

## ORIGIN OF PRAIRIES IN ILLINOIS

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The work of other investigators has shown features common to all prairies regardless of where they are found. The dominant prairie species are xerophytic grasses. The evaporation rate is much higher in prairies than in the adjoining forests while the soil moisture content is much lower, often falling below the wilting point of plants during the summer. This evidently explains the xerophytism of the prairie vegetation, for these grasses can become dormant and remain alive during these unfavorable conditions which would destroy tree seedlings. After a prairie grass sod is formed, it tends to exclude tree seedlings. Trees can, however, invade prairies along the slopes of streams, gullies and morainal ridges where erosion has removed the sod and the irregular topography checks the wind velocity and thus reduces its dessicating action. A much slower invasion takes place along forest borders where the trees check the wind velocity and the shade destroys the prairie grasses.

As the Illinois prairies are in a region that was covered by glacial ice they must be post-glacial in origin. During the ice age there were several advances of the ice sheet separated by long interglacial periods, except for the period between the Early and Late Wisconsin glaciations, which was short. The Kansan ice sheet invaded northeast Kansas and extended into Missouri as far south as the Missouri river. The Illinoisan ice sheet invaded Illinois as far as the Ozark Hills in the southern part of the state. Just east of the Illinois-Indiana line, the border of this ice sheet bends to the northeast, continuing to central Indiana, then turns south to the Ohio river, then east to south central Ohio, and then north to central Ohio where it is buried by drift of the Wisconsin ice sheets. The Iowan ice covered northeast Iowa and possibly a small area in northwest Illinois. The Early Wisconsin glacier only entered the east side of Illinois, extending to Shelbyville and Mattoon, but covered most of the Illinoisan drift in eastern Indiana and in Ohio. A

lobe of the Late Wisconsin entered western Iowa, extending south to Des Moines. Another lobe entered northeastern Illinois but did not extend as far to the west or south as the Early Wisconsin. In eastern Indiana and western Ohio, however, it covered nearly all of the Early Wisconsin drift while it overrode all earlier drift in northeastern Ohio. South of the glacial drift the country is badly dissected all the way from eastern Ohio to Missouri. In the Plains Region, however, the relief is moderate. The Late Wisconsin drift has many strong morainal ridges and depressions while the Early Wisconsin, although it has some strong moraines, is nearly level over large areas in east central Illinois. All the earlier glaciations left a comparatively plain surface, a large part of which has not been dissected up to the present time. Before the advance of the Late Wisconsin glacier, the Mississippi, the Illinois, and the Rock rivers had cut large valleys and had dissected the adjoining country to some extent. During the retreat of the last ice sheet, Lake Chicago was formed at the south end of Lake Michigan basin and Lake Maumee at the west end of the Erie basin. Both of these lakes found outlets to the southwest, the former emptying into the Illinois river and the latter through the Wabash valley into the Ohio river.

During the advance of each ice sheet, the timberline was depressed and the forest trees pushed farther and farther to the south. In hilly country the conifers probably occupied the hilltops and exposed slopes while the hardwoods were distributed along the protected slopes and in the valleys. Between the timberline and the ice front there was a tundra, whose width depended on the topography. At the time of the maximum advance of the last ice sheet the ice front was against rough hilly country in eastern Ohio, and the area of tundra in this place must have been small just as it is in mountainous Greenland today. In western Ohio and Indiana the tundra probably was wider but still rather narrow. Farther west, where the earlier glaciations left a comparatively flat surface, the tundra must have been very wide as it is in the flat country of north Siberia today. It seems probable that the tundra covered all the region between

the ice front and the Ozark Hills in Illinois and the dissected bluffs of the Missouri river in Missouri. In the Plains Region the tundra probably was bordered by prairie. The dessicating action of the strong winds would not permit the growth of trees except along protected stream slopes and possibly in some depressions.

Each glacial advance probably represents a long period of years during which the annual snowfall was greater than the annual loss of ice by melting. On the other hand the glacial retreats probably represent periods during which the snowfall was less than the loss by melting. The changes, then, which accompanied both advance and retreat must have been gradual. As the ice retreated it left a bare area composed of ground up rock fragments. This bare area was invaded by the mosses and lichens of the tundra because they can grow on such a substratum and can endure the severe climatic conditions found immediately below the glacial ice. As the ice retreated farther and farther to the north, other plants invaded the tundra. The dessicating action of the wind prevented tree development in exposed situations, so the trees invaded the protected slopes along streams and morainal ridges while grasses occupied the intervening areas. Swamps grasses and sedges undoubtedly were pioneers but, as the higher ground dried out, it probably was occupied by xerophytic grasses and the pioneers were restricted to the depressions which remained wet throughout the summers. In the Plains Region xerophytic grasses invaded the tundra and then moved east as far as Ohio, occupying all the high ground except the protected places where trees were able to grow.

Two kinds of tree vegetation invaded the tundra; the bottomland vegetation along the flood plains of the larger streams and the upland vegetation along morainal slopes and stream bluffs. In the former the pioneers are the willows followed by the river maple, cottonwood, ash, the elms, linden, the walnut and butternut, and the pignut. The pioneers of the latter are pines or xerophytic shrubs, followed by oaks, then maples, and, in some places, the beech. Pines have undoubtedly advanced along some of the stream bluffs and some remain as



relics along the Illinois and Rock rivers. It is probable also that they advanced along the steeper morainal ridges, especially those that are sandy or stony. Pines still remain on some of the sandy moraines in Ontario.

As streams and gullies cut back into the prairie, their slopes are invaded by shrubs and trees. Where the stream bluffs are low and but little dissected the timber belt is narrow but, where there is much erosion, the timber belt is correspondingly wider. Where streams cut through moraines, the forests have spread out along the morainal slopes. This is noticed along the Kaskaskia at Shelbyville and along the Embarrass at Charleston. The shores of small lakes probably have been invaded by bottomland forests from nearby streams. These forests gradually move inward as the lakes fill up or become drained. Some depressions develop into bogs which may be invaded by forests. Along the borders of forests, the prairie grasses are killed out by the shade and the wind velocity is checked so that tree seedlings are able to grow. In this way the forests enlarge at the expense of the prairie.

As already mentioned, most of Illinois is a region with low relief which probably was occupied by a tundra at the time of the Late Wisconsin glaciation. This region became a prairie at the close of the ice age and much of it still remains prairie because post-glacial time has been too short for the invasion of such large relatively flat areas by forests. The Late Wisconsin drift has more relief and can be invaded more rapidly by forests. Forests advancing up the Mississippi, the Rock, the Illinois, and the Wabash rivers invaded the Late Wisconsin drift and spread rapidly over its surface. Farther east the tundra belt was narrow and easily crossed by the forests so that invasion was rapid. These differences in topography and consequent differences in rate of forest invasion explain why Illinois still has large areas while the states to the north and east are almost completely timbered. It also explains why forests are found on the moraines in northern Illinois but only along the streams in southern Illinois.

The idea of Lesquereux "that all the prairies of the Mississippi Valley have been formed by the slow recess of sheets of water of various extent, first transformed into swamps and by and by drained and dried" is no longer tenable. It is true that glacial Lake Chicago and glacial Lake Maumee, as well as many smaller lakes, became swamps and later either prairies or forests, but there is no evidence that all of Illinois and the neighboring states, or even a large part of them, were ever covered by water since the ice age. The "prairie fire" theory has still less in its favor. Prairie fires may check the advance of the forests but it is not likely that forests destroyed by fire are ever replaced by prairies. Such areas usually are invaded by weeds followed by briers, then scrub, then forest.

Prairies are treeless because conditions, at the time of their origin, favored the invasion of a grass vegetation rather than a tree vegetation. The prairies of Illinois arose from a tundra which bordered the ice sheet and invaded the drift as the ice retreated. This tundra was invaded by prairie grasses except along streams and morainal ridges where the uneven topography checked the wind velocity and reduced evaporation so that tree seedlings could grow. Forests have been steadily invading the prairies since the ice age but the rate of advance is so slow on the relatively flat surface of Illinois that large areas still remain as prairies. In the states to the north and east invasion has been more rapid because of rougher topography and most of these states have been forested.