Some Geographic Aspects of Soil Erosion in Illinois

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To most laymen a map of Illinois (Fig. 1[1]) showing the areas that are subject to erosion may be a dull and meaningless pattern, but to some geographers such a map would stimulate them into attempting to interpret the distribution and seriousness of the eroded areas in terms of physical environmental factors.

State Distribution of Soil Erosion

Most of the soil erosion in Illinois is found in the west-central and southern part of the State. Looking on a map at the location of the 16 counties having over 75 per cent of the areal surface affected by erosion of a "serious" and "destructive"[2] nature, we find that the Ozark Ridge runs through 6 of them, and that 2 are influenced by the rough terrain in the northwestern part of the State. Of the remaining 8 counties, 6 are found by the Illinois River, one is badly eroded by three forks of the Big Muddy River, and the last is sandwiched between the Little Wabash and Saline rivers.

In contrast with the 16 badly eroded counties in the south and west-central part of the State are the 21 counties in the northeastern part having less than 11 per cent of their area affected by erosion of a "serious" and "destructive" nature. Not one of these 21 counties lies south of where the Wabash River becomes the eastern boundary of Illinois. It is interesting to recall that at one time most of these counties were covered with a prairie vegetation. It is also interesting to note that these 21 negligibly eroded counties generally occupy the more level terrain. Many of them, in fact, are so level that at one time they contained large swampy areas presenting drainage problems to the pioneers.

Besides comparing the badly eroded counties with the slightly eroded ones, a contrast of soil erosion made in the 24 northernmost counties with the 24 southernmost ones proves that erosion is more serious in southern Illinois. The following table gives the extent and seriousness of soil erosion in the two extremes of the State.[4]

Area Affected by Serious and Destructive Erosion

	Northern 24 counties	Southern 24 counties
More than 75 per cent	2	8
51 to 75 per cent	1	9
26 to 50 per cent	4	4
11 to 25 per cent	4	3
Less than 11 per cent	13	0
	24	24

Perhaps the most significant fact to be gained from this table is that over half of the 24 counties to the north have less than 11 per cent of their land affected by erosion of a "serious" and "destructive" nature while over two-

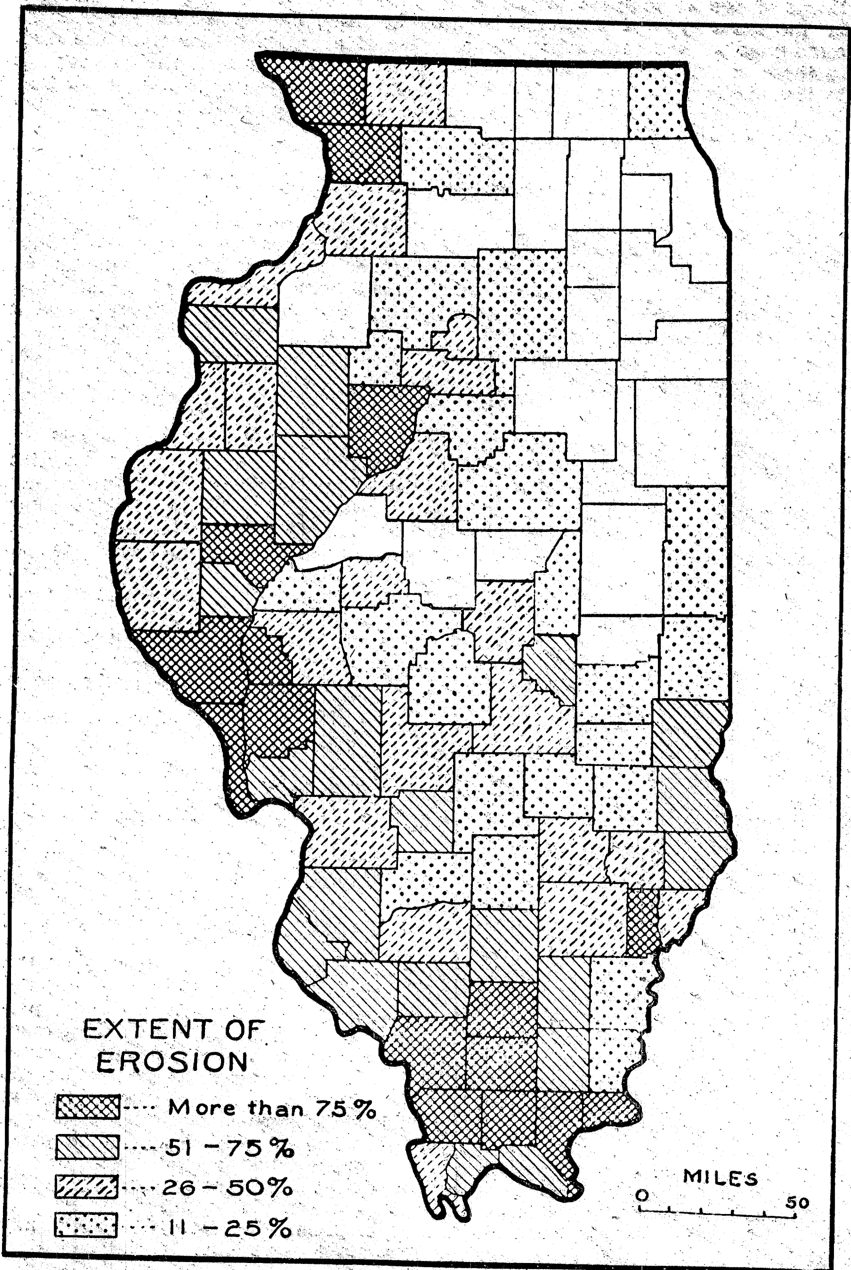

Fig. 1—Extent of Erosion in Illinois.

thirds of the 24 counties to the south have over half of their land affected by the same type of erosion. Looking at these figures we should bear in mind that we are contrasting the number of counties rather than the area in these counties. However, we should also remember that the 24 counties in the northern part of the State are larger than those to the south—a fact which increases the difference in the extent and seriousness of erosion between the two areas.

Reasons for Greater Soil Erosion

There are a number of physical environmental factors that cause the soil erosion problems to be greater in the southern part of the State. These important factors may be classified under three primary elements of geography, namely (1) weather and climate, (2) soil, and (3) landforms.

Weather and climate. Climate is not only the most important factor in the transformation of regolith into soil, but it is also one of the most important factors in the problems of soil erosion. All other factors being equal, soil erosion increases (a) with an increase in the amount of the thunder-shower rainfall, and (5) with longer periods when the ground is not frozen.

Except for large parts of Franklin, Perry, Washington, Monroe and St. Clair counties which have from 35 to 40 inches of rainfall, the 24 counties to the south get over 40 inches of rainfall with a large part of Union and Pope getting over 45 inches. The 24 counties to the north, on the other hand, get less than 35 inches. In the northern part of the State, moreover, a large per cent of the rainfall is of the cyclonic type. If the ground is not frozen, the slow drizzle characterizing cyclonic rains permits more of the moisture to enter into the ground. If the ground is frozen the run-off does not cause soil erosion.

The heavy, dashing, prolonged rains of southern Illinois in contrast with the cyclonic type to the north bring large volumes of water to the surface causing most of it to run-off. Then, the ground here being frozen for a very short time, the erosion period is longer.

Furthermore, during the winter months the heavy rains in southern Illinois often fall on a thawed surface with the lower part of the soil still frozen thus preventing the water percolating into the ground.[5] Under these conditions, sheet erosion is very effective. Sheet erosion also occurs with continual heavy rains in the late fall and early spring. Winter sheet erosion in northern Illinois is negligible.

Soil. In explaining the wider distribution and greater destruction by soil erosion in the southern part of the State, soil characteristics are of primary importance. In considering the soil erosion problems three soil characteristics should be borne in mind, namely, depth of soil and subsoil, character of soil, and subsoil permeability.

The depth of the soil and subsoil in part determines the size of the underground reservoir. If the mantle rock is thick and the texture of the soil is such that water can run into the ground readily, then, during prolonged rains a large quantity of water can be held in the underground reservoir. On the other hand, if the mantle rock is shallow, only a small amount of rain can be stored. Consequently, during prolonged rains the water table may approximately coincide with the surface of the earth and additional rainfall runs off unless it is held by surface features. Southern Illinois not only has large areas with shallow mantle rock, but in some counties barren out-crops are conspicuous features in the landscape. In contrast with this picture, the deep glacial drift in northern Illinois provides an ideal reservoir where a large quantity of water can be stored.

Because of the character of soil, it is possible to have a deep mantle rock and still not have a good underground reservoir. If the soil does not contain an abundance of humus and does not have a good structure, then water cannot seep into the ground rapidly. Therefore, during hard rains a higher per cent of the water runs off than it would if the rain fell upon a porous soil.

The most widely distributed soil in the northern 24 counties belongs to the brown and black group of soils.[6] Since these soils developed under a slough grass or prairie grass vegetation, they are high in humus. Being high in humus they are porous and permit rapid percolation. Consequently, these soils act as "open doors" to the mantle rock reservoirs below.

In contrast with the soil to the north, the two most widely distributed soils in the southern 24 counties belong to the yellow-gray and reddish-yellow groups. The reddish-yellow group developed under forest vegetation and is low in humus. The pore space in this type of soil, therefore, is low and the soil is "tight". Water does not percolate readily into this type of soil.

The other abundant soil in southern Illinois, the yellow-gray group, is more porous but it is underlain with a clay pan which prevents adequate underdrainage.

Subsoil permeability is a very important factor to consider in judging mantle rock as a probable reservoir. The southern 24 counties are found in two subsoil permeability regions, namely, (1) a region of "slow permeability on level areas, and moderate permeability on sloping areas," and (2), a region of "very slow permeability on nearly level, and moderate permeability on sloping topography."[7] In the first region, because of the downward movement of very fine-textured material and its collection in a zone, there has developed a layer of slowly pervious claypan beneath the level land. Beneath nearly all the level areas in the second region, a compact and plastic claypan has formed at a depth of about 18 inches. This slowly permeable stratum seriously interferes with the movement of moisture. Therefore, during heavy or prolonged rains the soil above the claypan is quickly filled with water and the excess must run-off.

The 24 northernmost counties on the other hand, are in two subsoil permeability regions of a different nature: (1) "rapid permeability on level and on sloping topography," and (2) "moderate permeability on nearly level and on sloping topography."[8] Both of these regions are primarily free of clay pans and permit rapid seepage into the mantle rock below.

Landforms. The importance of slope in the problem of soil erosion is well known. Not only does a steep land gradient increase the velocity of the run-off which in turn causes greater destruction, but there is a close correlation between slope and soil types. And since different soils respond differently to surface run-off, slope exerts an indirect as well as direct influence on soil erosion.

In the first part of this paper attention was called to the fact that one-half of the counties having over 75 per cent of their area affected by "serious" and "destructive" erosion contain the most rugged topography in the State. Because the hill region in southern Illinois is conducive to erosion, the Illinois Soil Survey, after studying the present conditions, recommends that "all slopes exceeding about 7 per cent should be in permanent pasture or forest. . . ." Slopes of less than 7 per cent, if tilled, should be farmed on the contour and some kind of vegetation cover left on the land as much of the year as possible to protect it from erosion."[9]

Thus we see that three primary physical features of geography, weather and climate, soil, and landforms play an important part in influencing the distribution and seriousness of soil erosion. In addition to physical causes, man, with many of his well meaning practices, has also accelerated erosion. It is only natural that when the ground was covered with a grass and tree vegetation erosion was negligible. But when man settled in southern Illinois, he could hardly have caused greater erosion had he planned it. He cut down forests and plowed the grass sod under. He brought steep slopes under cultivation. Open cultivated crops of corn, cotton, and sweet potatoes were grown under a one crop system and with the furrows running up the slope rather than against it. Man often burned the vegetation that might have become humus, and he often overgrazed the pastures. Cover crops and green manure crops were not generally grown.

Now that we are acquainted with the physical and cultural causes of soil erosion, a way of reducing and preventing it should be followed. Since we cannot change the physical environment, man must change his practices so that they will be more in harmony with conditions in nature. Through experimentations, remedial practices of soil erosion such as contour farming, terracing, winter cover crops, etc., should be studied and followed.

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[1] This map is taken from *A National Plan for American Forestry*, p. 375, Senate Document No. 12, First Sessions of the 73rd Congress. Since this map was issued, more detailed research indicates that a revised soil erosion map will be necessary. No revised map has been issued yet. (May 6, 1938.) Such a revised map, when issued, will show more detailed information. The relation of one eroded part of the state to another, however, which is the central theme of this paper, would be approximately the same on the new map.

[2] "Destructively eroded areas are defined by Dr. A. E. Norton, assistant chief of the Illinois State Soil Survey, as 'areas which cannot be cultivated by any practical known means at a profit because they erode faster than it is possible to build the soil up . . .' Dr. Norton defines 'seriously eroded' lands as 'areas which can be cultivated by specialized methods for profit' . . . No doubt, much of it could best be utilized in forests until such a time as there is greater demand for cultivated crops than at present." *A National Plan for American Forestry*, Senate Document No. 12, First Session of the 73rd Congress, p. 374.

[3] Two of these counties are also bound by the Mississippi river. Of the 16 counties having over 75 per cent of their area affected by "serious" and "destructive" erosion, 6 are bound by the Mississippi river.

[4] *A National Plan for American Forestry*, op. cit., Figures obtained from page 375.

[5] Norton, E. A., and others, *Jackson County Soils*. Soils Report No. 55, 1933, p. 20.

[6] Smith, R. S., and others, "Parent Materials, Subsoil Permeability and Surface Character of Illinois Soils," Map in pocket of book entitled, *Surface Character of Illinois Soils*.

[7] Ibid, Map in pocket of book entitled, *Subsoil Permeability of Illinois Soils*.

[8] Ibid.

[9] Ibid. p. 13.