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**ECOLOGICAL SYSTEM: CENTRAL APPALACHIAN FLOODPLAIN**

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**Summary:** This system encompasses floodplains from southern New England to Virginia. Mostly forested, these occur on floodplains of medium to large rivers where topography and process have resulted in the development of a relatively flat floodplain with a complex of upland and wetland temperate alluvial vegetation. This complex includes floodplain forests in which *Acer saccharinum* (silver maple), *Populus deltoides* (eastern cottonwood), and *Platanus occidentalis* (sycamore) are characteristic, as well as herbaceous sloughs and shrub wetlands. Most areas are underwater each spring; microtopography determines how long the various habitats are inundated. Depositional and erosional features may both be present depending on the particular floodplain, although there is a history of deposition in the floodplain formation.

**High-ranked Species:** *Arabis georgiana* (G1, georgia rock-cress), *Aspiromitus appalachianus* (G1), *Canis rufus* (G1Q, red wolf), *Catocala marmorata* (G3G4, marbled underwing), *Cicindela ancocisconensis* (G3, Appalachian tiger beetle), *Diervilla rivularis* (G3, mountain bush-honeysuckle), *Eurycea junaluska* (G3, junaluska salamander), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2, rock gnome lichen), *Hasteola suaveolens* (G3, false Indian-plantain), *Hygrohypnum closteri* (G3, closter's brook-hypnum), *Lejeunea blomquistii* (G1G2, blomquist leafy liverwort), *Lysimachia fraseri* (G2, Fraser's loosestrife), *Marshallia grandiflora* (G2, monongahela barbara's-buttons), *Myotis austroriparius* (G3G4, southeastern myotis), *Plethodon aureolus* (G2G3, tellico salamander), *Sagittaria secundifolia* (G1, little river arrowhead), *Sorex palustris punctulatus* (G5T3, southern water shrew), *Spiraea virginiana* (G2, Virginia spiraea)

**Range:** Southern New England west to Lake Erie and south to Virginia. The James River in Virginia marks the southern extent of this system. United States: CT, MA, MD, NH, NJ?, NY, OH, PA, VA, VT, WV

**Delaware Estuary Associations:**

Alluvial Alder Swamp	Box-elder Floodplain Forest
Coastal Plain Oak Floodplain Swamp	Floodplain Pool
Green Ash - Mixed Hardwood Floodplain Forest	• Mid-Atlantic Terrace Hardwood Floodplain Forest
Northeastern Buttonbush Shrub Swamp	Northeastern Temperate Cobble Scour Rivershore
Red Maple - Green Ash Forested Swamp	River Birch Low Floodplain Forest
Silver Maple - Elm Forest	Small River Red Maple - Elm Floodplain Forest
• Water-willow Rocky Bar and Shore	

## Similar Ecological Systems in the Delaware Estuary:

- Central Appalachian Riparian

### CLASSIFIERS FOR CENTRAL APPALACHIAN FLOODPLAIN

**Primary Division:** 202

**Land Cover Class:** Mixed Upland and Wetland

**Spatial Scale & Pattern:** Large patch

**Required Classifiers:** Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland

**Diagnostic Classifiers:** Forest and Woodland (Treed); Toeslope/Valley Bottom; Riverine / Alluvial; Broad-Leaved

Deciduous Tree; Intermittent Flooding; Short (<5 yrs) Flooding Interval

**Non-diagnostic Classifiers:** Lowland; Temperate; Eutrophic Soil; Deep Soil; Mineral: W/ A-Horizon >10 cm; Silt

Soil Texture; Udic; Ustic; Unconsolidated; Short Disturbance Interval; Flood Scouring; 1-29-day hydroperiod;

30-180-day hydroperiod; Moderate (100-500 yrs) Persistence

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### ALLUVIAL ALDER SWAMP

*Cornus amomum* - *Alnus serrulata* Shrubland

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**Range:** This Coastal Plain alluvial shrubland occurs in the Chesapeake Bay Lowlands and along the Christina River in Delaware in the Delaware Estuary.

**Environmental Description:** This Coastal Plain alluvial shrubland occurs in the Chesapeake Bay Lowlands on the non-tidal portions of rivers and non-tidal bay mouths.

**Vegetation Description:** The shrub canopy is characterized by *Cornus amomum* (silky dogwood) with other associates including *Alnus serrulata* (smooth alder), *Cephalanthus occidentalis* (common buttonbush), and *Viburnum* spp. (viburnum). as well as saplings of *Acer rubrum* (red maple), *Fraxinus pennsylvanica* (green ash), and *Salix nigra* (black willow). Herbaceous associates include *Osmunda regalis* (royal fern), *Decodon verticillatus* (swamp-loosestrife), *Utricularia* (bladderwort) spp., *Limnobiium spongia* (American spongeplant), and *Cicuta bulbifera* (bulb-bearing water-hemlock).

**Characteristic Species:** *Cornus amomum* (silky dogwood)

**Reference Sites:** Lewden-Green Park in New Castle County, DE, on the Christina River

**Global and State Conservation Ranks and Reasons:** GNR (10-Oct-2000). DE: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.683138](http://vegbank.org/natureserve/element_global.2.683138)

**References:** Eastern Ecology Working Group n.d., Harrison 2004, Tiner 1985a

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### MOST ABUNDANT SPECIES

STRATUM	LIFEFORM	SPECIES
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Alnus serrulata</i> (smooth alder)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Cornus amomum</i> (silky dogwood)
Herb (field)	Fern or fern ally	<i>Osmunda regalis</i> (royal fern)

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### BOX-ELDER FLOODPLAIN FOREST

*Acer negundo* Forest

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**Range:** This *Acer negundo* (box-elder) floodplain forest is found sporadically on floodplains in the southern, eastern, and midwestern United States, ranging from Maryland west to Iowa (and possibly

southeastern South Dakota), south to Louisiana and possibly Texas, and east to Georgia. It occurs in the Piedmont region in Pennsylvania and in the Coastal Plain and Piedmont regions in New Jersey and Delaware.

**Environmental Description:** Stands occur on large rivers in the active floodplain and on sandbars, and may form farther from the riverfront following disturbance. They are typically temporarily flooded in the spring. In Kentucky, these forests may also occur in old fields.

**Vegetation Description:** These early-successional forests are dominated by *Acer negundo* (box-elder). Other characteristic species include *Platanus occidentalis* (sycamore), *Acer rubrum* (red maple), *Liquidambar styraciflua* (sweetgum), *Acer saccharinum* (silver maple), *Ulmus americana* (American elm), *Carpinus caroliniana* (American hornbeam), *Morus rubra* (red mulberry), and *Populus deltoides* (eastern cottonwood). The shrub and herb layers range from sparse to relatively lush, and the vine component often is heavy. The range, dynamics and variability of this type are complicated by the "weedy" nature of *Acer negundo* (box-elder), often with *Dichanthelium clandestinum* (deer-tongue witchgrass) and *Carex* (sedge) spp. in the ground layer.

**Characteristic Species:** *Acer negundo* (box-elder)

**Dynamics/Successional Trajectory:** This type is an early-successional community that arises from natural and cultural disturbances on floodplains. Stands also occur where occasional flash floods create extensive open alluvial deposits that may be colonized by this type.

**Management Concerns:** This community type is not considered a desired target community for restoration in the Delaware Estuary. Some stands may develop following disturbance of other natural bottomland communities.

**Reference Sites:** No reference sites were identified because this community type is not considered a desired community for restoration in the Delaware Estuary.

**Global and State Conservation Ranks and Reasons:** G4G5 (28-Mar-2003). DE: SNR, NJ: SNR, PA: SNR. As currently defined this is a broad-ranging community type. However, the range, dynamics, and variability of this type is complicated by the "weedy" nature of *Acer negundo*. More information may be needed to clarify the extent to which this type represents purely natural vegetation. Some stands may develop following disturbance of other natural bottomland communities.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.686021](http://vegbank.org/natureserve/element_global.2.686021)

**References:** Blair 1938, Campbell pers. comm., Fleming et al. 2001, Foti pers. comm., Harrison 2004, Hoagland 2000, INAI unpubl. data, Leahy pers. comm., Patterson and DeSelm 1989, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Zollner pers. comm.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Acer negundo</i> (box-elder)

## COASTAL PLAIN OAK FLOODPLAIN SWAMP

*Quercus (palustris, phellos) - Acer rubrum / Cinna arundinacea* Forest

**Range:** This community is found in the Chesapeake Bay region north to the southern Coastal Plain of New Jersey and Pennsylvania.

**Environmental Description:** This floodplain swamp community of the Chesapeake Bay region and environs occurs in topographic depressions within alluvial floodplains. It occurs in pockets of saturated soils in, or at the edges of, depressions within a larger floodplain forest with annual flooding. Soils are poorly drained loams or clay loams.

**Vegetation Description:** The tree canopy is dominated by *Quercus palustris* (pin oak), *Quercus phellos* (willow oak), *Acer rubrum* (red maple), and *Liquidambar styraciflua* (sweetgum). The shrub layer is of relatively low cover and comprised of *Viburnum dentatum* (southern arrow-wood), *Viburnum prunifolium* (smooth blackhaw), and *Ilex verticillata* (common winterberry). *Vaccinium corymbosum* (highbush blueberry) is a less frequent shrub layer associate. Typical vines include *Toxicodendron radicans* (eastern poison-ivy), *Parthenocissus quinquefolia* (Virginia creeper), and *Smilax rotundifolia* (roundleaf greenbrier). The herb layer is characterized by *Cinna arundinacea* (sweet woodreed), *Boehmeria cylindrica* (small-spike false nettle), *Symphytichum lateriflorum* var. *lateriflorum* (calico aster), and *Carex* (sedge) spp., with less frequent associates including *Arisaema triphyllum* (Jack-in-the-pulpit), *Eurybia divaricata* (white wood-aster), *Lycopus virginicus* (Virginia water-horehound), *Ranunculus abortivus* (kidneyleaf buttercup), *Euonymus americanus* (American strawberry-bush), *Chasmanthium laxum* (slender spikegrass), and *Glyceria striata* (fowl mannagrass).

**Characteristic Species:** *Boehmeria cylindrica* (small-spike false nettle), *Cinna arundinacea* (sweet woodreed), *Quercus palustris* (pin oak)

**Dynamics/Successional Trajectory:** This floodplain forest is subject to annual flooding.

**Reference Sites:** Cape May, NJ, and potentially Cedar Swamp WMA, New Castle County, DE

**Global and State Conservation Ranks and Reasons:** GNR (27-Mar-2000). DE?: SNA, NJ?: SNA, PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.689632](http://vegbank.org/natureserve/element_global.2.689632)

**References:** Eastern Ecology Working Group n.d., Fleming et al. 2001, Harrison 2004, Harrison and Stango 2003, Patterson pers. comm., Thomson et al. 1999

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
Tree canopy	Broad-leaved deciduous tree	<i>Quercus palustris</i> (pin oak)
Tree canopy	Broad-leaved deciduous tree	<i>Quercus phellos</i> (willow oak)
Herb (field)	Graminoid	<i>Cinna arundinacea</i> (sweet woodreed)

## FLOODPLAIN POOL

*Peltandra virginica* - *Saururus cernuus* - *Carex crinita* / *Climacium americanum* Herbaceous Vegetation

**Range:** This association is found in the Piedmont, Southern Blue Ridge and related ecoregions, as well as the Coastal Plain in New Jersey, Delaware, and Pennsylvania. Its possible range is from Connecticut to Delaware and Maryland south to Tennessee and North Carolina.

**Environmental Description:** This vegetation typically occurs in Piedmont and mountain floodplains. These depressions are usually abandoned channel segments or swales behind natural levees in which water is ponded for all or much of the year. Water may be supplied primarily by stream flooding or by rainfall.

**Vegetation Description:** Emergent vegetation may include *Peltandra virginica* (green arrow-arum), *Dulichium arundinaceum* (threeway sedge), and *Polygonum* (smartweed, knotweed) spp. The vascular plant species vary widely among examples. *Carex crinita* (fringed sedge) or some other wetland *Carex* (sedge) species are almost always present, and *Climacium americanum* (tree moss) is often abundant on the landward side. Larger examples may have pad-leaved aquatic species such as *Brasenia schreberi* (watershield) or *Nymphaea odorata* (white water-lily). Piedmont examples may also have *Saururus cernuus* (lizard's-tail) and *Boehmeria cylindrica* (small-spike false nettle). Some examples have wetland

shrubs on edges or in shallow portions, including *Cornus amomum* (silky dogwood) and *Cephalanthus occidentalis* (common buttonbush).

**Characteristic Species:** *Carex crinita* (fringed sedge)

**Management Concerns:** Many sites for this community have been lost to clearing for agriculture, ditching and draining, hydrologic alteration, and development. These sites are important for amphibian breeding.

**Reference Sites:** No reference sites identified.

**Global and State Conservation Ranks and Reasons:** G2? (14-Dec-1998). DE: SNR, NJ: SNR, PA: SNR. This community is apparently quite rare. Individual occurrences are small, generally less than an acre.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.684674](http://vegbank.org/natureserve/element_global.2.684674)

**References:** Breden et al. 2001, Fleming et al. 2001, Harrison 2004, Metzler and Barrett 2001, Schafale 1998a, Schafale and Weakley 1990, Southeastern Ecology Working Group n.d., TDNH unpubl. data

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Graminoid	<i>Carex crinita</i> (fringed sedge)
Herb (field)	Graminoid	<i>Dulichium arundinaceum</i> (threeway sedge)

## GREEN ASH - MIXED HARDWOOD FLOODPLAIN FOREST

*Fraxinus pennsylvanica* - (*Juglans nigra*, *Platanus occidentalis*) Forest

**Range:** This type is currently described from the northern Piedmont of Pennsylvania, Delaware, New Jersey, and possibly Maryland.

**Environmental Description:** These floodplain forests occur behind levees and on low terraces that are flooded annually for short durations (less than one week per year). The water table is high for the majority of the growing season. Soils are generally silts or clay loams but can have coarser substrates where floodwater velocity is higher.



Photo by Pennsylvania Natural Heritage Program

**Vegetation Description:** The canopy is codominated by *Fraxinus pennsylvanica* (green ash) with *Juglans nigra* (black walnut) and/or *Platanus occidentalis* (sycamore). Additional associates include *Ulmus americana* (American elm), *Celtis occidentalis* (common hackberry), *Acer rubrum* (red maple), *Acer saccharinum* (silver maple), and *Quercus palustris* (pin oak). Subcanopy and shrub layers are sparse and generally comprised of canopy species regeneration plus *Lindera benzoin* (northern spicebush), *Viburnum prunifolium* (smooth blackhaw), and *Viburnum dentatum* (southern arrow-wood). Herbaceous species, where exotics are not rampant, can include *Impatiens pallida* (yellow jewelweed), *Impatiens capensis* (orange jewelweed), *Laportea canadensis* (Canadian wood-nettle), *Verbesina alternifolia* (wingstem), *Hydrophyllum canadense* (mapleleaf waterleaf), *Podophyllum peltatum* (mayapple), *Symplocarpus foetidus* (skunk-cabbage), *Circaea lutetiana* (broadleaf enchanter's-nightshade), *Boehmeria cylindrica* (small-spike false nettle), *Arisaema triphyllum* (Jack-in-the-pulpit), *Viola* (violet) spp., *Toxicodendron radicans* (eastern poison-ivy), and *Parthenocissus*

*quinquefolia* (Virginia creeper). Diagnostic features of this floodplain forest include the presence of *Juglans nigra* (black walnut) and rich herbs.

**Characteristic Species:** *Boehmeria cylindrica* (small-spike false nettle), *Impatiens pallida* (yellow jewelweed), *Juglans nigra* (black walnut)

**Dynamics/Successional Trajectory:** Flood frequency, intensity and duration influence the vegetation structure and composition of this type.

**Management Concerns:** Exotic invasive plants species are often abundant in this association due to disturbance from flooding and the mesic environment. *Rosa multiflora* (multiflora rose) and *Lonicera japonica* (Japanese honeysuckle) can be problematic in the shrub layer; *Alliaria petiolata* (garlic mustard), *Glechoma hederacea* (ground-ivy), and *Microstegium vimineum* (Japanese stiltgrass) often dominate the herbaceous layer. Many sites for this community have been lost to clearing for agriculture, ditching and draining, levees, hydrologic alteration, and development.

**Reference Sites:** Corderus Creek, York County, PA

**Global and State Conservation Ranks and Reasons:** GNR (21-Apr-2004). DE: SNR, NJ: SNR, PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.731010](http://vegbank.org/natureserve/element_global.2.731010)

**References:** Bowman 2000, Breden et al. 2001, Clancy 1996, Eastern Ecology Working Group n.d., Fike 1999, Podnieszinski and Wagner 2002, WPC and TNC 2002

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Fraxinus pennsylvanica</i> (green ash)
Tree canopy	Broad-leaved deciduous tree	<i>Juglans nigra</i> (black walnut)
Tree canopy	Broad-leaved deciduous tree	<i>Platanus occidentalis</i> (sycamore)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Lindera benzoin</i> (northern spicebush)

## MID-ATLANTIC TERRACE HARDWOOD FLOODPLAIN FOREST

*Liriodendron tulipifera* - *Fraxinus* spp. / *Lindera benzoin* - *Viburnum prunifolium* / *Podophyllum peltatum*  
Forest

**Range:** This community type occurs along the active floodplains of larger rivers in the Delaware Estuary in New Jersey, Delaware and Pennsylvania.

**Environmental Description:** These rich floodplain forests are found on slightly elevated alluvial terraces and active floodplains of larger rivers of the Delaware Estuary watershed and possible other watersheds in the Mid-Atlantic.

**Vegetation Description:** The canopy dominants can vary from site to site but are usually some combination of *Liriodendron tulipifera* (tuliptree) and *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Fraxinus nigra* (black ash), and/or *Fraxinus profunda* (pumpkin ash), *Carya cordiformis* (bitternut hickory), *Carya alba* (mockernut hickory), *Carya ovata* (shagbark hickory), *Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak), *Ulmus*



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*americana* (American elm), *Nyssa sylvatica* (blackgum), and *Prunus serotina* (black cherry). *Acer saccharum* (sugar maple) is often codominant along with *Tilia americana* (American basswood) in Pennsylvania; however, these species are less common or do not occur in New Jersey and Delaware. Minor canopy associates include *Juglans cinerea* (butternut) and *Acer rubrum* (red maple). Shrubs include *Lindera benzoin* (northern spicebush), *Viburnum prunifolium* (smooth blackhaw), *Carpinus caroliniana* (American hornbeam), *Staphylea trifolia* (American bladdernut), *Viburnum dentatum* (southern arrow-wood), *Corylus americana* (American hazelnut), *Viburnum lentago* (nannyberry), and *Prunus virginiana* (choke cherry); vines such as *Toxicodendron radicans* (eastern poison-ivy), *Parthenocissus* (Virginia creeper) spp., or *Vitis* (grape) spp. may be locally common. The herb layer usually features *Mertensia virginica* (Virginia bluebells), *Podophyllum peltatum* (mayapple), *Matteuccia struthiopteris* (ostrich fern), and a mixture of other ferns, forbs and graminoids. Characteristic species include *Ageratina altissima* (white snakeroot), *Eurybia divaricata* (white wood-aster), *Carex radiata* (eastern star sedge), and a very rich spring ephemeral flora. The presence of *Liriodendron tulipifera* (tuliptree), *Fraxinus profunda* (pumpkin ash), and *Mertensia virginica* (Virginia bluebells) differentiate this type from similar associations in the alliance.

**Characteristic Species:** *Ageratina altissima* (white snakeroot), *Carex radiata* (eastern star sedge), *Eurybia divaricata* (white wood-aster), *Fraxinus profunda* (pumpkin ash), *Mertensia virginica* (Virginia bluebells)

**Dynamics/Successional Trajectory:** Flood frequency, intensity, and duration influence the vegetation structure and composition of this type.

**Reference Sites:** Wainford on Crosswicks Creek, Monmouth County Park, NJ; Hogback in the Delaware Water Gap National Recreational Area, PA

**Global and State Conservation Ranks and Reasons:** GNR (21-Sep-2005). DE: SNR, NJ: SNR, PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.787703](http://vegbank.org/natureserve/element_global.2.787703)

**References:** Breden 1989, Breden et al. 2001, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Eyre 1980, Hupp 1982, Hupp 1986, McAvoy pers. comm., NAP pers. comm. 1998, Perles pers. comm., Podniesinski pers. comm., Rawinski 1984, Shreve 1910, Sperduto and Crowley 2002a, Thompson 1996

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Liriodendron tulipifera</i> (tuliptree)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Lindera benzoin</i> (northern spicebush)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Viburnum prunifolium</i> (smooth blackhaw)

## NORTHEASTERN BUTTONBUSH SHRUB SWAMP

*Cephalanthus occidentalis* - *Decodon verticillatus* Shrubland

**Range:** This association includes buttonbush swamps of the eastern and northeastern United States. In the Delaware Estuary, this community occurs in New Jersey, Pennsylvania, and Delaware.

**Environmental Description:** This association includes buttonbush swamps that experience prolonged or semipermanent flooding for much of the growing season with water tables receding below the soil surface only during drought or very late in the growing season. They occur in a



Photo by Pennsylvania Natural Heritage Program

variety of environmental settings including backwater sloughs or oxbow ponds, wet swales in floodplains, pond and lake borders, and small, isolated depressions where water levels recede very slowly, such as those with perched water tables. Soils are often organic mucks or silt loams.

**Vegetation Description:** *Cephalanthus occidentalis* (common buttonbush) is dominant and often monotypic. Occasional associates depend on the environmental setting and most often occur in drier areas. They include *Vaccinium corymbosum* (highbush blueberry), *Rhododendron viscosum* (swamp azalea), *Acer rubrum* (red maple), *Alnus serrulata* (smooth alder), and *Cornus* (dogwood) spp. closer to upland borders; *Acer saccharinum* (silver maple), *Fraxinus pennsylvanica* (green ash), or *Viburnum dentatum* (southern arrow-wood) where adjacent to floodplains; or *Decodon verticillatus* (swamp-loosestrife) and *Spiraea alba var. latifolia* (broadleaf meadowsweet) in more stagnant basins. Herbaceous species tend to be sparse but can include *Glyceria canadensis* (rattlesnake mannagrass), *Dulichium arundinaceum* (threeway sedge), *Carex stricta* (tussock sedge), *Scirpus cyperinus* (woolgrass bulrush), *Thelypteris palustris* (eastern marsh fern), *Alisma plantago-aquatica* (European water-plantain), *Polygonum* (smartweed, knotweed) spp., *Sparganium* (bur-reed) spp., and floating or submerged aquatic species such as *Lemna minor* (lesser duckweed), *Potamogeton natans* (floating pondweed), and *Nuphar lutea ssp. variegata* (variegated yellow pond-lily). Bryophytes, if present, cling to shrub bases and include *Warnstorfia fluitans*, *Drepanocladus aduncus* (drepanocladus moss), or *Sphagnum fallax* (flat-top bogmoss).

**Characteristic Species:** *Cephalanthus occidentalis* (common buttonbush)

**Dynamics/Successional Trajectory:** Seasonal flooding and heavy rains contribute nutrients, sediments, and organic debris to this community. Excessive inputs of any of these can greatly accelerate natural successional processes which are responsible for the conversion of wetlands to terrestrial habitats.

**Management Concerns:** Management would include protection of existing sites, but more importantly, restoration of deepwater shrub swamps where feasible.

**Reference Sites:** Coastal Plain Intermittent Ponds in NJ; Great Marsh, Chester County, PA; Seasonal Ponds, DE

**Global and State Conservation Ranks and Reasons:** G4G5 (8-Dec-2005). DE: SNR, NJ: SNR, PA: SNR. This association is widely distributed in the northeastern U.S. and relatively common in its small-patch setting.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.685066](http://vegbank.org/natureserve/element_global.2.685066)

**References:** Bowman 2000, Breden et al. 2001, CAP pers. comm. 1998, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fike 1999, Fleming et al. 2001, Gawler 2002, Harrison 2004, Harrison pers. comm., Metzler and Barrett 2001, Nichols et al. 2001, Sperduto 2000b, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000

### MOST ABUNDANT SPECIES

STRATUM	LIFEFORM	SPECIES
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Cephalanthus occidentalis</i> (common buttonbush)

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## NORTHEASTERN TEMPERATE COBBLE SCOUR RIVERSHORE

*Carex torta* - *Apocynum cannabinum* - *Cyperus* spp. Herbaceous Vegetation

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**Range:** This association is found from New England south through New York, Pennsylvania and Delaware.

**Environmental Description:** This community occurs on cobble, gravel, and sand bars or banks of streams and rivers with medium to high gradients. Seasonal flooding and ice-scour maintain the open nature of these communities.

**Vegetation Description:** Vegetation can be sparse to dense depending on degree of flooding and length of exposure. Characteristic perennial species that tolerate inundation and flood scouring include *Carex torta* (twisted sedge) and low *Salix* (willow) spp.



Photo by Delaware Natural Heritage Program

Associated species tend to vary widely from site to site, can be diverse, and may be sparse; they include *Apocynum cannabinum* (Indian-hemp), *Verbena hastata* (swamp verbena), *Symphotrichum puniceum* (purple-stem aster), *Doellingeria umbellata* (parasol whitetop), *Solidago rugosa* (wrinkleleaf goldenrod), *Solidago canadensis* (Canada goldenrod), *Solidago gigantea* (giant goldenrod), *Calamagrostis canadensis* (bluejoint), *Phalaris arundinacea* (reed canarygrass), *Scirpus expansus* (woodland bulrush), *Scirpus cyperinus* (woolgrass bulrush), *Thelypteris palustris* (eastern marsh fern), *Scutellaria lateriflora* (blue skullcap), *Dichanthelium clandestinum* (deer-tongue witchgrass), *Eupatorium maculatum* (spotted joe-pyeweed), *Eupatorium perfoliatum* (common boneset), *Elymus riparius* (riverbank wild rye), *Cyperus strigosus* (straw-colored flatsedge) and other *Cyperus* (flatsedge) spp., *Eleocharis* (spikerush) spp., *Lobelia cardinalis* (cardinal-flower), *Onoclea sensibilis* (sensitive fern), *Viola* (violet) spp., *Clematis virginiana* (virgin's-bower), *Polygonum amphibium* (water smartweed), *Polygonum hydropiper* (marsh-pepper knotweed), *Polygonum pennsylvanicum* (Pennsylvania smartweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Polygonum persicaria* (spotted lady's-thumb), *Polygonum lapathifolium* (pale smartweed), *Schizachyrium scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), and occasionally *Sanguisorba canadensis* (Canada burnet). Scattered, battered and stunted shrubs and trees can occur, including *Salix sericea* (silky willow), *Salix eriocephala* (Missouri willow), *Cornus amomum* (silky dogwood), *Betula nigra* (river birch), *Populus deltoides* (eastern cottonwood), and *Platanus occidentalis* (sycamore). Nonvascular plants can be sparse, but where present can include *Bryum* (bryum moss) spp.

**Characteristic Species:** *Apocynum cannabinum* (Indian-hemp), *Carex torta* (twisted sedge)

**Dynamics/Successional Trajectory:** These are highly dynamic communities with regular disturbance from flooding and ice-scour. Vegetation cover can be inversely proportional to inundation and scour.

**Management Concerns:** This association is particularly susceptible to invasive exotic species such as *Tussilago farfara* (colt's-foot), *Lythrum salicaria* (purple loosestrife), *Polygonum cuspidatum* (Japanese knotweed), *Polygonum persicaria* (spotted lady's-thumb), and *Microstegium vimineum* (Japanese stiltgrass). In addition, alteration in flow regime may affect the species composition and vegetation structure in this community.

**Reference Sites:** White Clay Creek, DE; Lycoming Creek, Lycoming County, PA

**Global and State Conservation Ranks and Reasons:** G4G5 (2-Feb-2005). DE: SNR, PA: SNR. This community is common in tributaries in the upper portions of watersheds. The rank within Pennsylvania is S3; considering its whole range, its rank should probably be changed to G5.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.684638](http://vegbank.org/natureserve/element_global.2.684638)

**References:** Bowman 2000, Eastern Ecology Working Group n.d., Edinger et al. 2002, Metzler and Barrett 2001, Nichols et al. 2001, Perles et al. 2004, Sperduto and Nichols 2004, Swain and Kearsley 2000, Thompson 1996, Thompson and Sorenson 2000

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Graminoid	<i>Carex torta</i> (twisted sedge)

### RED MAPLE - GREEN ASH FORESTED SWAMP

*Acer rubrum* - *Fraxinus pennsylvanica* / *Boehmeria cylindrica* Forest

**Range:** This community occurs within the New Jersey and Pennsylvania portions of the Delaware Estuary and possibly Delaware's portion as well.

**Environmental Description:** These communities are found on water-deposited clay or loamy sediments on oxbows or floodplains of rivers and large perennial streams. Soils are flooded or saturated for a significant portion of the growing season. Water may be ponded in shallow depressions for most of the year.

**Vegetation Description:** In the Central Appalachians these are closed-canopy deciduous floodplain forests characterized by abundant *Acer rubrum* (red maple) and *Fraxinus pennsylvanica* (green ash) with associates *Quercus palustris* (pin oak), *Quercus bicolor* (swamp white oak), *Ulmus americana* (American elm), *Acer saccharinum* (silver maple), and *Platanus occidentalis* (sycamore). The diverse shrub layer includes *Carpinus caroliniana* (American hornbeam), *Cephalanthus occidentalis* (common buttonbush), and *Cornus amomum* (silky dogwood). The herbaceous layer is usually well-developed and may include *Boehmeria cylindrica* (small-spike false nettle), *Symplocarpus foetidus* (skunk-cabbage), *Carex* (sedge) spp., *Glyceria* (mannagrass) spp., *Juncus* (rush) spp., *Laportea canadensis* (Canadian wood-nettle), *Leersia* (cutgrass) spp., *Pilea pumila* (Canadian clearweed), *Impatiens capensis* (orange jewelweed), *Urtica* (nettle) spp., *Elymus* (wild rye) spp., and exotics. Vines are characteristic, including *Vitis* (grape) spp., *Toxicodendron radicans* (eastern poison-ivy), and *Parthenocissus quinquefolia* (Virginia creeper).

**Characteristic Species:** *Acer rubrum* (red maple), *Boehmeria cylindrica* (small-spike false nettle), *Carpinus caroliniana* (American hornbeam), *Fraxinus pennsylvanica* (green ash)

**Management Concerns:** The herbaceous layer of this community is typically invaded by exotics.

**Reference Sites:** none identified

**Global and State Conservation Ranks and Reasons:** GNR (8-Jul-1999). DE?:SNA, NJ: SNR, PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.686717](http://vegbank.org/natureserve/element_global.2.686717)

**References:** Eastern Ecology Working Group n.d.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
Tree canopy	Broad-leaved deciduous tree	<i>Fraxinus pennsylvanica</i> (green ash)
Tall shrub/sapling	Broad-leaved deciduous shrub	<i>Carpinus caroliniana</i> (American hornbeam)

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## RIVER BIRCH LOW FLOODPLAIN FOREST

*Betula nigra* - *Platanus occidentalis* / *Impatiens capensis* Forest

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**Range:** This floodplain forest occurs in the Mid-Atlantic states including New Jersey, Pennsylvania and possibly Delaware.

**Environmental Description:** This floodplain forest can be found in large and moderately large rivers and their tributaries. It occurs on sandy, gravelly, well-drained soils of levees, gravel bars, islands, braided channels and other areas of frequent flooding. The substrate is usually coarse sand and gravel often with inclusions of cobble-lined scour channels.

**Vegetation Description:** The tree canopy is well-developed and dominated by *Betula nigra* (river birch) and *Platanus occidentalis* (sycamore), with associates including *Acer negundo* (box-elder) and occasionally *Acer saccharinum* (silver maple). The shrub layer includes *Carpinus caroliniana* (American hornbeam), *Lindera benzoin* (northern spicebush), *Cornus amomum* (silky dogwood), and *Alnus* (alder) spp. The vine and herb layers are lush and diverse and may include *Boehmeria cylindrica* (small-spike false nettle), *Elymus hystrix* (bottlebrush grass), *Stellaria pubera* (great chickweed), *Impatiens capensis* (orange jewelweed), *Impatiens pallida* (yellow jewelweed), *Laportea canadensis* (Canadian wood-nettle), *Pilea pumila* (Canadian clearweed), *Thelypteris palustris* (eastern marsh fern), *Toxicodendron radicans* (eastern poison-ivy), *Parthenocissus quinquefolia* (Virginia creeper), *Vitis rotundifolia* (muscadine) or *Vitis riparia* (riverbank grape), *Chasmanthium latifolium* (river-oats), *Podophyllum peltatum* (mayapple), *Polygonum virginianum* (jumpseed), *Apocynum cannabinum* (Indian-hemp), and *Urtica* (nettle) sp.

**Characteristic Species:** *Betula nigra* (river birch), *Impatiens capensis* (orange jewelweed)

**Management Concerns:** Exotic species are typical and may include *Lysimachia* (loosestrife) sp., *Microstegium vimineum* (Japanese stiltgrass), *Lonicera japonica* (Japanese honeysuckle), *Lonicera morrowii* (Morrow's honeysuckle), *Polygonum cuspidatum* (Japanese knotweed), and *Alliaria petiolata* (garlic mustard).

**Reference Sites:** Blackbird Creek, DE (?); Rancocas State Park, NJ; Kettle Creek, Clinton County, PA

**Global and State Conservation Ranks and Reasons:** GNR (1-Dec-1997). DE: SNR, NJ: SNR, PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.686338](http://vegbank.org/natureserve/element_global.2.686338)

**References:** Bartgis 1986, Bowman 2000, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Harrison 2004, Podnieszinski and Wagner 2002, Thomson et al. 1999

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Betula nigra</i> (river birch)
Tree canopy	Broad-leaved deciduous tree	<i>Platanus occidentalis</i> (sycamore)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Cornus amomum</i> (silky dogwood)

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## SILVER MAPLE - ELM FOREST

*Acer saccharinum* - *Ulmus americana* Forest

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**Range:** This association is found throughout the midwestern United States and parts of the eastern United States, ranging from Pennsylvania west to Minnesota, and south to Arkansas. It also occurs in all three states of the Delaware Estuary.

**Environmental Description:** This community occurs on temporarily flooded soils along major rivers and smaller perennial streams. Soils may be well-drained and sandy, more loamy on infrequently flooded bottomlands and levees, or deep silts on stabilized sites along larger rivers. The structure and composition of the type is influenced by the flooding regime. Floods leave river-deposited debris on the forest floor, ice scars on trees, and abandoned channels that retain water at or above the level of the main river channel.



Photo by Pennsylvania Natural Heritage Program

**Vegetation Description:** Canopy cover is more-or-less closed and dominated by *Acer saccharinum* (silver maple). Codominants may include *Platanus occidentalis* (sycamore), *Acer negundo* (box-elder), and *Betula nigra* (river birch). Associated species may include *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Salix nigra* (black willow), *Celtis occidentalis* (common hackberry), and *Fraxinus pennsylvanica* (green ash). The shrub and sapling layer is often open (<25% cover). Species that may be present include *Sambucus canadensis* (American elder) or *Lindera benzoin* (northern spicebush). Woody and herbaceous vines can be prominent, including, among the woody vines, *Parthenocissus quinquefolia* (Virginia creeper) and *Vitis riparia* (riverbank grape). Herbaceous vines species include *Apios americana* (groundnut), *Amphicarpaea bracteata* (American hog-peanut), and *Echinocystis lobata* (wild cucumber). Herbaceous grasses, forbs, and ferns dominate the ground layer, including *Symphotrichum lateriflorum* (calico aster), *Boehmeria cylindrica* (small-spike false nettle), *Elymus virginicus* (Virginia wild rye), *Impatiens pallida* (yellow jewelweed), *Laportea canadensis* (Canadian wood-nettle), *Matteuccia struthiopteris* (ostrich fern), *Onoclea sensibilis* (sensitive fern), *Pilea pumila* (Canadian clearweed), *Urtica dioica* (stinging nettle), and others.

**Characteristic Species:** *Acer saccharinum* (silver maple)

**Dynamics/Successional Trajectory:** The structure and composition of the type is influenced by the flooding regime, which is typically an annual flooding of relatively brief duration (several weeks), but may be absent in dry years or extensive during flash-flood years. Floods leave river-deposited debris on the forest floor, ice scars on trees, and abandoned channels that retain water at or above the level of the main river channel.

**Management Concerns:** Many of the forest stands have been impacted by drainage and conversion to agricultural land, logging, channel dredging, and dam construction. This can lead to changes in tree dominants and ground flora. *Acer negundo* (box-elder) is an increasingly common component of floodplain forests because of human disturbance, while *Ulmus americana* (American elm) has declined because of Dutch elm disease (MNNHP 1993). A variety of exotics may be present, including *Lysimachia* (loosestrife) spp., *Microstegium vimineum* (Japanese stiltgrass), *Polygonum cuspidatum* (Japanese knotweed), *Rosa multiflora* (multiflora rose), and *Lonicera japonica* (Japanese honeysuckle) (MNNHP 1993, Anderson 1996, Central Appalachian Ecoregional Team pers. comm. 1998). *Polygonum*

*cuspidatum* (Japanese knotweed) is a serious problem invasive plant species in this community type within the Delaware and Pennsylvania portions of the Delaware Estuary.

**Reference Sites:** Christiana River, DE; White Clay Creek, DE; Delaware Water Gap, PA (outside estuary); Crosswicks Creek at Provinceline Road, NJ; near Namanock Island in the Delaware Water Gap National Recreation Area, PA; Shapnack Island in the Delaware Water Gap National Recreation Area, PA

**Global and State Conservation Ranks and Reasons:** G4? (3-Oct-1996). DE: SNR, NJ: SNR, PA: SNR. There has been significant conversion of stands to agriculture, hydrologic modifications due to river dams, etc., and siltation caused by modified flooding regimes.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.686814](http://vegbank.org/natureserve/element_global.2.686814)

**References:** Anderson 1996, CAP pers. comm. 1998, Eyre 1980, Fike 1999, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., TDNH unpubl. data, WINHIP unpubl. data, WPC and TNC 2002

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Acer negundo</i> (box-elder)
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharinum</i> (silver maple)
Tree canopy	Broad-leaved deciduous tree	<i>Betula nigra</i> (river birch)
Tree canopy	Broad-leaved deciduous tree	<i>Platanus occidentalis</i> (sycamore)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Lindera benzoin</i> (northern spicebush)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Sambucus canadensis</i> (American elder)
Herb (field)	Forb	<i>Symphotrichum lateriflorum</i> (calico aster)

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### SMALL RIVER RED MAPLE - ELM FLOODPLAIN FOREST

*Acer (rubrum, saccharinum) - Ulmus americana* Forest

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**Range:** This floodplain community occurs within the Lower New England/Piedmont ecoregion within New Hampshire, Rhode Island, Massachusetts, New Jersey and Pennsylvania.

**Environmental Description:** This is a floodplain community that occurs often within the lower alluvial terraces, backwaters, bars, and islands of minor rivers and smaller tributaries, creeks and drainages. The terrain is relatively flat, and hummock-and-hollow microtopography is absent or poorly developed.

**Vegetation Description:** The canopy is typically dominated by either *Acer rubrum* (red maple) or, less commonly, by *Acer saccharinum* (silver maple). *Ulmus americana* (American elm) occurs as an associate in the canopy and/or subcanopy. *Fraxinus americana* (white ash) (to the north) or *Fraxinus pennsylvanica* (green ash) (to the south) may also be present in the subcanopy. The shrub layer is generally sparse, containing canopy species and occasional wetland shrubs, such as *Cornus amomum* (silky dogwood), *Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (common winterberry), *Lindera benzoin* (northern spicebush), and *Cephalanthus occidentalis* (common buttonbush). *Onoclea sensibilis* (sensitive fern) and *Boehmeria cylindrica* (small-spike false nettle) are characteristic in the herb layer. Other herbs that may be present include *Impatiens capensis* (orange jewelweed), *Phalaris arundinacea* (reed canarygrass), *Osmunda regalis* var. *spectabilis* (royal fern), *Carex crinita* (fringed sedge), *Lythrum salicaria* (purple loosestrife), *Cinna arundinacea* (sweet woodreed), and *Matteuccia struthiopteris* (ostrich fern).

**Characteristic Species:** *Acer rubrum* (red maple), *Boehmeria cylindrica* (small-spike false nettle), *Onoclea sensibilis* (sensitive fern), *Ulmus americana* (American elm)

**Dynamics/Successional Trajectory:** This community is adapted to the periodic flooding of the associated river or stream system. The soil is saturated for at least part of the growing season and may stay inundated for extended periods of time.

**Reference Sites:** None identified, but PA and NJ both have sites.

**Global and State Conservation Ranks and Reasons:** GNR (8-Nov-2000). NJ: SNR, PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.688249](http://vegbank.org/natureserve/element_global.2.688249)

**References:** Barrett and Enser 1997, Collins and Anderson 1994, Eastern Ecology Working Group n.d., Fike 1999, Sperduto and Nichols 2004

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
Tree canopy	Broad-leaved deciduous tree	<i>Ulmus americana</i> (American elm)
Tree subcanopy	Broad-leaved deciduous tree	<i>Fraxinus pennsylvanica</i> (green ash)
Herb (field)	Fern or fern ally	<i>Onoclea sensibilis</i> (sensitive fern)

## WATER-WILLOW ROCKY BAR AND SHORE

*Justicia americana* Herbaceous Vegetation

**Range:** This type is found primarily in the Piedmont, Interior Low Plateau, Cumberland Plateau, Ozarks, Ouachita Mountains, and adjacent provinces. It ranges from Alabama, Georgia and the Carolinas west to Arkansas and Oklahoma and north to Ohio, Pennsylvania, and Delaware. It occurs in Pennsylvania's portion of the Delaware Estuary.

**Environmental Description:** This association occurs on the heads of islands, along the edges of bars, banks, terraces and spits, and in shallow sections of river channels. The lower portion of the *Justicia* (water-willow) stems are under water for most of the year, with the tops of the plants emerging above the flowing water. These beds are entirely submerged by most flood events. During extreme low water periods, the soil below the beds can be exposed, showing a varied mixture of sand, gravel, cobbles, silt, and/or muck.



Photo by Pennsylvania Natural Heritage Program

**Vegetation Description:** *Justicia americana* (American water-willow) is the characteristic dominant. Since *Justicia americana* (American water-willow) spreads by rhizomes, it can form extensive monocultural colonies. *Saururus cernuus* (lizard's-tail) is often present and may be codominant. Other herbaceous species that may be present include *Diodia teres* (rough buttonweed), *Leersia oryzoides* (rice cutgrass), *Lemna minor* (lesser duckweed), *Podostemum ceratophyllum* (riverweed), *Scirpus* (bulrush) sp., *Schoenoplectus pungens* (common threesquare), *Cyperus* (flatsedge) spp., and *Eleocharis* (spikerush) spp. Exotics include *Lythrum salicaria* (purple loosestrife) and *Lysimachia vulgaris* (garden loosestrife). In some areas, *Justicia* (water-willow) usually grows in nearly pure patches, so that few other species are associated with it. *Hibiscus laevis* (halberd-leaf rosemallow), *Polygonum amphibium* (water smartweed), *Rorippa sylvestris* (creeping yellowcress), *Bidens* (beggarticks) spp., *Cuscuta gronovii* (scaldweed), *Mimulus ringens* (Allegheny monkeyflower), *Polygonum* (smartweed, knotweed) spp.,

*Rumex* (dock, sorrel) spp., and *Salix interior* (sandbar willow) can occur (Anderson 1982). A few scattered seedlings may be present, including *Betula nigra* (river birch), *Salix* (willow) spp., *Acer saccharinum* (silver maple), and *Platanus occidentalis* (sycamore).

**Characteristic Species:** *Justicia americana* (American water-willow)

**Dynamics/Successional Trajectory:** Stands in some situations may be obliterated by ongoing river channeling. Anderson (1982) describes some of the life-history characteristics of *Justicia americana* (American water-willow) that allow it to persist in river channels.

**Management Concerns:** This association is susceptible to invasion by *Lythrum salicaria* (purple loosestrife) and *Lysimachia vulgaris* (garden loosestrife).

**Reference Sites:** Dark Hollow County Park, Bucks County, PA

**Global and State Conservation Ranks and Reasons:** G4G5 (12-Sep-1997). PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.685634](http://vegbank.org/natureserve/element_global.2.685634)

**References:** Allard 1990, Anderson 1982, Anderson 1996, Fike 1999, Fleming et al. 2001, Harrison 2004, Hoagland 1997, Hoagland 2000, Major et al. 1999, McCoy 1958, Nelson 1986, OHNHD unpubl. data, Palmer-Ball et al. 1988, Peet et al. unpubl. data 2002, Penfound 1953, Perles et al. 2004, Schafale 1998b, Schafale 2002, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, TNC and WPC 2004

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Forb	<i>Justicia americana</i> (American water-willow)
Herb (field)	Forb	<i>Saururus cernuus</i> (lizard's-tail)