COMMON NAME (PARK-SPECIFIC): SUGAR MAPLE - AMERICAN BASSWOOD FOREST

SYNONYMS

NVC English Name: **Sugar Maple - White Ash - Butternut / American Bladdernut Forest**

NVC Scientific Name: ***Acer saccharum - Fraxinus americana - Juglans cinerea / Staphylea trifolia* Forest**

NVC Identifier: **CEGL006020**

LOCAL INFORMATION

Environmental Description: This association occurs on moderately steep to steep (30% to greater than 60%) slopes over calcareous bedrock, typically limestone. Aspect is variable. Typical soils include channery silt loams and loams of the Benson, Farmington and Galway soil series. These soils are usually circumneutral to alkaline with abundant calcium.

Vegetation Description: The canopy height varies from 20 to 30 m with total cover usually 85% or more. The dominant canopy tree is sugar maple (*Acer saccharum*) often with American basswood (*Tilia americana*) as a codominant. Other minor canopy associates may include sweet birch (*Betula lenta*), yellow birch (*Betula alleghaniensis*), oaks (*Quercus* spp.), eastern hemlock (*Tsuga canadensis*), and white ash (*Fraxinus americana*). The subcanopy is 5 to 15 m in height with total cover between 10 and 40%. Sugar maple is usually codominant to near monotypic in the subcanopy, with other associate species including sweet birch, eastern hop-hornbeam (*Ostrya virginiana*), American basswood, and eastern hemlock. The tall-shrub layer is 2-5 m in height and varies from sparse up to 30% total cover. The most characteristic tall shrub is American bladdernut (*Staphylea trifolia*). Other common tall-shrub/sapling species include eastern hop-hornbeam, sugar maple, American witch-hazel (*Hamamelis virginiana*), common serviceberry (*Amelanchier arborea*). The short-shrub layer, less than 2 m in height, is typically sparse (under 10% total cover). Common short-shrub/sapling species include American bladdernut, northern spicebush (*Lindera benzoin*), eastern hop-hornbeam, Japanese barberry (*Berberis thunbergii*), sugar maple, and American witch-hazel. The herbaceous layer typically has 50% cover or less and is under 1 m in height. The herbaceous layer is often diverse and may include Christmas fern (*Polystichum acrostichoides*), garlic mustard (*Alliaria petiolata*), Japanese stiltgrass (*Microstegium vimineum*), Jack in the pulpit (*Arisaema triphyllum*), bloodroot (*Sanguinaria canadensis*), blue cohosh (*Caulophyllum thalictroides*), dogtooth violet (*Erythronium americanum*), Virginia springbeauty (*Claytonia virginica*), northern maidenhair (*Adiantum pedatum*), and Canadian wild ginger (*Asarum canadense*).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	Acer saccharum, Tilia americana, Betula lenta
Tree subcanopy	Broad-leaved deciduous tree	Acer saccharum, Tilia americana, Ostrya virginiana
Tall shrub/sapling	Broad-leaved deciduous shrub	Staphylea trifolia, Hamamelis virginiana, Ostrya virginiana
Short shrub/sapling	Broad-leaved deciduous shrub	Berberis thunbergii, Lindera benzoin, Staphylea trifolia

Herb (field)	Forb	Alliaria petiolata, Arisaema triphyllum, Sanguinaria canadensis
Herb (field)	Graminoid	Microstegium vimineum
Herb (field)	Fern or fern ally	Polystichum acrostichoides

Characteristic Species: *Acer saccharum, Betula lenta, Tilia americana, Lindera benzoin, Ostrya virginiana, Staphylea trifolia, Adiantum pedatum, Arisaema triphyllum, Asarum canadense, Caulophyllum thalictroides, Polystichum acrostichoides.*

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk data:

State	State Rank	Confidence	State Name	Reference
NJ	S2	1	Calcareous Slope Forest	Walz et al. 2006
PA	S4	1	Sugar maple - basswood forest	Fike 1999

Local Range: This association appears to be restricted to moderately steep to steep slopes over calcareous bedrock (typically limestone or dolomite). The greatest concentration of calcareous bedrock (and this association) appears to be a southwest/northeast-trending series of calcareous limestone, shale and siltstone bedrock formations slightly north of Kittatinny Ridge (Buttermilk Falls, Decker, Kalkberg, Minisink and Roundout formations and others).

Classification Comments: This association is characterized by the dominance of *Acer saccharum* with an abundance (and occasional codominance) of *Tilia americana* and a rich diverse herb layer. It differs from Sugar Maple - American Beech - Sweet Birch Forest as the latter does not contain an abundance or even codominance of *Tilia americana* or the rich diverse herb layer. This type differs from Sugar Maple Floodplain Forest by not occurring on the Delaware River floodplain while the Sugar Maple Floodplain Forest lacks *Tilia americana* or the rich diverse herb layer.

Other Comments: None.

Local Description Authors: G. S. Podniesinski (PNHP).

Plots and Data Sources: DEWA.37, DEWA.85; Fike 1999.

Delaware Water Gap National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	Acer saccharum - Fraxinus americana - Tilia americana Forest Alliance (A.217)
Alliance (English name)	Sugar Maple - White Ash - American Basswood Forest Alliance
Association	*Acer saccharum - Fraxinus americana - Juglans cinerea / Staphylea trifolia* Forest
Association (English name)	Sugar Maple - White Ash - Butternut / American Bladdernut Forest

Ecological System(s): Laurentian-Acadian Northern Hardwoods Forest (CES201.564)
North-Central Appalachian Circumneutral Cliff and Talus (CES202.603)
South-Central Interior Mesophytic Forest (CES202.887)
Southern and Central Appalachian Cove Forest (CES202.373)

GLOBAL DESCRIPTION

Concept Summary: This semi-rich to rich forest of southern New England to Virginia occurs on talus slopes or shallow rocky soils overlying calcareous or circumneutral bedrock. Canopy dominants are *Acer saccharum* with *Fraxinus americana*. Canopy associates are *Juglans cinerea, Quercus rubra, Tilia americana, Carya cordiformis, Ostrya virginiana,* and *Carpinus caroliniana*. *Betula alleghaniensis, Fagus grandifolia, Quercus muehlenbergii,* and *Ulmus* spp. may also occur. The shrub layer is fairly open, characterized by *Staphylea trifolia, Corylus* spp., and *Hamamelis virginiana* along with *Parthenocissus quinquefolia, Toxicodendron radicans,* and *Vitis* spp. This community is characterized by a fairly diverse herbaceous flora. Typical herbs include *Actaea pachypoda, Adiantum pedatum, Allium tricoccum, Anemone quinquefolia, Aralia nudicaulis, Aralia racemosa, Arisaema triphyllum, Asplenium platyneuron, Asarum canadense, Eurybia divaricata (= Aster divaricatus), Circaea lutetiana* ssp. *canadensis, Claytonia virginica, Cystopteris fragilis, Cystopteris bulbifera, Dryopteris* spp., *Polystichum acrostichoides, Sanguinaria canadensis, Solidago flexicaulis, Trillium erectum, Woodsia obtusa,* and others. Characteristic graminoids include *Carex laxiflora, Carex sprengelii, Carex virescens, Elymus hystrix (= Hystrix patula),* and *Piptatherum racemosum (= Oryzopsis racemosa).* This association grades into open woodland [see related woodland types *Tilia americana - Fraxinus americana / Acer spicatum / Cystopteris fragilis* Woodland (CEGL006204) and *Acer saccharum - Tilia americana - Fraxinus americana / Ostrya virginiana / Geranium robertianum* Woodland (CEGL005058)] and bedrock upslope.

Environmental Description: Sites include talus slopes or shallow rocky soils weathered from calcareous or circumneutral bedrock. In Virginia and West Virginia, sites are restricted to mesic or submesic, weathered limestone and dolomitic boulderfields and bouldery to gravelly colluvium from these rocks. Habitats are situated on lower to middle slopes subtending streams in low-elevation montane valleys and gorges. Slopes are steep, usually with north to east aspects. Bedrock outcrops are frequent. Exposed rock (boulder + outcrop) cover can be up to 50%, which reduces both species richness and herbaceous cover. However, due to the relatively rapid weathering of carbonate materials and extremely fertile soils, these habitats are typically well vegetated with herbaceous plants. High cover of mosses provides a foothold for many species, while organic mats and soil pockets are also numerous.

Vegetation Description: In the northern part of this type's range, canopy dominants are *Acer saccharum* and *Fraxinus americana*, with typical associates of *Juglans cinerea, Quercus rubra, Tilia americana, Carya cordiformis,* and *Quercus muehlenbergii*. *Betula alleghaniensis, Betula lenta, Fagus grandifolia,* and *Ulmus* spp. may also occur locally. *Ostrya virginiana* and *Carpinus caroliniana* are typical small trees. The shrub layer is open and characterized by *Staphylea trifolia, Corylus* spp., *Hamamelis virginiana, Rubus odoratus, Parthenocissus quinquefolia, Toxicodendron radicans,* and *Vitis* spp. In the more southerly portions of the range, *Lindera benzoin* and *Asimina triloba* may also be present. Typical species of the fairly diverse herb layer include *Actaea pachypoda, Adiantum pedatum, Allium tricoccum, Anemone quinquefolia, Aralia nudicaulis, Aralia racemosa, Arisaema triphyllum, Asplenium platyneuron, Asarum canadense, Eurybia divaricata (= Aster divaricatus), Circaea lutetiana* ssp. *canadensis,*

Claytonia virginica, Cystopteris fragilis, Cystopteris bulbifera, Dryopteris spp., *Polystichum acrostichoides, Sanguinaria canadensis, Solidago flexicaulis, Trillium erectum, Woodsia obtusa,* and others. Characteristic graminoids include *Carex laxiflora, Carex sprengelii, Carex virescens, Elymus hystrix (= Hystrix patula),* and *Piptatherum racemosum (= Oryzopsis racemosa).* Virginia stands, representing the more southern expression of this type, often include *Asplenium rhizophyllum, Cimicifuga racemosa, Hepatica nobilis* var. *acuta (= Hepatica acutiloba), Impatiens pallida, Mitella diphylla, Osmorhiza claytonii, Polymnia canadensis, Sedum ternatum,* and *Thalictrum dioicum*. *Phacelia bipinnatifida* and *Meehania cordata* are locally abundant herbs at some southwestern Virginia sites. Virginia stands also have a variable overstory composition, with *Tilia americana* (including both var. *americana* and var. *heterophylla*) consistently important, along with *Acer saccharum* and/or *Acer nigrum*. *Fraxinus americana* and *Ulmus rubra* are minor but constant canopy associates. South of the James River, *Aesculus flava* becomes important or sometimes solely dominant in the overstory mixtures. In areas with a history of disturbance, exotic shrubs and herbs including *Berberis thunbergii, Alliaria petiolata,* and *Microstegium vimineum* may be common. Species richness of plot-sampled stands in Virginia ranges from 21 to 97 taxa per 400 m2 (mean = 57).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum*

Characteristic Species: *Acer saccharum, Asarum canadense, Cystopteris bulbifera, Hepatica nobilis* var. *acuta, Ostrya virginiana, Sanguinaria canadensis, Solidago flexicaulis, Staphylea trifolia, Thalictrum dioicum, Tilia americana.*

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community is known to occur in the northern and central Appalachian regions, from Vermont and New Hampshire south to Virginia and West Virginia. In Virginia, the type is locally scattered in carbonate rock districts throughout the Ridge and Valley and Cumberland Mountains.

States/Provinces: CT, MA, MD, NH, NJ:S2, NY, PA:S2?, VA:S3?, VT.

Federal Lands: NPS (Delaware Water Gap); USFS (George Washington, Jefferson).

CONSERVATION STATUS

Rank: G4? (1-Oct-2001).

Reasons: Although occurring mostly in small, local patches, this community type has a wide geographic range and occupies rugged habitats that are not prone to many anthropogenic disturbances. There are likely >50 occurrences in Virginia, and many in West Virginia (D. Walton pers. comm.).

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 – Moderate.

Comments: Prominent distinguishing features of this community are its extremely steep, bouldery/gravelly mesic habitats, the infrequency of *Quercus* spp., the general abundance of *Staphylea trifolia* and *Cystopteris bulbifera*, and, in Virginia, the prevalence of other more or less lithophytic or rock-loving species e.g., *Hydrangea arborescens, Asplenium rhizophyllum, Sedum* spp., *Mitella diphylla, Solidago flexicaulis*, etc. Conspicuously absent, or less important,

are species such as *Caulophyllum thalictroides, Trillium* spp., and *Diplazium pycnocarpon*, which thrive in deep mineral soils. It intergrades with both dry, open forests and other mesophytic forests along environmental continua defined by slope position and interrelated degrees of rock substrate and mineral soil development. As a result, transitional or intermediate stands that are difficult to classify may be encountered.

Similar Associations:

- *Acer saccharum - Liriodendron tulipifera - Fraxinus americana / Staphylea trifolia* Forest (CEGL006201).
- *Acer saccharum - Quercus muehlenbergii / Carex platyphylla* Forest (CEGL006162).
- *Acer saccharum - Tilia americana - Fraxinus americana / Ostrya virginiana / Geranium robertianum* Woodland (CEGL005058).

Related Concepts:

- *Acer (nigrum, saccharum) - Tilia americana - (Aesculus flava) / Staphylea trifolia / Cystopteris bulbifera* Forest (Fleming and Coulling 2001) ?
- *Acer saccharum / Asarum canadense* community (Metzler and Barrett 1996) ?
- *Tilia americana / Staphylea trifolia / Cystopteris bulbifera* Forest (type 1.2) (Fleming 1999) ?
- SNE Calcareous Talus Forest/Woodland (Rawinski 1984) ?
- SNE rich mesic forest (circumneutral to basic) (Rawinski 1984) ?
- Sugar Maple - Basswood: 26 (Eyre 1980) B
- Sugar maple-white ash-basswood cove forest (CAP pers. comm. 1998) ?
- Talus Slope Community (Breden 1989) B
- Transition Hardwood Talus Woodland (Thompson 1996) ?

SOURCES

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

References: Breden 1989, Breden et al. 2001, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Eyre 1980, Fike 1999, Fleming 1999, Fleming and Coulling 2001, Fleming et al. 2001, Harrison 2004, Lundgren 2000, Metzler and Barrett 1996, Metzler and Barrett 2001, Rawinski 1984, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, VDNH 2003, Walton pers. comm.

Figure 14. Sugar Maple - American Basswood Forest in Delaware Water Gap National Recreation Area (plot DEWA.37). June 2003.

Figure 15. Sugar Maple - American Basswood Forest in Delaware Water Gap National Recreation Area (plot DEWA.85). August 2003.

COMMON NAME (PARK-SPECIFIC): DRY HICKORY RIDGETOP FOREST

SYNONYMS

NVC English Name:	**Northern Red Oak - (Pignut Hickory, Shagbark Hickory) / Eastern Hop-hornbeam / Blue Ridge Sedge Forest**
NVC Scientific Name:	***Quercus rubra - Carya (glabra, ovata) / Ostrya virginiana / Carex lucorum* Forest**
NVC Identifier:	**CEGL006301**

LOCAL INFORMATION

Environmental Description: This forest association occurs on ridgetops and the upper portions of high slopes, usually with a southeast aspect. This forest type is common on the upper slopes of the southeast face of Kittatinny Ridge or in patches within a matrix of Dry Oak - Mixed Hardwood Forest. This association occurs on rapidly or well-drained, extremely rocky soils such as found in the Benson, Manlius, Arnot, Oquaga, and Lackawanna series. This forest type is restricted to xeric, acidic sites, often on shallow soils that occur in complexes with rock outcrops. Boulders and large rocks are frequent on the forest floor.

Vegetation Description: This ridgetop forest is dominated or codominated by hickories (*Carya* spp.), such that hickories compose greater relative cover in the canopy and subcanopy than oaks (*Quercus* spp.). The canopy is often open (40-75% cover) and is dominated by one or more of the following species: pignut hickory (*Carya glabra*), red hickory (*Carya ovalis*), mockernut hickory (*Carya alba*), chestnut oak (*Quercus prinus*), and/or black oak (*Quercus velutina*). Other occasional canopy associates include white ash (*Fraxinus americana*), eastern white pine (*Pinus strobus*), scarlet oak (*Quercus coccinea*), and red maple (*Acer rubrum*). Canopy trees range in height from 10-25 m, while the subcanopy trees extend 1-15 m in height. The subcanopy can be absent or moderately dense (0-50% cover) and contains pignut hickory, chestnut oak, mockernut hickory, red hickory, common serviceberry (*Amelanchier arborea*), striped maple (*Acer pensylvanicum*), and eastern red-cedar (*Juniperus virginiana*). The sparse tall-shrub layer (0-30% cover) consists of common serviceberry and saplings of the canopy trees. The sparse short-shrub layer (0-30% cover) contains scattered ericads such as deerberry (*Vaccinium stamineum*), Blue Ridge blueberry (*Vaccinium pallidum*), lowbush blueberry (*Vaccinium angustifolium*), and black huckleberry (*Gaylussacia baccata*), as well as Allegheny blackberry (*Rubus allegheniensis*), northern dewberry (*Rubus flagellaris*), blackhaw (*Viburnum prunifolium*), and mapleleaf viburnum (*Viburnum acerifolium*). The herbaceous layer is typically moderately dense to dense (50-95% cover) and can be fairly diverse compared to other xeric forest types. The herbaceous layer is dominated by xerophilic graminoids such as wavy hairgrass (*Deschampsia flexuosa*), poverty oatgrass (*Danthonia spicata*), and Pennsylvania sedge (*Carex pensylvanica*). Other associates include early saxifrage (*Saxifraga virginiensis*), dwarf cinquefoil (*Potentilla canadensis*), white snakeroot (*Ageratina altissima* var. *altissima*), Bosc's panicgrass (*Dichanthelium boscii*), upland bentgrass (*Agrostis perennans*), sweet vernalgrass (*Anthoxanthum odoratum*), common gypsyweed (*Veronica officinalis*), tapered rosette grass (*Dichanthelium acuminatum* var. *acuminatum*), Swan's sedge (*Carex swanii*), smooth forked nailwort (*Paronychia canadensis*), running clubmoss (*Lycopodium clavatum*), Atlantic goldenrod (*Solidago arguta*), and early goldenrod (*Solidago juncea*), among others. The invasive species Japanese stiltgrass (*Microstegium vimineum*) can be common in this forest. The vine Virginia creeper (*Parthenocissus quinquefolia*) is occasional in this forest.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Carya glabra*, *Quercus prinus*
Herb (field)	Forb	*Ageratina altissima* var. *altissima*, *Potentilla canadensis*
Herb (field)	Graminoid	*Carex pensylvanica*, *Danthonia spicata*, *Deschampsia flexuosa*

Characteristic Species: *Carya alba*, *Carya glabra*, *Carya ovalis*, *Quercus prinus*, *Quercus velutina*, *Amelanchier arborea*, *Carex pensylvanica*, *Danthonia spicata*, *Deschampsia flexuosa*.
Other Noteworthy Species: Information not available.
Subnational Distribution with Crosswalk data:

State	State Rank	Confidence	State Name	Reference
NJ	S2S3	1	Oak - Hickory / Hop-hornbeam / Sedge Lawn Forest	Walz et al. 2006
PA	S4	2	no crosswalk	Fike 1999

Local Range: This forest occurs on ridgetops and the upper portions of high slopes throughout the park and may occur as small or large patches.
Classification Comments: This type seems distinct from Dry Oak - Mixed Hardwood Forest and can be distinguished from the latter by the codominance or dominance of *Carya* spp., often *Carya glabra*.
Other Comments: None.
Local Description Authors: S. J. Perles (PNHP).
Plots and Data Sources: DEWA.78, DEWA.122, DEWA.179, DEWA.201, DEWA.216.
Delaware Water Gap National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	Carya (glabra, ovata) - Fraxinus americana - Quercus (alba, rubra) Forest Alliance (A.258)
Alliance (English name)	(Pignut Hickory, Shagbark Hickory) - White Ash - (White Oak, Northern Red Oak) Forest Alliance
Association	*Quercus rubra - Carya (glabra, ovata) / Ostrya virginiana / Carex lucorum* Forest
Association (English name)	Northern Red Oak - (Pignut Hickory, Shagbark Hickory) / Eastern Hop-hornbeam / Blue Ridge Sedge Forest

Ecological System(s): Northern Atlantic Coastal Plain Dry Hardwood Forest (CES203.475)
Central Appalachian Alkaline Glade and Woodland (CES202.602)

GLOBAL DESCRIPTION

Concept Summary: This association is a dry rich hickory forest of the northeastern United States that extends discontinuously south to Virginia's southern Appalachian Mountains. It is dominated by a mixture of hickories and oaks over a hop-hornbeam subcanopy and a park-like sedge lawn. The vegetation occurs on low-elevation ridgetops, upper slopes, south- or west-facing sideslopes, and is supported by well-drained loams or sandy loams, often derived from alkaline bedrock. The tree canopy, which ranges from nearly closed forest to partially open woodland, is dominated by a mixture of *Carya glabra, Carya ovata, Carya ovalis, Quercus rubra, Quercus alba, Quercus velutina*, with occasional *Ostrya virginiana* and *Acer rubrum*. Minor associates include *Acer saccharum, Pinus strobus*, and *Fraxinus americana*. A subcanopy of *Ostrya virginiana* is conspicuous in most areas. Additional species in the subcanopy or tall-shrub layer that occur in lower abundance can include *Hamamelis virginiana, Cornus florida, Amelanchier arborea, Acer pensylvanicum*, and *Viburnum acerifolium*. Low shrubs can include *Vaccinium angustifolium, Vaccinium pallidum, Rubus idaeus*, or *Viburnum rafinesquianum*. The herb layer is primarily a sedge lawn of *Carex lucorum* with some *Carex pensylvanica, Carex woodii, Carex appalachica*, or *Carex rosea*, but is also quite diverse with scattered *Elymus hystrix, Bromus pubescens, Ageratina altissima, Festuca subverticillata, Uvularia perfoliata, Aralia nudicaulis, Maianthemum racemosum (= Smilacina racemosa), Desmodium glutinosum, Desmodium paniculatum, Prenanthes alba, Solidago bicolor, Hepatica nobilis* var. *obtusa (= Hepatica americana), Carex* (Laxiflorae group), *Deschampsia flexuosa, Packera paupercula (= Senecio pauperculus), Packera obovata (= Senecio obovatus), Symphyotrichum undulatum (= Aster undulatus), Symphyotrichum patens (= Aster patens), Polystichum acrostichoides*, and *Dichanthelium* spp. Spring ephemerals such as *Erythronium americanum* and *Claytonia virginica* also occur in some portions of the range and *Solidago caesia* var. *curtisii* occurs in the south.

Environmental Description: This community occupies upper slopes and sideslopes at low elevations, generally with southeastern to western exposures. The low relief of southern New England limits this vegetation to small occurrences, most of which are <4 ha (10 acres). Soils are well-drained loams or sandy loams and often circumneutral. Soils are often stony, but exposed bedrock, boulders, cobbles, and mineral soil are sparse.

Vegetation Description: This forest has a closed to open canopy dominated by a mixture of *Carya glabra, Carya ovata, Carya ovalis, Quercus rubra, Quercus alba, Quercus velutina*, with occasional *Ostrya virginiana, Quercus prinus, Carya alba*, and *Acer rubrum*. Minor associates include *Acer saccharum, Pinus strobus*, and *Fraxinus americana*. A subcanopy of *Ostrya virginiana* is conspicuous in most areas. Additional species in the subcanopy or tall-shrub layers that occur in lower abundance include *Hamamelis virginiana, Cornus florida, Amelanchier arborea, Acer pensylvanicum*, and *Viburnum acerifolium*. Low shrubs can include *Vaccinium angustifolium, Vaccinium pallidum, Gaylussacia baccata, Rubus allegheniensis, Rubus idaeus, Viburnum dentatum*, or *Viburnum rafinesquianum*. *Vaccinium stamineum* may be present in the most southerly (NJ/PA) occurrences of this association. The herb layer is primarily a sedge lawn of *Carex lucorum*, with some *Carex pensylvanica, Carex woodii, Carex appalachica*, or *Carex rosea*, but is also quite diverse with scattered *Elymus hystrix, Bromus pubescens, Danthonia*

spicata, Anthoxanthum odoratum, Ageratina altissima, Festuca subverticillata, Uvularia perfoliata, Aralia nudicaulis, Maianthemum racemosum (= Smilacina racemosa), Desmodium glutinosum, Desmodium paniculatum, Prenanthes alba, Solidago bicolor, Solidago juncea, Hepatica nobilis var. *obtusa (= Hepatica americana), Carex* spp. (Laxiflorae group), *Deschampsia flexuosa, Packera paupercula (= Senecio pauperculus), Packera obovata (= Senecio obovatus), Symphyotrichum undulatum (= Aster undulatus), Symphyotrichum patens (= Aster patens), Veronica officinalis, Polystichum acrostichoides,* and *Dichanthelium* spp. Spring ephemerals such as *Erythronium americanum* and *Claytonia virginica* also occur in some portions, and *Solidago arguta* and *Solidago caesia* var. *curtisii* occur in the south. Also in the southern portion of the range, the invasive grass *Microstegium vimineum* can be common.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Carya glabra, Quercus rubra*
Tree canopy	Broad-leaved deciduous tree	*Quercus alba*
Herb (field)	Forb	*Ageratina altissima* var. *altissima*
Herb (field)	Graminoid	*Deschampsia flexuosa*

Characteristic Species: *Amelanchier arborea, Carex lucorum, Carex pensylvanica, Carex rosea, Carya glabra, Carya ovalis, Carya ovata, Deschampsia flexuosa, Elymus hystrix, Maianthemum racemosum, Potentilla canadensis, Potentilla simplex, Quercus alba, Quercus prinus, Quercus rubra, Quercus velutina, Solidago bicolor, Solidago juncea, Uvularia perfoliata.*

Other Noteworthy Species: *Crataegus spathulata.*

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: The principal distribution of this community type is centered in lower New England, ranging from southern New Hampshire to New Jersey and northern Pennsylvania. Several outlying occurrences have been documented from isolated ridges and peaks scattered over nearly 180 km (110 miles) in western and southwestern Virginia, chiefly in the Ridge and Valley. Additional occurrences are likely in West Virginia.

States/Provinces: CT, MA, ME, NH, NJ:S2S3, NY, PA, RI, VA:S3?, VT.

Federal Lands: NPS (Delaware Water Gap); USFS (George Washington, Jefferson).

CONSERVATION STATUS

Rank: G4? (1-Oct-2001).

Reasons: This association appears to be widely but somewhat locally distributed in the northeastern United States. The state rank reflects the locally restricted extent of a few widely scattered known occurrences. Additional examples can be expected on isolated ridge crests in the Ridge and Valley; other occurrences should be sought in the Northern Blue Ridge. The particular structure and composition of this type may be a function of a particular combination of specific site conditions and disturbance history.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 – Moderate.

Comments: Information not available.

Similar Associations:

- *Carya (glabra, ovata) - Fraxinus americana - Quercus* spp. Forest (CEGL006236).
- *Quercus alba - Quercus prinus - Carya glabra / Cornus florida / Vaccinium pallidum / Carex pensylvanica* Forest (CEGL008515)--occurs in similar settings in VA, WV, and MD but much more oak than hickory.
- *Quercus rubra - Quercus alba / Ilex montana / Dennstaedtia punctilobula - Carex pensylvanica - Deschampsia flexuosa* Forest (CEGL008506).

Related Concepts:

- *Acer saccharum - Carya glabra - Ostrya virginiana* Alliance: *Quercus alba - Carya ovata / Carex pensylvanica - Carex woodii* Association (Rawinski et al. 1996) ?
- *Quercus alba - Quercus rubra - Carya ovalis / Elymus hystrix* Forest (Fleming and Moorhead 2000) ?
- *Quercus rubra - Quercus alba - Carya (ovata, ovalis) / Ostrya virginiana / Carex pensylvanica* Forest (Fleming and Coulling 2001) ?
- Dry Oak-Hickory-Hophornbeam Forest (Thompson 1996) B
- Dry-Mesic Inland Mixed Oak Forest (Breden 1989) B
- SNE dry rich forest - Hickory - hop hornbeam forest variant (Rawinski 1984) ?
- White Oak - Black Oak - Northern Red Oak: 52 (Eyre 1980) B

SOURCES

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

References: Breden 1989, Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 2000, Fleming et al. 2001, Gawler 2002, Lundgren 2001, Metzler and Barrett 2001, Metzler and Barrett 2004, Rawinski 1984, Rawinski et al. 1996, Sperduto 2000a, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, VDNH 2003.

Figure 16. Dry Hickory Ridgetop Forest in Delaware Water Gap National Recreation Area (plot DEWA.78). August 2003.

Figure 17. Dry Hickory Ridgetop Forest in Delaware Water Gap National Recreation Area (plot DEWA.122). September 2003.

COMMON NAME (PARK-SPECIFIC): TULIPTREE - BEECH - MAPLE FOREST

SYNONYMS

NVC English Name:	**American Beech - Sweet Birch - Tuliptree - Sugar Maple Forest**
NVC Scientific Name:	***Fagus grandifolia - Betula lenta - Liriodendron tulipifera - Acer saccharum* Forest**
NVC Identifier:	**CEGL006296**

LOCAL INFORMATION

Environmental Description: This association occurs on gentle to slightly steep low and midslopes throughout the park, often on toeslopes, in coves, or along small drainages. Soils vary from sandy loam on higher floodplain terraces to gravelly and channery loams and silt loams at higher elevations (midslopes of ridges). Typical bedrock types include shale and siltstone of the Bloomsburg Formation and graywacke and shale of the Martinsburg Formation. This vegetation type often occurs on disturbed land where evidence of past agriculture (e.g., stonewalls, drainage ditches) or silviculture is visible.

Vegetation Description: This association is dominated by tuliptree (*Liriodendron tulipifera*), often with red maple (*Acer rubrum*), white ash (*Fraxinus americana*), sweet birch (*Betula lenta*), and yellow birch (*Betula alleghaniensis*) as associates. Early successional tree species, such as quaking aspen (*Populus tremuloides*) and black locust (*Robinia pseudoacacia*), may also be present, especially in stands with a more recent history of disturbance. Oaks (*Quercus* spp.) may be present but are a minor component. American beech (*Fagus grandifolia*) is inconstant and often restricted to the tall-shrub layer in the park. American beech may occur in the canopy of this forest type elsewhere in Pennsylvania (Fike 1999) but was only observed in the tall-shrub layer at the park. The canopy is usually 25 to 35 m in height with greater than 70 % canopy closure. The subcanopy is typically 15 to 20 m in height with total cover of 10 to 30%. Typical subcanopy trees are sugar maple (*Acer saccharum*), red maple, sweet birch, and white ash. The tall-shrub layer is 2-5 m in height with cover varying from 15 to 60%. Common tall shrubs/saplings include northern spicebush (*Lindera benzoin*), American witch-hazel (*Hamamelis virginiana*), and American beech. Invasive shrubs are occasional and may include multiflora rose (*Rosa multiflora*) and autumn-olive (*Elaeagnus umbellata*). The short-shrub layer is less than 2 m in height and may vary from sparse (10% cover) to dense (80% cover). This layer usually contains sparse to dense stands of Japanese barberry (*Berberis thunbergii*), with varying amounts of northern spicebush, multiflora rose, witch-hazel, and mapleleaf viburnum (*Viburnum acerifolium*). The herbaceous layer is typically less than 1 m in height with 30 to 50% total cover. Typical herbaceous species include eastern hayscented fern (*Dennstaedtia punctilobula*), Christmas fern (*Polystichum acrostichoides*), garlic mustard (*Alliaria petiolata*), dwarf cinquefoil (*Potentilla canadensis*), white snakeroot (*Ageratina altissima* var. *altissima*), Jack-in-the-pulpit (*Arisaema triphyllum*), and Canada mayflower (*Maianthemum canadense*). Vines may be present, usually as creeping plants in the herb or short-shrub layer, but may occasionally reach the lower portion of the canopy (usually summer grape, *Vitis aestivalis*). Typical vines include Virginia creeper (*Parthenocissus quinquefolia*), roundleaf greenbrier (*Smilax rotundifolia*), and summer grape. The invasive vine Japanese honeysuckle (*Lonicera japonica*) may also be present at low cover.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	Liriodendron tulipifera, Acer rubrum, Betula lenta, Fraxinus americana
Tree subcanopy	Broad-leaved deciduous tree	Acer saccharum, Acer rubrum, Betula lenta, Fraxinus americana
Tall shrub/sapling	Broad-leaved deciduous shrub	Lindera benzoin, Fagus grandifolia, Hamamelis virginiana
Short shrub/sapling	Broad-leaved deciduous shrub	Berberis thunbergii, Rosa multiflora, Lindera benzoin
Herb (field)	Forb	Alliaria petiolata
Herb (field)	Graminoid	Microstegium vimineum
Herb (field)	Fern or fern ally	Dennstaedtia punctilobula, Polystichum acrostichoides

Characteristic Species: *Liriodendron tulipifera*, *Acer rubrum*, *Acer saccharum*, *Betula lenta*, *Fraxinus americana*, *Hamamelis virginiana*, *Lindera benzoin*, *Berberis thunbergii*, *Dennstaedtia punctilobula*, *Polystichum acrostichoides.*

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk data:

State	State Rank	Confidence	State Name	Reference
NJ	SNR	1	Tuliptree - Beech - Maple Forest	Walz et al. 2006
PA	S4	1	Tuliptree - beech - maple forest	Fike 1999

Local Range: This association occurs throughout the park on mesic toeslopes (often at the base of the Kittatinny Ridge) and coves, possibly where near surface groundwater creates mesic conditions, or where past disturbance has opened up the forest canopy (e.g., logging, abandoned farmland).

Classification Comments: This vegetation type differs from Northeastern Modified Successional Forest on the basis of *Liriodendron tulipifera* as the clear canopy dominant. Where disturbance is more recent and *Liriodendron tulipifera* is codominant with early-successional trees such as *Populus grandidentata* and *Robinia pseudoacacia*, distinction between the two types may be difficult.

Other Comments: None.

Local Description Authors: G. S. Podniesinski (PNHP).

Plots and Data Sources: DEWA.118, DEWA.189, DEWA.192, DEWA.202; Fike 1999.

Delaware Water Gap National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)

Alliance	Fagus grandifolia - Acer saccharum - (Liriodendron tulipifera) Forest Alliance (A.227)
Alliance (English name)	American Beech - Sugar Maple - (Tuliptree) Forest Alliance
Association	*Fagus grandifolia - Betula lenta - Liriodendron tulipifera - Acer saccharum* Forest
Association (English name)	American Beech - Sweet Birch - Tuliptree - Sugar Maple Forest
Ecological System(s):	Northeastern Interior Dry-Mesic Oak Forest (CES202.592)

GLOBAL DESCRIPTION

Concept Summary: This mid- to lower slope deciduous forest of the mid-Atlantic region occurs on deep soils that are not strongly acidic. The tree canopy is characterized by a mixture of *Liriodendron tulipifera, Fagus grandifolia, Acer saccharum, Fraxinus americana, Betula lenta*, and other associated species, including *Acer rubrum, Betula alleghaniensis, Nyssa sylvatica*, and *Carya alba (= Carya tomentosa)*. The subcanopy, where present, is characterized by *Carpinus caroliniana, Cornus florida*, and *Ostrya virginiana*. Common species of the shrub layer include *Hamamelis virginiana* and *Lindera benzoin*. The herbaceous layer is characterized by *Podophyllum peltatum, Sanguinaria canadensis, Botrychium virginianum, Dicentra cucullaria, Dicentra canadensis, Allium tricoccum*, and *Claytonia virginica*. Associated herbs may include *Polystichum acrostichoides, Ageratina altissima* var. *altissima*, and *Arisaema triphyllum*. Invasive species such as *Berberis thunbergii, Elaeagnus umbellata, Rosa multiflora*, and *Alliaria petiolata* may be present and locally abundant in the shrub and herb layers. This vegetation type often occurs on land where evidence of past agriculture or silviculture is visible.

Environmental Description: This vegetation occurs on middle to lower slopes on moderately deep soils that are not extremely acidic.

Vegetation Description: The tree canopy is characterized by a mixture of *Liriodendron tulipifera, Fagus grandifolia, Acer saccharum, Fraxinus americana, Betula lenta*, and other associated species, including *Acer rubrum, Betula alleghaniensis, Nyssa sylvatica*, and *Carya alba (= Carya tomentosa)*. The subcanopy, where present, is characterized by *Carpinus caroliniana, Cornus florida*, and *Ostrya virginiana*. Common species of the shrub layer include *Hamamelis virginiana* and *Lindera benzoin*. The herbaceous layer is characterized by *Podophyllum peltatum, Sanguinaria canadensis, Botrychium virginianum, Dicentra cucullaria, Dicentra canadensis, Allium tricoccum*, and *Claytonia virginica*. Associated herbs may include *Polystichum acrostichoides, Ageratina altissima* var. *altissima*, and *Arisaema triphyllum*. Invasive species such as *Berberis thunbergii, Elaeagnus umbellata, Rosa multiflora*, and *Alliaria petiolata* may be present and locally abundant in the shrub and herb layers.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Acer saccharum, Liriodendron tulipifera*
Tree subcanopy	Broad-leaved deciduous tree	*Carpinus caroliniana, Cornus florida, Ostrya virginiana*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Hamamelis virginiana, Lindera benzoin*
Herb (field)	Forb	*Podophyllum peltatum*
Herb (field)	Fern or fern ally	*Botrychium virginianum*

Characteristic Species: *Acer saccharum*, *Allium tricoccum*, *Betula lenta*, *Botrychium virginianum*, *Carpinus caroliniana*, *Claytonia virginica*, *Cornus florida*, *Dicentra cucullaria*, *Fagus grandifolia*, *Liriodendron tulipifera*, *Ostrya virginiana*, *Podophyllum peltatum*, *Sanguinaria canadensis.*
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This vegetation is currently described primarily from Pennsylvania and is also documented in New Jersey. It may occur in Maryland.
States/Provinces: MD?, NJ, PA.
Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Friendship Hill, Morristown).

CONSERVATION STATUS

Rank: GNR (6-Dec-2004).
Reasons: More information is required to determine the range and rank of this vegetation type.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 – Moderate.
Comments: his description is based on the tuliptree - beech - maple forest of Fike (1999) as well as samples from NPS mapping projects in Pennsylvania and New Jersey. More information is required to determine the range of this type.
Similar Associations:

- *Fagus grandifolia - Acer saccharum - Liriodendron tulipifera* Unglaciated Forest (CEGL002411)--also contains *Liquidambar styraciflua, Asimina triloba, Carya cordiformis*, and *Betula lenta* is absent.
- *Fagus grandifolia - Acer saccharum* Glaciated Midwest Forest (CEGL005013)--has a shrub layer characterized by *Diervilla lonicera, Euonymus obovatus, Lonicera canadensis*, and *Betula lenta* is absent.
- *Fagus grandifolia - Betula lenta - Quercus (alba, rubra) / Carpinus caroliniana* Forest (CEGL006921)--lacks *Acer saccharum*, and *Quercus* spp. are more important.

Related Concepts: Information not available.

SOURCES

Description Authors: J. Fike and L. A. Sneddon, mod. E. Largay and S. C. Gawler.
References: Eastern Ecology Working Group n.d., Ehrenfeld 1977, Fike 1999.

Figure 18. Tuliptree - Beech - Maple Forest in Delaware Water Gap National Recreation Area (plot DEWA.189). May 2004.

Figure 19. Tuliptree - Beech - Maple Forest in Delaware Water Gap National Recreation Area (plot DEWA.202). June 2004.

COMMON NAME (PARK-SPECIFIC): BLACK WALNUT BOTTOMLAND FOREST

SYNONYMS

NVC English Name: **Black Walnut - White Ash / Northern Spicebush Forest**

NVC Scientific Name: ***Juglans nigra - Fraxinus americana / Lindera benzoin* Forest [Provisional]**

NVC Identifier: **CEGL006449**

LOCAL INFORMATION

Environmental Description: This association typically occurs along drainage swales and the floodplain of smaller streams in the Delaware River valley. The substrate varies from silt loam to gravelly sandy loams, with Venango silt loam, Hoosic-Otisville complex, and Delaware fine sandy loam being typical soil series. This association may also occur on mid to high floodplain terraces of the Delaware River (e.g., Poxono Island).

Vegetation Description: The canopy of this riparian forest is strongly dominated by black walnut (*Juglans nigra*), typically with greater than 50% relative canopy cover. Canopy associates may include white ash (*Fraxinus americana*), American elm (*Ulmus americana*), and sugar maple (*Acer saccharum*). Canopy height is usually 20 to 30 m. The subcanopy is usually open, 10 to 15 m in height and may include scattered individuals of American elm, black walnut, common hackberry (*Celtis occidentalis*), American hornbeam (*Carpinus caroliniana*), and bitternut hickory (*Carya cordiformis*). The tall-shrub layer is 2-5 m in height and often sparse. Typical tall shrubs may include blackhaw (*Viburnum prunifolium*), northern spicebush (*Lindera benzoin*), and white ash saplings. The short-shrub layer (under 2 m in height) cover is variable from sparse to dense (rarely). Common short shrubs include northern spicebush, multiflora rose (*Rosa multiflora*), and black haw. The herb layer is also variable, often with one or a few species providing most of the cover. Characteristic herbs include mayapple (*Podophyllum peltatum*), jewelweed (*Impatiens capensis*), broadleaf enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), and white snakeroot (*Ageratina altissima* var. *altissima*). One stand of this association was observed on Poxono Island with a near monotypic herb layer of hairyfruit sedge (*Carex trichocarpa*) (not sampled). Invasive exotic species are usually present and may be locally abundant, including Japanese stiltgrass (*Microstegium vimineum*), garlic mustard (*Alliaria petiolata*), and oriental ladysthumb (*Polygonum caespitosum*). Vines are occasional but rarely abundant; Virginia creeper (*Parthenocissus quinquefolia*) is a typical vine species.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Juglans nigra, Ulmus americana Fraxinus americana*
Tree subcanopy	Broad-leaved deciduous tree	*Juglans nigra, Ulmus americana Carpinus caroliniana*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Fraxinus americana, Lindera benzoin, Viburnum prunifolium*

Short shrub/sapling	Broad-leaved deciduous shrub	*Rosa multiflora, Lindera benzoin, Viburnum prunifolium*
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia*
Herb (field)	Forb	*Ageratina altissima* var. *altissima, Alliaria petiolata, Impatiens capensis, Podophyllum peltatum*
Herb (field)	Graminoid	*Microstegium vimineum*

Characteristic Species: *Juglans nigra, Lindera benzoin, Carpinus caroliniana, Fraxinus americana, Ulmus americana, Viburnum prunifolium, Impatiens capensis, Alliaria petiolata, Podophyllum peltatum*.

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk data:

State	State Rank	Confidence	State Name	Reference
NJ	SNA	1	Black Walnut Bottomland Forest	Walz et al. 2006
PA	SNA	2	not crosswalk	Fike 1999

Local Range: This association typically occurs along drainage swales and the floodplain of smaller streams in the Delaware River valley. This association may also occur on mid to high floodplain terraces of the Delaware River (e.g., Poxono Island).

Classification Comments: This association differs from Northeastern Modified Successional Forest in having black walnut as the clear canopy dominant and being restricted to wet-mesic sites along floodplains of small drainages, swales, and occasionally Delaware River floodplain terraces. Where black walnut occurs in Northeastern Modified Successional Forest (typically on drier upland soils), it is usually accompanied by other early-successional tree species, such as bigtooth aspen (*Populus grandidentata*), black locust (*Robinia pseudoacacia*), and black cherry (*Prunus serotina*), with a higher cover of invasive shrub and vine species.

Other Comments: None.

Local Description Authors: G. S. Podniesinski (PNHP).

Plots and Data Sources: DEWA.8, DEWA.12, DEWA.134.

Delaware Water Gap National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	Juglans nigra Forest Alliance (A.1932)
Alliance (English name)	Black Walnut Forest Alliance
Association	*Juglans nigra - Fraxinus americana / Lindera benzoin* Forest [Provisional]
Association (English name)	Black Walnut - White Ash / Northern Spicebush Forest
Ecological System(s):	Information not available

GLOBAL DESCRIPTION

Concept Summary: This association typically occurs along drainage swales and the floodplain of smaller streams of some mid-Atlantic rivers (e.g., in the Delaware River valley). It may also occur on mid to high floodplain terraces. The substrate varies from silt loam to gravelly sandy loams. The canopy of this riparian forest is strongly dominated by *Juglans nigra*, typically with greater than 50% relative canopy cover. Canopy associates may include *Fraxinus americana, Ulmus americana*, and *Acer saccharum*. Canopy height is usually 20 to 30 m. The subcanopy is usually open, 10 to 15 m in height and may include scattered individuals of the canopy species as well as *Celtis occidentalis, Carpinus caroliniana*, and *Carya cordiformis*. The shrub layer is usually sparse. Typical shrubs include *Viburnum prunifolium* and *Lindera benzoin*, along with the exotic *Rosa multiflora*. The herb layer is variable, often with one or a few species providing most of the cover. Characteristic herbs include *Podophyllum peltatum, Impatiens capensis, Circaea lutetiana* ssp. *canadensis*, and *Ageratina altissima* var. *altissima*. Invasive exotic herbs are usually present and may be locally abundant, including *Microstegium vimineum, Alliaria petiolata*, and *Polygonum caespitosum*. Vines are occasional but rarely abundant; *Parthenocissus quinquefolia* is a typical vine species.

Environmental Description: This association typically occurs along drainage swales and the floodplain of smaller streams of some mid-Atlantic rivers (e.g., in the Delaware River valley). It may also occur on mid to high floodplain terraces. The substrate varies from silt loam to gravelly sandy loams.

Vegetation Description: The canopy of this riparian forest is strongly dominated by *Juglans nigra*, typically with greater than 50% relative canopy cover. Canopy associates may include *Fraxinus americana, Ulmus americana*, and *Acer saccharum*. Canopy height is usually 20 to 30 m. The subcanopy is usually open, 10 to 15 m in height and may include scattered individuals of the canopy species as well as *Celtis occidentalis, Carpinus caroliniana*, and *Carya cordiformis*. The shrub layer is usually sparse. Typical shrubs include *Viburnum prunifolium* and *Lindera benzoin*, along with the exotic *Rosa multiflora*. The herb layer is variable, often with one or a few species providing most of the cover. Characteristic herbs include *Podophyllum peltatum, Impatiens capensis, Circaea lutetiana* ssp. *canadensis*, and *Ageratina altissima* var. *altissima*. Invasive exotic herbs are usually present and may be locally abundant, including *Microstegium vimineum, Alliaria petiolata*, and *Polygonum caespitosum*. Vines are occasional but rarely abundant; *Parthenocissus quinquefolia* is a typical vine species.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Juglans nigra, Ulmus americana*
Tree canopy	Broad-leaved deciduous tree	*Fraxinus americana*
Tree subcanopy	Broad-leaved deciduous tree	*Carpinus caroliniana*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Lindera benzoin, Viburnum prunifolium*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Fraxinus americana*
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia*
Herb (field)	Forb	*Ageratina altissima* var. *altissima, Impatiens capensis, Podophyllum peltatum*

Characteristic Species: *Carpinus caroliniana, Fraxinus americana, Impatiens capensis, Juglans nigra, Lindera benzoin, Podophyllum peltatum, Ulmus americana, Viburnum prunifolium.*
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION
Range: This association is currently documented from northern New Jersey and Pennsylvania but probably ranges further in the northeastern U.S.
States/Provinces: NJ, NY?, PA.
Federal Lands: NPS (Delaware Water Gap).

CONSERVATION STATUS
Rank: GNR (7-Feb-2006).
Reasons: Information not available.

CLASSIFICATION INFORMATION
Status: Provisional.
Confidence: 3 – Weak.
Comments: Information not available.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES
Description Authors: S. C. Gawler.
References: Eastern Ecology Working Group n.d.

Figure 20. Black Walnut Bottomland Forest in Delaware Water Gap National Recreation Area (plot DEWA.8). May 2003.

Figure 21. Black Walnut Bottomland Forest in Delaware Water Gap National Recreation Area (plot DEWA.12). May 2003.

COMMON NAME (PARK-SPECIFIC): RED MAPLE - SWEET BIRCH HARDWOOD FOREST

SYNONYMS

NVC English Name:	**Sweet Birch - Red Maple / Stiff Clubmoss - Hay-scented Fern Forest**
NVC Scientific Name:	***Betula lenta - Acer rubrum / Lycopodium annotinum - Dennstaedtia punctilobula* Forest**
NVC Identifier:	**CEGL008503**

LOCAL INFORMATION

Environmental Description: This association does not appear to have any particular fidelity to site conditions other than it does not occur on dry ridgetops, wet bottomlands or on active floodplains. The majority of stands appear to be forests established on former agricultural land or stands from which the oaks (*Quercus* spp.) were previously high-graded. These sites are often bounded by relict stonewalls. Slope and aspect are variable and not diagnostic. Soils and underlying bedrock are also variable and not diagnostic. Contrary to Sugar Maple - American Beech-Sweet Birch Forest, this association does not necessarily show the fidelity to limestone and calcareous sandstones, siltstones and shale.

Vegetation Description: This association is characterized by closed canopies (total cover 70 to 90%) with canopy height ranging from 20 to 30 m. Red maple (*Acer rubrum*) and/or sweet birch (*Betula lenta*) are usually the canopy dominants, often with high relative cover (>50%). Numerous associate species can be present, depending on site conditions and land-use history. Common associates include white ash (*Fraxinus americana*), northern red oak (*Quercus rubra*), white oak (*Quercus alba*), black oak (*Quercus velutina*), sugar maple (*Acer saccharum*), quaking aspen (*Populus tremuloides*), black cherry (*Prunus serotina*), eastern hemlock (*Tsuga canadensis*), sassafras (*Sassafras albidum*), American beech (*Fagus grandifolia*), and hickories (*Carya alba, Carya glabra, Carya ovata*). The subcanopy is typically dominated by red maple and/or sweet birch with black cherry, sugar maple, flowering dogwood (*Cornus florida*), American hornbeam (*Carpinus caroliniana*), and oaks as common associates. The subcanopy layer varies in height from 10 to 20 m (20 m in stands with a higher canopy) with total cover ranging from 20 to 40%. The tall-shrub layer is usually 2-5 m in height and varies from absent to moderately dense (30% total cover). Northern spicebush (*Lindera benzoin*) is the most common and locally abundant species in the tall-shrub/sapling layer. Several other species may be occasional to locally abundant, including red maple, sweet birch, American beech, blackhaw (*Viburnum prunifolium*), common serviceberry (*Amelanchier arborea*), and pink azalea (*Rhododendron periclymenoides*). The short-shrub layer is less than 2 m in height with total cover usually 20% or less. Occasionally the short-shrub layer maybe relatively dense and reach 50% or more total cover (usually when high cover of invasive shrubs are present). Typical short-shrub/sapling species include northern spicebush, Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), lowbush blueberry (*Vaccinium angustifolium*), Blue Ridge blueberry (*Vaccinium pallidum*), northern dewberry (*Rubus flagellaris*), and seedlings of the canopy and subcanopy trees. The herb layer is usually less than 1 m in height but varies greatly in total cover (10 to 70%). Eastern hayscented fern (*Dennstaedtia punctilobula*) is a typical dominant (often with 25-50% cover), with associates Christmas fern (*Polystichum acrostichoides*), Swan's sedge (*Carex swanii*), garlic mustard (*Alliaria petiolata*), New York fern

(*Thelypteris noveboracensis*), Jack in the pulpit (*Arisaema triphyllum*), groundcedar (*Lycopodium complanatum*), cinnamon fern (*Osmunda cinnamomea*), common cinquefoil (*Potentilla simplex*), white snakeroot (*Ageratina altissima* var. *altissima*), licorice bedstraw (*Galium circaezans*), and Canada mayflower (*Maianthemum canadense*). Vines are usually present at low cover but may reach the lower portions of the forest canopy. The most common vines include Virginia creeper (*Parthenocissus quinquefolia*), eastern poison ivy (*Toxicodendron radicans*), and grapes (*Vitis* spp.).

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum, Betula lenta*
Tall shrub/sapling	Broad-leaved deciduous shrub	*Acer rubrum, Betula lenta, Lindera benzoin*
Short shrub/sapling	Broad-leaved deciduous shrub	*Berberis thunbergii, Lindera benzoin*
Herb (field)	Vine/Liana	*Parthenocissus quinquefolia*
Herb (field)	Forb	*Alliaria petiolata*
Herb (field)	Graminoid	*Carex swanii*
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula, Polystichum acrostichoides, Thelypteris noveboracensis*

Characteristic Species: *Acer rubrum, Betula lenta, Quercus rubra, Lindera benzoin.*

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk data:

State	State Rank	Confidence	State Name	Reference
NJ	SNR	1	Red Maple - Sweet Birch Hardwood Forest	Walz et al. 2006
PA	S5	1	Red maple (terrestrial) forest	Fike 1999

Local Range: This association occurs throughout the park and is most prevalent on former agricultural land and in forest stands from which the oaks have been high-graded.

Classification Comments: This association is closely related to Dry Oak - Mixed Hardwood Forest and Northern Red Oak - Mixed Hardwood Forest in which oaks have greater than 25% relative canopy cover. Sugar Maple - American Beech - Sweet Birch Forest is also closely related; however, *Acer saccharum* (occasionally *Betula lenta*) is typically dominant in the Sugar Maple - American Beech - Sweet Birch Forest, which is often restricted to limestone or calcareous bedrock and tends to be less disturbed.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots and Data Sources: DEWA.2, DEWA.10, DEWA.27, DEWA.29, DEWA.70, DEWA.79, DEWA.98, DEWA.187, DEWA.191, DEWA.244, DEWA.245; Fike 1999.

Delaware Water Gap National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)

Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus spp. Forest Alliance (A.237)
Alliance (English name)	Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance
Association	*Betula lenta - Acer rubrum / Lycopodium annotinum - Dennstaedtia punctilobula* Forest
Association (English name)	Sweet Birch - Red Maple / Stiff Clubmoss - Hay-scented Fern Forest
Ecological System(s):	Appalachian (Hemlock)-Northern Hardwood Forest (CES202.593) Northeastern Interior Dry-Mesic Oak Forest (CES202.592)

GLOBAL DESCRIPTION

Concept Summary: This vegetation type is associated with mesic, generally infertile sites that have been altered by logging and fires. Its distribution is centered in the Central Appalachians. Stands are floristically depauperate and characterized by even-aged, nearly pure *Betula lenta, Acer rubrum*, or mixtures of the two. Associated species, minor in importance, vary somewhat with geography and include *Betula alleghaniensis, Fraxinus americana, Fagus grandifolia, Prunus serotina, Quercus rubra, Quercus alba, Quercus velutina, Liriodendron tulipifera, Populus tremuloides, Populus grandidentata,* and/or *Robinia pseudoacacia*. *Magnolia acuminata* and *Magnolia fraseri* are sometimes associates in the southern portion of the range. The subcanopy, when developed, consists mainly of *Fagus grandifolia*. *Tsuga canadensis* forms a scattered canopy or understory in some stands. *Ilex montana* is a characteristic shrub in the southern portion of the type's range, and *Lindera benzoin* is typical elsewhere. Shrub associates include *Kalmia latifolia, Acer pensylvanicum, Hamamelis virginiana, Amelanchier arborea, Viburnum prunifolium, Fagus* sprouts, *Rhododendron calendulaceum, Rhododendron periclymenoides*, and *Rhododendron maximum*. Herb layers may be dominated by dense and extensive colonies of *Lycopodium annotinum*, often in association with *Lycopodium dendroideum, Lycopodium clavatum*, and/or *Lycopodium digitatum*, or by *Dennstaedtia punctilobula*. Herbaceous associates include *Thelypteris noveboracensis, Polystichum acrostichoides, Carex swanii*, and others.

Environmental Description: This vegetation type is associated with mesic, generally infertile sites that have been severely altered by logging and fires. It occupies various slope and aspect positions. The type is rarely found on bouldery or rocky sites. Soils vary but are often acidic and low in base status. Deep surficial duff, with small pieces of charred wood or thin charcoal lenses are typical of soils at Virginia sampling sites (Fleming and Moorhead 1996).

Vegetation Description: Stands are floristically depauperate and characterized by even-aged, nearly pure *Betula lenta, Acer rubrum*, or mixtures of the two. Associated species vary somewhat with geography and include *Betula alleghaniensis, Fraxinus americana, Fagus grandifolia, Prunus serotina, Quercus rubra, Quercus alba, Quercus velutina, Populus tremuloides, Populus grandidentata,* and/or *Robinia pseudoacacia*. *Magnolia acuminata* and *Magnolia fraseri* are sometimes associates in the southern portion of the range. The subcanopy, when developed, consists mainly of *Fagus grandifolia*. *Tsuga canadensis* forms a scattered canopy or understory in some stands. *Ilex montana* is a characteristic shrub in the southern portion of the type's range, and *Lindera benzoin* is typical elsewhere. Shrub associates include

Kalmia latifolia, Acer pensylvanicum, Amelanchier arborea, Viburnum prunifolium, Fagus sprouts, *Rhododendron calendulaceum, Rhododendron periclymenoides,* and *Rhododendron maximum*. Herb layers may be dominated by dense and extensive colonies of *Lycopodium annotinum*, often in association with *Lycopodium dendroideum, Lycopodium clavatum*, and/or *Lycopodium digitatum*, or by *Dennstaedtia punctilobula*. Herbaceous associates include *Thelypteris noveboracensis, Polystichum acrostichoides, Carex swanii, Dryopteris intermedia, Smilax rotundifolia, Medeola virginiana, Maianthemum canadense, Monotropa uniflora*, and *Oclemena acuminata (= Aster acuminatus)*. Mean species richness of plot-sampled stands in Virginia is 15 taxa per 400 m2.

Most Abundant Species:

Stratum	Lifeform	Species
Tree (canopy & subcanopy)	Broad-leaved deciduous tree	*Acer rubrum*
Herb (field)	Fern or fern ally	*Dennstaedtia punctilobula*

Characteristic Species: *Acer rubrum, Betula lenta, Dennstaedtia punctilobula, Lycopodium annotinum, Lycopodium clavatum, Lycopodium dendroideum.*

Other Noteworthy Species: *Carex arctata, Pyrola elliptica, Schizachne purpurascens.*

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This community has been documented from the Central Appalachians in Virginia and West Virginia, north to Pennsylvania and New Jersey. Its range may extend further in the northeastern United States.

States/Provinces: MD?, NJ, PA, VA, WV.

Federal Lands: NPS (Delaware Water Gap); USFS (George Washington, Monongahela).

CONSERVATION STATUS

Rank: GNA (modified/managed) (21-Jun-2001).

Reasons: This association appears to be an early-successional but persistent vegetation type resulting from major anthropogenic disturbances. It has some significance for conservation in Virginia, however, since its successional development most likely will result in one of the state-rare community types that are confined in Virginia to Allegheny Mountain. For conservation planning in Virginia it is best considered a low-quality occurrence of Tsuga canadensis - Fagus grandifolia - Quercus rubra Forest (CEGL006088) or Picea rubens / Acer rubrum / Maianthemum canadense - (Lycopodium clavatum, Lycopodium dendroideum) Forest (CEGL008501).

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 – Moderate.

Comments: Because of the consistent dominance of *Betula lenta* and/or *Acer rubrum* and locally dense *Lycopodium* or *Dennstaedtia punctilobula* ground cover, this community type is readily identifiable in the field. *Lycopodium* spp. as well as *Dennstaedtia punctilobula* are specialized colonizers of moist, sterile, exposed mineral soils, which were plentiful in these habitats after the burning off of the original forest humus. Current stand composition suggests that the likely successors to this association in Virginia are *Tsuga canadensis - Fagus grandifolia - Quercus rubra* Forest (CEGL006088) or *Picea rubens / Acer rubrum / Maianthemum canadense - (Lycopodium clavatum, Lycopodium dendroideum)* Forest (CEGL008501). However, potentially devastating impacts of beech bark disease and hemlock woolly adelgid on

Allegheny Mountain could alter some of the present successional trends (Fleming and Moorhead 1996).

Similar Associations:

- *Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* Forest (CEGL006506)--occupies similar mid-successional settings but is generally more northern (*Betula papyrifera* more typical than *Betula lenta*)and contains a component of white pine.

Related Concepts:

- *Betula lenta / Ilex montana / Lycopodium annotinum* Association (Fleming and Moorhead 1996) ?
- *Betula lenta / Ilex montana / Lycopodium annotinum* Forest (Fleming and Coulling 2001) =

SOURCES

Description Authors: G. Fleming, mod. S. C. Gawler.

References: Eastern Ecology Working Group n.d., Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Fleming et al. 2004.

Figure 22. Red Maple - Sweet Birch Hardwood Forest in Delaware Water Gap National Recreation Area (plot DEWA.29). June 2003.

Figure 23. Red Maple - Sweet Birch Hardwood Forest in Delaware Water Gap National Recreation Area (plot DEWA.79). August 2003.

COMMON NAME (PARK-SPECIFIC): BOTTOMLAND MIXED HARDWOOD PALUSTRINE FOREST

SYNONYMS
NVC English Name: **Black Cherry - Tuliptree - Red Maple - White Ash Forest**
NVC Scientific Name: ***Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana* Forest**
NVC Identifier: **CEGL006599**

LOCAL INFORMATION

Environmental Description: This forest type occurs on high terraces above the Delaware River, low terrace floodplains of small creeks, or any broad flat area with saturated soils or diffuse/braided drainage. The substrate is often poorly drained soil, such as Alden silt loam, Catden mucky peat, Delaware fine sandy loam, Hazen-Hoosic complex, or Fredon-Halsey complex. These areas can be seasonally flooded or saturated, often with networks of small drainages and pools throughout. Many of these areas were previously used as pasture or farm land.

Vegetation Description: This palustrine forest type has variable species composition and is often of weedy character. Past land-use history and adjacent land uses often influence the existing species composition. The canopy can be dominated by one or more of the following species: black ash (*Fraxinus nigra*), red maple (*Acer rubrum*), American elm (*Ulmus americana*), pin oak (*Quercus palustris*), swamp white oak (*Quercus bicolor*), sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), green ash (*Fraxinus pennsylvanica*), American hornbeam (*Carpinus caroliniana*), and river birch (*Betula nigra*). Black cherry (*Prunus serotina*), bitternut hickory (*Carya cordiformis*), quaking aspen (*Populus tremuloides*), sweet birch (*Betula lenta*), and tuliptree (*Liriodendron tulipifera*) may be associates. Red maple, pin oak and swamp white oak each do not cover more than 25% of the canopy. Canopy trees typically extend 15-25 m in height and cover approximately 60% of the area, while subcanopy trees are 10-15 m in height and cover 10-30% of the area. The subcanopy can be composed of a mixture of the species listed above for the canopy. The tall-shrub layer (25-50% cover) is variable and contains such species as common winterberry (*Ilex verticillata*), northern spicebush (*Lindera benzoin*), blackhaw (*Viburnum prunifolium*), silky dogwood (*Cornus amomum*), southern arrowwood (*Viburnum dentatum* var. *lucidum*), and the invasive species multiflora rose (*Rosa multiflora*), Amur honeysuckle (*Lonicera maackii*), Morrow's honeysuckle (*Lonicera morrowii*), and common buckthorn (*Rhamnus cathartica*). The short-shrub layer covers 20-50% of the area and contains the species found in the tall-shrub layer, seedlings of the canopy trees and the invasive Japanese barberry (*Berberis thunbergii*). The herbaceous layer varies depending on past and adjacent land uses, local hydrology and available seed sources. Common species include ground ivy (*Glechoma hederacea*), blunt broom sedge (*Carex tribuloides*), bladder sedge (*Carex intumescens*), eastern hayscented fern (*Dennstaedtia punctilobula*), intermediate woodfern (*Dryopteris intermedia*), spotted ladysthumb (*Polygonum persicaria*), sensitive fern (*Onoclea sensibilis*), Christmas fern (*Polystichum acrostichoides*), cleavers (*Galium aparine*), white avens (*Geum canadense*), mayapple (*Podophyllum peltatum*), American golden saxifrage (*Chrysosplenium americanum*), jewelweed (*Impatiens capensis*), reed canarygrass (*Phalaris arundinacea*), false baby's breath (*Galium mollugo*), spotted geranium (*Geranium maculatum*), and Jack in the pulpit (*Arisaema triphyllum*). The invasive species creeping Jenny (*Lysimachia*

nummularia) and garlic mustard (*Alliaria petiolata*) can be abundant in this forest type. The vines fox grape (*Vitis labrusca*) and Virginia creeper (*Parthenocissus quinquefolia*) can also be abundant.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	highly variable, see description
Tree subcanopy	Broad-leaved deciduous tree	highly variable, see description
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Rosa multiflora, Lonicera* spp.
Herb (field)	Forb and Graminoid	highly variable, see description
Herb (field)	Vine/Liana	*Vitis labrusca, Parthenocissus quinquefolia*

Characteristic Species: *Acer rubrum, Acer saccharum, Betula nigra, Carpinus caroliniana, Carya cordiformis, Fraxinus americana, Fraxinus nigra, Fraxinus pennsylvanica, Quercus bicolor, Quercus palustris, Ulmus americana.*

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk data:

State	State Rank	Confidence	State Name	Reference
NJ	SNA	3	no crosswalk	Walz et al 2006
PA	SNA	3	no crosswalk	Fike 1999

Local Range: This broadly defined forest type occurs in a variety of palustrine settings throughout the park.

Classification Comments: This type is broadly inclusive of hardwood-dominated forests in palustrine settings, often weedy due to previous or existing adjacent agricultural land uses. Bottomland Mixed Hardwood Palustrine Forest can be distinguished from other palustrine forests by the dominance of one or more of the following species: *Fraxinus nigra, Acer rubrum, Carya cordiformis, Ulmus americana, Quercus palustris, Quercus bicolor, Acer saccharum, Fraxinus americana, Fraxinus pennsylvanica, Carpinus caroliniana*, and/or *Betula nigra*. *Acer rubrum, Quercus palustris*, and *Quercus bicolor* each do not cover more than 25% of the canopy.

Other Comments: None.

Local Description Authors: S. J. Perles (PNHP).

Plots and Data Sources: DEWA.3, DEWA.13, DEWA.49, DEWA.53.

Delaware Water Gap National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus spp. Forest Alliance (A.237)

Alliance (English name)	Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance
Association	*Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana* Forest
Association (English name)	Black Cherry - Tuliptree - Red Maple - White Ash Forest
Ecological System(s):	Information not available

GLOBAL DESCRIPTION

Concept Summary: This early-successional woody vegetation of the northeastern United States occurs on sites that have generally been cleared for agriculture. Environmental setting varies, but generally sites are dry-mesic to mesic, with small seepage inclusions in some examples. Physiognomy of this vegetation is highly variable, ranging from closed forest, open forest, tall dense shrubland, to more open tall shrubland. Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. Tree species may include *Prunus serotina, Liriodendron tulipifera, Fraxinus americana*, and *Acer rubrum*. Other associates can include *Juglans nigra, Sassafras albidum, Betula populifolia, Juniperus virginiana, Acer negundo, Acer saccharinum, Ailanthus altissima, Ulmus americana, Quercus* spp., *Betula lenta, Amelanchier* spp., and *Robinia pseudoacacia*. Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* and *Carpinus caroliniana*. The low-shrub layer, if present, is usually characterized by the presence of *Rubus* spp. such as *Rubus flagellaris, Rubus allegheniensis, Rubus phoenicolasius,* or *Rubus hispidus*. This layer is often dominated by exotic species such as *Lonicera tatarica, Lonicera japonica, Rhamnus cathartica, Crataegus* spp., *Rosa multiflora*, and *Berberis thunbergii*. The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin.
Environmental Description: Information not available.
Vegetation Description: Information not available.
Most Abundant Species: Information not available.
Characteristic Species: Information not available.
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: Information not available.
States/Provinces: Information not available.
Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Friendship Hill).

CONSERVATION STATUS

Rank: GNA (ruderal) (29-Nov-2004).
Reasons: Information not available.

CLASSIFICATION INFORMATION

Status: Nonstandard.
Confidence: 3 – Weak.
Comments: This vegetation is broadly defined and varies widely in composition across its range, presenting a classification challenge at the alliance level.
Similar Associations: Information not available.
Related Concepts: Information not available.

SOURCES
Description Authors: L. A. Sneddon, mod. S. C. Gawler.
References: Eastern Ecology Working Group n.d., Fike 1999, Perles et al. 2006c.

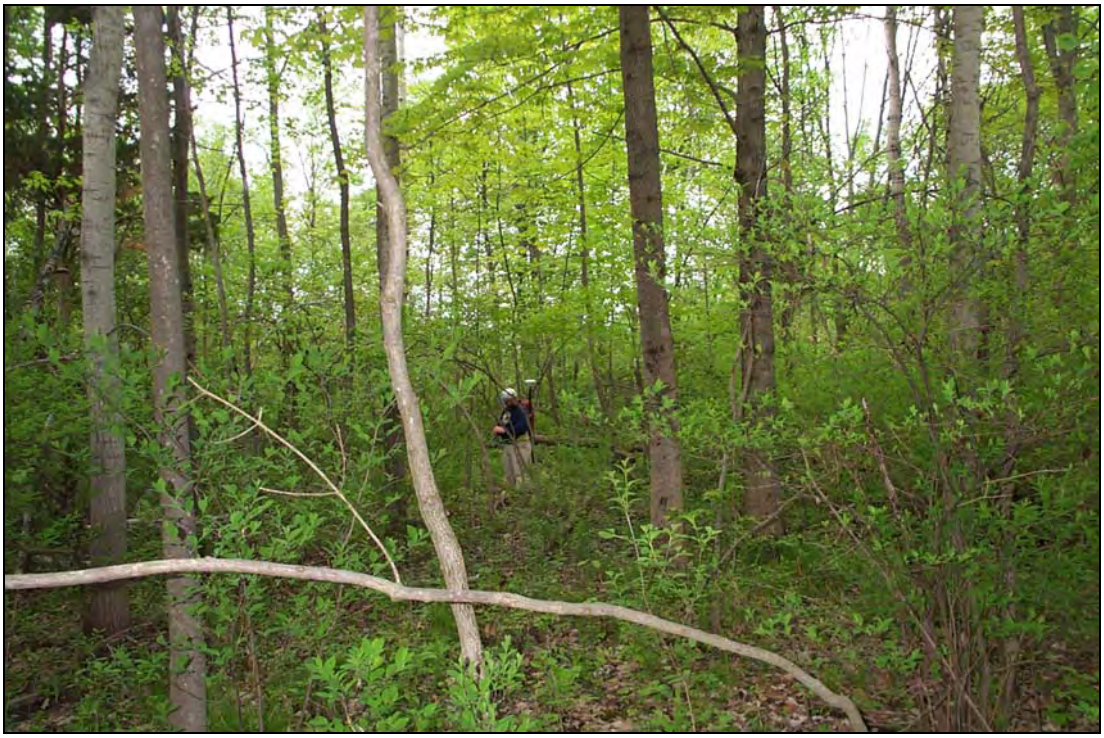

Figure 24. Bottomland Mixed Hardwood Palustrine Forest in Delaware Water Gap National Recreation Area (plot DEWA.3). May 2003.

Figure 25. Bottomland Mixed Hardwood Palustrine Forest in Delaware Water Gap National Recreation Area (plot DEWA.53). July 2003.

COMMON NAME (PARK-SPECIFIC): NORTHEASTERN MODIFIED SUCCESSIONAL FOREST

SYNONYMS

NVC English Name: **Black Cherry - Tuliptree - Red Maple - White Ash Forest**

NVC Scientific Name: ***Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana* Forest**

NVC Identifier: **CEGL006599**

LOCAL INFORMATION

Environmental Description: This forest type occurs on former agricultural lands and other disturbed or degraded environmental settlings. These sites are often mesic and occur at mid to low elevations. These disturbed forests are usually located on moderately well-drained to well-drained soils such as Wallpack fine sandy loam, Delaware fine sandy loam, Chenango gravelly fine sandy loam, Rexford gravelly silt loam, Galway loam, and/or Hoosic-Otisville complex. These forests nearly always contain or are bounded by stonewalls, evidence of past agricultural land use. Large old wolf trees may be present along the stonewalls. These forests are often young and resulted from the colonization of old agricultural fields by woody species. Recent disturbance or abundant invasive species give these forest stands a weedy character. The successional trajectory of these stands is uncertain.

Vegetation Description: The species composition and vegetation structure of this forest type are extremely variable among and within sites. The type is characterized by early-successional or weedy tree species and an abundance of invasive species and vines. Forests are typically young, with canopy trees extending from 10-30 m in height and covering 40-90% of the stand. The canopy can be dominated by one or more of the following species: white ash (*Fraxinus americana*), black locust (*Robinia pseudoacacia*), eastern red-cedar (*Juniperus virginiana*), bigtooth aspen (*Populus grandidentata*), black walnut (*Juglans nigra*), black cherry (*Prunus serotina*), red maple (*Acer rubrum*), and eastern white pine (*Pinus strobus*). Other canopy associates include sweet birch (*Betula lenta*), sassafras (*Sassafras albidum*), sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), tuliptree (*Liriodendron tulipifera*), oaks (*Quercus* spp.), and hickories (*Carya* spp.). Subcanopy trees range from 6-15 m in height and cover 5-40% of the stand. Dead or declining eastern red-cedars are characteristic subcanopy trees. Other common subcanopy trees include American elm (*Ulmus americana*), flowering dogwood (*Cornus florida*), and species from the canopy. The invasive species tree of heaven (*Ailanthus altissima*) may be present in the canopy or subcanopy. The variable tall-shrub layer (5-60% cover) can contain northern spicebush (*Lindera benzoin*), blackhaw (*Viburnum prunifolium*), common winterberry (*Ilex verticillata*), and mapleleaf viburnum (*Viburnum acerifolium*). The invasive shrubs multiflora rose (*Rosa multiflora*), autumn-olive (*Elaeagnus umbellata*), Tatarian honeysuckle (*Lonicera tatarica*), and Morrow's honeysuckle (*Lonicera morrowii*) can also be abundant in the tall- or short-shrub layers. The short-shrub layer is also variable (5-50% cover) and contains canopy, subcanopy and tall-shrub species, as well as black raspberry (*Rubus occidentalis*), northern dewberry (*Rubus flagellaris*), and the invasive species Japanese barberry (*Berberis thunbergii*) and wine raspberry (*Rubus phoenicolasius*). The herbaceous layer may be sparse or dense (20-95% cover) and has variable species composition influenced by local hydrology, land-use history, and available seed sources. Common species include white snakeroot (*Ageratina altissima* var. *altissima*), spotted ladysthumb (*Polygonum*

persicaria), touch-me-not (*Impatiens* spp.), broadleaf enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), mayapple (*Podophyllum peltatum*), ground ivy (*Glechoma hederacea*), Christmas fern (*Polystichum acrostichoides*), hedge false bindweed (*Calystegia sepium* ssp. *sepium*), cleavers (*Galium aparine*), common yellow oxalis (*Oxalis stricta*), jumpseed (*Polygonum virginianum*), eastern hayscented fern (*Dennstaedtia punctilobula*), Jack in the pulpit (*Arisaema triphyllum*), wild garlic (*Allium vineale*), and common gypsyweed (*Veronica officinalis*), among many others. The invasive species garlic mustard (*Alliaria petiolata*), Japanese stiltgrass (*Microstegium vimineum*) and oriental lady'sthumb (*Polygonum caespitosum*) can be abundant in this disturbed forest type. Vines can be absent or abundant (0-60% cover). In stands with high vine cover, the vegetation structure can be degraded by the weight of the vines pulling down trees and shrubs. Common vines include Virginia creeper (*Parthenocissus quinquefolia*), eastern poison ivy (*Toxicodendron radicans*), fox grape (*Vitis labrusca*), and the invasive vines oriental bittersweet (*Celastrus orbiculatus*) and Japanese honeysuckle (*Lonicera japonica*).

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	Fraxinus americana, Juglans nigra, Populus grandidentata, Robinia pseudoacacia
Tree subcanopy	Needle-leaved tree	Juniperus virginiana
Tall shrub/sapling	Broad-leaved deciduous shrub	Elaeagnus umbellata, Rosa multiflora
Short shrub/sapling	Broad-leaved deciduous shrub	Berberis thunbergii, Rosa multiflora
Herb (field)	Vine/Liana	Celastrus orbiculatus, Parthenocissus quinquefolia
Herb (field)	Forb	Ageratina altissima var. altissima, Alliaria petiolata, Polygonum persicaria
Herb (field)	Graminoid	Microstegium vimineum

Characteristic Species: *Fraxinus americana, Juglans nigra, Juniperus virginiana, Acer rubrum, Populus grandidentata, Prunus serotina, Robinia pseudoacacia, Ailanthus altissima, Berberis thunbergii, Elaeagnus umbellata, Rosa multiflora, Microstegium vimineum, Polygonum persicaria, Alliaria petiolata.*

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk data:

State	State Rank	Confidence	State Name	Reference
NJ	SNA	1	Northeastern Modified Successional Forest	Walz et al. 2006
PA	SNA	1	Black locust forest	Fike 1999

Local Range: This variable forest type is common in the park, particularly in mesic areas of mid to low elevations where past agricultural land use occurred. This association is rarely found on xeric ridgetops or at high elevations within the park.

Classification Comments: Modified Successional Forest is highly variable in species composition and vegetation structure; however, it is identifiable by the abundance of early-

successional or weedy tree species, invasive species, and vines. These forests will probably not succeed to a community dominated by native plants.
Other Comments: None.
Local Description Authors: S. J. Perles (PNHP).
Plots and Data Sources: DEWA.23, DEWA.24, DEWA.34, DEWA.38, DEWA.80, DEWA.125, DEWA.153, DEWA.157, DEWA.159, DEWA.160, DEWA.193.
Delaware Water Gap National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	Prunus serotina - Acer rubrum - Amelanchier canadensis - Quercus spp. Forest Alliance (A.237)
Alliance (English name)	Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance
Association	*Prunus serotina - Liriodendron tulipifera - Acer rubrum - Fraxinus americana* Forest
Association (English name)	Black Cherry - Tuliptree - Red Maple - White Ash Forest
Ecological System(s):	Central Appalachian Dry Oak-Pine Forest (CES202.591) Northeastern Interior Dry-Mesic Oak Forest (CES202.592)

GLOBAL DESCRIPTION

Concept Summary: This early-successional woody vegetation of the northeastern United States occurs on sites that are becoming reforested after having been cleared for agriculture. Environmental setting varies, but generally sites are dry-mesic to mesic, with small seepage inclusions in some examples. Physiognomy of this vegetation is highly variable, ranging from closed forest, open forest, tall dense shrubland, to more open tall shrubland. Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. Tree species often include some combination of *Prunus serotina, Liriodendron tulipifera, Fraxinus americana, Robinia pseudoacacia*, and *Acer rubrum*. Other associates can include *Juglans nigra, Sassafras albidum, Betula populifolia, Juniperus virginiana, Acer negundo, Acer saccharinum, Ailanthus altissima, Ulmus americana, Quercus* spp., *Betula lenta, Amelanchier* spp., *Pinus strobus*, and *Populus grandidentata*. Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* and *Carpinus caroliniana*. The low-shrub layer, if present, is usually characterized by the presence of *Rubus* spp. such as *Rubus flagellaris, Rubus allegheniensis, Rubus phoenicolasius*, or *Rubus hispidus*. This layer is often dominated by exotic species such as *Lonicera tatarica, Lonicera morrowii, Rhamnus cathartica, Crataegus* spp., *Rosa multiflora*, and *Berberis thunbergii*. The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin. Common species include *Ageratina altissima* var. *altissima, Polygonum persicaria, Impatiens capensis, Glechoma hederacea, Polystichum acrostichoides, Calystegia sepium* ssp. *sepium, Galium aparine, Oxalis stricta, Polygonum virginianum, Dennstaedtia punctilobula, Arisaema triphyllum, Allium vineale,* and

Veronica officinalis, among many others. The invasive species *Alliaria petiolata, Microstegium vimineum*, and *Polygonum caespitosum* can be abundant in this disturbed forest type. Vines can be absent or abundant. In stands with high vine cover, the vegetation structure can be altered by the weight of the vines pulling down trees and shrubs. Common vines include *Parthenocissus quinquefolia, Toxicodendron radicans, Vitis labrusca*, and the invasive vines *Celastrus orbiculatus* and *Lonicera japonica*. These forests are often young and resulted from the colonization of old agricultural fields by woody species. Recent disturbance or abundant invasive species give these forest stands a weedy character. It is unlikely that these stands will succeed to a natural plant community dominated by native species.

Environmental Description: This vegetation occurs on sites that have been cleared for agriculture or otherwise heavily modified in the past. Generally sites are dry-mesic and may have small seepage inclusions in some examples. Occasionally this type may occur in formerly agricultural bottomlands, in which case the soils may be temporarily flooded or saturated.

Vegetation Description: Early-successional woody species dominate the canopy in a widely variable mix, depending on geographic location. Tree species often include some combination of *Prunus serotina, Liriodendron tulipifera, Fraxinus americana, Robinia pseudoacacia*, and *Acer rubrum*. Other associates can include *Juglans nigra, Sassafras albidum, Betula populifolia, Juniperus virginiana, Acer negundo, Acer saccharinum, Ailanthus altissima, Ulmus americana, Quercus* spp., *Betula lenta, Amelanchier* spp., *Pinus strobus*, and *Populus grandidentata*. Other woody species may contribute to the canopy or form a tall-shrub layer, including *Lindera benzoin* and *Carpinus caroliniana*. The low-shrub layer, if present, is usually characterized by the presence of *Rubus* spp. such as *Rubus flagellaris, Rubus allegheniensis, Rubus phoenicolasius*, or *Rubus hispidus*. This layer is often dominated by exotic species such as *Lonicera tatarica, Lonicera morrowii, Rhamnus cathartica, Crataegus* spp., *Rosa multiflora*, and *Berberis thunbergii*. The herbaceous layer is variable, often containing grasses and forbs of both native and exotic origin. Common species include *Ageratina altissima* var. *altissima, Polygonum persicaria, Impatiens capensis, Glechoma hederacea, Polystichum acrostichoides, Calystegia sepium* ssp. *sepium, Galium aparine, Oxalis stricta, Polygonum virginianum, Dennstaedtia punctilobula, Arisaema triphyllum, Allium vineale*, and *Veronica officinalis*, among many others. The invasive species *Alliaria petiolata, Microstegium vimineum*, and *Polygonum caespitosum* can be abundant in this disturbed forest type. Vines can be absent or abundant. In stands with high vine cover, the vegetation structure can be altered by the weight of the vines pulling down trees and shrubs. Common vines include *Parthenocissus quinquefolia, Toxicodendron radicans, Vitis labrusca*, and the invasive vines *Celastrus orbiculatus* and *Lonicera japonica*.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	Acer rubrum, Fraxinus americana, Juglans nigra, Liriodendron tulipifera, Prunus serotina
Tree subcanopy	Broad-leaved deciduous tree	Acer rubrum
Tall shrub/sapling	Broad-leaved deciduous tree	Carpinus caroliniana
Tall shrub/sapling	Broad-leaved deciduous shrub	Lindera benzoin
Herb (field)	Forb	Alliaria petiolata, Polygonum persicaria
Herb (field)	Graminoid	Microstegium vimineum

Characteristic Species: *Acer rubrum*, *Alliaria petiolata*, *Berberis thunbergii*, *Elaeagnus umbellata*, *Fraxinus americana*, *Juglans nigra*, *Liriodendron tulipifera*, *Microstegium vimineum*, *Polygonum persicaria*, *Prunus serotina*, *Robinia pseudoacacia*, *Rosa multiflora*.
Other Noteworthy Species: Information not available.
USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This vegetation is currently described from Pennsylvania and New Jersey but is of broader distribution in the northeastern U.S.
States/Provinces: NJ, NY, PA.
Federal Lands: NPS (Allegheny Portage Railroad, Delaware Water Gap, Fort Necessity, Friendship Hill, Gettysburg, Johnstown Flood, Morristown, Valley Forge); USFWS (Great Meadows?).

CONSERVATION STATUS

Rank: GNA (ruderal) (29-Nov-2004).
Reasons: This vegetation is modified by human activity and not of conservation concern.

CLASSIFICATION INFORMATION

Status: Standard.
Confidence: 2 – Moderate.
Comments: This vegetation is broadly defined and varies widely in composition across its range, presenting a classification challenge at the alliance level.
Similar Associations:

- *Liriodendron tulipifera* - *Quercus* spp. Forest (CEGL007221)--is more strongly dominated by *Liriodendron* and is generally in a later successional state as evidenced by taller trees and more closed canopy.
- *Robinia pseudoacacia* Forest (CEGL007279).

Related Concepts: Information not available.

SOURCES

Description Authors: L. A. Sneddon, mod. S. C. Gawler.
References: Eastern Ecology Working Group n.d., Ehrenfeld 1977, Fike 1999, Perles et al. 2006c.

Figure 26. Northeastern Modified Successional Forest in Delaware Water Gap National Recreation Area (plot DEWA.153). July 2003.

Figure 27. Northeastern Modified Successional Forest in Delaware Water Gap National Recreation Area (plot DEWA.193). May 2004.

COMMON NAME (PARK-SPECIFIC): DRY OAK - MIXED HARDWOOD FOREST

SYNONYMS

NVC English Name:	**(White Oak, Northern Red Oak, Black Oak) / Flowering Dogwood / Mapleleaf Viburnum Forest**
NVC Scientific Name:	***Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium* Forest**
NVC Identifier:	**CEGL006336**

LOCAL INFORMATION

Environmental Description: This forest type is common on high to midslopes, steps-in-slope, and other dry-mesic sites. This association can occur on extremely stony xeric soils such the Manlius, Arnot, Dekalb, Oquaga, Lackawanna, and Chippawa series, as well as the more mesic and less rocky Hazen, Hoosic, and Otisville series. This association occurs on sandstone, shale, and siltstone within the park. This forest type often occurs downslope of Dry Oak - Heath Forest on slightly less xeric sites, and upslope of the more mesic Northern Red Oak - Mixed Hardwood Forest. The sites may be gentle to steeply sloping and may contain scattered boulders and large rocks. Also included here are more depauperate stands occurring on scree slopes below rapidly weathering siltstone and shale outcrops. These forests have likely been harvested numerous times in the past several centuries. Small scattered seeps or drainages may occur in this forest type, influencing the herbaceous layer immediately around them.

Vegetation Description: Species composition of the forest may vary with site-specific micro-climates, surrounding vegetation types, and land-use history. The canopy (70-80% cover) is dominated by oaks (*Quercus* spp.) that cover 25-75% of the stand, with a wide variety of associates. White oak (*Quercus alba*) and chestnut oak (*Quercus prinus*) are the most common oak dominants, although black oak (*Quercus velutina*) and northern red oak (*Quercus rubra*) can also be dominant. The most common canopy associates are red maple (*Acer rubrum*) and sweet birch (*Betula lenta*). Other common canopy associates include eastern hemlock (*Tsuga canadensis*), pignut hickory (*Carya glabra*), mockernut hickory (*Carya alba*), red hickory (*Carya ovalis*), blackgum (*Nyssa sylvatica*), eastern white pine (*Pinus strobus*), sugar maple (*Acer saccharum*), and yellow birch (*Betula alleghaniensis*). Canopy trees extend 15-30 m in height and subcanopy trees range 5-20 m in height. The subcanopy (10-50% cover) consists of red maple, blackgum, sugar maple, common serviceberry (*Amelanchier arborea*), eastern red-cedar (*Juniperus virginiana*), and the oaks and hickories found in the canopy. Stands with a woodland physiognomy (25-60% canopy cover) with a similar species composition are included in this type. These forests may contain dense white pine regeneration, indicating that the site will succeed to Dry White Pine - Oak Forest in the future. The sparse tall-shrub layer (0-30% cover) typically contains American witch-hazel (*Hamamelis virginiana*), common serviceberry, flowering dogwood (*Cornus florida*), mountain laurel (*Kalmia latifolia*), mapleleaf viburnum (*Viburnum acerifolium*), and saplings of the canopy trees. Occasionally, on north-facing slopes, this forest may contain dense stands of great laurel (*Rhododendron maximum*). Scattered patches of low heath that cover <40% of the forest floor are characteristic of this forest type. Common ericaceous species include black huckleberry (*Gaylussacia baccata*), Blue Ridge blueberry (*Vaccinium pallidum*), lowbush blueberry (*Vaccinium angustifolium*), and deerberry (*Vaccinium stamineum*). The heath patches are often interspersed with dense patches of eastern hayscented fern (*Dennstaedtia punctilobula*). The herbaceous layer is extremely variable (5-70% cover)

depending on site-specific conditions and land-use history. In stands with open woodland canopies, the herbaceous layer may be well-developed and dominated by graminoids. Some common species are Canada mayflower (*Maianthemum canadense*), marginal woodfern (*Dryopteris marginalis*), wild sarsaparilla (*Aralia nudicaulis*), white snakeroot (*Ageratina altissima* var. *altissima*), wavy hairgrass (*Deschampsia flexuosa*), Swan's sedge (*Carex swanii*), partridgeberry (*Mitchella repens*), striped prince's pine (*Chimaphila maculata*), Indian cucumber (*Medeola virginiana*), Pennsylvania sedge (*Carex pensylvanica*), smooth Solomon's seal (*Polygonatum biflorum*), sessileleaf bellwort (*Uvularia sessilifolia*), upland bentgrass (*Agrostis perennans*), tapered rosette grass (*Dichanthelium acuminatum* var. *acuminatum*), and starflower (*Trientalis borealis*). The invasive species Japanese stiltgrass (*Microstegium vimineum*) and Japanese barberry (*Berberis thunbergii*) may be present in this forest type.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	Quercus alba, Quercus prinus, Betula lenta, Acer rubrum,
Tree subcanopy	Broad-leaved deciduous tree	Nyssa sylvatica, Acer rubrum
Tall shrub/sapling	Broad-leaved deciduous shrub	Hamamelis virginiana
Short shrub/sapling	Broad-leaved deciduous shrub	Gaylussacia baccata, Vaccinium spp.
Herb (field)	Fern or fern ally	Dennstaedtia punctilobula

Characteristic Species: *Quercus alba, Quercus prinus, Quercus rubra, Quercus velutina, Acer rubrum, Amelanchier arborea, Betula lenta, Gaylussacia baccata, Hamamelis virginiana*

Other Noteworthy Species: Information not available.

Subnational Distribution with Crosswalk data:

State	State Rank	Confidence	State Name	Reference
NJ	S4S5	1	Northeastern Dry Oak-Hickory Forest	Walz et al. 2006
PA	S4	2	Dry oak - mixed hardwood forest	Fike 1999

Local Range: This very common forest type occurs throughout the park in moderately dry settings.

Classification Comments: Although species composition is variable, Dry Oak - Mixed Hardwood Forest can be distinguished from Northern Red Oak - Mixed Hardwood Forest (mesic oak) by the presence of drier canopy components such as *Quercus prinus, Carya glabra, Carya ovalis, Carya alba,* and *Amelanchier arborea*, as well as the presence of scattered ericads (*Gaylussacia baccata, Vaccinium* spp.). Dry Oak - Mixed Hardwood Forest is also found on higher elevation, more xeric sites than Northern Red Oak - Mixed Harwood Forest. Northern Red Oak - Mixed Hardwood Forest tends to contain more mesic associate species such as *Liriodendron tulipifera, Fagus grandifolia,* and *Lindera benzoin*. In stands of Dry Oak - Mixed Hardwood Forest from which the oaks have been high-graded, *Acer rubrum* and *Betula lenta* may be overabundant, reducing oak dominance below 25% relative cover. In these cases, Red Maple - Sweet Birch Hardwood Forest is more characteristic. If the canopy and subcanopy combined contain >25% relative cover of *Pinus strobus* or *Tsuga canadensis*, then refer to Dry Eastern White Pine - Oak Forest or Dry Eastern Hemlock - Oak Forest. Stands with a woodland physiognomy (25-60% canopy cover) with similar species composition to that described above are included here.

Other Comments: None.

Local Description Authors: S. J. Perles and G. S. Podniesinski (PNHP).
Plots and Data Sources: DEWA.62, DEWA.71, DEWA.86, DEWA.93, DEWA.117, DEWA.120, DEWA.128, DEWA.133, DEWA.142, DEWA.180, DEWA.214; Fike 1999.
Delaware Water Gap National Recreation Area Inventory Notes: Information not available.

GLOBAL INFORMATION

NVC CLASSIFICATION

Physiognomic Class	Forest (I)
Physiognomic Subclass	Deciduous forest (I.B.)
Physiognomic Group	Cold-deciduous forest (I.B.2.)
Physiognomic Subgroup	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
Formation	Lowland or submontane cold-deciduous forest (I.B.2.N.a.)
Alliance	Quercus alba - (Quercus rubra, Carya spp.) Forest Alliance (A.239)
Alliance (English name)	White Oak - (Northern Red Oak, Hickory species) Forest Alliance
Association	*Quercus (alba, rubra, velutina) / Cornus florida / Viburnum acerifolium* Forest
Association (English name)	(White Oak, Northern Red Oak, Black Oak) / Flowering Dogwood / Mapleleaf Viburnum Forest
Ecological System(s):	Northern Atlantic Coastal Plain Dry Hardwood Forest (CES203.475)
	Northeastern Interior Dry-Mesic Oak Forest (CES202.592)

GLOBAL DESCRIPTION

Concept Summary: This northeastern oak-hickory forest occurs on well-drained loamy sand of midslopes. This vegetation is ecologically transitional between dry-rich oak-hickory forests of relatively high diversity and dry, acidic oak species-poor forests. *Quercus rubra, Quercus alba*, and *Quercus velutina* are prominent in the canopy. *Quercus prinus* and *Quercus coccinea* are canopy associates in the southern portion of the range. Typical hickory species include *Carya glabra, Carya ovata, Carya alba (= Carya tomentosa)*, and *Carya ovalis*. Other canopy associates may include *Acer rubrum, Sassafras albidum*, and *Amelanchier arborea*. At the northern range limit of this type, *Pinus strobus* and *Betula lenta* also occur as minor associates. *Cornus florida* is a characteristic understory tree in portions of the range. The shrub layer is characterized by *Viburnum acerifolium*, with other frequent associates including *Hamamelis virginiana, Vaccinium corymbosum, Corylus cornuta*, and *Corylus americana*. A dwarf-shrub layer may be common, but is generally not abundant, and is characterized by *Vaccinium pallidum* and *Gaylussacia baccata*, with *Vaccinium angustifolium* occurring more frequently to the north. The herbaceous layer is characterized by *Carex pensylvanica, Carex rosea, Maianthemum racemosum (= Smilacina racemosa), Aralia nudicaulis, Hieracium venosum, Solidago bicolor, Desmodium glutinosum, Desmodium paniculatum, Melampyrum lineare, Chimaphila maculata, Eurybia divaricata (= Aster divaricatus), Danthonia spicata, Aureolaria* spp., and *Helianthemum canadense*.
Environmental Description: This forest type occurs on well-drained loamy sand of midslopes and other dry-mesic sites.

Vegetation Description: This vegetation is ecologically transitional between dry-rich oak-hickory forests of relatively high diversity and dry, acidic oak-species-poor forests. *Quercus rubra, Quercus alba*, and *Quercus velutina* are prominent in the canopy. Typical hickory species include *Carya glabra, Carya ovata, Carya alba (= Carya tomentosa)*, and *Carya ovalis*. Other canopy associates may include *Acer rubrum, Quercus prinus, Sassafras albidum*, and *Amelanchier arborea*. *Pinus strobus, Tsuga canadensis*, and *Betula lenta* may also occur as minor associates. *Cornus florida* is a characteristic understory tree in portions of the range. The shrub layer is typically rather sparse and characterized by *Viburnum acerifolium*, with other frequent associates including *Hamamelis virginiana, Vaccinium corymbosum, Kalmia latifolia, Corylus cornuta*, and *Corylus americana*. A dwarf-shrub layer may be common but generally not abundant, characterized by *Vaccinium pallidum* and *Gaylussacia baccata*, with *Vaccinium angustifolium* occurring more frequently to the north. The herbaceous layer is characterized by *Carex pensylvanica, Maianthemum racemosum (= Smilacina racemosa), Dryopteris marginalis, Aralia nudicaulis, Hieracium venosum, Solidago bicolor, Desmodium glutinosum, Desmodium paniculatum, Melampyrum lineare, Chimaphila maculata, Eurybia divaricata (= Aster divaricatus), Danthonia spicata, Deschampsia flexuosa, Dennstaedtia punctilobula, Aureolaria* spp., and *Helianthemum canadense*. The invasive species *Microstegium vimineum* and *Berberis thunbergii* may also be present in this forest type.

Most Abundant Species:

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	Quercus alba, Quercus prinus, Quercus rubra, Quercus velutina
Shrub/sapling (tall & short)	Broad-leaved deciduous tree	Cornus florida
Short shrub/sapling	Broad-leaved deciduous shrub	Gaylussacia baccata
Herb (field)	Graminoid	Carex pensylvanica

Characteristic Species: *Aralia nudicaulis, Carex pensylvanica, Carya alba, Carya glabra, Carya ovalis, Cornus florida, Gaylussacia baccata, Maianthemum racemosum, Quercus prinus, Vaccinium pallidum, Viburnum acerifolium.*

Other Noteworthy Species: Information not available.

USFWS Wetland System: Not applicable.

DISTRIBUTION

Range: This association occurs from Maine to Virginia.

States/Provinces: CT, DE:S3?, MA, MD, ME, NH, NJ:S4S5, NY:S3, PA, RI, VA, VT.

Federal Lands: NPS (Booker T. Washington, Cape Cod, Delaware Water Gap, Fort Necessity, Fredericksburg-Spotsylvania, Gettysburg, Minute Man, Morristown, Prince William?, Weir Farm); USFWS (Assabet River, Great Meadows).

CONSERVATION STATUS

Rank: G4G5 (24-Jan-2005).

Reasons: This type is not naturally rare and has a wide geographic distribution. Mature stands, however, are uncommon and most stands are subject to logging disturbances or even complete destruction if located in rapidly developing suburban areas.

CLASSIFICATION INFORMATION

Status: Standard.

Confidence: 2 – Moderate.

Comments: Information not available.

Similar Associations:

- *Acer saccharum - Betula alleghaniensis - Quercus rubra / Viburnum acerifolium* Forest (CEGL006943).
- *Carya (glabra, ovata) - Fraxinus americana - Quercus* spp. Forest (CEGL006236).
- *Pinus strobus - Quercus (rubra, velutina) - Fagus grandifolia* Forest (CEGL006293)--can intergrade with this type in New England but is characterized by *Fagus grandifolia* (more or less absent in CEGL006336), a greater amount of *Pinus strobus* in the canopy (usually >20%), and little or no *Carya*.
- *Quercus alba - Quercus (rubra, coccinea) - Carya (alba, glabra) / Vaccinium pallidum* Piedmont Dry-Mesic Forest (CEGL008475)--is more diverse and occupies soils with slightly higher base status. *Quercus velutina* is not as characteristic of this type. A number of southern herbs such as *Aristolochia serpentaria* are not found in CEGL006375.
- *Quercus alba - Quercus rubra - Carya (alba, ovata) / Cornus florida* Acid Forest (CEGL002067)--also contains *Cimifuga racemosa* and can occur on cherty limestone, and *Quercus velutina* is not characteristic.
- *Quercus coccinea - Quercus velutina / Sassafras albidum / Vaccinium pallidum* Forest (CEGL006375)--lacks *Viburnum acerifolium* and *Cornus florida* and in general is less diverse and occurring on relatively more nutrient-poor soils.
- *Quercus prinus - Quercus (rubra, velutina) / Vaccinium angustifolium* Forest (CEGL006282).
- *Quercus velutina - Quercus alba - Carya (glabra, ovata)* Forest (CEGL002076)--also contains *Quercus ellipsoidalis* or *Quercus macrocarpa* and is of shorter stature and more open canopy.
- *Quercus velutina / Carex pensylvanica* Forest (CEGL002078)--is drier and more infertile, and lacks *Viburnum acerifolium, Hamamelis virginiana* and other shrubs.

Related Concepts:

- *Quercus (alba, rubra, velutina) / Cornus florida - Viburnum acerifolium* Forest (Bartgis 1986) =
- *Quercus montana - Quercus rubra - Carya (ovalis, glabra) / Viburnum acerifolium* Forest (Fleming pers. comm.) ?
- Mesic Coastal Plain mixed oak forest (Breden 1989) ?
- Northeastern Acidic Oak-Hickory Forest (Fleming et al. 2004) ?
- SNE mesic central hardwood forest on acidic till (Rawinski 1984) ?

SOURCES

Description Authors: S. L. Neid and L. A. Sneddon, mod. S. C. Gawler.

References: Bartgis 1986, Berdine 1998, Breden 1989, Breden et al. 2001, Clancy 1996, Damman 1977, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Fike 1999, Fleming et al. 2001, Fleming et al. 2004, Fleming pers. comm., Gawler 2002, Harrison 2004, Hunt 1997a, MENHP 1991, McCoy and Fleming 2000, Metzler and Barrett 2001, Patterson pers. comm., Rawinski 1984, Sperduto 1997b, Sperduto and Nichols 2004, Swain and Kearsley 2001, VDNH 2003.

Figure 28. Dry Oak - Mixed Hardwood Forest in Delaware Water Gap National Recreation Area (plot DEWA.62). July 2003.

Figure 29. Dry Oak - Mixed Hardwood Forest in Delaware Water Gap National Recreation Area (plot DEWA.128). May 2003.