
ECOLOGICAL SYSTEM: ATLANTIC COASTAL PLAIN MESIC HARDWOOD FOREST

Summary: This upland system of the Atlantic Coastal Plain ranges from southern New Jersey south to Georgia in a variety of moist but non-wetland sites that are naturally sheltered from frequent fire. Such sites include lower slopes and bluffs along streams and rivers in dissected terrain, mesic flats between drier pine-dominated uplands and floodplains, and local topographic high areas within bottomland terraces or nonriverine wet flats. Soil textures are variable in both texture and pH. The vegetation consists of forests dominated by combinations of trees that include a significant component of mesophytic deciduous hardwood species, such as *Fagus grandifolia* (American beech) or *Acer barbatum* (southern sugar maple). Its southern limit is generally exclusive of the natural range of *Pinus glabra* (spruce pine) as mapped by Kossuth and Michael (1990) and *Magnolia grandiflora* (southern magnolia) as mapped by Outcalt (1990). Upland and bottomland oaks at the mid range of moisture tolerance are usually also present, particularly *Quercus alba* (white oak), but sometimes also *Quercus falcata* (southern red oak), *Quercus michauxii* (swamp chestnut oak), *Quercus shumardii* (shumard oak), or *Quercus nigra* (water oak). *Pinus taeda* (loblolly pine) is sometimes present, but it is unclear if it is a natural component or has entered only as a result of past cutting. Analogous systems on the Gulf Coastal Plain have pine as a natural component, and this may be true for some examples of this system. Understories are usually well-developed. Shrub and herb layers may be sparse or moderately dense. Within its range, *Sabal minor* (dwarf palmetto) may be a prominent shrub. Species richness may be fairly high in basic sites but is fairly low otherwise.

Range: This system ranges from southern New Jersey south to central Georgia in the Atlantic Coastal Plain. United States: DE, GA, MD, NC, NJ, SC, VA

Delaware Estuary Associations:

- Basic Mesic Ravine Forest
- Mesic Coastal Plain Oak Forest
- Mid-Atlantic Mesic Mixed Hardwood Forest
- Northern Coastal Plain/Piedmont Basic Mesic Hardwood Forest

Similar Ecological Systems in the Delaware Estuary:

- Atlantic Coastal Plain Brownwater Stream Floodplain Forest

CLASSIFIERS FOR ATLANTIC COASTAL PLAIN MESIC HARDWOOD FOREST

Primary Division: 203

Land Cover Class: Forest and Woodland

Spatial Scale & Pattern: Large patch

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

Diagnostic Classifiers: Forest and Woodland (Treed); Long Disturbance Interval

BASIC MESIC RAVINE FOREST

Fagus grandifolia - *Quercus muehlenbergii* / *Sanguinaria canadensis* Forest

Range: This community occurs in Virginia; however the same marl ravine community, or a very closely related community to this, occurs in New Jersey within the Delaware Estuary boundary.

Environmental Description: These rich mesophytic to submesophytic forests of calcareous ravines are found in the southeastern Virginia Coastal Plain, the adjacent Piedmont, and also in New Jersey. Habitats are north- to east-facing slopes and adjacent low interfluves downcut into Tertiary shell deposits or limesands, including the Pliocene marine shell deposits of the calcium-rich Yorktown Formation.

Vegetation Description: The canopies of stands of this association are typically dominated by variable combinations of *Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak), *Quercus muehlenbergii* (chinquapin oak), *Tilia americana* var. *americana* (American basswood), *Liriodendron tulipifera* (tuliptree), and *Quercus alba* (white oak). Although generally not as constant or abundant as *Fagus grandifolia* (American beech) or *Quercus muehlenbergii* (chinquapin oak) occurs in 75% of the plot samples and is a good diagnostic species. Characteristic or locally important understory species include *Magnolia tripetala* (umbrella magnolia), *Ulmus rubra* (slippery elm), *Ilex opaca* var. *opaca* (American holly), *Cornus alternifolia* (alternate-leaf dogwood), *Cercis canadensis* var. *canadensis* (eastern redbud), and *Carpinus caroliniana* (American hornbeam). Common herbs are *Polystichum acrostichoides* (Christmas fern), *Asarum canadense* (Canadian wild ginger), *Hepatica nobilis* var. *obtusata* (round-lobe liverleaf), *Arisaema triphyllum* (Jack-in-the-pulpit), *Actaea racemosa* (black cohosh), *Cardamine concatenata* (cutleaf toothwort), *Sanguinaria canadensis* (bloodroot), *Adiantum pedatum* (northern maidenhair), *Packera aurea* (golden ragwort), and *Luzula acuminata* var. *carolinae* (southern hairy woodrush). The grass *Brachyelytrum erectum* (bearded shorthusk) is abundant and characteristic of more submesic habitats (e.g., convex north slopes) occupied by the type. A number of herbaceous species found in this association are either at or near their northern range limit or are disjunct from a primary range farther west. Species in this group include *Chasmanthium sessiliflorum* (longleaf spikegrass), *Malaxis spicata* (Florida adder's-mouth), *Ponthieva racemosa* (hairy shadow-witch), *Panax quinquefolius* (American ginseng), *Actaea pachypoda* (white baneberry), *Solidago flexicaulis* (zigzag goldenrod), *Desmodium glutinosum* (large tick-trefoil), *Mitella diphylla* (twoleaf miterwort), *Thalictrum dioicum* (early meadowrue), *Prenanthes trifoliolata* (gall-of-the-earth), *Aralia racemosa* (American spikenard), *Scutellaria ovata* (heartleaf skullcap), *Deparia acrostichoides* (silver false spleenwort), and *Diplazium pycnocarpon* (glade fern). More floristic information is available in Ware and Ware (1992).

Characteristic Species: *Magnolia tripetala* (umbrella magnolia), *Quercus muehlenbergii* (chinquapin oak)

Management Concerns: Some stands have been impacted by removal of more valuable timber species (e.g., *Quercus alba* (white oak), *Quercus muehlenbergii* (chinquapin oak), *Quercus rubra* (northern red oak)). Timber harvesting degrades this community by allowing additional light and aggressive growth of invasive alien plants which thrive in well-lit, calcareous situations, including *Lonicera japonica* (Japanese honeysuckle). Residential and commercial development are additional threats to these historically protected ravine forests.

Reference Sites: Crosswicks Creek, NJ; Ors Creek, NJ

Global and State Conservation Ranks and Reasons: G2? (8-Jan-2001). NJ: SNR. This association is restricted to the southeastern Virginia Coastal Plain and possibly the adjacent Piedmont, on north- to east-facing slopes and adjacent low interfluves downcut into Tertiary shell deposits or lime sands, including the Pliocene marine shell deposits of the calcium-rich Yorktown Formation. Many herbaceous species found in this association are either at or near their northern range limit or are disjunct from a primary range farther west. A few examples are protected in Colonial National Park, Virginia, but others (including the best examples) are highly threatened by timber removal and development. Note: this is, or is related to, marl ravine association(s) in New Jersey; more inventory is needed to compare the types.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.687025

References: Fleming et al. 2001, Fleming pers. comm., Patterson pers. comm., Southeastern Ecology Working Group n.d., VDNH 2003, Ware and Ware 1992

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Fagus grandifolia</i> (American beech)
Tree canopy	Broad-leaved deciduous tree	<i>Quercus muehlenbergii</i> (chinquapin oak)
Tree subcanopy	Broad-leaved evergreen tree	<i>Ilex opaca</i> var. <i>opaca</i> (American holly)
Herb (field)	Forb	<i>Polystichum acrostichoides</i> (Christmas fern)
Herb (field)	Forb	<i>Sanguinaria canadensis</i> (bloodroot)

MESIC COASTAL PLAIN OAK FOREST

Quercus falcata - *Quercus phellos* / *Ilex opaca* Forest

Range: This Coastal Plain oak forest is currently described from New Jersey to Maryland. This community occurs in all three states within the Delaware Estuary.

Environmental Description: These forests occur on somewhat poorly-drained sands where the water table is close to the soil surface; they often border wetlands.

Vegetation Description: The canopy dominants include *Quercus falcata* (southern red oak), *Quercus phellos* (willow oak), *Quercus alba* (white oak), *Quercus michauxii* (swamp chestnut oak), with *Liquidambar styraciflua* (sweetgum) and *Acer rubrum* (red maple) common associates. Pines may be present, including *Pinus rigida* (pitch pine) or *Pinus echinata* (shortleaf pine) in New Jersey, or *Pinus taeda* (loblolly pine) in Delaware. A subcanopy is often present with *Ilex opaca* (American holly), *Vaccinium corymbosum* (highbush blueberry), and *Amelanchier canadensis* (Canada serviceberry). *Gaylussacia frondosa* (dangleberry) forms a patchy shrub layer draped with *Smilax rotundifolia* (roundleaf greenbrier), and the herb layer is sparse with species such as *Chasmanthium laxum* (slender spikegrass), *Osmunda regalis* (royal fern), and *Mitchella repens* (partridgeberry).

Characteristic Species: *Ilex opaca* (American holly), *Quercus falcata* (southern red oak), *Quercus phellos* (willow oak)

Dynamics/Successional Trajectory: This association grades into upland oak forests.

Management Concerns: This community typically occurs in a fragmented landscape setting and therefore is prone to invasion by exotic species.

Reference Sites: Milford Neck, DE; Prime Hook, DE; Five-mile Woods Preserve, Bucks County, PA

Global and State Conservation Ranks and Reasons: GNR (1-Dec-1997). DE: SNR, NJ: S2S3.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.683319

References: Berdine 1998, Bowman 2000, Breden 1989, Breden et al. 2001, Eastern Ecology Working Group n.d., Harrison 2004, Harrison and Stango 2003, Windisch pers. comm.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Quercus falcata</i> (southern red oak)
Tree canopy	Broad-leaved deciduous tree	<i>Quercus phellos</i> (willow oak)
Tree subcanopy	Broad-leaved evergreen tree	<i>Ilex opaca</i> (American holly)
Short shrub/sapling	Broad-leaved deciduous shrub	<i>Gaylussacia frondosa</i> (dangleberry)

MID-ATLANTIC MESIC MIXED HARDWOOD FOREST

Fagus grandifolia - *Quercus (alba, rubra)* - *Liriodendron tulipifera* / *Polystichum acrostichoides* Forest

Range: This association is currently described from Virginia northward to southern New England. The type is characteristic of the Coastal Plain throughout its range and of the Piedmont from south-central Virginia through much of Maryland. Small outliers of this vegetation occur at low elevations on both flanks of the Blue Ridge in Virginia and Maryland. This type occurs in the Delaware Estuary, in both New Jersey and Delaware.

Environmental Description: This forest association occurs on mesic to submesic slopes or gentle gradients. Ravines in dissected topography are particularly typical sites in the Piedmont and parts of the Inner Coastal Plain. The type also occupies rolling uplands with deep soils. Soils are typically well-drained, acidic sandy and silt loams derived from parent material of low to moderate fertility.



Photo by Keith Clancey

Vegetation Description: Rangewide, this vegetation type is characteristically a mixed mesophytic forest dominated by *Fagus grandifolia* (American beech), *Quercus alba* (white oak), *Quercus rubra* (northern red oak), and *Liriodendron tulipifera* (tuliptree) in various proportions. Overstory associates over the range include *Carya alba* (mockernut hickory), *Carya glabra* (pignut hickory), *Quercus velutina* (black oak), *Quercus falcata* (southern red oak), *Quercus coccinea* (scarlet oak), *Liquidambar styraciflua* (sweetgum), *Acer rubrum* (red maple), *Nyssa sylvatica* (blackgum), and *Fraxinus americana* (white ash). The subcanopy is characterized by young *Fagus grandifolia* (American beech), *Acer rubrum* (red maple), *Carpinus caroliniana* (American hornbeam), *Cornus florida* (flowering dogwood), *Ilex opaca* (American holly), and *Sassafras albidum* (sassafras). The shrub layer varies from very sparse to well-developed and can include *Asimina triloba* (common pawpaw), *Viburnum acerifolium* (mapleleaf viburnum), *Viburnum dentatum* (southern arrow-wood), and *Euonymus americana*. Heath shrubs, such as *Vaccinium corymbosum* (highbush blueberry) and *Vaccinium pallidum* (hillside blueberry), may be common but not abundant. Vines are common, including *Parthenocissus quinquefolia* (Virginia creeper), *Smilax glauca* (whiteleaf greenbrier), and *Toxicodendron radicans* (eastern poison-ivy). The herb layer is comprised of *Polystichum acrostichoides* (Christmas fern), *Uvularia perfoliata* (perfoliate bellwort), *Cypripedium acaule* (pink lady's-slipper), *Mitchella repens* (partridgeberry), *Tipularia discolor* (crippled crane-fly), *Goodyera pubescens* (downy rattlesnake-plantain), *Eurybia divaricata* (white wood-aster), *Chimaphila maculata* (striped pipsissewa), *Carex swanii* (swan's sedge), *Medeola virginiana* (Indian cucumber-root), *Athyrium filix-femina* (common ladyfern), *Carex digitalis* (slender wood sedge), *Carex willdenowii* (Willdenow's sedge), *Epifagus virginiana* (beechdrops), *Maianthemum canadense* (Canada mayflower), *Desmodium nudiflorum* (naked-flower tick-trefoil), *Polygonatum biflorum* (smooth Solomon's-seal), *Podophyllum peltatum* (mayapple), *Arisaema triphyllum* (Jack-in-the-pulpit), and *Maianthemum racemosum* (feathery false lily-of-the-valley). Several intergrading compositional variants have been noted in regional and local landscape analyses. On more submesic, convex slopes, *Fagus grandifolia* (American beech), *Quercus alba* (white oak), *Cornus florida* (flowering dogwood), and *Vaccinium pallidum* (hillside blueberry) tend to be prominent, while pronounced mesophytes, such as *Carpinus caroliniana* (American hornbeam) and herbaceous species in general, are usually sparse. Coastal Plain stands tend to have understories heavily dominated by *Ilex opaca* (American holly), while Piedmont stands generally have only scattered *Ilex opaca* (American holly), as well as slightly higher herbaceous richness.

Characteristic Species: *Fagus grandifolia* (American beech), *Liriodendron tulipifera* (tuliptree), *Polystichum acrostichoides* (Christmas fern)

Reference Sites: Augustine Creek, DE; Clayton Park (Monmouth County Park), Imlaystown, NJ

Global and State Conservation Ranks and Reasons: G5 (24-Jan-2005). DE: S5, NJ: S3, PA: S1. This association is common and widespread on the eastern Coastal Plain.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.684506

References: Bartgis 1986, Berdine 1998, Bernard and Bernard 1971, Bowman 2000, Breden 1989, Breden et al. 2001, Clancy 1993b, Clancy 1996, Davis et al. 1992, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fleming 2001, Fleming et al. 2001, Fleming pers. comm., Harrison 2004, Lea 2003, McCoy and Fleming 2000, Metzler and Barrett 2001, Patterson pers. comm., Rawinski 1984, Robichaud and Buell 1973, Smith 1983

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Fagus grandifolia</i> (American beech)
Tree canopy	Broad-leaved deciduous tree	<i>Liriodendron tulipifera</i> (tuliptree)
Tree canopy	Broad-leaved deciduous tree	<i>Quercus alba</i> (white oak)
Tree subcanopy	Broad-leaved deciduous tree	<i>Cornus florida</i> (flowering dogwood)
Tree subcanopy	Broad-leaved evergreen tree	<i>Ilex opaca</i> (American holly)
Herb (field)	Vine/Liana	<i>Parthenocissus quinquefolia</i> (Virginia creeper)
Herb (field)	Forb	<i>Podophyllum peltatum</i> (mayapple)
Herb (field)	Forb	<i>Polygonatum biflorum</i> (smooth Solomon's-seal)
Herb (field)	Fern or fern ally	<i>Polystichum acrostichoides</i> (Christmas fern)

NORTHERN COASTAL PLAIN/PIEDMONT BASIC MESIC HARDWOOD FOREST

Fagus grandifolia - *Liriodendron tulipifera* - *Carya cordiformis* / *Lindera benzoin* / *Podophyllum peltatum* Forest

Range: This community occurs in Delaware, New Jersey and Maryland.

Environmental Description: This association comprises luxuriant mesophytic forests of deep, sheltered ravines with base-rich soils in the northern portions of the Coastal Plain and adjacent Piedmont. In the Piedmont, these soils are derived from amphibolite and other mafic rocks. Coastal Plain habitats are in ravines that have downcut into Tertiary shell deposits or limesands. Although very high compared to those of most Coastal Plain soils, soil pH and base cation levels at plot sampling sites indicate only moderate fertility (G. Fleming unpubl. data). Mean soil chemistry values for the 12 plots are: pH = 5.0, Ca = 1353 (ppm), Mg = 163, Fe = 160, Mn = 128, Cu = 0.19, Zn = 3.9, Al = 780, P = 47, K = 117, cation exchange capacity = 14.2, total base saturation = 61.7%.

Vegetation Description: *Fagus grandifolia* (American beech) and *Liriodendron tulipifera* (tuliptree) are the principal canopy dominants, with *Carya cordiformis* (bitternut hickory) and *Quercus rubra* (northern red oak) as constant associates. Additional trees that may be locally important are *Juglans nigra* (black walnut), *Ulmus rubra* (slippery elm), *Quercus alba* (white oak), *Quercus muehlenbergii* (chinquapin oak), and *Fraxinus americana* (white ash). Stands typically have dense understories dominated by *Lindera benzoin* (northern spicebush). Herb layers are lush but tend to be characterized by patch-dominance of clonal forbs and ferns. *Podophyllum peltatum* (mayapple), *Arisaema triphyllum* (Jack-in-the-pulpit), *Circaea lutetiana* ssp. *canadensis* (broadleaf enchanter's-nightshade), *Maianthemum racemosum* ssp. *racemosum* (feathery false lily-of-the-valley), and *Polystichum acrostichoides* (Christmas fern) are widespread and abundant herbs. More locally abundant herbs include *Cystopteris protrusa* (lowland bladderfern), *Deparia acrostichoides* (silver false spleenwort), *Diplazium pycnocarpon* (glade fern),

Actaea racemosa (black cohosh), *Phegopteris hexagonoptera* (broad beech fern), *Nemophila aphylla* (small-flower baby-blue-eyes), and *Actaea pachypoda* (white baneberry). Many additional low-cover herbaceous species are present in plot-sampled stands.

Characteristic Species: *Carya cordiformis* (bitternut hickory)

Management Concerns: Many of these ravine areas, historically protected from land use, are being developed for residential and commercial uses in New Jersey. Invasive plants can also be a problem in the openings of this forest.

Reference Sites: Marl ravines on the Inner Coastal Plain of NJ

Global and State Conservation Ranks and Reasons: G4? (9-May-2002). DE: SNR, NJ: SNR.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.688077

References: Eastern Ecology Working Group n.d., Fleming et al. 2001, Fleming unpubl. data, Harrison 2004, VDNH 2003

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Broad-leaved deciduous tree	<i>Fagus grandifolia</i> (American beech)
Tree canopy	Broad-leaved deciduous tree	<i>Liriodendron tulipifera</i> (tuliptree)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Lindera benzoin</i> (northern spicebush)
Herb (field)	Forb	<i>Podophyllum peltatum</i> (mayapple)