

---

## **ECOLOGICAL SYSTEM: CENTRAL APPALACHIAN RIPARIAN**

---

**Summary:** This riparian system ranges from southern New England to Virginia and West Virginia and occurs over a wide range of elevations. It develops on floodplains and shores along river channels that lack a broad flat floodplain due to steeper sideslopes, higher gradient, or both. Flooding is the major process affecting the vegetation, but compared to flat floodplain areas, the substrate is more rapidly drained, and deposition is less important than erosion. The vegetation is a mosaic of forest, woodland, shrubland, and herbaceous communities. Common trees include *Betula nigra* (river birch), *Platanus occidentalis* (sycamore), and *Acer negundo* (box-elder). Open, flood-scoured rivershore prairies feature *Panicum virgatum* (switchgrass) and *Andropogon gerardii* (big bluestem), and *Carex torta* (twisted sedge) is typical of wetter areas near the channel.

**High-ranked Species:** *Bryoerythrophyllum ferruginascens* (G3G4), *Canis rufus* (G1Q, red wolf), *Catocala marmorata* (G3G4, marbled underwing), *Cicindela ancocisconensis* (G3, Appalachian tiger beetle), *Desmognathus aeneus* (G3G4, seepage salamander), *Desmognathus wrightii* (G3G4, pygmy salamander), *Fissidens appalachensis* (G2G3), *Gymnoderma lineare* (G2, rock gnome lichen), *Hasteola suaveolens* (G3, false Indian-plantain), *Hexastylis naniflora* (G3, dwarf-flower heartleaf), *Hexastylis rhombiformis* (G2, french broad heartleaf), *Hexastylis shuttleworthii* var. *harperi* (G4T3, harper's heartleaf), *Isotria medeoloides* (G2, small whorled pogonia), *Jamesianthus alabamensis* (G3, alabama warbonnet), *Lejeunea blomquistii* (G1G2, blomquist leafy liverwort), *Lysimachia fraseri* (G2, Fraser's loosestrife), *Marshallia grandiflora* (G2, monongahela barbara's-buttons), *Megaceros aenigmaticus* (G2G3), *Myotis austroriparius* (G3G4, southeastern myotis), *Plethodon hubrichti* (G2, peaks of otter salamander), *Plethodon punctatus* (G3, white-spotted salamander), *Sagittaria secundifolia* (G1, little river arrowhead), *Spiraea virginiana* (G2, Virginia spiraea), *Trillium rugelii* (G3, ill-scented wakerobin), *Waldsteinia lobata* (G2, lobed barren-strawberry)

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

### **Delaware Estuary Associations:**

- Birch - Willow Riverbank Shrubland
- Coastal Plain Oak Floodplain Swamp
- Fall-line Riverwash Bedrock Prairie
- Loosestrife - Dogbane Scoured Rivershore
- Northeastern Temperate Cobble Scour Rivershore
- Rocky Bar and Shore (Riverweed Type)
- Successional Aspen - Gray Birch Forest
- Water-willow Rocky Bar and Shore
- Willow River-Bar Shrubland

## Similar Ecological Systems in the Delaware Estuary:

- Central Appalachian Floodplain

### CLASSIFIERS FOR CENTRAL APPALACHIAN RIPARIAN

**Primary Division:** 202

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

**Spatial Scale & Pattern:** Linear

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

**Diagnostic Classifiers:** Lowland; Riverine / Alluvial; Very Short Disturbance Interval; Flood Scouring; Intermittent Flooding

**Non-diagnostic Classifiers:** Forest and Woodland (Treed); Sideslope; Toeslope/Valley Bottom; Temperate;

Mesotrophic Soil; Udic; Ustic; Short (<5 yrs) Flooding Interval; Short (50-100 yrs) Persistence

## BIRCH - WILLOW RIVERBANK SHRUBLAND

*Betula nigra* - *Platanus occidentalis* - *Salix* (*interior*, *caroliniana*) Shrubland

**Range:** This shrubland is found in the High Allegheny Plateau and Central Appalachian ecoregions from West Virginia, Maryland (and possibly Virginia) north to New York. It is also attributed to the Western Allegheny Plateau and occurs in Pennsylvania within the Delaware Estuary.

**Environmental Description:** This early-successional community occurs on riverbank floodplains and river gravel bars and islands and is subject to periodic flooding and ice-scour. It occurs on sand, gravel or cobble deposits.



Photo by Pennsylvania Natural Heritage Program

**Vegetation Description:** This association is dominated by stunted and often battered trees and shrubs (less than 5 m tall) that can include *Acer saccharinum* (silver maple), *Platanus occidentalis* (sycamore), *Betula nigra* (river birch), *Acer negundo* (box-elder), *Fraxinus* (ash) spp., *Populus deltoides* (eastern cottonwood), and *Ulmus americana* (American elm). *Betula nigra* (river birch) is characteristic and often dominant. Associates include *Cornus amomum* (silky dogwood), *Salix nigra* (black willow), *Salix interior* (sandbar willow), *Salix sericea* (silky willow), *Alnus serrulata* (smooth alder), and sometimes *Cephalanthus occidentalis* (common buttonbush) or *Physocarpus opulifolius* (eastern ninebark). Characteristic herbs include *Apocynum cannabinum* (Indian-hemp), *Polygonum virginianum* (jumpseed), *Eupatorium* (boneset, joe-pyeweed, thoroughwort) spp., *Hypericum* (St. John's-wort) spp., *Bidens* (beggarticks) spp., *Sorghastrum nutans* (yellow Indiangrass), *Andropogon gerardii* (big bluestem), and *Justicia americana* (American water-willow). Exotics such as *Lythrum salicaria* (purple loosestrife) and *Polygonum cuspidatum* (Japanese knotweed) are a frequent problem.

**Characteristic Species:** *Apocynum cannabinum* (Indian-hemp), *Betula nigra* (river birch)

**Dynamics/Successional Trajectory:** This association is maintained as a shrubland by frequent scour from floodwaters and ice.

**Management Concerns:** This association is susceptible to invasive exotic species such as *Lythrum salicaria* (purple loosestrife) and *Polygonum cuspidatum* (Japanese knotweed). Alteration of flow regimes may affect the species composition and vegetation structure of this type.

**Reference Sites:** Woodcock Bar Island in the Delaware Water Gap National Recreation Area, NJ

**Global and State Conservation Ranks and Reasons:** G4G5 (1-Dec-1997). NJ: SNR, PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.687668](http://vegbank.org/natureserve/element_global.2.687668)

**References:** CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Harrison 2004, Kartesz 1999, Perles et al. 2004, TNC and WPC 2004

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)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Salix exigua</i> ssp. <i>interior</i> (sandbar willow)

## 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), *Symphotrichum 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)

## FALL-LINE RIVERWASH BEDROCK PRAIRIE

*Andropogon gerardii* - *Panicum virgatum* - *Baptisia australis* Herbaceous Vegetation

**Range:** This riverwash grassland community is found in the east-central United States, from Pennsylvania, West Virginia, Virginia, and possibly Ohio.

**Environmental Description:** Stands occur only along high-gradient sections of major rivers, such as on low islands, in gorges and along the fall-line. They occur within the active channel shelf at an intermediate level above the low-water level and the bank-full level. Flood scouring and river ice may become powerful and ecologically important abrasive forces along the riverbanks. Soils are rapidly drained Psamments. Often, soil material is restricted to the narrow interstices of tightly packed boulders or to small crevices in bedrock exposures.



Photo by Pennsylvania Natural Heritage Program

**Vegetation Description:** This community is characterized by a luxuriant growth of the robust grasses *Andropogon gerardii* (big bluestem), *Sorghastrum nutans* (yellow Indiangrass), *Panicum virgatum* (switchgrass), *Schizachyrium scoparium* (little bluestem), and *Spartina pectinata* (prairie cordgrass), which resembles prairie vegetation. *Tripsacum dactyloides* (eastern gammagrass) may also occur. Many of the forbs are also typical of prairies. Characteristic species include *Toxicodendron radicans* (eastern poison-ivy), *Cerastium arvense* (field chickweed), *Coreopsis tripteris* (tall tickseed), *Phlox divaricata* (wild blue phlox), *Pycnanthemum virginianum* (Virginia mountainmint), *Apocynum* (dogbane, Indian-hemp) spp., *Lespedeza* (bushclover) spp., *Phalaris arundinacea* (reed canarygrass), *Solidago speciosa* (showy goldenrod), *Teucrium canadense* (American germander), *Veronicastrum virginicum* (culver's-root), *Vicia americana* (American purple vetch), and *Zizia aurea* (golden alexanders). Scattered shrubs also may be present, including *Betula nigra* (river birch), *Salix* (willow) spp., and *Platanus occidentalis* (sycamore).

**Noteworthy Associated Plant and/or Animal Species:** *Prunus pumila* var. *depressa* (sand cherry), *Vicia americana* (American purple vetch)

**Characteristic Species:** *Andropogon gerardii* (big bluestem), *Panicum virgatum* (switchgrass), *Schizachyrium scoparium* (little bluestem), *Sorghastrum nutans* (yellow Indiangrass), *Spartina pectinata* (prairie cordgrass)

**Dynamics/Successional Trajectory:** Flash floods actively scour the floodplain, keeping the vegetation open.

**Management Concerns:** This community is threatened by invasion of exotic weeds, especially *Sorghum halepense* (Johnson grass), *Centaurea biebersteinii* (spotted knapweed), and *Lythrum salicaria* (purple loosestrife).

**Reference Sites:** Shapnack Island in the Delaware Water Gap National Recreation Area, PA

**Global and State Conservation Ranks and Reasons:** G2G3 (14-Dec-1998). PA: SNR. There are probably fewer than 100 occurrences of this community rangewide, depending on how an occurrence is defined. It is known from Maryland, the District of Columbia, and Virginia along the Potomac River, from the James River, Shenandoah River, and various tributaries in Virginia, and from about 50 miles along the Greenbrier River in West Virginia. It is also reported from the Delaware River in Pennsylvania and may also occur in Ohio.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.688945](http://vegbank.org/natureserve/element_global.2.688945)

**References:** Eastern Ecology Working Group n.d., Fike 1999, Fleming and Coulling 2001, Fleming et al. 2001, Grossman et al. 1994, Harrison 2004, Lea 2000, Perles et al. 2004, Rawinski 1988, Rawinski et al. 1996, TDNH unpubl. data, VDNH 2003

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Graminoid	<i>Andropogon gerardii</i> (big bluestem)
Herb (field)	Graminoid	<i>Panicum virgatum</i> (switchgrass)
Herb (field)	Graminoid	<i>Schizachyrium scoparium</i> (little bluestem)
Herb (field)	Graminoid	<i>Sorghastrum nutans</i> (yellow Indiangrass)

---

### LOOSESTRIFE - DOGBANE SCoured RIVERSHORE

*Lysimachia ciliata* - *Apocynum cannabinum* Sparse Vegetation

---

**Range:** This community is found throughout the Delaware Watershed, on all orders of streams, and in a wide variety of riverine settings.

**Environmental Description:** Island heads, bars, spits, low terraces, and riverbanks are all home to this broadly defined community. The underlying substrate also varies greatly, although it is often cobbles and sand, with thin deposits of silt, muck or organic matter. Species composition also varies greatly from site to site. The unifying factor that bridges the differences in environmental factors and species composition is the frequent scour that these sites experience. This community establishes in areas of the active channel that are underwater for the majority of the year and are exposed only at low water or in drought years. Therefore, these areas are subjected to high water velocities, floods and ice-scour more frequently than the other herbaceous communities or shrublands described in this report (with the exception of the emergent beds). The constant scour removes established vegetation and maintains or creates exposed sediments, cobbles or bedrock. New seeds and plant propagules are constantly being dispersed to these areas by water, air and animals. This causes a continual flux in species composition that is characteristic of this community.

**Vegetation Description:** Frequent disturbance of these areas creates conditions that promote continual colonization by a wide variety of plants. After a disturbance, herbaceous and graminoid species may establish sparsely across bare substrate. As more time elapses between disturbance events, vegetation can become dense, completely covering the area. The species composition of the community varies depending upon the available seed bank, surrounding vegetation, type of substrate, ecoregion, and hydrologic conditions. Not all of the species listed below will be present at the same site. In general, species composition at a particular site will tend to favor species either towards the beginning of the list or towards the end of the list. However, many combinations and variations in species composition are possible. Some of the common species are *Cyperus* (flatsedge) spp., *Equisetum arvense* (field horsetail), *Eleocharis* (spikerush) spp., *Schoenoplectus pungens* (common threesquare), *Juncus* (rush) spp., *Justicia americana* (American water-willow), *Sagittaria latifolia* (broadleaf arrowhead), *Ludwigia palustris* (marsh seedbox), *Rorippa sylvestris* (creeping yellowcress), *Chamaesyce maculata* (spotted sandmat), *Hydrocotyle americana* (American marsh pennywort), *Rhexia virginica* (Virginia meadowbeauty), *Mollugo verticillata* (green carpetweed), *Polygonum amphibium* (water smartweed), *Polygonum pensylvanicum*

(Pennsylvania smartweed), *Polygonum hydropiper* (marsh-pepper knotweed), *Polygonum sagittatum* (arrowleaf tearthumb), *Polygonum caespitosum* (oriental lady's-thumb), *Polygonum persicaria* (spotted lady's-thumb), *Calystegia sepium* (hedge false bindweed), *Pilea pumila* (Canadian clearweed), *Galium* (bedstraw) spp., *Onoclea sensibilis* (sensitive fern), *Leersia oryzoides* (rice cutgrass), *Leersia virginica* (white cutgrass), *Setaria* (bristleglass) spp., *Packera aurea* (golden ragwort), *Epilobium ciliatum* ssp. *glandulosum* (fringed willowherb), *Lysimachia vulgaris* (garden loosestrife), *Lysimachia terrestris* (swamp-candles), *Lysimachia ciliata* (fringed loosestrife), *Mimulus ringens* (Allegheny monkeyflower), *Lindernia dubia* (yellowseed false pimpernel), *Apocynum cannabinum* (Indian-hemp), *Apocynum androsaemifolium* (spreading dogbane), *Bidens frondosa* (devil's pitchfork), *Bidens connata* (purple-stem beggarticks), *Boehmeria cylindrica* (small-spike false nettle), *Impatiens capensis* (orange jewelweed), *Hibiscus laevis* (halberd-leaf rosemallow), *Lythrum salicaria* (purple loosestrife), *Lycopus uniflorus* (northern bugleweed), *Lobelia cardinalis* (cardinal-flower), *Triadenum virginicum* (Virginia marsh St. John's-wort), *Hypericum mutilum* (dwarf St. John's-wort), *Hypericum ellipticum* (pale St. John's-wort), *Solidago gigantea* (giant goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Euthamia graminifolia* (flat-top goldentop), *Viola* (violet) spp., *Mentha arvensis* (wild mint), *Mentha X gracilis*(= *Mentha gentilis*), *Eupatorium perfoliatum* (common boneset), *Eupatorium maculatum* (spotted joe-pyeweed), *Verbena hastata* (swamp verbena), *Verbena urticifolia* (white vervain), *Asclepias incarnata* (swamp milkweed), *Heliopsis helianthoides* (smooth oxeye), *Coreopsis tinctoria* (golden tickseed), *Doellingeria umbellata* (parasol whitetop), *Symphotrichum lateriflorum* (calico aster), *Pycnanthemum virginianum* (Virginia mountainmint), *Carex lacustris* (lake sedge), *Carex torta* (twisted sedge), *Sorghastrum nutans* (yellow Indiangrass), *Andropogon gerardii* (big bluestem), *Echinochloa muricata* (rough barnyard grass)

**Characteristic Species:** *Apocynum cannabinum* (Indian-hemp), *Lysimachia ciliata* (fringed loosestrife)

**Dynamics/Successional Trajectory:** The unifying factor that bridges the differences in environmental factors and species composition is the frequent scour that these sites experience. This community establishes in areas of the active channel that are underwater for the majority of the year and are exposed only at low water or in drought years. Therefore, these areas are subjected to high water velocities, floods and ice-scour more frequently than the many other riverine herbaceous- or shrub-dominated communities (with the exception of the emergent beds). The constant scour removes established vegetation and maintains or creates exposed sediments, cobbles or bedrock. New seeds and plant propagules are constantly being dispersed to these areas by water, air and animals. This causes a continual flux in species composition that is characteristic of this community.

**Management Concerns:** This association is difficult to manage due to the constant scour and natural fluctuation in species composition and abundance. However, *Lythrum salicaria* (purple loosestrife) can invade and dominate this community.

**Reference Sites:** This is a difficult type to identify reference sites for in Pennsylvania because the type is extremely variable by definition.

**Global and State Conservation Ranks and Reasons:** GNR (8-Jul-1999). PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.685497](http://vegbank.org/natureserve/element_global.2.685497)

**References:** Eastern Ecology Working Group n.d., Fike 1999, TNC and WPC 2004

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Forb	<i>Lysimachia ciliata</i> (fringed loosestrife)

---

## NORTHEASTERN TEMPERATE COBBLE SCOUR RIVERSHORE

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

---

**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)



Photo by Delaware Natural Heritage Program

spp. 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), *Symphyotrichum 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)

## ROCKY BAR AND SHORE (RIVERWEED TYPE)

*Podostemum ceratophyllum* Herbaceous Vegetation

**Range:** This community is wide-ranging, occurring in rivers throughout the eastern and southeastern United States. Over 140 occurrences of *Podostemum ceratophyllum* (riverweed) have been documented in the upper Delaware River (Kunsman 1994). Its distribution and abundance in the Delaware Estuary study area is significantly less than in the upper Delaware River in Pennsylvania.

**Environmental Description:** This association includes vegetation of shoals in rocky streambeds and riverbeds in mature drainage systems where the streams have cut down to rock, and the floodplain is relatively narrow; or on dams in moderately fast- to fast-flowing water. It tends to be associated with higher pH streams which cut through diabase, limestone or calcareous shales. In the Piedmont region and possibly elsewhere, the occurrence of macrophytic vegetation may be limited by unstable sediments, moderate to high gradients, and large variations in stream flow (Mulholland and Lenat 1992). *Podostemum* (riverweed) is one of the few vascular plants present in Piedmont streams and rivers.

**Vegetation Description:** This vegetation is almost always a monospecific community dominated by *Podostemum ceratophyllum* (riverweed) with no other vascular plants present; some Rhodophyta (red algae) may be present.

**Characteristic Species:** *Podostemum ceratophyllum* (riverweed)

**Dynamics/Successional Trajectory:** *Podostemum* (riverweed) appears to require relatively stable streamflow to accumulate significant biomass; at high nutrient levels filamentous green algae may outcompete it (Mulholland and Lenat 1992). Dense beds of this vegetation may serve as important substratum for a variety of invertebrates and other aquatic species (Nelson and Scott 1962). At least one rare species of snail of the Piedmont drainages, *Somatogyrus virginicus* (panhandle pebblesnail), appears to be very closely tied to the occurrence of good beds of *Podostemum* (riverweed) (B. Adams pers. comm.). Although it is not clear whether the snail is actually dependent on *Podostemum* (riverweed), it could be that *Podostemum* (riverweed) is just a good habitat indicator.

**Management Concerns:** *Podostemum ceratophyllum* (riverweed) is adversely affected by sedimentation and other water pollution, including acid mine drainage. It also appears to be sensitive to nutrient enrichment which may cause this species to be outcompeted by algae.

**Reference Sites:** Woodcock Bar and Arrow Island, Delaware Water Gap National Recreation Area, PA

**Global and State Conservation Ranks and Reasons:** G3G5 (19-Aug-2002). DE: SNR, NJ: SNR, PA: SNR. Although this species appears to have a fairly extensive range across the eastern United States, it is unclear whether all geographic areas supporting the species actually support stands of this association. Secondly, *Podostemum* may be in trouble across large parts of this range. It is very sensitive

to sedimentation and watershed erosion (Mulholland and Lenat 1992). These factors may have contributed to declines of this type in the Piedmont, where it has been lost from many areas historically occupied in drainages such as the Upper Neuse (B. Adams pers. comm.).

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.685056](http://vegbank.org/natureserve/element_global.2.685056)

**References:** Adams pers. comm., Ambrose 1990a, Bowman 2000, Breden et al. 2001, CAP pers. comm. 1998, Campbell et al. 1990, Fleming et al. 2001, Harrison 2004, Hoagland 2000, Jones and Coile 1988, Kunsman 1994, Mulholland and Lenat 1992, Nelson 1986, Nelson and Scott 1962, Peet et al. unpubl. data 2002, Schafale 1998b, Schafale 2002, Schafale and Weakley 1990, Schmalzer and DeSelm 1982, Schotz pers. comm., Smith 1988b, Southeastern Ecology Working Group n.d., Sperduto 2000a, TDNH unpubl. data, Thomas and Allen 1993, Wharton 1978

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Submerged aquatic	Aquatic herb (floating & submergent)	<i>Podostemum ceratophyllum</i> (riverweed)

## SUCCESSIONAL ASPEN - GRAY BIRCH FOREST

*Populus tremuloides* - *Betula populifolia* Forest

**Range:** This community occurs in Pennsylvania in the Delaware Estuary.

**Environmental Description:** This is an early-successional forest type, commonly found on former agricultural land, in areas of ice-scour along streambanks, and where there has been major disturbance resulting in areas of exposed mineral soil. This type may also result from forestry practices that maintain an early-successional stage.

**Vegetation Description:** This type is frequently mixed, but sometimes occurs in nearly pure stands of one of the named species. The birch may be *Betula papyrifera* (paper birch) on more northern sites, or *Betula populifolia* (gray birch) and occasionally *Betula lenta* (sweet birch). The aspen may be *Populus grandidentata* (bigtooth aspen) or *Populus tremuloides* (quaking aspen). Associates include *Sassafras albidum* (sassafras), *Acer* (maple) spp., and *Prunus* (plum, cherry) spp.



Photo by Pennsylvania Natural Heritage Program

**Characteristic Species:** *Betula populifolia* (gray birch), *Populus tremuloides* (quaking aspen)

**Dynamics/Successional Trajectory:** Successional trajectory is uncertain and may be controlled by availability of propagules from adjacent forest stands.

**Management Concerns:** Not a conservation target, early-successional community typical of disturbed land.

**Reference Sites:** Fort Indiantown Gap National Guard Training Center, Lebanon County, PA; Delaware Water Gap National Recreation Area; Valley Forge National Historical Park

**Global and State Conservation Ranks and Reasons:** GNR (8-Jul-1999). PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.688070](http://vegbank.org/natureserve/element_global.2.688070)

**References:** Eastern Ecology Working Group n.d., Fike 1999

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Populus tremuloides</i> (quaking aspen)

## 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)

## WILLOW RIVER-BAR SHRUBLAND

*Salix nigra* / *Carex torta* Temporarily Flooded Shrubland

**Range:** This shrubland occurs in the eastern United States from New Hampshire and Vermont south to Pennsylvania. It occurs in Pennsylvania in the Delaware Estuary.

**Environmental Description:** It occurs on cobble substrates with sand and gravel in areas that are flooded only during high-water events but receive winter ice-scour. It occupies an intermediate position along disturbance gradient between open, herbaceous cobble shores and higher floodplain forests.



Photo by Pennsylvania Natural Heritage Program

**Vegetation Description:** This is a willow shrubland of low riverbanks along moderate- to high-energy rivers in the Northeast and High Allegheny Plateau. *Salix nigra* (black willow) is often dominant or codominant with other willows or dogwoods. Less frequent shrubs and tree saplings include *Platanus occidentalis* (sycamore), *Salix eriocephala* (Missouri willow), *Salix sericea* (silky willow), *Alnus incana* (speckled alder), *Alnus serrulata* (smooth alder), *Alnus viridis* (green alder) (infrequent), *Cornus amomum* (silky dogwood), *Cornus sericea* (red-osier dogwood), *Spiraea alba* var. *latifolia* (broadleaf meadowsweet), *Platanus occidentalis* (sycamore), and *Populus deltoides* (eastern cottonwood). The herbaceous layer is typically sparse with variable composition, including *Carex torta* (twisted sedge), *Carex trichocarpa* (hairy-fruit sedge), *Panicum dichotomiflorum* (fall panicgrass), *Dichanthelium clandestinum* (deer-tongue witchgrass), *Echinochloa crus-galli* (large barnyard grass), *Phalaris arundinacea* (reed canarygrass), *Calamagrostis canadensis* (bluejoint), *Apocynum cannabinum* (Indian-hemp), *Agrostis* (bentgrass) spp., *Solidago gigantea* (giant goldenrod), *Solidago rugosa* (wrinkleleaf goldenrod), *Eupatorium maculatum* (spotted joe-pyeweed), *Lysimachia terrestris* (swamp-candles), *Polygonum* (smartweed, knotweed) spp., and *Bidens* (beggarticks) spp. Invasive, exotic species can be problematic in this community, including *Polygonum cuspidatum* (Japanese knotweed), *Tussilago farfara* (colt's-foot), and *Cynanchum louiseae* (black swallow-wort).

**Characteristic Species:** *Carex torta* (twisted sedge), *Salix nigra* (black willow)

**Dynamics/Successional Trajectory:** This community is subject to extreme ice-scour events as well as erosion and deposition during floods. The clonal nature of most of the woody species in this community serves to stabilize the substrate and allows rapid regeneration of above-ground biomass following

damage and removal caused by flooding/scour events. Unless flow regime is altered (i.e., flow manipulation from dams), this type is relatively persistent, with minor spatial shifts due to erosion and sedimentation during flood events. Flow regulation may cause a shift to more mature vegetation by reducing flood severity and duration.

**Management Concerns:** This type is subject to invasion by some exotic species (e.g., *Lythrum salicaria* (purple loosestrife)). Flow regulation may cause a shift to riparian tall-shrub or forest communities.

**Reference Sites:** Shapnack Island, Delaware Water Gap National Recreation Area, PA

**Global and State Conservation Ranks and Reasons:** GNR (25-Mar-2003). PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.689581](http://vegbank.org/natureserve/element_global.2.689581)

**References:** Eastern Ecology Working Group n.d., Fike 1999, Gawler 2002, Metzler and Barrett 2001, Nichols et al. 2001, TNC and WPC 2004

<b>MOST ABUNDANT SPECIES</b>		
<b>STRATUM</b>	<b>LIFEFORM</b>	<b>SPECIES</b>
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Cornus amomum</i> (silky dogwood)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Salix nigra</i> (black willow)