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A Forest Census in Lyon County, Iowa

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A FOREST CENSUS IN LYON COUNTY, IOWA.

DAVID H. BOOT.

The northwest corner of Iowa has comparatively few native trees because of the xerophytic conditions which prevail there. The rainfall of this part of the state is the least in Iowa, at times going as low as eighteen inches for the year, and in exposed regions, the forest trees have been unable to obtain a

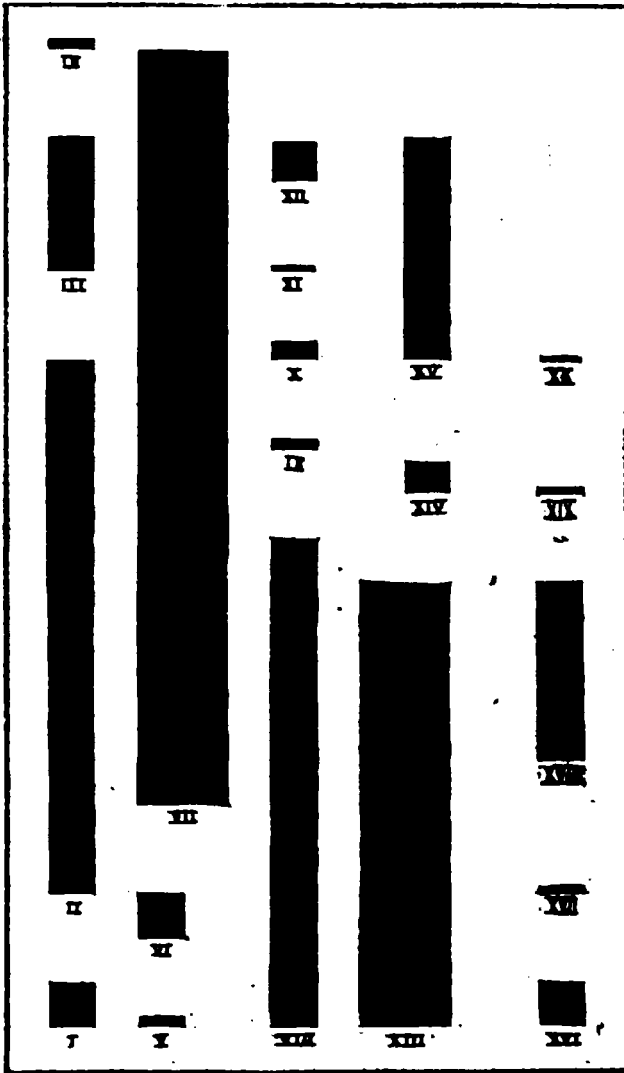


FIG. 46.

footing. The native trees are nearly all found along the streams or in protected valleys. A good illustration of this is in Centennial township in the southwestern corner of Lyon county,

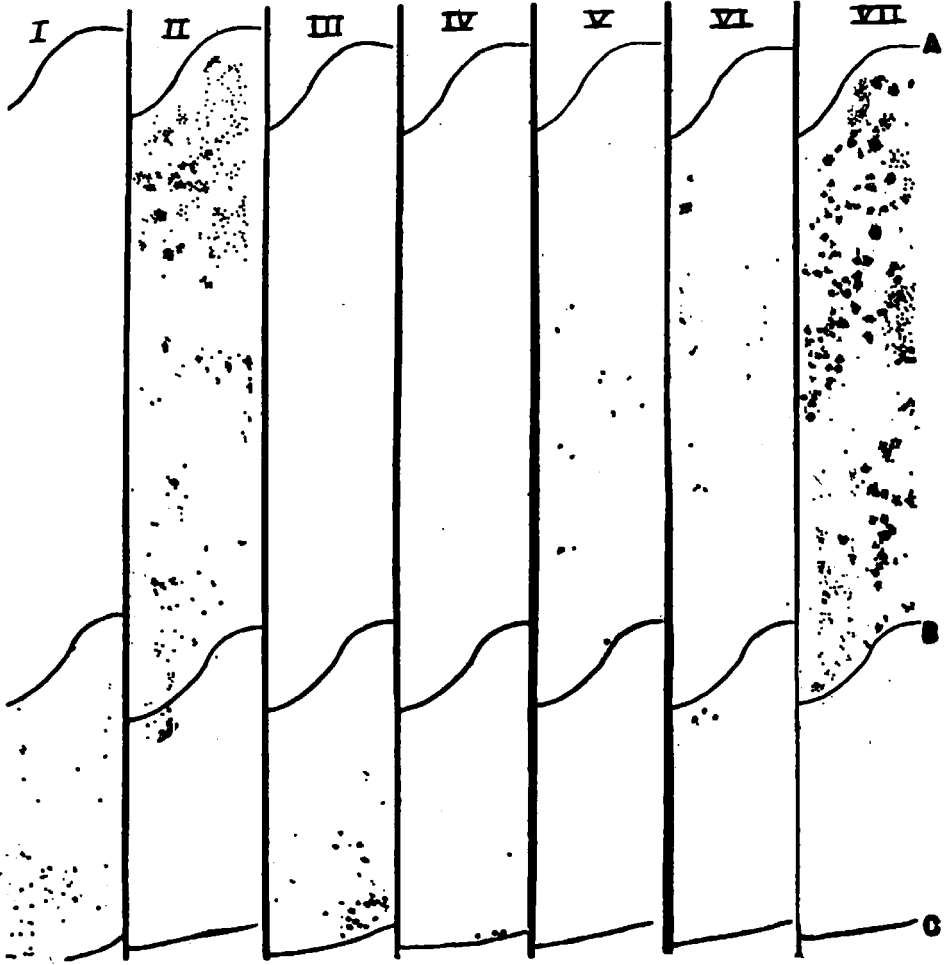
where the Big Sioux river flows in a westerly direction for several miles at the foot of a series of high bluffs. The north face of these bluffs is heavily timbered, and is the subject of this paper.

The particular locality chosen was on the south bank of the Big Sioux river at a point known as Syverud Bluff, where the high hills on the south side of the river rise to a height of about 180 feet above the stream. This maximum height is attained at a distance of about one-fourth of a mile south of the river. A typical strip of the timbered land extending from the river south to the bare prairie at the top of the bluff was selected for the survey. This strip was 145 feet wide. The woodland chosen was divided into quadrats, and a careful census made of all trees and shrubs, the size of each being taken, and a special effort made to locate each one accurately. The charts accompanying this report indicate the localities of growth. The list of trees, vines, and shrubs is as shown in the following table, and the accompanying graph, figure 46, indicates proportions.

NAME OF PLANT	NO. OF SPECIMENS	PER CENT
I. <i>Acer saccharinum</i> L. (soft maple).....	40	1. +
II. <i>Ulmus americana</i> L. (American elm).....	440	12. +
III. <i>Salix nigra</i> Marsh (black willow).....	117	3. +
IV. <i>Acer negundo</i> L. (box elder).....	9	.2 +
V. <i>Vitis vulpina</i> L. (wild grape).....	13	.3 +
VI. <i>Fraxinus pennsylvanica</i> var. <i>lanceolata</i> (Birk) Sarg. (green ash).....	43	1. +
VII. <i>Tilia americana</i> L. (Basswood).....	1184	34. +
VIII. <i>Ribes cynosbati</i> L. (goose berry).....	382	11. +
IX. <i>Alnus</i> sp. (alder).....	8	.2 +
X. <i>Prunus virginiana</i> L. (choke cherry).....	16	.4 +
XI. <i>Rubus idaeus</i> var. <i>aculeatissimus</i> (C. A. Mey) Regel & Tilling (raspberry).....	6	.1 +
XII. <i>Symphoricarpos occidentalis</i> Moench (buck bush)	33	.9 +
XIII. <i>Ostrya virginiana</i> (Mill) K. Koch (Ameri- can hop hornbeam).....	685	20. +
XIV. <i>Gymnocladus dioica</i> (L.) Koch (Kentucky coffee tree)	24	.7 +
XV. <i>Quercus macrocarpa</i> Michx. (bur oak)....	190	5. +
XVI. <i>Crataegus mollis</i> (L. & G.) Scheels (haw- thorn)	50	1. +
XVII. <i>Celastrus scandens</i> L. (climbing bitter sweet)	5	.1 +
XVIII. <i>Prunus americana</i> Marsh (wild plum)....	148	4. +
XIX. <i>Juglans nigra</i> L. (black walnut).....	5	.1 +
XX. <i>Juniperus virginiana</i> L. (red cedar).....	1	.02+
Total	3399	100.

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PLATE XII



The distribution of these trees and shrubs is very interesting and calls for the following description:

Extending south from the Big Sioux to the foot of the bluff is a tract of low river bottom subject to overflow, in width about 350 feet. At the south edge of this flat, the bluff rises abruptly, reaching its crest 1,250 feet south of the river, at which point it has an elevation of about 180 feet. All the soft maple trees (Plate XII, figure I) are located on the river flat, and none of them appear on any part of the bluff. This is to be accounted for because the soft maple is a water lover, and finds an abundance of moisture, and good protection from the dry southwest winds of summer, under the shelter of the bluff. These trees run to large dimensions, some of them being as much as twenty-four inches in diameter. The American elms (Plate XII, figure II), 440 specimens, are divided into four principal groups. The greater part are to be found in the thick timber on the upper third of the bluff face. Below this, there is an interval of several rods succeeded by a considerable interval thickly timbered with the American elm. Then comes another interval without elms, after which they are scattered rather freely down to the foot of the bluff. The fourth group consists of a few scattered individuals located on the river bottom, close to the foot of the bluff, and made up of trees probably seeded from the trees on the bluff face. There is a very conspicuous absence of these trees from the greater portion of the river bottom, which is to be accounted for by the river floods, by the sand and gravel soil, and by the over supply of ground water. The elm's ability to vary its transpiration and to withstand severe evaporating tendencies in environment will be brought out in the records of transpiration and evaporation to appear in another paper.

The black willows (Plate XII, figure III) are one hundred ten in number, all grouped on the low ground near the river, with the exception of a few trees about 100 feet from the river bank. This grouping is readily accounted for by the tree's fondness for water. These trees occur chiefly in clumps surrounding a center where the parent of the group formerly stood.

There are five box elder trees (Plate XII, figure IV), in the tract studied, four of which occur on the edge of the river, and the fifth one some seventy-five feet south of it, but all of them so located on the river bottom that they are certain of an un-

failing supply of water. As is well known, this tree adapts itself to varied conditions of climate and exposure when forced to it by artificial planting; but in this study, we consider only undisturbed trees, and these box elders have been planted by nature and grow in a very moist situation.

Eleven grape vines (Plate XII, figure V) are found in the tract, none of them on the river bottom, and none of them on the upper half of the bluff face. They are widely scattered, and evidently avivectant, all of them being located at the foot of trees, up and over which they climb. It is unusual not to find the wild grape on the river bottom nor in the forest on the upper part of the bluff face. For the river bottom this can only be ascribed to the chance work of the birds, with some help possibly toward elimination by the river floods. With the upper bluff face, the absence is probably in part due to overcrowding by other vegetation, as well as to the seed-carrying birds seeking out the lower, more sheltered regions, in the hot months of autumn when the fruit is ripe.

Forty-three specimens of green ash occur (Plate XII, figure VI), three only on the river bottom and close to the foot of the bluff, most of the river bottom being devoid of this species. The next group of them is at a considerable distance up the hill, and after another vacant space of several rods we find two other distinct groups, the one somewhat scattered, the members of the other near together in a manner to indicate that the several trees are the descendants of the same ancestor. Still farther up, and in the drier part of the wood area, we come to two groups, which also indicate by their manner of growth that each group is from one ancestor, and finally, almost at the upper tree limit, where the conditions for tree growth are severe, we find two individuals. Contrary to expectation, the trees at the bottom where moisture is abundant and protection good, do not differ in size very markedly from the trees at the top, where the conditions are more severe, as the largest of them vary from four to six inches in diameter, except in the case of two individuals close to the upper tree limit, which are stunted, and only two inches in diameter. A considerable part of the upper third of the forested area is devoid of ash, since it lacks sufficient moisture and is over-crowded with other vegetation, but lack of moisture cannot be urged for the lower third of the bluff, or for the river bot-

tom, and crowding can play no part in the distribution on the river bottom, because the forest there is thinly scattered. In place of over-crowding there, we have the river floods acting as a destructive agent when they periodically inundate this land.

Nearly twelve hundred bass wood trees (Plate XII, figure VII) grow in the region studied. None of these are found on the river bottom. On the bluff face they are scattered quite regularly from almost the foot of the bluff to within a distance of two to five rods of the upper tree limit, with the exception of an area about five rods wide a little below the middle of the forested tract. A most noticeable thing with the bass wood is the "family group," as it might be called, in which a considerable number of individuals are clustered about the grave of the parent from which they sprang. While the bass wood is able to adapt itself to great variations in growing conditions, it shows plainly by its development the influence of those conditions, as the largest and tallest trees are found near the foot of the bluff, where they are well protected. A large number of the trees at the upper limit of their growth do not run more than one or two inches in diameter.

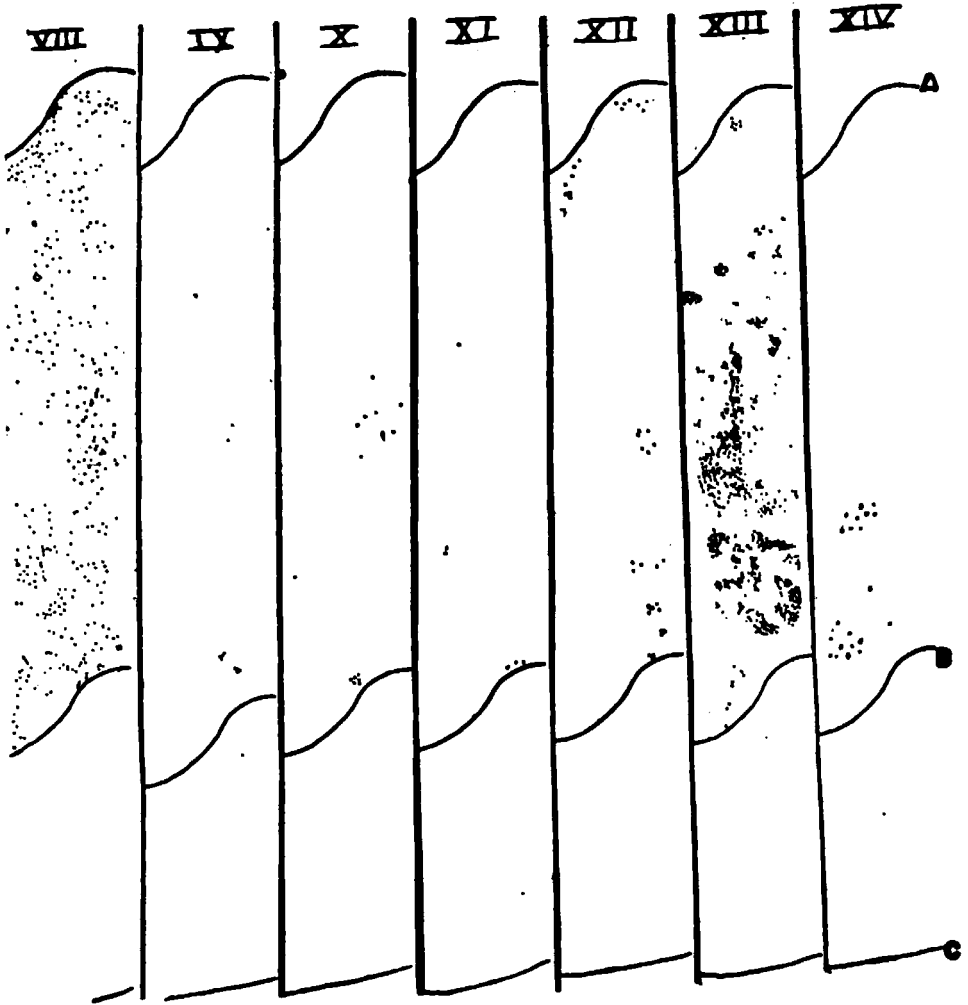
There are three hundred eighty-two gooseberry bushes (Plate XIII, figure VIII) in the tract. None of them occur on the river bottom, but they are distributed with a fair degree of equality from the foot of the bluff almost to the upper limit of the forest, with the exception of several large spaces a little below, and also a few a little above, the middle of the forest, where they are probably crowded out by other vegetation. In some cases, groups of these bushes indicate by their arrangement that they are from one parent plant.

There are eight elder bushes in this tract (Plate XIII, figure IX), located in two groups not far apart, near the mouth of a gully at the bottom of the bluff, where they are well protected, and receive abundant moisture. The arrangement of the members of these two groups is such as to show that each group is from a single parent that formerly stood at this spot. We may attribute their absence from the river flat to the flood waters of the river, and their absence from the upper parts of the wooded bluff to insufficient moisture.

There are sixteen choke-cherry trees (Plate XIII, figure X), one group of which is found on the escarpment at the foot of the bluff, about ten feet above the river flat. These are in a close

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PLATE XIII



group indicating common ancestry. The second group is somewhat scattered near the middle of the west side of the area. None of these trees occur in the upper half of the forested area, and none of them occur on the river bottom. They appear to seek the medium conditions as to moisture and shelter, and the scattered ones are apparently avivectant.

There are six raspberry bushes (Plate XIII, figure XI) distributed, three of them in the upper section, and three in the middle, of the lower part of the wooded bluff face in such a way as to indicate that they are planted by birds.

Thirty-three buck bushes (Plate XIII, figure XII) occur, distributed in three groups, one group, in two parts, near the upper limit of tree growth, another near the middle of the west side, the third a short distance above the foot of the bluff. This distribution may be taken to show ability in this plant to adapt itself to considerable ranges of humidity and exposure, and, in the lower groups at least, it is apparently the work of birds. The bush does not occur at all on the river bottom where the conditions affecting plant life are such as to require the ability to handle much moisture.

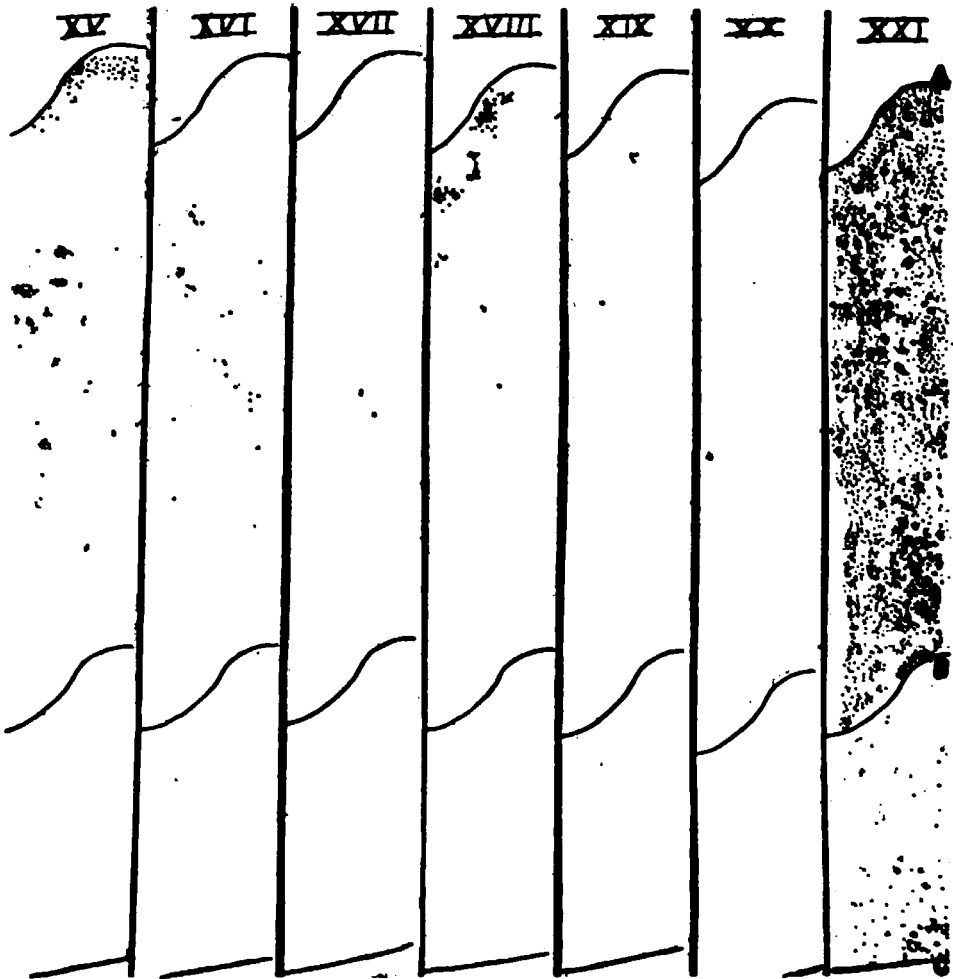
Six hundred eighty-five hop hornbeam trees (Plate XIII, figure XIII) appear in the tract. None of these trees are on the river bottom, and the greater part of them are grouped in close associations on the lower half of the bluff face. Some of these groups indicate a distribution from a common center, a parent tree. Vacant areas among them are to be attributed to over-crowding by other trees. Some of these trees are found in the upper part of the forest, and one small group occurs near the upper forest limit, showing that they are able to adapt themselves when necessary to considerable variation in conditions. None of these trees are large, as large size would be impossible because of their crowded manner of growth.

Twenty-four Kentucky coffee bean trees (Plate XIII, figure XIV) occur on the bluff face not far from its foot. This tree grows to considerable size and in this place has good protection and plenty of moisture, but is unable to survive the very wet conditions of the river flat.

Only one red cedar grows in this piece of timber (Plate XIV, figure XX), and it is a small one of only one-half inch diameter, found in an opening among the bass woods and hop hornbeams,

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PLATE XIV



so abundant about the middle of the bluff face. Red cedars are uncommon in this part of the state, this being the only one found in several years' work along the Big Sioux river in Lyon county.

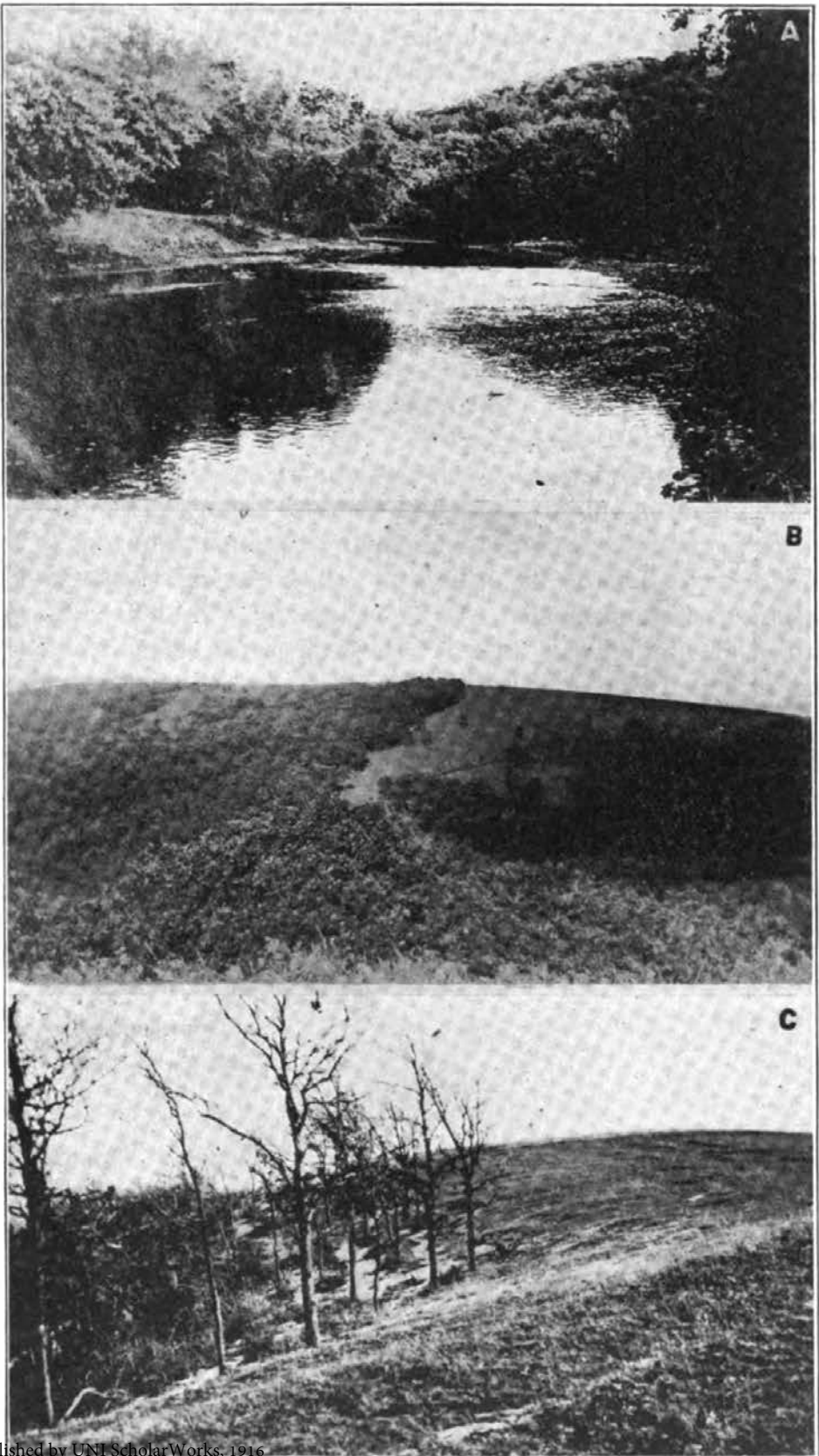
The one hundred and ninety bur oak trees (Plate XIV, figure XV) are arranged in two very significant groups, one of which is further subdivided in a characteristic manner. One group is near the top of the bluff, and comprises about seventy individuals. They are almost the extreme outposts of the xerophytic trees, crowding up close to the bare prairie. The remainder of the oaks are located chiefly near the middle of the north slope of the bluff, and are in about ten small clusters, plainly indicating by their grouping a common origin for the separate clusters. It is probable that a parent tree supplied acorns for each separate group. The great ability of the bur oak to adapt itself to extreme variations in humidity and water supply does not come out as strikingly here as in many other localities, for there is a total lack of these trees on the river bottom.

There are fifty hawthornes (Plate XIV, figure XVI), all located near the middle of the forest, none of them going as high as the extreme top of the hill, nor as low as the lower third of the hill, and they do not occur on the river bottom. Most of them are found in half a dozen clusters indicating centers of distribution, but about ten are scattered as if planted by birds.

Three climbing bitter-sweets (Plate XIV, figure XVII) are found near together at the middle of the woods. From their habitat at the foot of trees, they probably have been planted by birds.

There are about one hundred and fifty wild plum trees (Plate XIV, figure XVIII), none of them found on the river bottom, nor on the lower half of the hill, and nearly all within forty yards of the upper tree limit. They are grouped in thickets indicating their common origin from parent trees, and the method of propagation by suckers and fallen fruit. A very few scattered trees probably have been planted by animals. This tree is one of the hardier of the forest inhabitants, able to endure the severe conditions near the upper tree level.

Five black walnut trees (Plate XIV, figure XIX) occur, four in one group within thirty yards of the upper tree level, and one solitary specimen about one-third the way down the hillside. The group of four appear to have a common origin, the seed of



all of them probably having been planted by the same squirrel. It is rather remarkable that these trees should be found in this part of the wood only, and none lower down, especially on the river bottom.

Figure XXI of Plate XIV shows the entire forest. It will be noticed that the river bottom is thinly forested, that most of the trees on it are found close to the river, and that large tracts are devoid of arboreal vegetation. The face of the bluff is densely covered from its foot to the upper tree limit, excepting small openings here and there, usually not more than two or three rods in diameter. Looking at the chart the forest appears very uniform, and it is only when one goes out into the field that the great difference due to the different species of trees, and to the different conditions of growth becomes apparent, the lower forest (Plate XV, figure A), being very dense and heavy, and the upper forest lower and less dense, as will be seen in the accompanying photographs (Plate XV, figures B and C). The effect of environment in selecting the forest trees of a locality clearly appears in this tract. Figure 47 is a sketch of the bluff, giving elevations and

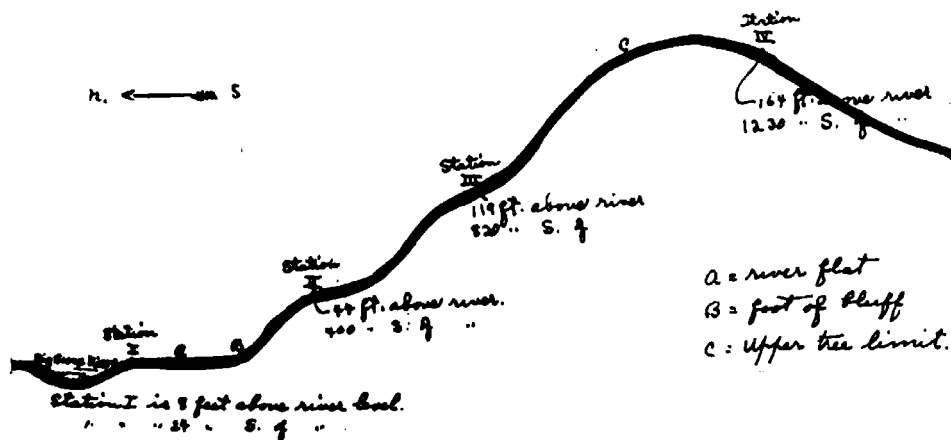


FIG. 47.

distances. The observations on the herbaceous plants, on evaporation, transpiration, and meteorological conditions made at this point during three years will appear in another paper.

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