

## SOIL AS A LIMITING FACTOR OF FORESTS IN LA SALLE COUNTY, ILLINOIS

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La Salle County, Illinois, is situated in the north-central part of the state within what is usually termed the "corn belt" on account of the extensive culture of that crop on the dark brown or black soils of the prairie. It is also within the region of the early Wisconsin glaciation, the Bloomington moraine skirting its northern boundary. The surface is gently rolling, the highest altitude at the north-west corner being 930 feet from which the plain slopes gradually to about 630 feet at the edge of the Illinois River valley. This valley, intersecting the county from east to west, lies about 200 feet below the level of the adjacent uplands. On account of the peculiar distribution of forests in this prairie county it was selected in the autumn of 1918 as one of the areas to be included in a State Forestry Survey. It seemed probable that it might present problems involving the factors which determine the relative extent of grassland and woodland in the State of Illinois.

This is not an opportune time to present the different theories as to the causes of the development of a grassland vegetation. These have been well summarized by Shimek<sup>1</sup>, who has also given in the same report an excellent bibliography of the earlier American literature upon the subject. Gleason<sup>2</sup> has stated some of the unsolved problems of the prairies and Cowles<sup>3</sup> has pointed out that the causes which explain the prairie vegetation of Illinois must not be applied, in all cases, to the great climatic prairies of the farther west.

<sup>1</sup> Shimek, B. The prairies. Bull. Lab. Nat. Hist. State Univ. Iowa 6: 169-240. plates 13. map. 1911.

<sup>2</sup> Gleason, H. A. Some unsolved problems of the prairies. Bull. Torr. Bot. Club 36: 265-271.

<sup>3</sup> Cowles, H. C. The physiographic ecology of Chicago and vicinity. Bot. Gaz. 31: 73-108, 145-182. figs. 35. 1901.

In the course of our forest survey certain relations in the distribution of soil types and native vegetation have impressed themselves upon the writer as affording some elucidation of one phase, at least, of the problem of the relative limits of the distribution of forests and grasslands in a portion of Illinois which lies in the tension zone of the great forest and grassland formations of this continent.

In the portion of the county covered in this survey the surface soil is dark brown in color and in a soil survey<sup>4</sup> is referred to as an upland prairie soil known as the "brown silt loam." It is described as composed largely of wind-blown loessial material to a depth of three to five feet the upper 6 or 8 inches having a humus content of about 6%. In depressions where drainage is poor a black silt loam is found. These together cover 80% of the entire area of the county.

In these soils streams are cutting their channels and developing their valleys. In the northern part of the county the cutting is slight and little or no valley has been developed, but as the Fox and Illinois Rivers are approached the tributary streams are found to be from 50 to 80 feet below the upland. As these streams have developed shallow valleys have been formed, portions of the surface silt loam being removed to depths varying from a few inches to several feet. As the usual depth of the prairie silt loam is about three feet it is clear that along the streams that have eroded definite valleys there will be exposed a strip of the soil immediately below that covering the upland. This soil naturally varies somewhat from that which overlaid it and this variation is manifest in differences of color and texture, and what is probable of much greater ecological significance, in slope and drainage. This difference in topography doubtlessly affects in a very material way the water content of the soil at various seasons of the year and these differences of soil moisture will naturally react upon the vegetation.

The Department of Soil Survey of the State Agricultural Experiment Station in making a soil survey of the county has recognized the differences between the upland prairie silt loams and the soil of slightly lower

<sup>4</sup>Hopkins, Cyril G., et al. La Salle County soils. Soil Report No. 5, Univ. Ill. Agr. Exper. Station. pp. 45. maps. 1913.

level bordering the streams, the latter being designated "yellow-grey silt loam." Aside from differences of color and water content it contains less of the finer wind blown material and has a lower humus content. The excellent maps accompanying the report of the Soil Survey, published in 1913, show the larger streams bordered by a narrower or broader band of this yellow-grey silt loam soil. Two or three of the streams flowing through the townships covered during the autumn of 1918 in our Forest Survey may be taken as examples of this soil distribution. Along the Little Vermilion in Troy Grove and Dimmick Townships the bordering strip of yellow-grey silt loam varies in width up to a maximum of 1500 yards.

Along Big Indian Creek in Earle Township it reaches a width of over a mile, while along Little Indian Creek in Adams and Serena Townships at its widest part the stream valley as indicated by the soil difference is two miles across.

For some reason not as yet clearly understood the strip of yellow-grey silt loam is decidedly wider upon the east side of these streams than upon the west. At times this difference is not great but it frequently happens that three-fourths of the entire strip is upon the left bank of the creek. An examination of other north and south streams shows that they possess the same soil fringe with a similar unequal lateral distribution.

It has been suggested that since the prevailing winds are from the west the inequality of the soil strip must be connected with the action of such winds in causing more deposition of wind-carried soil on the west bank of the stream or more wind erosion upon the east side. Another attempted explanation is connected with the movement of prairie fires from west to east but the causes of the distribution of this soil in this peculiar way is not of immediate importance in the present discussion. It is sufficient to point out that the soil has been recognized as essentially different, in some particulars, from the upland brown silt loam and its extent has been mapped in La Salle and other counties in the published reports of soil surveys.

In making our forest survey of portions of La Salle County it was soon noted that with the exception of a very narrow fringe of such trees as black willow along the small

streams there were no indigenous trees upon the brown silt loam soil nor could any indications be discovered that at any time had there been any forest upon this type of soil. The characterization of the brown silt loam by the members of the Soil Survey as an upland *prairie* soil seemed thus perfectly accurate.

On the other hand although all the bits of upland forest in the northwest portion of this county were upon the yellow-grey silt loam much of this soil was under cultivation and all trace of tree growth had disappeared. There is, however, good reasons for believing that it was all originally forested and hence that it may appropriately bear the designation given it by the Soil Survey of "upland timber soil." The evidence of former forestation is briefly as follows: (1) A map made in 1819 purporting to show the original forest areas of the county; (2) The township maps showing that these areas of yellow-grey silt loam were in the early surveys cut up into lots of 5 to 20 acres and that these areas were held as wood lots by farmers having larger farms of prairie soil elsewhere in the county; (3) The testimony of the oldest inhabitants which seems to agree perfectly with soil distribution as charted; and (4) The remnants of forest remaining at the time of our survey which were scattered over all parts of the yellow-grey silt loam but were found nowhere upon the brown silt loam.

Therefore since the original distribution of upland forest in this portion of Illinois where the vegetation is predominately grassland is limited to a particular type of soil bordering the streams and somewhat below the level of the prairie upland, it seems fair to conclude that here, at least the character of the soil is the controlling factor in deciding the limits of tree growth.