Terrestrial & Palustrine Plant Communities of Pennsylvania 2nd Ed.

Section 3

Terrestrial Communities

Serpentine pitch pine - oak forest

This community type is part of the "Serpentine barrens complex." It occurs in areas underlain by serpentine bedrock where soil development has proceeded far enough to support forest vegetation, but not so far as to override the influence of serpentine chemistry on species composition. Fire is an important factor in the establishment and persistence of pitch pine. In the absence of fire, pine is likely to decrease in favor of hardwood species. Characteristic overstory species include *Quercus stellata* (post oak), *Q. marilandica* (blackjack oak), *Pinus rigida* (pitch pine), *Sassafras albidum* (sassafras), *Juniperus virginiana* (red-cedar), *Nyssa sylvatica* (black-gum), *Populus grandidentata* (large-toothed aspen), and *Robinia pseudoacacia* (black locust)—which is generally invasive in these systems. The shrub layer is often dominated by an impenetrable tangle of *Smilax rotundifolia* (greenbrier) and *S. glauca* (catbrier). *Q. prinoides* (chinquapin oak) occurs in the understory and in openings; *Quercus ilicifolia* (scrub oak) is also present in openings. Low shrub species include *Vaccinium pallidum* (lowbush blueberry), *V. stamineum* (deerberry), and *Gaylussacia baccata* (black huckleberry). Herbaceous species include *Pteridium aquilinum* (bracken fern), *Aralia nudicaulis* (wild sarsaparilla), and a variety of graminoids.

Related types: The "Serpentine Virginia pine - oak forest" type also occurs on serpentinite-derived soils and shares many species with this type. The Virginia pine type is dominated by a mixture of *Pinus virginiana* and various oaks. *P. virginiana* produces denser shade and thicker litter than does P. *rigida.* Herbaceous and shrub growth under P. *virginiana* is generally sparse. The fire ecology of the two species is also vastly different. For a more detailed explanation of the ecology of serpentine barrens, see the description of the "Serpentine barrens complex."

Range: Piedmont.

Selected references: Latham 1992, Roger Latham-personal communication, PNDI field surveys.

[Crosswalk: Smith's "Eastern Serpentine Barren" (in part), TNC's *Quercus falcata - Quercus alba* Forest Alliance, SAF's Pitch pine (45).**]**

Serpentine Virginia pine - oak forest

This community type is part of the "Serpentine barrens complex." It occurs in areas underlain by serpentine bedrock, where soil development has proceeded far enough to support forest vegetation, but not so far as to override the influence of serpentine chemistry on species composition. Characteristic overstory species include *Quercus stellata* (post oak), *Q. marilandica* (blackjack oak), *Pinus virginiana* (Virginia pine), *Sassafras albidum* (sassafras), *Prunus serotina* (wild black cherry), *Juniperus virginiana* (red-cedar), *Nyssa sylvatica* (black-gum), *Robinia pseudoacacia* (black locust), and *Acer rubrum* (red maple). The shrub layer may be quite sparse under the dense shade and heavy litter of *Pinus virginiana* (Virginia pine). Where the canopy is more open there may be an impenetrable tangle of *Smilax rotundifolia* (greenbrier) and *S. glauca* (catbrier). Other shrub species include *Vaccinium pallidum* (lowbush blueberry), V. *stamineum* (deerberry), and *Gaylussacia baccata* (black huckle-berry). *Q. prinoides* (chinquapin oak) may be present in the understory or in openings. *Q. ilicifolia* (scrub oak) may also occur in openings. Herbaceous cover is also low; species include *Pteridium aquilinum* (bracken fern) and *Aralia nudicaulis* (wild sarsaparilla). **Related types:** The "Serpentine pitch pine - oak forest" type also occurs on serpentinite-derived soils and shares many species with this community. The pitch pine community is dominated by a mixture of *Pinus rigida* and various oaks. *P. virginiana* produces denser shade and thicker litter than does *P. rigida.* Herbaceous and shrub growth under *P. virginiana* is generally sparse. The fire ecology of the two species is also vastly different. For a more detailed explanation of the ecology of serpentine barrens, see the description of the "Serpentine barrens complex."

Range: Piedmont.

Selected references: Latham 1992, Roger Latham-personal communication, PNDI field surveys.

[Crosswalk: Smith's "Eastern Serpentine Barren" (in part), TNC *Pinus virginiana - Quercus (alba, stellata, falcata, velutina)* Forest Alliance, *Pinus (echinata, taeda, virginiana)* Forest Alliance, *Pinus virginiana / Quercus marilandica* Community, SAF's Virginia pine (79).

Pitch pine - mixed oak forest

This community type generally occurs on acidic, sandy soils, often on ridgetops and dry southern exposures. Fire is an important factor in the establishment and persistence of pitch pine. In the absence of fire, pitch pine is likely to decrease in favor of hardwood species. *Pinus rigida* (pitch pine), sometimes with a mixture of other pines, e.g. *P. strobus* (eastern white pine), *P. pungens* (table-mountain pine), *P. virginiana* (Virginia pine), and less often *P. echinata* (short-leaf pine) or *P. resinosa* (red pine), contribute over 25% of the overstory. Hardwood associates may include any of the dry-site oaks including *Quercus montana* (chestnut oak), *Q. coccinea* (scarlet oak), *Q. velutina* (black oak), and *Q. alba* (white oak). Other tree species include *Nyssa sylvatica* (black-gum), *Acer rubrum* (red maple), *Betula lenta* (sweet birch), and *Carya glabra* (pignut hickory). *Quercus ilicifolia* (scrub oak) may occur in more open areas; other shrubs include *Smilax* spp. (greenbrier), *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), *Parthenocissus quinquefolia* (Virginia creeper), and *Vaccinium angustifolium (pallidum, stamineum)* (low-bush blueberries). The forest type sometimes grades into an open-canopy type, or contains gaps with an open canopy. The herbaceous layer is sparse, often with *Pteridium aquilinum* (bracken fern), *Aralia nudicaulis* (wild sarsaparilla), *Gaultheria procumbens* (teaberry), *Cypripedium acaule* (pink lady's-slipper), and various *graminoids,* including *Danthonia spicata* (poverty grass), *Deschampsia flexuosa* (common hairgrass), *Carex pensylvanica* (Pennsylvania sedge), *Carex communis* (a sedge), and *C. rosea* (a sedge).

Related types: The "Dry oak - heath forest" is distin-guished from this type in that it has less than 25% relative cover by conifers. The "Pitch pine-mixed hardwood woodland" has an open canopy, the woodland type may occur up-slope adjacent to this community.

The "Serpentine pitch pine - oak forest" differs from this community in ecology and species composition. The serpentine type occurs only on serpentinite-derived soils. *Q.* stellata (post oak) and *Q. marilandica* (blackjack oak), which are not characteristic of the more common type, are found in the serpentine forest type. The understory of the serpentine type is generally dominated by *Smilax rotundifolia* (greenbrier) and/or *S. glauca* (catbrier). For a more detailed explanation of the ecology of serpentine barrens, see the description of the "Serpentine barrens complex."

Range: Glaciated NE, Piedmont, Pittsburgh Plateau, Pocono Plateau, Ridge and Valley, South Mountain.

Selected references: Hunter and Swisher 1983, Illick and Aughanbaugh 1930, Reschke 1990.

[Crosswalk: Smith's "Xeric Central Hardwood - Conifer Forest," TNC's *Pinus (rigida, echinata)* - *Quercus* Forest Alliance, SAF's Pitch pine (45).**]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Virginia pine - mixed hardwood forest

This community type most often occurs as a post-agricultural forest type on sand or silt loams, in the southeastern portion of the state. It may also occur on cleared and/or burned-over areas. *Pinus virginiana* (Virginia pine), sometimes with a mixture of other pines, e.g. *P. strobus* (eastern white pine), *P. rigida* (pitch pine), *P. pungens* (Table-Mountain pine), and less often *P. echinata* (short-leaf pine) or *P. resinosa* (red pine) contribute at least 25% of the overstory. Although this is typically a mixed type, some areas may be strongly dominated by pine. Hardwood associates vary; common species include *Quercus rubra* (red oak), *Q. velutina* (black oak), *Q. coccinea* (scarlet oak), *Q. alba* (white oak), *Prunus serotina* (wild black cherry), *Acer rubrum* (red maple), *Betula lenta* (sweet birch), *Carya* spp. (hickory), *Sassafras albidum* (sassafras), and *Fraxinus americana* (white ash). Shrubs include *Smilax* spp. (greenbrier), *Juniperus virginiana* (red-cedar), *Rhus copallina* (shining sumac), *Rubus allegheniensis* (Allegheny blackberry), *Toxicodendron radicans* (poison-ivy), and *Parthenocissus quinquefolia* (Virginia creeper). Due to the thick litter, the herbaceous layer is usually sparse, often with *Chimaphila maculata* (pipsissewa), *Pteridium aquilinum* (bracken fern), *Aralia nudicaulis* (wild sarsaparilla), *Gaultheria procumbens* (teaberry), *Desmodium* spp. (tick-trefoil), Ga*lium* spp. (cleavers), and various graminoids.

Related types: The "Virginia pine - mixed hardwood shale woodland" has an open canopy and is found on dry shale slopes. If the total conifer component is below 25%, consult the "Broadleaf terrestrial forest" section.

The "Serpentine Virginia pine - oak forest" differs from this type in ecology and species composition. The serpentine type occurs only on serpentinite-derived soils. *Q. stellata* (post oak) and *Q. marilandica* (blackjack oak), which are not characteristic of the more common type, are frequently found in the serpentine forest type. For a more detailed explanation of the ecology of serpentine barrens, see the description of the "Serpentine barrens complex."

Range: Piedmont, Ridge and Valley.

Selected references: Hunter and Swisher 1983, Eyre 1980.

[Crosswalk: Smith's "Xeric Central Hardwood - Conifer Forest," TNC's *Pinus virginiana - Quercus (alba, stellata, falcata, prinus, velutina)* Forest Alliance, SAF's Virginia pine-oak (78)**.]**

Dry white pine (hemlock) oak forest

This community type occurs on fairly dry sites, often with 25% or more of the forest floor covered by rocks, boulders and/or exposed bedrock. The canopy may be somewhat open and tree growth somewhat suppressed. The tree stratum is dominated by a mixture of *Pinus strobus* (eastern white pine), or occasionally *Tsuga canadensis* (eastern hemlock), and a mixture of dry-site hardwoods, predominantly oaks. On most sites, the conifer and the hardwood component both range between 25% and 75% of the canopy. The oak species most often associated with this type are *Quercus montana* (chestnut oak), and *Q. alba* (white oak), although *Q. velutina* (black oak), *Q. coccinea* (scarlet oak), or *Q. rubra* (northern red oak) may also occur. Other associated trees include *Nyssa sylvatica* (black-gum), Betula lenta (sweet birch), *Fraxinus americana* (white ash), *Prunus serotina* (wild black cherry), and *Castanea dentata* (American chestnut) sprouts. There is often a heath-dominated shrub layer with *Kalmia latifolia* (mountain laurel) being especially important; *Gaylussacia baccata* (black huckleberry), *Vaccinium* spp. (blueberries), and *Kalmia angustifolia* (sheep laurel) are also common. Other shrubs, like *Cornus florida* (flowering dogwood), *Hamamelis virginiana* (witch-hazel), *Viburnum acerifolium* (maple-leaved viburnum) may also occur on less acidic sites. There is typically a sparse herbaceous layer with a northern affinity; *Aralia nudicaulis* (wild sarsaparilla), *Pteridium aquilinum* (bracken fern), *Maianthemum canadense* (Canada mayflower), *Gaultheria procumbens* (teaberry), *Trientalis borealis* (star-flower), and *Medeola virginiana* (Indian cumber-root) are typical. The successional status of this type seems variable, in some cases, especially on harsher sites, it appears relatively stable, in other cases it appears to be transitional.

Related types: If the total conifer cover is less than 25% of the canopy, see the "Broadleaf terrestrial forests" section. This forest type shares several species with the "Hemlock (white pine) - red oak - mixed hardwood" forest type. The latter is more mesic; *Q. montana* (chestnut oak), *Pteridium aquilinum* (bracken fern) and *Aralia nudicaulis* (wild sarsaparilla) are more often associated with the dry type, while Q. *rubra* (red oak), *Podophyllum peltatum* (may-apple) and *Smilacina racemosa* (false Solomon's seal) are more characteristic of the mesic type.

Range: Most typical of the Ridge and Valley, also occurs on South Mountain, Glaciated NE, Glaciated NW, Pittsburgh Plateau.

Selected references: Braun 1950, Eyre 1980.

[Crosswalk: Smith's "Dry - Mesic Acidic Central Forest," TNC's *Pinus strobus - Quercus (rubra, alba, velutina)* Forest Alliance and *Tsuga canadensis - Pinus strobus* (dry) Forest Alliance, SAF's White pine - chestnut oak (51).**]**

Hemlock (white pine) - northern hardwood forest

Any of the three named components may be dominant; at least two are present in some amount. Conifers and hardwoods each contribute between 25% and 75% of the canopy. Characteristic hardwood species include *Fagus grandifolia* (American beech), *Acer saccharum* (sugar maple), *A. rubrum* (red maple), *Betula lenta* (black birch), and *B. alleghaniensis* (yellow birch). The conifer component may be *Pinus strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), or a combination of the two. These forests occur mostly on mesic sites, often north-facing, sometimes rocky and steep. This type is fairly widespread in northern Pennsylvania. *Rhododendron maximum* (rosebay) may be locally abundant. Other common shrubs include *Hamamelis virginiana* (witch-hazel), *Acer pensylvanicum* (moosewood), and Viburnums *(Viburnum* spp.). The herbaceous layer is generally sparse and reflects a northern affinity; common components include *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (star-flower), *Thelypteris noveboracensis* (New York fern), *Medeola virginiana* (Indian cucumber-root), *Lycopodium lucidulum* (shining clubmoss), *Mitchella repens* (partridge-berry), and *Clintonia borealis* (bluebead lily). There is often a rich bryophyte layer.

Related types: The "Northern hardwood forest" community type has less than 25% combined relative cover by conifers. The "Hemlock (white pine) - red oak - mixed hardwood forest" type is generally dominated by a combination of various oaks—characteristically *Quercus rubra* (red oak), *Tsuga canadensis* (eastern hemlock) and/or *Pinus strobus* (white pine). In the community described here, the same conifers usually share dominance with *Fagus grandifolia* (American beech), *Betula* spp. (birches), and *Acer saccharum* (sugar maple). The understory species associated with this community are likewise more northern in affinity.

Range: Entire state except the Coastal Plain, Piedmont, and South Mountain.

Selected references: Braun 1950, Nichols 1935, Whitney 1990a, 1990b.

[Crosswalk: Smith's "Northern Hardwood - Conifer Forest," TNC's *Tsuga canadensis - Pinus strobus* Forest Alliance. If split, *Tsuga canadensis* (mesic) Forest Alliance, SAF's Hemlock - yellow birch (24)**.]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Hemlock (white pine) - red oak - mixed hardwood forest

This type is similar to the "Red oak - mixed hardwood forest" type but with *Tsuga canadensis* (eastern hemlock) and/or *Pinus strobus* (eastern white pine) contributing more than 25% relative cover. Conifers may be scattered, locally abundant, may dominate the subcanopy, or may occur as a relict supracanopy *(Pinus strobus),* or in large former canopy gaps *(Pinus strobus). Quercus rubra* (northern red oak) is usually present, often dominant/codominant, most often with *Acer rubrum* (red maple), *Quercus velutina* (black oak), *Q. alba* (white oak), *Carya tomentosa* (mockernut hickory), *Betula lenta* (sweet birch), *Fraxinus americana* (white ash), *Fagus grandifolia* (American beech), and/or *Liriodendron tulipifera* (tuliptree). Shrubs include *Viburnum acerifolium* (maple-leaved viburnum), *Rhododendron periclymenoides* (pinxter-flower), *Amelanchier laevis* (smooth serviceberry), *A. arborea* (shadbush), *Carpinus caroliniana* (hornbeam), *Ostrya virginiana* (hop-hornbeam), *Hamamelis virginiana* (witch-hazel), and *Lindera benzoin* (spicebush). Herbaceous species include *Smilacina racemosa* (false Solomon's-seal), *Polygonatum biflorum* (Solomon's seal), *Gaultheria procumbens* (teaberry), *Maianthemum canadense* (Canada mayflower), and *Podophyllum peltatum* (may-apple).

Related types: The "Red oak - mixed hardwood forest" type has less than 25% combined relative cover by conifers. The type described here is generally dominated by a combination of various oaks—characteristically *Quercus rubra* (red oak), and *Tsuga canadensis* (eastern hemlock) and/or *Pinus strobus* (eastern white pine). In the "Hemlock (white pine) - northern hardwood forest," the same conifers usually share dominance with *Fagus grandifolia* (American beech), *Betula spp.* (birches), and *Acer saccharum* (sugar maple). The understory species associated with the "Hemlock (white pine) - northern hardwood forest" type are likewise more northern in affinity.

Range: Entire state except the Coastal Plain.

Selected references: Braun 1950, Eyre 1980.

[Crosswalk: Smith's "Dry - Mesic Acidic Central Forest" (in part), TNC's *Tsuga canadensis - Pinus strobus* Forest Alliance, SAF's White pine - northern red oak - red maple (20).**]**

Hemlock - tuliptree - birch forest

The presence of tuliptree and a mix of somewhat more southern species distinguish this type from the "Hemlock/white pine - northern hardwood" type. This is generally a lower slope or cove type. *Tsuga canadensis* (eastern hemlock) usually contributes at least 25% of the canopy. *Liriodendron tulipifera* (tuliptree), *Betula alleghaniensis* (yellow birch), and *B. lenta* (sweet birch) are the most characteristic hardwood species. Other tree species commonly found on these sites are *Acer rubrum* (red maple), *A. saccharum* (sugar maple), *Quercus spp.* (oaks)—usually *Q. rubra* (northern red oak), as well as *Fagus grandifolia* (American beech), *Fraxinus americana* (white ash), *Prunus serotina* (wild black cherry), *Tilia americana* (basswood), *Pinus strobus* (eastern white pine), and in western Pennsylvania, *Magnolia acuminata* (cucumber-tree). Shrubs include *Hamamelis virginiana* (witch-hazel), *Rhododendron maximum* (rosebay) and others. The herbaceous layer is highly variable; characteristic species include *Maianthemum canadense* (Canada mayflower)—especially under hemlock, *Podophyllum peltatum* (may-apple), *Dryopteris marginalis* (evergreen wood fern), *Botrychium virginianum* (rattlesnake fern), *Arisaema triphyllum* (jack-in-the-pulpit), *Aster divaricatus* (white wood aster), and *Polystichum acrostichoides* (Christmas fern).

Related types: If hemlock contributes less than 25% of the canopy cover, read the description of the "Tuliptree -(beech) - maple forest." This type is in some ways intermediate between the "Hemlock (white pine) - northern hardwoods forest," which has a more northern species composition and range, and the "Hemlock - rich mesic hardwoods forest," which has a richer, more southern species composition and a more southerly range. This type is also closely related to the "Hemlock (white pine) -red oak forest," which often occurs on dryer sites, and generally has *Quercus rubra* (red oak) as a major canopy component.

Range: Piedmont, Pittsburgh Plateau, Ridge and Valley.

Selected references: Braun 1950, Eyre 1980.

[Crosswalk: Smith's "Dry - Mesic Acidic Central Forest," TNC's *"Tsuga canadensis* (mesic) Forest Alliance, *Tsuga canadensis - Fagus grandifolia* Community, SAF's Yellow poplar eastern hemlock (58).**]**

Rich hemlock - mesic hardwoods forest

These are species-rich, lower slope forests, reminiscent of the "Mixed mesophytic forest" type in the southwestern part of the state, but usually with a strong *Tsuga canadensis* (eastern hemlock) component. The hardwood species vary; typical representatives include *Liriodendron tulipifera* (tuliptree), *Fagus grandifolia* (American beech), *Quercus rubra* (northern red oak), *Acer rubrum* (red maple), *A. saccharum* (sugar maple), *Betula lenta* (sweet birch), *B. alleghaniensis* (yellow birch), *Fraxinus americana* (white ash), *Tilia americana* (basswood) and *Carya ovata* (shagbark hickory). Hemlock cover is often patchy. Under hardwood cover, the herbaceous diversity approaches that of the richer "Mixed mesophytic" type, while under dense hemlock cover, the herbaceous stratum reflects a more northern flora. *Magnolia tripetala*^{S} (umbrella magnolia) is not uncommon. Other southern shrubs such as *Asimina triloba* (pawpaw) and *Staphylea trifolia* (bladdernut) may also occur, although *Rhododendron maximum* (rosebay), *Hamamelis virginiana* (witch-hazel), and *Lindera benzoin* (spicebush) are more abundant on most sites. Herbaceous species include *Adiantum pedatum* (maidenhair fern), *Erythronium americanum* (trout-lily), *Maianthemum canadense* (Canada mayflower), *Anemone quinquefolia* (wood anemone), *Dicentra canadensis* (squirrel-corn), *D. cucullaria* (dutchman's breeches), *Cimicifuga racemosa* (black snakeroot), *Geranium maculatum* (wood geranium), *Caulophyllum thalictroides* (blue cohosh), *Hepatica nobilis* (liverleaf), *Arisaema triphyllum* (jack-in-the-pulpit), *Allium tricoccum* (wild leek), *Sanguinaria canadensis* (bloodroot), *Corydalis flavula* (yellow fumewort), *Asplenium spp.* (spleenworts), *Botrychium virginianum* (rattlesnake fern), *Claytonia virginica* (spring-beauty), *Cardamine concatenata* (cut-leaved toothwort), *Mitella diphylla* (bishop's-cap), and *Asarum canadense* (wild ginger). In areas without a strong *Tsuga canadensis* (eastern hemlock) component, there may be complete annual litter turnover. This type may occur in a variety of lower slope/ravine situations.

Related types: This community type resembles a somewhat depauperate version of the "Mixed mesophytic forest" type, with the addition of *Tsuga canadensis* (eastern hemlock) usually with at least 25% relative cover. It is much richer in species composition than the most closely related mixed conifer/broadleaf forest type, the "Hemlock - tuliptree - birch forest." Species like *Magnolia tripetala* (umbrella magnolia), *Asimina triloba* (pawpaw), *Staphylea trifolia* (bladdernut), *Corydalis flavula* (yellow fumewort), *Sanguinaria canadensis* (bloodroot), and *Dicentra* spp. (dutchman's-breeches and squirrel-corn) are more typical of this richer, more southern type.

Range: Piedmont, Pittsburgh Plateau, southeastern portion of Ridge and Valley.

Selected references: Braun 1950, PNDI field surveys.

[Crosswalk: Smith's "Mesic Central Forest" (in part), TNC's *Tsuga canadensis* (mesic) Forest Alliance, SAF's Eastern hemlock (23) and Yellow poplar - white oak -northern red oak (59).**]**

Dry oak - heath forest

This is a fairly broadly defined community type. These forests occur on xeric to moderately dry, acidic sites, often on shallow or sandy soils and/or steep slopes. The most characteristic tree species for this forest type is *Quercus montana* (chestnut oak), usually occurring with a mix of *Q. velutina* (black oak), *Q. coccinea* (scarlet oak), and/or *Q. alba* (white oak). Other tree species include *Sassafras albidum* (sassafras), *Nyssa sylvatica* (black-gum), *Betula lenta* (sweet birch), *Acer rubrum* (red maple), *Carya glabra* (pignut hickory), *Pinus rigida* (pitch pine), *P. virginiana* (Virginia pine), and *Pinus strobus* (eastern white pine). Total cover by conifers generally does not exceed 25% of the canopy. *Castanea dentata* (American chestnut) stump sprouts are not uncommon. The shrub layer is dominantly ericaceous; common species include *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), *Vaccinium pallidum* (lowbush blueberry), *V. angustifolium* (low sweet blueberry), *Viburnum acerifolium* (maple-leaved viburnum), and in more open areas, *Comptonia perigrina* (sweet-fern). Owing largely to the thick, resistant oak/ericad leaf litter, the herbaceous layer is generally sparse. Common constituents include *Maianthemum canadense* (Canada mayflower), *Carex pensylvanica* (Pennsylvania sedge), *Carex communis* (a sedge), *Chimaphila maculata* (pipissewa), *Epigaea repens* (trailing arbutus), *Gaultheria procumbens* (teaberry), *Aralia nudicaulis* (wild sarsaparilla), *Pteridium aquilinum* (bracken fern), and *Cypripedium acaule* (pink lady's-slipper).

Related types: The "Dry oak - mixed hardwood forest" type is similar but occurs on less acidic (and often less dry) sites and does not have an overwhelming dominance of heaths in the shrub layer. As one moves up-slope or toward a drier exposure, the evergreen component may increase and this type may grade into the "Pitch pine - mixed hardwood forest" type. Where the canopy becomes open, with trees over five meters high covering less than 60% of the site overall, this becomes the “Dry oak - heath woodland."

Range: Entire state.

Selected references: Braun 1950, Sneddon, Anderson, and Metzler 1996.

[Crosswalk: Smith's " Xeric Central Hardwood Forest," TNC's *Quercus* - *Ericaceae* Forest Alliance and *Quercus (prinus, coccinea, velutina)* Forest Alliance, SAF: most of Chestnut oak (44), and parts of Northern red oak (55) and White oak - black oak - northern red oak (52).**]**

Dry oak-mixed hardwood forest

This type occurs on less acidic to somewhat calcareous, moderately dry soils. It is most often found on south and southwest-facing slopes. Common trees include *Quercus alba* (white oak), *Betula lenta* (sweet birch), *Carya cordiformis* (shellbark hickory), *Celtis occidentalis* (hackberry), *Acer rubrum* (red maple), *A. saccharum* (sugar maple), *Q. montana* (chestnut oak), *Q. velutina* (black oak), *Q. rubra* (northern red oak), *Carya glabra* (pignut hickory), *Fraxinus americana* (white ash), and *Tilia americana* (basswood). The shrub layer is perhaps more diagnostic. Characteristic shrubs include *Cornus florida* (flowering dogwood), *Carpinus caroliniana* (hornbeam), *Corylus cornuta* (beaked hazelnut), *Amelanchier arborea* (shadbush), *Cercis canadensis* (redbud), and *Ostrya virginiana* (hop-hornbeam). Ericaceous shrubs are uncommon, although *Kalmia latifolia* (mountain laurel) does occur on some sites. This type usually contains a somewhat richer herbaceous flora than the "Dry oak-heath" forest type (although restricted by moisture availability). Herbaceous species include *Smilacina racemosa* (false Solomon's-seal), *Uvularia sessilifolia* (wild-oats), *Polygonatum biflorum* (Solomon's-seal), *Asplenium platyneuron* (ebony spleenwort), *Desmodium spp.* (tick-trefoil), *Hieracium venosum* (rattlesnake weed), *Aralia nudicaulis* (wild sarsaparilla), *Carex pensylvanica* (a sedge), *Carex communis* (a sedge), and *Lysimachia quadrifolia* (whorled loosestrife).

Related types: The "Virginia pine - mixed hardwood forest" type sometimes occurs in association with this type (especially on calcareous shales) and is distinguished by the presence of a substantial conifer component (at least 25% relative cover). The "Dry oak - heath forest" occurs on more acidic sites and is distinguished from this by a clear dominance of ericaceous shrubs in the understory. The "Yellow oak - redbud woodland" type is more strongly calciphilic, with a clear dominance of calciphiles, is much more restricted in distribution, and generally has an open canopy.

Selected references: Braun 1955, Monk, 1mm, and Potter 1990, Pearson 1974, 1979.

Range: Entire state except Coastal Plain.

[Crosswalk: Smith's "Dry-Mesic Calcareous Central Forest," "Xeric Central Hardwood Forest," TNC's *Quercus (prinus, rubra) - Carya* Forest Alliance and parts of *Carya -Fraxinus - Quercus* Forest Alliance, although the latter is generally richer and more mesic, SAF's White oak - black oak - northern red oak (52).**]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Red oak - mixed hardwood forest

This broadly defined community type includes much of Pennsylvania's hardwood-dominated forests occurring on fairly mesic sites, and is therefore quite variable in composition. *Quercus rubra* (northern red oak) is usually present, often dominant/codominant, most often with *Acer rubrum* (red maple), *Quercus velutina* (black oak), *Q. alba* (white oak), *Carya tomentosa* (mockernut hickory), *C. ovata* (shagbark hickory), *Betula lenta* (sweet birch), *B. alleghaniensis* (yellow birch), *Fraxinus americana* (white ash), *Fagus grandifolia* (American beech), and/or *Liriodendron tulipifera* (tuliptree). Shrubs include *Viburnum recognitum* (northern arrowwood), *V. dentatum* (southern arrowwood), *V. acerifolium* (maple-leaved viburnum), *Amelanchier laevis* (smooth serviceberry), *A. arborea* (shadbush), *Kalmia latifolia* (mountain laurel), *Carpinus caroliniana* (hornbeam), *Ostrya virginiana* (hop-hornbeam), *Hamamelis virginiana* (witch-hazel), and *Lindera benzoin* (spicebush). The herbaceous layer is highly variable. Representative species include *Uvularia sessilifolia* (wild-oats), *Smilacina racemosa* (false Solomon's-seal), *Podophyllum peltatum* (may-apple), *Chimaphila maculata* (pipissewa), *Gaultheria procumbens* (teaberry), *Medeola virginiana* (Indian cucumber-root), *Caulophyllum thalictroides* (blue cohosh)—on richer sites, *Dryopteris spp.* (wood ferns), and *Dennstaedtia punctilobula* (hayscented fern).

Related types: The "Hemlock (white pine) - red oak -mixed hardwood forest" type is distinguished from this by the presence of at least 25% relative cover by hemlock and/or white pine. The "Northern hardwood forest" is distinguished by a greater percentage of birches, maples, and beech, and less oak.

Range: Entire state, although less common on the Unglaciated Allegheny Plateau.

Selected references: Braun 1955, Gordon 1941, Harshberger 1904, Pearson 1974, 1979.

[Crosswalk: falls between Smith's "Dry - Mesic Acidic Central Forest" and " Mesic central forest," TNC's *Quercus rubra - Acer saccharum* Forest Alliance (mostly) and *Quercus (prinus, rubra) - Carya* Forest Alliance (to a lesser extent), SAF's Northern red oak (55).**]**

Northern hardwood forest

Dominant trees usually include *Fagus grandifolia* (American beech), *Acer rubrum* (red maple), A. *saccharum* (sugar maple), *Prunus serotina* (wild black cherry)—at less than 40% relative cover, *Betula lenta* (sweet birch), *B. alleghaniensis* (yellow birch), *B. papyrifera* (paper birch), *Q. rubra* (northern red oak), and *Fraxinus americana* (white ash). This type may contain scattered *Pinus strobus* (eastern white pine) and/or *Tsuga canadensis* (eastern hemlock), but combined conifer cover does not exceed 25% of the canopy. *Rhododendron maximum* (rosebay) may be locally abundant. Other common shrubs include *Hamamelis virginiana* (witch-hazel), *Acer pensylvanicum* (moose-wood), *Viburnum lantanoides* (witch-hobble), *Ilex montana* (mountain holly), *Amelanchier laevis* (smooth serviceberry), A. *arborea* (shadbush), and *Carpinus caroliniana* (hornbeam). The herbaceous layer is generally sparse and reflects a northern affinity; common components include *Maianthemum canadense* (Canada mayflower), *Trientalis borealis* (starflower), *Thelypteris novaboracensis* (New York fern), *Dryopteris carthusiana* (fancy fern), *Lycopodium lucidulum* (shining clubmoss), *Gaultheria procumbens* (teaberry), *Mitchella repens* (partridge-berry), *Aralia nudicaulis* (wild sarsaparilla), *Medeola virginiana* (Indian cucumber-root), and *Maianthemum canadense* (Canada mayflower).

Related types: If combined relative cover by conifers exceeds 25%, please read description for the "Hemlock (white pine) - northern hardwood forest." If cover by *Prunus serotina* (wild black cherry) exceeds 40% of canopy, please read description for the "Black cherry - northern hardwood forest" type.

Range: Glaciated NE, Glaciated NW, Pocono Plateau, Unglaciated Allegheny Plateau.

Selected references: Braun 1950, Illick and Frontz 1928, Lindsey and Escobar 1976.

[Crosswalk: Smith's " Northern Hardwood (Broadleaf) Forest," TNC's *Acer saccharum - Betula alleghaniensis -Fagus grandifolia* Forest Alliance, SAF's Sugar maple -beech - yellow birch (24)**.]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Black cherry - northern hardwood forest

This forest type is characterized by at least 40% relative cover by black cherry and is most characteristic of the Unglaciated Allegheny Plateau. Common associates are *Acer rubrum* (red maple), A. *saccharum* (sugar maple), *Betula lenta* (sweet birch), *B. alleghaniensis* (yellow birch), *Fagus grandifolia* (American beech), and *Quercus* spp. (oaks), usually *Q. rubra* (northern red oak). *Pinus strobus* (eastern white pine) and/or *Tsuga canadensis* (eastern hemlock) may be present (at less than 25% relative cover). Shrubs include *Viburnum lantanoides* (witch-hobble), *Acer pensylvanicum* (moose-wood), *Rubus allegheniensis* (Allegheny blackberry), *Ilex montana* (mountain holly), *Hamamelis virginiana* (witch-hazel), and *Amelanchier arborea* (shadbush). Common herbaceous species include *Dennstaedtia punctilobula* (hayscented fern), *Thelypteris noveboracensis* (New York fern), *Dryopteris* intermedia (common wood fern), *Lycopodium* spp. (ground pine), *Aster acuminatus* (wood aster), *Viola* spp. (violets), *Medeola virginiana* (Indian cucumber-root), *Uvularia sessilifolia* (wild-oats), *Brachyelytrum erectum* (brachyelytrum), *Maianthemum canadense* (Canada mayflower), and *Oxalis acetosella* (common wood-sorrel).

Related types: The "Northern hardwood forest" may contain *Prunus serotina* (wild black cherry) as a component, but it does not generally exceed 40% relative cover. This forest type is most characteristic of the Unglaciated Allegheny Plateau.

Range: Glaciated NE, Glaciated NW, Unglaciated Allegheny Plateau.

Selected references: Hough and Forbes 1943, Marquis 1975.

[Crosswalk: Smith's " Northern Hardwood (Broadleaf) Forest," TNC's *Acer saccharum - Betula alleghaniensis -Fagus grandifolia* Forest Alliance, *Acer saccharum - Betula alleghaniensis - Prunus serotina* Community, SAF's Black cherry - maple (28).**]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Tuliptree - beech - maple forest

These woods occur on fairly deep, not strongly acidic soils, at a mid-to lower-slope position. The most consistent tree species for this often very mixed type are *Acer rubrum* (red maple) and *Liriodendron tulipifera* (tuliptree). *Fagus grandifolia* (American beech) is often present and, when present, is often codominant. In successional, lower slope situations, *Liriodendron tulipifera* (tuliptree) may occur in nearly pure stands. The long list of possible associates includes various oaks, mostly *Q. rubra* (red oak), as well as *Nyssa sylvatica* (black-gum), *Acer saccharum* (sugar maple), *Carya tomentosa* (mockernut hickory), *C. ovata* (shagbark hickory), *Betula lenta* (sweet birch), *Tsuga canadensis* (eastern hemlock)—less than 25% relative cover and in—western Pennsylvania, *Magnolia acuminata* (cucumber-tree). Common shrubs include various viburnums, *Carpinus caroliniana* (hornbeam), *Cornus florida* (flowering dogwood), *Ostrya virginiana* (hop-hornbeam), *Hamamelis virginiana* (witch-hazel), and *Lindera benzoin* (spicebush). This type has different expressions in different parts of the state as well as according to disturbance history etc. There may be a rich herbaceous layer, especially in the vernal flora. On richer sites that are not over-browsed, this may include species like *Podophyllum peltatum* (may-apple), *Sanguinaria canadensis* (bloodroot), *Botrychium virginianum* (rattlesnake fern), *Dicentra cucullaria* (dutchman's-breeches), *D. canadensis* (squirrel corn), *Allium tricoccum* (wild leek), *Claytonia virginica* (spring-beauty) etc.

Related types: This type is closely related to the "Red oak - mixed hardwood forest" type. They share many species in common. The "Red oak - mixed hardwood forest" type is more widespread, occurs across a broader ecological range, and is usually dominated by oaks and hickories. This type is more restricted, generally occurring on toeslopes, or north-facing lower and midslopes. The dominance of beech, tulip, and maple and the near-absence of heaths, such as *Gaultheria procumbens* (teaberry) and *Kalmia latifolia* (mountain laurel), distinguish these forests from the oak-dominated type.

Range: Piedmont, Pittsburgh Plateau, Ridge and Valley.

Selected references: Pearson 1974, PNDI field surveys.

[Crosswalk: falls between Smith's "Dry-mesic acidic central forest" and " Mesic central forest", TNC's *Fagus grandifolia - Acer saccharum (Liriodendron tulipifera)* Forest Alliance, SAF's Yellow poplar (57) (in part), also some non-oak dominated portions of Yellow poplar white - oak (59).**]**

Sugar maple - basswood forest

In eastern Pennsylvania, this type occurs on rich rocky slopes (although it may have occurred on less steep sites previous to extensive logging that left these inaccessible remnants as our only remaining examples). In western Pennsylvania, this type occurs on a wide range of sites. Aside from *Acer saccharum* (sugar maple) and *Tilia americana* (basswood), other trees typically present include *Quercus rubra* (northern red oak) *Fraxinus americana* (white ash), *Liriodendron tulipifera* (tuliptree), *Betula alleghaniensis* (yellow birch), and *B. lenta* (sweet birch). Shrubs include *Lindera benzoin* (spicebush), *Hamamelis virginiana* (witch-hazel), and on richer sites *Asimina triloba* (pawpaw) and *Staphylea trifolia* (bladdernut). There is generally a rich vernal flora; species include *Anemone quinquefolia* (wood anemone), *Cimicifuga racemosa* (black snakeroot), *Geranium maculatum* (wood geranium), *Caulophyllum thalictroides* (blue cohosh), *Allium tricoccum* (wild leek), *Hepatica nobilis* (liverleaf), *Sanguinaria canadensis* (bloodroot), *Erythronium americanum* (trout-lily), *Claytonia virginica* (spring-beauty), *Arisaema triphyllum* (jack-in-the-pulpit), *Mitella diphylla* (bishop's-cap), *Cardamine concatenata* (cut-leaved toothwort), and *Asarum canadense* (wild ginger). Other herbaceous species include *Smilacina racemosa* (false Solomon's-seal), *Dryopteris marginalis* (evergreen wood fern), and *Botrychium virginianum* (rattlesnake fern).

Related types: The "Red oak - mixed hardwood forest" is usually dominated by oaks and hickories, and more often has heaths like *Kalmia latifolia* (mountain laurel) and *Gaultheria procumbens* (teaberry) in the understory. The "Tuliptree - beech - maple forest" type generally lacks *Tilia americana* (basswood) and occurs on gentle toeslopes rather than rocky slopes. In western Pennsylvania, this type may resemble depauperate examples of the "Mixed mesophytic forest" type.

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

Selected references: Eyre 1980, Harker et al. 1993.

[Crosswalk: Smith's "Talus Slope Forest," TNC's *Acer saccharum - Fraxinus americana - Tilia americana* Forest Alliance and *Acer saccharum - Fraxinus americana - Ulmus americana* Forest Alliance, *Acer saccharum -Liriodendron tulipifera - Fraxinus americana - Staphylea trifolia* Community, SAF's Sugar maple - basswood (26).**]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Mixed mesophytic forest

This is specific to the southwestern part of the state and includes several species that find their northern and eastern limits in Pennsylvania. This is an extremely rich community type that typically occurs on deep soils at a lower slope position. Dominant trees include *Liriodendron tulipifera* (tuliptree), *Acer saccharum* (sugar maple), *Fagus grandifolia* (American beech), *Tilia americana* (basswood), *Quercus rubra* (northern red oak), *Magnolia acuminata* (cucumber-tree), *Prunus serotina* (wild black cherry), *Fraxinus americana* (white ash), *Juglans nigra* (black walnut), *Carya ovata* (shagbark hickory), *Aesculus glabra* (Ohio buckeye), and *A. flava* (yellow buckeye). *Tsuga canadensis* (eastern hemlock) may occur in these forests, but is not characteristically a dominant. Shrubs include *Asimina triloba* (pawpaw), *Staphylea trifolia* (bladdernut), *Rhododendron maximum* (rosebay), *Magnolia tripetala*^{S} (umbrella magnolia), *Cercis canadensis* (redbud), *Lindera benzoin* (spicebush), *Hydrangea arborescens* (wild hydrangea), and *Hamamelis virginiana* (witch-hazel). The herbaceous flora is extremely rich and includes such species as *Trillium grandiflorum* (white trillium), *T. erectum* (purple trillium), *T. sessile* (toadshade), *Erythronium americanum* (trout-lily), *Phlox divaricata* (wild blue phlox), *Anemone quinquefolia* (wood anemone), *Dicentra canadensis* (squirrelcorn), *D. cucullaria* (dutchman's-breeches), *Clintonia umbellulata* (speckled wood-lily), *Cimicifuga racemosa* (black snakeroot), *Geranium maculatum* (wood geranium), *Caulophyllum thalictroides* (blue cohosh), *Tiarella cordifolia* (foamflower), *Hepatica nobilis* (liverleaf), *Allium tricoccum* (wild leek), *Sanguinaria canadensis* (bloodroot), *Corydalis flavula* (yellow fumewort), *Botrychium virginianum* (rattlesnake fern), *Claytonia virginica* (spring-beauty), *Cardamine concatenata* (cut-leaved toothwort), *Mitella diphylla* (bishop's-cap), and *Asarum canadense* (wild ginger). Most of these systems have a complete, or nearly complete, annual litter turnover.

Related types: The "Hemlock - mesic hardwood forest" type usually has 25% or more relative cover by *Tsuga canadensis* (eastern hemlock), but is otherwise similar in ecology and species composition. The "Sugar maple -basswood forest" type is less species-rich than this type, often occurs on rocky slopes, and generally lacks the complete annual litter turnover that characterizes this type. The range of this community type is restricted to the Pittsburgh Plateau. Similar sites in other parts of the state most likely belong to either the "Sugar maple - basswood forest" type or the "Tuliptree - beech - maple forest" type.

Range: Pittsburgh Plateau.

Selected references: Braun 1950, Harker et al. 1993, PNDI field surveys

[Crosswalk: Smith's "Mesic Central Forest" (in part), TNC's *Liriodendron tulipifera - Tilia americana var. heterophylla - Aesculus flava - Acer saccharum* Forest Alliance, SAF's Yellow-poplar - white oak - northern red oak (59)—richer examples.**]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Sweet gum - oak coastal plain forest

This type is restricted to the level, sandy soils of the Coastal Plain the adjacent Piedmont; characteristic species include, *Liquidambar styraciflua* (sweet-gum)—usually a dominant, *Quercus falcata*[S] (southern red oak), *Q. phellos*[S] (willow oak), *Q. alba* (white oak), *Fagus grandifolia* (American beech), *Acer rubrum* (red maple), *Smilax rotundifolia* (greenbrier), *Leucothoe racemosa*[S] (fetter-bush), *Lyonia mariana*[S] (stagger-bush), *Clethra alnifolia* (sweet pepperbush), *Kalmia latifolia* (mountain laurel), and sometimes *Ilex opaca*[S] (American holly). Not much of this type remains in Pennsylvania, and what there is tends to be badly degraded.

Related types: The predominance of *Liquidambar styraciflua* (sweet gum), *Quercus phellos*[S] (willow oak), *Lyonia mariana*[S] (stagger-bush), and other coastal plain species makes this community type easily distinguishable from other terrestrial forest types in Pennsylvania. The "Red maple - magnolia Coastal Plain palustrine forest" is a palustrine forest type also characteristic of Pennsylvania's Coastal Plain. The difference in hydrology and associated species clearly differentiates the two.

Range: Coastal Plain, Piedmont.

Selected references: Heckscher 1994, Smith 1991.

[Crosswalk: Smith's "Coastal plain forest" (in part), TNC's *Quercus - Fagus grandifolia - Ilex opaca* Forest Alliance, *Quercus - Fagus grandifolia / Podophyllum peltatum* Community, SAF's White oak (53) (in part).**]**

Red maple (terrestrial) forest

This is generally an early-to mid-successional type that is becoming increasingly common as red maple increases in Pennsylvania's forests. This type is seldom pure, but *Acer rubrum* (red maple) dominates the tree stratum. Associate species include *Quercus* spp. (oaks), *Betula lenta* (sweet birch), *Liriodendron tulipifera* (tuliptree), *Carya* spp. (hickories), *Fraxinus americana* (white ash), *Prunus serotina* (wild black cherry), and other hardwoods. Because *Acer rubrum* (red maple) has such a wide ecological amplitude, this type may occur from the upper through the lower slope. Accordingly, the associated species vary greatly. Some shrubs commonly present include *Viburnum acerifolium* (maple-leaved viburnum), *Lindera benzoin* (spicebush), *Hamamelis virginiana* (witch-hazel), and *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), and *Corpus florida* (flowering dogwood). More information is needed regarding the ecology and species composition of this community type.

Related types: The "Northern hardwood forest" type may contain a substantial amount of *Acer rubrum* (red maple), especially in younger stands. This type is not intended to include very young successional stands of northern hardwoods.

Range: Entire state.

Selected reference: Abrams 1998.

[Crosswalk: Smith - no crosswalk, TNC - no crosswalk, SAF's Red maple (108).**]**

Black-gum ridgetop forest

This community type occurs on fairly dry ridgetops. The canopy may be somewhat open; tree growth is somewhat suppressed. These ridgetops may have been exposed to repeated fires. *Nyssa sylvatica* is the dominant species; *Betula lenta* (sweet birch), *Sassafras albidum* (sassafras), *Acer rubrum* (red maple), *Quercus montana* (chestnut oak), *Q. velutina* (black oak), and *Q. rubra* (red oak) are often present. The shrub layer is dominantly ericaceous; common species include *Kalmia latifolia* (mountain laurel), *Gaylussacia baccata* (black huckleberry), *Vaccinium* spp. (blueberry), and *Hamamelis virginiana* (witch-hazel). The herbaceous layer is generally sparse. Common constituents include *Carex pensylvanica* (Pennsylvania sedge), *Carex communis* (a sedge), *Epigaea repens* (trailing arbutus), *Gaultheria procumbens* (teaberry), *Aralia nudicaulis* (wild sarsaparilla), and *Pteridium aquilinum* (bracken fern).

Related types: This type is fairly uniform in composition and is restricted to ridgetops and high shoulders. The "Birch (black-gum) rocky slope woodland" occurs on talus or scree slopes and boulderfields, has an open canopy, and has a wide range of possible associates depending on aspect and location.

Range: Ridge and Valley.

Selected references: Daniel Devlin—personal communication.

[Crosswalk: none.**]**

Aspen/gray (paper) birch forest

This type is frequently mixed, but sometimes occurs in nearly pure stands of one of the named species. The birch may be *Betula papyrifera* (paper birch) on more northern sites, or *B. populifolia* (gray birch) and occasionally *B. lenta* (sweet birch). The aspen may be *Populus grandidentata* (large-toothed aspen), or *P. tremuloides* (quaking aspen). Associates include *Sassafras albidum* (sassafras), *Acer* spp. (maples), and *Prunus* spp. (cherry). This is an early successional forest type, commonly found on former agricultural land, in areas of ice scour along stream banks, and where there has been major disturbance resulting in areas of exposed mineral soil. This community type may also result from forestry practices that maintain an early successional stage.

Related types: The "Northern hardwood forest" type may contain a substantial birch component. Many forest types may contain patches of aspen or birch in former canopy gaps; this community type is not intended to describe such small patches.

Range: Entire state.

[Crosswalk: Smith's "Young Miscellaneous Forest," TNC's Populus tremuloides Forest Alliance, SAF's Aspen (16) and Gray birch - red maple (19).**]**

Black locust forest

This community type usually occurs on highly disturbed sites or in small woodlots in an agricultural or suburban matrix. *Robinia pseudoacacia* (black locust) is usually the dominant tree. *Betula lenta* (sweet birch) is frequently codominant. Other associates vary; typical representatives include *Acer rubrum* (red maple), the exotic *Acer platanoides*[I] (Norway maple), *Sassafras albidum* (sassafras), various oaks *(Quercus* spp.), or *Prunus serotina* (wild black cherry). There is generally a dense graminoid understory due to the light penetration through the canopy. *Toxicodendron radicans* (poison ivy) is commonly abundant. Exotic species usually predominate; common representatives include *Lonicera japonica*[I] (Japanese honeysuckle), *Ailanthus altissima*[I] (tree-of-heaven), *L. morrowii*[I] (Morrow's honeysuckle), *Berberis thunbergii*[I] (Japanese barberry), *Alliaria petiolata*[I] (garlic mustard), *Polygonum perfoliatum*[I] (mile-a-minute), *Microstegium vimineum*[I], (stilt grass), *Poa pratensis*[I] (Kentucky bluegrass), *Dactylis glomerata*[I] (orchard grass), and *Holcus lanatus*[I] (velvet grass).
Related types: Other forest types may contain Robinia pseudoacacia (black locust), this type refers to sites where it is clearly dominant.
Range: Piedmont, Pittsburgh Plateau, Ridge and Valley.
Selected references: Eyre 1980.
[Crosswalk: Smith's "Young Miscellaneous Forest," TNC -no crosswalk, SAF's Black locust (50).**]**

Pitch pine - heath woodland

This is a woodland community type that occurs on rocky ridge-tops, on sandy soils, or both. A similar type occurs on serpentinite-derived soils on the Piedmont (see related types section below). Soils for this community are acidic; conditions are dry. Trees are drought-stressed and of small stature. *Pinus rigida* (pitch pine) is usually the dominant tree, although in southern Pennsylvania, *P. virginiana* (Virginia pine), and *Pinus pungens* (Table-mountain pine) may accompany or replace *P rigida. Pinus resinosa* (red pine) may also occur on some sites. Hardwoods may be present but do not contribute more than 25% of the tree layer. Hardwood associates include *Nyssa sylvatica* (black-gum), *Sassafras albidum* (sassafras), *Betula lenta* (sweet birch), *Quercus montana* (chestnut oak), *Q. coccinea* (scarlet oak), *Betula populifolia* (gray birch), and *Acer rubrum* (red maple). *Pinus strobus* (eastern white pine) may also occur but is not common. Various shrubs, mostly ericads, form a low shrub layer. Characteristic species include *Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (low sweet blueberry), *V. pallidum* (lowbush blueberry), *Aronia melanocarpa* (black chokeberry), *Comptonia peregrine* (sweet-fern), *Gaultheria procumbens* (tea-berry), and *Kalmia angustifolia* (sheep laurel). Scattered *Q. ilicifolia* (scrub oak) may be present but is not domi-nant. Herbaceous species include *Pteridium aquilinum* (bracken fern), *Carex pensylvanica* (Pennsylvania sedge), *Carex communis* (a sedge), *Schizachyrium scoparium* (little bluestem), *Deschampsia flexuosa* (common hair-grass), *Melampyrum lineare* (cow-wheat), *Danthonia spicata* (poverty grass), *Lespedeza* spp. (bush-clovers), and *Aralia nudicaulis* (wild sarsaparilla). *Cladonia* spp. and *Cladina* spp. (reindeer lichens) are also very common. This community may occur as part of the "Ridgetop acidic barren complex."

Related types: This type may contain scattered *Q. ilicifolia* (scrub oak), but sites where *Q. ilicifolia* becomes the dominant shrub should be classified as "Pitch pine -scrub oak woodland". If the hardwood component of the canopy exceeds 25% relative cover, see the "Pitch pine - mixed hardwood woodland" type. The pine-dominated type here often occurs adjacent to and upslope of the more mixed type. On the Piedmont, on areas of serpentine geology, a similar dry pine type occurs with many of the same dominants. For sites in this ecoregion of unknown geology, please read both descriptions.

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

Selected references: Illick and Aughanbaugh 1930, Schweitzer and Rawinski 1987.

[Crosswalk: Smith's "Ridgetop Dwarf-tree Forest" (in part), "Appalachian Sand Barren" (in part), TNC's *Pinus rigida / Vaccinium* Woodland Alliance, SAF's Pitch pine (45)**.]**

Pitch pine - scrub oak woodland

This is a woodland community type that occurs on rocky ridge-tops, on sandy soils, or both. Soils for this community are acidic; conditions are dry. Trees are drought-stressed and of small stature. *Pinus rigida* (pitch pine) is usually the dominant tree, although in southern Pennsylvania, *P. virginiana* (Virginia pine), and *P. pungens* (Table-mountain pine) may accompany or replace *P. rigida*. *P. resinosa* (red pine) may also occur on some sites. Hardwoods may be present but do not contribute more than 25% of the tree layer. Hardwood associates include *Nyssa sylvatica* (black-gum), *Sassafras albidum* (sassafras), *Betula lenta* (sweet birch), *Quercus montana* (chestnut oak), *Q. coccinea* (scarlet oak), *B. populifolia* (gray birch), and *Acer rubrum* (red maple). *Pinus strobus* (eastern white pine) may also occur but is not common. *Quercus ilicifolia* (scrub oak) forms a dense understory. Various shrubs, mostly ericads, often form a low shrub layer. Characteristic species include *Gaylussacia baccata* (black huckleberry), *Vaccinium angustifolium* (low sweet blueberry), *V. pallidum* (lowbush blueberry), *Aronia melanocarpa* (black chokeberry), *Comptonia perigrina* (sweet-fern), and *Gaultheria procumbens* (teaberry). Herbaceous species include *Pteridium aquilinum* (bracken fern), *Carex pensylvanica* (Pennsylvania sedge), *C. communis* (a sedge), *Oryzopsis* spp. (ricegrass), *Schizachyrium scoparium* (little bluestem), *Deschampsia flexuosa* (common hairgrass), *Melampyrum lineare* (cow-wheat), *Danthonia spicata* (poverty grass), *Aristida dichotoma* (three-awn), and *Aralia nudicaulis* (wild sarsaparilla). This community may occur as part of the "Ridgetop acidic barren complex."

Related types: If the hardwood component of the canopy exceeds 25% relative cover, see the "Pitch pine - mixed hardwood woodland" type. The pine-dominated type here often occurs adjacent to and upslope of the more mixed type. If the shrub layer is dominated by ericaceous shrubs rather than *Quercus ilicifolia* (scrub oak), consult the description for the "Pitch pine - heath woodland."

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

Selected references: Illick and Aughanbaugh 1930, Schweitzer and Rawinski 1987.

[Crosswalk: Smith's "Ridgetop Dwarf-tree Forest" (in part), "Appalachian Sand Barren" (in part), TNC's *Pinus rigida / Quercus ilicifolia* Woodland Alliance, *Pinus rigida/Quercus ilicifolia/Aronia melanocarpa* Community, SAF's Pitch pine (45).**]**

Red spruce rocky summit

This type is known in the state from only one example, in Wyoming County, Northeastern Pennsylvania. The site is north-facing on fractured bedrock at an elevation of about 2200 ft. Woody species occur in pockets of soil that have accumulated in cracks in the bedrock. There are extensive areas of bare or lichen-encrusted rock. Aside from *Picea rubens* (red spruce), tree species include *Betula populifolia* (gray birch), *Pinus rigida* (pitch pine), *P. resinosa* (red pine), *P. strobus* (eastern white pine), *Tsuga canadensis* (eastern hemlock), and *Acer rubrum* (red maple). Trees are small in stature and shaped by exposure to wind and ice. Shrubs include *Gaylussacia baccata* (black huckleberry), *Vaccinium pallidum* (lowbush blueberry), *Aronia melanocarpa* (black chokeberry), *Sorbus americana* (American mountain-ash), *Ilex montana* (mountain holly), and *Kalmia angustifolia* (sheep laurel). Herbaceous species include *Carex pensylvanica* (Pennsylvania sedge), *Carex communis* (a sedge), *Deschampsia flexuosa* (common hairgrass), *Maianthemum canadense* (Canada mayflower), and *Melampyrum lineare* (cow-wheat). *Cladonia* spp and *Cladina* spp. (reindeer lichens), and crustose lichens are abundant. This community type is part of the "Ridgetop acidic barrens complex."

Related types: The Pennsylvania example of this community type lacks the fir component of spruce balds found both farther north in the Adirondacks (balsam fir), and farther south in the Blue Ridge (Fraser fir).

Range: Glaciated NE.

Selected references: PNDI field surveys.

[Crosswalk: TNC's *Picea rubens* Woodland Alliance, *Picea rubens — Vaccinium angustifolium* Community, SAF's Red spruce (32).**]**

Pitch pine - rhodora - scrub oak woodland

This community is part of the "Mesic till barren complex." This is a unique group of communities restricted to the southern Pocono Plateau. The barren-like vegetation does not appear to be a response to droughty or nutrient-poor soils. The same deep, fine-loamy Illinoian till on which it occurs also underlies the adjacent forests (Latham et al. 1996). The origin of the barrens, and the processes responsible for their persistence and distribution are not known, but fire appears to be a critical factor. Please see the description of the "Mesic till barrens complex" for more information. Included here are all areas of the complex with at least 10% cover by trees, mostly *Pinus rigida* (pitch pine) and *Acer rubrum* (red maple). *Rhododendron canadense* (rhodora) and *Quercus ilicifolia* (scrub oak), with a mixture of *Vaccinium angustifolium* (low sweet blueberry) and *Kalmia angustifolia* (sheep laurel), dominate the shrub layer. The most abundant species in the herbaceous and creeping shrub layer are *Carex pensylvanica* (Pennsylvania sedge), *Oryzopsis racemosa* (ricegrass), *Rubus hispidus* (swamp dewberry), *Pteridium aquilinum* (bracken fern), and *Gaultheria procumbens* (teaberry). Other species include *Amianthium muscaetoxicum* (fly-poison), *Aster umbellatus* (flat-topped aster), *Calamagrostis cinnoides* (reedgrass), and the globally rare species *Carex polymorpha*[S] (variable sedge) and *Lygodium palmatum*[S] (climbing fern).

Related types: This type is superficially similar to the much more common "Pitch pine - scrub oak woodland" type. Location, mesic soil conditions, and the importance of rhodora in the shrub layer distinguish this highly restricted community type. See the description of the "Mesic till barren complex" for a more detailed ecological description.

Range: Pocono Plateau.

Selected references: Davis et al. 1991, Latham et al. 1996.

[Crosswalk: Smith's "Mesic Scrub Oak - Heath - Pitch Pine Barrens" (in part), TNC's *Pinus rigida* Seasonally Flooded (sic.) Woodland Alliance, *Pinus rigida* - *Quercus ilicifolia* - *Rhododendron canadense* Community, SAF's Pitch pine (45).**]**

Pitch pine - mixed hardwood woodland

This community type occurs on dry, sandy, acidic soils. *Pinus rigida* (pitch pine) contributes between 25% and 75% relative cover. *Pinus pungens* (Table-mountain pine) or P. *resinosa* (red pine) may also occur on some sites. Hardwood associates include *Quercus montana* (chestnut oak), *Q. coccinea* (scarlet oak), *Q. velutina* (black oak), *Nyssa sylvatica* (black-gum), *Sassafras albidum* (sassafras), *Betula lenta* (sweet birch), *B. populifolia* (gray birch), and *Acer rubrum* (red maple). The shrub layer may be entirely composed of low shrubs like *Vaccinium angustifolium* (low sweet blueberry), *V. pallidum* (lowbush blueberry), *Comptonia perigrina* (sweet-fern), and *Gaylussacia baccata* (black huckle-berry), or may have an additional layer of taller shrubs like *Kalmia latifolia* (mountain laurel), *V. corymbosum* (highbush blueberry), and *Quercus ilicifolia* (scrub oak). Herbaceous species include *Pteridium aquilinum* (bracken fern), *Deschampsia flexuosa* (common hair-grass), *Danthonia spicata* (poverty grass), *Epigaea repens* (trailing arbutus), *Gaultheria procumbens* (teaberry), *Melampyrum lineare* (cow-wheat), *Carex pensylvanica* (Pennsylvania sedge), *C. communes* (a sedge), *Oryzopsis* spp. (ricegrass), *Aralia nudicaulis* (wild sarsaparilla). Lichens such as *Cladonia* spp. and *Cladina* spp. (reindeer lichens) are abundant in some areas. This community may occur as part of the "Ridgetop acidic barren complex."

Related types: This type is similar to and may grade into the "Pitch pine - scrub oak woodland" community. This type is distinguished from the pine type by having at least 25% of the tree stratum contributed by hardwoods. Likewise, this type is distinguished from the "Dry oak -heath woodland" community by its greater pine component—at least 25% relative cover. The canopy is generally less open than in the "Pitch pine - scrub oak woodland" type, and often occurs adjacent downslope of that type on somewhat less dry or more sheltered sites. See the "Ridgetop acidic barren complex" description for more information.

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

Selected references: Illick and Aughanbaugh 1930, Schweitzer and Rawinski 1987.

[Crosswalk: Smith's "Ridgetop Dwarf-Tree Forest" (in part), TNC's *Quercus (coccinea, velutina) - Pinus rigida* Woodland Alliance, *Quercus (coccinea, velutina) - Pinus rigida - Schizachyrium scoparium* Community, SAF's Pitch pine (45).**]**

Virginia pine - mixed hardwood shale woodland

This community type occurs on dry (typically acidic) shale slopes with a more or less southerly exposure. Although the overall character is that of a woodland, there may be herbaceous openings and sparsely vegetated areas within the woodland matrix. *Pinus virginiana* (Virginia pine), sometimes in combination with *P. strobus* (eastern white pine), *Juniperus virginiana* (red-cedar), or *P. pungens* (Table-mountain pine), contributes between 25% and 75% relative cover. Hardwood associates include *Fraxinus americana* (white ash), *Quercus montana* (chestnut oak), *Q. rubra* (red oak), *Q. velutina* (black oak), *Q. stellata* (post oak), *Carya glabra* (pignut hickory), *C. ovalis* (sweet pignut hickory), and *C. ovata* (shagbark hickory). The shrub layer includes such species as *Amelanchier arborea* (shadbush), *Gaylussacia baccata* (black huckleberry), *Vaccinium stamineum* (deerberry), and *Quercus ilicifolia* (scrub oak). The herbaceous layer is generally sparse; species include *Schizachyrium scoparium* (little bluestem), *Panicum linearifolium* (panic-grass), *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty grass), *Deschampsia flexuosa* (hairgrass), *Penstemon hirsutus* (beard-tongue), *Heuchera americana* (alum-root), *Cunila origanoides* (common dittany), *Aster cordifolius* (blue wood aster), and *Hieracium venosum* (rattlesnake-weed). Lichens such as *Cladonia* spp. and *Cladina* spp. (reindeer lichens) are abundant in some areas.

Related types: The "Red-cedar - mixed hardwood rich shale woodland" type also occurs on steep shale slopes. This type generally has a sparser herbaceous layer, and tends to be less open. More data are needed on substrate chemistry, but it appears that this type is more typically associated with acidic shales.

Range: Ridge and Valley and maybe Glaciated NE.

Selected references: Berdine 1998, PNDI field surveys.

[Crosswalk: *Pinus virginiana* Woodland Alliance, and *Quercus (rubra, prinus) - Pinus (strobus, virginiana)* Woodland Alliance, SAF's Virginia pine - oak (78).**]**

Red-cedar - mixed hardwood rich shale woodland

This is a woodland community type occurring on steep, south-facing slopes of thinly bedded, often calcareous, weathering shales. These sites are actively eroding, and very dry, at least at the surface. Surface temperatures are seasonally extremely high. Although the overall aspect is that of a woodland, there may be herbaceous openings and sparsely vegetated areas within the woodland matrix. Characteristic trees include *Juniperus virginiana* (red-cedar), *Fraxinus americana* (white ash), *Quercus montana* (chestnut oak), *Q. muhlenbergii* (yellow oak), *Q. stellata* (post oak), *Carya ovata* (shagbark hickory), *C. glabra* (pignut hickory), and *C. ovalis* (sweet pignut hickory). Other characteristic woody species include *Rhus aromatics* (fragrant sumac), *Amelanchier arborea* (shadbush), *Celtis tenuifolia* (dwarf hackberry), *Rosa carolina* (pasture rose), *Rhus copallina* (shining sumac), and *Parthenocissus quinquefolia* (Virginia creeper). This community type is characterized by a relatively dense, diverse herbaceous layer. Herbaceous species include *Danthonia spicata* (poverty grass), *Deschampsia flexuosa* (common hairgrass), *Panicum linearifolium* (panic grass), *Andropogon gerardii* (big bluestem), Schizachyrium *scoparium* (little bluestem), *Helianthus divaricatus* (rough sunflower), *Carex pensylvanica* (Pennsylvania sedge), *Phlox subulata* ssp. *subulata* (moss-pink), *Antennaria virginica*[S] (shale-barren pussytoes), *Solidago bicolor* (silver-rod), *Hedyotis longifolia* (bluets), *Melica nitens*[S] (tall melic grass), *Cunila origanoides* (common dittany), and *Viola pedata* (birdfoot violet). Endemic or near-endemic species include *Oenothera argillicola*[S] (shale-barren evening-primrose), *Phacelia dubia* (scorpion-weed), *Calystegia spithamaea* spp. *purshiana* (low bindweed), *Senecio antennarifolius*[S] (shale-barren ragwort), and *Trifolium virginicum*[S] (Kate's-mountain clover). Lichens such as *Cladina* spp. and *Cladonia* spp. (reindeer lichens) may be abundant on more exposed portions of these sites.

Related types: The "Red-cedar - prickly pear shale shrubland" also occurs on shale slopes, but in Pennsylvania is generally restricted to slopes above the Delaware River in the Northeastern part of the state, and lacks the endemic species which characterize this community type. The "Virginia pine - mixed hardwood shale woodland" type also occurs on shales, but is not generally as rich in endemic species as is this type. More research is needed on the relationship between substrate chemistry and vegetation on Pennsylvania shale barrens, but it appears that this type occurs on more base-rich shales than do the other two shale barren community types.

Range: Ridge and Valley.

Selected references: Berdine 1998, Dix 1990, Henry 1954, Platt 1951, Keener 1983, PNDI field surveys.

[Crosswalk: Smith's "Appalachian Shale Barren - Central Appalachian subtype," TNC's *Juniperus virginiana -(Fraxinus americana, Ostrya virginiana)* Woodland Alliance, *Juniperus virginiana - Fraxinus americana -Carya glabra / Carex pensylvanica - Chelianthes lanosa* Woodland, SAF's Eastern red-cedar (46).**]**

Dry oak - heath woodland

This community type occurs on dry, acidic soils. Dominant trees include *Quercus montana* (chestnut oak), *Q. coccinea* (scarlet oak), *Q. velutina* (black oak), *Nyssa sylvatica* (black-gum), *Sassafras albidum* (sassafras), *Betula lento* (sweet birch), *Betula populifolia* (gray birch), and *Acer rubrum* (red maple). *Pinus strobus* (eastern white pine) and *P. rigida* (pitch pine) or occasionally other dry-site pines may be present but contribute less than 25% of the tree stratum. The structure of the shrub layer is variable; it may be composed entirely of low shrubs like *Vaccinium angustifolium* (low sweet blueberry), *V. pallidum* (lowbush blueberry), *Gaylussacia baccata* (black huckleberry), and *Comptonia peregrina* (sweet-fern), or there may be an additional layer of taller shrubs like *Kalmia latifolia* (mountain laurel), *Quercus ilicifolia* (scrub oak), and V *corymbosum* (highbush blueberry). Typical herbaceous species include *Pteridium aquilinum* (bracken fern), *Carex pensylvanica* (Pennsylvania sedge), *C. communis* (a sedge), *Oryzopsis* spp. (ricegrass), *Maianthemum canadense* (Canada mayflower), *Aralia nudicaulis* (wild sarsaparilla), *Gaultheria procumbens* (teaberry), and *Epigaea repens* (trailing arbutus). This type often occurs downslope adjacent to the "Pitch pine - mixed hardwood woodland" type, or along lower ridgetops or on other dry sites. This community may occur as part of the "Ridgetop acidic barren complex."

Related types: This type often occurs along a soil-moisture gradient between the "Pitch pine - mixed hardwood woodland" type and the "Dry oak - heath forest" type. It is distinguished from the former by a lack of substantial conifer component (less than 25% relative cover) and from the latter by having an open canopy (less than 40% cover by trees).

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

Selected references: Davis et al. 1990, 1991.

[Crosswalk: Smith's "Ridgetop Dwarftree Forest" (in part), TNC's *Quercus rubra - Quercus prinus* Woodland Alliance, SAF's parts of Chestnut oak (44), Northern red oak (55) and White oak - black oak- northern red oak (52).**]**

Birch (black-gum) rocky slope woodland

This community type most often occurs on talus, scree or other rocky slopes. Although most typical of slopes, it may also occur on benches, ridgetops, or boulderfields. Birch, usually *Betula lenta* (sweet birch) or less commonly *B. papyrifera* (paper birch), *B. populifolia* (gray birch), or *B. alleghaniensis* (yellow birch), is nearly always present. Either birch or *Nyssa sylvatica* (black-gum) may be dominant. Associated tree species include *Tsuga canadensis* (eastern hemlock), *Acer rubrum* (red maple), *Carya glabra* (pignut hickory), *Quercus montana* (chestnut oak), *Q. alba* (white oak), *Q. velutina* (black oak), and *Q. coccinea* (scarlet oak). Other woody species include *Kalmia latifolia* (mountain laurel), *Viburnum acerifolium* (maple-leaved viburnum), *Hamamelis virginiana* (witch hazel), *Ribes* spp., *Vitis* spp., *Toxicodendron radicans* (poison ivy), and *Parthenocissus quinquefolia* (Virginia-creeper). The herbaceous layer is sparse; representative species include *Dryopteris marginalis* (common wood fern), *Polypodium virginianum* (rock polypody), *Woodsia obtusa* (blunt-lobed woodsia), and *Asplenium platyneuron* (ebony spleenwort). There are often rich bryophyte and lichen assemblages associated with these communities. The composition of this type is variable and often responds to aspect. On north-facing slopes, *Tsuga canadensis* (eastern hemlock) may become dominant. More information is needed to determine if such variation warrants additional types.

Related types: The "Black-gum ridgetop forest" may have an open canopy in places, but is characteristic of ridgetops rather than scree or talus slopes. Where the canopy is becoming closed, this type may grade into a variety of forest types.

Range: Pittsburgh Plateau, Ridge and Valley.

[Crosswalk: Smith's "Talus Slope Forest"- much modified, TNC - no crosswalk, SAF - no crosswalk.**]**

Yellow oak - redbud woodland

This community type represents the high-pH range of the moderately dry mixed oak woodlands. This woodland type is characterized by the consistent presence of calciphilic species. *Quercus muhlenbergii* (yellow oak) is nearly always present, often dominant or codominant. Associate tree species include *Quercus montana* (chestnut oak), *Q. alba* (white oak), *Nyssa sylvatica* (black-gum), *Acer saccharum* (sugar maple), *Fraxinus americana* (white ash), *Tilia americana* (basswood), *Carya ovalis* (sweet pignut hickory), *C. glabra* (pignut hickory), and *Juniperus virginiana* (red-cedar). Aside from *Cercis canadensis* (redbud), characteristic shrubs include *Ostrya virginiana* (hop-hornbeam), *Rhus aromatica* (fragrant sumac), *Celtis occidentalis* (hackberry), *Viburnum rafinesquianum* (downy arrow-wood), and *Cornus florida* (flowering dogwood). Herbs include *Aquilegia canadensis* (wild columbine), *Senecio obovatus* (groundsel), *Bouteloua curtipendula*[S] (side-oats gramma), and *Asclepias quadrifolia* (four-leaved milkweed).

Related types: In areas where the canopy becomes more open, this type may grade into the "Red cedar - redbud shrubland." Sufficiently large herbaceous openings may support the "Side-oat gramma grassland" or "Calcareous opening/cliff" types. As soil conditions become less dry and the canopy closes, this woodland type may grade into the "Dry oak - mixed hardwood forest" type.

Range: Pittsburgh Plateau, Ridge and Valley.

Selected references: PNDI field surveys.

[Crosswalk: Smith's "Dry-Mesic Calcareous Central Forest," TNC's *Acer saccharum - Quercus muhlenbergii* Forest Alliance, SAF - no crosswalk.**]**

Great Lakes Region scarp woodland

This community type is specific to the extremely steep, actively eroding lakeshore-bluff and creek-wall slopes along Lake Erie. The dominant aspect is that of a woodland (between 10% and 60% cover by trees over 5 meters tall), although some sites are forested and others are more open. Physiognomic differences generally reflect different seral stages in this very dynamic system. Common woody species include *Acer saccharum* (sugar maple), *Carpinus caroliniana* (hornbeam), *Ostrya virginiana* (hop-hornbeam), *Juniperus virginiana* (red-cedar), *Salix* spp. (willows), *Rhus typhina* (staghorn sumac), *Cornus rugosa* (round-leaved dogwood), and *Amelanchier arborea* (shadbush). Herbaceous species include *Aster cordifolius* (heart-leaved aster), *Thalictrum dioicum* (early meadow rue), *Dryopteris marginalis* (marginal wood fern), *Equisetum arvense* (common horsetail), and the exotic species *Tussilago farfara*I (coltsfoot). This community type has a somewhat different species composition on bluffs that front Lake Erie than on creek-wall scarps (Charles Bier, personal communication). More data are needed to determine if they warrant separation. This community type is part of the "Great Lakes Region scarp complex."

Related types: The lake sediment scams also contain areas where the substrate is saturated by groundwater seepage. These areas are actively "slumping" and support a combination of herbaceous and woody vegetation. These small wetlands are described in the palustrine section under "Great Lakes Region scarp seep."

Range: Great Lakes Region.

Selected references: Kline 1993, PNDI field surveys.

[Crosswalk: Smith's "Eastern Great Lakes Bluff/Cliff Community," TNC - no crosswalk, SAF - no crosswalk.**]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Great Lakes Region bayberry - mixed shrub palustrine shrubland

In Pennsylvania, this community type occurs only at Presque Isle. The substrate is sand, and the water table fluctuates seasonally; it is at or near the surface during the spring and below the surface in the fall. These are shrublands dominated by a mixture of *Myrica pensylvanica* (bayberry), *Cornus amomum* (red-willow), *Cornus sericea* (red-osier dogwood), *Lonicera morrowii*[I] (Morrow's honeysuckle), and *Salix* spp. (willows), with scattered *Populus deltoides* (cottonwood), and *Betula pendula*[I] (European white birch). Herbaceous species include *Calamagrostis canadensis* (bluejoint), *Carex scoparia* (a sedge), C. *bebbii*[I] (a sedge), *Scirpus atrocinctus* (blackish wool-grass), *Solidago canadensis* (Canada goldenrod), *Juncus acuminatus* (sharp-fruited rush), and *Iris virginicas*[S] (southern blue flag). This community type is part of the "Great Lakes Region beach -dune - sandplain complex."

Related types: This type may closely resemble the "Great Lakes Region bayberry -cottonwood community," which is drier. Because the substrate on which both communities occur is sand, at times when the water table is below the surface, palustrine sites may appear dry. A careful survey for wetland species may be necessary to make a determination. The two types may intergrade.

Range: Great Lakes Region.

Selected references: Bissell and Bier, 1987.

[Crosswalk: Smith's "Eastern Great Lakes Dune Community."**]**

Red-cedar - prickly pear shale shrubland

This community type is restricted to steep, south-facing, eroding slopes composed of thinly bedded, fissile shales. The most representative examples occur along the Delaware River in Pike County. There may be species overlap with the "Red cedar - mixed hardwood rich shale woodland" community type that also occurs on south-facing shale slopes, but examples of this type occur on steeper slopes and lack endemic shale barren species. Typical species here include *Juniperus uirginiana* (red-cedar), *Schizachyrium scoparium* (little bluestem), *Opuntia humifusa*[S] (prickly pear), *Quercus ilicifolia* (scrub oak), *Q. montana* (chestnut oak), *Gaylussacia baccata* (black huckleberry), *Carya glabra* (pignut hickory), *Carex pensylvanica* (Pennsylvania sedge), *Hieracium venosum* (rattlesnake-weed), *Hypericum gentianoides* (orange-grass), *Danthonia spicata* (poverty grass), *Deschampsia flexuosa* (common hairgrass), *Vaccinium angustifolium* (low sweet blueberry), *V. pallidum* (lowbush blueberry), *Campanula rotundifolia* (harebell), *Arabis lyrata* (lyre-leaved rock-cress), *Aster patens* (clasping aster), *Corydalis semperuirens* (rock harlequin), *Solidago nemoralis* (gray goldenrod), *Polytrichum* spp. (hairy-cap moss), *Cladina* spp., and *Cladonia* spp. (reindeer lichens).

Related types: The "Red cedar - mixed hardwood rich shale woodland" type also occurs on shale slopes, but is more southerly in distribution and, unlike this type, is characterized by the presence of shale barren endemics.

Range: Ridge and Valley.

Selected references: Dix 1990, Henry 1954, Keener 1983, Platt 1951, PNDI field surveys.

[Crosswalk: "Smith's Northern Appalachian Shale Barren," TNC's *Juniperus uirginiana - Fraxinus americana* Woodland Alliance, *Juniperus virginiana - Fraxinus americana / Senecio antennarifolius - Oenothera argillicola* Community.**]**

Red-cedar - pine serpentine shrubland

This community is part of the "Serpentine barren complex." It is restricted to areas underlain by serpentinite bedrock. It is this part of the serpentine barren complex that supports a dense, prairie-like graminoid cover with scattered trees and shrubs. Although the most typical aspect is that of a shrubland, some examples of this community type may have a woodland physiognomy. The dominant tree species, often less than 5 meters in height, are *Juniperus virginiana* (red-cedar), *Pinus rigida* (pitch pine), *Pinus virginiana* (Virginia pine), and *Robinia pseudoacacia* (black locust). Other trees include *Quercus marilandica* (blackjack oak), *Q. stellata* (post oak), and *Sassafras albidum* (sassafras). Shrubs include *Rhus copallina* (shining sumac), *Quercus prinoides* (chinquapin oak), *R. glabra* (smooth sumac), and *Gaylussacia baccata* (black huckleberry). Characteristic herbaceous species include graminoids like *Schizachyrium scoparium* (little bluestem), *Andropogon gerardii* (big bluestem), *Sporobolus heterolepis*[S] (prairie dropseed), *Panicum depauperatum*[S] (poverty panic-grass), *Sporobolus vaginiflorus* (poverty grass), *Aristida longispica* (slimspike three-awn), *A. purpurascens*[S] (arrow-feather), *A. dichotoma* (churchmouse three-awn), *Muhlenbergia mexicana* (satin grass), *Setaria geniculata* (knotroot fox-tail), *Eragrostis spectabilis* (purple lovegrass), *Scleria pauciflora*[S] (few-flowered nut-rush), *Sorghastrum nutans* (Indian grass), and *Bouteloua curtipendula*[S] (side-oats gramma), and forbs like *Aster depauperatus*[S] (serpentine aster), *Potentilla canadensis* (old-field cinquefoil), *Phlox subulata* ssp. *subulata* (creeping phlox), *Cerastium arvense* var. *uillosissimum*[S] (barrens chickweed), *Achillea millefolium*[I] (yarrow), *Eupatorium aromaticum* (small white snakeroot), *Oenothera fruticosa* (sundrops), *Senecio anonymus*[S] (plain ragwort), *Solidago nemoralis* (gray goldenrod), and *Antennaria plantaginifolia* (plantain pussytoe).

Related types: This community may be said to end either where woody cover of at least 25% ends (here the "Serpentine barren grassland community" generally begins), or where trees exceed 5 meters in height and the tree canopy reaches about 60% total cover, becoming sufficiently continuous to prohibit dense graminoid cover (here the "Serpentine Virginia pine-oak" or "Serpentine pitch pine - oak forest" generally begins). This type often grades into the one of the serpentine forest types downslope on somewhat deeper soils. This community shares many dominants with both the "Pitch pine - scrub oak woodland" and "Pitch pine - mixed hardwood woodland." The distinction lies in the less common species present in the serpentine type (e.g. *Sporobolus heterolepis, Panicum depauperatum, Bouteloua curtipendula*[S]*)* and the geology itself. This community is associated with several more distinctive community types that are found exclusively on areas of serpentine geology. For a list of those types, and a brief discussion of serpentine ecology, please see the description of the "Serpentine barren complex."

Range: Piedmont.

Selected references: Brooks 1987, Latham 1992, Miller 1977, Smith 1988.

[Crosswalk: Smith's "Eastern Serpentine Barren" (in part), TNC's Pinus (virginiana, rigida) / Schizachyrium scoparium Herbaceous Alliance, Pinus virginiana - Pinus rigida / Schizachyrium scoparium - Scleria pauciflora Community.**]**

Red-cedar - redbud shrubland

This community type occurs in areas of calcareous parent material, where conditions are dry enough to prevent forest development (may also occur successionally on calcareous sites that are less extreme). *Juniperus virginiana* (red-cedar) and *Cercis canadensis* (redbud) are both characteristic of these sites. Other shrubs commonly present include *Ostrya virginiana* (hop-hornbeam), *Amelanchier* spp. (shadbush), *Rhus aromatica* (fragrant sumac), and *Cornus florida* (flowering dogwood). Characteristic herbaceous species include *Bouteloua curtipendula*[S] (tall gramma), *Andropogon gerardii* (big bluestem), *Panicum virgatum* (switch grass), *Sorghastrum nutans* (Indian grass), *Aster oblongifolius* (aromatic aster), *Lithospermum latifolium*[S] (American gromwell), and *Aquilegia canadensis* (wild columbine).

Related types: This community type is closely related to both the "Yellow oak - redbud woodland" type and the "Side-oats gramma calcareous grassland" type. The three types are easily distinguished from each other on the basis of physiognomy. All three may occur together on some sites.

Range: Allegheny Mountain, Piedmont, Pittsburgh Plateau, Ridge and Valley.

Selected references: PNDI field surveys.

[Crosswalk: Smith's "Northern Appalachian Calcareous Rocky Summit Community," TNC's *Juniperus virginiana - Fraxinus americana* Woodland Alliance, *Juniperus uirginiana - Ostrya virginiana - Bouteloua curtipendula* Community and *Quercus muhlenbergii* Woodland Alliance, *Quercus muhlenbergii - Cercis canadensis / Senecio obovatus - Lithospermum canadense* Community.**]**

Low heath shrubland

This community type occurs on either sandy soil or on thin soil over bedrock. Soils are acidic, moisture availability is low. This type most commonly occurs on ridgetops or in other situations where exposure to the elements; the frost-pocket phenomenon, or droughty conditions limits the establishment of trees and taller shrubs. These sites are often subject to periodic fire. The dominant species are *Vaccinium angustifolium* (low sweet blueberry), *V. pallidum* (lowbush blueberry), *Kalmia angustifolia* (sheep laurel), *Aronia melanocarpa* (black chokeberry), and/or *Gaylussacia baccata* (huckleberry). Scattered small trees may occur in some places, for example where soil has accumulated in cracks in the bedrock. Typical species include *Pinus rigida* (pitch pine), *P. strobus* (eastern white pine), *Populus tremuloides* (quaking aspen), and *Betula populifolia* (gray birch). The herbaceous and creeping shrub layer includes such species as *Danthonia compressa* (northern oatgrass), *D. spicata* (poverty grass), *Lysimachia quadrifolia* (whorled loosestrife), *Melampyrum lineare* (cow-wheat), *Deschampsia flexuosa* (hairgrass), *Rubus hispidus* (swamp dewberry), *Mitchella repens* (partridge-berry), *Pteridium aquilinum* (bracken), *Schizachyrium scoparium* (little bluestem), *Carex pensylvanica* (Pennsylvania sedge), *C. communis* (a sedge), and *Gaultheria procumbens* (teaberry). Moss and lichen cover on rocks may be considerable; more information is needed on non-vascular species. This community may occur as part of the "Ridgetop acidic barren complex."

Related types: The "Scrub oak shrubland" and "Pitch pine - scrub oak woodland" types frequently occur adjacent to this type, usually downslope, on slightly deeper soils, or in less exposed areas.

Range: Glaciated NE, Glaciated NW, Pittsburgh Plateau, Pocono Plateau, Ridge and Valley, Unglaciated Allegheny Plateau, and perhaps South Mountain.

Selected references: Clark 1946, Hough 1945, Schege and Butch 1980.

[Crosswalk: Smith's "Northern Appalachian Low Elevation Acidic Rocky Summit." and "Ridgetop Dwarf-Tree Forest" (in part), TNC's *Vaccinium (myrtilloides, pallidum, angustifolium)* Dwarf-Shrubland Alliance, *Vaccinium (myrtilloides, pallidum, angustifolium)* high Alleghenies (HAL) Community.**]**

Low heath - mountain ash shrubland

This community type occurs at high elevations, usually on a thin soil layer over bedrock. Scattered trees may occur in pockets of deeper soil. Characteristic tree species include *Pinus strobus* (eastern white pine), *Betula populifolia* (gray birch), *Acer rubrum* (red maple), *Quercus montana* (chestnut oak), and rarely *Picea rubens* (red spruce). The most characteristic shrub species are *Vaccinium pallidum* (lowbush blueberry) and *Sorbus americana* (mountain ash), although *V. angustifolium* (low sweet blueberry), *Kalmia angustifolia* (sheep laurel), *Gaylussacia baccata* (huckleberry), *Aronia melanocarpa* (black chokeberry) also commonly occur. Herbaceous species include *Potentilla tridentata*^{S} (three-toothed cinquefoil), *Schizachyrium scoparium* (little bluestem), *Deschampsia flexuosa* (hairgrass), *Minuartia glabra*^{S} (Appalachian sandwort), *Campanula rotundifolia* (harebell), and *Lilium philadelphicum* (wood lily). Moss and lichen cover on rocks may be considerable; more information is needed on non-vascular species. This community type may occur as part of the "Ridgetop acidic barrens complex."

Related types: The "Low heath shrubland" is more common than this type and typically occurs at lower elevations than this does. A species mix reflecting a more northern affinity, and specifically the presence of *Sorbus americana* (mountain ash), may be used to distinguish this type. The "Red spruce rocky summit" community type occurs in similar situations, but is much less common in Pennsylvania, with only one known example at the time of writing. Dominance or codominance by *Picea rubens* (red spruce) distinguishes the rarer type from that described here.

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

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

[Crosswalk: Smith's "Northern Appalachian High Elevation Acidic Rocky Summit," TNC's *Vaccinium (myrtilloides, pallidum, angustifolium)* Dwarf-Shrubland Alliance, *Vaccinium angustifolium - Sorbus americana* Community.**]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Scrub oak shrubland

This community type occurs either on sandy soils or on thin soils over bedrock. Conditions are dry; soils are acidic. It most commonly occurs on rocky ridgetops. In this case, it may be part of the "Ridgetop barren complex." It also may occur on sites where frequent or recent disturbance has removed the tree layer. This type also includes most of what is referred to as "Sand barrens." Sand barrens are areas of sandy (Morrison series) infertile soils that form extensive, gently rolling expanses of mostly scrub oak with occasional patches of blueberries ("Low heath shrubland") and grassy frost pockets ("Little bluestem / Pennsylvania sedge grassy opening"). Sand barrens in Pennsylvania are found primarily in Huntingdon and Centre counties. *Quercus ilicifolia* (scrub oak) is by far the dominant shrub species, although low shrubs like *Vaccinium angustifolium* (low sweet blueberry), *V. pallidum* (lowbush blueberry), *Gaultheria procumbens* (teaberry), *Kalmia angustifolia* (sheep laurel), *Gaylussacia baccata* (black huckleberry), *Salix humilis* (dwarf upland willow), *Prunus pumila* var. *susquehanae*^{S} (Appalachian sand cherry), and *Comptonia peregrina* (sweet-fern) sometimes occur beneath the taller shrub stratum. Tree species may occur as scattered individuals or as small patches of woodland. Characteristic tree species include *Populus tremuloides* (quaking aspen), *Quercus prinoides* (chinquapin oak), *and Pinus rigida* (pitch pine). Herbs include *Danthonia compressa* (northern oatgrass), *Pteridium aquilinum* (bracken), *Melampyrum lineare* (cow-wheat), *Andropogon gerardii* (big bluestem), *Schizachyrium scoparium* (little bluestem), and *Hypericum gentianoides* (orange-grass). This community type may occur as part of the "Ridgetop acidic barrens complex."

Related types: The "Pitch pine - scrub oak woodland" type frequently occur in association with this community type; the two may be delineated at the physiognomic cutoff for woodlands: 10% cover by trees greater than five meters high.

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

Selected references: Slack et al. 1991.

[Crosswalk: Smith's "Northern Appalachian Sand Barren" (in part), "Ridgetop Dwarf-Tree Forest" (in part), TNC's *Quercus ilicifolia* Shrubland Alliance.**]**

Rhodora - mixed heath - scrub oak shrubland

This is a very rare, highly restricted community type. It is known only from the southern Pocono Plateau. This barren-like vegetation does not appear to be a response to droughty or nutrient-poor soils. The same deep, fine-loamy Illinoian till on which it occurs also underlies nearby forests (Latham et al. 1997). The origin of the barrens, and the processes responsible for their persistence and distribution are not known, but fire appears to be a critical factor. Please see the description for the "Mesic till barrens complex" for more information. The shrub layer is dominated by a combination of *Quercus ilicifolia* (scrub oak), *Kalmia angustifolia* (sheep laurel), *Rhododendron canadense* (rhodora), and *Vaccinium angustifolium* (low sweet blueberry), often with just one or two of these species in much greater abundance that the others, with an admixture of *Aronia melanocarpa* (black chokeberry), *Gaylussacia baccata* (black huckleberry), *V. pallidum* (lowbush blueberry), and *Viburnum cassinoides* (withe-rod). Other shrub species commonly include *Amelanchier sanguinea*[S] (round serviceberry), *A. stolonifera* (low juneberry), *Chamaedaphne calyculata* (leatherleaf), *Comptonia peregrina* (sweet-fern), *Gaylussacia frondosa* (dangleberry), *Hamamelis Virginiana* (witch-hazel), *Lyonia ligustrina* (maleberry), *Spiraea latifolia* (meadow-sweet), *Vaccinium corymbosum* (highbush blueberry), *Viburnum myrtilloides* (sour-top blueberry), and *V. stamineum* (deerberry). Scattered trees may be present, mostly *Pinus rigida* (pitch pine) and *Acer rubrum* (red maple). The most abundant species in the herbaceous and creeping shrub layer are *Carex pensylvanica* (Pennsylvania sedge), *Pteridium aquilinum* (braken fern), *Gaultheria procumbens* (teaberry), *Oryzopsis racemosa* (ricegrass) and *Rubus hispidus* (dewberry). This is part of the “Mesic till barren complex.”

Related types: This type usually occurs in combination with the “Pitch pine – rhodora –scrub oak woodland” type. These two types, together with small herbaceous openings or “frost pockets” constitute the “Mesic till barren complex.” For more information on the ecology of these systems, consult the description of the complex. This community type and its associated complex share many species with several community types belonging to the “Acidic ridgetop barren complex.” The predominance of *Rhododendron canadense* (rhodora), the presence of deep, mesic soils and the restricted distribution of this type easily distinguish it from its ridgetop counterpart.

Range: Pocono Plateau

Selected references: Latham et al. 1996

[Crosswalk: Smith’s “Mesic Scrub Oak – Heath – Pitch Pine Barrens” (in part), TNC’s *Pinus rigida* Seasonally Flooded (sic.) Woodland Alliance, *Pinus rigida – Quercus ilicifolia – Rhododendron canadense* Community.**]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Great Lakes Region bayberry - cottonwood community (also a shrubland type)

In Pennsylvania this community type occurs only on Presque Isle. This community type is dominated by a mixture of trees and shrubs. Characteristic species include *Myrica pensylvanica* (bayberry), *Amelanchier* spp. (shadbush), *Salix* spp. (willows), *Cornus* spp. (dogwoods), *Populus deltoides* (cottonwood), and the exotic species *Betula pendula*[I] (European white birch) and *Lonicera morrowii*[I] (Morrow's honeysuckle). Herbaceous species include *Sorghastrum nutans* (Indian grass), *Rumex acetosella*[I] (sheep sorrel), *Panicum uirgatum* (switch grass), *Schizachyrium scoparium* (little bluestem), *Carex tonsa* (a sedge), and *C. muhlenbergii* (a sedge). This type includes both shrubland and woodland physiognomy. Because of the extremely dynamic nature of this system, a variety of successional stages are main-tained in a complex mosaic. This community type is part of the "Great Lakes Region beach - dune - sandplain complex."

Related types: Because of the extremely dynamic nature of this system, the hydrology, physiognomy, and species composition of these sites may shift dramatically over short periods of time. Lake level changes, storm action, and shifting sands cause this community type to intergrade in space and time with the "Great Lakes Region dry sandplain," the "Great Lakes Region palustrine sandplain," "Great Lakes Region bayberry -mixed shrub palustrine shrubland" and, to a lesser extent, "Great Lakes Region sparsely vegetated beach." For more information on the ecology these community types, see the description of the "Great Lakes Region beach - dune - sandplain complex."

Range: Great Lakes Region.

Selected references: Bissell and Bier 1987.

[Crosswalk: Smith's "Eastern Great Lakes Dune Community," TNC - no crosswalk, SAF - no crosswalk (the Cottonwood (63) type is closest).**]**

Little bluestem - Pennsylvania sedge opening

These grasslands occur on dry, acidic sites (usually over sandstone) where woody invasion is prevented or slowed by thin soil, droughty conditions, microclimate (frost pockets), frequent fire, or other disturbance regime. Some of these sites include rock outcrops and near-vertical cliffs. Species include *Schizachyrium scoparium* (little bluestem), *Carex pensylvanica* (Pennsylvania sedge), *Danthonia spicata* (poverty grass), *Deschampsia flexuosa* (common hairgrass), *C. communis* (a sedge), *Rubus flagellaris* (prickly dewberry), *Lespedeza* spp. (bush-clovers), and less commonly, *Oryzopsis pungens*[S] (slender mountain ricegrass). Mosses and lichens, especially *Cladonia* spp. and *Cladina* spp. (reindeer lichens), and *Polytrichum* spp. (hairy-cap mosses) are abundant on some sites. This community type may occur as part of the "Ridgetop acidic barrens complex."

Related types: This community type may occur as openings in any of the dry acidic woody types (forests, woodlands, or shrublands).

Range: Entire state.

Selected references: Carke 1946, Hough 1945, Schegel and Butch 1980.

[Crosswalk: Smith's "Acidic Rocky Summit," "Ridgetop Dwarf-Tree Forest" (in part), TNC - no crosswalk.**]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Side-oats gramma calcareous grassland

These grasslands occur as small (usually well under 0.5 hectares) prairie-like openings in areas of thin soils over calcareous bedrock. The dominant vegetation is graminoid, although scattered forbs and woody species are usually also present. Characteristic species include *Bouteloua curtipendula*[S] (side-oats gramma), *Andropogon gerardii* (big bluestem), *Sorghastrum nutans* (Indian grass), *Panicum virgatum* (switchgrass), *Schizachyrium scoparium* (little bluestem), *Carex pensylvanica* (Pennsylvania sedge), *Lespedeza* spp. (bush clovers), *Desmodium* spp. (tick-trefoil), *Asclepias verticillata* (whorled milkweed), A. *viridiflora* (green milkweed), *Onosmodium molle* ssp. *Hispidissimum*[S] (false gromwell), *Senecio obovatus* (groundsel), *Lithospermum canescens* (hoary pucccoon), and *Solidago bicolor* (silver-rod). Typical woody species, which may occur scattered throughout or at margins, include *Cercis canadensis* (redbud), *Celtis tenuifolia* (dwarf hackberry), *Juniperus virginiana* (red-cedar), *Fraxinus americana* (white ash), *Quercus muhlenbergii* (yellow oak), *Ostrya virginiana* (hop-hornbeam), *Cornus florida* (flowering dogwood), *Rhus glabra* (smooth sumac), *Rhus aromatica* (fragrant sumac), and *Viburnum rafinesquianum* (downy arrow-wood).

Related types: Several woodland and shrubland types may contain openings of *Bouteloua curtipendula*[S] (side-oats gramma) and other grasses. These types include the "Yellow oak - redbud woodland," and the "Red-cedar -redbud shrubland." Very small openings within a matrix of these types may be considered to be part of the woodland or shrubland types in which they occur. The "Calcareous opening/cliff" is another open calcareous community type. The cliff type tends to occur on small outcrops or on steep slopes or cliffs. There is generally some degree of shading either from the landform itself or from the surrounding vegetation. Grasses dominate the grassland type, while forbs and ferns dominate the cliff type.

Range: Ridge and Valley, Piedmont.

Selected references: PNDI field surveys.

[Crosswalk: Smith's "Northern Appalachian Calcareous Rocky Summit" (in part), TNC's *Schizachyrium scoparium - Bouteloua curtipendula* Herbaceous Alliance.**]**

Calcareous opening/cliff

This community type occurs on calcareous cliffs, out-crops, and rocky slopes. There is generally some degree of shading from the surrounding forest or woodland community or from the land form itself. Species composition varies with the amount of moisture, shade and exposure. Herbaceous species include *Aquilegia canadensis* (wild columbine), *Dodecatheon meadia*[S] (shooting star), *Aster ericoides*[S] (white heath aster), *A. oblongifolius* (aromatic aster), *Cystopteris bulbifera* (bladder fern), *Bouteloua curtipendula*[S] (side-oats gramma), *Pellaea atropurpurea* (purple cliff-brake), *Dryopteris marginalis* (evergreen wood fern), *Allium cernuum* (nodding onion), *Heuchera americana* (alum-root), *Carex oligocarpa* (a sedge), *Asplenium trichomanes* (maidenhair spleenwort), *Arabis hirsuta*[S] (hairy rock-cress), *A. lyrata* (lyre-leaved rock-cress) and *Saxifraga virginiensis* (early saxifrage). Woody species may occur scattered throughout or at the margins, these species include *Juniperus virginiana* (red-cedar), *Rhus aromatica* (fragrant sumac), *Toxicodendron radicans* (poison-ivy), *Hydrangea arborescens* (seven-bark), *Fraxinus americana* (white ash), *Parthenocissus quinquefolia* (Virginia creeper), *Cercis canadensis* (redbud), *Tilia americana* (basswood), *Carya* spp. (hickories), *Quercus muhlenbergii* (yellow oak), *Ostrya virginiana* (hop-hornbeam), and *Cornus florida* (flowering dogwood).

Related types: The "Yellow oak - redbud woodland" may contain openings that resemble this type. Small openings within a matrix of this or other types may be considered to be part of the forest, woodland, or shrubland types in which they occur. The "Side-oats gramma calcareous grassland" is another open calcareous community type. Grasses dominate the grassland type, while forbs and ferns dominate the cliff type. This type tends to occur on small outcrops or on steep slopes or cliffs, often in a forested context, while the grassland type is generally more open, less steep, and often grades into a shrubland or woodland at the edges.

Selected references: PNDI field surveys.

Range: Ridge and Valley, Piedmont, and perhaps Allegheny Mountain and the Pittsburgh Plateau.

[Crosswalk: Smith's "Northern Appalachian Calcareous Cliff Community," TNC's *Pellaea atropurpurea* Sparsely Vegetated Calcareous Cliff Alliance.**]**

Serpentine grassland

This community type is part of the "Serpentine barren complex." It is restricted to areas underlain by serpentinite bedrock. The dense, prairie-like graminoid cover is usually dominated by warm-season (C4) grasses. Warm-season grasses characteristic of this community include *Schizachyrium scoparium* (little bluestem), *Muhlenbergia mexicana* (muhly), *Eragrostis spectabilis* (purple love-grass), *Setaria geniculata* (perennial foxtail), *Andropogon gerardii* (big bluestem), *Sporobolus heterolepis*S (prairie dropseed), *Sorghastrum nutans* (Indian grass), and *Bouteloua curtipendula*S (side-oats gramma). Other species commonly found include *Senecio anonymus*S (plain ragwort), *Aristida purpurascens*S (arrow-feather), *A. dichotoma* (churchmouse three-awn), *Aster depauperatus*S (serpentine aster), *Panicum acuminatum* (a panic-grass), *P. annulum* (annulus panic-grass), *P. dichotomum* (a panic-grass), *P. oligosanthes* (a panic-grass), *P. sphaerocarpon* (a panic-grass), *Potentilla canadensis* (old-field cinquefoil), *Rosa carolina* (prairie rose), *Setaria geniculata* (perennial foxtail), *Cerastium arvense* var. *villosissimum*S (barrens chickweed), *Phlox subulata* ssp. *subulata* (creeping phlox), *Achillea millefolium*I (yarrow), *Eupatorium aromaticum* (small white snakeroot), *Scleria pauciflora* (few-flowered nutrush), *Oenothera fruticosa* (sundrops), *Solidago nemoralis* (gray goldenrod), *Antennaria plantaginifolia* (plantain pussytoes), *Asclepias verticillata* (whorled milkweed), and A. *viridiflora* (green milkweed).

Related types: This community may be said to end either where graminoid dominance and continuous soil substrate ends (here the "Serpentine gravel forb community" generally begins), or where shrub cover reaches about 25% (here the "Red-cedar - pine serpentine shrubland" generally begins).

Range: Piedmont.

Selected references: Latham 1992, PNDI field surveys.

[Crosswalk: Smith's "Eastern Serpentine Barren," TNC's *Pinus (virginiana, rigida) / Schizachyrium scoparium* Herbaceous Alliance, *Pinus virginiana - Pinus rigida / Schizachyrium scoparium - Scleria pauciflora* Community.**]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Serpentine gravel forb community

This community type is part of the "Serpentine barren complex." It occurs exclusively on areas of gravel or very thin soil over serpentine bedrock. These areas are not shaded; conditions are intermittently extremely dry and daytime surface temperatures are high. These factors combined with the serpentine chemistry of the substrate support a community with sparse, xeromorphic forb cover. It is in these areas that the majority of serpentine endemic plant species are found. Characteristic species include *Asclepias verticillata* (whorled milkweed), *Arabis lyrata* (lyre-leaved rock-cress), *Minuartia michauxii* (rock sandwort), *Aster depauperatus*[S] (serpentine aster), *Cerastium arvense* var. *villosissimum*[S] (barrens chick-weed), *Fimbristylis annua*[S] (annual fimbry), *Aristida dichotoma* (churchmouse three-awn), A. *longispica* (slimspike three-awn), *Chamaecrista fasciculata* (prairie senna), *Juncus secundus* (one-sided rush), *Panicum sphaerocarpon* (a panic grass), *Polygala verticillata* (whorled milkwort), *Polygonum tenue* (slender knotweed), *Sporobolus vaginiflorus* (poverty grass), *Viola sagittata* (arrow-leaved violet), *Scleria pauciflora*[S] (few-flowered nut-rush), *Talinum teretifolium*[S] (round-leaved fame-flower), *Phlox subulata* ssp. *subulata* (moss-pink), and stunted *Schizachyrium scoparium* (little bluestem).

Related types: This community type generally grades into the "Serpentine grassland" type. They may be delineated where sod formation and graminoid dominance begins.

Range: Piedmont.

Selected references: Latham 1992, PNDI field surveys.

[Crosswalk: Smith's "Eastern Serpentine Barren," TNC's *Cerastium arvense* Sparsely Vegetated Alliance.**]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."

Great Lakes Region dry sandplain

These are dry grasslands occurring on sand deposits along the Lake Erie shoreline. In Pennsylvania, this community type occurs only at Presque Isle. The dominant species are *Sorghastrum nutans* (Indian grass), *Panicum virgatum* (switch grass), and *Schizachyrium scoparium* (little bluestem). Other species commonly present include *Carex muhlenbergii* (a sedge), *C. tonsa* (a sedge), *Rumex acetosella*[I] (sheep sorrel), and *Panicum commonsianum*[S] (panic grass). There may be scattered shrubs and small trees, although they usually contribute less than 25% cover overall. The most common woody species are *Populus deltoides* (cottonwood), *Betula pendula*[I] (European white birch), and *Myrica pensylvanica* (bayberry). This community type is part of the "Great Lakes Region beach - dune - sandplain complex."

Related types: This type often grades into the "Great Lakes Region bayberry - cottonwood community", which represents a somewhat later successional stage. This type may also resemble the "Great Lakes Region palustrine sandplain." Because of the sandy soils on which both types occur, the wetter type may appear dry for much of the year. It is the difference in species composition that distinguishes the two types.

Range: Great Lakes Region.

Selected references: Bissell and Bier, 1987.

[Crosswalk: Smith's "Eastern Great Lakes Sand Plain," TNC's *Panicum virgatum - Schizachyrium scoparium* Herbaceous Alliance.**]**

Vascular plant nomenclature follows Rhoads and Klein (1993). Bryophyte nomenclature follows Crum and Anderson (1981). Species not native to Pennsylvania are indicated by a superscript "I." The aggressive species *Phalaris arundinacea* (reed canary-grass) and *Phragmites australis* (common reed) are marked with a superscript "(I)", as their native status is unclear. Pennsylvania species of special concern are indicated by a superscript "S."