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PLANT COMMUNITIES OF FORT WAYNE: ANALYSIS OF EAGLE MARSH TREE TRAIL

Introduction

Different areas of Indiana have different vegetation because of events that have happened in the past. Whitehead (1997) first examined the events that lead to the distribution of plant communities as they are today. These events include climate changes, glacial movement and melting, and plant species' responses to those changes. Scientists can help determine these events and past communities by deciphering relevant prehistoric events.

Based on these events and looking at land surveys from 1820, Lindsey (1997) was able to generalize what the tree communities were in presettlement Indiana. Much of central Indiana was beech-maple while southwestern Indiana was mostly an oak-hickory community. Other communities were western mesophytic, wetlands and dry prairie.

Lindsey et al. (1965) found that different types of plant communities flourish in different types of soil. This is another factor that accounts for the types of plant communities in Indiana. They found that the best soils for beech-maple communities are those that are nutrient-filled. It is the least tolerant, of the plant communities, to different types of soil. According to Petty and Jackson (1966), beech-maple forests originally comprised 50% of Indiana's vegetation. In most beech-maple communities, beech is the most profuse canopy tree with sugar maple sharing co-dominance and

most commonly filling the understory. In 1820, beech-maple forests covered most of central Indiana (Figure 1). Today, however, most of these forests have been cleared to make way for farmland.

Another community type is the oak-hickory forests. Oak-hickory forests are commonly composed of species such as black oak, pin oak, bitternut hickory, pignut hickory, and shagbark hickory. Petty and Jackson (1966) found that this type of community is best in drier silt and loam soils. Oak-hickory is commonly the dominant species in some areas of the United States with these soil types. In presettlement times, 29% of Indiana's plant communities were dominated by oak-hickory forests. Today, this community is most common in the southeastern and central parts of the state and shares prominence with both beech-maple and western mesophytic communities. In oak-hickory forests it is common to find beech-maple species growing in the understory, but oak-hickory dominates in size, as well in the canopy. The oak-hickory forest composition is continuing to change in Indiana due to disease and man's increasing environmental impact.

The third type of forest were western mesophytic. These forests—composed of beech, maple, oak and hickory species—originally covered 8% of Indiana (Lindsey et al., 1965, Petty and Jackson, 1966). This percentage has dwindled since the land began to be settled. It is the most diverse community with anywhere from 10-20 species sharing dominance in the top canopy. It

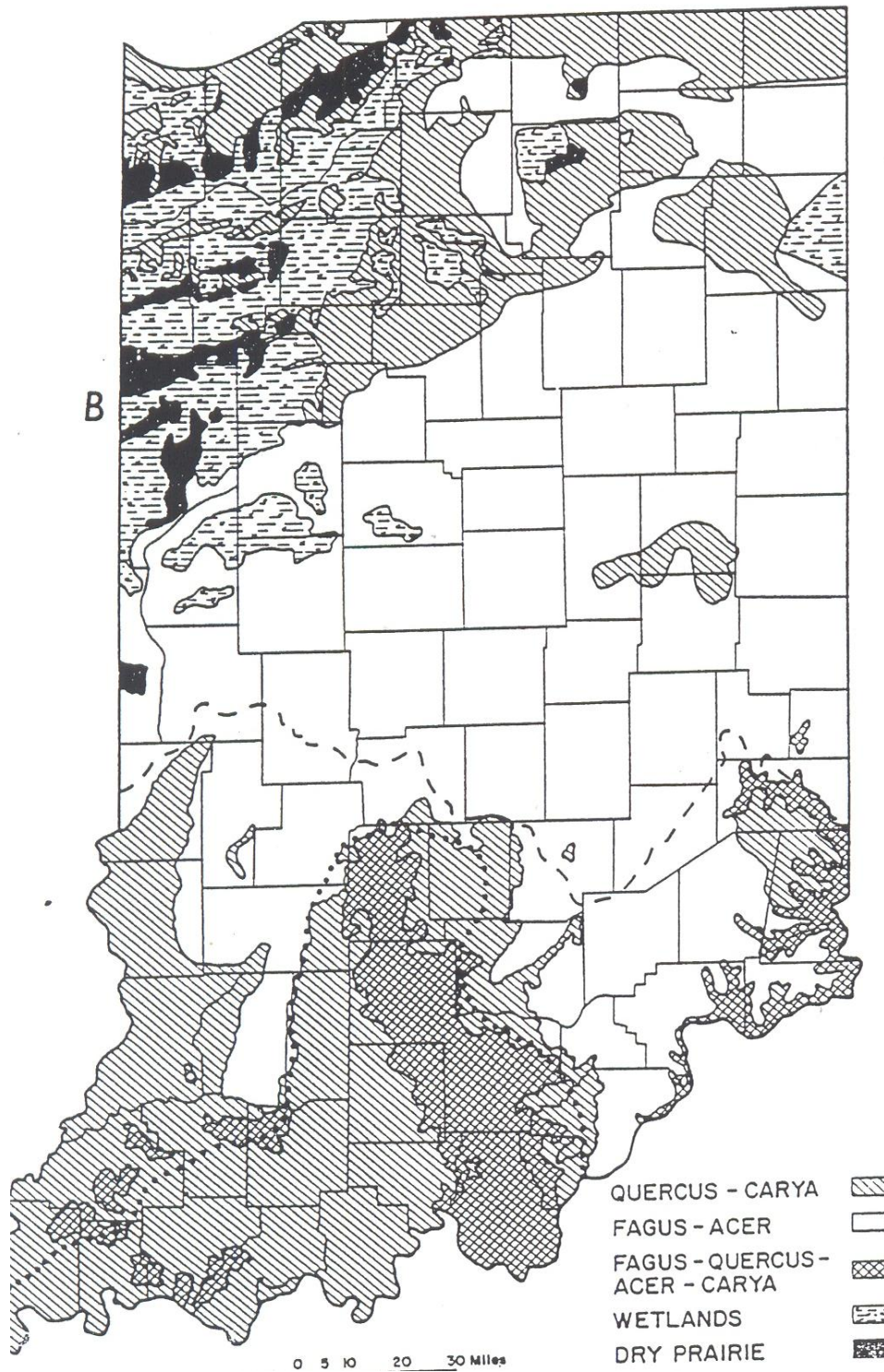


Figure 1. The Presettlement map of vegetation in Indiana (Lindsey et al., 1965)

is most commonly found in South-central and Southeastern Indiana, where it usually resides in ravines and on cooler slopes.

Petty and Jackson (1966) and Lindsey et al. (1965) define a fourth type of plant community found in Indiana—wetlands—as broad areas of poorly drained soil. This simply means that these communities have standing water covering parts of the land for all or part of the year. Wetlands in Indiana are usually found in silt, clay and sandy loam soils. Ten percent of presettlement Indiana was covered in this type of landscape.

Parrish (2001) states that wetlands are natural flood-control systems, which filter pollutants from the streams that flow into them. Petty and Jackson (1966) report that in a study done in 1961 the dominant tree species in wetland areas of Indiana were: black willow, silver maple, American elm and cottonwood. Lindsey (1997) states that in the late 1800's, ~~a biologist by the name of~~ Robert Ridgway found that the most dominant trees on the Wabash floodplain were tuliptrees, sycamores and bald cypress. Lindsey et al. (1965) and Petty and Jackson (1966) add beech trees to this list as being among the most prominent in wetlands. Today, however, tuliptrees and beeches are rarely found in floodplain forests of Indiana because most of those floodplain forest were cut and now grow crops. The number of wetlands is now declining due to filling, overexploitation and chemical pollution.

The fifth plant community found in Indiana (Lindsey et al., 1965) was “largely treeless tracts of land or open brushland”, otherwise known as prairies. Petty and Jackson (1966) state that the three types of original prairie found in Indiana were: wetland prairie, upland dry prairie and the border between grassy knolls and forest. Together, these prairies made up 13% of Indiana’s vegetation in 1816. Plant species

found in these communities (Lindsey et al., 1969) include little and big bluesteam grasses, timothy grass, switchgrass, horse nettle and prairie clover. Of the trees most commonly found along the border between forest and prairie, 85-100% were oak. The rest of the trees were composed primarily of hickory with a few records of sugar maple and beech (King, 2001). Today almost all of these prairies have been cleared for agricultural use. What remains of these prairies are found mostly in cemeteries and along railroads. Petty and Jackson (1966) classify the prairies remaining in Indiana into five types: big bluesteam, little bluesteam, prairie dropseed, poverty grass, bluegrass and slough grass. The distribution of these communities is largely determined by the level of soil moisture. Big and little bluesteam and poverty grass-bluegrass communities are found in areas with mid to low moisture levels. Prairie dropseed and slough grass populations both thrive in wetter soils.

Vegetation types in Allen County, and most of Indiana, have been heavily influenced by Pleistocene glaciers that moved through the area and stopped on the site of present day Fort Wayne (Petty and Jackson, 1966, Schutt, 1999). As the glaciers melted, the melt water created the St. Mary's and St. Joseph Rivers. Later, the melt water produced Glacial Lake Maumee. When the moraine that was acting as a dam for Lake Maumee broke, it created a sluiceway that is the site of Eagle Marsh today. Eagle Marsh is a wetland restoration project with a variety of plant communities. Recent studies at this site have found that these communities include lowland deciduous and swamp forests (Schutt, 1999 and 2000). The lowland forest of the Eagle Marsh area was classified as an American elm-cottonwood community and the swamp forest was classified as silver maple-cottonwood.

The purpose of this paper is to analyze the tree trail at Eagle Marsh and compare it to presettlement surveys of Indiana.

Methods

An analysis of the plant community was taken at the tree trail of Eagle Marsh. (See Figure 2) The research area measures 440 meters long, along the marked trail. We used a point-quarter analysis for this study. Our group began by marking the edge of the tree line with a construction flag. We then measured from this flag 20m along the trail to find our first analysis point and marked it with another construction flag. At this point we used a compass to find due north. Once we found due north we divided the point into four quadrants—north/east, east/south, south/west, and west/north. In each quadrant, we found the closest tree to the point that measured at least 10 cm in diameter. Once we found the tree in a quadrant, we measured the distance from the flag to the middle of the tree at breast height and recorded the distance. We then measured the diameter at breast height (dbh) of the tree, identified its genus and species, and entered the data on our data sheet. After we repeated this process in all four quadrants, we measured another 20m down the trail and marked it with a flag. This process was repeated along the entire 440m of the trail with two flags being placed every 100m.

Once all of the data had been collected, we entered the data into an Excel spreadsheet. We used the following formulas in the Excel program to analyze our data:

$$\text{density for a species} = \frac{\text{number of individuals of that species}}{\text{area sampled}}$$



Figure 2. This picture shows the research area of Eagle Marsh Tree Trail in Allen County, Ft. Wayne, Indiana.

$$\text{relative density for a species} = \frac{\text{density for each species}}{\text{total density for all species}} \times 100\%$$

$$\text{is basal area for a species} = \frac{\text{total basal area for that species}}{\text{area sampled}}$$

$$\text{relative basal area for a species} = \frac{\text{basal area for each species}}{\text{total basal area for all species}} \times 100\%$$

$$\text{importance value} = \frac{\text{relative density} + \text{relative basal area}}{2}$$

Note that when calculating dbh for trees with multiple stems, each stem was measured individually and a single dbh was found for the tree.

Results

The majority of trees measured and identified along the Tree Trail were silver maple, with a total of 31 trees. The second most numerous species was cottonwood with 11 trees, followed closely by hack berry with 10. Table 1 and Figure 3 show that silver maple had a relative density value of 35.6%, cottonwood's was 12.6% and hack berry's was 12.6%.

Silver maple had the highest relative basal area of 39.6% or 10.1 m²/h, as seen in Table 1 and Figure 4. Cottonwood had a relative basal area of 38.1% or 9.7 m²/h. Surprisingly, black cherry was a distant third to these species, with a relative basal area of 5.0% or 1.3 m²/h. Hack berry was not far behind black cherry, with a relative basal area of 4.9% or 1.3 m²/h. The trees with the largest average basal area of 0.257m² were cottonwood. This more than twice the size of the second largest species of trees, silver maple (0.095 m²).

Table 1. A summary of the density, basal area and importance value data collected at the Eagle Marsh Tree Trail.

Common Names	Density (stems/ha)	Relative Density (%)	Total Basal Area (m²)	Average Basal Area (m²)	Basal Area (m²/ha)	Relative Basal Area (%)	Importance Value (%)
Box Elder	20.6	6.9	0.114	0.019	0.4	1.5	4.2
Red Maple	3.4	1.1	0.027	0.027	0.1	0.4	0.8
Silver Maple	106.5	35.6	2.939	0.095	10.1	39.6	37.6
Hack Berry	34.4	11.5	0.366	0.037	1.3	4.9	8.2
Green Ash	10.3	3.4	0.073	0.024	0.2	1.0	2.2
Cottonwood	37.8	12.6	2.823	0.257	9.7	38.1	25.4
Black Cherry	20.6	6.9	0.368	0.061	1.3	5.0	5.9
Pin Oak	17.2	5.7	0.116	0.023	0.4	1.6	3.7
Black Willow	10.3	3.4	0.283	0.094	1.0	3.8	3.6
American Elm	27.5	9.2	0.270	0.034	0.9	3.6	6.4
Slippery Elm	10.3	3.4	0.036	0.012	0.1	0.5	2.0

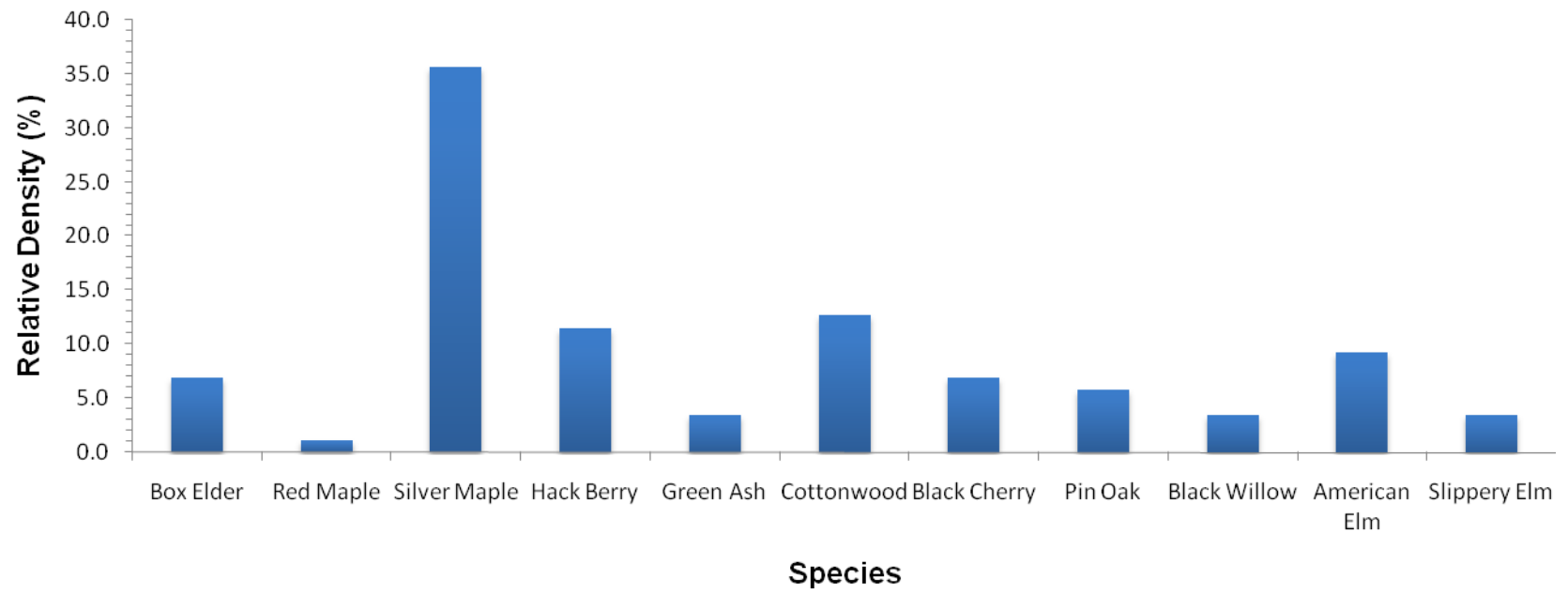


Figure 3: This graph shows the relative density of each species of tree that was found along the tree trail at Eagle Marsh.

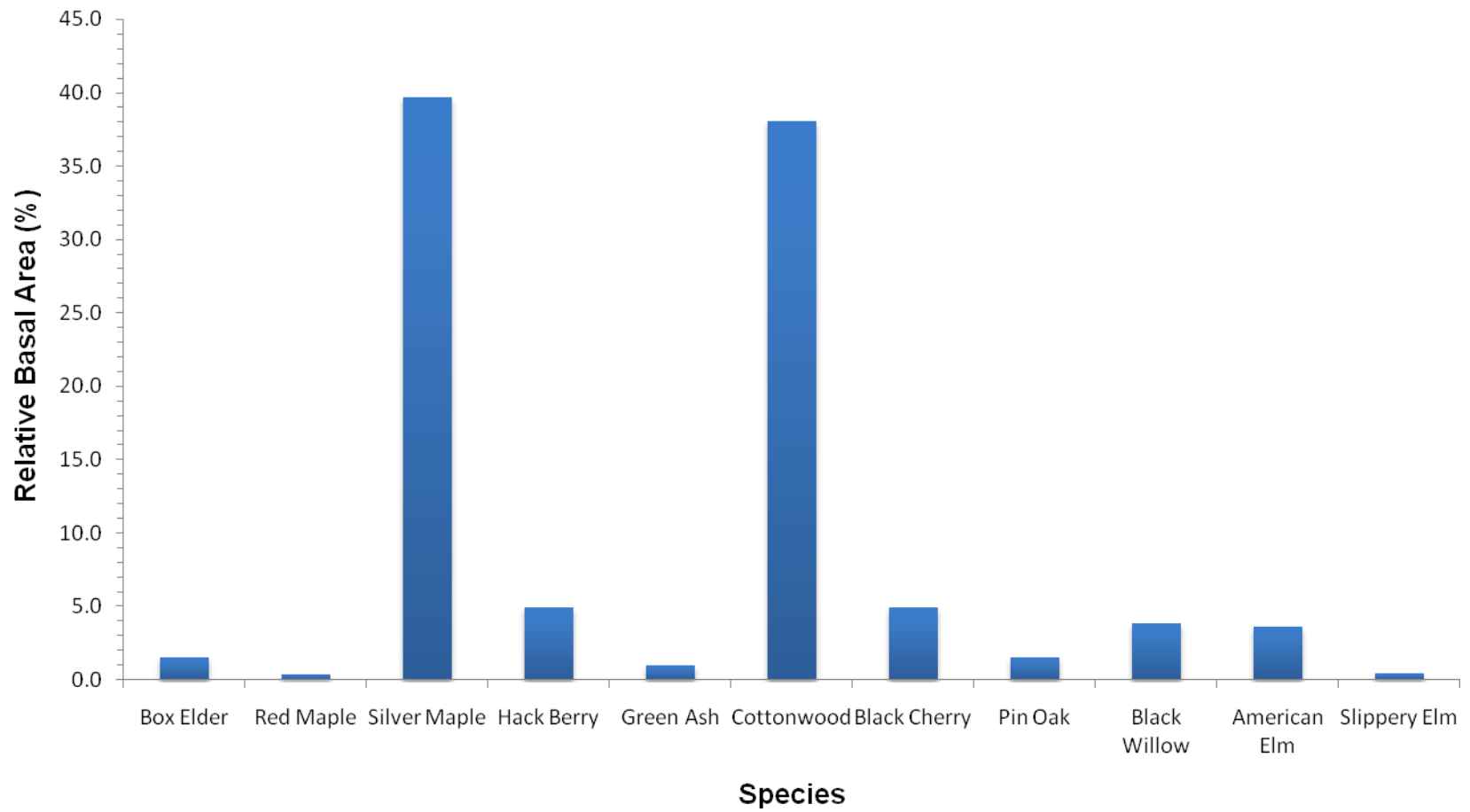


Figure 4: This graph shows the relative basal area of each species of tree that was found along the tree trail at Eagle Marsh.

Importance value data collected from the sample of trees is summarized in Table 1 and Figure 5. Because its basal area was so small, hack berry had an importance value of only 8.2%. In contrast, silver maple and cottonwood each had importance values of 37.6% and 25.4% respectively. Based on the combined importance value of silver maple and cottonwood (63.0%) we may conclude that the Eagle Marsh Tree Trail is a silver maple-cottonwood community.

Discussion

When Petty and Jackson (1966) conducted their survey of plant communities in presettlement Indiana, Allen County was predominantly composed of beech-maple, oak-hickory and wetland communities. When we surveyed the Eagle Marsh Tree Trail we found that the community included those species Petty and Jackson found to be most common in wetland areas of Indiana. The most common of these species was silver maple, followed by cottonwood. We also found several samples of American elm and black willow, two more species found in presettlement wetlands.

According to Schutt (2000), the sample of a swamp forest at Fox Island studied in Allen County was composed of a total of 228 trees. Of these trees, 58 were cottonwood and 120 were silver maple. This gave them an importance value of 34.9 and 49.0% respectively. Cottonwood had the greatest average basal area of 0.193 m². This area was more than twice the size of the second largest species, black willow. Although the Tree Trail in the present study is also a swamp forest and a silver maple-cottonwood community, the cottonwood in the area are much larger, while black willow (0.094 m²) and silver maple (0.095 m²) are almost the same size as they were in Schutt's 2000 study.

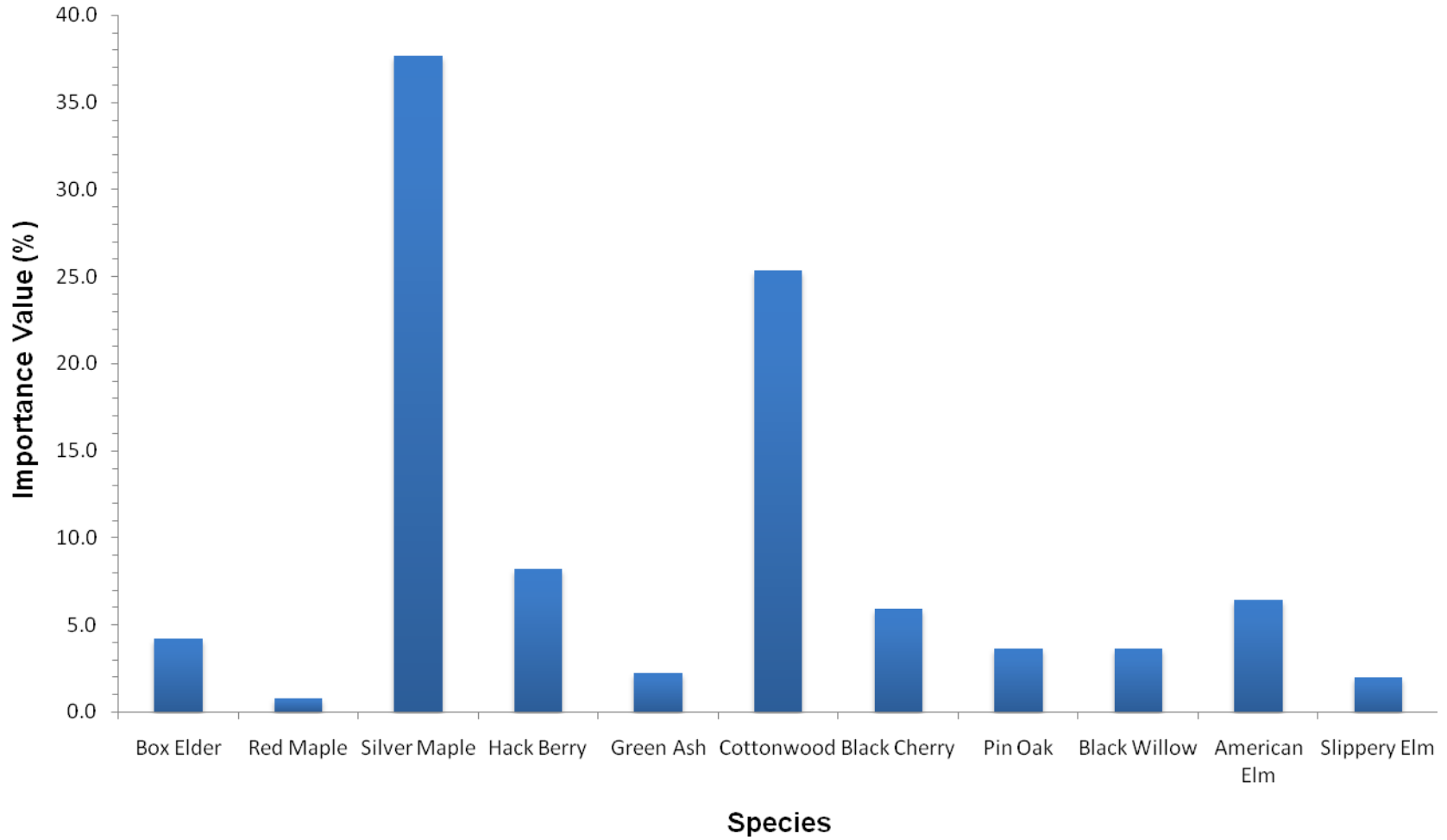


Figure 5: This graph shows the importance value of each species of tree that was found on the tree trail at Eagle Marsh.

Even with the many species that were also found in Petty and Jackson's study, there are several species that are unaccounted for in the modern wetland. This finding appears to be consistent with the research done by other professionals in recent years. Lindsey et al. (1965) and Petty and Jackson (1966) found that beech trees and tuliptrees used to be among the most common in wetlands, but are rarely found there today. Neither of these species was present in the research area.

Overall, the data collected in the present study of the Eagle Marsh Tree Trail were consistent with the trends observed by researchers in previous studies. Although this study did not find many of the main species that shared dominance in wetlands during presettlement times, the data was consistent with Lindsey et al. (1965) and Petty and Jackson (1966), which stated that the main wetland species today are black willow, silver maple, American elm and cottonwood. All four of these species were present at the Eagle Marsh Tree Trail.

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