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## **ECOLOGICAL SYSTEM: APPALACHIAN (HEMLOCK)-NORTHERN HARDWOOD FOREST**

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**Summary:** This forested system of the northeastern U.S. ranges from central New England west to Lake Erie and south to Virginia, continuing down the Appalachians to Georgia in a more attenuated fashion. It is one of the matrix forest types in the northern part of the Central Interior and Appalachian Division. Northern hardwoods such as *Acer saccharum* (sugar maple), *Betula alleghaniensis* (yellow birch), and *Fagus grandifolia* (American beech) are characteristic, either forming a deciduous canopy or mixed with *Tsuga canadensis* (eastern hemlock) (or in some cases *Pinus strobus* (eastern white pine)). Other common and sometimes dominant trees include *Quercus* (oak) spp. (most commonly *Quercus rubra* (northern red oak)), *Liriodendron tulipifera* (tuliptree), *Prunus serotina* (black cherry), and *Betula lenta* (sweet birch). It is of more limited extent and more ecologically constrained in the southern part of its range (more or less from central Virginia southwards), occurring at a smaller spatial extent.

**High-ranked Species:** *Acrobolbus ciliatus* (G3?), *Aneides aeneus* (G3G4, green salamander), *Brachymerium andersonii* (GH, anderson's brachymerium), *Bryocrumia vivicolor* (G1G2), *Bryoerythrophyllum ferruginascens* (G3G4), *Bryum riparium* (G2G4), *Buckleya distichophylla* (G2, piratebush), *Canis rufus* (G1Q, red wolf), *Carex brysonii* (G1, bryson's sedge), *Catocala marmorata* (G3G4, marbled underwing), *Cephaloziella spinicaulis* (G3G4), *Cheilolejeunea evansii* (G1), *Clematis addisonii* (G2, addison's leatherflower), *Desmognathus aeneus* (G3G4, seepage salamander), *Desmognathus imitator* pop. 1 (G3G4T1Q, waterrock knob salamander), *Desmognathus santeetlah* (G3G4Q, santeetlah dusky salamander), *Desmognathus wrightii* (G3G4, pygmy salamander), *Diervilla rivularis* (G3, mountain bush-honeysuckle), *Drepanolejeunea appalachiana* (G2?), *Fissidens appalachensis* (G2G3), *Hexastylis contracta* (G3, southern heartleaf), *Homaliadelphus sharpii* (G3?, sharp's homaliadelphus), *Hymenophyllum tayloriae* (G2, taylor's filmy fern), *Lejeunea blomquistii* (G1G2, blomquist leafy liverwort), *Lophocolea appalachiana* (G1G2Q), *Marsupella emarginata* var. *latiloba* (G5T1T2), *Metzgeria fruticulosa* (G2Q), *Metzgeria furcata* var. *setigera* (G5T1), *Metzgeria uncigera* (G3), *Microtus chrotorrhinus carolinensis* (G4T3, southern rock vole), *Nardia lescurii* (G3?), *Neotoma magister* (G3G4, Allegheny woodrat), *Pellia appalachiana* (G2), *Plagiochila austinii* (G3), *Plagiochila caduciloba* (G2, gorge leafy liverwort), *Plagiochila eurphyllon* ssp. *echinata* (GNRT2), *Plagiochila sharpii* (G2G4, sharps leafy liverwort), *Plagiochila sullivantii* var. *spinigera* (G2T1), *Plagiochila sullivantii* var. *sullivantii* (G2T2), *Plagiochila virginica* var. *caroliniana* (G3T2), *Plagiochila virginica* var. *virginica* (G3T3), *Plagiomnium carolinianum* (G3, mountain wavy-leaf moss), *Platyhypnidium pringlei* (G2G3), *Plethodon aureolus* (G2G3, tellico salamander), *Plethodon hubrichti* (G2, peaks of otter salamander), *Plethodon punctatus* (G3, white-spotted salamander), *Plethodon teyahalee* (G3, southern Appalachian salamander), *Plethodon welleri* (G3, weller's salamander), *Porella japonica* ssp. *appalachiana* (G5?T1), *Radula sullivantii* (G3), *Radula voluta* (G3), *Riccardia jugata* (G2), *Schlotheimia lancifolia* (G2, highlands moss), *Shortia galacifolia* var. *brevistyla* (G2T1Q, northern shortia), *Shortia galacifolia* var. *galacifolia* (G2T2, southern shortia), *Sorex palustris punctulatus* (G5T3, southern water shrew), *Stygobromus* sp. 17 (G2, massanutten spring amphipod), *Tetrodontium brownianum* (G3G4, little georgia), *Trillium persistens* (G1, persistent trillium), *Triphora trianthophora* (G3G4, threebirds), *Tsuga caroliniana* (G3, Carolina hemlock), *Virginia valeriae pulchra* (G5T3T4, mountain earth snake)

**Range:** This system is found from central New England south to West Virginia and Georgia. United States: CT, GA, KY, MA, MD, NC, NH, NJ, NY, OH, PA, SC, TN, VA, VT, WV.

### **Delaware Estuary Associations:**

- Central Appalachian Forested Acid Seep
- Central Appalachian White Pine - Eastern Hemlock Forest
- East-central Hemlock Hardwood Forest
- Golden-saxifrage Forested Seep
- Hemlock - Beech - Oak Forest
- Hemlock / White Pine - Red Oak - Mixed Hardwood Forest
- High Allegheny Rich Red Oak - Sugar Maple Forest
- Northern Hardwood Forest
- Red Maple - Blackgum Basin Swamp

- Red Maple Upland Forest
- Red Oak - Northern Hardwood Forest
- White Pine - Hemlock Dry-Mesic Coniferous Forest

#### CLASSIFIERS FOR APPALACHIAN (HEMLOCK)-NORTHERN HARDWOOD FOREST

**Primary Division:** 202

**Land Cover Class:** Forest and Woodland

**Spatial Scale & Pattern:** Matrix

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

**Diagnostic Classifiers:** Mesotrophic Soil; Needle-Leaved Tree; Broad-Leaved Deciduous Tree; *Pinus* spp. - *Tsuga canadensis*

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

Temperate; Acidic Soil; Shallow Soil; Deep Soil; Mineral: W/ A-Horizon >10 cm; Ustic; Long Disturbance Interval;

Moderate (100-500 yrs) Persistence

#### CENTRAL APPALACHIAN FORESTED ACID SEEP

*Acer rubrum* - *Nyssa sylvatica* High Allegheny Plateau, Central Appalachian Forest

**Range:** This acidic deciduous swamp occurs in the central Appalachian Mountains north of the Cumberland drainage in the Central Appalachians and High Allegheny ecoregions, as well as the adjacent Cumberlands and Western Allegheny Plateau. This seep community occurs in the Pennsylvania portion of the Delaware Estuary.

**Environmental Description:** This community occurs on substrates which are saturated for extended periods during the growing season but which rarely have standing water, including forested seeps, hillsides, streamheads, floodplain edges, and poorly drained depressions. Occurrences tend to be small.

**Vegetation Description:** Characteristic trees are *Acer rubrum* (red maple) and *Nyssa sylvatica* (blackgum), with other associates including *Tsuga canadensis* (eastern hemlock) and *Betula alleghaniensis* (yellow birch). The shrub stratum includes *Alnus serrulata* (smooth alder), *Photinia pyrifolia* (red chokeberry), *Ilex verticillata* (common winterberry), *Vaccinium corymbosum* (highbush blueberry), *Rhododendron maximum* (great laurel), and *Rubus hispidus* (bristly dewberry). Characteristic herbs include *Osmunda cinnamomea* (cinnamon fern), *Osmunda regalis* (royal fern), *Carex folliculata* (northern long sedge), *Carex trisperma* (three-seed sedge), *Carex intumescens* (greater bladder sedge), *Carex stricta* (tussock sedge), and *Poa trivialis* (rough bluegrass). *Sphagnum* (peatmoss) spp. are typical.

**Characteristic Species:** *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), *Osmunda cinnamomea* (cinnamon fern)

**Reference Sites:** none identified

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

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.689039](http://vegbank.org/natureserve/element_global.2.689039)

**References:** Anderson et al. 1998, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Fike 1999, Harrison 2004

## MOST ABUNDANT SPECIES

STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
Tree canopy	Broad-leaved deciduous tree	<i>Nyssa sylvatica</i> (blackgum)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Alnus serrulata</i> (smooth alder)

## CENTRAL APPALACHIAN WHITE PINE - EASTERN HEMLOCK FOREST

*Pinus strobus* - *Tsuga canadensis* / *Acer pensylvanicum* / *Polystichum acrostichoides* Forest

**Range:** The range of this community type includes the northern Blue Ridge, Ridge and Valley province, and Appalachian Mountains in Virginia, West Virginia, Maryland, and Pennsylvania. In Virginia, the type has been documented primarily from the northern Blue Ridge but is probably scattered throughout the state's mountain region north of the New River. One outlier apparently belonging to this association has been documented in the western Piedmont. In the Pennsylvania portion of the Delaware Estuary, this association only occurs in fragmented remnant stands.



Photo by Pennsylvania Natural Heritage Program

### Environmental Description:

This dry-mesic white pine - hemlock forest of the central Appalachian Mountains and High Allegheny Plateau occurs on well-drained, nutrient-poor acidic soils.

**Vegetation Description:** Throughout its range, this is a closed-canopy, largely coniferous forest dominated by *Pinus strobus* (eastern white pine) and *Tsuga canadensis* (eastern hemlock) in variable proportions. Canopy associates include *Fagus grandifolia* (American beech), *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Betula alleghaniensis* (yellow birch), *Quercus rubra* (northern red oak), and *Liriodendron tulipifera* (tuliptree). The often sparse shrub layer contains *Acer pensylvanicum* (striped maple), *Acer spicatum* (mountain maple), and *Hamamelis virginiana* (American witch-hazel). Herb cover is usually limited by deep shade but includes *Cypripedium acaule* (pink lady's-slipper), *Gaultheria procumbens* (wintergreen), *Lycopodium* (clubmoss) spp., *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Mitchella repens* (partridgeberry), and *Polystichum acrostichoides* (Christmas fern).

**Characteristic Species:** *Acer pensylvanicum* (striped maple), *Pinus strobus* (eastern white pine), *Polystichum acrostichoides* (Christmas fern), *Tsuga canadensis* (eastern hemlock).

**Management Concerns:** Hemlock wooly adelgid may have significant negative impacts to the vegetation structure, species composition, and habitat suitability of this association.

**Reference Sites:** Adams Creek in the Delaware Water Gap National Recreation Area, PA..

**Global and State Conservation Ranks and Reasons:** G4? (28-Sep-2001). PA: SNR. This is a somewhat geographically restricted type that is apparently uncommon but not rare. Although many small patches probably occur in the northern two-thirds of the Virginia mountains, the compositional integrity of these stands is highly threatened by ongoing outbreaks of the hemlock wooly adelgid (*Adelges tsugae*), an exotic insect pest.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.688339](http://vegbank.org/natureserve/element_global.2.688339)

**References:** Eastern Ecology Working Group n.d., Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming et al. 2001, Harrison 2004, Lutz 1930, Rawinski et al. 1996, Smith 1983, VDNH 2003.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Needle-leaved tree	<i>Pinus strobus</i> (eastern white pine)
Tree canopy	Needle-leaved tree	<i>Tsuga canadensis</i> (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	<i>Fagus grandifolia</i> (American beech)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i> (striped maple)

## EAST-CENTRAL HEMLOCK HARDWOOD FOREST

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

**Range:** This community is found in parts of the Interior Low Plateau and the Western Allegheny Plateau of the northeastern and east-central United States, ranging from Pennsylvania and Ohio, south to Maryland and West Virginia, and westward to a few stands in Indiana, and possibly Kentucky. Stands in Indiana are not part of the continuous range of *Tsuga canadensis* (eastern hemlock). It occurs in the Pennsylvania portion of the Delaware Estuary.

**Environmental Description:** Stands occur on dry-mesic to mesic slopes, sometimes in steep-sloped valleys, but also in more gently sloped valleys and rolling lakeplain ridges. Soils are typically acid, silty to sandy loams, with a sandstone or shale parent material (Anderson 1982). Some Indiana stands occur on limestone (M. Homoya pers. comm. 1999).



Photo by Pennsylvania Natural Heritage Program

**Vegetation Description:** The overstory is dominated by *Tsuga canadensis* (eastern hemlock), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and *Fagus grandifolia* (American beech). Rarely does any one of these comprise more than 50% of the mature trees in a stand. Other trees are common in the canopy, among them *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Carya* (hickory) spp., *Liriodendron tulipifera* (tuliptree), *Nyssa sylvatica* (blackgum), *Pinus strobus* (eastern white pine), *Prunus serotina* (black cherry), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Tilia americana* (American basswood). The shrub layer, occasionally sparse, contains *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush), and *Viburnum acerifolium* (mapleleaf viburnum), as well as ericaceous shrubs, including *Kalmia latifolia* (mountain laurel) and *Rhododendron maximum* (great laurel). The ground layer contains the ferns *Botrychium virginianum* (rattlesnake fern), *Dryopteris intermedia* (intermediate woodfern), *Dryopteris marginalis* (marginal woodfern), *Polystichum acrostichoides* (Christmas fern), and the herbs *Arisaema triphyllum* (Jack-in-the-pulpit), *Maianthemum canadense* (Canada mayflower), *Mitchella repens* (partridgeberry), *Podophyllum peltatum* (mayapple), *Viola blanda* (sweet white violet), and *Viola rotundifolia* (roundleaf violet), among others.

**Characteristic Species:** *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Kalmia latifolia* (mountain laurel).

**Management Concerns:** Hemlock woolly adelgid may have significant negative impacts to the vegetation structure, species composition, and habitat suitability of this association.

**Reference Sites:** St. Peters Woods, State Game Land 43, PA.

**Global and State Conservation Ranks and Reasons:** G3? (29-Sep-2004). PA: SNR. Occurrences are subject to compositional modification by outbreaks of hemlock woolly adelgid (*Adelges tsugae*), an exotic insect pest that causes decline and eventual mortality of *Tsuga canadensis*.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.687323](http://vegbank.org/natureserve/element_global.2.687323)

**References:** Anderson 1982, Black and Mack 1976, Campbell pers. comm., Eastern Ecology Working Group n.d., Fike 1999, Fleming pers. comm., Harrison 2004, Homoya pers. comm., OHNHD unpubl. Data.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple)
Tree canopy	Broad-leaved deciduous tree	<i>Fagus grandifolia</i> (American beech)
Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	<i>Kalmia latifolia</i> (mountain laurel)
Herb (field)	Fern or fern ally	<i>Polystichum acrostichoides</i> (Christmas fern)

## GOLDEN-SAXIFRAGE FORESTED SEEP

*Chrysosplenium americanum* Herbaceous Vegetation

**Range:** This association occurs throughout the eastern United States. It occurs in the Pennsylvania portion of the Delaware Estuary and possibly in Delaware.

**Environmental Description:** This type includes small herbaceous seepage areas with scattered cover of forbs. Herbs are strongly dominant and tend to be relatively diverse, especially where there is greater enrichment. Typically the community is over-topped by trees and shrubs from the surrounding forest, although large examples will be open.



Photo by Pennsylvania Natural Heritage Program

**Vegetation Description:** Characteristic species can include *Chrysosplenium americanum* (American golden-saxifrage), *Cardamine bulbosa* (bulbous bittercress), *Circaea alpina* (alpine enchanter's-nightshade), *Viola cucullata* (marsh blue violet), *Chelone glabra* (white turtlehead), *Glyceria melicaria* (melic manna grass), *Glyceria striata* (fowl mannagrass), *Cinna arundinacea* (sweet woodreed), *Impatiens capensis* (orange jewelweed), *Poa paludigena* (bog bluegrass), *Carex scabrata* (eastern rough sedge), *Mimulus ringens* (Allegheny monkeyflower), *Symplocarpus foetidus* (skunk-cabbage), *Pilea pumila* (Canadian clearweed), *Galium triflorum* (sweet-scent bedstraw), *Saxifraga pennsylvanica* (eastern swamp saxifrage), *Thelypteris noveboracensis* (New York fern), *Veratrum viride* (American false hellebore), *Hydrocotyle americana* (American marsh pennywort), *Onoclea sensibilis* (sensitive fern),

*Laportea canadensis* (Canadian wood-nettle), *Arisaema triphyllum* (Jack-in-the-pulpit), *Tiarella cordifolia* (heartleaf foamflower), *Carex gynandra* (nodding sedge), *Geum rivale* (purple avens), and the mosses *Rhizomnium punctatum*, *Rhizomnium appalachianum* (Appalachian rhizomnium moss), *Brachythecium rivulare* (waterside feather moss), *Thuidium delicatulum* (delicate fern moss), *Steerecleus serrulatus* (steerecleus moss), and *Bryhnia novae-angliae* (new england bryhnia moss).

**Noteworthy Associated Plant and/or Animal Species:** *Parnassia glauca* (fen grass-of-parnassus), *Trollius laxus* (American globeflower).

**Characteristic Species:** *Chrysosplenium americanum* (American golden-saxifrage).

**Reference Sites:** Warwick County Park in Chester County, PA; Red Clay Creek, DE.

**Global and State Conservation Ranks and Reasons:** G3G5 (1-Dec-1997). DE: SNR, PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.685735](http://vegbank.org/natureserve/element_global.2.685735)

**References:** Bowman 2000, CAP pers. comm. 1998, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Harrison 2004, Metzler and Barrett 2001, Schafale 1998b, Sperduto 2000a, Swain and Kearsley 2000, TDNH unpubl. data, Thompson and Sorenson 2000

MOST ABUNDANT SPECIES				
STRATUM	LIFEFORM	SPECIES		
Herb (field)	Forb	<i>Chrysosplenium</i>	<i>americanum</i>	(American golden-saxifrage)

## HEMLOCK - BEECH - OAK FOREST

*Tsuga canadensis* - *Fagus grandifolia* - *Quercus rubra* Forest

**Range:** This association is widespread in southern New England and ranges south locally in the northern Piedmont and high Allegheny Mountains to Virginia and West Virginia. In Virginia, the type is confined to the Allegheny Mountain / Laurel Fork area in northwestern Highland County. It occurs in the Pennsylvania portion of the Delaware Estuary.

**Environmental Description:** This forest occurs on dry to dry-mesic, nutrient-poor, well-drained, often stony sandy loams or loamy sands. Underlying bedrock is acidic. In Virginia, it occupies extremely acidic (mean pH = 3.8), infertile silt loams on mesic to submesic valley sideslopes and broad, convex ridges at elevations from 1000-1200 m.

**Vegetation Description:** The canopy is codominated by *Tsuga canadensis* (eastern hemlock) and *Fagus grandifolia* (American beech) in variable proportions depending on soil (site) and disturbance characteristics; drier sites tend to have more abundant *Fagus grandifolia* (American beech) and cooler sites tend to have more abundant *Tsuga canadensis* (eastern hemlock). Associated tree species include *Betula lenta* (sweet birch), *Quercus rubra* (northern red oak), *Pinus strobus* (eastern white pine), and *Acer rubrum* (red maple). Shrubs are often sparse but locally abundant and, in addition to saplings of canopy species, include *Hamamelis virginiana* (American witch-hazel), *Acer pensylvanicum* (striped maple), *Viburnum acerifolium* (mapleleaf viburnum), *Kalmia latifolia* (mountain laurel), and in the south *Ilex montana* (mountain holly). The herb layer is generally sparse, but usually includes several of the following: *Mitchella repens* (partridgeberry), *Epifagus virginiana* (beechdrops), *Gaultheria procumbens* (wintergreen), *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Medeola virginiana* (Indian cucumber-root), *Aralia nudicaulis* (wild sarsaparilla), *Uvularia sessilifolia* (sessile-leaf bellwort), *Dryopteris intermedia* (intermediate woodfern) or *Monotropa uniflora* (Indian-pipe), and occasionally *Lycopodium dendroideum* (tree clubmoss), *Coptis trifolia* (threeleaf goldthread), and *Dennstaedtia punctilobula* (eastern hay-scented fern).

**Characteristic Species:** *Dryopteris intermedia* (intermediate woodfern), *Fagus grandifolia* (American beech), *Tsuga canadensis* (eastern hemlock).

**Management Concerns:** Insect pests and pathogens, such as the hemlock woolly adelgid (*Adelges tsugae* (hemlock woolly adelgid)) and beech bark disease (also called beech scale / *Nectria* complex), are serious threats to the dominant canopy trees in this association.

**Reference Sites:** Green Hill Road Woods, Evansburg State Park, PA.

**Global and State Conservation Ranks and Reasons:** G4G5 (26-Jun-1998). PA: SNR. This community type is widely distributed in the northern part of its range. Its long-term viability is threatened by pathogens associated with its two dominant canopy trees.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.686026](http://vegbank.org/natureserve/element_global.2.686026)

**References:** Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Eyre 1980, Fike 1999, Fleming and Coulling 2001, Fleming and Moorhead 1996, Fleming et al. 2001, Gawler 2002, Metzler and Barrett 2001, Rawinski 1984, Reschke 1990, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, VDNH 2003.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Needle-leaved tree	<i>Tsuga canadensis</i> (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	<i>Fagus grandifolia</i> (American beech)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Hamamelis virginiana</i> (American witch-hazel)
Herb (field)	Forb	<i>Aralia nudicaulis</i> (wild sarsaparilla)
Herb (field)	Forb	<i>Trientalis borealis</i> (starflower)
Herb (field)	Fern or fern ally	<i>Dryopteris intermedia</i> (intermediate woodfern)

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## HEMLOCK / WHITE PINE - RED OAK - MIXED HARDWOOD FOREST

*Quercus rubra* - *Tsuga canadensis* - *Liriodendron tulipifera* / *Hamamelis virginiana* Forest

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**Range:** This vegetation occurs in New Jersey and Pennsylvania and may occur in adjacent states. In the Delaware Estuary, this community occurs in Pennsylvania.

**Environmental Description:** This vegetation occurs on deep, moist to well-drained loams and silt loams on northern and eastern midslopes and coves. Soils may be rocky, and slopes may be steep.

**Vegetation Description:** The canopy has a notable presence of *Tsuga canadensis* (eastern hemlock) and/or *Pinus strobus* (eastern white pine). Sharing dominance with these conifers is a variety of oaks and hickories including *Quercus rubra* (northern red oak), *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Quercus alba* (white oak), *Quercus velutina* (black oak), *Betula lenta* (sweet birch), *Carya alba* (mockernut hickory), *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree). The subcanopy and shrub layer consists of *Ostrya virginiana* (eastern hop-hornbeam), *Carpinus caroliniana* (American hornbeam), *Kalmia latifolia* (mountain laurel), *Hamamelis virginiana* (American witch-hazel), *Amelanchier laevis* (Allegheny serviceberry), *Lindera benzoin* (northern spicebush), *Viburnum acerifolium* (mapleleaf viburnum), and *Viburnum recognitum* (northern arrow-wood). The herbaceous layer is characterized by *Maianthemum racemosum* (feathery false lily-of-the-valley), *Gaultheria procumbens* (wintergreen), *Maianthemum canadense* (Canada mayflower), and *Podophyllum peltatum* (mayapple).

**Characteristic Species:** *Gaultheria procumbens* (wintergreen), *Hamamelis virginiana* (American witch-hazel), *Liriodendron tulipifera* (tuliptree), *Maianthemum canadense* (Canada mayflower), *Maianthemum racemosum* (feathery false lily-of-the-valley), *Pinus strobus* (eastern white pine),

*Podophyllum peltatum* (mayapple), *Quercus rubra* (northern red oak), *Tsuga canadensis* (eastern hemlock).

**Management Concerns:** Hemlock wooly adelgid may have significant negative impacts to the vegetation structure, species composition, and habitat suitability of this association.

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

**Global and State Conservation Ranks and Reasons:** G4? (29-Sep-2004). NJ: SNR, PA: SNR. Within its range, this community type occurs extensively in suitable habitats. Occurrences are subject to compositional modification by outbreaks of hemlock woolly adelgid (*Adelges tsugae*), an exotic insect pest that causes decline and eventual mortality of *Tsuga canadensis*.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.686716](http://vegbank.org/natureserve/element_global.2.686716)

**References:** Anderson et al. 1998, Eastern Ecology Working Group n.d., Fike 1999.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Needle-leaved tree	<i>Tsuga canadensis</i> (eastern hemlock)
Tree canopy	Broad-leaved deciduous tree	<i>Liriodendron tulipifera</i> (tuliptree)
Tree canopy	Broad-leaved deciduous tree	<i>Quercus rubra</i> (northern red oak)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Hamamelis virginiana</i> (American witch-hazel)
Herb (field)	Forb	<i>Maianthemum canadense</i> (Canada mayflower)

## HIGH ALLEGHENY RICH RED OAK - SUGAR MAPLE FOREST

*Quercus rubra* - *Acer saccharum* - *Liriodendron tulipifera* Forest

**Range:** This red oak - sugar maple community is found primarily in the Allegheny Plateau and Appalachian Mountain regions of the United States, with possible extensions east and west of those areas, ranging from southeastern New York and New Jersey, west to Pennsylvania, West Virginia, and southeastern Ohio. It occurs in Pennsylvania's portion of the Delaware Estuary.

**Environmental Description:** Stands are typically found in coves, on moist north- and east-facing slopes, and on well-drained flats. Soils are slightly acid and of intermediate fertility (Anderson 1982, Reschke 1990, Fike 1999).

**Vegetation Description:** Stands of this red oak - sugar maple forest contain a closed-canopy tree layer. *Acer saccharum* (sugar maple), *Liriodendron tulipifera* (tuliptree), *Quercus alba* (white oak), and *Quercus rubra* (northern red oak) are the leading dominants. *Acer rubrum* (red maple), *Carya ovata* (shagbark hickory), *Carya alba* (mockernut hickory), *Nyssa sylvatica* (blackgum), and *Quercus velutina* (black oak) are possible associates. *Liriodendron* (tuliptree) dominance may indicate a past disturbance history, and *Carya* (hickory) spp. may share dominance in some stands. There is evidence (Fleming 1999) that *Castanea dentata* (American chestnut) may have been important in these stands prior to its demise. A wide variety of more mesic associates, such as *Betula alleghaniensis* (yellow birch), *Betula lenta* (sweet birch), *Fagus grandifolia* (American beech), and *Fraxinus americana* (white ash), could occur but are negligible in dominance. In addition to *Acer saccharum* (sugar maple) reproduction, some understory species may include *Carpinus caroliniana* (American hornbeam), *Cercis canadensis* (eastern redbud), and *Ostrya virginiana* (eastern hop-hornbeam). Shrub and vine species include *Amelanchier laevis* (Allegheny serviceberry), *Amelanchier arborea* (common serviceberry), *Cornus* (dogwood) spp., *Hamamelis virginiana* (American witch-hazel), *Lindera benzoin* (northern spicebush), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum recognitum* (northern arrow-wood), and *Vitis riparia* (riverbank grape). Ericaceous shrubs, such as *Kalmia latifolia* (mountain laurel), *Vaccinium angustifolium* (northern lowbush blueberry) and *Vaccinium pallidum* (hillside blueberry), may also be present. The

ground layer species are highly variable but include *Caulophyllum thalictroides* (blue cohosh), *Dennstaedtia punctilobula* (eastern hay-scented fern), *Podophyllum peltatum* (mayapple), *Maianthemum racemosum* (feathery false lily-of-the-valley), *Medeola virginiana* (Indian cucumber-root), *Thelypteris noveboracensis* (New York fern), and *Uvularia sessilifolia* (sessile-leaf bellwort).

**Characteristic Species:** *Acer saccharum* (sugar maple), *Carpinus caroliniana* (American hornbeam), *Caulophyllum thalictroides* (blue cohosh), *Liriodendron tulipifera* (tuliptree).

**Reference Sites:** R.B. Gordon Natural Area, Chester County, PA.

**Global and State Conservation Ranks and Reasons:** GNR (31-Dec-1997). NJ: SNR, PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.687049](http://vegbank.org/natureserve/element_global.2.687049)

**References:** Anderson 1982, Braun 1950, Breden 1989, Breden et al. 2001, Eastern Ecology Working Group n.d., Fike 1999, Fleming 1999, Lundgren 2001, Metzler and Barrett 2001, Reschke 1990.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple)
Tree canopy	Broad-leaved deciduous tree	<i>Quercus alba</i> (white oak)
Tree canopy	Broad-leaved deciduous tree	<i>Quercus rubra</i> (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Viburnum acerifolium</i> (mapleleaf viburnum)
Short shrub/sapling blueberry)	Broad-leaved deciduous shrub	<i>Vaccinium angustifolium</i> (northern lowbush blueberry)
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Vaccinium pallidum</i> (hillside blueberry)
Herb (field)	Forb	<i>Podophyllum peltatum</i> (mayapple)
Herb (field)	Fern or fern ally	<i>Dennstaedtia punctilobula</i> (eastern hay-scented fern)

## NORTHERN HARDWOOD FOREST

*Acer saccharum* - *Betula alleghaniensis* - *Fagus grandifolia* / *Viburnum lantanoides* Forest

**Range:** This association is a widespread matrix forest in central New England and at lower elevations in northern New England and in small pockets of Pennsylvania. An example of this community occurs in the Pennsylvania portion of the Delaware Estuary.

**Environmental Description:** This association, known commonly as "northern hardwood forest," is a widespread matrix forest. This forest occurs most commonly on acidic (pH 5-6), moderate to well-drained tills at elevations generally below 762 m (2500 feet). In northern New England, they cover extensive mid-elevation ridges; elsewhere slope settings are common.



Photo by Pennsylvania Natural Heritage Program

**Vegetation Description:** The closed-canopy forest has sparse to moderate shrub and herb cover and may have local carpets of tree seedlings in the ground vegetation. Bryoids are a minor component of the forest floor. On some rocky, higher elevation sites,

dense ferns and other herbs may form a lush understory (the "fern-glade variant"). The canopy is dominated by *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), and *Betula alleghaniensis* (yellow birch) with associated hardwood species, including *Acer rubrum* (red maple), *Betula papyrifera* (paper birch), and *Fraxinus americana* (white ash). Conifers are usually present at low abundance. Characteristic species include *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), and in the northern portion of the range *Picea rubens* (red spruce). Oaks are generally not present, although *Quercus rubra* (northern red oak) and (southward) *Quercus alba* (white oak) may be present in low numbers. Characteristic understory shrubs or subcanopy trees include *Viburnum lantanoides* (hobblebush), *Acer spicatum* (mountain maple), and *Acer pensylvanicum* (striped maple). The patchy herbaceous layer is a mix of ferns, rhizomatous herbs and clubmosses. Characteristic species include *Dryopteris intermedia* (intermediate woodfern), *Dryopteris campyloptera* (mountain woodfern), *Huperzia lucidula* (shining clubmoss), *Maianthemum canadense* (Canada mayflower), *Clintonia borealis* (yellow bluebead-lily), *Trientalis borealis* (starflower), *Oclemena acuminata* (whorled wood aster), and *Uvularia sessilifolia* (sessile-leaf bellwort). Occasional species include *Aralia nudicaulis* (wild sarsaparilla), *Trillium erectum* (stinking benjamin), *Trillium undulatum* (painted wakerobin), *Streptopus lanceolatus* (rosy twisted-stalk), *Cinna latifolia* (slender woodreed), *Thelypteris noveboracensis* (New York fern), *Solidago macrophylla* (largeleaf goldenrod), and *Medeola virginiana* (Indian cucumber-root). The bryophyte layer may include *Dicranum* (broom moss) spp. and *Leucobryum glaucum* (pincushion moss). At higher elevations any of the understory herbs characteristic of montane spruce-fir forests may be locally abundant.

**Noteworthy Associated Plant and/or Animal Species:** *Accipiter striatus* (sharp-shinned hawk), *Aegolius acadicus* (northern saw-whet owl), *Ambystoma maculatum* (spotted salamander), *Contopus virens* (eastern wood-pewee), *Dendroica caerulescens* (black-throated blue warbler), *Dendroica virens* (black-throated green warbler), *Desmognathus fuscus* (dusky salamander), *Empidonax minimus* (least flycatcher), *Empidonax virescens* (acadian flycatcher), *Erethizon dorsatum* (north American porcupine), *Eurycea bislineata* (northern two-lined salamander), *Glaucomys sabrinus* (northern flying squirrel), *Hylocichla mustelina* (wood thrush), *Martes pennanti* (fisher), *Melanerpes carolinus* (red-bellied woodpecker), *Meleagris gallopavo* (wild turkey), *Mniotilta varia* (black-and-white warbler), *Napaeozapus insignis* (woodland jumping mouse), *Notophthalmus viridescens* (eastern newt), *Parula americana* (northern parula), *Peromyscus leucopus* (white-footed deermouse), *Peromyscus maniculatus* (north American deermouse), *Picoides pubescens* (downy woodpecker), *Picoides villosus* (hairy woodpecker), *Piranga olivacea* (scarlet tanager), *Poecile atricapillus* (black-capped chickadee), *Rana sylvatica* (wood frog), *Seiurus aurocapilla* (ovenbird), *Setophaga ruticilla* (American redstart), *Sitta carolinensis* (white-breasted nuthatch), *Sorex cinereus* (cinereus shrew), *Tamias striatus* (eastern chipmunk), *Urocyon cinereoargenteus* (gray fox), *Ursus americanus* (American black bear), *Vireo olivaceus* (red-eyed vireo).

**Characteristic Species:** *Acer pensylvanicum* (striped maple), *Acer saccharum* (sugar maple), *Acer spicatum* (mountain maple), *Betula alleghaniensis* (yellow birch), *Dryopteris intermedia* (intermediate woodfern), *Fagus grandifolia* (American beech), *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), *Viburnum lantanoides* (hobblebush).

**Dynamics/Successional Trajectory:** This is a "climax" forest type where it occurs, with canopy dominants tending to replace themselves under normal small-gap disturbance regimes. Sugar maple leaf litter is high in nitrogen relative to lignin and thus decomposes rapidly, increasing the nutrient pool in the soil organic layer. Structure and composition of the forest are maintained primarily by single small tree-fall gaps. Yellow birch is maintained in the system by mineral soils on "tip-up mounds."

**Management Concerns:** Deer browse impacts on herbs, shrubs and woody plant regeneration is often severe and may require local intervention to maintain healthy forests. This community often occurs on rich mesic soils which are also vulnerable to a number of invasive herb and shrub species.

**Reference Sites:** Locust Creek State Park, Schuylkill County, PA.

**Global and State Conservation Ranks and Reasons:** G5 (7-Dec-2005). NJ: S1S3, PA: SNR. This association is a widespread matrix forest in New England.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.684503](http://vegbank.org/natureserve/element_global.2.684503)

**References:** Adamus 1978, Baldwin 1977, Breden 1989, Breden et al. 2001, Campbell and Eastman 1978, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Flaccus 1972, Gawler 2002, Gordon 1937b, Kern 1985, Kuchler 1956, Kuchler 1964, Little 1974, McIntosh 1972, Metzler and Barrett 1996, Metzler and Barrett 2001, Moore and Taylor 1927, NAP pers. comm. 1998, Niering 1953, Ohmann and Buell 1968, Rawinski 1984, Simko 1987, Sperduto 1996, Sperduto and Nichols 2004, Thompson 1996, Thompson and Sorenson 2000, Woods 1987.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple)
Tree canopy	Broad-leaved deciduous tree	<i>Betula alleghaniensis</i> (yellow birch)
Tree canopy	Broad-leaved deciduous tree	<i>Fagus grandifolia</i> (American beech)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Acer pensylvanicum</i> (striped maple)

## RED MAPLE - BLACKGUM BASIN SWAMP

*Acer rubrum* - *Nyssa sylvatica* - *Betula alleghaniensis* / *Sphagnum* spp. Forest

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

**Environmental Description:** This blackgum basin swamp of the northeastern United States is found from the central Appalachians north to central New England, at the northern range limit for *Nyssa sylvatica* (blackgum). It occupies saturated or seasonally wet basins, typically perched basins in small watersheds within upland forests. In most settings, the mineral soil is overlain with a shallow to deep peat layer. Conditions are highly acidic and nutrient-poor.



Photo by Pennsylvania Natural Heritage Program

**Vegetation Description:** The canopy is dominated by *Acer rubrum* (red maple) and *Nyssa sylvatica* (blackgum); however, even where red maple is more abundant, the longevity and stature of the blackgum trees give them a strong impact. *Betula alleghaniensis* (yellow birch), *Tsuga canadensis* (eastern hemlock), *Pinus strobus* (eastern white pine), and in the north *Picea rubens* (red spruce) may be minor canopy associates. The most abundant shrubs are *Ilex verticillata* (common winterberry) and *Vaccinium corymbosum* (highbush blueberry); associated shrub species include *Viburnum nudum* var. *cassinoides* (northern wild raisin), *Nemopanthus mucronatus* (catberry), *Kalmia angustifolia* (sheep laurel), *Lyonia ligustrina* (maleberry), and *Cephalanthus occidentalis* (common buttonbush). *Osmunda cinnamomea* (cinnamon fern) is the characteristic dominant in the herb layer, with associates including *Osmunda regalis* (royal fern), *Thelypteris palustris* (eastern marsh fern), *Woodwardia virginica* (Virginia chainfern), *Glyceria canadensis* (rattlesnake mannagrass), *Coptis trifolia* (threeleaf goldthread), *Carex trisperma* (three-seed sedge), *Carex intumescens* (greater bladder sedge), *Triadenum virginicum* (Virginia marsh St. John's-wort), and *Symplocarpus foetidus* (skunk-cabbage). Mosses are primarily *Sphagnum* (peatmoss) spp., including *Sphagnum palustre* (prairie peatmoss) and *Sphagnum magellanicum*

(Magellan's peatmoss). These swamps are distinguished from other basin swamps in the Northern Appalachians by the presence of *Nyssa sylvatica* (blackgum). They are distinguished from blackgum swamps further south by the absence of more central-Appalachian species such as *Liquidambar styraciflua* (sweetgum), *Rhododendron maximum* (great laurel), *Rhododendron viscosum* (swamp azalea), and *Magnolia virginiana* (sweetbay).

**Characteristic Species:** *Acer rubrum* (red maple), *Ilex verticillata* (common winterberry), *Nyssa sylvatica* (blackgum), *Osmunda cinnamomea* (cinnamon fern), *Vaccinium corymbosum* (highbush blueberry).

**Dynamics/Successional Trajectory:** The tree canopy varies from an open woodland to nearly complete. Shrubs are well represented and may be locally dense. Herbs are likewise patchy, and the herb layer is usually dominated by only a few species. The bryoid layer varies, but is often extensive. Hummock-and-hollow topography is often pronounced, with bryophytes common on the hummocks and in those hollows where water does not stand for long periods.

**Reference Sites:** near Portland Pumphouse #2, Delaware Water Gap, PA.

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

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.688103](http://vegbank.org/natureserve/element_global.2.688103)

**References:** Breden et al. 2001, Cain and Penfound 1938, Cowardin et al. 1979, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Gawler 2002, Golet et al. 1993, Harrison 2004, Metzler and Barrett 2001, NAP pers. comm. 1998, Rawinski 1984, Sperduto 2000b, Sperduto et al. 2000b, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000, Vogelmann 1976, Windisch 1995c, Zebryk 1990.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
Tree canopy	Broad-leaved deciduous tree	<i>Nyssa sylvatica</i> (blackgum)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Ilex verticillata</i> (common winterberry)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Vaccinium corymbosum</i> (highbush blueberry)

## RED MAPLE UPLAND FOREST

*Acer rubrum* / *Dennstaedtia punctilobula* Forest

**Range:** This red maple upland forest occurs in the Pennsylvania portion of the Delaware Estuary.

**Environmental Description:** This community occurs in upland settings and tends to persist when embedded in an oak forest matrix but is ephemeral as part of a "northern hardwoods" matrix.

**Vegetation Description:** This is a successional to persistent closed-canopy forest dominated by *Acer rubrum* (red maple). Canopy associates include *Quercus* (oak) spp., *Betula lenta* (sweet birch), *Liriodendron tulipifera* (tuliptree), *Prunus serotina* (black cherry), *Fraxinus americana* (white ash), and *Carya* (hickory) spp. Typical shrubs include *Viburnum acerifolium* (mapleleaf viburnum), *Lindera benzoin* (northern spicebush), *Hamamelis virginiana* (American witch-hazel), *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), and *Cornus*



Photo by Pennsylvania Natural Heritage Program

*florida* (flowering dogwood). The understory is variable and dominated by *Dennstaedtia punctilobula* (eastern hay-scented fern) and *Thelypteris noveboracensis* (New York fern).

**Characteristic Species:** *Acer rubrum* (red maple), *Dennstaedtia punctilobula* (eastern hay-scented fern).

**Dynamics/Successional Trajectory:** This is a successional forest type and is becoming more common where heavy deer browse pressure following canopy disturbance favors red maple regeneration over oaks and other hardwoods. In northern hardwood forests, this type may be considered early- to mid-successional and may be expected to add typical northern hardwood canopy dominants over time (e.g., sugar maple, beech, and hemlock).

**Management Concerns:** None, not a conservation target. This community is heavily deer browsed.

**Reference Sites:** No need for reference sites as this community is not a desired target for restoration.

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

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.685013](http://vegbank.org/natureserve/element_global.2.685013)

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

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
Tree canopy	Broad-leaved deciduous tree	<i>Betula lenta</i> (sweet birch)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Viburnum acerifolium</i> (mapleleaf viburnum)

## RED OAK - NORTHERN HARDWOOD FOREST

*Quercus rubra* - *Acer saccharum* - *Fagus grandifolia* / *Viburnum acerifolium* Forest

**Range:** This association occurs in New England and adjacent Canada and in New Jersey. This forest type is very common in the Pennsylvania portion of the Delaware Estuary.

**Environmental Description:** Transitional between temperate and boreal regions, these mesic forests of oak, beech and maple are distributed across the glaciated northeastern United States. They occur on slightly acidic, well-drained loamy and often rocky soils of intermediate fertility, most often positioned on midslopes and coves. Soil depth is often shallow, but some stands occur on deep tills. Most are at low to mid elevations, usually under 515 m (1700 feet), but in the southern portion of their distribution, they may range up to 765 m (2500 feet).

**Vegetation Description:** The deciduous-to-mixed canopy is mostly closed, and the lower layers are variable in extent. Tall shrubs are well-represented, although scattered, with occasional denser patches. Herbs are sparse and bryoids are nearly absent. Ericads and other dwarf-shrubs are also nearly absent, a characteristic that distinguishes this association from most other red oak forests in the Northeast. Canopy composition is a variable mixture of *Quercus rubra* (northern red oak) (usually at least 30% of the canopy), *Fagus grandifolia* (American beech), *Acer saccharum* (sugar maple), *Acer rubrum* (red maple), and in some stands, *Pinus strobus* (eastern white pine) or *Tsuga canadensis* (eastern hemlock). In mixed stands, the cover of deciduous trees exceeds that of conifers. Minor canopy associates include *Fraxinus americana* (white ash), *Tilia americana* (American basswood), *Betula lenta* (sweet birch), *Juglans cinerea* (butternut), and *Ulmus americana* (American elm). *Acer pensylvanicum* (striped maple) occurs occasionally as a small tree; *Cornus florida* (flowering dogwood) and *Prunus serotina* (black cherry) are common small trees. *Corylus cornuta* (beaked hazelnut), *Viburnum acerifolium* (mapleleaf viburnum), and *Hamamelis virginiana* (American witch-hazel) are standard shrubs, with *Kalmia latifolia* (mountain laurel) and *Lindera benzoin* (northern spicebush) occasional in all but the northern portions of the range. Typical

species in the herb layer include *Gaultheria procumbens* (wintergreen), *Maianthemum canadense* (Canada mayflower), *Aralia nudicaulis* (wild sarsaparilla), *Trientalis borealis* (starflower), *Uvularia sessilifolia* (sessile-leaf bellwort), *Medeola virginiana* (Indian cucumber-root), *Brachyelytrum erectum* (bearded shorthusk), *Dryopteris intermedia* (intermediate woodfern), *Polystichum acrostichoides* (Christmas fern), *Dennstaedtia punctilobula* (eastern hay-scented fern), *Pteridium aquilinum* (bracken fern), and *Thelypteris noveboracensis* (New York fern). On more nutrient-rich soils, the herb layer may contain *Solidago caesia* (wreath goldenrod), *Caulophyllum thalictroides* (blue cohosh), and *Eurybia divaricata* (white wood-aster).

**Characteristic Species:** *Acer pensylvanicum* (striped maple), *Aralia nudicaulis* (wild sarsaparilla), *Cornus florida* (flowering dogwood), *Corylus cornuta* (beaked hazelnut), *Fagus grandifolia* (American beech), *Hamamelis virginiana* (American witch-hazel), *Prunus serotina* (black cherry), *Pteridium aquilinum* (bracken fern), *Quercus rubra* (northern red oak), *Trientalis borealis* (starflower), *Viburnum acerifolium* (mapleleaf viburnum).

**Reference Sites:** (Note: very common forest type - lots of records for it in the PA CNAIs, but none on public land).

**Global and State Conservation Ranks and Reasons:** G4G5 (7-Dec-2005). NJ: SNR, PA: SNR. This association is well-distributed in the northeastern U.S. in its large-patch setting.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.684448](http://vegbank.org/natureserve/element_global.2.684448)

**References:** Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Eyre 1980, Gawler 2002, Metzler and Barrett 2001, Rawinski 1984, Sperduto 2000a, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Acer rubrum</i> (red maple)
Tree canopy	Broad-leaved deciduous tree	<i>Acer saccharum</i> (sugar maple)
Tree canopy	Broad-leaved deciduous tree	<i>Fagus grandifolia</i> (American beech)
Tree canopy	Broad-leaved deciduous tree	<i>Quercus rubra</i> (northern red oak)
Tree subcanopy	Broad-leaved deciduous tree	<i>Acer pensylvanicum</i> (striped maple)
Tree subcanopy	Broad-leaved deciduous tree	<i>Cornus florida</i> (flowering dogwood)
Tree subcanopy	Broad-leaved deciduous tree	<i>Prunus serotina</i> (black cherry)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Corylus cornuta</i> (beaked hazelnut)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Hamamelis virginiana</i> (American witch-hazel)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Viburnum acerifolium</i> (mapleleaf viburnum)
Herb (field)	Forb	<i>Aralia nudicaulis</i> (wild sarsaparilla)
Herb (field)	Forb	<i>Trientalis borealis</i> (starflower)

## WHITE PINE - HEMLOCK DRY-MESIC CONIFEROUS FOREST

*Pinus strobus* - *Tsuga canadensis* Lower New England / Northern Piedmont Forest

**Range:** This association occurs in the northeastern United States and possibly adjacent Canada. In the Delaware Estuary study area, this association is probably confined to the upper portions of the Schuylkill watershed.

**Environmental Description:** This dry-mesic coniferous forest usually occurs on sloping (moderately to steeply) sites or in sheltered ravines. Soils are moderately to extremely well-drained (dry-mesic to mesic), loamy sands and sandy loams, often sandy, stony or bouldery.



Photo by Pennsylvania Natural

**Vegetation Description:** This coniferous forest type is dominated by *Pinus strobus* (eastern white pine) and/or *Tsuga canadensis* (eastern hemlock). Other frequent tree species depend on geography and can include *Acer pensylvanicum* (striped maple), *Quercus rubra* (northern red oak), and *Acer rubrum* (red maple), with *Prunus serotina* (black cherry), *Betula lenta* (sweet birch), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), *Betula alleghaniensis* (yellow birch), and *Betula populifolia* (gray birch) occurring less frequently. Although frequent, deciduous tree species generally occur with low abundance. Shrubs are absent or sparse but when present may include *Hamamelis virginiana* (American witch-hazel), *Kalmia latifolia* (mountain laurel), *Vaccinium angustifolium* (northern lowbush blueberry), and *Viburnum acerifolium* (mapleleaf viburnum). The herbaceous layer is generally not well-developed nor diverse and is generally characterized by *Gaultheria procumbens* (wintergreen), *Medeola virginiana* (Indian cucumber-root), and *Thelypteris noveboracensis* (New York fern). Other herbaceous associates often include *Aralia nudicaulis* (wild sarsaparilla), *Uvularia sessilifolia* (sessile-leaf bellwort), *Mitchella repens* (partridgeberry), *Trientalis borealis* (starflower), *Monotropa uniflora* (Indian-pipe), *Dryopteris intermedia* (intermediate woodfern), and *Maianthemum canadense* (Canada mayflower). Nonvascular plants tend to be sparse but can include *Leucobryum albidum* (pincushion moss) and *Polytrichum* (haircap moss) and *Dicranum* (broom moss) species.

**Characteristic Species:** *Gaultheria procumbens* (wintergreen), *Medeola virginiana* (Indian cucumber-root), *Pinus strobus* (eastern white pine), *Thelypteris noveboracensis* (New York fern), *Tsuga canadensis* (eastern hemlock).

**Dynamics/Successional Trajectory:** The major natural disturbance in this forest type is generally single-tree blowdowns. Fire is not a particularly important feature of this forest type.

**Management Concerns:** Hemlock wooly adelgid may have significant negative impacts to the vegetation structure, species composition, and habitat suitability of this association.

**Reference Sites:** Hogback Road, Delaware Water Gap, PA.

**Global and State Conservation Ranks and Reasons:** G5 (22-Mar-1999). PA: SNR.

**VegBank Link for Plot Data:** [http://vegbank.org/natureserve/element\\_global.2.689294](http://vegbank.org/natureserve/element_global.2.689294)

**References:** Brown et al. 1982a, Eastern Ecology Working Group n.d., Edinger et al. 2002, Enser 1999, Eyre 1980, Fike 1999, Gawler 2002, Gordon 1937a, Hough 1943, Hough and Forbes 1943, MENHP 1991, Metzler and Barrett 2001, NAP pers. comm. 1998, Rawinski 1984, Sperduto and Nichols 2004, Swain and Kearsley 2001, Thompson 1996, Thompson and Sorenson 2000.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Needle-leaved tree	<i>Pinus strobus</i> (eastern white pine)
Tree canopy	Needle-leaved tree	<i>Tsuga canadensis</i> (eastern hemlock)
Herb (field)	Fern or fern ally	<i>Thelypteris noveboracensis</i> (New York fern)