VASCULAR PLANTS AND PLANT HABITATS OF BRUSH CREEK ISLAND, LEWIS COUNTY, KENTUCKY, U.S.A.

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ABSTRACT
A descriptive survey of the vascular flora and plant habitats of Brush Creek Island, a 6.7-ha Ohio River island in Lewis County, Kentucky, was conducted during 1995–1996 and 2012. Brush Creek Island (BC), one of three Ohio River islands politically a part of Kentucky, is currently under private ownership and projected as a future part of the Ohio River Islands National Wildlife Refuge. Two major habitats in 2012 were Vegetated Unconsolidated Shoreline and Bottomland Hardwood Forest, a final sere of Late Old Field and Immature Bottomland Hardwood Forest. Two additional 1996 habitats, a seasonal Riverine Emergent Wetland and Late Old Field, were altered through fluvial action and secondary succession processes by 2012. An annotated list consists of 330 species in 220 genera from 82 families. Taxa are composed of one Monilophyte, four Magnoliids, 76 Monocots, and 249 Eudicots. Ninety-three taxa (28.2%) are non-native adventive or naturalized species. Forty-eight taxa (54%) are classified as Kentucky invasive plants. A total of 189 species (57.3%) are hydrophytes. Ninety-five native or non-native taxa (28.8%) are Lewis County distribution records.

Key Words: Brush Creek Island, flora, habitats, invasives, Lewis County, Kentucky, Ohio River

INTRODUCTION
Brush Creek Island (BC), a 6.7-ha spindle-shaped, perched island, is one of three Ohio River islands politically a part of Lewis County, Kentucky (Fig. 1). Brush Creek Island is currently under the private ownership of the Earl Parr estate, Ashland, Kentucky. BC has been projected to become a future part of the Ohio River National Wildlife Refuge (Tolin & Schettig 1983).

The other two Lewis County islands, Manchester No. 1 (10.9-ha), and Manchester No. 2 (46.5-ha), are part of the Ohio River National Wildlife Refuge (ORINWR) located 13.3–13.6 km downstream from BC (Tolin & Schettig 1983). The ORINWR was established in 1990 to protect 22 islands and their backwater channels for their high quality of fish and wildlife, recreation, natural heritage, geological uniqueness, and scientific value along a 203-km corridor of the Ohio River from Pennsylvania, West Virginia, and Kentucky (ORINWR 2002).

We began a comprehensive study of Brush Creek Island flora and vegetation throughout the growing seasons of 1995–1996. The survey was reinitiated and concluded in 2012 with comparisons made between the
flora and habitats from fluvial processes of the Ohio River and natural secondary succession after 16 years. The descriptive study represents the first complete floristic survey of Brush Creek Island since a reconnaissance by Tolin and Schettig (1983). Gelis (1996) conducted and published a bird survey of Brush Creek, Manchester No. 1, and Manchester No. 2 concurrently with this flora project.

Our study objectives were to: 1) conduct a thorough floristic survey to document all vascular plants with representative herbarium voucher specimens; 2) prepare an annotated species list with Lewis County distribution records, non-native plant origin, invasive plant status, vernacular name, habitats, relative abundance, and federal wetland status; 3) describe plant habitats and associated taxa within the BC terrestrial boundary; and, 4) produce detailed flora and vegetation baseline data of Brush Creek Island for refuge personnel, educators, and scientists.

The flora and vegetation of freshwater river islands in the eastern United States have been published in Wisconsin (Barnes 1978, 1991), Pennsylvania (Whitbeck et al. 1997; Walters & Williams 1999; Williams 2010a), and Kentucky (Vance et al. 2014). Riverine ecosystems are among the most dynamic and rich of ecological systems, and riverine corridors are major determinants of plant distribution patterns due to fluvial and hydrologic processes (Naiman & DeCamps 1997; Naiman et al. 2005).

River flooding regimes greatly influence plant species richness. Spatial dispersal patterns (zones) change...
as distance increases from riverwash (sand, silt, clay mudflats) and island riverbanks to first and second bottoms of flood plain bottomland hardwood forests (Barnes 1978). These spatial dispersion factors are correlated to alluvial soils, flood frequency and duration, drainage, topography, light conditions, and elevation of the islands (Barnes 1978).

Vascular plant species richness of riparian areas often exceeds species richness of adjacent upland areas (Naiman & DéCamps 1997; Hood & Naiman 2000; Naiman et al. 2005). The greatest species richness (number of species) was forbs rather than graminoids or woody taxa in two Pennsylvanian river island studies (Walters & Williams 1999; Williams 2010b) and in Kentucky (Vance et al. 2014).

Plant assemblages continuously change due to fluvial processes throughout the growing seasons. The migration, establishment, colonization, and spread of naturalized non-native taxa, particularly invasives, have resulted in the reduction and in some cases, the elimination of native species, as well as altered ecosystem structure and function, propagule dispersal, regeneration, and nutrient cycling (Walters & Williams 1999; Richardson et al. 2000, 2007; Williams 2010a).

The dominant vegetation of Brush Creek Island is Bottomland Hardwood Forest (BHF), a climax sere derived from sub-sere Late Old Field and Immature Bottomland Forest (Tolin & Schettig 1983; ORINWR 2002). As an isolated riverine island, BC has been relatively free from human destruction and manipulation, such as what has occurred in the nearby Bluegrass Section of the Western Mesophytic Forest Region (Braun 1950; Tolin & Schettig 1983). Woods et al. (2002) placed northwestern forested Lewis County in the northern glaciated Outer Bluegrass Ecoregion of the Interior Low Plateau Province. The remaining forested terrain of Lewis County is characterized by various stands of Mixed Oak-Hickory Forest (Woods et al. 2002), or classified as Mesophytic Forest (Dyer 2006).

THE STUDY AREA

Brush Creek Island is located in the Meldahl Navigation Pool of the Ohio River below Greenup Dam between km 624.25 and km 625.05, and 0.63 km north from Chalkey Station and 3.1 km ESE of Concord, Lewis County, Kentucky. The island center lies at latitude (38°40’17.8”) and longitude (83°27’35.7”), within the Concord and Buena Vista Quadrangle (Fig. 1). The 6.7-ha island has a circumnavigated shoreline perimeter of 1.2 km (0.40 km long × 0.10 km wide) (Tolin & Schettig 1983). Elevations fluctuate from 146 m at island river surface to 158 m on the uppermost perched island terrace (Morris 1966).

Moderate to heavy erosion occurs when the flow energy of the Ohio River exceeds the resistance of shoreline and island materials. Springer et al. (1984) described erosion of alluvial streambanks and island soils along the Ohio River through the “sliding wedge mechanism,” an erosion process involving sand and silt partings on upper bank layers that underlie cohesive upper soil layers being lost when alluvial soils slump or collapse from the fluvial action floodwater regimes.

Ohio River fluvial processes included the erosion, transportation, and deposition of alluvial sediments and other materials to and from the island head, channel side, backwater side, and toe of Brush Creek Island (Figs. 1, 2). Brush Creek Island is characterized by moderate to severe erosion during winter and spring floods at the shallow water zone off the tapered head with exposed and submerged logs becoming embedded in sand, gravel, and cobbles (Fig. 2). At high velocity current, the Ohio River erodes sand, silt, mud, and lighter detritus most strongly from the uppermost tapered island head to moderate erosion on the swift channel side to low erosion on the slower steep backwater channel. Light sand, silt, and clay sediments, muck, and detritus accumulate on the slender island toe (Tolin & Schettig 1983).

Ohio River islands were formed by the accretion of alluvium from the Recent Series of the Quaternary System and have been greatly influenced by geologic processes during the Pleistocene and Holocene Epochs (Morris 1966). BC was formed by the accumulation of fluvial deposits over gravel and rock bars to the height of the annually flooded Ohio River floodplain (Tolin & Schettig 1983).

At BC, Wheeling and Nolin alluvial soils belong to the fine sandy and/or silt loams of the Wheeling-Nolin-Otwell Complex (Jacobs & Jones 2004). Wheeling loam soils are medium acid, moderately
well-drained, mixed alluvium of sand, silt, clay, and some gravel over 152 cm in depth with minor soil profile development. Wheeling soils are found on infrequently flooded upper terraces near the perched island center at approximately 156–158 m elevation (Jacobs & Jones 2004). Nolin silt loam soils are medium acid to alkaline, well-drained, mixed loamy sand, silt, and clay alluvium less than 152 cm deep with little soil profile development. Nolin soils are present on annually flooded lower terraces at approximately 144–148 m where considerable seasonal alluvium deposition occurs (Jacobs & Jones 2004). Mean two-year floods typically reach elevations of 154–158 m on the high terraces (Jacobs & Jones 2004).

Kentucky climate is continental temperate, humid mesothermal characterized by hot summers and mild to cold winter temperatures (Trewartha & Horn 1980). Midwest climatic summary data (1981–2010) were derived from the Maysville Sewage Plant station (155243) weather station bordering the Ohio River in the surrounding areas west of Brush Creek (MRCC 2019). The median growing season was 186 days at 0°C with the median first frost in late October and the median last frost in middle April. The mean annual temperature was 12.5°C with the coldest months January-February (~0.6°C) and the warmest months July-August (~24°C). Mean annual rainfall precipitation was 103 cm and 56 cm of snowfall (MRCC 2019).

MATERIALS AND METHODS

Boat transportation to Brush Creek Island for reconnaissance and specimen collections was provided by our personal boat or ORINWR personnel craft. Standard collection and specimen procedures were employed. Manuals for identification were: Beal and Thieret (1986); Jones (2005); and Weakley (2015). Plant clades, families, and nomenclature follow Weakley (2020).

A master set of representative voucher specimens are deposited in the Berea College, Ralph L. Thompson Herbarium (BEREA), now part of the Ronald L. Jones Herbarium of Eastern Kentucky University (EKY).
Partial duplicate sets are on file in EKY and the Northern Kentucky University, John W. Thieret Herbarium (KNK). BC specimens are publicly accessible through the SERNEC Data Portal (2021).

An annotated species list is arranged alphabetically by families, genera, species and infraspecific taxa within major vascular plant groups. Symbol codes for each taxon entry in the annotated list before the scientific name are: (o) Lewis County distribution records (Campbell & Medley 2006, 2012, 2020); (*) non-native plant origin (Weakley 2020; USDA, NRCS 2021); and (**) Kentucky invasive species status (KY-EPPC 2013).

Following every scientific name, a common name (Weakley 2020; USDA, NRCS 2021), an inclusive relative abundance value (Thompson & Rivers Thompson 2016), plant habitats (Tolin & Schettig 1983), a National Wetland Plant List (NWPL) rating for Kentucky (Lichvar 2013), and a representative BC plant voucher number or numbers, are provided.

Wetland plant habitats adapted from Tolin and Schettig (1983) are: Vegetated Unconsolidated Shoreline (US), Riverine Emergent Wetland (REW), Late Old Field (LO), and both Immature Bottomland Forest (IB) and Mature Bottomland Forest (MB). In our study, IB and MB mosaics are treated as Bottomland Hardwood Forest (BHF).

Major Brush Creek Island habitats were delineated through field reconnaissance, field collections, physical site characteristics (general topographic-moisture regimes, slope aspect, flood elevation, fluvial frequency, light conditions, species composition), associated species, and belt transect sampling. Associated plant species (associates) are characteristic or indicator native and non-native taxa which possess a similar phenological life cycle, plant duration, ecological adaptation, and habitat requirements (Thompson & Rivers Thompson 2016).

A relative abundance scale inclusive for each taxon from all plant habitats is derived from Thompson and Rivers Thompson (2016): R (Rare); S (Scarce); I (Infrequent); O (Occasional); F (Frequent); and A (Abundant).

National wetland indicator status classification in the Eastern Mountains and Piedmont including Kentucky (Lichvar 2013) are: OBL (Obligate Wetland); FACW (Facultative Wetland); FAC (Facultative); FACU (Facultative Upland); UPL (Upland); and NI (Non-indicator).

During October 2012, thirty (2 m × 100 m) belt transects were situated within the Bottomland Hardwood Forest for a tree population analysis by size-classes (dm) for species composition based on Daubenmire (1968). Fifteen belt transects were situated on each of the two well-defined BHF terraces: the first bottom terrace, annually flooded adjacent to the US at the Ohio River, and the second bottom terrace, rarely-flooded adjoining the first bottom terrace. Size-class species categories [diameter breast height (DBH) measured at 1.37 m above ground] adapted from Vance et al. (2014) were: tree seedlings (<1.0 m tall, 2.5 cm DBH); saplings (> 1.0 m tall, 2.5–4.9 cm DBH); small trees or poles (4.9–9.9 cm DBH); trees (1–16 dm DBH).

RESULTS AND DISCUSSION

The Taxonomic Summary

Vascular flora of Brush Creek Island consists of 330 specific and infraspecific taxa in 220 genera from 82 families (Table 1). Vascular plants include: one Monilophyte, four Magnoliids, 76 Monocotyledonae, and 249 Eudicotyledonae (Table 1). A total of 330 taxa are composed of 289 herbaceous plants and 50 woody plants: 23 trees (20 native, 3 non-native); 15 shrubs (12 native, 3 non-native); and 12 vines (10 native, 2 non-native).

The five largest families in number of species are: Asteraceae (46), Poaceae (41), Cyperaceae (19), and 12 each from Lamiaceae and Polygonaceae. The ten largest families in terms of taxa account for 173 (52.4%) of 330 taxa (Table 2). Carex (7), Persicaria (6), and Symphyotrichum (5) are the largest genera. Ninety-five (26 Monocots, 69 Dicots) native or non-native taxa (28.8%) are Lewis County distribution records.

Vance et al. (2014) conducted an ecological study of three ORINWR islands (Blennerhassett, Buckley, and Muskingum) in West Virginia. From 31 quadrats sampled, they recorded 170 species that consisted of 39 woody species (29 trees, 10 shrubs and woody vines) and 131 herbs. In comparison, Brush Creek Island had 160 (94.0%) of the 170 taxa recorded by Vance et al. (2014); BC only lacked 11 species (4 trees, 1 woody vine and 6 herbs) within its 330 species.
The ORINWR (2002) Final Comprehensive Conservation Plan with an updated refuge 2016 plant list contained 552 species (66 trees, 53 shrubs and woody vines, and 433 herbs). The Brush Creek Island list documented 296 species, or (53.6%), of all reported ORINWR plants, including 23 trees, 24 shrubs and woody vines, and 249 herbs.

**Rare and Significant Native Species**

Four Kentucky rare species (OKNP 2019) documented at Brush Creek Island were *Heracleum maximum* (Historic), *Ripariosida hermaphrodita* (Threatened), *Senecio suaveolens* (Special Concern), and *Vallisneria americana* (Special Concern). On Brush Creek Island, three of four state-listed taxa were collected in an existing LO habitat, and *V. americana* from aquatic beds along the Unconsolidated Shoreline during 1995 (Abbott et al. 2004). Campbell and Medley (2020) mapped only Lewis, Greenup, and Harlan counties for *Heracleum maximum*, and seven Kentucky counties bordering the Ohio River for *Ripariosida hermaphrodita*. *Senecio suaveolens* was collected in the BHF as a Lewis County distribution record (Abbott et al. 2004); it had been mapped by Campbell and Medley (2020) in 10 Kentucky counties. *Senecio suaveolens*, a predominately perennial riparian flood plain species, has been listed as a “special concern” in 13 eastern U.S. states (Williams 2010b). *Vallisneria americana* has been vouchered in eight Kentucky counties according to Campbell and Medley (2020). *Floerkea proserpinacoides* and *Vallisneria americana* were also Lewis County range extension plants from BC (Abbott et al. 2004). The rare *Bromus latiglumus*, documented in the LO and BHF, have been reported only in Lewis and Pulaski counties by Campbell and Medley (2020).

**Naturalized and Invasive Exotics**

A total of 93 non-native (alien, exotic, non-indigenous) taxa were documented at BC. Forty-eight (51.6%) of the 93 naturalized taxa (20 monocots, 73 dicots) were Kentucky state-listed invasives (Table 1). Invasives were: 23 Severe-Threat, 13 Significant-Threat, eight Moderate-Threat, and four Watch List plants (KY-EPPC 2013). The Severe-Threat invasive species with the greatest impact on BC native flora and vegetation included: *Achyranthes japonica*, *Alliaria petiolata*, *Arthraxon hispidus*, *Celastrus orbiculatus*, *Glechoma hederacea*, *Lonicer japonica*, *L. maackii*, *Microstegium vimineum*, *Reynoutria japonica*, *Rosa multiflora*, *Sorghum halepense*, and

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**Table 1. Taxonomic distribution of vascular plants of Brush Creek Island, Lewis County, KY.**

<table>
<thead>
<tr>
<th>Clade</th>
<th>Family</th>
<th>Genera</th>
<th>Species</th>
<th>Native</th>
<th>Exotic</th>
<th>Invasive</th>
<th>Species %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monilophyta</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0.30</td>
</tr>
<tr>
<td>Magnoliids</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>1.21</td>
</tr>
<tr>
<td>Monocotyledone</td>
<td>12</td>
<td>43</td>
<td>76</td>
<td>56</td>
<td>20</td>
<td>13</td>
<td>23.03</td>
</tr>
<tr>
<td>Eudicotyledone</td>
<td>66</td>
<td>172</td>
<td>249</td>
<td>176</td>
<td>73</td>
<td>35</td>
<td>75.46</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>82</td>
<td>220</td>
<td>330</td>
<td>237</td>
<td>93</td>
<td>48</td>
<td>100.00</td>
</tr>
</tbody>
</table>

**Table 2. Species richness of 10 largest families of Brush Creek Island, Lewis County, KY.**

<table>
<thead>
<tr>
<th>Family</th>
<th>Genera</th>
<th>Species</th>
<th>Native</th>
<th>Exotic</th>
<th>Invasive</th>
<th>Species %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asteraceae</td>
<td>30</td>
<td>46</td>
<td>38</td>
<td>8</td>
<td>4</td>
<td>13.94</td>
</tr>
<tr>
<td>Poaceae</td>
<td>27</td>
<td>41</td>
<td>26</td>
<td>15</td>
<td>9</td>
<td>12.42</td>
</tr>
<tr>
<td>Cyperaceae</td>
<td>5</td>
<td>19</td>
<td>18</td>
<td>1</td>
<td>0</td>
<td>5.76</td>
</tr>
<tr>
<td>Polygonaceae</td>
<td>5</td>
<td>12</td>
<td>5</td>
<td>7</td>
<td>3</td>
<td>3.64</td>
</tr>
<tr>
<td>Lamiaceae</td>
<td>11</td>
<td>12</td>
<td>9</td>
<td>3</td>
<td>3</td>
<td>3.64</td>
</tr>
<tr>
<td>Brassicaceae</td>
<td>8</td>
<td>11</td>
<td>3</td>
<td>8</td>
<td>3</td>
<td>3.33</td>
</tr>
<tr>
<td>Fabaceae</td>
<td>9</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>2.73</td>
</tr>
<tr>
<td>Rosaceae</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>2.42</td>
</tr>
<tr>
<td>Solanaceae</td>
<td>3</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>2.42</td>
</tr>
<tr>
<td>Ranunculaceae</td>
<td>4</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>2.12</td>
</tr>
<tr>
<td><strong>Total:</strong></td>
<td>108</td>
<td>173</td>
<td>120</td>
<td>53</td>
<td>28</td>
<td>52.42</td>
</tr>
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</table>
Stellaria media. Severe-threat and many significant-threat invasives may be termed “transformers,” a subset of invasives that clearly alter the character and nature of ecosystems over substantial areas through time (Richardson et al. 2000, 2007).

Abbott et al. (2004) documented Achyranthes japonica, Cardamine impatiens, Filicaria verna, and Stellaria aquatica as Kentucky range extensions on BC. Non-native classification includes 87 naturalized taxa and six adventive annuals (likely just waifs): Cannabis sativa, Citrullus lanatus, Cucurbita pepo, Solanum lycopersicum, S. arrachoides, and Tarenaya hassleriana. Schwartz et al. (2016) reported Achyranthes japonica, an invasive Asian perennial, in essentially all counties of states bordering the Ohio River and upper tributaries down to its confluence with the Mississippi River.

National Wetland Taxa
A total of 189 wetland species (57.3%) classified as hydrophytes on the National Wetland Plant List (NWPL) were present at Brush Creek Island: OBL (38 taxa), FACW (76 taxa), and FAC (75 taxa). This significant number of wetland plants may be attributed mainly to the fluvial action of the Ohio River on the Vegetated Unconsolidated Shoreline and the Riverine Emergent Wetland habitats. The Late Old Field and Bottomland Hardwood Forest habitats contained the majority of non-hydrophyte species: FACU (99 taxa) and UPL (18 taxa). These non-hydrophytes demonstrated plant adaptability to the less infrequently-flooded terrestrial habitats. Twenty-four NI (non-indicator) taxa were also documented.

Plant Habitats
Tolin and Schettig (1983) are followed for terrestrial and wetland habitats during this study. Plant habitats, associates, and secondary succession on BC are described through three time periods: 1983, 1995–1996, and 2012. BC habitats have been considerably altered or modified through secondary succession processes and annual seasonal fluvial effects of the Ohio River over the 29-year time period of this survey: 1983 to 1995–1996 (13 years) and from 1996 to the final 2012 survey (16 years). These habitats are described for each survey with their associated plants.

1983 Plant Survey and Habitats
Tolin and Schettig (1983) conducted a reconnaissance survey of Brush Creek Island (6.76 ha) from four mapped habitats: Vegetated Unconsolidated Shoreline (US), 0.81 ha; Late Old Field (LO), 2.55 ha; Immature Bottomland Hardwoods (IB), 0.12 ha; and Mature Bottomland Hardwoods (MB), 3.28 ha. They listed a total of 54 plant taxa: 14 trees, 5 shrubs and woody vines, and 35 herbs. In their IB and MB habitats, the dominant canopy trees were: Acer negundo, Acer saccharinum, Juglans nigra, Platanus occidentalis, Populus deltoides, Robinia pseudoacacia, and Salix nigra (Tolin & Schettig 1983).

The LO and IM habitats at BC designated by Tolin and Schettig (1983) had progressed through secondary succession stages over those 13 years into four major habitats during the 1995–1996 survey: Vegetated Unconsolidated Shoreline (US) 0.80 ha; Riverine Emergent Wetland (REW) 0.01 ha; Late Old Field (LO) 1.8 ha; our Bottomland Hardwood Forest (BHF), 4.1 ha; and a consolidated mixture including some earlier LO and Immature Bottomland Forest (IB).

Vegetated Unconsolidated Shoreline (US).—This riverine habitat is maintained by annual seasonal winter and spring flooding of the Ohio River that scours and erodes the island head, channel side, backwater channel, and toe. The 2.0-ha US habitat mapped by Tolin and Schettig (1983) remained about the same sized-area in 1995–1996. The Ohio River substrate is mainly composed of mud, silt, and sand intermixed with small gravel in a near level gradient. River fluctuations regularly disturb and eliminate plants while also dispersing seed propagules to reestablish those plants and new plants on these “new seasonally dewatered sand and mudflats.”

In the spring, the unstable US is mostly bare of plants from scouring winter and spring flood action, while dense low herbaceous vegetation covers the seasonal dewatered sand and mudflats during the summer.
and early fall as the Ohio River levels recede. The US habitat has a moderately high species richness with flora dominated by pioneering, seasonal native and non-native annuals, biennials, perennials (functioning as annuals), and true perennial herbs.

Woody plants less than 10 m tall occupied the US habitat on the island head and channel side to the toe. Abrasive mechanical damage occurred from seasonal heavy flooding, and first year saplings often did not persist. Characteristic shrub-scrub woody plants with extensive underground roots colonize the US habitat adjacent to the BHF first terrace (first bottoms) included seedlings and saplings of *Acer saccharinum*, *Amorpha fruticosa*, *Betula nigra*, *Cephalanthus occidentalis*, *Cornus amomum*, *Platanus occidentalis*, *Populus deltoides*, *Salix interior*, and S. nigra.

*Equisetum arvense* was an indicator spring species of the vegetated US zone. Characteristic summer-fall mudflat graminoids were *Cyperus biflorus*, *C. erythrorhizos*, *C. esculentus*, *C. odoratus*, *C. squarrosus*, *C. strigosus*, *Echinocloa muricata*, *Eragrostis hypnoides*, *E. pectinata*, *Fimbristylis autumnalis*, *F. pectinacea*, *Panicum dichotomiflorum*, and *Paspalum fluviatilis*.

Native and non-native sand and mudflat summer-fall forbs [*Amaranthus-Bidens-Cyperus-Persicaria Community*] included *Abutilon theophrasti*, *Acalypha hongmoidea*, *Ammannia coccinea*, *Amaranthus spinosus*, *A. tuberculatus*, *Artemisia annua*, *Bidens cernua*, *B. frondosa*, *Datura stramonium*, *Diospyris virginiana*, *Dysphania ambrosioides*, *Eclipta prostrata*, *Euphorbia henniostata*, *E. maculata*, *Leucospora multifida*, *Lysimachia nummularia*, *Mollugo verticillata*, *Oxalis stricta*, *Persicaria spp.*, and *Xanthium chinense*, among numerous other taxa. Rare or scarce adventives were *Cannabis sativa*, *Citrullus vulgaris*, *Cucurbita pepo*, and *Solanium lycopersicum*.

Williams (2010a) found the flood plain scour community (i.e., our US habitat) had the greatest non-native species richness in a survey of seven islands in the Allegheny River Islands Wilderness, Pennsylvania.

**Riverine Emergent Wetland (REW).—** In 1995 and 1996, a small seasonal Riverine Emergent Wetland [*Carex-Cyperus-Eleocharis Community*] was present on the channel side near the island head between the US and the BHF lower terrace border. The REW was formed when severe erosion scoured a shallow depression (ca. 40.0 m long × 8.0 m wide) prior to 1995. Several FACW and OBL wetland annuals and perennial graminoids and forbs occupied the REW.

Indicator wetland emergents were *Alisma subcordatum*, *Ammannia coccinea*, *Asclepias incarnata*, *Carex tribuloides*, *C. vulpinoidea*, *Cicuta maculata*, *Cyperus esculentus*, *C. erythrorhizos*, *C. strigosus*, *C. odoratus*, *Eleocharis erythropoda*, *E. obtusa*, *Glyceria striata*, *Hypericum mutilum*, *Juncus acuminatus*, *J. interior*, *Justicia americana*, *Leersia oryzoides*, *Lindernia dubia*, *Ludwigia alternifolia*, *L. decurrens*, *L. palustris*, *Lycopus americanus*, *L. virginicus*, *Lythrum salicaria*, *Mollugo verticillata*, *Mimulus alatus*, *Rorippa palustris* var. *fernaldiana*, *Sadigastaria calycina*, *Samolus parviflorus*, *Scirpus tabernaemontani*, *Scutellaria lateriflora*, and *Spermacoce glabra*. This REW habitat was not present on BC during the survey of Tolin and Schettig (1983) and the REM habitat was extirpated before 2012.

**Late Old Field (LO).—** This successional habitat [*Rosa-Rubus-Sambucus-Vitis Community*] was characterized by perennial herbs and woody vines on the upper terrace near the island head and is enclosed by the BHF. Because of significant insolation, the LO included many species of the late old field habitat of Tolin and Schettig (1983). The LO was seasonally flooded with less regularity and intensity, ca. every 5–10 years, than BHF. Because of significant insolation, the LO included many species of the late old field habitat of Tolin and Schettig (1983). The LO consisted of a high number of species.

Shrubs, woody vines, and trees included a conglomeration of *Carex blanda*, *C. grisea*, *Chaerophyllum procumbens*, *Convulvus sepium*, *Erigeron annuus*, *E. philadelphicus*, *Euthamia graminifolia*, *Eutrochium fistulosum*, *Fallopsia scandens*, *Gallium aparine*, *Phalaris arundinacea*, *Phytolacca americana*, *Potentilla norvegica*, *Ranunculus abortivus*, *Rubus occidentalis*, *R. pensilvanicus*, *Sambucus canadensis*, *Toxicodendron radicans*, and *Vernonia gigantea* among others.
**Bottomland Hardwood Forest (BHF).**—Tolin and Schettig (1983) classified the Mature Bottomland (i.e., our BHF) as the climax (final sere) of the flood plain plant community. By 1995–1996, the LO and IB habitats represented a mosaic toward the dominant Bottomland Hardwood Forest (BHF) based upon forest stand structure and number of canopy tree species.

A mature BHF flood plain stand included *Acer negundo, A. saccharinum, Celtis occidentalis, Juglans nigra, Populus deltoides, Platanus occidentalis*, and *Ulmus americana* [*Acer-Celtis-Juglans-Platanus-Populus-Ulmus Community*]. The four-layered vegetation; herb, shrub, subcanopy, and canopy layers, comprised the greatest species richness of the BC habitats. Indicator woody shrubs and vines included *Ampelopsis cordata, Asimina triloba, Campsis radicans, Lindera benzoin, Lonicera japonica, L. maackii, Menispermum canadense, Parthenocissus quinquefolia, Sambucus canadensis, Toxicodendron radicans, Vitis riparia*, and *V. vulpina*.

Characteristic native spring herbs were *Carex davisi, C. grayi, Chaerophyllum procumbens, Claytonia virginica, Corydalis flavula, Floerkea proserpinacoides, Galium aparine, Polygonatum biflorum, Ranunculus abortivus, Viola sororia*, and *V. striata*. Typical summer and fall native herbs were *Ageratina altissima, Bromus latiglumus, Chasmanthium latifolium, Cinna arundinacea, Conoclinium coelestinum, Cryptotaenia canadensis, Eurybia divaricata, Geum canadense, Helianthus tuberosus, Impatiens capensis, I. pallida, Laportea canadensis, Leersia virginica, Muhlenbergia frondosa, Persicaria virginiana, Pilea pumila, Rudbeckia laciniata, Solidago gigantea, Symphyotrichum ontariois, Thalictrum pubescens, Utica gracilis*, and *Verbesina alternifolia*.

The majority of invasive herbs, *Achyranthes japonica, Alliaria petiolata, Cardamine hirsuta, Glechoma hederacea, Lamium purpureum, Microstegium vimineum, Reynoutria cuspidata*, and *Stellaria media*, were present in the BHF.

**2012 Plant Survey: Habitats and Associated Species**

Secondary plant succession and fluvial processes from 1995–1996 to 2012 changed the physical features, habitats, and flora over that 16-year period on Brush Creek Island.

**Vegetated Unconsolidated Shoreline (US).**—The US had not significantly changed in surface area (~0.81 ha) nor in species richness since 1996 (Fig. 3). *Curcurbita pepo, Cyperus flavescens, Dysphania botrys, Euphorbia humistrata, Ipomoea purpurea, and Mazus pumilus* were a few new taxa collected, while several US species had vanished.

**Riverine Emergent Wetland (REW).**—The REW habitat was non-persistent and had disappeared by 2012 and the temporary area had been incorporated within the vegetated US sand and mudflat zone. Several unique OBL and FACW taxa were extirpated from BC presumably through fluvial processes between 1996 and 2012. REM wetland missing emergents included *Alisma subcordatum, Carex vulpinoidea, Cicutta maculata, Eleocharis erythropoda, Juncus interior, Justicia americana, Sagittaria calycina, Samolus parviflorus, Schoenoplectus tabernaemontani*, and *Spermacoce glabra* among others.

**Late Old Field (LO).**—The LO habitat was partly assimilated into an expanded BHF habitat through progressive secondary succession, and many of the annual and perennial graminoids and forbs adapted or were lost as the LO sub-sere changed with the variation in insolation to the BHF habitat and the establishment and colonization by more shade-tolerant herbaceous and woody species.

**Bottomland Hardwood Forest (BHF).**—The largest and most stable habitat (~5.7 ha) has continued to expand by consolidation of the LO and the IM habitats (Fig. 3). The lower flood plain terrace continues to be inundated during annual high fluvial action of the Ohio River and the perched upper terrace only infrequently inundated for brief periods during high Ohio River flood levels. Woody and herbaceous taxa were largely those colonizers from 1995–1996 BHF and the advent of the LO and IM taxa adapting to less insolation and more shade-tolerant conditions.

A size-class distribution analysis of 18 understory and overstory trees sampled in October 2012 is presented in Table 3. The largest canopy trees in DBH were: *Populus deltoides* (121, 160, 187 cm); *Platanus occidentalis* (90, 107, 166 cm); *Acer saccharinum* (95, 104, 107 cm); *Robinia pseudoacacia* (50, 61, 63 cm); *Juglans nigra* (56, 59, 61 cm); *Acer negundo* (38, 40, 51 cm); and *Ulmus americana* (43, 53, 57 cm).

Permanent tree occupants based on seedlings, saplings, small trees (poles), and canopy trees in continuing decimeter size-classes were: *Acer saccharinum, A. negundo, Ulmus americana*, and *Celtis occidentalis* (Table
3). Probable disappearing canopy relics of an earlier sere of shade-intolerant trees were: *Platanus occidentalis*, *Populus deltoides*, *Juglans nigra*, and *Robinia pseudoacacia*. These four native canopy trees and two exotics, *Morus alba* and *Ailanthus altissima*, were not regenerating well in the seedling, sapling, and small tree classes (Table 3). Unsuccessful invaders comprised the remaining understory and overstory trees: *Prunus serotina*, *Fraxinus pennsylvanica*, *Catalpa speciosa*, *Betula nigra*, *Liriodendron tulipifera*, *Acer saccharum*, *Cornus florida*, and *Frangula caroliniana* (Table 3).

**Annotated List of Vascular Plants**

The following features were assessed for each taxon: (o) Lewis County distribution records (Campbell & Medley 2006, 2012); (*) non-native plant origin (Weakley 2020; USDA, NRCS 2021); (**) invasive species status (KY-EPPC 2013); habitat(s) of occurrence; inclusive relative abundance value (Thompson & Rivers Thompson 2016); national wetland indicator status (Lichvar 2013); and italicized voucher specimen number(s), e.g., BC-39, BC-1519.

Wetland plant habitats adapted from Tolin and Schettig (1983) include Vegetated Unconsolidated Shoreline (US), Riverine Emergent Wetland (REW), Late Old Field (LO), and both Immature Bottomland Forest (IB) and Mature Bottomland Forest (MB), as BHF.

A relative abundance scale of categories inclusive for each taxon from all plant habitats is derived from Thompson and Rivers Thompson (2016): R (Rare)=1 to 4 plants or colonies, very difficult to find in one or two locations; S (Scarcе)=5 to 10 plants or colonies, difficult to find in a few locations; I (Infrequent)=11 to 30 plants or colonies, uncommon, scattered in some locations; O (Occasional)=31 to 100 plants or colonies, widely scattered in several locations; F (Frequent)=101 to 1000 plants or colonies, common, easily found in
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<th>Species</th>
<th>Seedlings</th>
<th>Saplings</th>
<th>Poles (cm)</th>
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**Table 3. Size-class distribution (DBH) of Bottomland Hardwood Forest (BHF) at Brush Creek Island (2012).**
numerous locations; and A (Abundant)= >1000 plants or colonies, diagnostic or dominant species throughout many locations.

Five NWPL indicator categories are: Obligate (OBL)—hydrophytes almost always occurring in wetlands; Faculative Wetland (FACW)—hydrophytes usually occurring in wetlands; and, Faculative (FAC)—hydrophytes occurring in wetlands and non-wetlands. Non-wetland indicator categories are: Facultative Upland (FACU)—non-hydrophytes usually occurring in non-wetlands, and Upland (UPL)—non-hydrophytes almost never occurring in wetlands (Lichvar 2013). Not Included (NI) rating is designated for plants not currently classified by the National and Regional Panel (Lichvar 2013).

**MONILOYPTA**

**Equisetaceae**

_Equisetum arvense_ L. (Field Horsetail). US, REW; A; FAC. BC-39, BC-1519

**Lauraceae**

_Lindera alba_ (L.) Nees (Sassafras). BHF; S; FACU.

**Magnoliaceae**

_Liriodendron tulipifera_ L. var. _tulipifera_ (Tulip-Tree). BHF; R; FACU. BC-50, BC-174

**Monocotyledones (Monocots)**

**Alismataceae**

_Alisma subcordatum_ Raf. (Southern Water-Plantain). REW; S; OBL. BC-1308

_Sagittaria calycula_ Engelm. (Mississippi Arrowhead). REW; R; OBL. BC-1007

**Alliaceae**

_{Allium canadense}_ L. (Wild Onion). LO; I; FACU. BC-450

_{**Allium vineale_ L. (Field Garlic). LO; I; FACU. BC-431

_{Commelina communis_ L. (Asiatic Dayflower). US, LO; I; FAC. BC-1006

_{Commelina virginica_ L. (Virginia Dayflower). US; S; FACW. BC-1061

**Cyperaceae**

_Carex blanda_ Dewey (Eastern Woodland Sedge). LO, BHF; F; FAC. BC-161

_Carex davisi_ Schwein. & Torr. (Davis's Sedge). BHF; S; FAC. BC-164

_Carex frankii_ Kunth (Frank's Sedge). REW; S; OBL. BC-413

_Carex grayi_ Carey (Gray's Sedge). BHF; F; FACW. BC-162

_Carex grisea_ Wahlenb. (Inflated Narrowleaf Sedge). LO, BHF; F; FAC. BC-163

_Carex triquetroides_ Wahlenb. (Blunt Broom Sedge). REW; S; FACW. BC-412, BC-1277

_Carex vulpinoides_ Michx. (Fox Sedge). REW; R; OBL. BC-415

_Cyperus bifurcatior_ Thieret & Delchousaye (Asiatic Greenhead Sedge). US, REW; I; FACW. BC-1305, BC-1506

_Cyperus esculentus_ L. (Yellow Nutsedge). REW; O; FACW. BC-1008

_Cyperus Flavescens_ L. (Yellow Flatsedge). US, OBL. BC-1504

_Cyperus odoratus_ L. var. _odoratus_ (Fragrant Flatsedge). US, REW; I; FACW. BC-1083

_Cyperus striatus_ L. (False Nutsedge). US; REW; O; FACW. BC-612, BC-1055

_Eleocharis erhythropoda_ Steud. (Bald Spikerush). REW; R; OBL. BC-604

_Eleocharis obtusa_ (Wild.) J.A. Schultes (Blunt Spikerush). REW; I; OBL. BC-1313

_Elmirista autumnalis_ (L.) Roemer & Schultes (Slender Fimbly). US, REW; O; FACW. BC-1046, BC-1532

_Schoenoplectus tabernaemontani_ (C.C. Gmel.) Palla (Softstem Bulrush). REW; R; OBL. BC-605

_Hemerocallidaceae**

**Hemerocallis fulva_ L. (Orange Day-Lily). LO; S; FACU. BC-1276

_Hyacinthaceae**

**Ornithogalum umbellatum_ L. (Star-of-Bethlehem). LO; I; FACU. BC-1185

_Hydrocharitaceae**

_Vallisneria americana_ Michx. (Eelgrass). US; I; OBL. BC-1000

_Juncaceae**

_Juncus effusus_ L. ssp. _sulatus_ (Fernald & Wiegand) Hämët-Ahti (Soft Rush). REW; O; FACW. BC-422

_Juncus interior_ Wiegand (Inland Rush). REW; S; FAC. BC-263

_Juncus tenuis_ Willd. (Slennder Path Rush). REW, S; I; FACU. BC-1538

_Liliaceae**

_Erythronium americanum_ Ker-Gawl. ssp. _americanum_ (Yellow Trout-Lily). BHF; I; FACU. BC-45

_Poaceae**

*Agrostis gigantea_ Roth (Redtop). LO; S; FACW. BC-827

_Agristis perennans_ (Walter) Tuckerm. (Upland Bent). LO; S; FACU. BC-1078

**Arthraxon hispidus_ (Thunb.) Makino var. _hispidus_ (Basket Grass). US; F; FAC. BC-1100, BC-1525

_Bromus latilimum_ (Shear) A.S.Hitchc. (Riverbank Brome). BHF; I; FACW. BC-1560

_Chasmanthium latifolium_ (Michx.) Yates (River Oats). BHF; O; FACU. BC-1528

_Cinna arundinacea_ L. (Common Woodreed). LO; BHF; O; FACW. BC-569

_Dichanthelium clandestinum_ (L.) Gould (Deer-Tongue Panicum). LO; O; FACU. BC-570

**Magnoliids and Primitive Angiosperms**

**Monilophyta**

**Asimina triloba_ (L.) Dunal (Common Pawpaw). BHF; I; FAC. BC-182

**Magnoliaceae**

_Liriodendron tulipifera_ L. var. _tulipifera_ (Tulip-Tree). BHF; R; FACU. BC-50, BC-174

**Annonaceae**

_{Asimina triloba_ L. (Common Pawpaw). BHF; I; FAC. BC-182

**Lauraceae**

_Lindera alba_ (L.) Nees (Sassafras). BHF; S; FACU.

**Magnoliaceae**

_Liriodendron tulipifera_ L. var. _tulipifera_ (Tulip-Tree). BHF; R; FACU. BC-50, BC-174

**Bryaceae**

_{Cinna arundinacea_ L. (Common Woodreed). LO; BHF; O; FACW. BC-569

_Dichanthelium clandestinum_ (L.) Gould (Deer-Tongue Panicum). LO; O; FACU. BC-570
Echinochloa crusgalli (L.) P. Beauv. var. crusgalli (Common Barnyard-Grass). US; F; FAC.  BC-577, BC-803
Echinochloa muricata (P. Beauv.) Fernald var. muricata (Rough Barnyard-Grass). US; O; FACW. BC-823, BC-1524

**Elesine indica** (L.) Gaertn. (Yard Grass). US; O; FACU. BC-575, BC-1556

Elymus virgicus L. (Virginia Wild-Rye). LO; BHF; F; FACW. BC-426, BC-1285

**Eragrostis cilianensis** (All) Vign. ex Janc. (Stinkgrass). US; S; FACU. BC-558
Eragrostis frankii C.A. Meyer ex Steud. (Sandbar Lovegrass). US; I; FACW. BC-1315
Eragrostis hypnoides (Lam.) B.S.P. (Creeping Lovegrass). US; A; OBL; BC-567
Eragrostis pectinacea (Michx.) Nees ex Steud. var. pectinacea (Carolina Lovegrass). US; F; FAC. BC-565, BC-1512
Festuca subverticillata (Pers.) E. Alexeev. (Nodding Fescue). BHF; I; FACU. BC-165, BC-245
Glyceria striata (Lam.) A.S. Hitchc. var. striata (Fowl Mannagrass). REW; O; OBL; BC-288
Leersia oryzoides (L.) Swartz (Rice Cutgrass). REW; O; OBL; BC-421
Leersia virginica Willd. (White Cutgrass). BHF; A; FAC. BC-573-574, BC-1549

**Lolium arundinaceum** (Schreb.) Darbyshire (Tall Fescue). LO; I; FACU. BC-420
**Microstegium vimineum** (Trin.) A. Camus (Japanese Stilt-Grass). BHF; A; FAC. BC-1107
Muhlenbergia frondosa (Poir.) Fernald (Satin-Grass Muhly). BHF; F; FAC. BC-1541
Panicum capillare L. (Old Witch-Grass). US; F; FAC. BC-809, BC-1526
Panicum dichotomiflorum Michx. var. dichotomiflorum (Fall Panic Grass). US; REW; F; FACW. BC-808, BC-1492
Panicum virgatum L. var. virgatum (Switchgrass). LO; I; FAC. BC-579
oPaspalum fluitans (Ell.) Kunth (Mudflat Beadgrass). US; O; OBL. BC-822, BC-1516
Phalaris arundinacea L. (Reed Canary-Grass). LO; O; FACW. BC-169
oPoa alsodes A. Gray (Woodland Bluegrass). BHF; R; FAC. BC-1195
**Poa pratensis** L. ssp. pratensis (Kentucky Bluegrass). LO; O; FACU. BC-166, BC-1198

Poa trivialis L. ssp. trivialis (Rough Bluegrass). LO; R; FACW. BC-170
**Setaria faberi** R.A.W. Herrm. (Nodding Foxtail). US; I; FACW. BC-566
**Setaria pumila** (Poir) Roemer & J.A. Schultes (Yellow Foxtail). US; I; FAC. BC-574

**Sorghum halepense** (L.) Pers. (Johnson Grass). US; LO; O; FACU. BC-445, BC-1520
Sphenopholis intermedia (Rydby.) Rydb. (Slender Wedgegrass). LO; O; FAC. BC-168
Tridens flavus (L.) A.S. Hitchc. (Purpletop). LO; I; FACU. BC-1125
oTriticum aestivum L. (Common Wheat). US; R; NI. BC-167

**Ruscieae**
Polygonaum biflorum (Walter) Ell. var. biflorum (Small Solomon’s- Seal). BHF; R; FACU. BC-1184
Smilacaceae
Smilax hispida Raf. var. hispida (Bristly Greenbrier). LO; S; FAC. BC-300, BC-444

**Acanthaceae**
Justicia americana (L.) M. Vahl (American Water-Willow). US, REM; S; OBL. BC-239

**Aceraceae**
Acer negundo L. var. negundo (Eastern Box-Elder). BHF; A; FAC. BC-296, BC-1563
Acer saccharinum L. (Silver Maple). US; BHF; A; FACW. BC-49, BC-820
oAcer saccharum Marsh. var. saccharum (Sugar Maple). BHF; S; FACU. BC-1192

**Amaranthaceae**
o*Achyranthes japonica* (Miq.) Nakai. var. hachjoensis Honda (Japanese Chaff-Flower). LO; BHF; A; NI. BC-1077, BC-1553
*Amaranthus albus* L. (Tumbleweed Amaranth). US; R; FACU. BC-1499
*Amaranthus hybridus* L ssp. hybridus (Smooth Amaranth). US; O; NC-1490
*Amaranthus spinosus* L. (Spiny Amaranth). US; F; FACU. BC-545
Amaranthus tuberculatus (Moquin-Tandon) J.D. Sauer (Inland Water-Hemp). US; O; FACW. BC-825, BC-1508

**Anacardiaceae**
Rhus typhina L. (Staghorn Sumac). LO; S; NI. BC-798
oToxicodendron radicans (L.) Kuntze (Midwestern Poison-Ivy). LO; BHF; A; FAC. BC-66

**Apiaceae**
Chaerophyllum procumbens (L.) Crantz. var. procumbens (Common Spreading Chervil). LO; O; FACW. BC-1186

Cicuta maculata L. var. maculata (Water-Hemlock). REW; R; OBL. BC-1282
Cryptotaenia canadensis (L.) DC. (Canada Honewort). BHF; F; FAC. BC-188, BC-248
**Daucus carota** L. ssp. carota (Queen-Anne’s-Lace). LO; I; UPL. BC-291
oHelenium maximum W. Bartr. (Cow-Parship). LO; O; FAC. BC-254
Osmorhiza longistylis (Torr.) A.P. DC. (Smooth Sweet Cicely). LO; BHF; O; FACU. BC-1190

**Apocynaceae**
Apocynum cannabinum L. (Indian-Hemp). LO; I; FACU. BC-307
Asclepias incarnata L. (Western Swamp Milkweed). REW; S; OBL. BC-455
Asclepias syriaca L. (Common Milkweed). LO; O; FACU. BC-306, BC-796
oCynanchum laeve (Michx.) Pers. (Honeyvine). US; LO; NI. BC-560

**Asteraceae**
Ageratina altissima (L.) R.M. King & H. Rob. (White Snakeroot). BHF; F; FACU. BC-1537
Ambrosia artemisiifolia L. (Common Ragweed). US; O; FACU. BC-556
Ambrosia trifida L. var. trifida (Giant Ragweed). LO; I; FAC. BC-1028
*Artemisia annua* L. (Annual Mugwort). US; O; FACU. BC-998
**Artemisia vulgaris** L. (Common Mugwort). US; F; UPL. BC-539, BC-1496
oBidens cernua L. (Nodding Bur-Marigold). US; REW; O; OBL. BC-1108
oBidens comosa (A. Gray) Wiegand (Strawberry Beggars-Ticks). US; I; FACW. BC-1109
Caryophyllaceae
*Cerasium* (Thall. (Sticky Mouse-Ear Chickweed). LO; I; UPL. BC-65
*Stellaria aquatica* (L.) Scop. (Water-Chickweed). LO, REW; F; FACW. BC-184, BC 805
**Stellaria media** (L) Villars (Common Chickweed). LO, BHF; A; UPL. BC-59

Celastraceae
o**Celastrus arbiculatus** Thunb. (Oriental Bittersweet). LO, BHF; I; FACU. BC-449
*Euonymus* atrapopurus Jacq. (American Wahoo). BHF; R; FACU. BC-434

Chenopodiaceae
*Chenopodium ambrosioides* (L) Mosyakin & Clemants (Mexican-Tea). US; A; FACU. BC-1507
*Euphorbia humistrata* L. (Hog-Peanut). BC-592

Clemaceae
o*Tarenaya hassleriana* (Chodat) H.H. Itlis (Spiderflower). US; R; FAC. BC-804

Convolvulaceae
*Convolvulus sepium* L. (Hedge-Bindweed). LO; I; FAC. BC-427, BC-1510
*Cuscuta gronovii* Willd. ex Roemer & J.A. Schultes (Common Dodder). LO; S; NI. BC-1102
**Ipomoea hederacea** Jacq. (ivyleaf Morning-Glory). US; S; FACU. BC-1081
*Ipomoea lacunosa* L. (Small White Morning-Glory). US; O; FACW. BC-800
**Ipomoea purpurea** (L) Roth (Common Morning-Glory). US; S; UPL. BC-1501

Cornaceae
o*Cornus amomum* P. Mill. (Silky Dogwood). US; LO; S; FACW. BC-285, BC-1076
*Cornus florida* L. Spach. (Flowering Dogwood). BHF; S; FACU. BC-452

Cucurbitaceae
*Citrullus lanatus* (Thunb.) Matsum. & Nakai (Watermelon). US; R; NI. BC-1527
*Sicyos angulatus* L. (Bur-Cucumber). LO; S; FACW. BC-1022, BC-1545

Euphorbiaceae
*Acalypha rhomboidea* Raf. (Rhombic Copperleaf). US; F; FACU. BC-1117
*Euphorbia humistrata* Engelm. ex A. Gray (Spreading Sandmat). US; S; FAC. BC-1041
*Euphorbia maculata* L. (Spotted Sandmat). US; F; FACU. BC-1500
*Euphorbia nutans* Lagasca & Segura (Eyebane Spurge). US; O; FACU. BC-824

Fabaceae
*Amorpha fruticosa* L. (Tall Indigo Bush). US; LO; O; FACW. BC-C592
*Amphicarpaea bracteata* (L.) Fernald var. bracteata (Hog-Peanut). LO; F; FAC. BC-1105
*Apios americana* Medik. (Common Groundnut). LO, BHF; I; FACW. BC-997
*Desmodium globelum* (Michx.) DC. (Dillenius' Tick-Trefoil). LO; S; FACU. BC-1062
**Lespedeza cuneata** (Dum.-Cours.) G. Don. (Sericea Lespedeza). LO; I; FACU. BC-1031
**Melilotus officinalis** (L) Pallas (Yellow Sweetclover). US; I; UPL. BC-302
*Robinia pseudoacacia* L. (Black Locust). BHF; O; FACU. BC-41
*Strophostyles helvola* (L) Ell. (Annual Sand Bean). US; LO; F; FACU. BC-1531
**Trifolium repens** L. (White Clover). US; I; FACU. BC-179

Fumariaceae
*Corydalis flavula* Raf. (Yellow Fumewort). BHF; F; FACU. BC-63

Geraniaceae
*Geranium carolinianum* L. (Carolina Crane’s-Bill). LO; O; NI. BC-190

Hyperiaceae
*Hypericum mutilum* L. var. mutilum (Dwarf St. John’s-Wort). US, REW; O; FACW. BC-542
*Hypericum prolificum* L. (Shrubby St. John’s-Wort). LO; R; FACU. BC-171, BC-1075
*Hypericum punctatum* Lam. (Spotted St. John’s-Wort). LO; S; FAC. BC-999

Juglandaceae
*Juglans nigra* L. (Black Walnut). BHF, F; FACU. BC-256

Lamiaceae
o*Agastache nepetoides* (L.) Kunz (Yellow Giant-Hyssop). LO; R; FACU. BC-1011
*Blephilia hirsuta* (Pursh) Bentham (Hairly Woodmint). BHF; R; NI. BC-430
**Glechoma hederacea** L. (Ground-ivy). LO, BHF; A; FACU. BC-55
**Lamium purpureum** L. (Red Dead-Nettle). LO; A; NI. BC-61
*Lycopus americanus* Muhl. ex W. Barton (American Bugleweed). REW; S; OBL. BC-1522
*Lycopus virginicus* L. (Virginia Bugleweed). REW; S; OBL. BC-1101
*Monarda fistulosa* L. var. mollis (L) Bentham (Wild Bergamot). LO; I; UPL. BC-1284
**Perilla frutescens** (L.) Britton (India Perilla). US; LO; I; FACU. BC-1114

Limiaceae
*Prunella vulgaris* L. (Self-Heal). LO; R; FACU. BC-562

Lythraceae
*Scutellaria lateriflora* L. (Mad-Dog Skullcap). REW; I; FACW. BC-546
*Stachys tenufolia* Willd. (Smooth Hedge-Nettle). LO; S; FACW. BC-443; BC-547
*Teucrium canadense* L. var. canadense (Common Germander). LO; O; FACW. BC-439

Limnanthaceae
*Fioerica proserpinacoides* Willd. (False-Mermaid). LO; BHF, F; A; FACU. BC-280, BC-1193

Linderniaeaceae
*Lindernia dubia* (L) Pennell (Yellowseed False-Pimpernel). US; F; OBL. BC-1518

Lythraceae
*Ammania coccinea* Rothb. (Eared Redstem). US, REW; I; OBL. BC-1037, BC-1509
**Lythrum salicaria** L. (Purple Loosestrife). US; I; FACW. BC-606

Malvaceae
o*Abutilon theophrasti* Medik. (Velvetleaf). US; I; FACU. BC-131; BC-1565
*Hibiscus moschutos* L. (Eastern Rose-Mallow). US; R; OBL. BC-812
*Oripariosa hermaphrodita* (L) Weakly & Pointedex (Virginia-Sida). LO; S; FAC. BC-1125
*Sida spinosa* L. (Prickly Sida). US; O; UPL. BC-1045

Mazaceae
o*Mazus pumilus* (Berm. f) Stennis (Japanese Mazus). US; I; FACU. BC-1498
Menispermaceae
Menispermum canadense L. (Canada Moonseed). BHF; O; FACU. BC-172

Molluginaceae
* Mollugo verticillata L. (Carpetweed). US; F; FAC. BC-424, BC-1497

Montiaceae
Claytonia virginica L. var. virginica (Eastern Spring Beauty). BHF; t; FACU. BC-58

Moraceae
** Morus alba L. (White Mulberry). BHF; O; FACU. BC-47, BC-175

Oleaceae
Fraxinus pennsylvanica Marsh. (Green Ash). BHF; S; FACW. BC-462
** Ligustrum vulgare L. (Chinese Privet). LO; R; FACU. BC-283, BC-12283

Onagraceae
Ludwigia alternifolia L. (Alternateleaf Seedbox). US, REW; S; FACW. BC-1048
Ludwigia decurrens Walter (Wingstem Water-Primrose). REW; O; OBL. BC-1044
Ludwigia leptocarpa (Nutt.) H. Harra (Water-Willow). REW; R; OBL. BC-1116
Ludwigia palustris (L.) Ell. (Common Water-Purslane). US, REW; F; OBL. BC-1491
Oenothera biennis L. (Common Evening-Primrose). LO; O; FACU. BC-602, BC-1493

Oxalidaceae
Oxalis dillenii Jacq. (Southern Yellow Wood-Sorrel). US, LO; O; FACU. BC-273
Oxalis stricta L. (Common Yellow Wood-Sorrel). US,LO; O; FACU. BC-428, BC-1050

Paulowniaceae
** Paulownia tomentosa (Thunb.) Sieb. & Zucc. ex Steud. (Chinese Empress Tree). BHF; R; UPL. BC-1551

Penthoraceae
Penthorum sedoides L. (American Ditch-Stonecrop). US, REW; O; OBL. BC-563

Phrymaceae
Mimulus alatus Aiton (Winged Monkey-Flower). REW; R; OBL. BC-435
Mimulus ringsen L. var. ringsen (Allegheny Monkey-Flower). REW; t; OBL. BC-436

Phytolacaceae
Phytolacca americana L. (Common Pokeweed). US, LO; O; FACU. BC-272

Plantaginaceae
Leucospora multifida (Michx.) Nutt. (Narrowleaf Paleseed). US; O; OBL. BC-1279; BC-1568
* Linaria vulgaris P. Mill. (YellowToadflax). US; R; NL. BC-1024; BC-1562
* Plantago lanceolata L. (English Plantain). US; LO; UPL. BC-267
Plantago rugelli Deane. (Rugel’s Plantain). US; O; FACU. BC-270
* Veronica arvensis L. (Corn Speedwell). LO; I; UPL. BC-188
Veronica peregrina L. var. peregrina (Purslane Speedwell). US, REW; t; FACU. BC-258

Platanaceae
Platanus occidentalis L. (American Sycamore). LO, BHF; F; FACW. BC-293

Polemoniaceae
Phlox paniculata L. (Summer Phlox). BHF; S; FACU. BC-555, BC-1035

Polygonaceae
Fallopia scandens (L.) Holub (Climbing Buckwheat). LO, BHF; F; FAC. BC-1550
Persicaria lapathifolia (L.) S.F. Gray (Dockleaf Smartweed). US, REW; O; FACW. BC-1495
** Persicaria longiseta (de Brujin) Kitagawa. (Longbristle Asiatic Smartweed). US, REW; F; FAC. BC-596
** Persicaria maculosa S.F. Gray (Heart’s-Ease). US; O; FACW. BC-593
Persicaria pensylvanica (L.) M. Gómez (Pennsylvania Smartweed). US, REW; O; FACW. BC-1054, BC-1521
Persicaria punctata (Ell.) Small (Dotted Smartweed). US, REW; O; OBL. BC-1070
Persicaria virginiana (L.) Gaertn. (Virginia Knotweed). BHF; F; FAC. BC-597
* Polygonum aviculare L. (Dooryard Knotweed). US; S; FAC. BC-1314
** Reynoutria japonica Houtt. (Japanese Knotweed). LO, BHF; A; FACU. BC-69, BC-1559
* Rumex crispus L. ssp. crispus (Curly Dock). US; O; OBL. BC-180
* Rumex obtusifolius L., (Bitter Dock). US; LO; O; FACU. BC-463, BC-1027
* Rumex patientia L. (Monk’s Rhubarb). US; I; NL. BC-417

Portulacaceae
** Portulaca oleracea L. (Common Purslane). US; O; FAC. BC-1280, BC-1514

Prismulaceae
** Lysimachia nummularia L. (Creeping Jenny). US, REW; O; FACW. BC-183
Samolus parviflorus Raf. (Water-Pimpernel). REW; R; OBL. BC-1120
Steironema ciliatum (L.) Baude (Fringed Loosestrife). BHF; S; FACW. BC-441

Ranunculaceae
Clematis virginiana L. (Virgin’s-Bower). LO; O; FAC. BC-446
** Filicarpa verna Huds. ssp. calthifolia (Reich.) Nyman. (Lesser Celadine). BHF; I; FAC. BC-51
** Ranunculus abortivus L. (Kidneyleaf Crowfoot). LO, BHF; O; FACW. BC-64
** Ranunculus recurvatus Poir. var. recurvatus (Hooked Buttercup). BHF; S; FAC. BC-1196
* Ranunculus repens L. (Creeping Buttercup). US; t; FAC. BC-247
** Ranunculus sceleratus L. ssp. sceleratus (Celeryleaf Crowfoot). REW; R; OBL. BC-1306
Thalictrum pubescens Pursh (Late Meadowrue). BHF; O; FACW. BC-185, BC-432

Rhamnaceae
Frangula caroliniana (Walter) A. Gray (Carolina Buckthorn). LO, BHS; R; FAC. BC-253

Rosaceae
Geum canadense Jacq. (White Avens). BHF; O; FACU. BC-460
** Physocarpus opulifolius (L.) Maxim. (Eastern Ninebark). LO; R; FACW. BC-1187
** Potentilla indica (Andrews) T. Wolf (India Strawberry). LO; F; FACU. BC-191
Potentilla norvegica L. (Rough Cinquefoil). US; O; FACW. BC-68
Prunus serotina Ehrh. var. serotina (Eastern Wild Black Cherry). LO, BHF; O; FACU. BC-249
** Rosa multiflora Thunb. ex Murr. (Multiflora Rose). LO; O; FACU. BC-600
Rubus occidentalis L. (Black Raspberry). LO; F; NL. BC-67, BC-295
** Rubus pensylvanicus Poir. (Eastern Blackberry). LO; F; FAC. BC-257

Rubiacaeae
Cephalanthus occidentalis L. (Buttonbush). REW; S; OBL. BC-1047
**Diodia virginiana** L. (Large Buttonweed). US, RE; F; FACW. *BC-418*

**Galium aparine** L. (Common Cleavers). LO; BHF; A; FACU. *BC-265*

**Galium triflorum** Michx. (Fragrant Bedstraw). BHF; I; FACU. *BC-614*

**Spermacoce glabra** Michx. (Smooth Buttonweed). REW; R; FACW. *BC-1053*

### Rutaceae

**Ptelea trifoliata** L. (Common Hop-Tree). BHF; R; FAC. *BC-451*

### Salicaceae

**Populus deltoides** Bartr. ex Marsh. ssp. deltoides (Eastern Cottonwood). US, BHF; F; FAC. *BC-46*

**Salix interior** Rowlee (Sandbar Willow). US; F; FACW. *BC-557*

**Salix nigra** Marsh. (Black Willow). US; F; OBL. *BC-536; BC-1564*

### Scrophulariaceae

**Scrophularia marilandica** L. (Eastern Figwort). LO; O; FACU. *BC-551; BC-1539*

*Verbasum blattaria* L. (Moth Mullein). US; UPL. *BC-181; BC-242*

**Verbasum thapsus** L. ssp. thapsus (Woolly Mullein). US; O; FACU. *BC-305; BC-1557*

### Simaroubaceae

**Ailanthus altissima** (P. Mill.) Swingle (Tree-of-Heaven). BHF; I; FACU. *BC-241; BC-1566*

### Solanaceae

*Daturn stramonium* L. (Jimson-Weed). US; F; NI. *BC-438; BC-1561*

**Physalis heterophylla** Nees (Clammy Ground-Cherry). US; I; NI. *BC-187*

**Physalis longifolia** Nutt. var. subglabrata (Mack. & Bush) Cronq. (Longleaf Ground-Cherry). US; I; UPL. *BC-423*

**Physalis pubescens** L. var. pubescens (Downy Ground-Cherry). US; I; FAC. *BC-1310*

**Solanum carolinense** L. var. carolinense (Carolina Horse-Nettle). LO; I; FACU. *BC-550*

**Solanum emulans** Raf. (Eastern Black Nightshade). US; I; FACU. *BC-238*

*Solannus lycopersicum* L. (Tomato). US; S; NI. *BC-549; BC-1015*

*Solannus sarrachoides* Sendtnr (Hairy Nightshade). US; R; NI. *BC-1505*

### Ulmaceae

**Ulmus americana** L. var. americana (American Elm). LO, BHF; A; FACW. *BC-42; BC-1546*

### Urticaceae

**Boehmeria candelina** (L.) Swartz (False-Nettle). LO, BHF; A; FACW. *BC-553*

**Laportea canadensis** (L.) Weddell (Canada Wood-Nettle). LO, BHF; A; FACW. *BC-554; BC-1536*

**Pilea pumila** (L.) A. Gray (Greenfruit Clearweed). LO, BHF; A; FACW. *BC-1106*

**Urtica gracilis** Aiton ssp. gracilis (American Stinging-Nettle). LO, BHF; A; FAC. *BC-1530*

### Verbenaceae

**Phyla lanceolata** (Michx.) Greene (Marsh Frogfruit). US, REW; I; OBL. *BC-543*

**Verbena hastata** L. (Blue Vervain). LO; S; FACW. *BC-433; BC-1533*

**Verbena urticifolia** L. (White Vervain). LO; O; FAC. *BC-447*

### Viburnaceae

**Sambucus canadensis** L. (Common Elderberry). LO, BHF; F; FACW. *BC-282*

### Violaceae

**Viola sororia** Willd. var. sororia (Common Blue Violet). LO, BHF; A; FAC. *BC-62*

**Viola striata** Aiton (Cream Violet). LO, BHF; O; FACW. *BC-119*

### Vitaceae

**Ampelopsis cordata** Michx. (Raccoon Grape). LO, BHF; O; FAC. *BC-244*

**Parthenocissus quinqufolia** (L.) Planchon (Virginia-Creeper). LO, BHF; F; FACU. *BC-250*

**Vitis riparia** Michx. (Riverbank Grape). US, LO, BHF; A; FACW. *BC-616*

**Vitis vulpina** L. (Frost Grape). US, LO, BHF; A; FAC. *BC-246; BC-1124*

## CONCLUSIONS

Brush Creek Island, as a Kentucky Ohio River island, will have its future flora and vegetation determined to a great extent by its physical features (the environmental complex) and existing vegetation. Brush Creek Island continues to be influenced and shaped by the dynamic fluvial processes of the Ohio River through severe erosion, abrasive mechanical damage, and transportation and deposition of light to heavy sediments.

Brush Creek Island has a very high species richness (330 taxa) for a small 6.7-ha freshwater island in comparison to other recently studied river island floras in the eastern United States. This high species richness is strongly affected by Ohio River flooding regimes and hydrology in conjunction with the current and former habitats on Brush Creek Island. The Bottomland Hardwood Forest [Acer-Ulmus-Celtis-Juglans-Platanus-Populus Community] remains the final climax sere derived in part from the sub-sere of Late Old Field and Immature Bottomland Hardwood Forest.

Ohio River fluvial effects include the influx of new native and non-native plant propagules (seeds, fruits, spores, plant parts) as well as the extirpation of some present-day and past plant species on the Ohio River Islands. The Ohio River remains an important corridor for the migration, establishment, colonization, and spread of native and non-native naturalized and invasive plants. Ultimately, non-native invasive species will continue to have deleterious ecosystem structure and function effects on the flora and vegetation of Brush Creek Island.
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