HANDLING NORTHEASTERN ILLINOIS SOILS

Does your farm lie in the problem area?

CIRCULAR 663
UNIVERSITY OF ILLINOIS - COLLEGE OF AGRICULTURE
EXTENSION SERVICE IN AGRICULTURE AND HOME ECONOMICS
IF YOU OWN OR FARM LAND in Northeastern Illinois

If your farm lies in the shaded area on the cover, chances are better than even that you have a tough problem on part or all of it. Yields have dropped, the land does not drain as well as it used to, and it washes much faster. What is wrong? Probably the trouble is that you have land with a tight subsoil.

Surface soil, or topsoil, in northeastern Illinois is usually only a few inches thick and then shades gradually into the underlying subsoil. About two-thirds of the land has a subsoil which is a very tough clay and is tight, heavy, and hard to manage. Water goes through it very slowly. As a result, flat land stays wet and water runs quickly off the slopes, carrying good topsoil with it. As washing goes on, the topsoil becomes thinner. The thinner it is, the faster it washes, until finally, if erosion is not checked, the land becomes just about worthless. A lot of land in northeastern Illinois is in danger of becoming entirely useless for crops or pasture.

The trouble started many thousand years ago. A great ice sheet once covered all this part of Illinois. In moving down from the north it brought with it great quantities of clay, silt, sand, gravel, and boulders. When the glacier melted, it left this material over the entire area in thicknesses varying from a few feet to more than a hundred feet. This material is known as glacial drift. In some places, it is a mixture of gravel, sand, and finer particles through which water can move readily. But in many other places the glacier deposited a very fine shaley material, which has formed a heavy, putty-like clay that holds water like a jug.

Over this layer of glacial drift, a thin blanket of silty material, called “loess,” was carried in by the wind and deposited. A high-grade topsoil developed from the loess. It became a rich dark silt or clay loam which contained an ample supply of humus left there by many centuries of grasses growing up and falling down. The soil was easy to work and could take up and hold a large amount of water. Good topsoil developed both on the “tight” subsoils and on the more open subsoils. For a long time the two areas looked much alike. But the one with the tight subsoil had a definite handicap.

Research men have marked out for us the areas of tight subsoils. They did this by identifying the soil types. Of the soil types that have the problem

Good soil management has kept this farm highly productive in spite of its tight subsoil. The farm lies in the problem area of northeastern Illinois.
of a tight subsoil, the best is the Elliott-Ashkum group, an intermediate group is called Swygert-Bryce, and those with an almost impervious subsoil are called Clarence-Rowe (the first name of each pair refers to sloping soils and the second to those which are level or nearly so). Although these groups cover most of the area, there is a lot of local variation, so the situation differs from farm to farm or even between parts of the same farm.

Hard farming has brought out sharply the differences between the tight soils and the more open soils. Common practice has been to raise a high proportion of grain crops — corn and oats in the early years, corn and soybeans more recently — with little or no soil-improving legumes and grasses. This leads to more erosion if there is any slope at all to the land. As topsoil gets thinner, plows gouge into the subsoil and mix it with what is left of the surface soil. This mixture is harder to work and much less productive than the topsoil alone. Once the topsoil is gone and the tight clay subsoil exposed, almost nothing will grow — even trees do poorly. Such land is gone beyond reclamation. Fortunately there is not much land in this condition as yet.

On a great many farms danger signs are becoming clear. Some land is almost to the point of being abandoned. On some the topsoil is so thin that the light-colored subsoil is showing through. Crop yields have dropped. Immediate action is needed to keep what little topsoil remains.

A large acreage of the land in northeastern Illinois has not suffered severely. If handled carefully, this land can be kept in a high state of fertility for a long time to come.

You will see on the following pages some of the ways that this problem makes itself evident. You will also see some things that can be done to save what we have. Remember this is not just a question of declining fertility, important as that is. It is a question of permanently ruining some of our good corn-belt land.
DOES YOUR LAND SHOW THESE DANGER SIGNS?

On these two pages you see what can happen to land with a tight subsoil. The main problem on such land is to take care of the water. Very little can drain down through the subsoil, so the topsoil has to try to handle it.

Originally the topsoil had so much organic matter in it that it was loose, porous, and granular, and absorbed water easily. Hard farming, however, has gradually used up much of the original stock of organic matter, so that during heavy rains the topsoil soon becomes saturated. On level land any extra water stands on the field. The soil stays wet so long that planting is often delayed. After the field is planted, growing crops may be drowned out. If there is enough slope, the water that falls after the topsoil is saturated must run off the surface, carrying along some of the topsoil. This again makes the problem worse, for next time there will be even less soil to absorb water. As the topsoil gets thin, gullies begin to form.

Loss of topsoil on these soils is quickly reflected in lower yields. This was brought out in recent studies at the Illinois Station. On Swygert silt loam where the depth of surface soil ranged from 2 to 7 inches, each inch difference in depth meant 5 bushels difference in corn yield an acre. Where the topsoil was 7 to 16 inches deep, the loss in yield per inch of topsoil lost was only about 3 bushels. On Tama silt loam, which has a subsoil that water can move through rapidly, a loss of an inch of topsoil cut yields about 1½ bushels an acre.

It is very desirable, of course, to keep the topsoil on Tama silt loam, but it is doubly important to save it on Swygert and other soil types which have a tight subsoil.

As the layer of topsoil becomes thin, plows dig into the subsoil and mix it with what is left of the topsoil. The result is a cloddy mixture that is heavy, sticky, and hard to work.

When corn is planted up and down the slope, as it was in this field, water has a chance to strip the upper part of the field of its good rich topsoil.
Erosion caused by too much corn and soybeans and too much farming up and down the slope has taken so much topsoil from this field that the lighter-colored subsoil is showing through on the high spots.

Heavy runoff of water caused by hard farming, and lack of a grass waterway uncovered this tile line.

A tight clay subsoil underlying this field is keeping the water from going down normally into the soil. Tile will not work. Drainage by surface ditches may be possible. A cultivated crop in a place like this is always in danger of being drowned out.

Only a posthole auger can reach the good soil in this field. Raw exposed subsoil (right) washed down from a nearby slope and covered the productive topsoil (left) to a depth of several inches. This field can no longer support a good crop.
TIME IS RUNNING OUT

If you have land that looks like this, all you can do is to write it off as a total loss. There is nothing you can do to save it. Once the topsoil is gone, a barren field is all that remains. Right now there is not much land in northeastern Illinois that has reached this stage, but on a very large acreage the topsoil is becoming dangerously thin. In one county it has been estimated that unless present farming practices are changed, a fifth of the farm land will go out of production in the next fifteen years. And the problem is no more severe in this county than in several others in northeastern Illinois.

Close-growing hay and pasture can prevent erosion damage to sloping land. But we cannot get good stands and growth of these crops unless a fair amount of topsoil remains.

The field at the left is almost worthless as pasture. Most of the topsoil is gone and pebbles from the subsoil can be seen on the surface. The stand of grass is thin and is making little growth. The cattle are not finding much to eat. The owners waited too long before shifting from crops to pasture.
As the topsoil goes, only the stones and clay of the subsoil remain, as shown in the picture at the lower left. Not only is grass a failure, but not even trees will grow, or at best do very poorly.

The poor and spindly black-locust trees above are 10 years old. They should be large enough to make good posts. A good many have already died and disappeared. Those that are left are growing on the few places where some patches of topsoil remain. This land is gone—there is no way to reclaim it.

The sparse vegetation on the field at the lower right is of no practical value. This field too has joined the "badlands" of northeastern Illinois.
THE LAND MUST BE PROTECTED

The good land in northeastern Illinois must be saved while it is still good. This can be done — and profitably. Some practical changes in its use, in the cropping systems practiced, and in ways of getting rid of surplus water can protect the soil and build it up.

Number one job is to know whether your land has a tight subsoil.

There are people who can help you find out. You can call on your farm adviser, who represents the College of Agriculture and the Extension Service in your county. He can give you the latest information about the soils in your area.

The farm adviser will have in his office publications of the College of Agriculture which apply to this area. Soil reports have been printed for many of the counties (unfortunately when some of the early maps were printed, the tight subsoils were not recognized). Detailed maps in the later reports show where the different soil types occur, including those with a tight subsoil, and the text describes each type briefly. For some counties for which there are no printed reports, maps alone are available. Circular 604, "Shall We Fall-Plow or Spring-Plow in Northeastern Illinois?" describes in detail the Elliott-Ashkum, Swygert-Bryce, and Clarence-Rowe soil types. It also contains valuable suggestions for handling these soils.

You can also write to the College of Agriculture at any time for information and advice.

Your soil-conservation district through its farmer directors and the technicians assigned to it by the U. S. Soil Conservation Service cooperates with farmers in helping them figure out what their soil problems are. It also helps them plan and carry out a better system of land management. This district assistance is usually given to small neighborhood groups of farmers.

Once you know your land has a tight subsoil, what is the remedy?

In brief it is to follow nature’s example. Most of these soils developed under prairie vegetation, which gave the soil its rich dark color and its fine open structure. The grasses bound the soil particles together and held them against the eroding force of wind and water. The soils that developed under tree cover were not as fertile as the prairie soils, but they also were protected against erosion.

For the last century and a half, however, much of this land has not had the good care it needed. It has been operated under a cash-grain system, which has meant a high proportion of grain crops — corn and soybeans in recent years. To make matters worse, these crops have been commonly planted up and down the slope. The land is no longer protected against erosion.

A complete return to nature is, of course, not practical. You cannot afford to turn your whole farm over to grass and let it grow for years without being harvested or grazed. Fortunately, however, it is not necessary to go that far in order to do the job. Some of the things that you can do are shown on the following pages.
MAKE A LAND-USE PLAN

To get the best results from these problem soils, a definite long-time plan must be worked out for each farm. Such a plan should include all the things that need to be done to hold the soil in place and to control the movement of water. The plan should also include the order in which these things will be done. The conservation plan for your farm will have to be tailor-made to fit not only your land but also your system of farming.

- Figure out the best use to be made of each acre.
- Put each acre to its best use and treat it according to its needs.

Where the topsoil is getting thin, particularly where plows are bringing up subsoil, the land should be taken out of the rotation and retired to permanent pasture or trees without further delay. Examination with a spade will show where this is happening. If you wait until the topsoil is all gone, it will be very difficult if not impossible, even with complete soil treatment, to establish good pastures or get a satisfactory stand of trees.

In many pastures in northeastern Illinois the change to pasture was not made in time. The pebbly glacial subsoil is exposed over large areas; the stand of grass is poor and produces little feed.

Land that still has a fair amount of topsoil can be used for grain crops if plenty of legumes and grasses are included in the rotation. These two crops build up the soil and give it protection. Thus they balance the soil-depleting grain crops.

To protect slopes planted to cultivated crops, you will need to plant on the contour or perhaps use strip cropping or terracing.

Ways to dispose of surplus water will have to be a part of your plans. Some grass waterways and open ditches for draining water off the low spots are sure to be needed. You may also need dams or flumes or other structures to protect the waterways or outlets to the ditches.

A good plan will save both time and money. It is like a road map in showing you the shortest and easiest route to where you want to go.
GROW MORE LEGUMES AND GRASSES

Corn, soybeans, and other cultivated row crops have been grown too often on these tight soils. They use up the humus in the soil, encourage erosion, and make drainage more uncertain. More legumes and grasses need to be worked into the rotation to replace part of the corn and soybeans. The higher grain yields that will result will offset the smaller acreage of the grain crops.

The proportion of row crops should be adjusted to the soil's fertility and the danger of erosion. The better soils ought to have a legume-grass mixture on them at least 25 percent of the time. Even level land, where erosion is no problem, needs more legumes and grasses to improve drainage and make the soil easier to work. The less productive soils may need these sod crops as much as 60 percent of the time. A rotation that leaves the legume-grass meadow down two or three years is much better than one that leaves it down only one year. Notice how the alfalfa roots in the two-year-old meadow at left have penetrated deep into the subsoil, while the fine fibrous roots of the bromegrass are making the topsoil porous and easy to work.

A vital step in insuring good growth of meadow crops is to have the soils tested for acidity, phosphorus, and potassium and to apply any needed soil treatments.

These soils once had a good supply of organic matter. But much of that supply has now been used up by cultivation, hauled off the fields as harvested crops, or eroded away. To replace some of this lost organic matter, more legumes and grasses, crop residues, and manure need to be plowed under.
TAKE CARE OF THE WATER

Handling surplus water is a big problem on these tight soils. Growing more grasses and legumes will enable them to soak up more water, but the tight subsoil places a limit on the amount. If still more rain falls after the topsoil is soaked full, the extra water must run off. This water running down unprotected slopes or standing in pools in the low places is a serious threat to the land.

On flat land some way must be found to drain the water off. From depressions that now have no surface outlet, the water can best be removed through open ditches or through well-maintained surface inlets to tile lines, where they are available.

Tile may be satisfactory on Elliott-Ashkum soil, where water movement through the subsoil is only moderately slow. Even there frequent crops of deep-rooted legumes are needed to keep the subsoil in condition to let water seep on down to the tile.

On land where water moves through the subsoil very slowly (as on Swygert-Bryce, Clarence-Rowe, and similar soil types) tile drainage is not effective enough to be worth the cost. Open ditches are a better answer.

On slopes, working the land and running the rows across the slope on the contour will hold the water back, give more time for it to soak in, and thus reduce erosion. In dry seasons, getting more water into the soil will increase yields. On long, regular slopes contour strip-cropping — alternate strips of row crops and small grain or meadow crops — is better than having the whole slope in one crop on the contour.

Grass waterways to protect the drainage channels are a must in this area, but they have to be established while there is still some topsoil left. In shaping the waterway, be sure to make the channel wide and flat-bottomed in order to spread the water and reduce its cutting power. If possible, push the topsoil to one side with a grader, shape the waterway, and then bring the topsoil back in a thin layer over the finished channel. Heavy rates of fertilization and seeding will help insure a stand of grass good enough to carry the running water.

Terraces can be used to break up a long slope into a series of short slopes, to aid in drainage, and to divert excess water from land below. In some places soil-saving dams or flumes will be needed to stabilize a waterway or help check severe erosion. Or an earth dam can be used to form a farm pond which will check a gully. Such a pond can also supply water for livestock, fire protection, and recreation for the family.

All these water-control measures should be planned and established with the guidance of an experienced conservationist who understands the soil problems of northeastern Illinois.
Hay and pasture from legumes and grasses are the backbone of a good, sound livestock program.

How to Use Meadow Crops Your Soil Needs

Depending on the kind of land you have, you will probably need to keep from 25 percent up to 60 percent of your cropland in stand-over legumes and grasses. Your first questions are likely to be, "How am I going to use so much more of these forage crops? How can I make any money from my farm with so little of it in grain crops?"

Farm records give you the answers. They show that good crops of legumes and grasses, when used right, are high-profit crops. Alfalfa is a good example — under favorable conditions an acre of this No. 1 legume has a feed value equal to an acre of corn. Remember too that there are a number of ways to put legumes and grasses to profitable use.

Hay and pasture. Far too many farmers do not grow enough forage for their livestock, and so have to feed more grain and protein supplements. More high-quality hay and pasture would cut down cost of production and on some farms would increase the rate of gain, give more uniform production of milk and more rapid growth of young animals, and require less labor.

Farmers who depend principally on bluegrass pasture usually have to feed additional grain during the summer to prevent a drop in milk flow or loss of weight when these pastures are dormant. The use of rotation pastures will fill this gap and also make possible a better sanitation system for hogs.

Making silage of your meadow crops will extend by several months the period over which you can feed them. These men are making silage of an alfalfa-bromegrass mixture.
Harvesting seed is a good way to use a legume or grass crop that you do not need for livestock feed. Here we see bromegrass seed being threshed.

Silage. If you are using corn for silage, you can change over to legume-grass silage and have more corn to harvest for grain. Farmers throughout the country are using grass silage and finding that it does the job.

Seed production. You may find an outlet for the extra acres of legumes and grasses by producing seed. This has frequently been very profitable. Supplies of legume and grass seed have not been keeping up with demand, and more acres need to go into seed production. Harvesting a crop for seed has the advantage too of leaving the greater part of the growth in the field, where it can be plowed back into the soil.

Plowing under. The most important use you can make of these crops, so far as the good of your soil is concerned, is to plow them under. If you use them for feed, be sure there is a good second growth to plow under, and be sure too to put all manure back on the land. When you sell your hay to someone else, you are helping him to improve his land, but you are cutting down the benefit to your own.

Plow under all the top growth you can. The soil will then be able to furnish more nitrogen for other crops in the rotation. It will work better and drain better. It will be able to hold more water and resist erosion.
A Conservation Program WILL PAY

Naturally you are interested in knowing just how conservation farming will affect the current income from your farm. Will it be greater or smaller under a conservation system?

Farmers' own records, analyzed by the Experiment Station and U. S. Soil Conservation Service, show that conservation does pay. One comparison in northeastern Illinois concerned forty high-conservation farms (farms doing a good job of conservation) and forty low-conservation farms. All were on land with a tight subsoil. For the years 1945-1947 the difference favored the high-conservation farms by almost $32 an acre, or over $5,000 for a 160-acre farm. Another comparison in 1947 concerned two groups of farms on Clarence-Swygert-Elliott mixed soils in northeastern Illinois. The high-conservation farms averaged 6 more bushels of corn an acre, produced twice as much livestock, and had a net income of $11 more an acre, which is equivalent to $1,760 for a 160-acre farm.

Long-time studies confirm these results. In McLean county for the ten years 1936-1945, a period of lower farm prices, the high-conservation farms had a net income of $17.54 an acre compared with $14.08 an acre for the low-conservation farms. The difference, $3.46, represented almost a 25-percent increase for the high-conservation farms. (Further information on these comparisons can be found in Bulletin 540, "Costs and Benefits of Soil Conservation in Northeastern Illinois," and in various mimeographed publications of the Department of Agricultural Economics.)

But, you say, it costs money to put a conservation program into operation. That's true. It does take money to pay for limestone, phosphate, grass and legume seeds, etc. On forty-eight farms for which a complete soil-conservation plan had been worked out, it was estimated that the cost of putting the program into effect would average $34 an acre. This estimate included not only the cost of improving the land itself but also an allowance for buildings, equipment, machinery, and livestock needed to make the program most effective. This investment would not, of course, be made all at once, but would be spread over several years. The increase in earnings resulting from the program — $10 or $11 an acre a year according to the studies reported above — would almost pay the whole cost of the conservation plan in three years. And the program would continue to pay dividends for many years to come.

If you adopt and follow a good conservation plan, you can be sure it will pay off in money, in soil saved, in general satisfaction, and in security for the future. And in the long run on the tight soils of northeastern Illinois, you will have to follow a good soil-conservation program or face the loss of your farm's ability to produce.

A fine waterway and corn on the contour are parts of a conservation program which this successful farmer in northeastern Illinois has worked out for his entire farm.
THIS PUBLICATION HAS BUT ONE PURPOSE —
to start you thinking about the serious farming problem
that exists in northeastern Illinois. To anyone who owns
a farm in that area or is renting there, the problem is of
immediate and direct importance. The problem of soil loss,
however, is one that should concern everyone, wherever
he lives.

But thinking must be carried forward into action. The
authors have not attempted to fill in the details of a soil-
management program for the area. For that you will need
to go to some of the people and publications mentioned and
to other sources of help. Many things can be done and are
worth doing, for most of the land will stay good for a long
time to come, if handled right.

The tight subsoil underlying much of the land in
the area is something like a physical handicap in a person.
He may be able to live with it all his life and never have
any serious trouble as long as he is careful. Carelessness
with the tight soils of northeastern Illinois means their
destruction.

This publication was prepared by W. F. PUR-
NELL, Assistant Extension Soil Conservationist,
and E. D. WALKER, Extension Soil Conserva-
tionist. All pictures in the publication were
taken in the area shown on the cover.
The Life of Your Soil Is In Your Own Hands