# A PRELIMINARY NATURAL COMMUNITY CLASSIFICATION FOR NEW JERSEY

by
Thomas F. Breden

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In this conference we have addressed many different groups of endangered species. We have discussed vascular plants and one group of non-vascular plants. We have looked at vertebrate animals and two groups of invertebrate species. But we haven't addressed the full array of biological diversity in the state. There are many groups of non-vascular plants and invertebrate animals which we haven't addressed and may not even have the expertise to inventory. We haven't even addressed fungi and microbial organisms.

In order to work towards preserving the full array of natural diversity, Natural Heritage Programs have identified entire natural communities as elements of natural diversity to be inventoried and preserved in total. It is our assumption that if high quality examples of all of the natural communities in the state are preserved, then the majority of the species which cannot be inventoried individually will be preserved as well. It is hoped that formal recognition of these communities will bring about increased preservation efforts. Appendix VIII ranks each of the communities according to it's rarity in the state. Out of 58 communities recognized here, 27 may be imperiled within the State. Please see appendix III for a description of natural heritage ranks.

This paper will present a preliminary natural community classification for New Jersey. We have defined a natural community to be: a distinct and reoccurring assemblage of populations of plants, animals, bacteria and fungi naturally associated with each other and their physical environment. Natural communities are characterized and defined by a combination of physiognomy, vegetation structure and composition, topography, substrate, and soil moisture and reaction. Open canopied communities which have formed as a result of anthropogenic ground disturbances such as agriculture or mining have not been included in this classification.

The classification is broken down into seven systems: Marine,

Estuarine, Riverine, Lacustrine, Palustrine, Terrestrial,

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and Subterranean. Within the systems, the communities have been grouped based on canopy closure, tidal regime, and salinity. The classification does not yet include communities from the Riverine and Lacustrine systems. The wetland system definitions were paraphrased from the US Fish and Wildlife Service's Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et. al. 1979). The Terrestrial and Subterranean system definitions were developed by The Nature Conservancy (White 1986).

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MARINE SYSTEM

Definition. The Marine System consists of the open ocean overlying the continental shelf and its associated high-energy coastline. Marine habitats are exposed to the waves and currents of the open ocean and the water regimes are determined primarily by the ebb and flow of oceanic tides. Salinities exceed 30 ppt, with little or no dilution except outside the mouths of estuaries. Shallow coastal indentations or bays without appreciable freshwater inflow, and coasts with exposed rocky islands that provide the mainland with little or no shelter from the wind and waves, are also considered part of the Marine System because they generally support typical marine biota.

Limits. The Marine System extends from the outer edge of the continental shelf shoreward to one of three lines: (1) the landward limit of tidal inundation (extreme high water of spring tides), including the splash zone from breaking waves; (2) the seaward limit of wetland emergents, trees, or shrubs; or (3) the seaward limit of the Estuarine System, where this limit is determined by factors other than vegetation. Deepwater habitats lying beyond the seaward limit of the Marine System are outside the scope of this classification system.

Description. The distribution of plants and animals in the Marine System primarily reflects differences in four factors: (1) degree of exposure of the site to waves; (2) texture and physiochemical nature of the substrate; (3) amplitude of the tides; and (4) latitude, which governs water temperature, the intensity and duration of solar radiation, and the presence or absence of ice. Community descriptions have been grouped based on tidal regime.

SUBTIDAL COMMUNITIES:

Marine Deepwater Community

Bottom is deeper than the zone of light penetration (greater than 6 feet). Not inventoried by NJNHP.

Marine Subtidal Aquatic Bed

Shallow waters (less than 6 feet) below mean low water where light penetrates to the bottom allowing for growth of rooted aquatic plants. Not inventoried by NJNHP.

INTERTIDAL COMMUNITIES:

Marine Intertidal Gravel/Sand Beach Community

Communities forming on the sandy beach area from mean low water to the extreme high water of spring tides. Vegetation is sparse due to heavy wave action and wind erosion. Sparse vegetation of the upper beach includes Cakile edentula, Arenaria peploides, Salsola kali, Euphorbia polygonifolia, Cenchrus tribuloides, Sesuvium maritimum, and occasionally Ammophila breviligulata. Some sites are important shorebird feeding and nesting grounds.

Range: Outer Coastal Plain, Cape May to Sandy Hook.

References: Harshberger, 1910
Martin, 1959
Tiner, 1985
Unpublished Natural Heritage Program field studies

ESTUARINE SYSTEM

Definition. The Estuarine System consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semienclosed by land but have open, partly obstructed, or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. The salinity may be periodically increased above that of the open ocean by evaporation. Along some low-energy coastlines there is appreciable dilution of sea water. Offshore areas with typical estuarine plants and animals, such as red mangroves (Rhizophora mangle) and eastern oysters (Crassostrea virginica), are also included in the Estuarine System.

Limits. The Estuarine System extends (1) upstream and landward to where ocean-derived salts measure less than 0.5 ppt* during the period of average annual low flow; (2) to an imaginary line closing the mouth of a river, bay, or sound; and (3) to the seaward limit of wetland emergents, shrubs, or trees where they are not included in (2). The Estuarine System also includes off-shore areas of continuously diluted sea water.

*note: Some oligohaline tidal wetlands with salinities higher

than 0.5ppt may have been classified as palustrine communities because of similarities of species composition with strictly freshwater tidal wetlands.

Description. The Estuarine System includes both estuaries and lagoons. It is more strongly influenced by its association with land than is the Marine System. In terms of wave action, estuaries are generally considered to be low-energy systems (Chapman 1977).

Estuarine water regimes and water chemistry are affected by one or more of the following forces: oceanic tides, precipitation, freshwater runoff from land areas, evaporation, and wind. Estuarine salinities range from hyperhaline to oligohaline. The salinity may be variable, as in hyperhaline lagoons (e.g., Laguna Madre, Texas) and most brackish estuaries (e.g., Chesapeake Bay, Virginia-Maryland); or it may be relatively stable, as in sheltered euhaline embayments (e.g., Chincoteague Bay, Maryland) or brackish embayments with partly obstructed access or small tidal range (e.g., Pamlico Sound, North Carolina). (For an extended discussion of estuaries and lagoons see Lauff 1967.) Community descriptions have been grouped based on tidal regime and salinity.

## SUBTIDAL COMMUNITIES

### Polyhaline Subtidal Aquatic Bed

Shallow waters (less than 6 feet) below mean low water where light penetrates to the bottom allowing for growth of rooted aquatic plants. Found in saline parts of estuaries behind barrier islands where large bays exist. Ulva lactuca, Codium fragile, Gracilaria spp. are common algae, and Zostera marina, and Ruppia maritima are common vascular plants in this NC. Potamogeton pectinatus and Zannichellia palustris are found in bay areas of decreasing salinity.

Range: Outer Coastal Plain, in estuaries behind barrier islands. Cape May to Monmouth Co.

References: Good, et al., 1978
Taylor, 1970
Tiner, 1985

### Estuarine Deepwater Community

Bottom is deeper than zone of light penetration (greater than 6 feet). No data collected by NJNHP.

### Mesohaline/Oligohaline Subtidal Aquatic Bed

Shallow waters (less than 6 feet) below mean low water where light penetrates to the bottom allowing for growth of rooted aquatic plants. Found in lower salinity portions of coastal rivers. Plant species include Potamogeton perfoliatus, P. pusillus, P. epihydrus, Lilaeopsis chinensis, Vallisneria americana, Najas flexilis, and submergent forms of Eriocaulon parkeri and Sagittaria calycina. Included in this NC are coastal salt ponds - large ponds adjacent to ocean or tidal bays which are occasionally breached by storm tides.

Range: Reported from coastal rivers in Outer Coastal Plain.

References: Ferren, et al., 1981
Tiner, 1985

INTERTIDAL/POLYHALINE COMMUNITIES:

Salt Marsh Complex

A marsh community occupying saline reaches of estuaries. Low marsh areas that experience regular daily flooding are dominated by Spartina alterniflora. High marsh areas are flooded less often with Spartina patens, Distichlis spicata, Juncus gerardii dominating the high marsh; Salicornia bigelovii, S. europea, S. virginica, Atriplex patula, and Pluchea purpurascens in the pannes (ephemeral high salinity pools); and Spartina patens, Sabatia dodecandra, S. stellaris, Solidago sempervirens, Phragmites australis, Baccharis halimifolia, and Iva fructescens along the marsh-upland border.

Range: Coastal Plain and Piedmont from Delaware Bay to New York Harbor.

References: Good, 1965
Martin, 1959
Tiner, 1985

INTERTIDAL/MESOHALINE (BRACKISH) COMMUNITIES:

Brackish Tidal Marsh Complex

Tidal marshes occupying zones in estuaries where fresh and salt water mix. Dominant species include Typha angustifolia, Spartina cynosuroides, Phragmites australis, and Scirpus americanus. Associated species include Amaranthus cannabinus, Lilaeopsis chinensis, Scirpus pungens, Hibiscus moscheutos, Kosteletzkya virginica, Pluchea odorata, Ptilimnium capillaceum, Scirpus cylindricus.

Range: Brackish portions of coastal rivers along Inner Coastal

Plain, Outer Coastal Plain, and possibly the Piedmont.

References: Ferren, 1976
Ferren et. al, 1981
Tiner, 1985

PALUSTRINE SYSTEM

Definition. The Palustrine System includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens, and all such wetlands that occur in tidal areas where salinity due to ocean-derived salts is below 0.5 ppt. It also includes wetlands lacking such vegetation, but with all of the following four characteristics: (1) area less than 8 ha (20 acres); (2) active wave-formed or bedrock shoreline features lacking; (3) water depth in the deepest part of basin less than 2 m at low water; and (4) salinity due to ocean-derived salts less than 0.5 ppt.

Limits. The Palustrine System is bounded by upland or by any of the other four systems.

Description. The Palustrine system was developed to group the vegetated wetlands traditionally called by such names as marsh, swamp, bog, fen, and prairie, which are found throughout the United States. It also includes the small, shallow, permanent or intermittent water bodies often called ponds. Palustrine wetlands may be situated shoreward of lakes, river channels, or estuaries; on river floodplains; in isolated catchments; or on slopes. They may also occur as islands in lakes or rivers. The erosive forces of wind and water are of minor importance except during severe floods.

The emergent vegetation adjacent to rivers and lakes is often referred to as "the shore zone" or the "zone of emergent vegetation" (Reid and Wood 1976), and is generally considered separately from the river itself. As an example, Hynes (1970) wrote in reference to riverine habitats, "We will not here consider the long list of emergent plants which may occur along the banks out of the current, as they do not belong, strictly speaking, to the running water habitat." There are often great similarities between wetlands lying adjacent to lakes or rivers and isolated wetlands of the same class in basins without open water. Within this system, community descriptions are grouped based on canopy

closure and tidal regime.

OPEN CANOPY/TIDAL/FRESHWATER-OLIGOHALINE COMMUNITIES:

Freshwater Tidal Marsh Complex

An intertidal marsh community found adjacent to oligohaline-/freshwater portions of tidal rivers. Although some examples or portions of this community may belong in the Estuarine or Riverine Systems, the community is described in it's entirety here under the Palustrine System. Generally speaking, freshwater tidal marshes can be broken down into three zones: a lower intertidal flat, a midtidal zone, and an upper tidal zone. Not all occurrences have all three zones and in some instances where the slope of the shoreline is abrupt, species from all three zones may be found in close proximity to one another.

The lower intertidal flat is a sparsely vegetated zone which is only exposed for a few hours each tide. Associated species include Isoetes riparia, Scirpus smithii var. smithii, Eriocaulon parkeri, Sagittaria rigida, S. gramineum, S. subulata. Small pools and seeps may contain Najas flexilis, Potamogeton pectinatus, Elodea canadensis, and Vallisneria americana. Widely spaced patches of Nuphar lutea and Pontederia cordata may also be present.

Above the lower marsh zone is the midtidal zone where Zizania aquatica often dominates. Also found associated with Z. aquatica or as dominants or codominants in other patches are Nuphar lutea, Pontederia cordata, Peltandra virginica, Scirpus pungens, Amaranthus cannabinus, Polygonum punctatum. Also associated with this zone are Bidens laevis, Sagittaria latifolia, Heteranthera reniformis, Heteranthera multiflora, Cyperus rivularis, Cyperus brevifolioides, Sagittaria spp.

The upper tidal zone has a diversity of species including Typha angustifolia, Typha glauca, Onoclea sensibilis, Polygonum arifolia, Sagittaria spp., Scirpus fluviatilis, Acorus calamus, Bidens laevis, Impatiens capensis, Hibiscus palustris, Lythrum salicaria, Phragmites australis, and other species. Shrubs include Cornus amomum, Cephalanthus occidentalis, and Rosa palustris. In marshes where a well developed levee forms in front of this zone, pond like areas can be found with Nuphar lutea, Pontederia cordata, Peltandra virginica, and some of the above species dominating.

Range: Inner Coastal Plain and Outer Coastal Plain.

References: Batory, 1980
Ferren, 1976
Good and Good, 1974
Metzler, 1984
McCormick and Ashbaugh, 1972
Tiner, 1985
Unpublished Natural Heritage Program field studies

OPEN CANOPY/NONTIDAL COMMUNITIES:

Inland Acidic Seep

An open, graminoid/herb dominated community occurring on hillsides in North Jersey where cold ground water emerges in a diffuse pattern. Presence of a shallow fragipan in the soil may contribute to the emergence of ground water. Sphagnum moss is present on hummocks at the base of scattered shrubs and trees. Calcicoles are absent. Species of northern affinities may be found in this cool spring water environment.

Deschampsia cespitosa is the dominant species in our exemplary EO. Other characteristic species include species of seepage areas such as Symplocarpus foetidus, and species of more northern affinities such as Cerastium beeringianum, Pinus strobus.

Range: Only known from Kittatinny Mountains in Sussex Co. One small seep (not an exemplary occurrence) known from Musconetcong Mountain in Hunterdon Co.

References: Unpublished Natural Heritage field studies.

Coastal Interdunal Marsh

A marsh occupying low areas between dunes. Usually dominated by robust emergents such as Typha latifolia, Phragmites australis, Hibiscus palustris, or Thelypteris palustris. Additional species include Andropogon virginicus var. abbreviatus, Cyperus filicinus, Cyperus odoratus, Eleocharis erythropoda, Eupatorium album, Oenothera perennis, Osmunda cinnamomea, Osmunda regalis, Polygonum pensylvanicum, Scirpus americanus. Shrubs which commonly invade this marsh are Toxicodendron radicans, Rosa rugosa, and Vaccinium corymbosum. Thickets can develop which include in addition to the above Myrica pensylvanica, Juniperus virginiana, Acer rubrum, Baccharis halimifolia, and Aronia arbutifolia.

Range: Outer Coastal Plain.

References: Harshberger, 1900
Martin, 1959

Calcareous Fen

A shrub and herb dominated community formed in low areas where calcareous groundwater seepage is present. The calcareous seepage creates a harsh environment in which a number of characteristic species are adapted to survive. These fens are found in level basins where peat mats often develop, and on sloping hillsides where a build up of peat material is not as noticeable. Some fens have small localized spring seeps where the groundwater bubbles up and flows over mineral soil. Marl can build up and form rings around rocks in seepage rivulets. Groundwater seepage is not so apparent in other areas of fens and may simply act to keep the soil moist or saturated throughout the year.

Dominant plant species include Deschampsia cespitosa, Carex stricta, Betula pumila, Potentilla fruticosa, Salix serissima, Salix discolor, Salix gracilis, Acer rubrum, Toxicodendron vernix.

Other characteristic plant species include Ribes hirtellum,

Salix candida, Salix pedicillaris, Parnassia glauca, Rhamnus alnifolia, Carex tetanica, Utricularia intermedia, Lobelia kalmii, Cirsium muticum, Solidago uliginosum linoides, Epilobium strictum, Aster borealis, Thuja occidentalis, Eriophorum viridi-carinatum, Carex aquatilis, Muhlenbergia glomerata, Carex hystricina, Carex flava, Carex prairea, Juncus brachycephalus, Juncus dudleyi. Characteristic animal species include Neonympha mitchellii, Hemileuca new species #2, and Macrochilo hypocritalis.

Range: The great valley of the Ridge and Valley physiographic province in Sussex and Warren Counties.

References: Karlin and Andrus, 1988
Unpublished Natural Heritage field studies.

Streamside/Lakeside Shrub Swamp

Shrub swamp receiving streamside or lakeside sediments. Common species include Alnus, Salix, Cornus amomum, Cephalanthus occidentalis, Rosa palustris. Classification needs work, need more data.

Range: Probably occurs in the Ridge and Valley, Highlands, Piedmont and perhaps Inner Coastal Plain.

Coastal Plain Intermittent Pond

Intermittent pond of the Outer Coastal Plain. Dominated by herbaceous vegetation (shrub dominated intermittent ponds are classified as pine barrens shrub swamps). Several ponds important for endangered plant species have been surveyed. Dominant (>10% cover) species include Carex walteriana, Panicum verrucosum, Scleria reticularis, Panicum capillare, Coreopsis rosea, Cladium mariscoides, Panicum mattamuskeettense, Muhlenbergia torreyana, Eleocharis microcarpa. Additional rare species include Lobelia canbyi, Nymphoides cordata, Sagittaria teres, Panicum wrightianum, Psilocarya nitens, Lobelia boykinii, Paspalum dissectum, Ludwigia linearis, Panicum hirstii, Manisuris rugosa, Xyris smalliana, Eleocharis equisetoides. Sphagnum macrophyllum, Sphagnum macrophyllum var. floridanum and Sphagnum lescurii are characteristic bryophytes. More survey work is needed to describe the full range of variability in species composition for these ponds.

Range: Outer Coastal Plain.

References: Cavileer and Gallegos, 1982
Montgomery and Fairbrothers, 1963
Unpublished Natural Heritage field studies

River Bar Community

Formed on islands or river banks with sandy, gravelly, or cobbly river deposits. Betula nigra forms thickets in some areas. Characteristic species include Prunus depressa, Salix interior, Betula nigra.

Range: Ridge and Valley, Piedmont, and perhaps Highlands.

References: Unpublished Natural Heritage field studies.

Inland Calcareous Pond Shore

Shallow edges of calcareous ponds which experience seasonal rise and drop of water level. Limestone sinkhole ponds are included here. Common species include Nuphar variegatum, Myriophyllum spp., Utricularia spp. Rare plants include Boltonia asteroides, Sagittaria cuneata, Scirpus torreyi, Ranunculus flabellaris, Alisma triviale. More data needed.

Range: Great valley of the Ridge and Valley physiographic province.

References: Snyder, 1986

Inland Graminoid Marsh

Marshes outside of the coastal plain with narrow leaved graminaceous dominants such as Carex stricta, Scirpus cyperinus, Juncus effusus, Leersia oryzoides, Calamagrostis canadensis. Other species frequently present include Lythrum salicaria, Iris versicolor, Polygonum spp., Sagittaria spp., Sparganium spp., Symplocarpus foetidus. Much variability exists. Classification needs work.

Range: Ridge and Valley, Highlands, and Piedmont.

References: Jervis, 1963
Tiner, 1985

Inland Noncalcareous Pond Shore

Shallow edges of noncalcareous ponds which experience seasonal rise and drop of water level. Includes species such as Nymphoides cordata, Polygonum pennsylvanicum, Isoetes echinata. Rare species include Eriocaulon septentrionalis and Lobelia dortmanna. More data needed.

Range: Mostly glaciated portions of Ridge and Valley, Highlands,

and Piedmont.

Glacial Bog

A shrub and herb dominated community on a sphagnum mat which fills in acidic kettlehole depressions in Northern New Jersey. Often dominated by Chamaedaphne calyculata, other characteristic shrubs include Andromeda glaucophylla, Kalmia polifolia, Kalmia angustifolia. Small trees of Picea mariana and Larix laricina are often scattered on the bog mat. Sphagnum bartlettianum, Sphagnum cuspidatum, Sphagnum fallax and Sphagnum recurvum are the most prominent bryophytes.

Range: Glaciated portions of Ridge and Valley and Highlands.

References:
Karlin and Andrus, 1986
Karlin and Lynn, 1988
Lynn and Karlin, 1985
Mackenzie, 1918
Montgomery and Fairbrothers, 1963

Pine Barren Savanna

A grass and sedge dominated community found in the floodplains of pine barrens streams, along old stream channels. Usually the savanna is separated from the river by a well developed levee. Barren areas of bog iron are present in some savannas, often in the bed of the old stream channel. Ground water seepage occurs in portions of some savannas, usually on a side which borders a Chamaecyparis swamp. Flooding from the adjacent river occurs to a variable extent. Often, when flooding does occur, it floods from the downstream end first.

Dominant species include: Cladium mariscoides, Carex exilis, Muhlenbergia torreyana, Lophiola americana.

Other characteristic or rare species include: Rhynchospora oligantha, Rhynchospora cephalantha, Narthecium americana, Scleria reticularis, Danthonia epilis, Panicum scabriusculum, Juncus canadensis, Hypericum denticulatum, Carex livida.

Range: Found along Pine Barrens streams in Atlantic, Burlington, and Ocean Counties.

References: Harshberger, 1916
McCormick, 1979
Stone, 1911
Unpublished Natural Heritage field studies

Pine Barren Shrub Swamp

An Outer Coastal Plain swamp dominated by Chamaedaphne calyculata often with Vaccinium corymbosum or Ilex glabra associated. Woodwardia virginica and Sphagnum moss are common ground cover.

Range: Outer Coastal Plain.

References: McCormick, 1979

Calcareous Riverside Seep Community

A community which develops along major river shores where ice scouring maintains open seepage areas along the limestone river bank. Characteristic species include Deschampsia cespitosa, Juncus dudleyi, Carex hystricina, Salix interior, Parnassia glauca, Scirpus microcarpus, Carex viridula, Spiranthes lucida.

Range: Known from the Delaware River in the Ridge and Valley.

References: Unpublished Natural Heritage field studies.

Robust Emergent Marsh

A marsh in which Typha latifolia or Phragmites australis is the dominant species. Somewhat arbitrarily separated from inland graminoid marsh because of physiognomy. Both communities are often found together in a wetland complex. Classification needs work.

Range: Probably statewide.

References: Tiner, 1985

Northern New Jersey Shrub Swamp

An acidic shrub swamp of Northern New Jersey. Dominant species include Vaccinium corymbosum, Rhododendron viscosum, and Clethra alnifolia. Also common are Ilex verticillata and Aronia melanocarpa. Ground cover includes Carex stricta and Sphagnum moss. One example is described in Tiner (1985). Classification needs work.

Range: Ridge and Valley, Highlands, and Piedmont.

References: Tiner, 1985

FORESTED/TIDAL COMMUNITIES:

Freshwater Tidal Swamp

A tidal swamp forest with an open canopy dominated by Fraxinus pennsylvanica with Acer rubrum also occasionally present in the canopy layer. A diverse shrub layer is present including Acer rubrum, Viburnum dentatum, Rhododendron viscosum, Clethra alnifolia, Alnus rugosa, Ilex verticillata, Rosa palustris, Cephalanthus occidentalis, Aronia sp., Vaccinium corymbosum. Herbs include Nuphar lutea, Pontederia cordata, Peltandra virginica, Thelypteris palustris, Osmunda regalis, Impatiens capensis, Zizania aquatica, Aster puniceus, Helenium autumnale, and Polygonum punctatum. More data are needed.

Range: Inner Coastal Plain and probably also Outer Coastal Plain.

References: Unpublished Natural Heritage field studies.

FORESTED/NONTIDAL COMMUNITIES:

Calcareous Seepage Swamp

Seepage swamps in limestone regions of the state which contain an assemblage of calciphilic species. Dominant tree is often Acer rubrum, although Fraxinus nigra can be locally abundant. Characteristic calciphilic species include Ribes hirtellum, Potentilla fruticosa, Betula pumila, Rhamnus alnifolia, Cypripedium calceolus, Geum rivale.

Range: Great valley of the Ridge and Valley province.

References: Unpublished Natural Heritage field studies.

Coastal Plain Atlantic White Cedar Swamp

Swamps along streams or in low areas of the coastal plain in which Chamaecyparis thyoides makes up over 50% of the canopy trees. Other tree and shrub species include Acer rubrum, Magnolia virginiana, Nyssa sylvatica, Clethra alnifolia, Leucothoe racemosa, Vaccinium corymbosum, Gaylussacia frondosa, Ilex glabra, Rhododendron viscosum. A dense cover of Sphagnum moss often covers the ground, with Sphagnum fallax, Sphagnum flavicomans, Sphagnum magellanicum, Sphagnum pulcrum and Sphagnum recurvum commonly occurring. Successional edges and tussocks are habitat

for Schizaea pusilla, Arethusa bulbosa, and Pogonia ophioglossoides.

Range: Outer Coastal Plain.

References: Karlin and Andrus, 1988
McCormick, 1979
McCormick and Jones, 1973
Olsson, 1979
Roman et al., 1987
Tiner, 1985
Zampella, 1987

Floodplain Forest

A rich mesophytic forest occupying flood plains of major rivers outside of the Outer Coastal Plain of the state. Stands have a high diversity and it is often difficult to determine any single species as a dominant. Characteristic tree species include Platanus occidentalis, Celtis occidentalis, Fraxinus americana, Acer saccharum, Acer negundo, Tilia americana, Juglans nigra, Fagus grandifolia, Ulmus rubra, Ulmus americana.

The shrub layer is often dominated by Lindera benzoin. Other characteristic shrubs and lianas include Toxicodendron radicans and Staphylea trifolia.

Herbs include Allium tricoccum, Carex amphibola, Carex grayii, Carex rosea, Hydrophyllum virginianum, Impatiens capensis, Laportea canadensis, Tovaria virginiana, Viola striata, Floerkea proserpinacoides, Mimulus alatus, Dicentra cucullaria, Trillium cernuum, Arisaema dracontium, Corydalis flavula. Rare species include Hydrophyllum canadense, Carex jamesii, Ellisia nyctelea, Cystopteris protrusa, Chaerophyllum procumbens. Flood plains of the Raritan River and Crosswicks Creek may have lush growth of Mertensia virginica. Flood plain islands of the Delaware River often have stands of Pteretis pensylvanica.

Range: Statewide excluding the Outer Coastal Plain.

References: Buell and Wistendahl, 1955
Van Vechten and Buell, 1959
Unpublished Natural Heritage field studies

Hardwood-Conifer Swamp

A Northern New Jersey swamp in which Acer rubrum and Tsuga canadensis codominate the canopy. Rhododendron maximum is often the dominant shrub in this community. Other species include Nyssa sylvatica, Ilex verticillata, Vaccinium corymbosum, Rhododendron viscosum, and Alnus rugosa. Sphagnum moss is common ground cover, with Sphagnum bartlettianum, Sphagnum fallax and Sphagnum magellanicum as prominent species. More data are needed.

Range: Ridge and Valley and Highlands.

References: Karlin and Andrus, 1988
Niering, 1953
Tiner, 1985

Inland Atlantic White Cedar Swamp

A Northern New Jersey swamp in which Chamaecyparis thyoides makes up more than 30% of the canopy. Grades into Hardwood Conifer Swamp and shares similar associated species.

Range: Ridge and Valley and Highlands.

References: Karlin and Andrus, 1988
Niering, 1953

Liquidambar/Acer Hardwood Swamp

A Southern New Jersey swamp usually dominated by Liquidambar styraciflua and Acer rubrum. Other species include Quercus palustris, Quercus phellos, Quercus falcata, Liriodendron tulipifera, Fagus grandifolia, Quercus bicolor, Fraxinus sp., Ulmus sp., Sassafras albidum, Ilex opaca, and Diospyros virginiana. Shrubs include Viburnum dentatum, Lindera benzoin, Vaccinium corymbosum, Clethra alnifolia, and Rhododendron viscosum. Classification needs work.

Range: Inner Coastal Plain and fringes of Outer Coastal Plain.

References: Robichaud and Buell, 1973
Stone, 1911

Pine Barren Hardwood Swamp

Hardwood swamp in the pine barrens portion of the outer coastal plain dominated by Acer rubrum. Other trees and shrubs include Magnolia virginiana, Nyssa sylvatica, Clethra alnifolia, Vaccinium corymbosum, Rhododendron viscosum, Chamaedaphne calyculata, Leucothoe racemosa, Gaylussacia frondosa. This swamp is often situated adjacent to Chamaecyparis Swamps and may replace it after logging.

Range: Outer Coastal Plain.

References: Ehrenfeld and Gluck, 1981
McCormick, 1979
McCormick and Jones, 1973
Robichaud and Buell, 1973

Pitch Pine Lowland Forest

A Pinus rigida dominated forest with a well developed understory layer - especially Kalmia angustifolia, with Gaylussacia frondosa, Gaylussacia dumosa, Leucothoe racemosa, and Lyonia mariana. The ground water level lies just below the ground surface, therefore creating damp sand conditions. This NC occupies narrow bands fringing swamps along stream courses or in areas of low relief, circular depressions, and other poorly

drained areas. Typical species include Leiophyllum buxifolium, Pyxidanthera barbulata, Xerophyllum asphodeloides, Polygala lutea, and Calamovilfa brevipilis. Gaylussacia baccata becomes common in drier areas.

A small number of stands have intermittent channels or swales running through them. Dominant species in the swales include Carex walteriana, Iris prismatica, Lachnanthes tinctoria, Panicum agrostoides, Woodwardia virginica, Agrostis elata. Wetter portions of swales have Utricularia geminiscapa, Utricularia fibrosa, Sagittaria engelmanniana, and Glyceria obtusa. Rare species

include Lobelia canbyi, Rhynchospora cephalantha, Carex livida, Muhlenbergia torreyana, and Scirpus longii.

Range: Outer Coastal Plain.

References: Little, 1979
McCormick, 1979
McCormick and Jones, 1973

Inland Red Maple Swamp

A swamp of Northern New Jersey. Acer rubrum is the dominant tree. Other trees are Nyssa sylvatica, Fraxinus, and Betula lutea. Shrubs include Vaccinium corymbosum, Alnus rugosa, Lindera benzoin, Cephalanthus occidentalis, Rhododendron viscosum, Clethra alnifolia, Ilex verticillata. Herbs and mosses include Symplocarpus foetidus, Thelypteris palustris, Osmunda cinnamomea, Onoclea sensibilis, Sphagnum spp.

Range: Ridge and Valley, Highlands, Piedmont.

References: Robichaud and Buell, 1973
Tiner, 1985

Cape May Lowland Swamp

Lowland forests predominantly known from Cape May County, NJ. Typically occupy the headwaters of streams where they are likely fed by groundwater discharge. Topography is gently rolling with a series of wet depressions alternating with dryer islands. Stands typically have a high diversity (one stand was found to have 20-25 species of trees and 40 species of shrubs). Typical canopy trees include Acer rubrum, Liquidambar styraciflua, Fraxinus tomentosa, Nyssa sylvatica. The most frequent understory trees are Magnolia virginiana and Ilex opaca. The most common shrub is Clethra alnifolia. Other typical shrubs include Rhododendron viscosa, Lindera benzoin, Itea virginica.

Species with a more southern distribution are found in these swamps, including Quercus michauxii, Quercus nigra, Triadenum walteri, Quercus phellos, Populus heterophylla.

Rare species from this natural community include Euphorbia purpurea, Hottonia inflata, Triadenum walteri, Listera australis,

Fraxinus tomentosa, Quercus michauxii, Populus heterophylla.

Range: Cape May portion of Outer Coastal Plain.

References: Bernard, 1963
Stone, 1911
Unpublished Natural Heritage field studies

Black Spruce Swamp

A swamp with over 25% of the canopy dominated by black spruce (Picea mariana). Often found adjacent to low shrub bogs, these swamps form a later successional stage of bogs. Species with northern affinities find refuge in this cool swamp environment. Species include Arceuthobium pusillum, Clintonia boreale, Coptis groenlandica, Smilacina trifolia, Gaultheria hispidula, Trillium undulatum.

Range: Ridge and Valley and possibly Highlands.

References: Lynn and Karlin, 1985

TERRESTRIAL SYSTEM

Definition. The Terrestrial System includes natural habitats that are often termed "uplands." A habitat is placed in the Terrestrial System, as opposed to being an aquatic (wetland or deepwater) habitat, if it has all of the following characteristics: (1) vegetative cover that is never (not even periodically) predominantly hydrophytic, (2) soil that is not predominantly hydric, and (3) a surface that is not flooded or saturated at any time during the year.

Limits. The Terrestrial System extends laterally to the edge of wetland, deepwater, and cultural habitats. It extends downward to the lower limit of normal soil horizons and surface biological activity, including the maximum depth of plant roots and burrowing surface animals. Within this system, community descriptions are grouped based on canopy closure.

OPEN CANOPY COMMUNITIES:

Silicaceous Rock Outcrop Community

An open canopied community forming over bare silicaceous rock outcrops and cliffs. Silicaceous rocks include a variety of rock types such as quartzite, sandstone, granite, schist,

granitic-gneiss, certain conglomerates, and various other rock types which, upon weathering, yield strongly acidic, base-poor soils. Primary invaders on bare rock include the lichens Rinodina sp., Umbilicaria spp., and with them mosses such as Leucobryum glaucum, Polytrichum juniperinum, Polytrichum commune, Bryum spp., and Dicranum spp. Herbaceous vascular plants include Potentilla tridentata, Andropogon scoparius, Danthonia spicata, Panicum depauperatum, Carex spp., Dryopteris marginalis, Polypodium virginianum.

Range: Ridge and Valley and Highlands.

References: Robichaud and Buell, 1973

Limestone Glade

Grass and forb dominated openings on limestone hillsides surrounded by, and partially invaded by Juniperus virginiana. The hills are fairly steeply sloped (ca. 35 degrees) and are made of glacially deposited calcareous sand and gravel.

Dominant species include Andropogon scoparius, Sporobolus sp., Juniperus virginiana.

Other characteristic species include midwest prairie species such as Anemone cylindrica, Chrysopsis camporum, and Linum sulcatum, and locally rare dry ground or limestone species such as Kuhnia eupatorioides, Asclepias verticillata, Bouteloua curtipendula, and Carex bicknellii.

Range: Only two sites known in state. Found on Franklin Limestone deposit in Highlands.

References: Snyder, 1986
Unpublished Natural Heritage field studies

Coastal Dune Grass Community

An herbaceous community of primary dunes and back dunes dominated by Ammophila breviligulata. Other species include Solidago sempervirens, Cakile edentula, Euphorbia polygonifolia, Lathyrus japonicus, Lechea maritima. Areas dominated by Hudsonia tomentosa are present in protected portions of back dunes.

Range: Outer Coastal Plain.

References: Harshberger, 1900
Martin, 1959
Robichaud and Buell, 1973

Coastal Dune Shrubland

A shrub and scattered low tree (less than 15 ft) dominated community occupying back dunes and secondary dunes, generally landward of a coastal dune grass community. Dominant shrubs include Prunus maritima, Myrica pensylvanica. Scattered low trees of Juniperus virginiana usually dominate the tree canopy. Other common species are Ilex opaca, Diospyros virginiana, Prunus serotina, Quercus stellata, Quercus falcata, Parthenocissus quinquefolia, Toxicodendron radicans. Open patches dominated by Hudsonia tomentosa may be present.

Range: Outer Coastal Plain.

References: Harshberger, 1900
Martin, 1959
Robichaud and Buell, 1973

Coastal Dune Woodland

Low tree and shrub dominated community with greater than 40% canopy low trees (approximately 15-30 ft). Usually found on secondary dunes. Dominant trees include Juniperus virginiana and Ilex opaca and Pinus rigida. Other common species include Prunus serotina, Amelanchier canadensis, Quercus falcata, Celtis occidentalis, Sassafras albidum, Myrica pensylvanica, Parthenocissus quinquefolia, Toxicodendron radicans.

Range: Outer Coastal Plain.

References: Martin, 1959
Robichaud and Buell, 1973

Pine Plains

A dwarf Pinus rigida forest of the New Jersey pine barrens.

These are found at elevations of 100-200ft above sea level in gently rolling terrain with sandy soils that are characterized as being well drained to poorly drained, with high permeability, and a sand to sandy loam subsoil (Woodmansie-Lakehurst association).

The dominant trees are dwarf (smaller than 11ft), multiple stemmed Pinus rigida, Quercus marilandica and Quercus ilicifolia. Pinus rigida makes up 25% to 65% of the trees with the two oak species making up the rest. There is a noted predominance of the serotinus P. rigida race. It is also notable that there is almost a complete absence of Pinus echinata and all oaks except Q. marilandica and Q. ilicifolia.

Other characteristic shrubs include Kalmia angustifolia, Kalmia latifolia, Myrica asplenifolia, and Leiophyllum buxifolium. Prostrate shrubs include Gaultheria procumbens, Arctostaphylos Uva-ursi, and Epigaea repens. Corema conradii is prominent in places.

Range: Outer Coastal Plain.

References:
Good and Good, 1975
Good et al., 1979
Harshberger, 1916
Ledig and Fryer, 1972
McCormick and Buell, 1968
Windisch, 1987

Ridgetop Pitch Pine - Scrub Oak Forest

A community dominated by Pinus rigida occurring on high ridgetops where soil is thin and climatic conditions are severe with frequent sleet and ice storms and strong winds. Quercus ilicifolia is the dominant shrub on the most exposed stands. Gaylussacia baccata becomes more abundant on more protected stands. Other trees include Acer rubrum, Betula lenta, Betula populifolia and Amelanchier sp. Quercus prinus, Quercus coccinea, Quercus alba also occur on more protected sites. In addition to Q. ilicifolia and G. baccata, shrubs include Vaccinium spp., Kalmia latifolia, Myrica asplenifolia, Rhus spp., and Aronia melanocarpa. Herbs include Aralia nudicaulis, Pteridium aquilinum, Maianthemum canadense.

Range: Ridge and Valley and Highlands.

References: Niering, 1953
Robichaud and Buell, 1973

Shale Cliff/Rock Outcrop Community

Community formed on shale cliffs which contain many small ledges, crevices, talus areas providing diverse micro habitats. Species include Juniperus communis, Celtis occidentalis, Opuntia humifusa, Woodsia obtusa, Asplenium trichomanes, Aquilegia canadensis, Phlox subulata. Rare species include Cheilanthes lanosa.

Range: Piedmont and Ridge and Valley.

References: Fables and Houda, 1951
Unpublished Natural Heritage field studies

Talus Slope Community

A woodland occurring on steep ridge slopes, often at the base of cliffs, on coarse textured colluvial deposits. Canopy coverage is 40-60%. Trees include Quercus prinus, Quercus ilicifolia, Pinus strobus, Betula lenta.

Rare species from this NC include Carex deweyana, Pinus resinosum, Asplenium montanum, Betula papyrifera, Ribes glandulosum, Clematis verticillaris, Adlumia fungosa, Lonicera canadensis, short-tailed shrew, timber rattlesnake, woodrat.

Range: Ridge and Valley, Highlands, and Piedmont.

References: Davis, 1956
Unpublished Natural Heritage field studies

Traprock Glade/Rock Outcrop Community

These are dry, grass and forb dominated openings on south and west facing slopes of traprock ridges. Thin soils and exposed rocky substrate contribute to the xeric conditions at these sites, and allow the underlying traprock to have an influence on the types of species found.

The dominant species in the balds are Andropogon scoparius,

Panicum sp., and mosses and lichens. The surrounding dry forest is usually dominated by Quercus prinus. Other common trees are Quercus rubra, Carya spp., and Juniperus virginiana.

Other characteristic species include Asclepias verticillata, Scutellaria leonardii, Muhlenbergia capillaris, Cunilia origanoides, Viburnum rafinesquianum, Asclepias quadrifolia, Hypoxis hirsuta, Hypericum gentianoides, Tephrosia virginiana, and Galium pilosum.

Range: Piedmont physiographic province. Known from the Watchung mountains, which span four counties. May also occur on the Sourlands and Palisades. Similar communities may exist in Connecticut (Lee, 1985).

References: Lee, 1985
Unpublished Natural Heritage field studies

Calcareous Riverside Outcrop Community

A calcareous rock outcrop community maintained open by winter ice scouring. Characteristic species include Anemone riparia, Zizia aptera, Andropogon gerardi, Campanula rotundifolia, Platanus occidentalis, Potentilla arguta, Arabis lyrata, Physocarpus opulifolius, Spartina pectinata. More data needed.

Range: Known from Delaware River in the Ridge and Valley province.

References: Unpublished Natural Heritage field studies.

Silicaceous Riverside Outcrop Community

A rock outcrop community on silicaceous bedrock types such as quartzite, sandstone, granite, schist, granitic-gneiss and other rock types which upon weathering yield strongly acidic, base-poor soils. More data needed.

Range: May occur in Ridge and Valley, Highlands, and Piedmont.

CLOSED CANOPY COMMUNITIES:

Dry Oak-Pine Forest

An oak dominated forest of the outer coastal plain. Larger treeform oaks including Quercus velutina, Quercus prinus, Quercus coccinea, Quercus stellata, and Quercus alba cover 40% or more of the ground, contribute 50% or more of the stems, and form 35% or more of the basal area. Pinus rigida is present in nearly all stands, Pinus echinata outnumbers P. rigida in some stands. Canopy heights range from 11-15m to 23-31m depending on fire history. In general these forests are less dense than Pine-Oak Forests. Three subtypes are included: the Mixed Oak-Pine Forest, the Oak Hilltop Forest, and the Scarlet Oak-Shortleaf Pine Forest.

In the Mixed Oak-Pine Forest several treeform oaks may be prominent in the canopy, with Quercus velutina most common north of the Mullica River and Quercus falcata prominent to the south. Quercus prinus, Quercus coccinea and Quercus alba vary in abundance from stand to stand. Quercus stellata is generally more abundant than Quercus marilandica. The average height of stands is about 12m. The canopy covers 70% of the ground, and at least 60% of its cover is contributed by oaks. Pines form about 50% of the basal area.

The Oak Hilltop Forests have Quercus prinus and Quercus velutina forming 90% or more of the canopy. They occur on many small hilltops and a few larger areas in the Pine Barrens. Woody undergrowth is sparse, clumped, covering only 25% of the ground, and dominated by an almost equal mix of Gaylussacia frondosa, Quercus ilicifolia, Gaylussacia baccata, and Vaccinium vacillans. Mosses and lichens cover 30% of the soil surface.

The Scarlet Oak-Shortleaf Pine Forests occur most commonly on the eastern half of the Pine Barrens and north of the Mullica River. Quercus coccinea and Quercus velutina form about 60% of the canopy and Pinus echinata nearly 20%. Quercus prinus, Quercus alba, Quercus stellata and Pinus rigida are only minor components.

Range: Outer Coastal Plain.

References: McCormick, 1979
McCormick and Jones, 1973

Dry Pine-Oak Forest

Pine Barrens forests where Pinus rigida covers 30% or more of the ground, contributes to 50% or more of the tree stems 2.5cm or

greater in diameter, and forms 50% or more of the basal area. Large broadleaf trees including Quercus velutina, Quercus prinus, Quercus coccinea, Quercus stellata, and Quercus alba cover no more than 25% of the ground, contribute no more than 25% of the stems, and form no more than 25% of the basal area. Three subtypes are included: the Pine-Blackjack Oak Forest, the Pine-Post Oak Forest, and the Pine-Black Oak Forest. In the subtypes, two kinds of shrub understories are found. One is mostly dominated by heaths, Gaylussacia baccata and Vaccinium vacillans. The other has Quercus ilicifolia emerging above the heaths.

A large part of the Pine-Oak Forests of the central Pine Barrens is covered by the open Pine-Blackjack Oak Forest Subtype (Pinus rigida, Quercus marilandica). Quercus stellata trees range from scattered to relatively abundant in these stands. Quercus velutina and Quercus coccinea occur sporadically throughout these forests. Fire is believed to exert a dramatic selective action on these forests. This subtype is lumped together with the dwarf pine plains by McCormick (1979). Both heath dominated shrub layers and Quercus ilicifolia dominated shrub layers occur with this subtype.

The Pine-Post Oak Forest Subtype (Pinus rigida, Quercus stellata) occurs in the central Pine Barrens. Pinus rigida is the dominant tree, Quercus stellata forms 20% of the canopy, and Quercus velutina is widely spaced. This forest occurs with two different types of undergrowth. One type has Quercus ilicifolia and Kalmia angustifolia in the undergrowth with a 6m tall forest canopy. The other has larger more widely spaced canopy trees with Quercus ilicifolia and Gaylussacia baccata in the undergrowth. Neither type is widely distributed.

In the Pine-Black Oak Forest Subtype, Pinus rigida is dominant in the canopy, but 10-20% of the trees are Quercus velutina, Quercus coccinea, or Quercus falcata. Quercus alba and Quercus prinus is present in some areas, and Quercus marilandica may be absent or frequent. Shrub layers may be dominated by heaths or Quercus ilicifolia.

Range: Outer Coastal Plain

References: McCormick, 1979
McCormick and Jones, 1973

Dry-Mesic Calcareous Forest

A diverse forest occurring on calcareous soils. Canopy dominants include: Acer saccharum and Fraxinus americana. Other woody species include Tilia americana, Ostrya virginiana, Carya glabra, Liriodendron tulipifera. Characteristic species include Quercus muhlenbergia, Xanthoxylum americanum.

Range: Ridge and Valley.

References: Balter and Loeb, 1983
Pearson, 1960
Pearson, 1962

Dry-Mesic Inland Mixed Oak Forest

Mixed oak forests of the Piedmont, Highlands, and Ridge and Valley regions. Dominant species include Quercus rubra, Quercus alba, and Quercus velutina. Other associated trees include Fraxinus americana, Acer rubrum, Acer saccharum, Quercus prinus, Carya spp., Fagus grandifolia, and Liriodendron tulipifera. Cornus florida is often prominent in the understory layer, and Viburnum acerifolium is often prominent in the shrub layer. Two subtypes are currently recognized: the Mixed Oak Forest subtype, and the Mixed Oak-Hardwood Forest subtype.

The Mixed Oak-Hardwood Forest Subtype, or "Cove Forest" sensu. Raup (1938), are found in cooler, moister sites such as northern and eastern facing slopes and ravines. Although the canopy is generally dominated by a mixture of Quercus rubra, Quercus alba and Quercus velutina, Liriodendron tulipifera and Betula lenta are prevalent with L. tulipifera becoming abundant in places. Other tree species include Fraxinus americana, Acer saccharum, Acer rubrum, Tilia americana, Nyssa sylvatica, and Fagus grandifolia. In addition to Cornus florida, understory trees include Carpinus caroliniana and Ostrya virginiana.

The Mixed Oak Forest Subtype are found on drier southern and western facing slopes throughout Northern New Jersey and on level areas with shallow soil on the red shale portions of the Piedmont region. The canopy is dominated by Quercus alba, Quercus rubra and Quercus velutina. Other species include Acer rubrum, Carya spp., Acer saccharum, Fagus grandifolia, Fraxinus americana, Quercus prinus. Liriodendron tulipifera and Betula lenta may be absent or present only in low numbers. Understory trees include Cornus florida, Ostrya virginiana and Sassafras albidum.

Range: Piedmont, Highlands, and Ridge and Valley.

References: Cantlon, 1953
Forman and Elfstrom, 1975
Raup, 1938
Robichaud and Buell, 1973

Mesic Coastal Plain Mixed Oak Forest

A mesic forest dominated by oaks, particularly Quercus velutina, Quercus alba, Quercus rubra. In some stands Fagus grandifolia becomes the dominant tree. Liriodendron tulipifera and Liquidambar styraciflua become abundant in some stands. Typical understory trees include Cornus florida, Sassafras albidum, and Carpinus caroliniana. Some stands, instead, have an understory dominated by heath plants. Predominantly found along the Inner Coastal Plain and southern portions of the Outer Coastal Plain. Three subtypes are included: Oak-Heath Forest, Mixed Oak-Beech Forest, Southern Coastal Plain Mixed Oak Forest.

The Oak-Heath Forest Subtype is a mesic upland, forest of Inner Coastal Plain areas with sandy soil adjacent to the Pine Barrens. Canopy trees include Quercus alba, Quercus velutina, Quercus rubra, Quercus prinus, and Quercus coccinea. The understory is primarily heath plants including Kalmia latifolia, Vaccinium spp., Gaylussacia spp., and Rhododendron viscosum.

The Mixed Oak-Beech Forest Subtype is found on the western and southwestern part of the coastal plain where soil fertility improves. The most abundant larger trees include Quercus rubra, Quercus velutina, Quercus alba. Fagus grandifolia is very common and becomes the dominant tree in some sites. Liriodendron tulipifera and Liquidambar styraciflua are abundant in some stands. Other trees include Carya spp., Nyssa sylvatica, Fraxinus americana, Diospyros virginiana, and Ilex opaca. Common understory trees include Cornus florida, Carpinus caroliniana, and Sassafras albidum. Shrubs and lianas include Lindera benzoin, Viburnum dentatum, Viburnum prunifolium, Euonymus americanus, Parthenocissus quinquefolia, Toxicodendron radicans. Lonicera japonica is an exotic trailing vine often found in these forests. Abundant herbs include Podophyllum peltatum, Arisaema triphyllum, Smilacina racemosa, Aster divaricatus.

The Southern Coastal Plain Mixed Oak Forest subtype is known from Cape May and Cumberland Counties. Important tree species

include Quercus falcata, Quercus phellos, Liquidambar styraciflua, Acer rubrum, Fagus grandifolia, Ilex opaca, and Cornus florida. Quercus michauxii and Quercus nigra reach their northernmost distribution in these forests. Shrubs and vines include Viburnum dentatum, Clethra alnifolia, Rhododendron viscosum, Smilax glauca, Vaccinium corymbosum, Myrica pensylvanica, Gaylussacia baccata, Toxicodendron radicans and Parthenocissus quinquefolia. Herbs include Mitchella ripens, Podophyllum peltatum, Pteridium aquilinum, Monotropa uniflora, and Cypripedium acaule.

Range: Inner Coastal Plain and Outer Coastal Plain.

References: Bernard and Bernard, 1971
Robichaud and Buell, 1973

Mesic Hemlock-Hardwood Forest

A forest in which more than 50% of the canopy is made up of Tsuga canadensis. Occurs on cooler and moister sites in ravines and steep lower north facing slopes of the Piedmont, Highlands, and Ridge and Valley regions. Associated trees include Betula lenta, Betula lutea, Acer saccharum, and Tilia americana. Also present are Fagus grandifolia, Quercus rubra, Liriodendron tulipifera, Fraxinus americana, and Acer rubrum. The shrub understory is often sparse due to dense shading by the canopy trees.

Range: Ridge and Valley, Highlands, and Piedmont.

References: Raup, 1938
Robichaud and Buell, 1973

Virginia Pine-Oak Forest

A forest dominated by Pinus virginiana with mixed hardwoods including Quercus alba, Quercus velutina, Quercus falcata, and Carya tomentosa in the canopy. The understory is dominated by heaths including Vaccinium stramineum, Vaccinium vacillans, Kalmia angustifolia and Gaylussacia baccata. Regarded by some authors as a post-agricultural successional community which eventually may become a mixed hardwood forest. One study suggests that as a stand approaches 70 years in age the P. virginiana begins to lose vigor

and declines rapidly. Need more data. May eventually be included as a subtype of the Oak-Pine forest.

Range: Most abundant in the Cumberland County portion of the Outer Coastal Plain with a string of outliers along the Inner Coastal Plain.

References: McCormick and Andresen, 1963
Robichaud and Buell, 1973

Chestnut Oak Forest

A forest dominated by Quercus prinus found on slopes and ridgetops of higher elevations in Northern New Jersey where dryer and poorer soil conditions generally prevail. Other trees which may be common include Quercus rubra, Quercus alba, Quercus coccinea, Betula lenta, Pinus rigida. Additional less common trees include Quercus velutina, Acer rubrum, Carya spp., Prunus serotina. Most typical shrubs are heaths including Vaccinium spp., Gaylussacia sp., and Kalmia latifolia.

Range: Ridge and Valley, Highlands, and Piedmont.

References: Niering, 1953
Robichaud and Buell, 1973

SUBTERRANEAN SYSTEM

Definition. The Subterranean System includes both aquatic and non-aquatic habitats beneath the earth's surface. It includes not only large air-filled cavities with openings to the surface (commonly known as caves), but also water-filled aquifers and interstitial habitats in small crevices. As a result, the Subterranean System usually has the following features: (1) no sunlight (except near cave entrances), (2) relatively stable temperature and high humidity, (3) low energy inputs, and (4) troglobitic species, with special adaptations for life underground.

Limits. The Subterranean System can occur beneath any of the other systems. Under vegetated lands, the Subterranean System begins below the lower limit of plant roots; as such, the

Subterranean System starts beneath the usual soil horizons as defined in Soil Taxonomy (U.S. Soil Conservation Service, 1975). Benthic organisms and soil organisms are not part of the Subterranean System: they are part of epigean communities in some other system. A surface stream that sinks underground becomes part of the Subterranean System where it sinks; an underground stream becomes part of the Riverine System where it resurges as a spring. The Subterranean System extends downward as far as organisms live.

Aquatic Cave

Communities which form in aquatic portions (streams & pools) of large caves (>100 ft) having a zone of permanent darkness.

Range: Ridge and Valley.

References: Dalton, 1976

Terrestrial Cave

Communities which form in terrestrial portions of large (>100 ft.) caves having a zone of permanent darkness.

Range: Ridge and Valley and Highlands.

References: Dalton, 1976

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