

VEGETATION SURVEY OF FLOODPLAIN FORESTS IN EAST-CENTRAL ILLINOIS

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ABSTRACT.—Woody and herbaceous vegetation surveys were made of six areas (13.75 acres) located in the Embarrass River Floodplain in east-central Illinois. A total of twelve species were found with *Acer saccharinum*, *Populus deltoides*, *Acer negundo*, and *Salix nigra* being the most important. Reproduction in the areas indicate that *Acer negundo* and *Acer saccharinum* will continue to be of major importance. However, there was very little *Populus deltoides* reproduction and *Salix nigra* was only able to reproduce in wet areas near the river's edge. Observations indicate that these floodplain forests are becoming drier since *Celtis occidentalis*, *Ulmus rubra*, *Ulmus americana*, and *Fraxinus americana* are beginning to invade these areas.

The Embarrass River, which has its headwaters in Champaign County, flows south through east-central Illinois for 160 miles and finally enters the Wabash River south of Lawrenceville, Illinois. The river drains most of the fertile farm land in this area and usually floods at least once each year in the latter part of May or early June. The flooded conditions usually last no longer than five days. During the latter part of the summer, the river often becomes so low that a person can jump the small stream in many places.

The Embarrass River was formed as a result of the Wisconsin Glacier which moved into Illinois about 12,000 years ago from the northeast and extended southward and westward to a position along a line from Paris through Charleston, Shelbyville, Decatur, and Peoria. The glacial drift, deposited at this position of the ice front, formed a series of ridges called the Shelbyville Moraine that is built up to an elevation of 700 to 750 feet above sea level (Leighton, Eckblaw, and Horberg, 1948). The proposed dam site of the Lincoln Reservoir is located near the southern edge of this moraine, and the reservoir would occupy the channel cut by the Embarrass River through this moraine and the ground moraine to the north.

The topography of the Shelbyville Moraine in the vicinity of the proposed reservoir is extremely rugged. Numerous small streams enter the steep-walled valley cut by the Embarrass River. Most of these streams are less than two miles from headwater to mouth and flow rapidly down extreme gradients (50-70 feet per mile). Four major tributaries

(Indian Creek, Kickapoo Creek, Whetstone Creek, and Polecat Creek) enter the Embarrass River in the Shelbyville Moraine. These streams are found between the major east-west ridges of the moraine and each has numerous small valleys leading into them. No large or undisturbed floodplain forests are found along these tributaries. Except for near the Embarrass River, these smaller valleys are too narrow and their gradients too steep for the prolonged flooding necessary for the development of floodplain forests.

At one time, the lowland areas along the Embarrass River were covered with floodplain forests. Presently, most of this area has been cleared for agricultural purposes. The few forest areas that remain have been subjected to some cutting and grazing. Since most of this forest type will be inundated by the proposed Lincoln Reservoir, this study was undertaken to determine the forest composition before it was destroyed.

LOCATION OF WOODLOTS INVESTIGATED

In this survey the floodplain, referred to as "first bottoms" by Putnam (1951), was considered to be that area of the bottomland which is associated with the present river channel and which

normally floods when the river overflows. In each area, a hillside or a terrace formed by an earlier channel served as the limit of the floodplain. In most areas, a natural levee was located just back from the river's edge. Except for small depressions or occasionally an old channel or levee, the areas were relatively flat, seldom varying more than five feet in elevation. All areas were approximately fifteen feet above the present river bed.

Only those areas considered large enough for study and representing relatively mature woodlots were used in this survey. The areas ranged from 0.93 to 3.55 acres, with a total of 13.75 acres surveyed. All six areas surveyed are located along the Embarrass River, 4-12 miles south of Charleston, Illinois, and all will be flooded if the proposed Lincoln Reservoir is built.

METHOD OF STUDY

Each of the six areas studied was divided into 25-meter square quadrats (0.154 acre or 0.0625 hectare) and the number, size, and species of trees were recorded for each. The diameter of all trees with a d.b.h. of more than four inches was recorded to the nearest 1/10 inch.

Dead-standing trees were also measured and identified when possible. Dead-down trees were not recorded as they could have easily been carried into the areas by the frequent floods of the Embarrass River. The Importance Value Index (IVI) was then calculated from the actual data to provide a better basis of comparison of the various species and areas. The IVI, as used here, follows the procedure outlined by McIntosh (1957), in which the IVI is the sum of the

relative density

$$\frac{\text{number of individuals of a species}}{\text{number of individuals of all species}} \times 100,$$

relative dominance

$$\frac{\text{basal area of a species}}{\text{basal area of all species}} \times 100,$$

and the relative frequency

$$\frac{\text{number of plots of occurrence of a species}}{\text{total plots of occurrence of all species}} \times 100.$$

Due to the low frequency of saplings, seedlings, and shrubs their abundance and occurrence in the floodplain forests studied was determined by making a total count in the plots used to study the overstory. Also, the topography and overstory where they were growing was recorded.

All herbaceous species found in the areas studied were identified and their abundance recorded. Collections and observations were made in May, July, and September. The abundance of each species was determined by a modification of the procedure outlined by Acocks (1953). A mean distance was determined after a series of measurements was made between individuals of the same species and the abundance was determined by using the following scale:

Average Distance between Plants	Abundance Category
3 in. - 1 ft.	abundant
1 ft. - 3 ft.	common
3 ft. - 12 ft.	frequent
12 ft. - 50 ft.	occasional
50 ft.	rare

Voucher specimens of all species have been deposited in the Eastern Illinois University Herbarium. The taxonomic nomenclature used in this paper follows that of Jones (1963).

RESULTS AND DISCUSSION

Twelve species of trees were found in the six floodplain forests studied. Of these, *Acer saccharinum*, *Populus deltoides*, and *Acer negundo* were extremely important and in most instances had an IVI above 50. *Salix nigra*, *Ulmus rubra*, *Platanus occidentalis*, and *Fraxinus americana* were also relatively important in these forests with their IVI's sometimes exceeding 20 but rarely 40. These seven species with their relative values, number of individuals per acre, and basal area per acre in diameter classes for the six areas studied are included in Tables 1 through 6. The remaining species

(*Aesculus glabra*, *Morus rubra*, *Celtis occidentalis*, *Gleditsia triacanthos*, and *Juglans nigra*) were rarely encountered and had extremely low IVI's. This latter group of species comprises the "others" in the tables.

Of the arborescent species found in the floodplain forests, *Acer saccharinum* has the highest IVI in all areas studied except area five. It was found in nearly every quadrat examined and in most areas has the highest relative frequency and relative density. This species is well represented in all diameter classes, but is sometimes exceeded by *Populus deltoides* in the larger classes. In area 5 (Table 5), *Acer negundo* exceeds *Acer saccharinum* in the number of individuals per acre in the 4-6 inch diameter class. A few saplings and seedlings of *Acer saccharinum* were found in the floodplain forests. Seedlings were very common at the edge of the forests near the river and some saplings were observed on the higher parts of the floodplain and in small openings in the forest. The number of small diameter trees, as well as the presence of saplings, indicates this species will continue to be an important stand component of the floodplain forests.

Populus deltoides ranks second in IVI in most of the areas studied, mainly because of its high relative dominance. It ranks well below *Acer saccharinum* in relative density, but was well scattered throughout the forests, as indicated by its high relative frequency. This species ranks first in IVI only in area 5 (Table 5). The largest trees found in the survey were *Populus deltoides*, and this species usually had the most individuals and the highest basal

TABLE 1.—Number of Trees and Basal Area Per Acre by Diameter Classes and Relative Values for Area One Located Eight Miles South of Charleston, Coles County, Illinois (NW $\frac{1}{4}$, SW $\frac{1}{4}$, Section 23, T11N, R9E). This area includes 3.55 acres with a variation in elevation of 3.5 feet.

Species	Number of Trees and Basal Area Per Acre by Diameter Class										Relative Values			
	4-6		7-12		13-24		25+		Total		Rel. Freq.	Rel. Den.	Rel. Dom.	I.V.I.
	No.	B.A.	No.	B.A.	No.	B.A.	No.	B.A.	No.	B.A.				
<i>Acer saccharinum</i>	70.4	11.7	76.1	37.6	23.1	34.8	0.6	2.4	170.2	86.5	26.1	62.4	50.7	139.2
<i>Populus deltoides</i>	6.2	1.1	22.0	12.1	22.0	38.5	3.4	14.5	53.6	66.2	23.8	19.6	38.8	82.2
<i>Acer negundo</i>	12.1	1.9	7.0	2.5	1.7	1.9	.....	.....	20.8	6.3	22.7	7.6	4.3	34.6
<i>Salix nigra</i>	15.2	2.3	3.7	1.6	2.0	2.5	.....	.....	20.9	6.4	9.0	7.6	3.7	20.3
<i>Ulmus rubra</i>	2.5	0.3	0.3	0.2	.....	.....	.....	.....	2.8	0.5	6.8	1.0	0.3	8.1
<i>Platanus occidentalis</i>	0.3	0.1	0.3	0.2	0.8	2.5	.....	.....	1.4	2.8	4.5	0.5	1.6	6.6
<i>Fraxinus americana</i>	2.2	0.4	0.3	0.1	.....	.....	.....	.....	2.5	0.5	4.5	0.9	0.2	5.6
Others.....	0.6	0.1	.....	.....	.....	.....	.....	.....	0.6	0.1	2.6	0.4	0.4	3.4
Totals.....	109.5	17.9	109.7	54.3	49.6	80.2	4.0	16.9	272.8	169.3	100.0	100.0	100.0	300.0

TABLE 2.—Number of Trees and Basal Area Per Acre by Diameter Classes and Relative Values for Area Two Located Ten Miles South of Charleston, Cumberland County, Illinois (SW $\frac{1}{4}$, SE $\frac{1}{4}$, Section 27, T11N, R9E). This area includes 2.32 acres with a variation in elevation of 7.5 feet.

Species	Number of Trees and Basal Area Per Acre by Diameter Class											
	4-6			7-12			13-24			25+		
	Total			Total			Total			Total		
	No.	B.A.	I.V.I.	No.	B.A.	I.V.I.	No.	B.A.	I.V.I.	No.	B.A.	I.V.I.
<i>Acer saccharinum</i>	55.2	9.2	94.8	48.0	21.6	27.2	171.6	84.4	32.6	60.7	169.3	
<i>Populus deltoides</i>	2.6	0.4	7.3	4.4	21.6	37.9	31.5	42.7	26.0	13.9	30.7	70.6
<i>Acer negundo</i>	6.0	1.0	5.6	2.6	1.3	1.8	12.9	5.4	19.5	5.7	3.9	29.1
<i>Salix nigra</i>	0.4	.....	4.7	3.2	2.6	2.6	7.7	5.8	13.0	3.4	4.1	20.5
<i>Ulmus rubra</i>	0.4	0.1	0.4	0.2	.....	.....	0.8	0.3	4.3	0.3	0.1	4.7
<i>Platanus occidentalis</i>.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<i>Fraxinus americana</i>.....	.....	.....	0.4	0.2	.....	.....	0.4	0.2	2.1	0.1	0.1	2.3
Others.....	0.4	.....	0.4	0.2	.....	.....	0.8	0.2	2.5	0.6	0.4	3.5
Totals.....	65.0	10.7	113.6	58.8	47.1	69.5	225.7	139.0	100.0	100.0	300.0	

TABLE 3.—Number of Trees and Basal Area Per Acre by Diameter Classes and Relative Values for Area Three Located Seven Miles South of Charleston, Coles County, Illinois (NE¼, NE¼, Section 23, T11N, R9E). This area includes 2.32 acres with a variation in elevation of 5.0 feet.

Species	Number of Trees and Basal Area Per Acre by Diameter Class										Relative Values			
	4-6		7-12		13-24		25+		Total		Rel. Freq.	Rel. Den.	Rel. Dom.	I.V.I.
	No.	B.A.	No.	B.A.	No.	B.A.	No.	B.A.	No.	B.A.				
<i>Acer saccharinum</i>	45.7	7.2	51.7	26.6	29.7	43.5	.....	.....	127.1	77.3	28.3	56.5	49.4	134.2
<i>Populus deltoides</i>.....	.....	.....	3.4	2.0	21.1	37.0	1.7	8.0	26.2	47.0	18.8	11.6	30.0	60.4
<i>Acer negundo</i>	17.7	3.0	34.9	17.9	3.4	3.9	.....	.....	56.0	24.8	24.5	24.9	15.8	66.2
<i>Salix nigra</i>	0.9	0.2	1.7	0.9	3.0	4.3	.....	.....	5.6	5.4	7.5	2.4	3.3	13.2
<i>Ulmus rubra</i>	7.3	1.1	0.9	0.3	.....	.....	.....	.....	8.2	1.4	15.0	3.6	0.8	19.4
<i>Platanus occidentalis</i>.....	.....	.....	0.4	0.2	.....	.....	.....	.....	0.4	0.2	1.8	0.1	0.1	2.0
<i>Fraxinus americana</i>.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Others.....	0.4	.....	0.9	0.4	.....	.....	.....	.....	1.3	0.4	4.1	0.9	0.6	5.6
Totals.....	72.0	11.5	93.9	48.3	57.2	88.7	1.7	8.0	224.8	156.5	100.0	100.0	100.0	300.0

TABLE 4.—Number of Trees and Basal Area Per Acre by Diameter Classes and Relative Values for Area Four Located Seven Miles South of Charleston, Coles County, Illinois (NW¼, NE¼, Section 23, T11N, R9E). This area includes 3.09 acres with a variation in elevation of 5.0 feet.

Species	Number of Trees and Basal Area Per Acre by Diameter Class										Relative Values			
	4-6		7-12		13-24		25+		Total		Rel. Freq.	Rel. Den.	Rel. Dom.	I.V.I.
	No.	B.A.	No.	B.A.	No.	B.A.	No.	B.A.	No.	B.A.				
<i>Acer saccharinum</i>	58.9	9.8	53.4	26.4	9.4	12.1	.....	.....	121.7	48.3	28.1	50.0	37.6	115.7
<i>Populus deltoides</i>	6.2	1.2	22.6	13.0	27.2	45.4	.....	.....	56.0	59.6	25.3	23.0	46.3	94.6
<i>Acer negundo</i>	20.1	2.9	5.8	2.8	0.6	0.9	.....	.....	26.5	6.6	25.3	10.9	5.1	41.3
<i>Salix nigra</i>	20.1	3.0	13.9	7.5	2.6	3.2	.....	.....	36.6	13.7	14.0	15.1	10.6	39.7
<i>Ulmus rubra</i>	1.3	0.2	0.3	0.1	.....	.....	.....	.....	1.6	0.3	4.2	0.6	0.2	5.0
<i>Platanus occidentalis</i>.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<i>Fraxinus americana</i>.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Others.....	0.6	0.1	.....	.....	.....	.....	.....	.....	0.6	0.1	3.1	0.4	0.2	3.7
Totals.....	107.2	17.2	96.0	49.8	39.8	61.6	.....	.....	243.0	128.6	100.0	100.0	100.0	300.0

TABLE 5.—Number of Trees and Basal Area Per Acre by Diameter Class and Relative Values for Area Five, Located Six Miles South of Charleston, Coles County, Illinois (NW¼, SW¼, Section 13, T11N, R9E). This area includes 1.54 acres with a variation in elevation of 5.6 feet.

Species	Number of Trees and Basal Area Per Acre by Diameter Class										Relative Values			
	4-6		7-12		13-24		25+		Total		Rel. Freq.	Rel. Den.	Rel. Dom.	I.V.I.
	No.	B.A.	No.	B.A.	No.	B.A.	No.	B.A.	No.	B.A.				
<i>Acer saccharinum</i>	9.1	1.5	26.0	13.1	11.7	17.4	3.2	16.6	50.0	48.6	14.8	20.0	28.1	62.9
<i>Populus deltoides</i>	3.9	0.8	39.0	22.4	29.9	45.4	3.2	17.1	76.0	85.7	21.2	30.3	49.6	101.1
<i>Acer negundo</i>	76.6	11.8	18.8	7.0	3.2	4.6	.....	.....	98.6	23.4	21.2	39.4	13.5	74.1
<i>Salix nigra</i>	5.8	0.7	0.6	0.2	.....	.....	.....	.....	6.4	0.9	6.3	2.5	0.5	9.3
<i>Ulmus rubra</i>	3.2	0.5	2.0	0.8	0.6	0.8	0.6	2.8	6.4	4.9	8.5	2.5	2.8	13.8
<i>Platanus occidentalis</i>	0.6	0.1	0.6	0.2	1.3	3.6	.....	.....	2.5	3.9	8.5	1.0	2.2	11.7
<i>Fraxinus americana</i>	0.6	0.1	1.3	0.4	.....	.....	.....	.....	1.9	0.5	2.1	0.7	0.2	3.0
Others.....	3.9	0.8	1.3	0.7	2.6	3.2	.....	.....	7.8	4.7	17.4	3.6	3.1	24.1
Totals.....	103.7	16.3	89.6	44.8	49.3	75.0	7.0	36.5	249.6	172.6	100.0	100.0	100.0	300.0

TABLE 6.—Number of Trees and Basal Area Per Acre by Diameter Classes and Relative Values for Area Six Located Six Miles South of Charleston, Coles County, Illinois (NE $\frac{1}{4}$, SE $\frac{1}{4}$, Section 14, T11N, R9E). This area includes 0.93 acres with a variation in elevation of 3.8 feet.

Species	Number of Trees and Basal Area Per Acre by Diameter Class										Relative Values			
	4-6		7-12		13-24		25+		Total		Rel. Freq.	Rel. Den.	Rel. Dom.	I.V.I.
	No.	B.A.	No.	B.A.	No.	B.A.	No.	B.A.	No.	B.A.				
<i>Acer saccharinum</i>	49.5	7.5	62.4	30.6	37.6	60.2	2.2	9.5	151.7	107.8	28.5	55.0	51.1	134.6
<i>Populus deltoides</i>	3.2	0.7	20.4	11.3	28.0	38.6	4.3	17.0	55.9	67.6	14.2	20.3	32.1	66.6
<i>Acer negundo</i>	22.6	3.8	18.3	7.9	8.6	9.8	.....	.....	49.5	21.5	28.5	17.9	10.1	56.5
<i>Salix nigra</i>.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
<i>Ulmus rubra</i>	7.5	1.2	3.2	1.2	.....	.....	.....	.....	10.7	2.4	14.2	3.9	1.1	19.2
<i>Platanus occidentalis</i>.....	.....	.....	.....	.....	.....	.....	2.2	8.6	2.2	8.6	4.7	0.7	4.0	9.4
<i>Fraxinus americana</i>	1.1	0.2	2.2	1.0	1.1	1.2	.....	.....	4.4	2.4	4.7	1.5	1.1	7.3
Others.....	.....	.....	1.1	0.4	.....	.....	.....	.....	1.1	0.4	5.2	0.7	0.5	6.4
Totals.....	83.9	13.4	107.6	52.4	75.3	109.8	8.7	35.1	275.5	210.7	100.0	100.0	100.0	300.0

area per acre in the 13-24 inch and the 25+ inch diameter classes. Only two saplings and one seedling of this species were found in the areas studied, although seedlings are common nearby in open fields and at the edge of the river. Due to this lack of reproduction and the few individuals in the lower diameter classes, this species will become less important as these forests become more mature.

Acer negundo is third in IVI in areas 1, 2, 4, and 6, due mainly to its high relative frequency. It ranks second in IVI in areas 3 and 5 because of the large number of individuals in the lower diameter classes. This species is much more common than *Populus deltoides* in the 4-6 inch diameter class in all areas studied. No trees of this species were found with a diameter greater than 18 inches. Saplings and seedlings of *Acer negundo* were more common than those of any other species and were well scattered throughout most of the forests. Since this species is able to reproduce in the floodplain forests, indicating some degree of shade tolerance it will probably continue to be relatively important. However, it usually does not attain the size of *Acer saccharinum* and *Populus deltoides*, and its importance will not increase greatly.

Salix nigra is fourth in IVI in areas 1, 2, and 4, and fifth or lower in the others. This species is usually restricted to the lower parts of the floodplain. Often the individuals are clumped and in straight rows, suggesting the river channel was near these areas at one time, and has since changed its course. No seedlings or saplings of this species were found in the forests, but some were found

near the river's edge, particularly on sandbars and in association with *Salix interior*. This species will probably die out except near the river's edge.

Ulmus rubra ranks fourth in IVI in areas 3, 5, and 6, and fifth in the remaining areas, due chiefly to its high relative frequency. No trees were found with a diameter greater than 12 inches in five of the areas, and most individuals were in the 4-6 inch diameter class. Saplings were more restricted, however, occurring on natural levees and toward the back of the floodplain near a terrace or hillside where there was less chance of prolonged flooding.

Platanus occidentalis and *Fraxinus americana* are found in some of the areas and usually rank sixth and seventh in IVI. These species are commonly associated with terraced and drier areas and usually do not occur in large number in the typical floodplain forest (Braun, 1950).

The remaining species were scattered and not very abundant. In most cases, these were found near the terrace or hillside limiting the back of the floodplain and in higher areas where it is slightly drier and there is less chance of prolonged flooding. These species are more characteristic of small creeks where flooding is not a common occurrence.

A total of 215 dead-standing individuals were found with a total basal area of 69.62 square feet. Of these, 22 were *Acer negundo* with a total basal area of 4.08 square feet; 83 were *Acer saccharinum* with a total basal area of 24.78 square feet; 52 were *Populus deltoides* with a total basal area of 13.52 square feet and 49 were *Salix nigra* with a total

TABLE 7.—Average Number of Seedlings and Saplings Per Acre in The Six Floodplain Forests Studied, and The Average Per Acre for All Areas Combined.

Species	Average Number of Seedlings Per Acre							Average Number of Saplings Per Acre						
	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Average All Areas	Area 1	Area 2	Area 3	Area 4	Area 5	Area 6	Average All Areas
<i>Acer negundo</i>	46.2	28.9	40.9	23.3	7.8	32.3	29.9	22.5	46.1	38.4	42.1	172.7	40.9	60.5
<i>Acer saccharinum</i>	4.2	4.7	18.1	4.2	1.3	32.3	10.8	44.5	19.4	41.8	29.1	9.1	45.2	31.5
<i>Ulmus americana</i>	18.6	4.7	21.6	2.9	18.8	34.4	16.8	23.6	1.7	23.7	2.6	20.8	17.2	14.9
<i>Celtis occidentalis</i>	14.6	12.1	.....	11.3	13.0	92.5	23.9	3.1	2.6	0.4	2.6	4.5	12.9	4.3
<i>Morus rubra</i>	4.2	2.6	4.3	4.5	2.6	9.7	4.7	2.0	0.4	3.9	1.9	2.6	2.2	2.2
<i>Fraxinus americana</i>	4.2	1.7	4.3	0.3	.....	4.3	2.5	2.3	0.4	1.7	.....	3.2	6.5	2.3
Others.....	2.5	3.9	0.9	3.2	4.5	15.1	5.0	0.3	.....	1.7	0.9	2.6	4.3	1.6
Totals.....	94.5	58.6	90.1	49.7	48.0	220.6	93.6	98.3	70.6	111.6	79.2	215.5	129.2	117.3

basal area of 23.27 square feet. Also, two large stumps of *Acer saccharinum* and three of *Populus deltoides* were found in area 2. These were included in the dead-standing totals. Most of the dead individuals were scattered throughout the floodplain forests. However, dead-standing individuals of *Salix nigra* showed definite clumping, usually associated with old river channels.

The average number of seedlings (more than 1 foot tall and less than 1 inch d.b.h.) and saplings (1-4 inches d.b.h.) per acre in the six areas studied are shown in Table 7. Seedlings less than 1 foot tall were not recorded due to the dense herbaceous understory. The species with the most seedlings and saplings were *Acer negundo*, *Acer saccharinum*, *Ulmus americana*, *Celtis occidentalis*, *Morus rubra*, and *Fraxinus americana*, in that order of abundance. These were especially common on higher areas and in more open parts of the forests. *Acer negundo* seedlings and saplings were scattered throughout the forests with heavy populations of saplings occurring in open areas. *Acer saccharinum* saplings, in contrast, were mostly found on the natural levees while seedlings were found in open areas and on sandbars at the river's edge. Saplings and seedlings of *Ulmus americana* and *Celtis occidentalis* were also common throughout the floodplain forests. *Ulmus americana* was not represented by trees above 4 inches d.b.h. in the areas studied while *Celtis occidentalis* was very poorly represented. Saplings and seedlings of both species were scattered throughout the forests and exhibited no site preference. A few saplings

and seedlings of *Morus rubra* and *Fraxinus americana* were scattered throughout the floodplain and occasional individuals of *Juglans nigra*, *Maclura pomifera*, *Ulmus rubra*, *Aesculus glabra*, *Quercus macrocarpa*, *Platanus occidentalis*, *Gleditsia triacanthos*, and *Gymnocladus dioica* were found. This latter group, which are included under others in Table 7, will probably have little effect on the future composition of the forests until the sites become drier.

Some shrubs and vines were found in the floodplain forests. These included the shrubs *Sambucus canadensis*, *Salix interior*, *Rhus radicans*, *Staphylea trifolia*, *Lindera benzoin*, *Euonymus atropurpureus*, and the vines *Campsis radicans*, *Parthenocissus quinquefolia*, and *Vitis aestivalis*. *Sambucus canadensis* averaged about 25 individuals per acre and was scattered throughout the forests with high concentrations in open areas. *Salix interior*, in contrast, was found only on sandbars near the river's edge and in full sunlight with an extensive growth resulting from "root shoots". The remaining shrubs were rarely encountered and were usually associated with higher elevations and open areas.

By far, the most abundant herbaceous species was *Laportea canadensis*. This species grew in all parts of the floodplain forests studied. *Impatiens biflora*, *Viola papilionacea*, *Cryptotaenia canadensis*, and *Polygonum virginianum* were also frequently encountered, but not as often as *Laportea*. The distribution of most of the species seems to be dependent upon the moisture in the area and the amount of sunlight which penetrates the overstory. A

complete listing of the herbaceous vascular plants with their distribution and abundance is included in an annotated checklist at the end of this paper.

The results obtained in this study compare favorably with the descriptions of a floodplain forest as described by Braun (1950) except for white elm (*Ulmus americana*). This species was not a significant component of the floodplain forests studied. However, red elm (*Ulmus rubra*) was important and ranked as high as fourth in IVI. The absence of white elm was probably due to phloem necrosis and Dutch Elm disease which killed many of the elm trees about fifteen years ago.

The floodplain forests studied are mixed soft-hardwood according to Hosner and Minckler (1963). In their successional studies of this type of floodplain forest in Southern Illinois, *Salix nigra*, *Salix interior*, and *Populus deltoides* represent the pioneer species. Soon *Platanus occidentalis*, *Acer saccharinum*, and *Acer negundo* seedlings appear, but since these species grow slower, they are pole-sized or smaller as *Salix nigra* and *Populus deltoides* approach biological maturity. They further state that the frequency of *Acer negundo* and *Acer saccharinum* suggests that the next stand will consist predominantly of these two species. The results obtained in the present study suggest that these forests are progressing toward the *Acer saccharinum*-*Acer negundo* stage, and that *Salix nigra* and *Populus deltoides* will become less important. This is indicated by the large number of dead-standing individuals of *Salix nigra*, the small number of lower

diameter individuals of *Populus deltoides*, and the lack of seedlings and saplings of both species in the forested areas.

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Annotated Checklist of Vascular Herbaceous Plants of the Embarras Floodplain Forests with Their occurrence and General Distribution

The total number of herbaceous taxa of vascular plants recorded from the Embarras floodplain forest areas was 51. None of these were fern or fern-allies, while 8 were monocots and 43 were dicots. In the following list, the nomenclature follows that of Jones (1963). Each species is followed by its general distribution and occurrence in the areas studied, the collector's name, and collecting number. All specimens are deposited in the herbarium of Eastern Illinois University.

Acanthaceae

Ruellia strepens L. Opening near back of Area Two; rare. Ebinger 7888.

Amaranthaceae

Amaranthus hybridus L. Openings in Areas Two and Three; Ebinger 7878.

Araceae

Arisaema dracontium (L.) Schott. Shaded, higher parts of all areas; rare. Observed.

Balsaminaceae

Impatiens biflora Walt. Throughout the floodplain forests; frequent to locally common. Observed.

Impatiens pallida Nutt. Mostly near back of Area Five; locally common. Crites 501.

Campanulaceae

Campanula americana L. Openings on levees; rare. Crites 519.

Chenopodiaceae

Chenopodium album L. Opening at back of Area Two; rare. Ebinger 7927.

Compositae

Ambrosia trifida L. Opening in Area Two; locally common. Ebinger 7944.

Aster ontarionis Wieg. Scattered throughout the floodplain forests; common. Ebinger 7933.

- Eupatorium coelestinum* L. Openings on levees; rare. Crites 502.
- Eupatorium rugosum* Houtt. Openings on levees; rare. Crites 512.
- Rudbeckia laciniata* L. Scattered throughout the floodplain forests; occasional to locally frequent. Crites 511.
- Verbesina alternifolia* (L.) Britt. Drier parts of Areas Five and Six; rare. Ebinger 7935.
- Convolvulaceae**
- Cuscuta gronovii* Willd. Growing as a parasite on *Laportea* in Area Two; occasional. Ebinger 7891.
- Cruciferae**
- Iodanthus pinnatifidus* (Michx.) Steud. Drier parts of Areas Two and Three; rare. Ebinger 7609.
- Cucurbitaceae**
- Sicyos angulatus* L. Vine growing in shaded parts of most areas; occasional. Ebinger 7887.
- Cyperaceae**
- Carex grayii* Carey. Low, wet parts of floodplain forests; rare. Crites 515.
- Euphorbiaceae**
- Acalypha deamii* (Weatherby) Ahles. Opening on levee in Area Four; rare. Ebinger 7941.
- Acalypha rhomboidea* Raf. Openings in most areas; occasional. Ebinger 7882.
- Acalypha virginica* L. Opening at back of Area Two; rare. Ebinger 7930.
- Chamaesyce maculata* (L.) Small. Opening near back of Area Two; rare. Ebinger 7931.
- Gramineae**
- Cinna arundinacea* L. Scattered throughout most areas; occasional. Ebinger 7929.
- Elymus villosus* Muhl. Scattered throughout most of the floodplain forests; occasional. Ebinger 7936.
- Elymus virginicus* L. Shaded areas; occasional. Crites 504.
- Glyceria striata* (Lam.) Hitchc. Low, wet parts of Area Six; rare. Crites 510.
- Leersia virginica* Willd. Moist, open areas; locally common. Ebinger 7946.
- Muhlenbergia frondosa* (Poir.) Fern. Openings on levees; rare. Ebinger 7880.
- Labiatae**
- Lycopus virginicus* L. Drier part of Area Three; rare. Ebinger 7934.
- Scutellaria lateriflora* L. Moist part of Area Four; rare. Ebinger 7942.
- Stachys tenuifolia* Willd. Opening near back of Area Two; rare. Ebinger 7890.
- Leguminosae**
- Amphicarpa comosa* (L.) G. Don. Vine growing in shaded areas; rare. Ebinger 7883.
- Polemoniaceae**
- Phlox paniculata* L. Openings in Area Six; locally frequent. Crites 509.
- Polygonaceae**
- Polygonum scandens* L. Openings on levees; occasional. Ebinger 7886.
- Polygonum pennsylvanicum* L. Openings on levees; rare. Ebinger 7885.
- Polygonum punctatum* Ell. Openings on levees; rare. Ebinger 7881.
- Polygonum virginianum* L. Scattered throughout the floodplain forests; common. Ebinger 7928.
- Rumex verticillatus* L. Wet areas; rare. Crites 508.
- Ranunculaceae**
- Delphinium tricornis* Michx. Heavily shaded areas; rare. Crites 506.
- Ranunculus abortivus* L. Wet, shaded areas; rare. Crites 507.
- Ranunculus septentrionalis* Poir. Wet, shaded areas; rare. Crites 505.
- Rosaceae**
- Geum canadense* Jacq. Near back of Area Five; occasional. Ebinger 7938.
- Scrophulariaceae**
- Chelone obliqua* L. Small colony in open part of Area Five; rare. Ebinger 7940.
- Solanaceae**
- Physalis pendula* Rydb. Openings on levees in Areas Five and Six; rare. Ebinger 7874.
- Solanum nigrum* L. Openings on levees in Areas Five and Six; rare. Ebinger 7884.
- Umbelliferae**
- Cryptotaenia canadensis* (L.) DC. Scattered throughout the floodplain forests; common. Crites 514.
- Sanicula gregaria* Bickn. Scattered throughout the floodplain forests; occasional. Crites 513.
- Urticaceae**
- Boehmeria cylindrica* (L.) Sw. Near back of Area Two; rare. Ebinger 7889.
- Laportea canadensis* (L.) Gaud. Throughout the floodplain forests; abundant. Crites 503.
- Pilea pumila* (L.) A. Gray. Scattered throughout the floodplain forests; frequent. Ebinger 7945.
- Urtica gracilis* Ait. Scattered through-

out the floodplain forests; occasional. Ebinger 7879.
Violaceae

Viola papilionacea Pursh. Scattered throughout the floodplain forests; abundant. Crites 517.

LITERATURE CITED

- ACOCKS, J. 1953. Veld types of South Africa. Bot. Survey Mem. No. 28, Dept. Agric., Div. Bot., Pretoria, Union of South Africa.
- BRAUN, E. LUCY. 1950. Deciduous forests of Eastern North America. Philadelphia, Blakston Co.
- HOSNER, J. F. and L. S. MINCKLER. 1963. Bottomland hardwood forests of Southern Illinois — regeneration and succession. Ecol. 44: 29-41.
- JONES, G. N. 1963. Flora of Illinois. Amer. Midl. Nat. Monogr. 7: vi + 401.
- LEIGHTON, M. M., G. E. EKBLAW and L. HORBERG. 1948. Physiographic divisions of Illinois. Illinois State Geol. Survey, Report of Investigations No. 129: 16-33.
- MCINTOSH, R. P. 1957. The York woods, a case history of forest succession in Southern Wisconsin. Ecol. 38: 29-37.
- PUTNAM, J. A. 1951. Management of bottomland hardwoods. Southern Forest Expt. Sta. Occas. Paper 16. 60 pp.

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