COMMON NAME (PARK-SPECIFIC): EASTERN HEMLOCK - AMERICAN BASSWOOD FOREST

SYNONYMS

NVC English Name: **Eastern Hemlock - (American Beech, Appalachian Basswood) / Umbrella Magnolia Forest**

NVC Scientific Name: ***Tsuga canadensis* - (*Fagus grandifolia, Tilia americana* var. *heterophylla) / Magnolia tripetala* Forest**

NVC Identifier: **CEGL008407**

LOCAL INFORMATION

Environmental Description: This association occurs in small patches (0–11.7 ha) on gorge slopes with low solar exposure. Aspects are usually northerly to northeasterly but may range to southerly in lower positions shaded by opposing gorge slopes. Slopes in mapped polygons range from 1 to 47 degrees (mean = 27). Elevations in mapped polygons range from 439 to 718 m (mean = 572). Bedrock geology is predominantly shale of the Mauch Chunk Group. Surficial rock types noted in plots include both shale (presumably residual) and sandstone (probably colluvial in part). Unvegetated ground cover in plots is dominated by litter, with significant cover by large rocks in several plots, and lesser amounts of bare soil and coarse woody debris. Soils in plots are described as somewhat moist to moist, well-drained, stony silt loam and sandy loam. Soils from plots tested extremely to medium acidic (mean pH = 4.7) with relatively high levels of organic matter, estimated N release, S, Al, B, Ca, Fe, K, Mg, Mn, and P, and relatively low levels of Cu, Na, and Zn compared to average values in the park. Polygons of this association are often adjacent to polygons of Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222), the dominant deciduous forest of cool-aspect gorge slopes in the park. These two associations share many environmental attributes, but Eastern Hemlock - American Basswood Forest has overall higher slope position, and lower solar exposure, pH, and soil cations. Polygons of this association may also border and grade towards polygons of Eastern Hemlock - Chestnut Oak Forest (CEGL006923), which occur in drier slope positions, often upslope, with less fertile soils. As aspects become warmer polygons of this association may also be adjacent to polygons of Oak - Hickory - Sugar Maple Forest (CEGL007268).

Vegetation Description: This association is a closed-canopy mixed evergreen-deciduous forest codominated by *Tsuga canadensis* (eastern hemlock) with deciduous trees including *Tilia americana* (American basswood). Total canopy cover in plots ranges from 30–80%, with cover by *Tsuga canadensis* (eastern hemlock) ranging from 10–60% and cover by *Tilia americana* (American basswood) ranging from 0–20%. Additional canopy trees in plots include (in decreasing order of constancy) *Quercus rubra* (northern red oak), *Quercus prinus* (chestnut oak), *Acer saccharum* var. *saccharum* (sugar maple), *Liriodendron tulipifera* (tuliptree), *Acer rubrum* var. *rubrum* (red maple), *Aesculus flava* (yellow buckeye), *Fraxinus americana* (white ash), and *Fagus grandifolia* (American beech). Subcanopy cover in plots ranges from 5–60%, composed primarily of the species listed for the canopy. Additional species in the subcanopy of plots include *Ulmus rubra* (slippery elm), *Amelanchier arborea* var. *arborea* (common serviceberry), *Magnolia acuminata* (cucumber-tree), *Carya ovata* (shagbark hickory), and *Carya alba* (mockernut hickory). Vines which reach the canopy layers include *Aristolochia macrophylla* (pipevine) and *Vitis aestivalis* var. *bicolor* (summer grape). Cover in the shrub layers of plots ranges from 6–40%, including tree saplings, shrubs, and vines. Regeneration of *Tsuga*

canadensis (eastern hemlock), *Acer saccharum* var. *saccharum* (sugar maple), and *Tilia americana* (American basswood) in the shrub layer is often evident. Common shrubs in plots include (in decreasing order of constancy) *Viburnum acerifolium* (mapleleaf viburnum), *Acer pensylvanicum* (striped maple), *Hydrangea arborescens* (wild hydrangea), *Rhododendron maximum* (great laurel) (4% cover), and *Hamamelis virginiana* (American witchhazel). Herb cover in plots ranges 5–30% and its composition is usually diverse and includes some nutrient demanding species. Common herbs in plots include (in decreasing order of constancy) *Polystichum acrostichoides* (Christmas fern), *Eurybia divaricata* (white wood aster), *Dryopteris marginalis* (marginal woodfern), *Prosartes lanuginosa* (yellow fairybells), *Dioscorea quaternata* (fourleaf yam), *Solidago caesia* (wreath goldenrod), *Ageratina altissima* var. *altissima* (white snakeroot), *Parthenocissus quinquefolia* (Virginia creeper), *Sedum ternatum* (woodland stonecrop), *Polygonatum pubescens* (hairy Solomon's seal), *Osmorhiza claytonii* (Clayton's sweetroot), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), *Hepatica nobilis* var. *acuta* (sharplobe hepatica), *Dryopteris intermedia* (intermediate woodfern), *Adiantum pedatum* (northern maidenhair), and *Carex digitalis* var. *digitalis*. Additional herbs indicative of enriched soils include *Actaea racemosa* var. *racemosa* (black bugbane), *Sanguinaria canadensis* (bloodroot), *Asarum canadense* (Canadian wildginger), *Caulophyllum thalictroides* (blue cohosh), and *Laportea canadensis* (Canadian woodnettle). Vascular plant species richness ranges from 37 to 58 (mean = 42.8) species per 400-square-meter plot. Nonvascular cover in plots ranges from 0–20%. Nonvascular species identified in plots include *Thuidium delicatulum* (delicate thuidium moss), *Hypnum imponens* (hypnum moss), *Dicranum fulvum* (dicranum moss), *Aulacomnium heterostichum* (aulacomnium moss), *Bryoandersonia illecebra* (bryoandersonia moss), *Brachythecium oxycladon* (brachythecium moss), *Metzgeria conjugata*, *Metzgeria crassipilis*, *Plagiomnium ciliare* (plagiomnium moss), *Plagiothecium denticulatum* (toothed plagiothecium moss), *Polytrichum juniperinum* (juniper polytrichum moss), *Pylaisiadelpha tenuirostris* (pylaisiadelpha moss), and *Steerecleus serrulatus* (steerecleus moss).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum* var. *saccharum* (sugar maple), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak), *Tilia americana* (American basswood)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Acer pensylvanicum* (striped maple)
Herb (field)	Vine/Liana	*Aristolochia macrophylla* (pipevine)
Herb (field)	Fern or fern ally	*Dryopteris marginalis* (marginal woodfern), *Polystichum acrostichoides* (Christmas fern)

Characteristic Species: *Actaea racemosa* var. *racemosa* (black bugbane), *Adiantum pedatum* (northern maidenhair), *Arisaema triphyllum* ssp. *triphyllum* (Jack in the pulpit), *Asarum canadense* (Canadian wildginger), *Caulophyllum thalictroides* (blue cohosh), *Hepatica nobilis* var. *acuta* (sharplobe hepatica), *Hydrangea arborescens* (wild hydrangea), *Laportea canadensis* (Canadian woodnettle), *Osmorhiza claytonii* (Clayton's sweetroot), *Prosartes lanuginosa* (yellow fairybells), *Sanguinaria canadensis* (bloodroot), *Sedum ternatum* (woodland stonecrop)

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	=	1	[gname]	Vanderhorst et al. 2008

Local Range: A total of 38 polygons covering 69.62 hectares are mapped in the park. Stands are scattered on gorge slopes throughout the southern 8/10 of the park, becoming more abundant in the southern third.

Classification Comments: In West Virginia, the varieties of *Tilia americana* (American basswood) are sympatric and intergrade and are not very useful for circumscribing vegetation types. Another nominal tree species in the global name of this association, *Magnolia tripetala* (umbrella-tree), is absent from all plots and is not common in the park; however, this species is known from the association elsewhere in the state. In the park, this association often borders and grades towards Eastern Hemlock - Chestnut Oak Forest (CEGL006923). These two associations are best distinguished by abundance of *Tilia americana* (American basswood) and rich-site herbs in Eastern Hemlock - American Basswood Forest and their scarcity or absence in Eastern Hemlock - Chestnut Oak Forest. This association is most similar to the "sugar maple - northern red oak - eastern hemlock" type classified by Rentch et al.'s (2005) study of upland forests in the Bluestone River gorge; this type has relatively high importance value for *Tilia americana* (American basswood) and a number of rich-site herbs. This association has also been sampled in southern West Virginia at Panther State Forest (McDowell County) and Cabwaylingo State Forest (Wayne County). Similar rich hemlock communities have also been observed on cool aspects on limestone bedrock in water gaps of the Ridge and Valley in eastern West Virginia, but their relationship to this association has not been determined.

Other Comments: *Tsuga canadensis* (eastern hemlock) is currently threatened by the exotic insect hemlock woolly adelgid (*Adelges tsugae*). This pest was first discovered in the park in 2000 and NPS has since initiated insecticide treatment and monitoring of individual trees (J. Perez pers. comm.). Many hemlocks in the park appear stressed, but large scale mortality was not observed during the 2003–2006 vegetation surveys.

Local Description Authors: J. P. Vanderhorst.

Plots: Eight plots were sampled: BLUE.28, BLUE.47, BLUE.69, BLUE.98, BLUE.100, BLUE.101, BLUE.120, and BLUE.123.

Bluestone National Scenic River Inventory Notes: Estimated thematic accuracy of the vegetation map class representing this association (86.7% estimated user's accuracy) is slightly lower than overall estimated accuracy of the vegetation map for the park (92.6%). This reflects three accuracy assessment points identified in the field as Eastern Hemlock - Chestnut Oak Forest which were mapped as Eastern Hemlock - American Basswood Forest. This is an indication of both the overall validity and minor pitfalls of splitting these related communities.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	*Tsuga canadensis - Liriodendron tulipifera* Forest Alliance (A.413)
Alliance (English name)	Eastern Hemlock - Tuliptree Forest Alliance
Association	*Tsuga canadensis - (Fagus grandifolia, Tilia americana* var. *heterophylla) / Magnolia tripetala* Forest
Association (English name)	Eastern Hemlock - (American Beech, Appalachian Basswood) / Umbrella Magnolia Forest
Ecological System(s):	Southern and Central Appalachian Cove Forest (CES202.373).

GLOBAL DESCRIPTION

Concept Summary: This association represents mixed forests of lower slopes, coves, etc. dominated by *Tsuga canadensis* (eastern hemlock) and mesic hardwood species, occurring in the Cumberland Mountains and Cumberland Plateau of Kentucky, Tennessee, and West Virginia, the Southern Ridge and Valley of Tennessee, and the Western Allegheny Plateau of West Virginia and potentially southwestern Pennsylvania. It may range into extreme northwestern Georgia and northeastern Alabama, Deciduous associates, which may vary widely in relative frequency, include *Fagus grandifolia* (American beech), *Tilia americana* var. *heterophylla* (American basswood), *Liriodendron tulipifera* (tuliptree), *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Quercus rubra* (northern red oak), *Fraxinus americana* (white ash), *Carya ovata* (shagbark hickory), and *Magnolia acuminata* (cucumber-tree). The relative proportion of *Tsuga* (hemlock) and the various hardwood species may vary greatly; individual stands may be strongly dominated by *Tsuga* (hemlock), or *Tsuga* (hemlock) may share dominance with one or more of the hardwoods. *Aesculus flava* (yellow buckeye) and/or *Magnolia tripetala* (umbrella-tree) may be present in the canopy or subcanopy, respectively, but these characteristic species may not be dominant in the particular stratum. Some important shrubs include *Rhododendron maximum* (great laurel) (which may dominate shrub layers of some stands), *Rhododendron catawbiense* (Catawba rosebay) (within its range), *Ribes cynosbati* (eastern prickly gooseberry), *Asimina triloba* (pawpaw), *Hydrangea arborescens* (wild hydrangea), *Viburnum acerifolium* (mapleleaf viburnum), and the lianas *Aristolochia macrophylla* (pipevine) and *Smilax rotundifolia* (roundleaf greenbrier). Ferns are diverse and abundant. Mesic herbaceous components include *Dryopteris marginalis* (marginal woodfern), *Dryopteris intermedia* (intermediate woodfern), *Thelypteris noveboracensis* (New York fern), *Polystichum acrostichoides* (Christmas fern), *Asplenium rhizophyllum* (walking fern), *Athyrium filix-femina* (common ladyfern), *Arisaema triphyllum* (Jack in the pulpit), *Asarum canadense* (Canadian wildginger), *Carex plantaginea* (plantainleaf sedge), *Chimaphila maculata* (striped prince's pine), *Goodyera pubescens* (downy rattlesnake plantain), *Hepatica nobilis* var. *acuta* (sharplobe hepatica), *Maianthemum racemosum* (feathery false lily of the valley), *Mitchella repens* (partridgeberry), *Phacelia bipinnatifida* (fernleaf phacelia), *Sanguinaria canadensis* (bloodroot), *Tiarella cordifolia* (heartleaf foamflower), and *Trillium* (trillium) spp.

Environmental Description: This forest occurs in coves, valleys, bases of cliffs, and lower slopes, usually in somewhat protected settings. Soils are typically derived from slope alluvium and colluvium, composed of acidic shales, siltstones, and sandstones; the soils typically have a high stone content (Martin 1975). Soils in eight West Virginia plots near the Bluestone River are described as somewhat moist to moist, well-drained, stony silt loam and sandy loam. They tested extremely to medium acidic (mean pH = 4.7) with relatively high levels of organic matter, estimated N release, S, Al, B, Ca, Fe, K, Mg, Mn, and P, and relatively low levels of Cu, Na, and Zn compared to average values in the area.

Vegetation Description: This association is dominated by *Tsuga canadensis* (eastern hemlock) and mesic hardwood species, often including *Tilia americana* (American basswood). Deciduous associates, which may vary widely in relative frequency, include *Fagus grandifolia* (American beech), *Liriodendron tulipifera* (tuliptree), *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Quercus rubra* (northern red oak), *Fraxinus americana* (white ash), *Carya ovata* (shagbark hickory), *Magnolia acuminata* (cucumber-tree), *Quercus prinus* (chestnut oak), *Acer saccharum* (sugar maple), and *Acer rubrum* (red maple). The relative proportion of *Tsuga canadensis* (eastern hemlock) and the various hardwood species may vary greatly; individual

stands may be strongly dominated by *Tsuga* (hemlock), or *Tsuga* (hemlock) may share dominance with one or more of the hardwoods. *Aesculus flava* (yellow buckeye) and/or *Magnolia tripetala* (umbrella-tree) may be present in the canopy or subcanopy, respectively, but these characteristic species may not be dominant in the particular stratum. Vines which may reach the canopy include *Aristolochia macrophylla* (pipevine) and *Vitis aestivalis* var. *bicolor* (summer grape). Regeneration of *Tsuga canadensis* (eastern hemlock), *Acer saccharum* (sugar maple), and *Tilia americana* (American basswood) in the shrub layer is often evident. Some important shrubs include *Rhododendron maximum* (great laurel) (which may dominate shrub layers of some stands but be very low in others), *Rhododendron catawbiense* (Catawba rosebay) (within its range), *Ribes cynosbati* (eastern prickly gooseberry), *Asimina triloba* (pawpaw), *Viburnum acerifolium* (mapleleaf viburnum), *Acer pensylvanicum* (striped maple), *Hydrangea arborescens* (wild hydrangea), and *Hamamelis virginiana* (American witchhazel), and the lianas *Parthenocissus quinquefolia* (Virginia creeper) and *Smilax rotundifolia* (roundleaf greenbrier). Ferns are diverse and abundant. The herbaceous component includes some nutrient-demanding plants such as *Actaea racemosa* var. *racemosa* (black bugbane), *Adiantum pedatum* (northern maidenhair), *Sanguinaria canadensis* (bloodroot), *Asarum canadense* (Canadian wildginger), *Caulophyllum thalictroides* (blue cohosh), and *Laportea canadensis* (Canadian woodnettle). Additional herbaceous species include *Dryopteris marginalis* (marginal woodfern), *Dryopteris intermedia* (intermediate woodfern), *Thelypteris noveboracensis* (New York fern), *Polystichum acrostichoides* (Christmas fern), *Asplenium rhizophyllum* (walking fern), *Athyrium filix-femina* (common ladyfern), *Ageratina altissima* var. *altissima* (white snakeroot), *Arisaema triphyllum* (Jack in the pulpit), *Carex digitalis* var. *digitalis*, *Carex plantaginea* (plantainleaf sedge), *Chimaphila maculata* (striped prince's pine), *Dioscorea quaternata* (fourleaf yam), *Goodyera pubescens* (downy rattlesnake plantain), *Hepatica nobilis* var. *acuta* (sharplobe hepatica), *Maianthemum racemosum* (feathery false lily of the valley), *Mitchella repens* (partridgeberry), *Osmorhiza claytonii* (Clayton's sweetroot), *Phacelia bipinnatifida* (fernleaf phacelia), *Polygonatum pubescens* (hairy Solomon's seal), *Prosartes lanuginosa* (yellow fairybells), *Sanguinaria canadensis* (bloodroot), *Sedum ternatum* (woodland stonecrop), *Solidago caesia* (wreath goldenrod), *Tiarella cordifolia* (heartleaf foamflower), and *Trillium* (trillium) spp. Across eight plots sampled in West Virginia, vascular plant richness ranged from 37 to 58 species (mean = 42.8) per 400-square-meter plot. At the northern limit of this association, some more southern species will be absent (e.g., *Rhododendron catawbiense* (Catawba rosebay), *Phacelia bipinnatifida* (fernleaf phacelia), *Halesia tetraptera* (mountain silverbell)) (J. Fike pers. comm.). One variant of this association is apparently dominated by *Tsuga canadensis* (eastern hemlock) and *Betula alleghaniensis* (yellow birch), with *Tilia americana* var. *heterophylla* (American basswood) and *Oxydendrum arboreum* (sourwood) (Caplenor 1965).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	*Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Liriodendron tulipifera* (tuliptree), *Tilia americana* var. *heterophylla* (American basswood)
Tall shrub/sapling	Broad-leaved evergreen shrub	*Rhododendron maximum* (great laurel)
Herb (field)	Fern or fern ally	*Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern)

Characteristic Species: *Aesculus flava* (yellow buckeye), *Arisaema triphyllum* (Jack in the pulpit), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Fagus grandifolia* (American beech), *Magnolia tripetala* (umbrella-tree), *Rhododendron maximum* (great laurel), *Tilia americana* var. *heterophylla* (American basswood), *Tsuga canadensis* (eastern hemlock).

Other Noteworthy Species:

Species	GRank	Type	Note
Panax quinquefolius (American ginseng)	G3G4	plant	vulnerable

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association occurs in the Cumberland Mountains and Cumberland Plateau of Kentucky, Tennessee, and West Virginia, the Southern Ridge and Valley of Tennessee, and the Western Allegheny Plateau of West Virginia and possibly southwestern Pennsylvania. It may range into extreme northwestern Georgia and northeastern Alabama. Occurrences in the Interior Low Plateau are rare and of limited extent.

States/Provinces: AL?, GA?, KY, PA, TN, VA, WV.

Federal Lands: NPS (Allegheny Portage Railroad, Big South Fork, Bluestone, Cumberland Gap, Obed); USFS (Daniel Boone).

CONSERVATION STATUS

Rank: G4 (5-Apr-2000).

Reasons: Occurrences are threatened by the hemlock woolly adelgid (*Adelges tsugae*), an exotic insect pest.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: This forest is known from the Rock Creek Research Natural Area in the Daniel Boone National Forest, Kentucky (Winstead and Nicely 1976). It is also found at Lilley Cornet Woods in eastern Kentucky (Martin 1975). Some Tennessee occurrences include Fall Creek Falls State Park (Caplenor 1965) and Savage Gulf in the South Cumberland Recreation Area (Quarterman et al. 1972). There is at least one disjunct occurrence of a mesic ravine with *Tsuga canadensis* (eastern hemlock) in the Eastern Highland Rim of DeKalb County, Tennessee (222Eb), which would be accommodated here. The substrate at this site is siliceous limestone of the Mississippian Fort Payne Formation, immediately underlain by upper Ordovician limestones. This association is better defined in the southern part of its range. In the Western Allegheny Plateau of West Virginia, there is some conceptual overlap with *Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana*, *Kalmia latifolia)* Forest (CEGL005043), in particular a subtype of this "(1) steep-walled sandstone gorges and talus, where *Hydrangea arborescens* (wild hydrangea), *Kalmia latifolia* (mountain laurel), and *Dryopteris marginalis* (marginal woodfern) may be indicative." Classification difficulties may be encountered where the potential ranges of these two types could overlap (e.g., in parts of Kentucky, Pennsylvania, and West Virginia).

Similar Associations:

Liriodendron tulipifera - Betula lenta - Tsuga canadensis / Rhododendron maximum Forest (CEGL007543).

Tsuga canadensis - (Liriodendron tulipifera, Fagus grandifolia) / (Magnolia macrophylla, Ilex opaca) / Polystichum acrostichoides Forest (CEGL004767).

Tsuga canadensis - Fagus grandifolia - Acer saccharum / (Hamamelis virginiana, Kalmia latifolia) Forest (CEGL005043).

Related Concepts:

Hemlock Type (Schmalzer and DeSelm 1982) B

Hemlock-basswood Community (Caplenor 1965) ?

Hemlock-yellow birch Community (Caplenor 1965) ?

Rich hemlock - mesic hardwoods forest (Fike 1999) ?

Sugar Maple - Northern Red Oak - Eastern Hemlock (Rentch et al. 2005) ?

SOURCES

Description Authors: M. Pyne, mod. R. White and S. C. Gawler.

References: Caplenor 1965, Fike 1999, Fike pers. comm., Martin 1975, Perez pers. comm., Perles et al. 2007, Quarterman et al. 1972, Rentch et al. 2005, Schmalzer and DeSelm 1982, Schotz pers. comm., Southeastern Ecology Working Group n.d., TDNH unpubl. data, Vanderhorst et al. 2008, Winstead and Nicely 1976.

Plot BLUE.69. Eastern Hemlock - American Basswood Forest.

COMMON NAME (PARK-SPECIFIC): EASTERN HEMLOCK - CHESTNUT OAK FOREST

SYNONYMS
NVC English Name: **Eastern Hemlock - Chestnut Oak - Sweet Birch Forest**
NVC Scientific Name: ***Tsuga canadensis* - *Quercus prinus* - *Betula lenta* Forest**
NVC Identifier: **CEGL006923**

LOCAL INFORMATION

Environmental Description: This association occurs in small patches (0–5.3 ha) primarily on convex upper slopes with northerly aspects which have low solar exposure. A few stands also occur on warmer aspects and on convex lower and midslope positions. Slopes are often very steep, and stands often occur above and below cliff bands. Slopes in mapped polygons range from 4 to 47 degrees (mean = 27.3). Elevations in mapped polygons range from 446 to 687 m (mean = 610). Bedrock geology is mapped as shales and sandstones in the Mauch Chunk Group, and both shale and sandstone surficial deposits were observed in plots. Unvegetated ground cover in plots is dominated by litter, with significant cover by large rocks in a few plots. There is higher mean ground cover by coarse woody debris (7.4%) compared to plots of all other upland forest associations in the park. Soils in plots are described as dry to somewhat moist, well-drained, stone-free to very stony sandy loam, silt loam, sandy silt loam, and sandy clay loam. Soils from plots tested extremely to medium acidic (mean pH = 4.4) with relatively high levels of organic matter, estimated N release, S, Al, B, and Fe and relatively low levels of Ca, Cu, K, Mg, Mn, P, and Zn compared to average values in the park. Polygons of this association often border and grade towards polygons of Eastern Hemlock - American Basswood Forest (CEGL008407), which occur in more moist, concave slope positions, often downslope, with more fertile soils. Polygons of this association may also border larger polygons of the predominant upland forest types of the park, including Oak - Eastern White Pine / Ericad Forest (CEGL008539) in positions with higher solar exposure, Oak - Hickory - Sugar Maple Forest (CEGL007268) in positions with higher solar exposure and soil fertility, and Sugar Maple - Yellow Buckeye - American Basswood Forest (CEGL005222) in positions with higher soil moisture and fertility.

Vegetation Description: This association is a closed-canopy mixed evergreen-deciduous forest codominated by *Tsuga canadensis* (eastern hemlock) in association with species of *Quercus* (oak) and other deciduous trees indicative of relatively dry, infertile soils. Canopy cover in plots ranges from 50–80%. Important canopy species in plots include (in decreasing order of constancy) *Tsuga canadensis* (eastern hemlock), *Quercus prinus* (chestnut oak), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), *Pinus strobus* (eastern white pine), *Quercus coccinea* var. *coccinea* (scarlet oak), *Acer rubrum* var. *rubrum* (red maple), and *Betula lenta* (sweet birch). Subcanopy cover in plots ranges from 5–60%. Important trees in the subcanopy, in addition to those listed for the canopy, include *Oxydendrum arboreum* (sourwood) and *Acer saccharum* var. *saccharum* (sugar maple). Cover in the shrub layers of plots ranges from 6–30%, including tree saplings, shrubs, and vines. Tree regeneration in the shrub layers is dominated by shade-tolerant species, including *Tsuga canadensis* (eastern hemlock), *Fagus grandifolia* (American beech), and *Acer saccharum* var. *saccharum* (sugar maple), but regeneration by *Quercus prinus* (chestnut oak) is significant in a few plots. Common shrubs and vines in plots include (in decreasing order of constancy) *Viburnum acerifolium* (mapleleaf viburnum),

Amelanchier arborea var. *arborea* (common serviceberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Rhododendron maximum* (great laurel) (about 10% cover), and *Smilax rotundifolia* (roundleaf greenbrier). Cover in the herb layer of plots ranges from 1–20%, with high representation of species tolerant of shade and dry, infertile soils. Common herbs in plots include (in decreasing order of constancy) *Parthenocissus quinquefolia* (Virginia creeper), *Dioscorea quaternata* (fourleaf yam), *Polygonatum pubescens* (hairy Solomon's seal), *Monotropa uniflora* (Indianpipe), *Goodyera pubescens* (downy rattlesnake plantain), *Eurybia divaricata* (white wood aster), *Dryopteris marginalis* (marginal woodfern), and *Chimaphila maculata* (striped prince's pine). Additional characteristic herbs with lower constancy include *Gaultheria procumbens* (eastern teaberry), *Mitchella repens* (partridgeberry), *Hexastylis virginica* (Virginia heartleaf), and *Monotropa hypopithys* (pinesap). Vascular plant species richness ranges from 16 to 43 (mean = 26.5) species per 400-square-meter plot. Nonvascular cover in plots ranges from 0–5%. Mosses identified in plots include *Leucobryum glaucum* (leucobryum moss), *Thuidium delicatulum* (delicate thuidium moss), and *Hypnum imponens* (hypnum moss).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	*Acer rubrum* var. *rubrum* (red maple), *Betula lenta* (sweet birch), *Quercus alba* (white oak), *Quercus coccinea* var. *coccinea* (scarlet oak), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	*Oxydendrum arboreum* (sourwood)

Characteristic Species: *Chimaphila maculata* (striped prince's pine), *Gaultheria procumbens* (eastern teaberry), *Goodyera pubescens* (downy rattlesnake plantain), *Hexastylis virginica* (Virginia heartleaf), *Leucobryum glaucum* (leucobryum moss), *Mitchella repens* (partridgeberry), *Monotropa hypopithys* (pinesap), *Monotropa uniflora* (Indianpipe), *Vaccinium pallidum* (Blue Ridge blueberry), *Viburnum acerifolium* (mapleleaf viburnum).

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	=	1	[gname]	Vanderhorst et al. 2008

Local Range: A total of 38 polygons covering 43.09 hectares are mapped in the park.

Classification Comments: In the park, this association often borders and grades towards Eastern Hemlock - American Basswood Forest (CEGL008407). These two associations are best distinguished by abundance of *Tilia americana* (American basswood) and rich-site herbs in Eastern Hemlock - American Basswood Forest and their scarcity or absence in Eastern Hemlock - Chestnut Oak Forest. Strong indicator species for this association include *Leucobryum glaucum* (leucobryum moss) and *Monotropa uniflora* (Indianpipe).

Other Comments: *Tsuga canadensis* (eastern hemlock) is currently threatened by the exotic insect hemlock woolly adelgid (*Adelges tsugae*). This pest was first discovered in the park in 2000 and NPS has since initiated insecticide treatment and monitoring of individual trees (J. Perez pers. comm.). Many hemlocks in the park appear stressed, but large scale mortality was not observed during the 2003–2006 vegetation surveys.

Local Description Authors: J. P. Vanderhorst.

Plots: Nine plots were sampled: BLUE.20, BLUE.31, BLUE.32, BLUE.37, BLUE.36, BLUE.59, BLUE.66, BLUE.70, and BLUE.125.

Bluestone National Scenic River Inventory Notes: Estimated thematic accuracy of the vegetation map class representing this association (90.3% estimated user's accuracy) is slightly lower than overall estimated accuracy of the vegetation map for the park (92.6%). This reflects two accuracy assessment points identified in the field as Eastern Hemlock - American Basswood Forest which were mapped as Eastern Hemlock - Chestnut Oak Forest. This is an indication of both the overall validity and minor pitfalls of splitting these related communities.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Mixed evergreen-deciduous forest (I.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous forest (I.C.3.N.a.)
Alliance	*Tsuga canadensis - Liriodendron tulipifera* Forest Alliance (A.413)
Alliance (English name)	Eastern Hemlock - Tuliptree Forest Alliance
Association	*Tsuga canadensis - Quercus prinus - Betula lenta* Forest
Association (English name)	Eastern Hemlock - Chestnut Oak - Sweet Birch Forest
Ecological System(s):	Central Appalachian Dry Oak-Pine Forest (CES202.591).

GLOBAL DESCRIPTION

Concept Summary: This association is a hemlock - mixed oak forest which often occurs on steep northeastern to northwestern exposures. It ranges from the New Jersey Highlands south to the Blue Ridge, Ridge and Valley, Cumberlands, and Piedmont provinces (Maryland, West Virginia, and Virginia). Occurrences in West Virginia are known from the Bluestone River Gorge and are likely elsewhere. Stands occur at elevations from 150 m to about 750 m (500–2500 feet) on moderately to very steep, sheltered slopes. Northerly aspects and middle slope positions prevail among documented examples. Some sites are "boulderfields" with up to 60% cover by large rocks. Geologic substrate is variable. Soils are usually very stony to extremely stony sandy loams, consistently oligotrophic, with very low pH and base status. Stands of this association are typically floristically depauperate and generally dominated by variable combinations of *Quercus prinus* (chestnut oak) and *Tsuga canadensis* (eastern hemlock). *Betula lenta* (sweet birch) and, less commonly, *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), and *Quercus rubra* (northern red oak) are major overstory associates, each attaining codominance in a subset of stands. *Quercus alba* (white oak), *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Pinus strobus* (eastern white pine), *Sassafras albidum* (sassafras), and *Fagus grandifolia* (American beech) are minor overstory associates. Small trees and shrubs can be absent or sparse due to dense shading by hemlock, with *Hamamelis virginiana* (American witchhazel) most consistently providing moderate cover. Less frequently, *Kalmia latifolia* (mountain laurel), *Rhododendron maximum* (great laurel), and *Viburnum acerifolium* (mapleleaf viburnum) are shrub components. At some New Jersey sites, a single dense stratum or multiple open strata of ericaceous species can develop, including *Rhododendron maximum* (great laurel), *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), and *Vaccinium pallidum* (Blue Ridge blueberry). The herb layer of this community is typically very sparse or absent; typical scattered species include *Maianthemum canadense* (Canada

mayflower), *Dennstaedtia punctilobula* (eastern hayscented fern), *Chimaphila maculata* (striped prince's pine), *Deschampsia flexuosa* (wavy hairgrass), *Carex swanii* (Swan's sedge), and *Aralia nudicaulis* (wild sarsaparilla).

Environmental Description: Stands occur at elevations from 150 m to about 750 m (500–2500 feet) on moderately to very steep, sheltered slopes. Northern to northwestern aspects and middle slope positions prevail among documented examples. Some sites are "boulderfields" with up to 60% cover by large rocks; some appear above or below cliff bands. Geologic substrate is variable but includes shales and sandstone. Soils are usually very stony to extremely stony sandy loams, consistently oligotrophic, with very low pH and base status. Soils in eight West Virginia plots in the environs of Bluestone National Scenic River are described as dry to somewhat moist, well-drained, stone-free to very stony sandy loam, silt loam, sandy silt loam, and sandy clay loam; they tested extremely to medium acidic (mean pH = 4.4) with relatively high levels of organic matter, estimated N release, S, Al, B, and Fe and relatively low levels of Ca, Cu, K, Mg, Mn, P, and Zn compared to average values in the area.

Vegetation Description: This association is a hemlock - mixed oak forest dominated by *Tsuga canadensis* (eastern hemlock) in association with species of *Quercus* (oak) and other deciduous trees indicative of relatively dry, infertile soils. Stands are typically floristically depauperate and generally dominated by variable combinations of *Quercus prinus* (chestnut oak) and *Tsuga canadensis* (eastern hemlock). *Betula lenta* (sweet birch) and, less commonly, *Quercus velutina* (black oak), *Quercus coccinea* (scarlet oak), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak) are major overstory associates, each attaining codominance in a subset of stands. *Acer rubrum* (red maple), *Liriodendron tulipifera* (tuliptree), *Pinus strobus* (eastern white pine), *Sassafras albidum* (sassafras), and *Fagus grandifolia* (American beech) are very minor overstory associates. *Oxydendrum arboreum* (sourwood) and *Acer saccharum* (sugar maple), along with overstory species, may be present in the subcanopy. Small trees and shrubs are often absent or sparse due to dense shading by hemlock, with *Hamamelis virginiana* (American witchhazel) most consistently providing moderate cover. Less frequently, *Kalmia latifolia* (mountain laurel), *Rhododendron maximum* (great laurel), *Vaccinium pallidum* (Blue Ridge blueberry), *Amelanchier arborea* (common serviceberry), and *Viburnum acerifolium* (mapleleaf viburnum) are shrub components. At some New Jersey sites, a single dense stratum or multiple open strata of ericaceous species can develop, including *Rhododendron maximum* (great laurel), *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), and *Vaccinium pallidum* (Blue Ridge blueberry). The herb layer of this community is typically very sparse or absent with scattered individuals of a few species; typical species vary somewhat with geography and include *Maianthemum canadense* (Canada mayflower), *Dennstaedtia punctilobula* (eastern hayscented fern), *Dioscorea quaternata* (fourleaf yam), *Chimaphila maculata* (striped prince's pine), *Deschampsia flexuosa* (wavy hairgrass), *Dryopteris marginalis* (marginal woodfern), *Chimaphila maculata* (striped prince's pine), *Carex swanii* (Swan's sedge), *Eurybia divaricata* (white wood aster), *Goodyera pubescens* (downy rattlesnake plantain), *Gaultheria procumbens* (eastern teaberry), *Mitchella repens* (partridgeberry), *Monotropa hypopithys* (pinesap), *Monotropa uniflora* (Indianpipe), *Parthenocissus quinquefolia* (Virginia creeper), and *Aralia nudicaulis* (wild sarsaparilla). In nine West Virginia plots, vascular plant richness ranged from 16 to 43 (mean = 26.5) species per 400-square-meter plot.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Needle-leaved tree	*Tsuga canadensis* (eastern hemlock)
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus prinus* (chestnut oak)
Tree subcanopy	Broad-leaved deciduous tree	*Betula lenta* (sweet birch)
Tall shrub/sapling	Broad-leaved deciduous shrub	*Hamamelis virginiana* (American witchhazel)
Tall shrub/sapling	Broad-leaved evergreen shrub	*Rhododendron maximum* (great laurel)
Short shrub/sapling	Broad-leaved deciduous shrub	*Gaylussacia baccata* (black huckleberry), *Vaccinium pallidum* (Blue Ridge blueberry)

Characteristic Species: *Chimaphila maculata* (striped prince's pine), *Quercus prinus* (chestnut oak), *Tsuga canadensis* (eastern hemlock).
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This association ranges from the New Jersey Highlands south to the Blue Ridge, Ridge and Valley, and Piedmont provinces of Pennsylvania, Maryland, and Virginia and the Cumberlands in West Virginia.
States/Provinces: MD, NJ, PA, VA, WV.
Federal Lands: NPS (Allegheny Portage Railroad, Bluestone, C&O Canal?, Catoctin Mountain, Delaware Water Gap, Shenandoah); USFS (George Washington).

CONSERVATION STATUS
Rank: G3 (4-Oct-2006).
Reasons: While this association does not appear to be intrinsically rare, it occurs in small patches in very specific habitats, and its viability is critically threatened by the spread of hemlock woolly adelgid.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 2 - Moderate.
Comments: The original description was based on A. Windisch's (1993) Picatinny Arsenal Hemlock-Mixed Oak-(Heath) Cool Sub-Mesic forest description (TcQf). An expanded circumscription is based on analysis of data from 20 Maryland and Virginia plots, data from Delaware Water Gap, and nine West Virginia plots.
Similar Associations: Information not available.
Related Concepts:
Picatinny Arsenal Hemlock-Mixed Oak-(Heath) Cool Sub-Mesic forest description (TcQf) (Windisch 1993) F

SOURCES
Description Authors: A. Windisch, mod. S.C. Gawler and G.P. Fleming
References: Eastern Ecology Working Group n.d., Fike 1999, Perez pers. comm., Perles et al. 2007, Vanderhorst et al. 2008, Windisch 1993.

Plot BLUE.70. Eastern Hemlock - Chestnut Oak Forest.

COMMON NAME (PARK-SPECIFIC): SYCAMORE - RIVER BIRCH RIVERSCOUR WOODLAND

SYNONYMS

NVC English Name: **Sycamore - River Birch / Silky Dogwood / (Big Bluestem, River-oats) Woodland**

NVC Scientific Name: ***Platanus occidentalis - Betula nigra* / *Cornus amomum* / (*Andropogon gerardii, Chasmanthium latifolium*) Woodland**

NVC Identifier: **CEGL003725**

LOCAL INFORMATION

Environmental Description: This association occurs in small patches (0.13–0.77 ha in polygons of the map class) and linear zones on deposition bars along river shorelines subject to frequent high-energy flooding. Floods damage and remove trees, maintaining a short, open canopy. Stands of this association below about 445 m (1460 feet) elevation are occasionally flooded by reservoir backup from Bluestone Lake; however, high-energy, downstream flooding remains a dominant disturbance force. Slopes in mapped polygons range from 0 to 22 degrees (mean = 3.9). Elevations in mapped polygons range from 436 to 483 m (mean = 446). Variation in this community related to flooding frequency and intensity is expressed in sediment particle size, ranging from boulders and cobbles in areas subject to the most frequent, highest energy floods to stone-free silty sand in areas subject to less frequent, lower energy floods. Unvegetated ground cover in plots is dominated by various mixtures of boulders, cobbles, and sand, with significant cover by coarse woody debris (flotsam) and standing water in some plots. Soils in plots are described as temporarily flooded, poorly to well-drained, stone-free to very stony sand and sandy loam. Soils from plots tested medium to slightly acidic (mean pH = 5.6) with relatively high levels of B, Cu, Fe, Na, and Zn, and relatively low levels of organic matter, estimated N release, S, Al, Ca, K, Mg, Mn, and P compared to average values in the park. During low water, unvegetated boulder and cobble bars are exposed downslope from this association. Upslope, this association is usually bordered by and grades towards less frequently flooded associations in the Floodplain Forest and Woodland map class and Modified Successional Floodplain Forest and Woodland map class. Adjacent associations in these map classes include Eastern Hemlock Floodplain Forest (CEGL006620), Oak - Hickory Floodplain Forest (CEGL006462), Sycamore - Yellow Buckeye Floodplain Forest (CEGL006466), Riverbank Tall Herbs (CEGL006480), Successional Black Walnut Floodplain Forest (CEGL007879), Successional Box-elder Floodplain Forest (CEGL005033), and Successional Tuliptree / Northern Spicebush Forest (CEGL007220), and Sycamore - Ash Floodplain Forest (CEGL006458).

Vegetation Description: This association is a deciduous woodland dominated by flood-battered *Platanus occidentalis* (American sycamore) and/or *Betula nigra* (river birch). Variation in physiognomy and species composition is related to flooding frequency and intensity. Stands subject to the most frequent, highest energy floods usually have open canopies over sparse understories, with herbs and shrubs restricted to protected microsites. Stands subject to less frequent, lower energy floods often have more closed canopies, usually dominated by *Betula nigra* (river birch), over a lush tall herb layer. Canopy cover in plots ranges from 0–50%. (note: 0% canopy cover represents one plot with trees <6 m, which are included in the tall-shrub layer, and another plot which was confined to a narrow herbaceous zone dominated by *Carex emoryi* (Emory's sedge), which extends beyond the woodland canopy). Subcanopy cover ranges from

0–30%, dominated by the two canopy species. Subcanopies cannot be distinguished in many stands due to low canopy height. Additional trees in plots which are tolerant of heavy flooding include *Ulmus americana* (American elm), *Carpinus caroliniana* ssp. *virginiana* (American hornbeam), *Diospyros virginiana* (common persimmon), and *Catalpa bignonioides* (southern catalpa). Presence of tree species less tolerant of flooding (e.g., *Quercus velutina* (black oak), *Liriodendron tulipifera* (tuliptree)) in plots is due to overhanging canopies or inclusion of ecotones. Cover in the shrub layers of plots ranges from 0–80%, with highest cover representing stands dominated by short (<6 m) *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch). Common shrubs in plots include *Cephalanthus occidentalis* (common buttonbush), *Lindera benzoin* (northern spicebush), *Cornus amomum* (silky dogwood), and the invasive exotic *Rosa multiflora* (multiflora rose). Herb cover in plots ranges from 1–80%. The herb layer is usually exceptionally diverse and includes a large number of species with high constancy. Common native herbs in plots include (in decreasing order of constancy) *Dichanthelium clandestinum* (deertongue), *Symphyotrichum prenanthoides* (crookedstem aster), *Packera aurea* (golden ragwort), *Galium triflorum* (fragrant bedstraw), *Pilea pumila* var. *pumila* (Canadian clearweed), *Verbesina alternifolia* (wingstem), *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Cryptotaenia canadensis* (Canadian honewort), *Chasmanthium latifolium* (Indian woodoats), *Tradescantia ohiensis* (bluejacket), *Apios americana* (groundnut), *Onoclea sensibilis* (sensitive fern), *Carex emoryi* (Emory's sedge), *Andropogon gerardii* (big bluestem), *Solidago gigantea* (giant goldenrod), and *Apocynum cannabinum* (Indianhemp). Exotic herbs which are common in trace amounts include *Prunella vulgaris* (common selfheal), *Plantago rugelii* var. *rugelii* (blackseed plantain), *Trifolium pratense* (red clover), *Melilotus officinalis* (yellow sweetclover), *Lysimachia nummularia* (creeping jenny), and *Coronilla varia* (purple crownvetch). State and globally rare plant species known from this association in the park include *Carex emoryi* (Emory's sedge), *Juncus dichotomus* (forked rush), *Vitis rupestris* (sand grape), *Spiraea virginiana* (Virginia meadowsweet), and *Stachys tenuifolia* (smooth hedgenettle). Vascular plant species richness ranges from 15 to 87 (mean = 54.69) species per 400-square-meter plot. Nonvascular cover in plots ranges from 0–5%. The most abundant moss in plots is *Climacium americanum* (American climacium moss).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Betula nigra* (river birch), *Platanus occidentalis* (American sycamore)
Herb (field)	Forb	*Packera aurea* (golden ragwort), *Solidago gigantea* (giant goldenrod), *Tradescantia ohiensis* (bluejacket), *Verbesina alternifolia* (wingstem)
Herb (field)	Graminoid	*Andropogon gerardii* (big bluestem), *Carex emoryi* (Emory's sedge), *Chasmanthium latifolium* (Indian woodoats), *Dichanthelium clandestinum* (deertongue), *Elymus riparius* (riverbank wildrye)

Characteristic Species: *Apios americana* (groundnut), *Cephalanthus occidentalis* (common buttonbush), *Galium triflorum* (fragrant bedstraw), *Pilea pumila* var. *pumila* (Canadian clearweed), *Symphyotrichum prenanthoides* (crookedstem aster).

Other Noteworthy Species:

Species	GRank	Type	Note
Carex emoryi (Emory's sedge)	-	plant	WV state-imperiled
Coronilla varia (purple crownvetch)	-	plant	exotic
Juncus dichotomus (forked rush)	-	plant	WV state-critically imperiled
Lysimachia nummularia (creeping jenny)	-	plant	exotic
Melilotus officinalis (yellow sweetclover)	-	plant	exotic
Rosa multiflora (multiflora rose)	-	plant	exotic
Spiraea virginiana (Virginia meadowsweet)	G2	plant	Federally listed threatened
Trifolium pratense (red clover)	-	plant	exotic
Vitis rupestris (sand grape)	G3	plant	WV state-imperiled

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	=	1	[gname]	Vanderhorst 2001b

Local Range: A total of 11 polygons of the Sycamore - River Birch Riverscour Woodland map class, covering 3.17 hectares, are mapped in the park. Small patches and linear zones of this association are also included as one of several associations within the Floodplain Forest and Woodland map class. A total of 48 polygons (57.11 ha) of this map class are mapped in the park. Eight accuracy assessment points in the Floodplain Forest and Woodland map class were attributed to this association. These represent 24% of the accuracy assessment points in this map class and are an indication of the relative abundance of this association within the map class. Stands are scattered along the Bluestone River throughout its length in the park, and small patches may also occur along the Little Bluestone and other large tributaries in the park.

Classification Comments: Two phases of this association can be recognized at Bluestone. Stands on cobble and boulder substrate, which are subject to more frequent, higher energy floods, have more open canopies and relatively sparse herb layers, with *Andropogon gerardii* (big bluestem) prominent in late season. Stands on sand substrate, which are subject to less frequent, lower energy floods, have taller, more closed canopies, often dominated by *Betula nigra* (river birch), over lush, tall herb layers with abundant *Dichanthelium clandestinum* (deertongue) and *Chasmanthium latifolium* (Indian woodoats). The tough rooted, flood-tolerant *Carex emoryi* (Emory's sedge) often grows in a line along the riverside edge of this association, sometimes beyond the woodland canopy. These zones are included within the association concept presented here, although purely herbaceous stands could be recognized as a distinct community analogous to Twisted Sedge Rocky Creekbed (*Carex torta* (twisted sedge) Herbaceous Vegetation (CEGL004103)) which occurs along tributaries of the New River (Vanderhorst et al. 2007).

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Thirteen plots were sampled: BLUE.13, BLUE.27, BLUE.39, BLUE.42, BLUE.63, BLUE.77, BLUE.78, BLUE.79, BLUE.89, BLUE.91, BLUE.110, BLUE.111, and BLUE.127.

Bluestone National Scenic River Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Woodland (II)
Physiognomic Subclass	Deciduous woodland (II.B.)
Physiognomic Group	Cold-deciduous woodland (II.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous woodland (II.B.2.N.)
Formation	Temporarily flooded cold-deciduous woodland (II.B.2.N.b.)

Alliance	*Platanus occidentalis - (Betula nigra, Salix* spp.) Temporarily Flooded Woodland Alliance (A.633)
Alliance (English name)	Sycamore - (River Birch, Willow species) Temporarily Flooded Woodland Alliance
Association	*Platanus occidentalis - Betula nigra* / *Cornus amomum* / (*Andropogon gerardii, Chasmanthium latifolium*) Woodland
Association (English name)	Sycamore - River Birch / Silky Dogwood / (Big Bluestem, River-oats) Woodland
Ecological System(s):	Cumberland Riverscour (CES202.036).

GLOBAL DESCRIPTION

Concept Summary: These woodlands occur along high-energy Appalachian rivershores, such as along the New, Bluestone, and Gauley rivers in West Virginia. They maintain an open canopy due to mechanical disturbance (flooding and scouring). The coarse-textured substrates are potentially well-drained, but fluvial topography and proximity to the water table often result in a mixture of well-drained and poorly drained microsites. The usually short, open canopy is composed mostly of flood-battered trees, typically codominated by *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch). The tallest trees are often the younger ones which have not yet been subjected to damage by severe floods. Additional important trees include *Acer saccharinum* (silver maple), *Carpinus caroliniana* (American hornbeam), *Catalpa speciosa* (northern catalpa), *Diospyros virginiana* (common persimmon), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Robinia pseudoacacia* (black locust), *Salix nigra* (black willow), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). Common shrubs include *Alnus serrulata* (hazel alder), *Cephalanthus occidentalis* (common buttonbush), *Chionanthus virginicus* (white fringetree), *Cornus amomum* (silky dogwood), *Hypericum prolificum* (shrubby St. Johnswort), *Lindera benzoin* (northern spicebush), and *Salix caroliniana* (coastal plain willow). There is often a large component of woody vines, including *Campsis radicans* (trumpet creeper), *Toxicodendron radicans* (eastern poison ivy), and *Vitis rupestris* (sand grape). The herb layer is composed of a mixture of warm-season grasses and forbs adapted to frequent flooding and high light exposure. Characteristic herbs include *Andropogon gerardii* (big bluestem), *Apocynum cannabinum* (Indianhemp), *Baptisia australis* (blue wild indigo), *Chasmanthium latifolium* (Indian woodoats), *Conoclinium coelestinum* (blue mistflower), *Cryptotaenia canadensis* (Canadian honewort), *Dichanthelium clandestinum* (deertongue), *Eupatorium fistulosum* (trumpetweed), *Galium triflorum* (fragrant bedstraw), *Justicia americana* (American water-willow), *Lobelia cardinalis* (cardinalflower), *Lysimachia ciliata* (fringed loosestrife), *Onoclea sensibilis* (sensitive fern), *Packera aurea* (golden ragwort), *Panicum virgatum* (switchgrass), *Pilea pumila* (Canadian clearweed), *Rudbeckia laciniata* (cutleaf coneflower), *Solidago gigantea* (giant goldenrod), *Solidago juncea* (early goldenrod), *Symphyotrichum prenanthoides* (crookedstem aster), *Tradescantia ohiensis* (bluejacket), *Tripsacum dactyloides* (eastern gamagrass), *Verbesina alternifolia* (wingstem), and *Viola cucullata* (marsh blue violet).

Environmental Description: These woodlands occur along high-energy Appalachian rivershores, such as the New River in West Virginia. They maintain an open canopy due to mechanical disturbance (flooding and scouring). This association occurs as relatively continuous linear zones (sometimes in small patches), commonly on deposition bars, in positions that are subject to frequent high-energy flooding. These floods damage and remove trees, maintaining an open canopy. Variation in this community related to flooding frequency and intensity is expressed in sediment particle size, ranging from boulders and cobbles in areas subject to the most frequent, highest energy floods to stone-free silty sand in areas subject to less frequent, lower energy floods. There is no soil horizon development. These coarse-textured substrates are

potentially well-drained, but fluvial topography and proximity to the water table often result in a mixture of well-drained and poorly drained microsites. Unvegetated ground cover is dominated by various mixtures of boulders, cobbles, and sand, with significant cover by coarse woody debris (flotsam) and standing water in some plots. Soil chemistry analyzed from four plots indicates low levels of macronutrients (N, P, K) and organic matter, and high levels of several micronutrients (Fe, Mg, Mn, Zn). Plots along the New River have soils with relatively high pH (mean = 6.73), while those along the Bluestone are more acidic (mean pH = 5.6). Slopes range from level to steep but are generally gentle. Known elevations range from 250 to 485 m (810–1575 feet).

Vegetation Description: This association is a deciduous woodland with a short, open canopy typically codominated by flood-battered *Platanus occidentalis* (American sycamore) and *Betula nigra* (river birch). (One atypical stand on the New River has a canopy codominated by *Pinus virginiana* (Virginia pine).) Additional important trees include *Acer saccharinum* (silver maple), *Carpinus caroliniana* (American hornbeam), *Catalpa speciosa* (northern catalpa), *Diospyros virginiana* (common persimmon), *Fraxinus americana* (white ash), *Fraxinus pennsylvanica* (green ash), *Robinia pseudoacacia* (black locust), *Salix nigra* (black willow), *Ulmus americana* (American elm), and *Ulmus rubra* (slippery elm). The tallest trees are often the younger ones which have not yet been subjected to damage by severe floods. Common shrubs include *Alnus serrulata* (hazel alder), *Cephalanthus occidentalis* (common buttonbush), *Chionanthus virginicus* (white fringetree), *Cornus amomum* (silky dogwood), *Hypericum prolificum* (shrubby St. Johnswort), *Lindera benzoin* (northern spicebush), and *Salix caroliniana* (coastal plain willow). The invasive exotic shrub *Rosa multiflora* (multiflora rose) is sometimes present. There is often a large component of woody vines in the short-shrub layer, including *Campsis radicans* (trumpet creeper), *Toxicodendron radicans* (eastern poison ivy), and *Vitis rupestris* (sand grape). The herb layer is composed of a mixture of warm-season grasses and forbs adapted to frequent flooding and high light exposure. Characteristic herbs include *Andropogon gerardii* (big bluestem), *Apocynum cannabinum* (Indianhemp), *Baptisia australis* (blue wild indigo), *Chasmanthium latifolium* (Indian woodoats), *Conoclinium coelestinum* (blue mistflower), *Cryptotaenia canadensis* (Canadian honewort), *Dichanthelium clandestinum* (deertongue), *Eupatorium fistulosum* (trumpetweed), *Galium triflorum* (fragrant bedstraw), *Justicia americana* (American water-willow), *Lobelia cardinalis* (cardinalflower), *Lysimachia ciliata* (fringed loosestrife), *Onoclea sensibilis* (sensitive fern), *Packera aurea* (golden ragwort), *Panicum virgatum* (switchgrass), *Pilea pumila* (Canadian clearweed), *Rudbeckia laciniata* (cutleaf coneflower), *Solidago gigantea* (giant goldenrod), *Solidago juncea* (early goldenrod), *Symphyotrichum prenanthoides* (crookedstem aster), *Tradescantia ohiensis* (bluejacket), *Tripsacum dactyloides* (eastern gamagrass), *Verbesina alternifolia* (wingstem), and *Viola cucullata* (marsh blue violet). Exotic herbs which are common in small amounts include *Prunella vulgaris* (common selfheal), *Plantago rugelii* (blackseed plantain), *Trifolium pratense* (red clover), *Melilotus officinalis* (yellow sweetclover), *Lysimachia nummularia* (creeping jenny), and *Coronilla varia* (purple crownvetch). Plants tracked as rare in West Virginia by the Natural Heritage Program include *Baptisia australis* (blue wild indigo), *Carex emoryi* (Emory's sedge), *Coreopsis pubescens* var. *robusta* (star tickseed), *Juncus dichotomus* (forked rush), *Solidago simplex* var. *racemosa* (Rand's goldenrod), *Spiraea virginiana* (Virginia meadowsweet), *Stachys tenuifolia* (smooth hedgenettle), and *Vitis rupestris* (sand grape). Vascular plant species richness in the 28 sampled plots ranged from 15 to 87 (mean = 46.7). The bryophyte layer is usually poorly developed; crustose lichens may occur on large rocks.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Betula nigra* (river birch), *Platanus occidentalis* (American sycamore)

Characteristic Species: *Acer saccharinum* (silver maple), *Alnus serrulata* (hazel alder), *Andropogon gerardii* (big bluestem), *Apocynum cannabinum* (Indianhemp), *Baptisia australis* (blue wild indigo), *Campsis radicans* (trumpet creeper), *Catalpa speciosa* (northern catalpa), *Cephalanthus occidentalis* (common buttonbush), *Chasmanthium latifolium* (Indian woodoats), *Chionanthus virginicus* (white fringetree), *Conoclinium coelestinum* (blue mistflower), *Cornus amomum* (silky dogwood), *Dichanthelium clandestinum* (deertongue), *Diospyros virginiana* (common persimmon), *Eupatorium fistulosum* (trumpetweed), *Hypericum prolificum* (shrubby St. Johnswort), *Justicia americana* (American water-willow), *Lobelia cardinalis* (cardinalflower), *Lysimachia ciliata* (fringed loosestrife), *Panicum virgatum* (switchgrass), *Robinia pseudoacacia* (black locust), *Salix caroliniana* (coastal plain willow), *Salix nigra* (black willow), *Solidago juncea* (early goldenrod), *Toxicodendron radicans* (eastern poison ivy), *Tripsacum dactyloides* (eastern gamagrass), *Ulmus americana* (American elm), *Ulmus rubra* (slippery elm), *Viola cucullata* (marsh blue violet), *Vitis rupestris* (sand grape).

Other Noteworthy Species:

Species	GRank	Type	Note
Baptisia australis (blue wild indigo)	-	plant	WV state-rare plant
Carex emoryi (Emory's sedge)	-	plant	WV state-rare plant
Coreopsis pubescens var. *robusta* (star tickseed)	-	plant	WV state-rare plant
Coronilla varia (purple crownvetch)	-	plant	exotic
Lysimachia nummularia (creeping jenny)	-	plant	exotic
Melilotus officinalis (yellow sweetclover)	-	plant	exotic
Rosa multiflora (multiflora rose)	-	plant	exotic
Solidago simplex var. *racemosa* (Rand's goldenrod)	G5T3?	plant	WV state-rare plant
Spiraea virginiana (Virginia meadowsweet)	G2	plant	Federally listed threatened
Trifolium pratense (red clover)	-	plant	exotic
Vitis rupestris (sand grape)	G3	plant	WV state-rare plant

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This type is currently documented from high-energy Appalachian rivers, such as the New, Bluestone, and Gauley rivers in West Virginia. Its range may include some of western Virginia as well.

States/Provinces: VA, WV.

Federal Lands: NPS (Bluestone, New River Gorge).

CONSERVATION STATUS

Rank: GNR (1-Dec-1997).

Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: Along the New River, this association is ecologically and floristically intermediate between *Andropogon gerardii - Panicum virgatum - Baptisia australis* Herbaceous Vegetation (CEGL006283), which is more open and occurs on sites which are more severely impacted by flooding, and *Platanus occidentalis - Fraxinus pennsylvanica / Carpinus caroliniana / Verbesina alternifolia* Forest (CEGL006458), which has a more closed canopy, usually lacking *Betula*

nigra (river birch), and occurs on sites less severely impacted by flooding. It is also similar to *Salix nigra - Betula nigra / Schoenoplectus pungens* Wooded Herbaceous Vegetation [Provisional] (CEGL006463), which occurs on finer textured alluvium in riverside positions along lower energy reaches. Similar vegetation was described from the New River Gorge by Suiter (1995) as *Platanus occidentalis - Betula nigra* forest. Two phases of this association can be recognized along the Bluestone River and its tributaries. Stands on cobble and boulder substrate, which are subject to more frequent, higher energy floods, have more open canopies and relatively sparse herb layers with *Andropogon gerardii* (big bluestem) prominent in late season. Stands on sand substrate, which are subject to less frequent, lower energy floods, have taller, more closed canopies, often dominated by *Betula nigra* (river birch), over lush, tall herb layers with abundant *Dichanthelium clandestinum* (deertongue) and *Chasmanthium latifolium* (Indian woodoats). The tough-rooted, flood-tolerant *Carex emoryi* (Emory's sedge) often grows in a line along the riverside edge of this association, sometimes beyond the woodland canopy. These zones are included within the association concept presented here. Recent classification studies in the National Park Service National Capitol Region have shown this association to be distinct from similar vegetation in the Potomac drainage, which is classified as *Platanus occidentalis - Betula nigra - Salix (caroliniana, nigra)* Woodland (CEGL003896).

Similar Associations:

Betula nigra - Platanus occidentalis Forest (CEGL002086)--with a more-or-less closed canopy.

Platanus occidentalis - Betula nigra - Salix (caroliniana, nigra) Woodland (CEGL003896).

Quercus bicolor - Fraxinus pennsylvanica - (Platanus occidentalis) / Chasmanthium latifolium - Dichanthelium clandestinum - Zizia aurea Woodland (CEGL006218).

Salix nigra - Betula nigra / Schoenoplectus pungens Wooded Herbaceous Vegetation [Provisional] (CEGL006463)--occurs in similar riverside positions along lower energy reaches, often just downstream from rapids.

Related Concepts:

Platanus occidentalis - Betula nigra / Cornus amomum riparian woodland (Vanderhorst 2001b) =

Platanus occidentalis - Betula nigra forest (Suiter 1995) ?

SOURCES

Description Authors: M. Pyne, mod. S. C. Gawler.

References: Fleming et al. 2001, Mitchem 2004, Southeastern Ecology Working Group n.d., Suiter 1995, Vanderhorst 2000b, Vanderhorst 2001b, Vanderhorst et al. 2007, Vanderhorst et al. 2008, Vanderhorst pers. comm.

Plot BLUE.89. Sycamore - River Birch Riverscour Woodland (sycamore - river birch / big bluestem phase).

Plot BLUE.77. Sycamore - River Birch Riverscour Woodland (river birch / Indian woodoats phase).

COMMON NAME (PARK-SPECIFIC): VIRGINIA PINE - OAK SHALE WOODLAND

SYNONYMS

NVC English Name:	**Chestnut Oak - Virginia Pine - (Table Mountain Pine) / Little Bluestem - Starved Witchgrass Woodland**
NVC Scientific Name:	***Quercus prinus - Pinus virginiana - (Pinus pungens) / Schizachyrium scoparium - Dichanthelium depauperatum* Woodland**
NVC Identifier:	**CEGL008540**

LOCAL INFORMATION

Environmental Description: This association occurs in small patches (0.1–6.6 ha) on hot, dry gorge slopes with infertile soils. It is restricted to south-southwest aspects on steep convex slopes, ridge spurs, and clifftops which have the highest solar exposure of all sites in the park. Slopes in mapped polygons range from 12 to 43 degrees (mean = 32). Elevations in mapped polygons range from 469 to 676 m (mean = 567). Bedrock geology is mapped as shales and sandstones of the Hinton Formation in the Mauch Chunk Group. Both shale and sandstone surficial rocks, including outcrops of sandstone bedrock, were noted in plots. Unvegetated ground cover in plots includes significant portions of litter, bare soil, and rock. Soils in plots are described as dry to very dry, well-drained to rapidly drained, stony to extremely stony sandy loam and silt loam. Soils from plots tested extremely to strongly acidic (mean pH = 4.6) with relatively high levels of estimated N release, Al, and K, and relatively low levels of organic matter, S, B, Ca, Cu, Fe, Mg, Mn, Na, P, and Zn compared to average values in the park. Polygons of this association are usually adjacent to larger polygons of Oak - Eastern White Pine / Ericad Forest (CEGL008539), which occur in slightly less xeric positions, and Oak - Hickory - Sugar Maple Forest (CEGL007268), which occur in more mesic positions with more fertile soils. Sometimes polygons of this association are uphill from small polygons of Calcareous Oak Forest (CEGL004793), which occur on southerly aspects with limestone-influenced soils.

Vegetation Description: This association represents mixed evergreen-deciduous woodlands and open-canopy forests codominated by *Pinus virginiana* (Virginia pine) and *Quercus* (oak) spp. Canopy cover in plots ranges from 20–70%. Important canopy species in plots include (in decreasing order of constancy) *Pinus virginiana* (Virginia pine), *Quercus rubra* (northern red oak), *Quercus prinus* (chestnut oak), *Carya glabra* (pignut hickory), *Quercus stellata* (post oak), *Quercus alba* (white oak), *Fraxinus americana* (white ash), and *Carya alba* (mockernut hickory). Subcanopy cover in plots ranges from 10–60%, consisting of the canopy species, with high constancy of *Juniperus virginiana* var. *virginiana* (eastern redcedar) and *Quercus stellata* (post oak). Cover in the shrub layers of plots ranges from 1–70%, dominated by regeneration of the canopy and subcanopy tree species. Common shrubs in plots include *Amelanchier arborea* var. *arborea* (common serviceberry), *Vaccinium stamineum* (deerberry), *Vaccinium pallidum* (Blue Ridge blueberry), *Rosa carolina* var. *carolina* (Carolina rose), and *Rhus aromatica* var. *aromatica* (fragrant sumac). Herb cover in plots ranges from 10–50%, dominated by species tolerant of dry, acidic soils. Common herbs include (in decreasing order of constancy in plots) *Carex pensylvanica* (Pennsylvania sedge), *Antennaria plantaginifolia* (woman's tobacco), *Houstonia longifolia* (longleaf summer bluet), *Helianthus divaricatus* (woodland sunflower), *Cunila origanoides* (common dittany), *Taenidia integerrima* (yellow pimpernel), *Symphyotrichum undulatum* (waxyleaf aster), *Lespedeza frutescens* (shrubby lespedeza),

Danthonia spicata (poverty oatgrass), and *Asplenium platyneuron* (ebony spleenwort). State and globally rare plant species found in this association in the park include *Allium oxyphilum* (lillydale onion), *Monarda fistulosa* ssp. *brevis* (Smoke Hole bergamot), and *Viburnum rafinesquianum* (downy arrowwood). The latter two of these species are more typical of calcareous soils, and their presence here is peripheral to larger populations in adjacent habitats. Vascular plant species richness ranges from 23 to 56 (mean = 42.13) species per 400-square-meter plot. Nonvascular cover in plots ranges from 0–10%, often dominated by fruticose lichens including *Cladina arbuscula* (reindeer lichen).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Quercus stellata* (post oak)
Tree canopy	Needle-leaved tree	*Pinus virginiana* (Virginia pine)
Tree canopy	Broad-leaved deciduous tree	*Carya glabra* (pignut hickory), *Quercus prinus* (chestnut oak), *Quercus rubra* (northern red oak)
Tree subcanopy	Needle-leaved tree	*Juniperus virginiana* var. *virginiana* (eastern redcedar)
Herb (field)	Graminoid	*Carex pensylvanica* (Pennsylvania sedge)

Characteristic Species: *Antennaria plantaginifolia* (woman's tobacco), *Cunila origanoides* (common dittany), *Danthonia spicata* (poverty oatgrass), *Helianthus divaricatus* (woodland sunflower), *Houstonia longifolia* (longleaf summer bluet), *Lespedeza frutescens* (shrubby lespedeza), *Rosa carolina* var. *carolina* (Carolina rose), *Symphyotrichum undulatum* (waxyleaf aster), *Taenidia integerrima* (yellow pimpernel), *Vaccinium pallidum* (Blue Ridge blueberry), *Vaccinium stamineum* (deerberry).

Other Noteworthy Species:

Species	GRank	Type	Note
Allium oxyphilum (lillydale onion)	G2Q	plant	globally and WV state-imperiled
Monarda fistulosa ssp. *brevis* (Smoke Hole bergamot)	G5T1	plant	globally critically imperiled
Viburnum rafinesquianum (downy arrowwood)	-	plant	WV state-imperiled

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	=	1	[gname]	WVNHP unpubl. data b

Local Range: A total of 23 polygons covering 26.10 hectares are mapped in the park.

Classification Comments: This community at Bluestone resembles open communities in the Ridge and Valley which occur on both sandstone and shale. Stands at Bluestone are centered on thin bands of sandstone bedrock which outcrop on predominantly shale slopes. Both sandstone and shale surficial rocks were noted in plots. It is similar to shale barrens but lacks the endemics (Braunschweig et al. 1999) which characterize those communities as cohesive evolutionary units. The association has not been documented elsewhere on shale, but this difference is probably related to contrasting geology of stacked, gently dipping strata at Bluestone compared to dramatically folded and faulted strata of the Ridge and Valley. The community at Bluestone also differs from the main range of the association by having higher canopy cover, probably reflecting somewhat more mesic climate and soils. In multivariate analysis of upland forests at Bluestone, plots of this association consistently cluster and ordinate together as an outlying group. In statewide analysis, plots of this association from Bluestone cluster and ordinate as a group separate from shale barrens in the Ridge and Valley. Presence of the calciphilic species *Monarda fistulosa* ssp. *brevis* (Smoke Hole bergamot), *Viburnum rafinesquianum* (downy arrowwood), and *Quercus muehlenbergii* (chinkapin oak) in plots of this association probably

reflects an ecotone between this association and Calcareous Oak Forest which occurs downslope on limestone bedrock.
Other Comments: Information not available.
Local Description Authors: J. P. Vanderhorst.
Plots: Eight plots were sampled: BLUE.2, BLUE.22, BLUE.26, BLUE.30, BLUE.84, BLUE.118, BLUE.130, and BLUE.131.
Bluestone National Scenic River Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Woodland (II)
Physiognomic Subclass	Mixed evergreen - deciduous woodland (II.C.)
Physiognomic Group	Mixed needle-leaved evergreen - cold-deciduous woodland (II.C.3.)
Physiognomic Subgroup	Natural/Semi-natural mixed needle-leaved evergreen - cold-deciduous woodland (II.C.3.N.)
Formation	Mixed needle-leaved evergreen - cold-deciduous woodland (II.C.3.N.a.)
Alliance	*Pinus (rigida, pungens, virginiana)* - *Quercus prinus* Woodland Alliance (A.677)
Alliance (English name)	(Pitch Pine, Table Mountain Pine, Virginia Pine) - Chestnut Oak Woodland Alliance
Association	*Quercus prinus - Pinus virginiana - (Pinus pungens) / Schizachyrium scoparium - Dichanthelium depauperatum* Woodland
Association (English name)	Chestnut Oak - Virginia Pine - (Table Mountain Pine) / Little Bluestem - Starved Witchgrass Woodland
Ecological System(s):	Central Appalachian Pine-Oak Rocky Woodland (CES202.600).

GLOBAL DESCRIPTION

Concept Summary: This community is a mixed oak-pine woodland with a canopy of stunted, often gnarled trees, varying from semi-open to very open. It occurs on steep convex slopes, ridge spurs, and clifftops which have high solar exposure. Most are on moderate to steep slopes with much exposed mineral soil. Sites are confined to lower elevations (<770 m [2500 feet]), are distinctly xeric, and usually have southeast to southwest aspects. Underlying bedrock includes quartzite, metasandstone and sandstone, granite, shale, and other acidic rocks. Surface cover of outcrops and loose stones is relatively high. Soils are extremely acidic. The canopy is typically codominated by *Quercus prinus* (chestnut oak) and *Pinus virginiana* (Virginia pine) in variable proportions; in some slightly more mesic occurrences, *Quercus rubra* (northern red oak) may occur with or in place of *Quercus prinus* (chestnut oak). *Pinus pungens* (Table Mountain pine) is an important, even dominant, associate in a minority of stands. Minor but relatively constant tree associates include *Carya glabra* (pignut hickory), *Amelanchier arborea* (common serviceberry), and *Sassafras albidum* (sassafras). Minor, inconstant tree associates include *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Quercus alba* (white oak), *Carya alba* (mockernut hickory), *Carya ovata* (shagbark hickory), *Juniperus virginiana* (eastern redcedar), *Pinus strobus* (eastern white pine), and *Fraxinus americana* (white ash). The shrub layer varies from moderately dense to sparse, with *Vaccinium pallidum* (Blue Ridge blueberry) and *Vaccinium stamineum* (deerberry) the most constant and abundant species. *Quercus ilicifolia* (bear oak), *Kalmia latifolia* (mountain laurel), *Rhus copallinum* (flameleaf sumac), *Rhus aromatica* (fragrant sumac), *Rosa carolina* (Carolina rose), *Castanea pumila* (chinkapin), *Viburnum acerifolium* (mapleleaf viburnum), and *Toxicodendron pubescens* (Atlantic poison oak) are inconstant, but occasionally common, in the type. Herbaceous composition and density vary with shrub density. Graminoid-rich openings

dominated by *Schizachyrium scoparium* (little bluestem), *Dichanthelium depauperatum* (starved panicgrass), *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), and *Dichanthelium commutatum* (variable panicgrass) are frequent. Also present is a surprising variety of low-cover forbs, among the most characteristic of which are *Hieracium venosum* (rattlesnakeweed), *Solidago erecta*, *Potentilla canadensis* (dwarf cinquefoil), *Campanula divaricata* (small bonny bellflower), *Viola sagittata* (arrowleaf violet), *Houstonia longifolia* (longleaf summer bluet), *Antennaria plantaginifolia* (woman's tobacco), *Aureolaria laevigata* (entireleaf yellow false foxglove), *Helianthus divaricatus* (woodland sunflower), *Cunila origanoides* (common dittany), *Symphyotrichum undulatum* (waxyleaf aster), *Coreopsis verticillata* (whorled tickseed), *Tephrosia virginiana* (Virginia tephrosia), *Lespedeza frutescens* (shrubby lespedeza), *Polygonatum biflorum* var. *biflorum* (smooth Solomon's-seal), *Taenidia integerrima* (yellow pimpernel), *Asplenium platyneuron* (ebony spleenwort), and *Clitoria mariana* (Atlantic pigeonwings).

Environmental Description: This association occurs on steep convex slopes, ridge spurs, and clifftops which have high solar exposure. Most habitats are characterized by moderate to steep (mean = 24 degrees) slopes with much exposed mineral soil. Sites are confined to lower elevations (<770 m [2500 feet]), are distinctly xeric, and usually have southeast to southwest aspects. Underlying bedrock at plot-sampling sites in VA, MD, and WV includes Antietam quartzite, ferruginous metasandstone of the Harper's Formation, acidic granites, acidic phases of Catoctin metabasalt, schistose metasedimentary rocks of the Mather Gorge Formation, shales and sandstones of the Hinton formation in the Mauch Chunk group, and ancient alluvium composed of quartzitic cobbles. Surface cover of outcrops and loose stones is relatively high (mean = 38% in MD and VA plots). Soils are extremely acidic (mean pH = 4.4) and very low in base status, except for high aluminum levels and sometimes relatively high potassium levels. One somewhat anomalous site is located on massive alluvial fans that overlie the floor of the Great Valley of Virginia along the foot of the Blue Ridge in Augusta County. Here, stands occupy barren, elevated cobble terraces bordering a stream and representing the floodplain level of an earlier erosional cycle.

Vegetation Description: The canopy cover of stunted, often gnarled trees varies from semi-open to very open. *Quercus prinus* (chestnut oak) and *Pinus virginiana* (Virginia pine) are usually codominant in variable proportions; in some slightly more mesic occurrences, *Quercus rubra* (northern red oak) may occur with or in place of *Quercus prinus* (chestnut oak). *Pinus pungens* (Table Mountain pine) is an important, even dominant, associate in a minority of stands. Minor but relatively constant tree associates include *Carya glabra* (pignut hickory), *Amelanchier arborea* (common serviceberry), and *Sassafras albidum* (sassafras). Minor, inconstant tree associates include *Quercus coccinea* (scarlet oak), *Quercus velutina* (black oak), *Quercus stellata* (post oak), *Quercus marilandica* (blackjack oak), *Quercus alba* (white oak), *Carya alba* (mockernut hickory), *Carya ovata* (shagbark hickory), *Juniperus virginiana* (eastern redcedar), *Pinus strobus* (eastern white pine), and *Fraxinus americana* (white ash). The shrub layer varies from moderately dense to sparse, with *Vaccinium pallidum* (Blue Ridge blueberry) and *Vaccinium stamineum* (deerberry) the most constant and abundant species. *Quercus ilicifolia* (bear oak), *Kalmia latifolia* (mountain laurel), *Rhus copallinum* (flameleaf sumac), *Rhus aromatica* (fragrant sumac), *Rosa carolina* (Carolina rose), *Castanea pumila* (chinkapin), *Viburnum acerifolium* (mapleleaf viburnum), and *Toxicodendron pubescens* (Atlantic poison oak) are inconstant, but occasionally common, in the type. Herbaceous composition and density vary with shrub density. Graminoid-rich openings dominated by *Schizachyrium scoparium* (little

bluestem), *Dichanthelium depauperatum* (starved panicgrass), *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty oatgrass), and *Dichanthelium commutatum* (variable panicgrass) are frequent. Also present is a surprising variety of low-cover forbs, among the most characteristic of which are *Hieracium venosum* (rattlesnakeweed), *Solidago erecta*, *Potentilla canadensis* (dwarf cinquefoil), *Campanula divaricata* (small bonny bellflower), *Viola sagittata* (arrowleaf violet), *Houstonia longifolia* (longleaf summer bluet), *Antennaria plantaginifolia* (woman's tobacco), *Aureolaria laevigata* (entireleaf yellow false foxglove), *Helianthus divaricatus* (woodland sunflower), *Cunila origanoides* (common dittany), *Symphyotrichum undulatum* (waxyleaf aster), *Coreopsis verticillata* (whorled tickseed), *Tephrosia virginiana* (Virginia tephrosia), *Lespedeza frutescens* (shrubby lespedeza), *Polygonatum biflorum* var. *biflorum* (smooth Solomon's-seal), *Taenidia integerrima* (yellow pimpernel), *Asplenium platyneuron* (ebony spleenwort), and *Clitoria mariana* (Atlantic pigeonwings). Additional herbs occurring less frequently include *Lespedeza hirta* (hairy lespedeza), *Solidago odora* (anisescented goldenrod), *Deschampsia flexuosa* (wavy hairgrass), *Coreopsis major* (greater tickseed), *Solidago puberula* var. *puberula* (downy goldenrod), *Solidago bicolor* (white goldenrod), *Solidago arguta* var. *caroliniana* (Atlantic goldenrod), *Solidago sphacelata* (autumn goldenrod), *Hypericum hypericoides* ssp. *multicaule* (St. Andrew's cross), *Lysimachia quadrifolia* (whorled yellow loosestrife), *Asclepias amplexicaulis* (clasping milkweed), *Sericocarpus asteroides* (toothed whitetop aster), *Dicentra eximia* (turkey corn), *Paronychia fastigiata* (hairy forked nailwort), *Sericocarpus linifolius* (narrowleaf whitetop aster), *Ionactis linariifolius* (flaxleaf whitetop aster), *Symphyotrichum laeve* (smooth blue aster), *Phlox subulata* (moss phlox), *Pellaea atropurpurea* (purple cliffbrake), *Polygonum scandens* var. *cristatum* (climbing false buckwheat), *Viola X palmata* (early blue violet), *Arabis laevigata* (smooth rockcress), and *Zizia trifoliata* (meadow alexanders). Vascular plant species richness of plot-sampled stands ranges from 17 to 56 taxa per 400 square meters (mean = 37). Nonvascular cover tends to be sparse and characterized by fruticose lichens, including *Cladina arbuscula* (reindeer lichen).

Most Abundant Species: Information not available.

Characteristic Species: *Carex umbellata* (parasol sedge), *Castanea pumila* (chinkapin), *Dichanthelium commutatum* (variable panicgrass), *Dichanthelium depauperatum* (starved panicgrass), *Hieracium venosum* (rattlesnakeweed), *Lespedeza hirta* (hairy lespedeza), *Pinus virginiana* (Virginia pine), *Quercus marilandica* (blackjack oak), *Rhus copallinum* (flameleaf sumac), *Solidago odora* (anisescented goldenrod), *Tephrosia virginiana* (Virginia tephrosia), *Toxicodendron pubescens* (Atlantic poison oak).

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: The known range of this community is limited to the northern Blue Ridge, Ridge and Valley, Cumberlands, and Piedmont in Virginia, West Virginia, and Maryland, but geologic substrates and site conditions similar to those supporting the known examples occur elsewhere in the Central Appalachians, and a broader geographic range seems likely.

States/Provinces: MD, VA:S2, WV.

Federal Lands: NPS (Blue Ridge Parkway, Bluestone, C&O Canal, Catoctin Mountain, Harpers Ferry, Shenandoah); USFS (Jefferson).

CONSERVATION STATUS

Rank: G3? (8-Feb-2008).

Reasons: Although this community is likely to have a broader distribution in the Central Appalachians than present documentation suggests, it is a small-patch vegetation type restricted to special habitat conditions.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 - Moderate.

Comments: The classification of this type is supported by analysis of 12 Virginia, 3 Maryland, and 8 West Virginia plot samples. Additional inventory and data collection are needed to clarify the geographic range, classification, and environmental context of this type. The known range of this community is limited to the northern Blue Ridge, Ridge and Valley, Cumberlands, and Piedmont in Virginia, West Virginia, and Maryland, but geologic substrates and site conditions similar to those supporting the known examples occur elsewhere in the Central Appalachians, and a broader geographic range seems likely.

Similar Associations:

Pinus virginiana / Vaccinium pallidum / Schizachyrium scoparium - Carex pensylvanica Woodland (CEGL003624)--on dry shale slopes of the Southern Appalachians.

Quercus prinus - Juniperus virginiana - (Pinus virginiana) / Philadelphus hirsutus - Celtis occidentalis Woodland (CEGL007720)--on steep, rocky, riverine bluffs in the Southern Blue Ridge with exposed and eroding shale.

Quercus prinus / Quercus ilicifolia / Danthonia spicata Woodland [Provisional] (CEGL008526)--on dry shale slopes of the Central Appalachians.

Related Concepts:

Pinus pungens - Pinus rigida / Quercus ilicifolia / Gaylussacia baccata Association: *Andropogon scoparius - Coreopsis verticillata - Dichanthelium depauperatum* Subassociation, *pro parte* (Rawinski et al. 1996) F

Quercus prinus - Pinus virginiana - Quercus (marilandica, stellata) / Dichanthelium depauperatum Woodland (Fleming and Coulling 2001) =

SOURCES

Description Authors: G. P. Fleming and P. P. Coulling, mod. S. C. Gawler.

References: Braunschweig et al. 1999, Fleming and Coulling 2001, Fleming et al. 2001, Fleming et al. 2004, Fleming et al. 2007, Rawinski et al. 1996, WVNHP unpubl. data b.

Plot BLUE.84. Virginia Pine - Oak Shale Woodland.

COMMON NAME (PARK-SPECIFIC): RIVERBANK TALL HERBS

SYNONYMS

NVC English Name: **Wingstem - Riverbank Wild Rye - Giant Goldenrod - (American Germander) Herbaceous Vegetation**

NVC Scientific Name: ***Verbesina alternifolia - Elymus riparius - Solidago gigantea - (Teucrium canadense)*** **Herbaceous Vegetation**

NVC Identifier: **CEGL006480**

LOCAL INFORMATION

Environmental Description: This association occurs in small patches on sunny riverbanks and floodplains. It is included as one of several associations in both the Floodplain Forest and Woodland map class and the Modified Successional Floodplain Forest and Woodland map class. Patches in the former are affected by a natural flooding regime, those in the latter may be occasionally flooded by reservoir backup from Bluestone Lake. In natural settings, this association occurs on sandy riverbanks where heavy annual deposits of alluvial sediments inhibit tree establishment. The rate and extent of sedimentation have been greatly increased by flooding of Bluestone Lake, probably increasing the extent of this association. It can also occur as successional vegetation on floodplains previously cleared for agriculture. Slopes in mapped polygons of Floodplain Forest and Woodland and Modified Successional Floodplain Forest and Woodland range from 0 to 34 degrees. Elevations in mapped polygons of these two map classes range from 436 to 506 m. Unvegetated ground cover in plots is dominated by litter and exposed sand. Soils in plots are described as temporarily flooded, deep, moderately well-drained to well-drained, stone-free or slightly stony sand and loamy sand. Soils from plots tested medium to slightly acidic (mean pH = 5.8) with relatively high levels of Ca, Cu, Mg, Mn, and Zn, and relatively low levels of organic matter, estimated N release, S, Al, B, Fe, K, Na, and P compared to average values in the park. Adjacent associations in the Modified Successional Floodplain Forest and Woodland map class may include Successional Black Walnut Floodplain Forest (CEGL007879), Successional Box-elder Floodplain Forest (CEGL005033), Successional Tuliptree / Northern Spicebush Forest (CEGL007220), River Birch Backwater Floodplain Forest (CEGL002086), and Sycamore - Ash Floodplain Forest (CEGL006458). Adjacent associations in the Floodplain Forest and Woodland map class may include Oak - Hickory Floodplain Forest (CEGL006462), Sycamore - River Birch Riverscour Woodland (CEGL003725), Sycamore - Yellow Buckeye Floodplain Forest (CEGL006466), and Eastern Hemlock Floodplain Forest (CEGL006620).

Vegetation Description: This association represents herbaceous vegetation or wooded herbaceous vegetation dominated by rank growth of tall herbs. Canopy cover in plots ranges from 0–40% and subcanopy cover ranges from 0–30%. Common trees include *Platanus occidentalis* (American sycamore), *Liriodendron tulipifera* (tuliptree), *Betula nigra* (river birch), and *Fraxinus pennsylvanica* (green ash). Cover in the shrub layers of plots ranges from 0–15%, including tree saplings, shrubs, and vines. Common shrubs include *Physocarpus opulifolius* var. *opulifolius* (common ninebark), *Lindera benzoin* (northern spicebush), *Viburnum prunifolium* (blackhaw), *Hypericum prolificum* (shrubby St. Johnswort), and the exotic invasive *Rosa multiflora* (multiflora rose). The shrub *Spiraea virginiana* (Virginia meadowsweet) is a federally listed threatened species which was found in one plot. Vines include *Toxicodendron radicans* (eastern poison ivy), *Smilax tamnoides* (bristly greenbrier), and *Vitis vulpina* (frost grape). Herb

cover in plots ranges from 40–100%. Common native herbs include (in decreasing order of constancy in plots) *Verbesina alternifolia* (wingstem), *Dichanthelium clandestinum* (deertongue), *Solidago gigantea* (giant goldenrod), *Boehmeria cylindrica* (smallspike false nettle), *Apios americana* (groundnut), *Packera aurea* (golden ragwort), *Onoclea sensibilis* (sensitive fern), *Amphicarpaea bracteata* (American hogpeanut), *Chasmanthium latifolium* (Indian woodoats), *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Verbena urticifolia* (white vervain), *Leersia virginica* (whitegrass), *Tradescantia ohiensis* (bluejacket), *Elymus riparius* (riverbank wildrye), *Verbesina occidentalis* (yellow crownbeard), and *Helenium autumnale* var. *autumnale* (common sneezeweed). *Teucrium canadense* var. *canadense* (Canada germander), a nominal species in the association name, occurs in one plot. The state-rare *Carex emoryi* (Emory's sedge) may grow in a line along the river's edge. The exotic herbs *Humulus japonicus* (Japanese hop) and *Urtica dioica* ssp. *dioica* (stinging nettle) may out-compete the native herbs in this association and form large monospecific patches in floodplain openings, especially those affected by reservoir backup. Vascular plant species richness in floristically complete plots ranges from 41 to 80 (mean = 44.57) species per 400 square meters.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Betula nigra* (river birch), *Liriodendron tulipifera* (tuliptree), *Platanus occidentalis* (American sycamore)
Herb (field)	Vine/Liana	*Toxicodendron radicans* (eastern poison ivy)
Herb (field)	Forb	*Boehmeria cylindrica* (smallspike false nettle), *Helenium autumnale* var. *autumnale* (common sneezeweed), *Rudbeckia laciniata* var. *laciniata* (cutleaf coneflower), *Solidago gigantea* (giant goldenrod), *Verbesina alternifolia* (wingstem)
Herb (field)	Graminoid	*Chasmanthium latifolium* (Indian woodoats), *Dichanthelium clandestinum* (deertongue)

Characteristic Species: *Amphicarpaea bracteata* (American hogpeanut), *Apios americana* (groundnut), *Elymus riparius* (riverbank wildrye), *Onoclea sensibilis* (sensitive fern), *Teucrium canadense* var. *canadense* (Canada germander).

Other Noteworthy Species:

Species	GRank	Type	Note
Carex emoryi (Emory's sedge)	-	plant	WV state-imperiled
Humulus japonicus (Japanese hop)	-	plant	exotic
Rosa multiflora (multiflora rose)	-	plant	exotic
Spiraea virginiana (Virginia meadowsweet)	G2	plant	Federally listed threatened
Urtica dioica ssp. *dioica* (stinging nettle)	-	plant	exotic

Subnational Distribution with Crosswalk Data:

State	SRank	Rel	Conf	SName	Reference
WV	SNR	=	1	[gname]	Vanderhorst et al. 2007

Local Range: This association is included as one of several within two natural/semi-natural map classes: the Floodplain Forest and Woodland and the Modified Successional Floodplain Forest and Woodland. A total of 73 polygons (138.45 ha) of the two map classes are mapped in the park. Only one accuracy assessment point in the Floodplain Forest and Woodland map class is attributed to this association, probably indicating low abundance and/or small patch size of the association in these map classes. Patches may also occur in the Disturbed Area map class (total

33 polygons, 25.3 ha). Known stands are scattered along the floodplain of the Bluestone River throughout its length in the park.

Classification Comments: At Bluestone, this association occurs adjacent to and is floristically similar to several natural and semi-natural floodplain forest associations. It is best characterized by combining an open canopy with deep alluvial sediments which promote rank growth of tall herbs adapted to full sunlight. Elsewhere, this association occurs adjacent to floodplain forest associations different from those at Bluestone; this supports its recognition as a distinct association rather than an ecotone.

Other Comments: Information not available.

Local Description Authors: J. P. Vanderhorst.

Plots: Seven plots were sampled: BLUE.86, BLUE.94, BLUE.96, BLUE.109, BLUE.114, BLUE.115, and BLUE.128.

Bluestone National Scenic River Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Herbaceous Vegetation (V)
Physiognomic Subclass	Perennial forb vegetation (V.B.)
Physiognomic Group	Temperate or subpolar perennial forb vegetation (V.B.2.)
Physiognomic Subgroup	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
Formation	Temporarily flooded temperate perennial forb vegetation (V.B.2.N.d.)
Alliance	*Eupatorium* spp. - *Polygonum* spp. Temporarily Flooded Depositional Shore and Bar Herbaceous Alliance (A.3038)
Alliance (English name)	Thoroughwort species - Knotweed species Temporarily Flooded Depositional Shore and Bar Herbaceous Alliance
Association	*Verbesina alternifolia - Elymus riparius - Solidago gigantea - (Teucrium canadense)* Herbaceous Vegetation
Association (English name)	Wingstem - Riverbank Wild Rye - Giant Goldenrod - (American Germander) Herbaceous Vegetation
Ecological System(s):	Central Appalachian Stream and Riparian (CES202.609). Central Appalachian River Floodplain (CES202.608).

GLOBAL DESCRIPTION

Concept Summary: This tall herb-dominated association is known from the shores of rivers and large streams in the Piedmont and mountain regions of Maryland, Virginia, and West Virginia. It occupies well-drained riverbanks and, less commonly, depositional bars or alluvial fans of medium-sized to large rivers that experience low rates of sediment erosion and turnover during small to moderate floods. Heavy annual deposits of alluvial sediments inhibit tree establishment. The type typically occurs as a narrow, linear strip along the outer edge of a floodplain forest. Occurrences have high solar exposure, though they may experience partial shading from adjacent (landward) forests. Vegetation is characterized by a dense growth of tall (1–3 m), light-demanding, native perennial herbs. The most characteristic species across the range are *Chasmanthium latifolium* (Indian woodoats), *Dichanthelium clandestinum* (deertongue), *Verbesina alternifolia* (wingstem), *Elymus* (wildrye) spp. (*Elymus riparius* (riverbank wildrye), *Elymus canadensis* (Canada wildrye), *Elymus villosus* (hairy wildrye), *Elymus virginicus* (Virginia wildrye)), *Conoclinium coelestinum* (blue mistflower), several species of *Eupatorium* (thoroughwort) (*Eupatorium fistulosum* (trumpetweed), *Eupatorium perfoliatum* (common boneset), *Eupatorium serotinum* (lateflowering thoroughwort)), *Rudbeckia laciniata* (cutleaf coneflower), *Solidago gigantea* (giant goldenrod), *Calystegia sepium* (hedge

false bindweed), and *Verbena urticifolia* (white vervain). Along the Potomac in the Great Valley of Virginia downstream to the fall line, *Teucrium canadense* (Canada germander) and *Scrophularia marilandica* (carpenter's square) are also abundant; less abundant species include *Ageratina altissima* (white snakeroot), *Helianthus decapetalus* (thinleaf sunflower), *Oenothera biennis* (common evening-primrose), *Phytolacca americana* (American pokeweed), and *Monarda fistulosa* (wild bergamot).. Along the New and Bluestone rivers in West Virginia, additional characteristic species include *Amphicarpaea bracteata* (American hogpeanut), *Apios americana* (groundnut), *Helenium autumnale* (common sneezeweed), *Helianthus strumosus* (paleleaf woodland sunflower), *Heliopsis helianthoides* (smooth oxeye), *Packera aurea* (golden ragwort), *Phlox paniculata* (fall phlox), *Polygonum scandens* (climbing false buckwheat), *Polygonum virginianum* (jumpseed), *Senna hebecarpa* (American senna), *Solanum carolinense* (Carolina horsenettle), *Solidago canadensis* (Canada goldenrod), *Symphyotrichum lanceolatum* (white panicle aster), *Symphyotrichum lateriflorum* (calico aster), *Tradescantia ohiensis* (bluejacket), *Tripsacum dactyloides* (eastern gamagrass), *Verbesina occidentalis* (yellow crownbeard), and *Vernonia noveboracensis* (New York ironweed). Tall annual species characteristically dominant on less stabilized bars may be present but generally do not dominate. Woody vines are often common and include *Toxicodendron radicans* (eastern poison ivy), *Vitis riparia* (riverbank grape), and *Vitis vulpina* (frost grape). Scattered shrubby or occasionally full-sized trees of flood-tolerant species may occur, with *Acer saccharinum* (silver maple), *Platanus occidentalis* (American sycamore), *Fraxinus pennsylvanica* (green ash), *Betula nigra* (river birch), and *Acer negundo* (boxelder) the most frequent. *Lindera benzoin* (northern spicebush) may be present as a shrub. This type often has a number of invasive exotic weeds, including *Polygonum cuspidatum* (Japanese knotweed), *Polygonum perfoliatum* (Asiatic tearthumb), *Lolium arundinaceum* (tall fescue), *Phalaris arundinacea* (reed canarygrass), *Humulus japonicus* (Japanese hop), *Glechoma hederacea* (ground ivy), *Microstegium vimineum* (Nepalese browntop), and *Stellaria media* (common chickweed).

Environmental Description: This community occupies well-drained riverbanks and, less commonly, depositional bars of medium-sized to large rivers that experience low rates of sediment erosion and turnover during small to moderate floods. The type typically occurs as a narrow, linear strip along the outer edge of a floodplain forest, where heavy annual deposits of alluvial sediments inhibit tree establishment. Along the Potomac River in the Potomac River Gorge west of Washington, DC, habitats are inundated for 1–4% of the full year and are generally exposed for nearly all of the growing season in most years (Lea 2000). Hydrologic regime is best described as temporarily flooded. Substrates in the Potomac River Gorge are sandy loams or loamy sands (Lea 2000). Samples collected from 10 plots in the Potomac drainage had 100% total base saturation, high pH, and very high calcium levels. Along the New and Bluestone rivers, West Virginia, patches typically occur along slow, straight reaches of river with high banks, as well as on eroded alluvial fans at the mouths of small drainages. Soils are deep alluvial sands with little horizon development. Soils in seven plots along the Bluestone River are described as temporarily flooded, deep, moderately well-drained to well-drained, stone-free or slightly stony sand and loamy sand. They tested medium to slightly acidic (mean pH = 5.8) with relatively high levels of Ca, Cu, Mg, Mn, and Zn, and relatively low levels of organic matter, estimated N release, S, Al, B, Fe, K, Na, and P compared to average values in the area. Elevations range from near sea level on the Potomac River to 506 m on the Bluestone River.

Vegetation Description: This association represents vegetation consisting of a dense growth (90% cover) of tall (1–3 m), light-demanding, native perennial herbs. Scattered shrubby or occasionally full-sized trees of flood-tolerant species may occur, with *Acer saccharinum* (silver maple), *Platanus occidentalis* (American sycamore), *Betula nigra* (river birch), *Liriodendron tulipifera* (tuliptree), *Fraxinus pennsylvanica* (green ash), and *Acer negundo* (boxelder) the most frequent. Along the Potomac River in the Great Valley of Virginia downstream to the fall line, the most abundant herbs are *Verbesina alternifolia* (wingstem), *Teucrium canadense* (Canada germander), *Elymus riparius* (riverbank wildrye), *Verbena urticifolia* (white vervain), *Conoclinium coelestinum* (blue mistflower), several species of *Eupatorium* (thoroughwort) (*Eupatorium fistulosum* (trumpetweed), *Eupatorium perfoliatum* (common boneset), *Eupatorium serotinum* (lateflowering thoroughwort)), *Dichanthelium clandestinum* (deertongue), *Scrophularia marilandica* (carpenter's square), and *Chasmanthium latifolium* (Indian woodoats). Less abundant species include *Ageratina altissima* (white snakeroot), *Elymus villosus* (hairy wildrye), *Elymus virginicus* (Virginia wildrye), *Helianthus decapetalus* (thinleaf sunflower), *Oenothera biennis* (common evening-primrose), *Phytolacca americana* (American pokeweed), *Monarda fistulosa* (wild bergamot), *Rudbeckia laciniata* (cutleaf coneflower), *Calystegia sepium* (hedge false bindweed), and *Solidago gigantea* (giant goldenrod). Tall annual species characteristically dominant on less stabilized bars may be present but generally do not dominate. Woody vines are often common and include *Toxicodendron radicans* (eastern poison ivy), and *Vitis riparia* (riverbank grape). Along the New and Bluestone rivers in West Virginia, herbs with high constancy and/or cover include *Amphicarpaea bracteata* (American hogpeanut), *Apios americana* (groundnut), *Boehmeria cylindrica* (smallspike false nettle), *Chasmanthium latifolium* (Indian woodoats), *Conoclinium coelestinum* (blue mistflower), *Dichanthelium clandestinum* (deertongue), *Elymus canadensis* (Canada wildrye), *Elymus riparius* (riverbank wildrye), *Elymus virginicus* (Virginia wildrye), *Eupatorium fistulosum* (trumpetweed), *Eupatorium serotinum* (lateflowering thoroughwort), *Helenium autumnale* (common sneezeweed), *Helianthus strumosus* (paleleaf woodland sunflower), *Heliopsis helianthoides* (smooth oxeye), *Leersia virginica* (whitegrass), *Packera aurea* (golden ragwort), *Phlox paniculata* (fall phlox), *Polygonum scandens* (climbing false buckwheat), *Polygonum virginianum* (jumpseed), *Rudbeckia laciniata* (cutleaf coneflower), *Senna hebecarpa* (American senna), *Solanum carolinense* (Carolina horsenettle), *Solidago canadensis* (Canada goldenrod), *Solidago gigantea* (giant goldenrod), *Symphyotrichum lanceolatum* (white panicle aster), *Symphyotrichum lateriflorum* (calico aster), *Tradescantia ohiensis* (bluejacket), *Tripsacum dactyloides* (eastern gamagrass), *Verbena urticifolia* (white vervain), *Verbesina alternifolia* (wingstem), *Verbesina occidentalis* (yellow crownbeard), and *Vernonia noveboracensis* (New York ironweed). Vascular plant richness is generally high: in West Virginia plots, values range from 41–80 species per 400 square meters, averaging 44.6 (Vanderhorst et al. 2008). This type often has a number of invasive exotic weeds, including *Polygonum cuspidatum* (Japanese knotweed), *Polygonum perfoliatum* (Asiatic tearthumb), *Lolium arundinaceum* (tall fescue), *Phalaris arundinacea* (reed canarygrass), *Humulus japonicus* (Japanese hop), *Glechoma hederacea* (ground ivy), *Microstegium vimineum* (Nepalese browntop), *Urtica dioica* (stinging nettle), and *Stellaria media* (common chickweed). In some locations, nonnative species may out-compete the native herbs in this association and form large monospecific patches in floodplain openings, especially those affected by reservoir backup. On the Potomac River above the Great Valley, on the Monocacy River, and on smaller streams outside the Great Valley, several of the more characteristic species for the Shenandoah River, Antietam Creek, and the rest of the Potomac are

apparently rare or absent, particularly *Rudbeckia laciniata* (cutleaf coneflower) and *Solidago gigantea* (giant goldenrod). These differences may reflect the influence of more calcareous substrates and/or stream order on the communities. *Hasteola suaveolens* (false Indian plaintain), *Sida hermaphrodita* (Virginia fanpetals), *Iresine rhizomatosa* (Juda's bush), *Rumex altissimus* (pale dock), and *Ruellia strepens* (limestone wild petunia) are Maryland rare species known from this type.

Most Abundant Species:

Stratum	Lifeform	Species
Herb (field)	Forb	*Verbesina alternifolia* (wingstem)
Herb (field)	Graminoid	*Chasmanthium latifolium* (Indian woodoats), *Dichanthelium clandestinum* (deertongue)

Characteristic Species: *Chasmanthium latifolium* (Indian woodoats), *Dichanthelium clandestinum* (deertongue), *Elymus canadensis* (Canada wildrye), *Elymus riparius* (riverbank wildrye), *Elymus virginicus* (Virginia wildrye), *Eupatorium fistulosum* (trumpetweed), *Eupatorium serotinum* (lateflowering thoroughwort), *Helianthus strumosus* (paleleaf woodland sunflower), *Heliopsis helianthoides* (smooth oxeye), *Leersia virginica* (whitegrass), *Packera aurea* (golden ragwort), *Polygonum virginianum* (jumpseed), *Rudbeckia laciniata* (cutleaf coneflower), *Scrophularia marilandica* (carpenter's square), *Solanum carolinense* (Carolina horsenettle), *Solidago canadensis* (Canada goldenrod), *Solidago gigantea* (giant goldenrod), *Verbena urticifolia* (white vervain), *Verbesina alternifolia* (wingstem), *Vernonia noveboracensis* (New York ironweed).

Other Noteworthy Species:

Species	GRank	Type	Note
Carex emoryi (Emory's sedge)	-	plant	WV state-rare plant
Glechoma hederacea (ground ivy)	-	plant	exotic
Hasteola suaveolens (false Indian plaintain)	-	plant	MD state-rare plant
Humulus japonicus (Japanese hop)	-	plant	exotic
Iresine rhizomatosa (Juda's bush)	-	plant	MD state-rare plant
Lolium arundinaceum (tall fescue)	-	plant	exotic
Microstegium vimineum (Nepalese browntop)	-	plant	exotic
Polygonum cuspidatum (Japanese knotweed)	-	plant	exotic
Polygonum perfoliatum (Asiatic tearthumb)	-	plant	exotic
Ruellia strepens (limestone wild petunia)	-	plant	WV & MD state-rare plant
Rumex altissimus (pale dock)	-	plant	MD state-rare plant
Sida hermaphrodita (Virginia fanpetals)	G3	plant	WV & MD state-rare plant
Spiraea virginiana (Virginia meadowsweet)	G2	plant	Federally listed threatened
Stellaria media (common chickweed)	-	plant	exotic
Urtica dioica (stinging nettle)	-	plant	exotic

USFWS Wetland System: Palustrine.

DISTRIBUTION

Range: This community is known from the shores of rivers and large streams in the Piedmont and mountain regions of Maryland, Virginia, and West Virginia. It has been documented by plots or observed on the Potomac, Shenandoah, New, Bluestone, and Monocacy rivers and Antietam Creek (Maryland). Small-stream analogues or variants have been observed on Fifteen Mile Creek (Maryland) and on the South Fork of Quantico Creek (Virginia). Potential habitat for this association is widespread, and the type is likely to have a wider geographic range than current documentation indicates.

States/Provinces: DC, MD, VA, WV.

Federal Lands: NPS (Antietam, Bluestone, C&O Canal, Harpers Ferry, New River Gorge, Prince William).

CONSERVATION STATUS
Rank: GNR (2-Aug-2006).
Reasons: More data on the global distribution are needed to determine a conservation rank for this community.

CLASSIFICATION INFORMATION
Status: Standard.
Confidence: 1 - Strong.
Comments: The classification of this type was based, in part, on analysis of data from 10 plots collected during the National Capital Region Parks project, with an additional 10 plots from the New River Gorge and Bluestone River in West Virginia. Although some plots of this type performed convincingly as a discrete group in the National Capital Region analysis, others could not be separated from a group representing the Central Appalachian silver maple floodplain forest, with which this type frequently co-occurs. These results suggest that this type is weakly distinct floristically, sharing many species with the silver maple forest and varying from it along a gradual cline of (presumed) light exposure and increased stress from flooding near the channel. Because the type also tends to occur in small patches, it might, therefore, be considered an ecotonal expression of the silver maple forest. However, it also has similar classification issues with other floodplain forest and woodland types, and the distinctiveness of its physiognomy and habitat (open canopy which promotes rank growth of herbs adapted to full sunlight), its occurrence adjacent to various floodplain forest associations, as well as floristic similarity of stands across a broad range, and certain conservation issues supports its recognition.
Similar Associations:
Eupatorium serotinum - Polygonum (lapathifolium, punctatum, pensylvanicum) Herbaceous Vegetation (CEGL006481).
Related Concepts:
Rudbeckia laciniata - Solidago gigantea - Teucrium canadense Wooded Herbaceous Vegetation (Lea 2000) =
Verbesina alternifolia - Teucrium canadense - Verbena urticifolia - (Rudbeckia laciniata - Solidago gigantea) Wooded Herbaceous Vegetation (Lea 2003) =

SOURCES
Description Authors: C. Lea and G. P. Fleming, mod. S. C. Gawler.
References: Eastern Ecology Working Group n.d., Lea 2000, Lea 2003, Vanderhorst et al. 2007, Vanderhorst et al. 2008.

Plot BLUE.94. Riverbank Tall Herbs.

Appendix L. Bibliography for global association descriptions from the U. S. National Vegetation Classification

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