(e) Use the duckfoot cultivator, where possible, in the place of the moldboard plow and disc.
(f) Decrease the amount of fallow, and discourage fall plowing.
(g) Till on the contour to conserve moisture, and till so as to control weeds.

ACTIVITIES

1. Inspect, at the local implement house, the new machines, such as the deep-furrow drill and basin lister.
2. Discuss the tillage methods used on your farm.
3. Make a list of the types of farm machinery that you would like to own, in addition to what your farm already has.

5. Progress in Erosion Control

(a) NATIONAL:

Movements to conserve the soil began in this country in colonial days, but made little headway on a national scale until recent years.

As early as 1685, William Byrd of Virginia described a heavy rain which carried away the topsoil from tobacco hills. The concern of colonial planters over soil waste was shown in the experiments of George Washington at Mount Vernon and those of Thomas Jefferson. Patrick Henry is quoted as having said:

"Since the achievement of independence, he is the greatest patriot who stops most gullies."

The efforts of erosion control in the early days included contour plowing, which was used and recommended by Jefferson.

The actual development of soil erosion control in the United States was preceded, in some cases, by hundreds of years in other parts of the world. Erosion control was practiced in Peru long before the discovery of America.

The first real erosion investigation in the United States was not made until 1890. Terracing and contour cultivation were developed in South Carolina between 1893 and 1905. The United States Department of Agriculture put out a bulletin in 1894 entitled, "Washed Soils—How to Prevent and Reclaim Them." Different states made appropriations for erosion surveys, and the Federal Government started a program of soil surveys.

It was not until September, 1933, that the Soil Erosion Service was set up in the Department of the Interior. In 1934, a nationwide erosion survey was made, covering almost two million acres. In 1935, the Soil Erosion Service was renamed the Soil Conservation Service, and transferred to the United States Department of Agriculture. Since that time the Soil Conservation Service has set up projects in all but a few states, and has demonstrated in cooperation with farmers themselves, means and methods of erosion control.

South Dakota is in Region Nine of the Soil Conservation Service, with Montana, North Dakota and Wyoming. Regional headquarters are at Rapid City, S. D.

ACTIVITIES

1. Obtain a copy of the Soil Conservation Act of April 27, 1935, and study what the Federal Government is doing in erosion control.
2. Find references to erosion control in other states.
3. Encourage library reading dealing with erosion and its control in early Virginia, China, Peru, and European countries.
4. Have a debate on the subject, "The Soil is the Most Important Resource of the United States."

(b) STATE:

Considerable work along the lines of erosion control and soil and moisture conservation has already been attempted in South Dakota. The Federal Government entered the picture in 1935, cooperating with the State Extension Service in the exprimental and demonstration phases of erosion control. The Soil Conservation Service set up demonstration projects at Huron, called the Wolsey-Shue Creek area, and at Winner, called the Winner-Dixon area. The CCC camps at Alcester, Huron, Chamberlain, and Sturgis also are doing erosion control work. In each one of these areas, the Soil Conservation Service is cooperating with local farmers in controlling wind and water erosion, and these areas are serving as a demonstration for the state.

In more than half of the counties of the state, the County Agent, with the cooperation of the Soil Conservation Service, has established one or more demonstration farms. These farmers are carrying on a program of erosion control that will show more clearly the value of conservation, and the necessity of saving soil and water.

The revised AAA program, beginning in 1936, likewise encouraged conservation of the soil by making payments for certain practices to all cooperating farmers in the state. Other agencies, such as the Bureau of Agricultural Economics are bringing about better land use through their purchase programs.

The newest development in erosion control in South Dakota is the setting up of Soil Conservation Districts under the state law that enables farm communities to establish such districts.

These districts are run by a board of five local farmers, and assistance is given to the district by the Soil Conservation Service and other federal, state and local agencies upon request by the supervisors. The State Extension Service assists in the districts by carrying on agricultural educational work.

The districts are carrying on the conservation practices which have been demonstrated in other parts of the state. By July 1, 1938, there were four such districts in South Dakota: The Tri-County at Faith, including parts of Meade, Ziebach and Perkins counties; the Brown-Marshall at Britton and Hecla, comprising parts of Brown and Marshall counties; the Brule-Buffalo at Chamberlain, covering parts of Brule and Buffalo counties; and the Clearfield-Keyapaha at Winner, comprising a part of Tripp county.

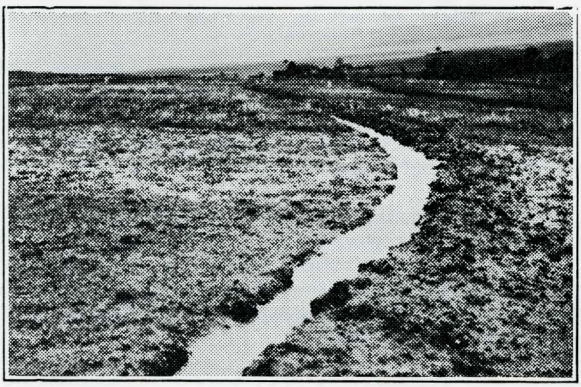
By studying over the number of farms already being operated under better land-use programs in South Dakota, it may be seen that there has been a material start made in conserving the state's soil and water. If a farmer is in doubt as to whether a certain practice will prevent erosion, there are these different places in the state where he can go and study the work that already has been done.

The work and the practices demonstrated have just started, however; and it is necessary for all farmers in the state to become interested in

conservation and to do all that they can to assist in conserving the soil and moisture of South Dakota.

ACTIVITIES

1. Have the pupils tour one of the Soil Conservation Service projects or camp areas, or a District or Extension Demonstration Farm, to see soil conservation practices.
2. Invite the County Agent to make a talk at your school, to explain the principles of soil conservation.
3. Write to the County Agent or the State Extension Service, mailing the best letter written by a pupil, for copies of bulletins on erosion control work.
4. Write the County Agent asking the Extension Soil Conservationist at Brookings, to show film strips, slides or pictures on consesrvation in your community.
5. Find out how many erosion control programs are under way in the county as a result of federal or state activities.
6. Make a bulletin board of magazine and newspaper clippings and pictures on Soil Conservation.



Holding water by Mechanical means, one of the control practices recommened-ed by South Dakota District Supervisors. —Courtesy of Dakota Farmer, Aberdeen, S. D.

(c) INDIVIDUAL:

The conservation work that is to be done in this state must be done by the individual farmer.

This work, however, must be carefully planned, or it may not be successful. For instance, a pasture furrow that is not on the level may help to carry off the water instead of holding it, and may form a gully.

The individual, in planning a conservation program for his farm, must take into consideration the following steps:

1. Make an outline map of the farm, using a scale of four inches to the mile, showing the size of all the fields.
2. Study the soil types on the farm, and figure out the proper land use.
3. Determine the degree of slope on each field, and study the best uses for various slopes.
4. Make a survey of the farm in order to find the degree and extent of erosion, and study the relation of the degree of erosion to the soil type and slope.
5. Study the present use of the land on the farm, and list the acreages of each different crop, pasture, etc.

6. Plan for the future use of the land on the farm by drawing a map which shows the soil type, the degree of slope, the degree of erosion and the present land use of each field on the farm.
7. Determine the conservation practices that should be used on each field of the farm. Study the soil conservation practices, such as strip cropping, contour tillage, pasture furrows, etc., that would work best in connection with the various soil types, slopes and degrees of erosion on the farm.
8. Select the areas that are to be regrassed, and plan a complete crop rotation for the farm.

ACTIVITIES

1. The pupils should visit other farms in the community, and learn what their neighbors are doing with fields similar to their own.
2. Let each student present his completed farm map, showing the recommended conservation measures, to his parents and give them his reasons for making the recommendations.
3. Discuss the part the AAA farm program has played in sponsoring the use of soil conservation practices.

The problem of soil conservation and erosion control is a serious one. There are many things to think about. We cannot just pick out a program of strip cropping on every farm, and let it go at that.

We also have to guard against too much enthusiasm. We have to have balance and use common sense. We are young yet and still have a lot to learn.

Soil conservation already is a term that really means something to farmers and city people alike. Soil erosion is a national menace, a state menace, and an individual problem. It is a problem which must be met by the present generation of Americans who live in a country that is credited with having destroyed its soil faster than any other nation in the history of the world.

V. GLOSSARY OF TERMS USED:

ABANDONED FARM—A former farm operating unit, on which the land is no longer cultivating.

ARID—A term applied to lands or climates which lack sufficient moisture for agricultural use without irrigation.

BLOW SOIL—Soil that has been moved by wind.

BLOW-OUT—The sunken area from which soil has been removed by wind erosion.

BROAD-BASE TERRACE—A long ridge of earth 10 to 30 inches high, and 15 to 30 feet wide with gently sloping sides, a rounded crown, and a broad shallow channel along the upper side.

BUFFER STRIPS—More or less permanent contour strips of variable width planted to erosion-resisting vegetation which are not a part of the rotation and may or may not be harvested.

CARRYING CAPACITY UNIT—Forage acreage sufficient to support one animal of a given class for the period of one year.

CLEAN TILLAGE—A process of intensive cultivation to prevent growth of all vegetation except the particular crop desired.

CLOSE GRAZING—Refers to the practice of pasturing as many animals on a given type of pasture, using all of the food possible without injury to the plants or stand.

CONTOUR—An imaginary line on the surface of the earth connecting points of the same elevation.

CONTOUR FARMING—The plowing or cultivation of slopes on the contour.

CONTOUR FURROW—A furrow plowed along a contour; also refers to level furrows made in pastures for the purpose of preventing run-off and soil loss.

CONTOUR PLOWING—Plowing on a contour or line of equal elavation; running a level furrow regardless of the irregularities of the landscape.

CONTOUR STRIP CROPPING—The production of crops in long variable strips placed crosswise of the line of slope approximately on the contour.

CONTOUR TILLAGE—A system of performing the tillage practices of farming so that the various operations are performed on the contour.

COVER CROPS—Crops grown for the purpose of soil protection, between periods of regular crop production.

CROP RESIDUE—That part of a plant, or crop, left in the field after harvest.

CROP ROTATION—In general, a crop rotation is an orderly cropping procedure, usually covering a period of years, in which certain crops will follow each other on the field in certain definite order. Its purpose is to maintain soil fertility or to control erosion on that field.

DAM—A barrier to confine or raise water for storage.

DEFERRED GRAZING—Keeping animals off a pasture until the vegetation has made a good growth, or under western range conditions until the seed crop has matured.

DENSITY—A term applied to vegetation which indicates the percentage of the ground which is covered.

DIVERSION DAM—A barrier built for the purpose of diverting part or all the water from a stream into a different course.

DIVERSION DITCH—An artificial ditch to divert water from its natural course

DUNE SAND—Areas of wind-drifted sand in dunes, hummocks, and ridges, usually free from vegetation.

ERODE—To eat away or into; to destroy by slow breaking down; to wear away.

ERODIBLE—Subject to erosion; e.g., soil is erosible.

EROSION—Wearing away of the lands by running water, glaciers, winds and waves.

EROSION CONTROL—The application of necessary mearsures to control man-made erosion.

EROSION-RESISTANT CROPS—Those crops which because of dense stand, large fibrous root system, or similiar characteristics, provide effective protection against soil loss by wind and water.

FINGER GULLY—Very small gullies; the fan-shaped extensions at the head of a gully system.

FORAGE CROPS—Crops produced primarily for feeding livestock.

FOREST PLANTING—The artificial establishment of a forest by setting trees or planting cuttings.

GEOLOGICAL EROSION—The process by which land surfaces are broken down and transported to some other place, free from the influence of man.

GRADE—The slope of a road, water course or natural ground.

GRADIENT—Change of elevation, velocity, pressure, or other characteristics per unit length; slope.

GRAZING CONTROL—A method of livestock management planned to maintain good vegetative cover or improve such cover if in poor condition.

GRAZING LAND—Land regularly used for grazing except cropland and rotation pasture. It should not be confined to land suitable only for grazing.

GRAZING UNIT—Any division of the range used in the handling of livestock in grazing.

GULLY—A furrow, channel, or minature valley cut by running water, but through which water commonly runs only during and immediately after rains, or during the melting of snow.

GULLY CONTROL—Regulation of gully erosion by mechanical or vegetal means.

GULLY EROSION—Carrying off of soil by the action of water flowing in distinct channels or ditches.

HUMUS—A more or less stable stage in the decomposition of soil organic matter.

IMPERVIOUS SOIL—A soil very resistant to penetration by water and usually to air and to plant roots.

LEGUME—Any nodule-bearing plant which has the ability to collect nitrogen from the air and store it in the soil, such as peas, beans, clover, alfalfa, etc.

LISTER FURROWING—A system of furrowing and loosening the ground with a lister crosswise of the prevailing wind direction to encourage moisture penetration, and to help control soil blowing.

MECHANICAL CONTROL—Man-built structures used to control erosion such as terraces, dams, etc., in contrast to vegetative control.

OVERGRAZING—The practice of permitting livestock to graze in such a way that desirable vegetation is injured or destroyed, and natural reseeding is not possible.

OVERSTOCKING—Stocking a range beyond carrying capacity.

PASTURE IMPROVEMENT—Any practice of grazing, clipping, fertilization, liming, seeding, contour furrowing, or other methods of management designed to improve the vegetation for grazing purposes.

PROFILE—SOIL PROFILE—A soil profile is a vertical section of the soil from the surface to the underlying unweathered material.

RANGE—Any large tract of grazing land supporting native forage.

RANGE MANAGEMENT—The regulation of grazing with the object of using the grazing resources to the fullest extent possible, consistent with the protection, development, and use of other resources without injury to the grazing capacity of the range.

RILL—A very small channel or stream of water; a rivulet; streamlet; used to describe the first stages of development of a channel which may later become a gully.

RIP RAP—Broken stone placed on earth surfaces for their protection against the action of water.

ROTATION GRAZING—Grazing two or more pastures or areas in regular order, with definite resting periods.

RUN-OFF—That portion of precipitation falling on the lands which flows off over the surface without sinking in is termed run-off.

SHEET EROSION—Removal of a more or less uniform layer of material from a portion of the land surface by processes of slope-wash, sheet flood, etc.; contrasted to gullying and stream erosion which act only along drainage lines.

SLOPE—The slope of land in per cent as determined by measurement.

SOIL—The soil is a natural body occupying the surface portion of the earth, composed of mineral and organic materials.

STRIP CROPPING—The practice of planting bands or strips of certain close-growing or close-rooted crops with cultivated or row crops alternating with the strips.

SUBSOIL—The horizons or layers of soil beneath the surface soils.

SUMMER FALLOW—Tilling land during the growing season, without planting crops.

SUPPLEMENTAL PASTURES—Fields used for grazing when the permanent or rotation pastures are unproductive and do not supply enough feed for the farm livestock.

SUPPLEMENTARY FEED—Feeds, such as hay and ensilage or concentrates, such as cottonseed cake, corn, etc., which are fed to livestock when the range forage is of insufficient quantity.

TERRACE—A long, low embankment and shallow ditch combined constructed across a slope to control run-off and minimize soil erosion.

TERRACE CHANNEL—The depression along the upper side of the terrace ridge in which the water flows to the outlet.

TERRACE OUTLET—The end of the terrace at which the run-off is discharged.

VEGETATION—Any group or association of plants; the sum of vegetable life, plants in general.

VEGETATIVE CONTROL—Any method of effecting soil and moisture conservation by the use of vegetation.

VEGETATIVE COVER—Any plant growth occupying the land.

WEED—To the farmer a weed is a plant out of place.

WIND EROSION—Erosion of soil by wind action.

WIND STRIP CROPPING—The production of crops in long, relatively narrow strips, placed crosswise of the direction of the prevailing winds without regard to the contour of the land.

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