



Palustrine Forests



Delhaas Woods, Bucks County.
Photograph by Roger Earl Latham.



Columbus Bog, State Game Lands 197,
Warren County. Photograph by Paul Wiegman.



CONIFEROUS PALUSTRINE FORESTS

Black spruce - tamarack peatland forest

Picea mariana (black spruce) and/or *Larix laricina* (tamarack) dominate this community type. Other trees that may occur include *Betula populifolia* (gray birch), *Acer rubrum* (red maple), *Tsuga canadensis* (eastern hemlock), *Pinus strobus* (eastern white pine), and *Populus tremuloides* (quaking aspen). Shrub species include *Rhododendron viscosum* (swamp azalea), *Nemopanthus mucronatus* (mountain-holly), *Ilex verticillata* (winterberry), and *Vaccinium corymbosum* (highbush blueberry). Herbaceous species include *Carex trisperma* (a sedge), *C. disperma*^s (a sedge), *Trientalis borealis* (starflower), *Osmunda cinnamomea* (cinnamon fern), *O. regalis* (royal fern), *Viola* spp. (violets), *Gaultheria hispidula*^s (creeping snowberry) and *Coptis trifolia* (goldthread). Sphagnum occurs throughout. This community type may occur as part of the "Acidic glacial peatland complex."

Related types: Where canopy closure is less than 60%, this type becomes the "Black spruce - tamarack palustrine woodland." The open canopy of the woodland type allows for a much more extensive shrub layer—usually dominated by *Chamaedaphne calyculata* (leatherleaf), and a herbaceous layer more typical of open bogs.

Range: Glaciated NE, Glaciated NW, Pocono Plateau.

Selected references: PNDI field surveys, Sneddon, Anderson, and Metzler 1996.

[Crosswalk: Smith's "Boreal Conifer Swamp," TNC's *Picea mariana* - *Larix laricina* Saturated Forest Alliance, SAF's Black spruce-sphagnum (12d).]

Red spruce palustrine forest

This community type occurs on shallow organic soils or mineral soils with a substantial accumulation of organic matter. *Picea rubens* (red spruce) is always present, usually dominant or codominant. Other tree species include *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), *Acer rubrum* (red maple), *Betula populifolia* (gray birch), *B. alleghaniensis* (yellow birch), *Nyssa sylvatica* (black-gum), and occasionally *Abies balsamea* (balsam fir). *Rhododendron maximum* (rosebay) is common and often forms a dense understory. Other shrub species that may be present include *Viburnum cassinoides* (with-rod), *Ilex verticillata* (winterberry), *Vaccinium corymbosum* (highbush blueberry), and *Nemopanthus mucronatus* (mountain-holly). There is usually a pronounced mound and pool microtopography. Characteristic herbs occurring on

mounds include *Osmunda cinnamomea* (cinnamon fern), *Viola* spp. (violets), *Mitchella repens* (partridge-berry), *Maianthemum canadense* (Canada mayflower), *Coptis trifolia* (goldthread), *Cornus canadensis* (bunchberry), *Carex trisperma*, and other sedge species. The bryophyte layer is usually well developed and dominated by sphagnum.

Related types: Where canopy closure is less than 60%, this type becomes the "Red spruce palustrine woodland," where dominance is shared with hardwoods (where total conifer cover is less than 75% of the canopy) this becomes the "Red spruce - mixed hardwood palustrine forest."

Range: Glaciated NE, Pocono Plateau.

Selected references: Sneddon, Anderson, and Metzler 1996.

[Crosswalk: Smith's "Boreal Conifer Swamp," TNC's *Picea rubens* Saturated Forest Alliance, SAF's Red spruce (32).]

Hemlock palustrine forest

These are wetland forests dominated or co-dominated by *Tsuga canadensis* (eastern hemlock). The canopy may also contain a mixture of other conifers, e.g. *Picea rubens* (red spruce), *Larix laricina* (tamarack), and *Pinus strobus* (eastern white pine). Hardwoods may contribute up to 25% of the tree stratum; common species include *Acer rubrum* (red maple), *Betula alleghaniensis* (yellow birch), and *Fraxinus nigra* (black ash). There is generally a pronounced mound and pool microtopography. This community type may occur as a zone around a wetter community type of a more northern affinity. It may also occur in basins or on slopes fed by groundwater seepage. *Rhododendron maximum* (rosebay) is often present, sometimes quite dense. *Viburnum cassinoides* (with-rod), *Rhododendron viscosum* (swamp azalea), *Ilex verticillata* (winterberry), and *Vaccinium corymbosum* (highbush blueberry) are also commonly associated with this type. Herbs include *Osmunda cinnamomea* (cinnamon fern), *Symplocarpus foetidus* (skunk-cabbage), *Onoclea sensibilis* (sensitive fern), *Mitchella repens* (partridge-berry), *Maianthemum canadense* (Canada mayflower), *Coptis trifolia* (goldthread), *Viola* spp. (violets), *Dalibarda repens* (false-violet), *Trientalis borealis* (star-flower), and various grasses and sedges. There may be a strong bryophyte component, usually dominated by sphagnum.

Related types: Where total conifer cover is less than 75% of the canopy, this type becomes the "Hemlock - mixed hardwood palustrine forest."



Range: Great Lakes Region, Glaciated NE, Glaciated NW, Pittsburgh Plateau, Pocono Plateau, Ridge and Valley, Unglaciated Allegheny Plateau.

Selected references: PNDI field surveys, Sneddon, Anderson, and Metzler 1996.

[Crosswalk: Smith's "Northern Conifer Swamp," TNC's *Tsuga canadensis* (eastern hemlock) Wetland Forest Alliance, SAF's Eastern hemlock (23).]

CONIFER - BROADLEAF PALUSTRINE FORESTS

Hemlock - mixed hardwood palustrine forest

This describes a group of wetland forests that are dominated by a mixture of conifers and hardwood species. The substrate is usually mineral soil or muck over mineral soil. There is generally some groundwater enrichment in these systems. *Tsuga canadensis* (eastern hemlock) contributes between 25% and 75% of the canopy. Other conifer species that may occur with hemlock include *Pinus strobus* (eastern white pine), *Picea rubens* (red spruce), and *Larix laricina* (tamarack). The most common hardwood species are *Betula alleghaniensis* (yellow birch), *Acer rubrum* (red maple), *Fraxinus nigra* (black ash), *Nyssa sylvatica* (black-gum), and *Betula populifolia* (gray birch). *Rhododendron maximum* (rosebay) often forms a dense understory; other shrubs include *Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (winterberry), *Rhododendron viscosum* (swamp azalea) and *Viburnum cassinoides* (withe-rod). Herbaceous species include *Osmunda cinnamomea* (cinnamon fern), *Carex folliculata* (a sedge), *Viola* spp. (violets), *C. trisperma* (a sedge), *Symplocarpus foetidus* (skunk-cabbage), *Veratrum viride* (false hellebore), *Onoclea sensibilis* (sensitive fern), and *Aster puniceus* (purple-stemmed aster). The bryophyte layer is usually well developed and dominated by sphagnum.

Related types: Where the conifer component is less than 25% of the canopy, see the "Broadleaf palustrine forests" section, and where the conifer component is greater than 75%, see the "Hemlock palustrine forest" type under "Coniferous palustrine forests."

Range: Glaciated NE, Glaciated NW, Pocono Plateau, Ridge and Valley, Unglaciated Allegheny Plateau,.

Selected references: Smith 1991, Sneddon, Anderson, and Metzler 1996, Reschke 1990.

[Crosswalk: Smith's "Broadleaf - Conifer Swamp" subtype "a", TNC's *Tsuga canadensis* - *Acer rubrum* Saturated

Forest Alliance, SAF's Hemlock - yellow birch (24) and parts of Eastern hemlock (23).]

Red spruce - mixed hardwood palustrine forest

This describes a group of wetland forests that are dominated by a mixture of conifers and hardwood species. This community type is most typical of the Unglaciated Allegheny Plateau, although isolated occurrences may be found elsewhere. The substrate is usually shallow organic matter over mineral soil. There is generally some groundwater enrichment in these systems. *Picea rubens* (red spruce), sometimes in combination with other conifers, contributes between 25% and 75% of the canopy. Other conifer species that may occur include *Tsuga canadensis* (eastern hemlock) *Pinus strobus* (eastern white pine), and *Larix laricina* (tamarack). The most common hardwood species are *Betula alleghaniensis* (yellow birch), *Acer rubrum* (red maple), *Fraxinus nigra* (black ash), *Nyssa sylvatica* (black-gum), and *Betula populifolia* (gray birch). Shrubs include *Nemopanthus mucronatus* (mountain-holly), *Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (winterberry), *Rhododendron viscosum* (swamp azalea) and *Viburnum cassinoides* (withe-rod). Herbaceous and creeping shrub species include *Coptis trifolia* (goldthread), *Osmunda cinnamomea* (cinnamon fern), *Onoclea sensibilis* (sensitive fern), *Carex folliculata* (a sedge), *C. trisperma* (a sedge), *Viola* spp. (violets), *Gaultheria hispidula*^s (creeping snowberry), and *C. disperma*^s (soft-leaved sedge). The bryophyte layer is usually well developed and dominated by sphagnum.

Related types: Where the conifer component is less than 25% of the canopy, see the "Broadleaf palustrine forests" section, and where the conifer component is greater than 75%, see the "Red spruce palustrine forest" type under "Coniferous palustrine forests."

Range: Glaciated NE, Pocono Plateau, Ridge and Valley, Unglaciated Allegheny Plateau.

Selected references: Smith 1991, Sneddon, Anderson, and Metzler 1996.

[Crosswalk: Smith's "Broadleaf - Conifer Swamp" - subtype "a", TNC's *Picea rubens* - *Acer rubrum* Saturated Forest Alliance, SAF's Red spruce (32).]



BROADLEAF PALUSTRINE FORESTS

Bottomland oak - hardwood palustrine forest

These are palustrine forests characterized by the dominance or near-dominance of *Quercus palustris* (pin oak) and/or *Q. bicolor* (swamp white oak), often with *Acer rubrum* (red maple), *Ulmus americana* (American elm), *Nyssa sylvatica* (black-gum), and *Fraxinus nigra* (black ash). Shrubs include *Lindera benzoin* (spicebush), *Vaccinium corymbosum* (highbush blueberry), *Dirca palustris* (leatherwood), *Viburnum recognitum* (northern arrow-wood), and *V. dentatum* (southern arrow-wood). Herbs include *Impatiens* spp. (jewelweed), *Thelypteris palustris* (marsh fern), *Polygonum sagittatum* (arrow-leaved tearthumb), *P. arifolium* (halberd-leaved tearthumb), and *Agrimonia parviflora* (southern agrimony).

Related types: This community types is distinguished from the various red maple palustrine forest types by the dominance or near-dominance of *Quercus palustris* (pin oak), and/or *Q. bicolor* (swamp white oak).

Range: Piedmont, Pittsburgh Plateau, Ridge and Valley.

Selected references: Smith 1991, Sneddon, Anderson, and Metzler 1996.

[Crosswalk: Smith's "Circumneutral Broadleaf Swamp" (in part), TNC's *Quercus (palustris, bicolor)* Seasonally Flooded Forest Alliance, closest SAF's type is Pin oak -sweet gum (65).]

Red maple - black-gum palustrine forest

The canopy is dominated by *Acer rubrum* (red maple) and/or *Nyssa sylvatica* (black-gum). Other trees, e.g. *Betula alleghaniensis* (yellow birch), *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), *Quercus bicolor* (swamp white oak), *Q. palustris* (pin oak), or *Salix nigra* (black willow), may also occur. The shrub layer is variable and may include *Vaccinium corymbosum* (highbush blueberry), *Ilex verticillata* (winterberry), *Alnus* spp. (alder), and *Cornus* spp. (dogwoods). Herbs include *Symplocarpus foetidus* (skunk-cabbage), *Viola* spp. (violets), *Osmunda cinnamomea* (cinnamon fern), *Carex* spp. (various sedges), and *Onoclea sensibilis* (sensitive fern).

Related types: The "Red maple - black ash palustrine forest" occurs under the influence of calcareous waters, and is characterized by the presence of *Fraxinus nigra* (black ash) on most sites and herbaceous calciphiles on some sites.

Range: Entire state.

Selected references: Golet et al. 1993, Sneddon, Anderson, and Metzler 1996.

[Crosswalk: subtypes "a" and "d" of Smith's "Acidic Broadleaf Swamp," and parts of "Circumneutral Broadleaf Swamp," TNC's *Acer rubrum - Nyssa sylvatica* Forest Alliance, SAF's Red maple (108).]

Red maple - black ash palustrine forest

These are palustrine forests enriched by base-rich groundwater. The substrate is usually mineral soil with a thin layer of organic matter. Calciphiles characterize this community type. The dominant trees are usually *Acer rubrum* (red maple) and *Fraxinus nigra* (black ash). Associates include *Quercus bicolor* (swamp white oak), *Nyssa sylvatica* (black-gum), and *Ulmus americana* (American elm). Common understory species include *Rhamnus alnifolia* (alder-leaved buckthorn), *Physocarpus opulifolius* (ninebark), *Spiraea latifolia* (meadowsweet), *Ilex verticillata* (winterberry), *Alnus serrulata* (smooth alder), *Vaccinium corymbosum* (highbush blueberry), and *Rhododendron viscosum* (swamp azalea). Common herbs include *Osmunda regalis* (royal fern), *Carex stricta* (tussock sedge), *C. lacustris* (lakebank sedge), *Symplocarpus foetidus* (skunk cabbage), *Viola* spp. (violets), and *Onoclea sensibilis* (sensitive fern). Most calciphilic species associated with this type have moderate to high light requirements, and thus are found in openings. These species include *Conioselinum chinense*^s (hemlock parsley), *Trollius laxus*^s (spreading globeflower), *Carex interior* (inland sedge), *C. flava*^s (yellow sedge), *C. leptalea* (bristly-stalked sedge), *Cypripedium calceolus* var. *parviflorum*^s (small yellow lady's-slipper), *C. reginae*^s (showy lady's-slipper), *Geum rivale* (water avens), and *Epilobium strictum*^s (downy willow-herb).

Related types: The much more common "Red maple - black-gum palustrine forest" is not generally influenced by calcareous waters, and lacks the *Fraxinus nigra* (black ash) and herbaceous calciphiles that characterize this type.

Range: Glaciated NE, Glaciated NW, Piedmont, Ridge and Valley.

Selected references: Golet et al. 1993, Sneddon, Anderson, and Metzler 1996.

[Crosswalk: Smith's "Eastern calcareous seepage swamp," TNC's *Acer rubrum - Fraxinus nigra* Saturated Forest Alliance, SAF's Red maple (108).]



Red maple - magnolia Coastal Plain palustrine forest

This community type is largely restricted to low-lying areas of the Coastal Plain, with outliers occurring in the Piedmont and South Mountain sections. The dominant trees are *Acer rubrum* (red maple), *Magnolia virginiana*^s (sweet-bay magnolia), *Nyssa sylvatica*, (black-gum), *Liquidambar styraciflua* (sweet-gum), and *Quercus bicolor* (swamp white oak). Shrubs include *Clethra alnifolia* (sweet pepperbush), *Leucothoe racemosa*^s (fetter-bush), *Ilex verticillata* (winterberry), *laevigata* (smooth winterberry), *Vaccinium corymbosum* (highbush blueberry), *Rhododendron viscosum* (swamp azalea), and *Viburnum nudum* (possum-haw). The herbaceous layer is often sparse; species include *Triadenum virginicum* (marsh St.-John's-wort)—in openings, *Viola* spp. (violets), *Osmunda regalis* (royal fern), *Osmunda cinnamomea* (cinnamon fern), and other ferns, sedges, and sphagnum.

Related Types: The upland forest type often associated with this is the "Sweet gum - oak Coastal Plain forest." In Pennsylvania, both of these types are largely restricted to the Coastal Plain. The presence of *Magnolia virginiana*^s (sweet-bay magnolia), *Liquidambar styraciflua* (sweet-gum), and other coastal plain species distinguish this type from other red maple palustrine forests.

Range: Coastal Plain, Piedmont, South Mountain.

Selected references: Heckscher 1994, PNDI field surveys, Sneddon, Metzler and Anderson 1994.

[Crosswalk: Smith's "Coastal Plain Forest" (in part), TNC's *Acer rubrum* - *Liquidambar styraciflua* Seasonally Flooded/Saturated Forest Alliance, SAF's Red maple (108).]

Great Lakes Region lakeplain palustrine forest

These wetlands are specific to the Erie Lake Plain. While the usual aspect is that of a forest, on wetter and/or more recently disturbed sites, there may be a more open canopy. The topography is flat overall with a hummock-hollow microtopography, often with small vernal ponds scattered throughout. The water table is near the surface throughout most of the year. The dominant tree species are *Ulmus americana* (American elm), *Fraxinus pennsylvanica* (red ash), *Fraxinus profunda*^s (pumpkin ash), and *Acer saccharinum* (silver maple). Other trees commonly present include *Acer rubrum* (red maple), *Populus deltoides* (cottonwood), *Tilia americana* (basswood), *Betula alleghaniensis* (yellow birch), and *Nyssa sylvatica* (black-gum). The shrub layer is usually dominated by *Lindera benzoin* (spicebush)— although this is

likely a result of deer over-browsing. The herbaceous layer may be very diverse, representative species include *Carex bromoides* (a sedge), *C. intumescens* (a sedge), *C. crinita* var. *crinita*^s (short hair sedge), *Dryopteris carthusiana* (triploid wood fern), *Onoclea sensibilis* (sensitive fern), *Cardamine douglassii* (purple cress), *Osmunda cinnamomea* (cinnamon fern), and *Viola cucullata* (blue marsh violet). This community type in Pennsylvania remains on only a handful of sites.

Related types: In Pennsylvania this type is restricted to the Erie Lake Plain. It shares species with both floodplain forest types and rich upland types, but is distinguishable by its setting, by the presence of *Fraxinus profunda*^s (pumpkin ash) on most sites, and by the unusual combination of tree species.

Range: Great Lakes Region.

Selected references: PNDI field surveys.

[Crosswalk: none.]

Sycamore - (river birch) - box-elder floodplain forest

This community type occurs along the floodplains of our larger and mid-size river systems that receive periodic or seasonal flooding. Although this is typically a palustrine community type, there may be examples that are terrestrial. The most characteristic tree species of this type are *Platanus occidentalis* (sycamore) and *Acer negundo* (box-elder), often with *Acer rubrum* (red maple), *A. saccharinum* (silver maple), *Ulmus americana* (American elm), *Ulmus rubra* (red elm), *Fraxinus pennsylvanica* (red ash), and *Salix nigra* (black willow). *Betula nigra* (river birch) is a common component of these sites in eastern Pennsylvania, but rarely occurs in the Ohio River drainage. Common shrubs include *Salix sericea* (silky willow), *Cornus amomum* (red-willow), *C. racemosa* (swamp dogwood), *Vitis riparia* (frost grape), *Lindera benzoin* (spicebush), and *Toxicodendron radicans* (poison-ivy). Exotic shrubs such as *Rosa multiflora*^d (multiflora rose), *Lonicera japonica*^d (Japanese honeysuckle), and *Lonicera morrowii*^z (Morrow's honeysuckle) are common. Herbs include *Impatiens capensis* (jewelweed), *I. pallida* (pale jewelweed), *Pilea pumila* (clearweed), *Laportea canadensis* (wood-nettle), *Polygonum hydropiper*^d (common smartweed), *Urtica dioica* (great nettle), *P. virginianum* (jumpseed), *Microstegium vimineum*^d (stilt grass), *Polygonum cuspidatum*^d (Japanese knotweed), and *Alliaria petiolate*^d (garlic mustard). This community type is part of the "River bed - bank - floodplain complex."

Related types: The "Silver maple floodplain forest" occurs in a similar setting, but is distinguished by *Acer*



saccharinum (silver maple) dominance. In backwater areas with standing water through much of the year, the "Red maple - elm - willow floodplain swamp" often occurs. Where the canopy becomes open, usually on islands or gravel bars, this type may grade into the "River birch - sycamore floodplain scrub."

Range: Entire state.

Selected references: Eyre 1980, PNFI field surveys, Reschke 1990.

[Crosswalk: Smith's "Floodplain Forest" (in part), TNC's *Platanus occidentalis* - *Betula nigra* - *Acer negundo* Seasonally / Temporarily Flooded Forest Alliance, SAF's River birch - sycamore (61).]

Silver maple floodplain forest

These forests occur along larger rivers with a well-developed floodplain. Although this is typically a palustrine community type, there are examples that are terrestrial. Aside from *Acer saccharinum* (silver maple), which is usually dominant, other trees include *Acer rubrum* (red maple), *Salix nigra* (black willow), *Betula nigra* (river birch), *Acer negundo* (box-elder), *Ulmus americana* (American elm), and *U. rubra* (red elm). Shrubs include *Cornus amomum* (red-willow), *C. racemosa* (swamp dogwood), *Toxicodendron radicans* (poison-ivy), *Lindera benzoin* (spicebush), *Sambucus canadensis* (American elder) and, *Viburnum recognitum* (northern arrow-wood). Exotic shrubs, such as *Rosa multiflora*^a (multiflora rose), *Lonicera japonica*^d (Japanese honeysuckle), and *Lonicera morrowii*^e (Morrow's honeysuckle), are common. Herbs include *Impatiens capensis* (jewelweed), *I. pallida* (pale jewelweed), *Pilea pumila* (clearweed), *Polygonum hydropiper*¹ (common smart-weed), *P. virginianum* (jumpseed), *Microstegium vimineum*^d (stilt grass), *Polygonum cuspidatum*^l (Japanese knotweed), and *Alliaria petiolata*^l (garlic mustard). This community type is part of the "River bed - bank -floodplain complex."

Related types: The "Sycamore - (river birch) - box-elder floodplain forest" occurs in a similar setting, but is dominated by a mix of species, rather than by *Acer saccharinum* (silver maple). In backwater areas with standing water throughout much of the year, the "Red maple - elm - willow floodplain swamp" often occurs. Where the canopy becomes open, usually on islands or gravel bars, this type may grade into the "River birch - sycamore floodplain scrub."

Range: Entire state—major river systems, main stem.

Selected references: Eyre 1980, PNFI field surveys, Sneddon, Anderson, and Metzler 1996.

[Crosswalk: Smith's "Floodplain Forest" (in part), TNC's *Acer Saccharin* Temporarily Flooded Forest Alliance, SAF's Silver maple - American elm (62).]

Red maple - elm - willow floodplain swamp

This palustrine forest type is primarily associated with major rivers, often located in old oxbows along the floodplain, or in depressions behind natural levees. These systems are subject to periodic flooding, may stay inundated for substantial periods of time, and may also receive groundwater enrichment and/or surface water from adjacent uplands. Characteristic species include *Acer rubrum* (red maple), *Fraxinus Pennsylvania* (red ash), *Ulmus americana* (American elm), *U. rubra* (red elm), *Quercus palustris* (pin oak), *Q. bicolor* (swamp white oak), *Carya cordiformis* (bitternut hickory), *Salix nigra* (black willow), *S. sericea* (silky willow), *Viburnum recognitum* (northern arrow-wood), *Cornus amomum* (red-willow), *Lindera benzoin* (spicebush), *Vitis riparia* (frost grape), *Sambucus canadensis* (American elder), *Onoclea sensibilis* (sensitive fern), *Matteuccia struthiopteris* (ostrich fern), and *Polygonum* spp. This community type is part of the "River bed - bank -floodplain complex."

Related types: The other floodplain forest types, "Sycamore - (river birch) - box-elder floodplain forest" and "Silver maple floodplain forest" generally occur in areas that respond more quickly to changes in river level, and do not hold water for substantial periods of time following flooding.

Range: Entire state.

Selected references: Sneddon, Anderson, and Metzler 1996, Reschke 1990.

[Crosswalk: Smith's "Floodplain Swamp," TNC's *Acer (rubrum, saccharinum)* - *Ulmus americana* - *Quercus (bicolor, palustris)* Temporarily Flooded Forest Alliance, SAF's Silver maple - American elm (62).]