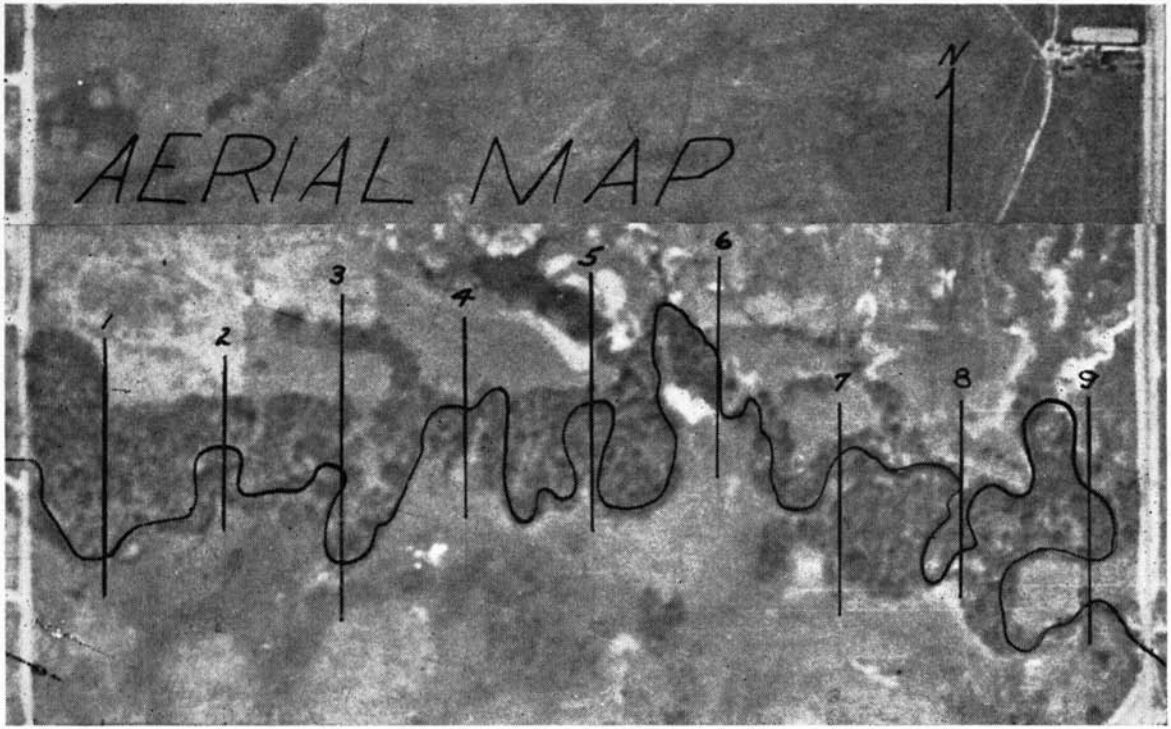
FIGURE 1.



# ECOLOGICAL STUDIES IN AN EASTERN OKLAHOMA FLOOD PLAIN

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The eastern and northern parts of Tulsa County lie in what is called "subclimax grassland" by Bruner (1931). Ecologically it may be designated as Andropogon associes, and is subclimax because it occurs in an area with a potential forest climate. The dominants of the area as a whole are coarse, tall, sod-forming grasses such as various species of Andropogon, Panicum, and Elymus. This tall-grass prairie represents the southern extension of a vast grassland area which borders the forests and ranges northward to Minnesota. It occupies an area where the vegetation, because of unfavorable edaphic conditions, recurrent fires, or other reasons, has not developed to the point where it is in harmony with the climate. These factors have kept this grassland from developing into the climax deciduous forest like the Oak-Hickory association which borders it on the east.

In northeastern Oklahoma the grassland area is subdivided by strips of woodland which follow the courses of the streams. It was the purpose of this study to examine one of these isolated areas and determine the ecological relationship between the trees and the adjoining grassland.

## LOCATION

The woodland chosen for study is situated five miles east of Tulsa. A small stream flows from west to east through the center of the wooded area, which is about one-half mile long and one-quarter mile broad. To the north and south of the trees the land rises fairly sharply and is covered with prairie grasses.

The underlying stratum here is the Nowata shale of Pennsylvanian age. This makes a clay mud soil of rather fine texture. The water-holding capacity is high and the ample rainfall results in a high moisture content. The 11th Street Limestone occurs here as a layer about eighteen inches thick, capping the less resistant shale. To the south this layer is just below the surface, and the vegetation growing over it is xerophytic and scrawny.

Evidences of erosion are abundant in the area. The stream is nearly dry between periods of rainfall, but during a rain the stream fills rapidly and the whole area is flooded. Ground litter and humus is swept away by the frequent floods. In the northern part of the area the heads of the gullies are rapidly encroaching on the prairie, making it possible for the tree area to expand. It is the ultimate fate of the region drained by this stream to be worn down to a gently rolling plain, with very even, well-drained slopes.

## METHODS

In studying the trees of the region, nine belt transects, each ten feet wide, were made. As seen on the aerial map (Fig. 1) they are evenly spaced 100 yards apart, and taken so as to be perpendicular to the general direction of flow of the stream. The diameters breast-high of all the trees over one inch in diameter were taken and recorded. A chart (Fig. 2) of the position of the most important trees was made from the results of the belt transects. The rest of the area was covered by observation.

Fig. 2. CHART OF BELT TRANSECTS

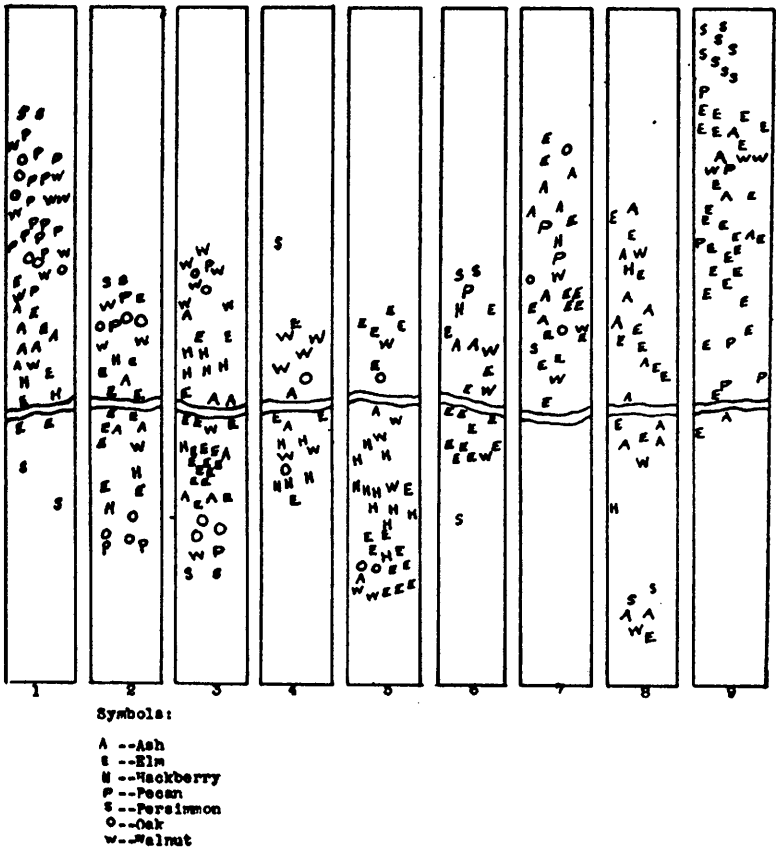


TABLE I. *Summary of Nine Belt Transects*

| Species | No. Trees | Av. D.B.H. | No. Seedlings |
|---|---|---|---|
| Ulmus americana | 37 | 8.6 in. | 84 |
| Fraxinus pennsylvanica | 31 | 4.7 in. | 14 |
| Juglans nigra | 23 | 5.6 in. | 28 |
| Carya pecan | 17 | 6.4 in. | 22 |
| Celtis mississippiensis | 24 | 8.8 in. | 7 |
| Quercus borealis maximus | 21 | 12.2 in. | 1 |
| Diospyros virginiana | 17 | 5.2 in. | 0 |

## DISCUSSION

The woodland is somewhat open in character, with the single trees spaced about 10 feet apart. From the standpoint of size and number of individuals, the American elm, *Ulmus americana*, is easily dominant. Large

oaks, *Quercus borealis maximus*, occur here and there on the drier sites, and ash, *Fraxinus pennsylvanica*, hackberry, *Celtis mississippiensis*, walnut, *Juglans nigra*, and pecan, *Carya pecan*, are also common. The other trees present are here listed.

| | |
|---|---|
| *Fraxinus americana* | white ash |
| *Bumelia lanuginosa* | wooly buckthorn |
| *Cornus asperifolia* | rough-leaved dogwood |
| *Gleditsia triacanthos* | honey locust |
| *Cercis canadensis* | redbud |
| *Salix nigra* | black willow |
| *Carya cordiformis* | bitternut hickory |
| *Ostrya virginiana* | ironwood |
| *Ulmus alata* | winged elm |
| *Ulmus fulva* | slippery elm |
| *Crataegus sp.* | red haw |
| *Viburnum rufidulum* | black haw |
| *Gymnocladus dioicus* | Kentucky coffee tree |
| *Robinia pseudacacia* | black locust |
| *Evonymus atropurpureus* | wahoo |
| *Acer negundo* | box elder |
| *Morus rubra* | mulberry |
| *Populus deltoides* | cottonwood |
| *Sambucus canadensis* | elder |
| *Rhus glabra* | smooth sumac |
| *Rhus copallina* | dwarf sumac |
| *Symphoricarpos orbiculatus* | coral berry |

The coral berry forms a ground cover over nearly all the area.

The herbs in the area seemed unimportant except in showing the type of environmental conditions present. Some of them are listed.

| | |
|---|---|
| *Solanum rostratum* | *Hypericum sp.* |
| *Galium sp.* | *Specularia perfoliata* |
| *Delphinium penardi* | *Lepidium virginicum* |
| *Phacelia dubia* | *Viola sp.* |
| *Claytonia virginica* | *Allium reticulatum* |
| *Anemone caroliniana* | *Nothoscordum bivalve* |
| *Phlox sp.* | *Oxybaphus nyctagineus* |
| *Menispermum canadense* | *Solanum sp.* |
| *Geranium carolinianum* | *Oenothera pallida* |
| *Specularia leptocarpa* | Various sedges and grasses |

Table I shows that from the standpoint of the tree area as a whole, the American elm is the dominant tree. Its reproduction is much greater than any of the others. The oak is the oldest and largest tree present, but there are fewer oaks than elms, and there is very little oak reproduction. Ash, hackberry, walnut, and pecan all seem to be of about equal importance in the region. The chart (Fig. 2) gives a much clearer picture of the succession. It shows the ordinary flood plain succession from elm, ash, and hackberry by the stream side and in the moister places to oak, hickory, and walnut in the more mesophytic sites. Persimmon, the most xerophytic species, is invading the prairie, since the chart shows it occurring at the woodland edge.

There seem to be two successions or series here, each tending toward the Oak-Hickory climax. Near the stream side the succession is from elm, ash, and hackberry to oak, hickory and walnut in the central, drier area. Along the ecotone of the prairie is persimmon, which seems to prepare the habitat for the expansion of the central Oak-Hickory region.

It is necessary to mention a very important disturbance in the woodland. This is the effect of hogs and cattle, which are allowed to roam over the area by farmers. The lack of reproduction of oak is probably explained by the action of the hogs in eating the acorns. The cattle trample seedlings of all kinds, packing the soil so that run-off and erosion is accelerated. Because of these disturbances and because the frequent flooding prevents the accumulation of a humus layer, it is probable that the succession here will be very slow.

There are several reasons for believing that this small woodland is expanding. The prevailing climate is capable of supporting a forest. When eventually the region is eroded down to a gently rolling plain the moisture will be more evently distributed and trees will be able to grow over the entire region. The erosion of the gullies will be a factor making for wider tree distribution. The trees follow up the gullies as fast as they are cut back. Another factor making for tree expansion is the lack of prairie fires since the advent of white man in the region. It is thought that the prairie fires in past periods has prevented the Andropogon associes from developing into a forest. It is believed that in the more mature parts the oak will increase along with the pecan and other hickories, until eventually an Oak-Hickory forest like that to the east will form the dominant cover.

## SUMMARY

A flood plain area surrounding a small stream five miles east of Tulsa was selected as a typical example of a common community in northeastern Oklahoma. By taking nine belt transects perpendicular to the general direction of flow of the stream flowing through the center of the region, the successional relationships between the trees and the surrounding grassland were determined. The transects showed that oak, hickory, and walnut were succeeding elm, ash, and hackberry by the stream side, and persimmon by the prairie edge. From the standpoint of numbers, the American elm dominated the situation, but the Northern red oak attained greater size on the dry and mature sites in the center of the woodland. It was concluded that this community, and also others of its type in northeastern Oklahoma, is expanding and maturing along the water courses and gullies as they are cut back, until eventually the Oak-Hickory climax is obtained as a dominant cover.

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## LITERATURE CITED

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