

Ecological Communities of New York State

by

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Deep emergent marsh in the foreground and red maple-hardwood swamp in the background, at Lake Alice Wildlife Management Area, Clinton County.

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A spruce-northern hardwood forest bordering Jordan Lake, Kildare Forest, St. Lawrence County.

Back cover, bottom center:

An alvar grassland at Chaumont Barrens, Jefferson County.

Back cover, bottom right:

Calcareous pavement barrens near Three Mile Creek Road, Jefferson County.

All photographs by Carol Reschke.

INTRODUCTION

OBJECTIVES

The primary objective of this report is to classify and describe ecological communities representing the full array of biological diversity of New York State. An ecological community is a variable assemblage of interacting plant and animal populations that share a common environment. As part of the New York Natural Heritage Program inventory, this classification has been developed to help assess and protect the biological diversity of the state. The Natural Heritage Program inventory is a regularly updated database of information on rare animals, rare plants, and significant natural communities of New York State. This inventory also provides a ranking system for determining priorities for conservation and management of New York State's significant natural areas.

The Natural Heritage Program inventory uses a "coarse filter/fine filter" strategy to identify conservation priorities for protection of biological resources. Preservation of good examples of each of the natural communities in the state serves as a coarse filter that assures the protection of most of the species that make up the biological diversity of the state. The species that might not be protected in these representative communities, or the species that "fall through" this coarse filter because of their narrow or unusual habitat requirements, are rare species. Identifying and protecting viable populations of each of the rare species serves as the fine filter for "capturing" or protecting the state's biological diversity.

Developing and refining a classification of communities is an essential step in the Heritage inventory process. The inventory requires a classification of discrete community types because these types are used as mapping units, and because the types are assigned ranks that establish priorities for conducting the inventory. This classification represents the fifth revision of a draft classification that has been in use by the Natural Heritage Program since 1985.

APPLICATIONS

In addition to serving as the framework for the Natural Heritage Program inventory of significant natural communities in New York State, this community classification is designed to meet a variety of needs. The classification provides natural resource managers with a standard set of terms and concepts to describe wildlife habitats, and it also provides mapping units to use in plans for managing public and private natural areas such as forest preserves, wildlife management areas, parks, and nature preserves. The classification can be used to

identify ecological communities for environmental impact statements and other forms of environmental review. In combination with the Heritage ranking system, the classification can be used to establish priorities for land acquisition by public agencies and private conservation organizations. Programs for long-term monitoring of environmental change can use the classification to guide the selection of monitoring sites. The classification and community descriptions provide a general survey useful to students of the natural history of New York State.

COMMUNITY CONCEPTS

In this classification a community is defined as a variable assemblage of interacting plant and animal populations that share a common environment. Most communities occur repeatedly in the landscape. The plants and animals in a community occupy a habitat, often modifying the habitat. For example, the canopy trees in a hemlock-northern hardwood forest shade the ground and keep the forest floor cool and dark, a large deer population can modify the structure of a forest community by browsing the understory shrubs and saplings, and beavers can modify a stream corridor by damming the stream and flooding the surrounding habitats.

No two examples of a community are identical in composition or environment, however they are similar within a given range of variability. The range of variability of each community (or the percent similarity between different examples of a community) is not defined quantitatively in this classification. Some communities are narrowly defined. Different examples of a narrowly defined community, such as alpine krummholz, will be very similar. Other communities are more broadly defined, such as shrub swamp. The more broadly defined community types provide a catch-all category for communities that are quite variable.

Ecological communities form a complex mosaic in the landscape; they change through time, and they intergrade spatially and temporally. This classification is an attempt to establish a set of discrete categories into which units of the intergrading landscape mosaic can be sorted and organized. The classification is an artificial construct, and the community types are intended to be conceptually discrete, non-overlapping entities. For the purpose of organizing an inventory of ecological communities, artificial boundaries between communities have been drawn across the continuous ecological gradients that occur in the real landscape. For example, near the summits of the Adirondack Mountains there is a continuous change in communities along an elevation gradient. On many mountains

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at an elevation of 3000 feet there is a mountain fir forest, a forest dominated by balsam fir trees. At higher elevations the trees become stunted and deformed, and they form dense thickets; this community, at an elevation of 4000 feet, is alpine krummholz. On the summits of the highest peaks, at elevations above timberline (about 4900 feet), is an alpine meadow community. The change from mountain fir forest to alpine krummholz to alpine meadow is a gradual transition on the mountain slopes. In order to conduct an inventory and map occurrences, artificial boundaries between these communities are defined, with the recognition that in the landscape the transitions are often not so distinct.

Communities can be described at many scales, ranging from a fine scale "microcosm" (such as the plankton in a drop of pond water) to a large scale "biome" (such as the eastern deciduous forest). An important consideration in the development of this classification has been to distinguish communities at a scale that is appropriate for statewide inventory work, yet compatible with community classifications developed by other Heritage programs in the eastern U. S. To some extent the classification reflects the amount of information available to the Heritage Program. Therefore, communities that the Heritage Program has studied in detail (such as open uplands and open peatlands) may be divided more finely than communities we have studied only briefly (such as riverine and lacustrine communities).

ORGANIZATION

The classification is organized by "systems", and each system is composed of two to five "subsystems". Within each subsystem are many community types. System, subsystem, and community descriptions are included in the text. There are seven systems: marine, estuarine, riverine, lacustrine, palustrine, terrestrial, and subterranean. Marine and estuarine systems are divided into subtidal and intertidal subsystems. The palustrine system is divided into open mineral soil wetlands, forested mineral soil wetlands, open peatlands, and forested peatlands. The terrestrial system is divided into open uplands, barrens and woodlands, and forested

uplands. An additional subsystem, cultural, is included in each system. Definitions of the systems and subsystems are adapted from the *Heritage Operations Manual* (The Nature Conservancy 1982), the U.S. Fish and Wildlife Service wetland classification (Cowardin et al. 1979), and a U.S. Department of Agriculture ecological land classification (Driscoll et al. 1984).

The communities classified as cultural are created or maintained by human activities, or they are modified by human influence to such a degree that the physical conformation of the land or the biological composition of the resident community is significantly different from the character of the land or community prior to modern human influence. Most, if not all, "natural" communities are to some degree exposed to the influence of civilization in the form of acid rain deposition, air and groundwater pollution, logging, fire suppression and ignition, road construction, and so forth. There is a continuous gradient of human-influenced disturbances between "natural" and "cultural" communities. The decision to classify an intermediate community as cultural is based on its biological composition (such as presence of exotic species) and its lack of similarity to communities less disturbed by human activities. Rather than emphasizing land use in the classification of cultural communities, the intention is to emphasize biological composition and environmental features. The Heritage Program does very little field work on cultural communities, and occurrences are not mapped or documented in the Heritage database.

The communities in this classification are intended to include all the resident organisms, including everything from earthworms, bacteria, and fungi to shrubs and trees in a forest, or everything from plankton to fishes and aquatic macrophytes in aquatic systems. In each system, certain groups of organisms and environmental features are used as an index to habitat conditions. The primary group of organisms and the main environmental characteristics used to describe and distinguish communities within each system are listed below.

<u>System</u>	<u>Group of organisms</u>	<u>Environmental characteristics</u>
marine	fauna (fishes, invertebrates)	tidal regime, substrate
estuarine	vegetation	tidal regime, salinity, substrate
riverine	fauna (fishes)	watershed position, stream flow
lacustrine	fauna (fishes, invertebrates)	trophic state, stratification, morphometry, water chemistry
palustrine	vegetation	substrate, hydrologic regime
terrestrial	vegetation	substrate, disturbance regime
subterranean	fauna (bats, invertebrates)	hydrology, geological structure

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The communities in this classification are distinguished by physiognomy, composition of resident organisms, and ecological processes. The descriptions include dominant species (species with the greatest abundance or percent cover), codominant species (species with relatively high abundance or percent cover), and characteristic species (species that are commonly found in the community, although not necessarily abundant). The community descriptions are derived from a review of literature sources, species lists compiled from both qualitative and quantitative field surveys conducted by Heritage Program biologists, and in some cases, either from interviews with biologists studying communities or from reviewers' comments. The species lists are presented as a representative sample. An individual occurrence of a community may not include all the species listed in the description, and the description includes only a very small proportion of the all the species present in a community. Some descriptions also include a brief discussion of ecologically important environmental characteristics (geology, soils, hydrology) and disturbance patterns (e.g. flood regime, fire regime) that distinguish the community. For certain communities a more detailed description is provided than for other communities. In most cases, the communities with more detailed descriptions have been the focus of Heritage inventory work; in some cases these communities are not well-documented in the literature or are described from New York State for the first time. Comments in the descriptions about variability of communities and relationships between communities are qualitative observations; evaluation of these observations will require quantitative sampling and analysis.

Following each community description is a brief summary of the distribution of the community in New York State, and the state rank and estimated global rank currently assigned by the Heritage Program. The statewide distribution of each community is described in terms of "ecozones" or ecological zones of New York State as described by Dickinson (1979) and Will et al. (1979). A map of these ecozones is provided on the inside of the back cover. The ranks are based upon the estimated number of occurrences of each community type as well as the vulnerability of the community to human disturbance or destruction. An explanation of the Heritage ranks is provided in Appendix A. In addition to global and state ranks assigned to each community type, each occurrence of a community that is documented in the Heritage database is assigned an "element occurrence rank" (EO rank) that reflects the quality of the individual occurrence. These EO ranks range

from "A" for an outstanding or pristine example to "D" for a poor quality or degraded example. The Heritage Program documents as "significant" all occurrences of rare communities (with state ranks of S1 and S2) regardless of EO rank, and the highest quality occurrences (EO rank of "A") of more common communities (with state ranks S3, S4, and S5). For example, all known occurrences of alvar grassland (a rare community), and only the best occurrences, such as an old-growth forest, of beech-maple mesic forest (a common community) are documented as significant natural areas.

For many communities, examples are provided and sources of data are listed. Examples are selected from sites documented either in the Heritage database or in the listed sources. Each example is given as a site and county in which a good example of the community is present; a map of the counties of New York State is provided following the Index. A single site may include examples of several different communities. Sources are either literature cited in References, or unpublished data collected by the Natural Heritage Program (NHP) or the Significant Habitat Unit (both programs are housed in the N.Y.S. Department of Environmental Conservation's Bureau of Wildlife). These unpublished data sources are cited as either "NHP field surveys" or "Significant Habitat Unit files".

Community names simply provide a label for each community type; the names are not intended to identify all of the dominant or characteristic species, or all the significant environmental qualities. Number codes could be used instead of names, but codes are not as easy to remember nor as meaningful. In some cases the community name includes dominant species (such as black spruce-tamarack bog). Some names include physiographic provinces to which the community is more or less restricted (such as coastal plain pond shore). Some names include adjectives denoting floristic affinities of the characteristic species (such as alpine meadow or boreal heath barrens).

In a few cases the term "Appalachian" is used in this classification to refer to a community with floristic affinities to the so-called "Alleghenian floristic element" (Curtis 1959, Eaton and Schrot 1987), which refers to a group of species centered in the Cumberland and Great Smoky Mountains of the southern Appalachians. The term "Allegheny" is here reserved for the unglaciated portion of the Appalachian Plateau in Cattaraugus County in and around Allegany State Park and the Allegheny River (note the two

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different spellings). This area is within the "Allegheny Hills" ecozone. The terms "Appalachian" and "Allegheny" are used by different authors to refer to the same geographic area. In this classification "Appalachian" is used in a broad sense to refer to the Appalachian highlands that extend from Quebec to Georgia. "Allegheny" is used in a narrow sense to refer to a specific portion of the Appalachian Plateau.

Plant nomenclature used in the community descriptions follows Mitchell (1986) for vascular plants; Andrus (1980) for *Sphagnum*, and Ketchledge (1980) for other mosses. Animal nomenclature follows C. L. Smith (1985) for fishes; American Ornithologist's Union (1983) for birds; Collins et al. (1982) for reptiles; Frost (1985) for amphibians; Honacki et al. (1982) for mammals; Miller and Brown (1981) for butterflies; and Hodges et al. (1983) for moths. Nomenclature for any other species in a community description is taken from one of the references listed under "Sources" for that community.

HOW TO USE THIS CLASSIFICATION

This classification is designed to be used by biologists to identify communities in the field. It can also be used to identify communities from written descriptions of a site, if enough information on composition and structure is provided in the description. The first step in identifying an unknown community is to determine the system and subsystem. A dichotomous key to systems and subsystems is provided in Appendix C, with instructions on how to use the key to determine system and subsystem. For an explanation of unfamiliar terms, a glossary is provided in Appendix B. Once the system and subsystem are known, then the descriptions in the appropriate section of the text can be reviewed. As a shortcut, you can review the communities listed in the Contents under the appropriate subsystem, and select a few communities that seem most closely related to the site you are trying to identify. The order of the communities in each subsystem reflects environmental and geographical gradients, so that similar

communities within a subsystem are usually grouped in the list. Finally, read the descriptions to determine which community type best fits the unknown community. In some cases a site will be equally similar to two different community types; these sites are best described as intermediate between the two most similar community types.

The classification can be used in combination with the Heritage ranking system to help make natural resource management decisions. As an example, consider the process of making decisions regarding wildlife management in a natural area. The interactions between wildlife and their habitat can have both positive and negative effects on communities. For example, beaver flooding may increase waterfowl habitat, while at the same time decreasing adjacent wetland or upland habitats for other species. Some types of rare peatlands are vulnerable to flooding by beavers. The costs and benefits of these kinds of modifications need to be weighed in making management decisions. The manager may wish to consider the rarity or significance of a community in the process of evaluating the effects of wildlife on an ecosystem.

This classification of ecological communities is flexible and open to future modifications. New communities can be added as they are discovered, and previously described or designated communities can be changed, divided, or combined as new information becomes available. This classification is our current working hypothesis; it will be refined as new data obtained from field surveys and literature review become available. The Heritage Program welcomes feedback from users of this classification; please send comments or data to the attention of the author at the following address:

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MARINE COMMUNITIES

I. MARINE SYSTEM

The marine system consists of open ocean overlying the continental shelf, the associated coastline that is exposed to wind and waves, and shallow coastal bays that are saline because they lack significant freshwater inflow. The limits extend from mean high water seaward, beyond the limits of rooted vascular vegetation. Salinity is greater than 18.0 parts per thousand (ppt) ocean-derived salts.

A. MARINE SUBTIDAL

This subsystem includes the area below the lowest tide that is permanently flooded with tidal water.

1. Marine deepwater community: a broadly-defined community that includes both quiet and rough waters of the open ocean below the lowest tide level and beyond the seaward limits of rooted vascular vegetation. This community includes all substrate types (ranging from rock bottom to unconsolidated bottom).

Distribution: in the open ocean surrounding Long Island, in the Coastal Lowlands ecozone.

Rank: G5 S5

Source: Cowardin et al. 1979

2. Marine eelgrass meadow: a community of subtidal aquatic beds occurring in quiet waters below the lowest tide level where fluctuations in salinity are minor. Characteristic plants include eelgrass (*Zostera marina*), sea lettuce (*Ulva lactuca*), and algae such as *Enteromorpha* spp., *Polysiphonia* spp., and *Cladophora gracilis*. Characteristic animals include bay scallop (*Aequipecten irradians*), fourspine stickleback (*Apeltes quadracus*), mummichog (*Fundulus heteroclitus*), northern pipefish (*Syngnathus fuscus*), and threespine stickleback (*Gasterosteus aculeatus*). Brant (*Branta bernicla*) utilize eelgrass meadows in winter. Eelgrass meadows are highly productive, provide habitat for a rich variety of marine organisms, and enhance sediment stability.

Distribution: in the ocean surrounding Long Island, in the Coastal Lowlands ecozone.

Rank: G5 S3

Example: Great South Bay, Suffolk County.

Sources: Briggs and O'Connor 1971; Muenscher 1939; Thayer et al. 1984.

B. MARINE INTERTIDAL

This subsystem includes the area between the highest tide level and the lowest tide level; the substrate is periodically exposed and flooded by semidiurnal tides (two high tides and two low tides per tidal day).

1. Marine intertidal mudflats: a community of quiet waters, with substrates composed of silt or sand that is rich in organic matter and poorly drained at low tide. The substrate may be covered with algae. Characteristic organisms are polychaetes such as *Polydora ligni*, *Streblospio benedicti*, *Nereis virens*, *Lumbrineris tenuis*, and *Heteromastus filiformis*, mudsnail (*Ilyanassa obsoleta*), softshell clam (*Mya arenaria*), and blue mussel (*Mytilus edulis*). This community is an important feeding ground for shorebirds such as American oystercatcher (*Haematopus palliatus*), and willet (*Catoptrophorus semipalmatus*).

Distribution: along the seacoast of the Coastal Lowlands and Manhattan Hills ecozones.

Rank: G5 S4

Sources: Whitlatch 1982; Townes 1939.

2. Marine intertidal gravel/sand beach: a community washed by rough, high-energy waves, with sand or gravel substrates that are well-drained at low tide. These areas are subject to high fluctuations in salinity and moisture. A relatively low diversity community, it is perhaps best characterized by the benthic invertebrate fauna including polychaetes (*Spiophanes bombyx*, *Pygospio elegans*, *Clymenella torquata*, *Scoloplos fragilis*, and *Nephtys incisa*) and amphipods (*Protohaustorius deichmannae* and *Acanthohaustorius millsii*). It provides feeding grounds for migrant shorebirds such as sanderling (*Calidris alba*) and semipalmated plover (*Charadrius semipalmatus*) and breeding shorebirds such as piping plover (*Charadrius melodus*).

Distribution: along the seacoast of the Coastal Lowlands and Manhattan Hills ecozones.

Rank: G5 S5

Sources: Whitlatch 1982; Townes 1939.

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3. Marine rocky intertidal: a community inhabiting rocky shores that are washed by rough, high-energy ocean waves. Characteristic organisms are attached algae, mussels, starfish, urchins, and barnacles that are capable of withstanding the impact of the waves and periodic desiccation. The community is typically rich in species. Usually more than 60% of the substrate is covered by attached organisms. Characteristic marine algae attached to the rocks include *Ascophyllum nodosum*, *Fucus vesiculosus*, *Rhizoclonium tortuosum*, *R. riparium*, *Enteromorpha clathrata*, *E. intestinalis*, and *Monostroma latissimum*. More data on this community are needed.

Distribution: uncommon along the seacoast of the Coastal Lowlands and Manhattan Hills ecozones.

Rank: G5 S1S2

Example: Huckleberry Island, Westchester County.

Sources: Conard 1935; Künstler and Capainolo 1987.

C. MARINE CULTURAL

This subsystem includes communities that are either created and maintained by human activities, or are modified by human influence to such a degree that the physical conformation of the substrate, or the biological composition of the resident community is substantially different from the character of the substrate or community as it existed prior to human influence.

1. Marine submerged artificial structure/reef: the aquatic community associated with an artificially introduced structure submerged in marine waters that provides habitat for marine fish and other marine organisms. This includes structures that have been intentionally sunk for the purpose of attracting fish, as well as sunken

ships, disposed waste, or any other introduced material that provides suitable habitat.

Distribution: in the ocean surrounding Long Island, in the Coastal Lowlands ecozone.

Rank: G5 S5

Source: Weisburd 1986.

2. Marine dredge spoil shore: the wetland community of a constructed, intertidal or subtidal, marine shore in which the substrate is composed of dredge spoils. This community has minimal vegetative cover and relatively low species diversity. Dredge spoil shores provide foraging habitat for terns, gulls, and several shorebirds. Characteristic fishes in Great South Bay on sandy dredge spoils include Atlantic silverside (*Menidia menidia*), striped killifish (*Fundulus majalis*), and sheepshead minnow (*Cyprinodon variegatus*).

Distribution: along the seacoast of the Coastal Lowlands and Manhattan Hills ecozones.

Rank: G5 S5

Source: Briggs and O'Connor 1971.

3. Marine riprap/artificial shore: the wetland community of a constructed marine shore in which the substrate is composed of broken rocks, stones, wooden bulkheads, or concrete placed so as to reduce erosion. Characteristic organisms are attached algae, mussels, and barnacles; percent cover and species diversity are low compared to a marine rocky intertidal community.

Distribution: along the seacoast of the Coastal Lowlands and Manhattan Hills ecozones.

Rank: G5 S5

II. ESTUARINE SYSTEM

The estuarine system consists of deepwater tidal habitats and adjacent tidal wetlands that are usually semienclosed but have open, partly obstructed, or sporadic access to open ocean or tidal fresh waters, and in which ocean water is at least occasionally diluted by freshwater runoff. The limits extend from the upstream limit of tidal influence seaward to an imaginary line closing the mouth of a river or bay. Salinity is usually less than 30.0 parts per thousand (ppt) ocean-derived salts.

A. ESTUARINE SUBTIDAL

This subsystem includes the area below the lowest tide; the substrate is permanently flooded with tidal water; it is continuously submerged.

1. Tidal river: the aquatic community of continuously flooded substrates that support no emergent vegetation. Within the river there are two zones; the deepwater zone includes areas where substrates are usually over 6 ft (2 m) deep at low tide, the shallows zone includes submerged areas less than 6 ft (2 m) deep at low tide that lack rooted aquatic vegetation. In the river there is a vertical salinity gradient, with a surface layer of fresh water (salinity less than 0.5 ppt) floating over a deeper layer of brackish water (salinity between 0.5 and 18.0 ppt). Salinities at any one place in the river may fluctuate as the tides flow in and out because the "salt wedge" of brackish water alternately rises and falls with the tides. Characteristic fishes include year-round residents as well as seasonal migrants or anadromous species that enter the river as adults to spawn and return to the ocean afterwards. The progeny of these anadromous fishes occupy the river as a nursery area for the remainder of the year or longer. Characteristic fishes of the deepwater include Atlantic tomcod (*Microgadus tomcod*), hogchoker (*Trinectes maculatus*), and rainbow smelt (*Osmerus mordax*). Characteristic fishes of the shallows include striped bass (*Morone saxatilis*), American shad (*Alosa sapidissima*), banded killifish (*Fundulus diaphanus*), spottail shiner (*Notropis hudsonius*), tessellated darter (*Etheostoma olmstedii*), and pumpkinseed (*Lepomis gibbosus*). Fishes that occur in both deepwater and shallows include bay anchovy (*Anchoa mitchilli*), blueback herring (*Alosa aestivalis*), white perch (*Morone americana*), and alewife (*Alosa pseudoharengus*).

Distribution: in the Hudson Valley and Coastal Lowlands ecozones.

Rank: G4 S3

Example: the Hudson River, from New York City to Troy

Source: Gladden et al. 1988.

2. Tidal creek: the aquatic community of a continuously flooded creek that drains the tidal waters of a coastal salt marsh. The water is brackish to saline (salinity between 0.5 and 30.0 ppt). Water levels fluctuate with the tides; the creek bottom is permanently flooded, but the banks are exposed at low tide. Most tidal creeks flow in a very sinuous pattern through the salt marsh. Although the vertical banks of the creek are regularly eroded and slump into the creek bottom, the position of the creek bed in the marsh is fairly stable and oxbows are rare. The sinuous meanders of the creek are not formed by recent erosion of the marsh, rather they are thought to be relicts of the drainage channels that were active in the tidal flats when the salt marsh grasses first became established. Characteristic plants include widgeon-grass (*Ruppia maritima*), and several cyanobacteria including *Hydrocoleum lyngbaceum*, *Anabaena torulosa*, and *Agmenellum quadruplicatum*. Several fishes that are resident in tidal creeks at low tide also use the low salt marsh when it is flooded by high tide. Characteristic fishes that have this distribution pattern include Atlantic silverside (*Menidia menidia*), mummichog (*Fundulus heteroclitus*), striped killifish (*Fundulus majalis*), sheepshead minnow (*Cyprinodon variegatus*), fourspine stickleback (*Apeltes quadracus*), threespine stickleback (*Gasterosteus aculeatus*), and American eel (*Anguilla rostrata*). Tidal creeks are also utilized as nursery areas for several important marine fishes, including winter flounder (*Pseudopleuronectes americanus*), black sea bass (*Centropristis striata*), bluefish (*Pomatomus saltatrix*), and striped bass (*Morone saxatilis*).

Distribution: in salt marshes along the seacoast in the Coastal Lowlands ecozone, and along the Long Island Sound in the Manhattan Hills ecozone.

Rank: G4 S3S4

Examples: Hubbard Creek Marsh, Suffolk County; Northwest Harbor, Suffolk County.

Sources: Redfield 1972; Teal 1986; Webber 1967.

3. Brackish subtidal aquatic bed: the aquatic community of continuously flooded substrates with rooted aquatic vegetation. The water is brackish (salinity between 0.5 and 18.0 ppt) and the water is usually less than 6 ft (2 m) deep at low tide. Characteristic species are waterweed (*Elodea nuttallii*), coontail (*Ceratophyllum demersum*), naiad (*Najas guadalupensis*), sago pondweed (*Potamogeton pectinatus*), horned pondweed (*Zannichellia palustris*), and widgeon grass (*Ruppia maritima*). A common weedy exotic is Eurasian milfoil (*Myriophyllum spicatum*).

Distribution: along the Hudson River from New York City to Newburgh, in the Hudson Valley and Triassic Lowlands ecozones; may also occur in the Coastal Lowlands ecozone.

Rank: G4 S3S4

Example: Piermont Marsh, Rockland County.

Sources: Metzler and Rosza 1982; Muenscher 1937; Senerchia-Nardone et al. 1985.

4. Freshwater subtidal aquatic bed: the aquatic community of continuously flooded substrates with rooted aquatic vegetation. The water is fresh (salinity less than 0.5 ppt) and the water is usually less than 6 ft (2 m) deep at low tide. Characteristic species are waterweed (*Elodea nuttallii*), tapegrass (*Vallisneria americana*), naiads (*Najas guadalupensis*, and *N. minor*), and pondweed (*Potamogeton perfoliatus*). Two exotic weeds, Eurasian milfoil (*Myriophyllum spicatum*) and water-chestnut (*Trapa natans*), are common in the Hudson River aquatic beds.

Distribution: along the Hudson River from Newburgh to Troy, in the Hudson Valley ecozone.

Rank: G4 S3

Sources: Metzler and Rosza 1982; Muenscher 1937.

B. ESTUARINE INTERTIDAL

This subsystem includes the area between the highest tide level and the lowest tide level; the substrate is periodically exposed and flooded by semidiurnal tides (two high tides and two low tides per tidal day). Some areas are only irregularly exposed at low tide, while other areas are only irregularly flooded at high tide.

Semidiurnal submergence, warm water, copious deposits of mud, and varying salinity make the intertidal estuarine communities extreme and specialized habitats (Fassett 1928).

1. Salt shrub: a shrubland community that forms the ecotone between salt marsh and upland vegetation. Salinity levels are generally lower here than in the salt marsh; and the elevation is higher. Periodic disturbance associated with storms causes die-back of shrubs. Characteristic shrubs are groundsel-tree (*Baccharis halimifolia*), saltmarsh-elder (*Iva frutescens*), and pasture rose (*Rosa carolina*); salt-meadow grass (*Spartina patens*), and switchgrass (*Panicum virgatum*) are typical herbs. A characteristic animal is marsh wren (*Cistothorus palustris*). This community is usually present as a linear feature at the upper edge of a salt marsh; where local topography is nearly level, an extensive shrubland or meadow sometimes occurs.

Distribution: in sheltered areas of the seacoast in the Coastal Lowlands and Manhattan Hills ecozones.

Rank: G5 S4

Examples: Hubbard Creek Marsh, Suffolk County; Northwest Harbor, Suffolk County.

Sources: Clark 1985; Clark 1986a; Conard 1935; Nixon 1982; Redfield 1972; NHP field surveys.

2. High salt marsh: a coastal marsh community that occurs in sheltered areas of the seacoast, in a zone extending from mean high tide up to the limit of spring tides. It is periodically flooded by spring tides and flood tides. High salt marsh typically consists of a mosaic of patches that are mostly dominated by a single graminoid species. The dominant species in many large areas are either salt-meadow grass (*Spartina patens*) or a dwarf form (6 to 12 in. tall) of cordgrass (*Spartina alterniflora*); also common are large areas dominated by spikegrass (*Distichlis spicata*), black-grass (*Juncus gerardi*), or a mixture of salt-meadow grass and cordgrass. Characteristic species of the upper slope of the high marsh (the area that grades into salt shrub) are black-grass, switchgrass (*Panicum virgatum*), sea-lavender (*Limonium carolinianum*), and slender saltmarsh aster (*Aster tenuifolius*). Characteristic animals include salt marsh mosquitoes (*Aedes* spp.), greenhead flies (*Tabanidae*), coffeebean snail (*Melampus bidentatus*), sharp-tailed sparrow (*Ammodramus caudacutus*), marsh wren

(*Cistothorus palustris*), eastern meadowlark (*Stumella magna*), clapper rail (*Rallus longirostris*), and American black duck (*Anas rubripes*).

High salt marsh is one zone within a coastal salt marsh ecosystem; it occurs in a complex mosaic with several other communities. Other communities in a salt marsh ecosystem include salt shrub at the upland border of the high marsh; low salt marsh at the seaward border of the high marsh and along the edges of tidal creeks that drain the high marsh; and salt pannes in shallow depressions within the marsh.

Distribution: in sheltered areas of the seacoast in the Coastal Lowlands and Manhattan Hills ecozones.

Rank: G4 S3S4

Examples: Hubbard Creek Marsh, Suffolk County; Northwest Harbor, Suffolk County.

Sources: Clark 1985; Clark 1986a; Conard 1935; Nixon 1982; Redfield 1972; NHP field surveys.

3. Salt panne: a shallow depression in a salt marsh where the marsh is poorly drained. Pannes occur in both low and high salt marshes. Pannes in low salt marshes usually lack vegetation, and the substrate is a soft, silty mud. Pannes in a high salt marsh are irregularly flooded by spring tides or flood tides, but the water does not drain into tidal creeks. After a panne has been flooded the standing water evaporates and salinity of the soil water is raised well above the salinity of sea-water. Soil water salinities fluctuate in response to tidal flooding and rainfall. Small pond holes occur in some pannes; the pond holes are usually deeper than the thickness of the living salt marsh turf, and the banks or "walls" of the pond holes are either vertical or they undercut the peat. Characteristic plants of a salt panne include the dwarf form (6 to 12 in. tall) of cordgrass (*Spartina alterniflora*), glassworts (*Salicornia europaea* and *S. virginica*), marsh fleabane (*Pluchea odorata*), salt marsh plantain (*Plantago maritima* ssp. *juncooides*), arrowgrass (*Triglochin maritimum*), and salt marsh sand spurry (*Spergularia marina*). Widgeon-grass (*Ruppia maritima*) grows in the pond holes; fishes that may be permanent residents in large pond holes include mummichog (*Fundulus heteroclitus*) and sheepshead minnow (*Cyprinodon variegatus*).

Distribution: in salt marshes along the seacoast of the Coastal Lowlands ecozone.

Rank: G3G4 S3

Examples: Hubbard Creek Marsh, Suffolk County; Northwest Harbor, Suffolk County.

Sources: Nixon 1982; Redfield 1972; NHP field surveys.

4. Low salt marsh: a coastal marsh community that occurs in sheltered areas of the seacoast, in a zone extending from mean high tide down to mean sea level or to about 6 ft (2 m) below mean high tide. It is regularly flooded by semidiurnal tides. The vegetation of the low salt marsh is a nearly monospecific stand of cordgrass (*Spartina alterniflora*), a coarse grass that grows up to about 10 ft (3 m) tall. A few species of marine algae can form dense mats on the surface sediments between the cordgrass stems, including knotted wrack (*Ascophyllum nodosum*) and rockweed (*Fucus vesiculosus*); sea lettuce (*Ulva* spp.) and green algae in the genus *Enteromorpha* can be abundant, especially in early summer. Other plants that are present in very low numbers include glasswort (*Salicornia europaea*), salt marsh sand-spurry (*Spergularia marina*), and lesser sea blite (*Suaeda maritima*). Characteristic animals include clapper rail (*Rallus longirostris*), willet (*Catoptrophorus semipalmatus*), marsh wren (*Cistothorus palustris*), seaside sparrow (*Ammodramus maritimus*), fiddler crabs (*Uca pugnator* and *U. pugnax*) nesting along creek banks, and at high tide mummichog (*Fundulus heteroclitus*) and several other small fishes that live in the tidal creeks at low tide.

The low salt marsh is one zone within a coastal salt marsh ecosystem; it occurs in a mosaic with several other communities. Low salt marsh grades into high salt marsh at slightly higher elevations, and it grades into intertidal mudflats at slightly lower elevations. Tidal creeks that drain the salt marsh flow in a sinuous pattern through the marsh, and a narrow band of low marsh lines the banks of the tidal creeks. Shallow depressions or pannes may also occur in the low marsh.

Distribution: in sheltered areas of the seacoast in the Coastal Lowlands and Manhattan Hills ecozones.

Rank: G4 S3S4

Examples: Hubbard Creek Marsh, Suffolk County; Northwest Harbor, Suffolk County.

Sources: Clark 1985; Clark 1986a; Conard 1935; Nixon 1982; Redfield 1972; NHP field surveys.

5. Coastal salt pond: a community inhabiting marine shoreline lakes or ponds formed by sandspits that close off a lagoon or bay. The water is brackish or slightly brackish. Occasionally the barrier beach is broken by hurricanes and the pond becomes saline until the sandspit closes the pond again. Some ponds have permanent (natural or artificial) inlets. Characteristic species are dwarf spikerush (*Eleocharis parvula*), switchgrass (*Panicum virgatum*), salt-meadow grass (*Spartina patens*), reedgrass (*Phragmites australis*), saltmarsh fleabane (*Pluchea odorata*), three-square (*Scirpus americanus*), rose-mallow (*Hibiscus moscheutos*), pigweeds (*Chenopodium* spp.) and mock bishop's-weed (*Ptilimnium capillaceum*).

Distribution: along the seacoast in the Coastal Lowlands ecozone.

Rank: G4 S1S2

Examples: Oyster Pond, Suffolk County; Island Pond, Fisher's Island, Suffolk County.

Source: NHP field surveys.

6. Brackish tidal marsh: a marsh community that occurs where water salinity ranges from 0.5 to 18.0 ppt, and water is less than 6 ft (2 m) deep at high tide. This community consists of a mixture of salt marsh and freshwater tidal marsh species, with no species attaining dominance over extensive areas (although some species are locally abundant in patches). The vegetation in a brackish tidal marsh is dense and dominated by tall graminoids. Characteristic plants are narrowleaf cattail (*Typha angustifolia*), arrowleaf (*Peltandra virginica*), pickerel-weed (*Pontederia cordata*), water smartweed (*Polygonum punctatum*), reedgrass (*Phragmites australis*), marsh fern (*Thelypteris palustris*), wild rice (*Zizania aquatica*), soft-stem bulrush (*Scirpus tabernaemontani*), river bulrush (*S. fluviatilis*), dwarf spikerush (*Eleocharis parvula*), arrowhead (*Sagittaria latifolia*), lilaopsis (*Lilaeopsis chinensis*), rose-mallow (*Hibiscus moscheutos*), yellow iris (*Iris pseudacorus*) and saltmarsh fleabane (*Pluchea odorata*). Purple loosestrife (*Lythrum salicaria*) is a common weed in brackish marshes. Characteristic birds include red-winged blackbird (*Agelaius phoeniceus*), swamp sparrow (*Melospiza georgiana*), marsh wren (*Cistothorus*

palustris), yellow warbler (*Dendroica petechia*), common yellowthroat (*Geothlypis trichas*), song sparrow (*Melospiza melodia*), Virginia rail (*Rallus limicola*), American goldfinch (*Carduelis tristis*), and eastern kingbird (*Tyrannus tyrannus*).

Brackish marshes are best developed on large river systems characterized by gentle slope gradients coupled with tidal influence over considerable distances. The downstream limits of the community begin where cordgrass (*Spartina alterniflora*) no longer dominates tidal creek or river banks, and the upstream limits extend to where the green seaweed *Enteromorpha intestinalis* can no longer be found. Brackish tidal marshes can be distinguished from freshwater tidal marshes by the lack of species restricted to freshwater, such as spatterdock (*Nuphar luteum* ssp. *macrophyllum*), sweetflag (*Acorus americanus*), and blue flag (*Iris versicolor*), and a decrease in cover of sedges (*Carex* spp. and *Cyperus* spp.).

Distribution: along the seacoast of the Coastal Lowlands ecozone, and along the Hudson River from New York City to Newburgh in the Triassic Lowlands and Hudson Valley ecozones.

Rank: G4 S3S4

Examples: Constitution Marsh, Putnam County; Iona Island, Rockland County; Piermont Marsh, Rockland County.

Sources: Metzler and Rosza 1982; Muenscher 1937; Odum et al. 1984; Senerchia-Nardone et al. 1985; Swift 1987; NHP field surveys.

7. Brackish intertidal mudflats: a sparsely vegetated community, characterized by low-growing, rosette-leaved aquatics. The community occurs on exposed intertidal mudflats where water salinity ranges from 0.5 to 18.0 ppt. This community is best developed where mudflats are nearly level so that broad expanses are exposed at low tide. The rosette-leaved aquatics are completely submerged at high tide, and they are usually coated with mud. Characteristic species are spongy arrowhead (*Sagittaria calycina* var. *spongiosa*), strap-leaf arrowhead (*Sagittaria subulata*), mudwort (*Limosella australis*), three-square bulrush (*Scirpus americanus*), and tapegrass (*Vallisneria americana*).

Distribution: along the Hudson River from New York City to Newburgh in the Triassic Lowlands and Hudson Valley ecozones; may also occur in the Coastal Lowlands ecozone.

Rank: G3G4 S1S2

Examples: Piermont Marsh, Rockland County; Constitution Marsh, Putnam County.

Sources: Muenscher 1937; NHP field surveys.

8. Brackish intertidal shore: a community of the intertidal gravelly or rocky shores of brackish tidal rivers and creeks where water salinity ranges from 0.5 to 18.0 ppt. This community is usually sparsely vegetated. More data on this community are needed.

Distribution: along the seacoast of Long Island in the Coastal Lowlands ecozone, and along the Hudson River from New York City to Poughkeepsie in the Triassic Lowlands and Hudson Valley ecozones.

Rank: G3G4 S1S2

Example: Hands Creek, Suffolk County.

Source: NHP field surveys.

9. Freshwater tidal swamp: a forested or shrub-dominated tidal wetland that occurs in lowlands along large river systems characterized by gentle slope gradients coupled with tidal influence over considerable distances. The swamp substrate is always wet and is subject to semidiurnal flooding by fresh tidal water (salinity less than 0.5 ppt). The characteristic trees are green ash (*Fraxinus pennsylvanica*), black ash (*F. nigra*), red maple (*Acer rubrum*), slippery elm (*Ulmus rubra*) and American hornbeam (*Carpinus caroliniana*); northern white cedar (*Thuja occidentalis*) is a distinctive associate in at least one example in the Hudson Valley. Common shrubs and vines are alders (*Alnus serrulata*, *A. rugosa*), spicebush (*Lindera benzoin*), arrowwood (*Viburnum recognitum*), silky dogwood (*Cornus amomum*), red-osier dogwood (*C. sericea*), gray dogwood (*C. foemina* ssp. *racemosa*), Virginia creeper (*Parthenocissus quinquefolius*), and poison ivy (*Toxicodendron radicans*). Characteristic groundlayer species are rice cutgrass (*Leersia oryzoides*), sensitive fern (*Onoclea sensibilis*), clearweed (*Pilea pumila*), spotted jewelweed (*Impatiens capensis*), common monkeyflower (*Mimulus ringens*), knotweeds (*Polygonum hydropiper*, *P. hydropiperoides*, *P. sagittatum*), skunk cabbage (*Symplocarpus foetidus*), hog peanut (*Amphicarpa bracteata*), groundnut (*Apios americana*), wild yam (*Dioscorea villosa*), sedge

(*Carex grayi*), Jack-in-the-pulpit (*Arisaema triphyllum*), and swamp milkweed (*Asclepias incarnata*).

Distribution: along the Hudson River from Newburgh to Troy, in the Hudson Valley ecozone.

Rank: G2G3 S1

Examples: Roger's Island, Columbia County; Catskill Marsh, Greene County.

Sources: DeVries and DeWitt 1986; McVaugh 1958; Westad and Kiviat 1985; NHP field surveys.

10. Freshwater tidal marsh: a marsh community that occurs in shallow bays, shoals, and at the mouth of tributaries of large tidal river systems, where the water is usually fresh (salinity less than 0.5 ppt), and less than 6 ft (2 m) deep at high tide. The vegetation is dominated by aquatics that are emergent at high tide. Typically there are two zones in a freshwater tidal marsh: a low-elevation area dominated by short, broad-leaf emergents bordering mudflats or open water, and a slightly higher-elevation area dominated by tall graminoids.

Characteristic plants of the low-elevation, broad-leaf emergent zone include spatterdock (*Nuphar luteum* ssp. *macrophyllum*), pickerelweed (*Pontederia cordata*), arrowleaf (*Peltandra virginica*), and fowl mannagrass (*Glyceria striata*). Under the canopy of emergents (or between clones) there may be a sparse understory of rosette-leaved aquatics such as narrow-leaved arrowheads (*Sagittaria subulata*, *S. graminea*, and *S. rigida*), and mud-plantain (*Heteranthera reniformis*).

Characteristic plants of the slightly higher, graminoid zone include narrowleaf cattail (*Typha angustifolia*), river bulrush (*Scirpus fluviatilis*), bur-reed (*Sparganium eurycarpum*), wild rice (*Zizania aquatica*), and blue flag (*Iris versicolor*).

Other characteristic plants that occur in both zones include arrowhead (*Sagittaria latifolia*), rice cutgrass (*Leersia oryzoides*), water-hemp (*Amaranthus cannabinus*), spotted jewelweed (*Impatiens capensis*), estuary beggar-ticks (*Bidens bidentoides*), sweetflag (*Acorus americanus*), softstem bulrush (*Scirpus tabernaemontanii*), sedges (*Carex hystericina*, *C. lacustris*), and cyperus (*Cyperus* spp.). Purple loosestrife (*Lythrum salicaria*) and reedgrass (*Phragmites australis*) are common exotics in this community.

Some marshes include small areas of sandflats, often dominated by one or a few

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species. Characteristic plants of sandflats include three-square bulrush (*Scirpus americanus*), water horsetail (*Equisetum fluviatile*), Pennsylvania bittercress (*Cardamine pennsylvanica*), mud-hyssop (*Gratiola neglecta*), water smartweed (*Polygonum punctatum*), and an exotic, black mustard (*Brassica nigra*).

Characteristic birds include marsh wren (*Cistothorus palustris*), red-winged blackbird (*Agelaius phoeniceus*), swamp sparrow (*Melospiza georgiana*), Virginia rail (*Rallus limicola*), song sparrow (*Melospiza melodia*), yellow warbler (*Dendroica petechia*), least bittern (*Ixobrychus exilis*), American goldfinch (*Carduelis tristis*), willow flycatcher (*Empidonax traillii*), and common yellowthroat (*Geothlypis trichas*).

Distribution: along the Hudson River from Newburgh to Troy, in the Hudson Valley ecozone.

Rank: G3G4 S2

Examples: Stockport Creek Marshes, Columbia County; Catskill Marsh, Greene County.

Sources: DeVries and DeWitt 1986; Metzler and Rosza 1982; Muenscher 1937; Odum et al. 1984; Swift 1987; NHP field surveys.

11. Freshwater intertidal mudflats: a sparsely vegetated community characterized by low rosette-leaved aquatics. This community occurs on exposed intertidal mudflats where the water is fresh (salinity less than 0.5 ppt). This community is best developed where mudflats are nearly level so that broad expanses are exposed at low tide. The plants are completely submerged in 3 to 4 ft (0.9 to 1.2 m) of water at high tide; and they are usually coated with mud. Characteristic species are strap-leaf arrowhead (*Sagittaria subulata*), mud-plantain (*Heteranthera reniformis*), grass-leaf arrowhead (*Sagittaria graminea*), stiff arrowhead (*Sagittaria rigida*), three-square bulrush (*Scirpus americanus*), golden club (*Orontium aquaticum*), and wild rice (*Zizania aquatica*).

Distribution: along the Hudson River from Newburgh to Troy, in the Hudson Valley ecozone.

Rank: G3G4 S2

Examples: Stockport Creek Marshes, Columbia County; North Tivoli Bay, Dutchess County.

Sources: Muenscher 1937; NHP field surveys.

12. Freshwater intertidal shore: a community of the intertidal gravelly or rocky shores of freshwater tidal rivers and creeks, sometimes occurring at the base of cliffs. The vegetation may be very sparse. Characteristic species are heartleaf plantain (*Plantago cordata*), estuary beggar-ticks (*Bidens bidentoides*), water-hemp (*Amaranthus cannabinus*), smartweed (*Polygonum hydropiperoides*), cardinal flower (*Lobelia cardinalis*), Pennsylvania bittercress (*Cardamine pennsylvanica*), mud-hyssop (*Gratiola neglecta*), golden club (*Orontium aquaticum*), and an exotic, black mustard (*Brassica nigra*).

Distribution: along the Hudson River from Newburgh to Troy, in the Hudson Valley ecozone.

Rank: G3G4 S2S3

Examples: Tivoli Bays, Dutchess County; Inbocht Bay, Greene County.

Sources: McVaugh 1958; Muenscher 1937; NHP field surveys.

C. ESTUARINE CULTURAL

This subsystem includes communities that are either created and maintained by human activities, or are modified by human influence to such a degree that the physical conformation of the substrate, or the biological composition of the resident community is substantially different from the character of the substrate or community as it existed prior to human influence.

1. Estuarine channel/artificial impoundment: the aquatic community of an estuarine channel or bay that was created or modified by a barrier or dam which obstructs the outflow of water; an artificial estuarine deepwater community.

Distribution: in the Hudson Valley, Hudson Highlands, Manhattan Hills, and Coastal Lowlands ecozones.

Rank: G5 S5

2. Estuarine ditch: the aquatic community of a ditch or narrow channel excavated in an estuarine marsh for the intended purpose of reducing mosquito populations. These ditches have not been very effective in reducing mosquito populations; the ditches have probably done more harm to the salt marsh vegetation than is justified

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by the effectiveness of the mosquito control efforts.

Distribution: along the seacoast of the Coastal Lowlands and Manhattan Hills ecozones.

Rank: G5 S5

3. Estuarine impoundment marsh: a marsh community that occurs in a wetland created or modified by a barrier or dam that obstructs the outflow or inflow of water, and which has a biological composition significantly different from the composition of a natural estuarine marsh. This community is characterized by an abundance of weedy species such as purple loosestrife (*Lythrum salicaria*), reedgrass (*Phragmites australis*), or water-chestnut (*Trapa natans*).

Distribution: in the Hudson Valley, Hudson Highlands, Manhattan Hills, and Coastal Lowlands ecozones.

Rank: G5 S5

4. Estuarine dredge spoil shore: the wetland community of a constructed estuarine shore in which the substrate is composed of dredge spoils. This is a community with minimal vegetative cover and relatively low species diversity.

Distribution: in the Hudson Valley, Hudson Highlands, Manhattan Hills, and Coastal Lowlands ecozones.

Rank: G5 S5

5. Estuarine riprap/artificial shore: the wetland community of a constructed estuarine shore in which the substrate is composed of broken rocks, wooden bulkheads, or concrete placed so as to reduce erosion. Vegetative cover and species diversity are low compared to natural estuarine shores.

Distribution: in the Hudson Valley, Hudson Highlands, Manhattan Hills, and Coastal Lowlands ecozones.

Rank: G5 S5

III. RIVERINE SYSTEM

The riverine system consists of the aquatic communities of flowing, non-tidal waters that lack persistent emergent vegetation, but may include areas with submerged or floating-leaved aquatic vegetation. The riverine communities in this classification are distinguished primarily by position of the stream in the watershed, and water flow characteristics. These communities are broadly defined, and may include two or more finer scale habitats, such as riffles, runs, springs, pools, and waterfalls; these habitats may have distinctive species assemblages. A riffle is a part of the stream that is shallow and has a comparatively fast current; the water surface is disturbed by the current and may form standing waves. A run is a part of the stream that has a moderate to fast current; the water is deep enough that the water surface is smooth and unbroken by the water current (although it may be disturbed by wind). A pool is a part of the stream that is deep and has a comparatively slow current; the water surface is calm unless disturbed by wind. The riverine communities are also distinguished by size of the stream. Large streams have an average width greater than 100 ft (about 30 m), medium streams are from 10 ft to 100 ft (about 3 to 30 m) wide, and small streams have an average width less than 10 ft (about 3 m). The fish assemblages in the riverine communities (especially in main channel streams) vary according to the watershed. A finer scale classification of streams that distinguishes types according to watershed needs to be evaluated.

This classification of riverine communities is based entirely on literature review and discussions with aquatic ecologists. Bob Daniels of the New York State Museum provided much of the information on fish communities. The Heritage program has done limited inventory work on streams; we do not currently have in our files sufficient field data for evaluating the riverine classification. Therefore the riverine classification is more tentative than the classification of estuarine, palustrine, and terrestrial communities; it needs to be tested with field surveys, and it will probably need further refinement after field data are evaluated.

A. NATURAL STREAMS

This subsystem includes streams in which the stream flow, morphometry, and water chemistry have not been substantially modified by human activities, or the native biota are dominant. The biota may include some introduced species (for

example, introduced fishes), however the introduced species are not usually dominant in the stream community as a whole.

1. Rocky headwater stream: the aquatic community of a small- to moderate-sized rocky stream with a moderate to steep gradient, and cold water that flows over eroded bedrock in the area where a stream originates. These streams may include alternating riffle and pool sections. Most of the erosion is headward, and deposition is minimal. Waterfalls and springs may be present; these are here treated as features of the more broadly defined community. The predominant source of energy to the stream is terrestrial leaf litter or organic matter; trees shading the stream reduce primary productivity. Characteristic fishes include eastern blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), slimy sculpin (*Cottus cognatus*) or mottled sculpin (*C. bairdi*), and brook trout (*Salvelinus fontinalis*). Common introductions are rainbow trout (*Salmo gairdneri*) and brown trout (*S. trutta*). These streams typically have mosses and periphytic algae present, but few larger rooted plants. Characteristic mosses include: *Brachythecium rivulare*, *B. plumosum*, *Eurhynchium riparioides*, *Hygroamblystegium tenax*, and *Rhizomnium punctatum*.

Distribution: throughout upstate New York north of the Coastal Lowlands ecozone

Rank: G4 S4

Sources: Slack and Glime 1985, C. L. Smith 1985.

2. Marsh headwater stream: the aquatic community of a small, marshy brook with a low gradient, slow flow rate, and cool to cold water that flows through a marsh, fen, or swamp in the area where a stream originates. Most of the erosion is headward, and deposition is minimal. Springs may be present; these are here treated as a feature of the more broadly defined community. The substrate is gravel or sand, with silt, muck, peat, or marl deposits along the shore. Characteristic fishes are fathead minnow (*Pimephales promelas*), northern redbelly dace (*Phoxinus eos*), golden shiner (*Notemigonus crysoleucas*), and central mudminnow (*Umbra limi*). Characteristic aquatic macrophytes include water milfoil (*Myriophyllum heterophyllum*), coontail (*Ceratophyllum demersum*), pondweeds (*Potamogeton* spp.), duckweed (*Lemna minor*),

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water stargrass (*Heteranthera dubia*), and waterweed (*Elodea nuttallii*).

Distribution: throughout New York State.

Rank: G4 S4

Example: Campbell Marsh, Jefferson County.

Sources: Gilman 1979; Haslam 1978; Peverly 1979; C. L. Smith 1985.

3. Midreach stream: the aquatic community of a stream that has a well-defined pattern of alternating pool, riffle, and run sections. Most of the erosion is lateral. Waterfalls and springs may be present; these are here treated as features of the more broadly defined community. Characteristic fishes include creek chub (*Semotilus atromaculatus*), pumpkinseed (*Lepomis gibbosus*), common shiner (*Notropis cornutus*), and trout-perch (*Percopsis omiscomaycus*) in pools; rosyface shiner (*Notropis rubellus*) at the head of pools; tessellated darter (*Etheostoma olmstedii*), greenside darter (*E. blennioides*), longnose dace (*Rhinichthys cataractae*), slimy sculpin (*Cottus cognatus*) or mottled sculpin (*C. bairdi*), and stonecat (*Noturus flavus*) in riffles; and bluntnose minnow (*Pimephales notatus*) and northern hog sucker (*Hypentelium nigricans*) in runs. Common introductions are rainbow trout (*Salmo gairdneri*), brown trout (*S. trutta*), and (in streams where it is not native) smallmouth bass (*Micropterus dolomieu*). Typical aquatic macrophytes include waterweed (*Elodea canadensis*) and linear-leaved pondweeds such as sago pondweed (*Potamogeton pectinatus*). More data on this community are needed.

Distribution: throughout New York State.

Rank: G4 S4

Example: French Creek, Chautauqua County.

Sources: C. L. Smith 1985; NHP field surveys.

4. Main channel stream: the aquatic community of a large, quiet, base level sections of streams where there are no distinct riffles. Main channel streams usually have clearly distinguished meanders. They are characterized by considerable deposition, with a relatively minor amount of erosion. Waterfalls and springs may be present; these are here treated as features of the more broadly defined community.

Characteristic fishes are deep-bodied fishes such as suckers (Catostomids) - especially redborses (*Maxostoma* spp.), sturgeon (*Acipenser* spp.), and shad (*Alosa* spp.). Many of the fishes are anadromous. The species of these genera present in any one stream varies with the watershed. Five major watersheds in upstate New York were distinguished by C. L. Smith (1985): the St. Lawrence River basin, Hudson River, Delaware River, Susquehanna River, and Allegheny River. Based on the fish communities, these watersheds could be treated as 5 separate community types; however an analysis of the invertebrate fauna and the flora of main channel streams in these watersheds may show a greater similarity in the invertebrate fauna and flora between watersheds than is found in the fish assemblages. Other characteristic fishes include warmwater fishes such as pickerel (*Esox americanus*), northern pike (*E. lucius*), largemouth bass (*Micropterus salmoides*), and smallmouth bass (*M. dolomieu*). Although the middle of a main channel stream is too deep for aquatic macrophytes to occur, the shallow shores and backwaters typically have rooted macrophytes. Mosses in the genus *Fontinalis* are characteristic of shallow areas. Two exotic weeds, Eurasian milfoil (*Myriophyllum spicatum*) and water chestnut (*Trapa natans*) may also occur along shores and backwaters. More data on flora and invertebrate fauna are needed.

Distribution: throughout the state north of the Coastal Lowlands ecozone.

Rank: G4 S4

Example: Mohawk River from Utica to the Hudson River

Source: C. L. Smith 1985.

5. Backwater slough: the aquatic community of quiet to stagnant waters in sloughs that form in embayments and old meanders that are partially cut off from a main channel stream by deposition of a levee. Aquatic vegetation is usually abundant. Characteristic aquatic plants include waterweed (*Elodea canadensis*), and milfoil (*Myriophyllum* spp.). Characteristic fishes are golden shiner (*Notemigonus crysoleucas*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ictalurus nebulosus*), and chain pickerel (*Esox niger*). More data on this community are needed.

Distribution: throughout upstate New York north of the Coastal Lowlands ecozone.

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Rank: G4 S2S3

Sources: C. L. Smith 1985; NHP field surveys.

6. Intermittent stream: the community of a small, ephemeral streambed with a moderate to steep gradient, where water flows only during the spring or after a heavy rain. Fauna is limited to species that do not require a permanent supply of running water, or that inhabit the streambed only during the rainy season. The streambed may be covered with mosses; a characteristic moss is *Bryhnia novae-angliae*. More data on this community are needed.

Distribution: throughout New York State.

Rank: G4 S4

Source: comments by Nancy Slack (of Russell Sage College).

7. Coastal plain stream: the aquatic community of slow-moving, often darkly-stained streams of the coastal plain of Long Island. Often there is abundant submerged vegetation: characteristic aquatic plants include pondweeds (*Potamogeton pusillus*, *P. epihydrus*), naiads (*Najas flexilis*, *N. guadalupensis*), waterweeds (*Elodea nuttallii*, *E. canadensis*, *E. densa*), stonewort (*Nitella* sp.), bladderwort (*Utricularia vulgaris*), duckweed (*Lemna minor*), and white water-crowfoot (*Ranunculus trichophyllus*). Watercress (*Nasturtium officinale*), an introduced species, is also common. Characteristic fishes include American eel (*Anguilla rostrata*), redbfin pickerel (*Esox americanus americanus*), eastern banded killifish (*Fundulus diaphanus diaphanus*), pumpkinseed (*Lepomis gibbosus*), banded sunfish (*Enneacanthus obesus*), and swamp darter (*Etheostoma fusiforme*).

Distribution: restricted to the Coastal Lowlands ecozone.

Rank: G3G4 S1

Sources: Beitel 1976; Greeley 1939; Muenscher 1939.

B. RIVERINE CULTURAL

This subsystem includes communities that are either created and maintained by human activities, or are modified by human influence to such a degree that stream flow, morphometry, water

chemistry, or the biological composition of the resident community are substantially different from the character of the stream community as it existed prior to human influence.

1. Acidified stream: the aquatic community of a stream that has received so much acid deposition that the pH of the stream has decreased significantly. The dominant anions in precipitation in the Northeast are sulfate and nitrate; the pH of this precipitation is less than 4.7. The biota of streams may be more sensitive to acidification than the biota of lakes. In the Adirondack Highlands of Ontario, several species of mayflies and stoneflies have disappeared from acidified reaches of streams. Fish kills have been observed in streams following acid pulses (for example, after snowmelt). More data on this community are needed.

Distribution: most common in the Adirondacks, may also occur throughout eastern New York in the Appalachian Plateau, Taconic Highlands, and Hudson Valley ecozones.

Rank: G5 S5

Source: Schindler 1988.

2. Canal: the aquatic community of an artificial waterway or modified stream channel constructed for inland navigation or irrigation. Most canals have a low gradient between locks; however, some feeder canals (built to supply water to another canal) have a steep gradient and are not navigable. Characteristic fishes include brook stickleback (*Culaea inconstans*), central mudminnow (*Umbra limi*), brook silverside (*Labidesthes sicculus*), and pikes (*Esocidae*).

Distribution: throughout New York State.

Rank: G5 S5

3. Ditch/artificial intermittent stream: the aquatic community of an artificial waterway constructed for drainage or irrigation of adjacent lands. Water levels either fluctuate in response to variations in precipitation and groundwater levels, or water levels are artificially controlled. The sides of ditches are often vegetated, with grasses and sedges usually dominant. Exotic or weedy species are common. Purple loosestrife (*Lythrum salicaria*), reedgrass (*Phragmites australis*), and reed canary grass (*Phalaris*

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arundinacea) often become established and may form dense, monospecific stands. Reed canary grass is often planted along ditches for erosion control. Other plants that are characteristic include sedges (*Carex* spp.) and cattails (*Typha* spp.).

Distribution: throughout New York State.

Rank: G5 S5

4. Industrial effluent stream: the aquatic community of a stream or a small section of a stream in which the temperature, chemistry, or transparency of the water is significantly modified

by discharge of effluent from an industrial, commercial, or sewage treatment plant. The water or sediments may contain elevated concentrations of heavy metals, PCBs, ammonia, and other pollutants. Relative to unpolluted streams of similar morphology, species richness of fishes is low, and pollution-intolerant species (e.g. lampreys, darters, sculpins) may be absent.

Distribution: throughout New York State.

Rank: G5 S5

Source: Reash and Berra 1987.

IV. LACUSTRINE SYSTEM

The lacustrine system consists of waters situated in topographic depressions or dammed river channels, lacking persistent emergent vegetation, but including areas with submerged or floating-leaved aquatic vegetation. The lacustrine communities in this classification are distinguished primarily by trophic state, annual cycles of thermal stratification and circulation, morphometry (size and shape of the lake basin and drainage area), and water chemistry. The communities are described in terms of the free-floating organisms of the open water or limnetic zone (including plankton and fish), the aquatic macrophytes and fish near the shore or littoral zone, and the bottom-dwelling organisms or benthos. The limnetic zone may be divided into the epilimnion (upper lake zone), which is sunny, mixed by the wind, and comparatively rich in oxygen, and the hypolimnion (lower lake zone), which is darker, and comparatively rich in carbon dioxide from respiration and decay. The transition between the epilimnion and hypolimnion is called the thermocline. The lake bottom or benthic zone may be divided into the peripheral shallows or littoral zone, the slightly deeper sublittoral zone, and (in summer-stratified lakes) the deep, cold region where currents are minimal and light is much reduced, called the profundal zone. These zones may each have a distinctive biota at any one point in time; however, many of the plankton and fish move between zones on a regular basis.

This classification of lacustrine communities is based entirely on literature review and discussions with aquatic ecologists. The Heritage program has not done inventory work on lakes; we do not currently have in our files sufficient field data for a detailed evaluation of the lacustrine classification. Therefore the lacustrine classification is more tentative and the communities are more broadly defined than in the classification of estuarine, palustrine, and terrestrial communities. This classification needs to be tested with field surveys, and it will probably need further refinement after field data are evaluated.

A. NATURAL LAKES AND PONDS

This subsystem includes the Great Lakes, and inland lakes and ponds in which the trophic state, morphometry, and water chemistry have not been substantially modified by human activities, or the native biota are dominant. The biota may include some introduced species (for example, non-native macrophytes, introduced fishes),

however the introduced species are not usually dominant in the lake or pond community as a whole.

1. Great Lakes deepwater community: the open water community in any of the Great Lakes. In general, the Great Lakes are summer-stratified monomictic lakes: they usually do not freeze over in winter, they are mixed and isothermal in winter, and stratified in summer. One exception is that portions of eastern Lake Erie, along the New York shores, freeze over quite frequently. The Great Lakes are distinguished from inland summer-stratified monomictic lakes because of their size and access to estuarine biota through the St. Lawrence River and Welland Canal. Characteristic fishes include cisco (*Coregonus artedii*), lake whitefish (*Coregonus clupeaformis*), sea lamprey (*Petromyzon marinus*), lake trout (*Salvelinus namaycush*), rainbow smelt (*Osmerus mordax*), alewife (*Alosa pseudoharengus*), quillback (*Carpionodes cyprinus*), white bass (*Morone chrysops*), burbot (*Lota lota*), emerald shiner (*Notropis atherinoides*), mooneye (*Hiodon tergisus*), and silver chub (*Hybopsis storeriana*). Two introduced salmonids that are now common in Lake Ontario are coho salmon (*Oncorhynchus kisutch*) and chinook salmon (*O. tshawytscha*). New York's share of the Great Lakes has been significantly polluted and modified by introductions of non-native species; some introductions have resulted from migrations through the Welland and Erie canals. Many of the formerly common native fish have apparently disappeared from Lake Erie or Lake Ontario including blue pike (*Stizostedion vitreum glaucum*), bloater (*Coregonus hoyi*), kiyi (*C. kiyi*), shortnose cisco (*C. reighardi*), shortjaw cisco (*C. zenithicus*), spoonhead sculpin (*Cottus ricei*), and deepwater sculpin (*Myoxocephalus thompsoni*).

Distribution: restricted to the Great Lakes Plain ecozone.

Rank: G2G3 S1S2

Examples: Lake Ontario; Lake Erie.

Sources: Berg 1963, C. L. Smith 1985.

2. Great Lakes aquatic bed: the aquatic community of the protected shoals of the Great Lakes that occur in quiet bays that are protected from extreme wave action, and support large areas of "weeds" or aquatic macrophytes. These bays may freeze over in winter and become

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inversely stratified. Characteristic fishes in the aquatic bed include pickerel (*Esox americanus*), threespine stickleback (*Gasterosteus aculeatus*), longnose gar (*Lepisosteus osseus*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), Iowa darter (*Etheostoma exile*), and tadpole madtom (*Noturus gyrinus*). Goldfish (*Carassius auratus*) is an introduced fish that is well-established in Great Lakes aquatic beds. Characteristic macrophytes include the algae *Cladophora* and *Chara*, tape grass (*Vallisneria americana*), pondweeds (*Potamogeton richardsonii*, *P. pectinatus*, *P. gramineus*, and *P. pusillus*), naiad (*Najas flexilis*), horned pondweed (*Zannichellia palustris*), water stargrass (*Heteranthera dubia*), and coontail (*Ceratophyllum demersum*). Growth of *Cladophora* has been related to point sources of nutrient enrichment, especially phosphorus enrichment.

Distribution: restricted to the Great Lakes Plain ecozone.

Rank: G4 S3

Examples: Irondequoit Bay, Monroe County; North Pond, Oswego County.

Source: Clausen 1940.

3. Great Lakes exposed shoal: the aquatic community of the shallow littoral zone of the Great Lakes that occurs along windswept shores that are exposed to wave action. Aquatic macrophytes are uncommon. The alga *Cladophora* grows on rocks in the wave zone; growth of *Cladophora* has been related to point sources of nutrient enrichment, especially phosphorus enrichment. The lake substrate may be sandy, gravelly, rocky, or with submerged bedrock outcrops. Characteristic fishes include stonecat (*Noturus flavus*), freshwater drum (*Aplodinotus grunniens*), mottled sculpin (*Cottus bairdi*), and lake chub (*Couesius plumbeus*). Lake sturgeon (*Acipenser fulvescens*) was once abundant in shoal waters in the Great Lakes, has declined sharply, but should recover). More data on this community are needed.

Distribution: restricted to the Great Lakes Plain ecozone.

Rank: G4 S4

Source: C. L. Smith 1985.

4. Bog lake: the aquatic community of a dystrophic lake that typically occurs in a small, shallow basin that is protected from wind and is poorly drained. These lakes occur in areas with non-calcareous bedrock or glacial till; many are fringed by a floating mat of vegetation (in New York usually either bog or poor fen). Characteristic features of a dystrophic lake include the following: murky water that is stained brown, with low transparency; water that is low in plant nutrients (especially low in calcium), with low pH (less than 5.4); and the lake may have oxygen deficiencies in deeper water. Species diversity in bog lakes is low in all types of aquatic organisms (phytoplankton, macrophytes, zooplankton, zoobenthos, and fish); many bog lakes have no fish at all. The abundance of each species present is also low in all types of organisms, except for aquatic macrophytes and peat mosses (*Sphagnum* spp.) along the edge of the bog mat. The lack of calcium blocks bacterial action, reducing the rate of decay of organic matter with subsequent accumulation of peat or muck sediments. Colloidal and dissolved humus material reduces transparency and increases acidity of the water. Characteristic invertebrates include larvae of midges (*Chironomus* spp.) and phantom midges (*Chaoborus* spp.) in the benthos. Characteristic macrophytes include water-shield (*Brasenia schreberi*), white water-lily (*Nymphaea odorata*), yellow pond-lily (*Nuphar luteum* ssp. *pumilum* and *N. luteum* ssp. *variegatum*), and common bladderwort (*Utricularia vulgaris*).

A common feature of bog lakes is the development of a false bottom at a depth of about 1 to 3 ft (0.3 to 0.9 m) below the surface. The false bottom is composed of colloidal material and dissolved humus held in suspension that appears to be a more or less continuous bottom. When disturbed, the suspended material quickly clouds the upper layer of clear water, then slowly settles when the water becomes quiet again. Occasionally bog lakes become meromictic or chemically stratified; the chemical gradient supercedes the usual stratification by temperature.

Distribution: sparsely scattered throughout New York State north of the coastal lowlands ecozone.

Rank: G4 S3

Examples: Spring Pond, Franklin County; Mud Lake, Rensselaer County.

Sources: Clausen 1940; Cole 1975; Maitland 1978.

5. Oligotrophic dimictic lake: the aquatic community of a nutrient-poor lake that typically occurs in a deep, steeply banked basin. These lakes are dimictic: they have two periods of mixing or turnover (spring and fall), they are thermally stratified in the summer, and they freeze over and become inversely stratified in the winter. Characteristic features of an oligotrophic lake include the following: blue or green water that is clear, with high transparency (Secchi disk depths of 4 to 8 m); water low in plant nutrients (especially low in nitrogen, also low in calcium); low primary productivity (inorganic carbon fixed = 7 to 25 g/m²/yr); lake sediments that are low in organic matter (usually consisting of stones and inorganic silt); epilimnion volume that is relatively small compared with hypolimnion; and an abundance of oxygen all year, in all strata. The profundal benthos includes many species, but the abundance of each species is very low. Phytoplankton and zooplankton also have many species, with low abundance; the characteristic phytoplankton include desmids (*Staurastrum* spp.), chrysophytes (*Dinobryum* spp.), and the diatoms *Tabellaria* and *Cyclotella*. The characteristic profundal invertebrates include midge larvae such as *Tanytarsus*; in contrast to bog lakes, oligotrophic lakes usually lack phantom midges (*Chaoborus* spp.). Characteristic fishes are smallmouth bass (*Micropterus dolomieu*) in shallow areas, lake trout (*Salvelinus namaycush*) in deep water, and either slimy sculpin (*Cottus cognatus*) or mottled sculpin (*C. bairdi*). Brown trout (*Salmo trutta*) and rainbow trout (*S. gairdneri*) are commonly introduced. In the Adirondacks, this community provides habitat for the common loon (*Gavia immer*). Characteristic macrophytes include small rosette-leaved aquatics that are restricted to shallow bottoms from 3 to 10 ft (1 to 3 m) deep. Characteristic rosette-leaved aquatics include pipewort (*Eriocaulon aquaticum*), water lobelia (*Lobelia dortmanna*), and quillwort (*Isoetes echinospora* ssp. *muricata*). Characteristic free-floating aquatics are slender water milfoil (*Myriophyllum tenellum*) and bladderworts (*Utricularia purpurea*, *U. resupinata*).

Distribution: throughout New York State, especially common in the Adirondacks.

Rank: G4 S3

Examples: Lake George, Warren and Essex Counties; Schroon Lake, Essex and Warren Counties; Skaneateles Lake, Onondaga and Cayuga Counties.

Sources: Bloomfield 1978a; Cole 1975; Ferris et al. 1980; Maitland 1978; Roberts et al. 1985.

6. Mesotrophic dimictic lake: the aquatic community of a lake that is intermediate between an oligotrophic lake and a eutrophic lake. These lakes are dimictic: they have two periods of mixing or turnover (spring and fall); they are thermally stratified in the summer, and they freeze over and become inversely stratified in the winter. Characteristic features of a mesotrophic lake include the following: water that is moderately clear, with medium transparency (Secchi disk depths of 2 to 4 m); water with moderate amounts of plants nutrients; moderate primary productivity (inorganic carbon fixed = 25 to 75 g/m²/yr); lake sediments with moderate amounts of organic matter; and moderately well-oxygenated water. Characteristic fishes are warmwater fishes such as yellow perch (*Perca flavescens*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and pumpkinseed (*L. gibbosus*). These lakes typically have a diverse mixture of submerged macrophytes, such as several species of pondweeds (*Potamogeton amplifolius*, *P. praelongus*, *P. robbinsii*) and tapegrass (*Vallisneria americana*). More data on this community are needed.

Distribution: throughout New York State.

Rank: G4 S3S4

Examples: Hemlock Lake, Livingston and Ontario Counties; Lower St. Regis Lake, Franklin County.

Sources: Bloomfield 1978a; Cole 1975; Maitland 1978.

7. Eutrophic dimictic lake: the aquatic community of a nutrient-rich lake that occurs in a broad, shallow basin. These lakes are dimictic: they have two periods of mixing or turnover (spring and fall); they are thermally stratified in the summer, and they freeze over and become inversely stratified in the winter. Characteristic features of a eutrophic lake include the following: yellow, green, or brownish-green water that is murky, with low transparency (Secchi disk depths less than 2.5 m); water rich in plant nutrients (especially high in phosphorus, nitrogen and calcium), high primary productivity (inorganic carbon fixed = 75 to 250 g/m²/yr); lake sediments that are rich in organic matter (usually consisting of a fine organic silt or copropel),

water that is well-oxygenated above the summer thermocline, but oxygen-depleted below the summer thermocline or under ice; epilimnion volume that is relatively large compared with hypolimnion; and a weedy shoreline. Phytoplankton and zooplankton are usually abundant, but there are only a few species present; characteristic phytoplankton are cyanobacteria (blue-green algae). Aquatic macrophytes are abundant in shallow water, and there are many species present, but species diversity is generally lower than in mesotrophic lakes. Typically these are the lakes with nuisance problems of exotic plants such as Eurasian water milfoil (*Myriophyllum spicatum*), water chestnut (*Trapa natans*), and pondweed (*Potamogeton crispus*). The abundant profundal benthos is poor in species, including only species tolerant of low oxygen; characteristic profundal invertebrates are larvae of midges (*Chironomus* spp.) and phantom midges (*Chaoborus* spp.). Usually there are many species of fish, especially minnows (*Cyprinidae*). Characteristic fishes are warmwater fishes such as yellow perch (*Perca flavescens*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), pumpkinseed (*L. gibbosus*), yellow bullhead (*Ictalurus natalis*), brown bullhead (*I. nebulosus*), golden shiner (*Notemigonus crysoleucas*), and stocked white perch (*Morone americana*). Two additional species that are characteristic of eutrophic lakes on Long Island are eastern mudminnow (*Umbra pygmaea*) and pirate perch (*Aphredoderus sayanus*). More data on aquatic macrophytes are needed.

Distribution: throughout New York State, usually at low elevations.

Rank: G4 S3S4

Examples: Canandarago Lake, Otsego County; Honeoye Lake, Ontario County; Onondaga Lake, Onondaga County; Saratoga Lake, Saratoga County.

Sources: Bloomfield 1978a, 1980; Cole 1975; Maitland 1978.

8. Summer-stratified monomictic lake: the aquatic community of a lake that is so deep (or large) that it has only one period of mixing or turnover each year (monomictic), and one period of stratification. These lakes generally do not freeze over in winter (except in unusually cold years), so the water circulates and is isothermal during the winter. These lakes are thermally stratified only in the summer; they are

oligotrophic to mesotrophic. The dominant fishes are salmonids such as cisco (*Coregonus artedii*), and lake trout (*Salvelinus namaycush*). A characteristic crustacean of the hypolimnion is *Senecella calanoides*, which was named after Seneca Lake. Characteristic aquatic macrophytes include pondweeds (*Potamogeton gramineus*, *P. richardsonii*, *P. pectinatus*), horned pondweed (*Zannichellia palustris*), naiad (*Najas flexilis*), waterweed (*Elodea canadensis*), tapegrass (*Vallisneria americana*), and coontail (*Ceratophyllum demersum*).

The best-known examples in New York are Cayuga and Seneca lakes. These lakes are very deep (mean depths of 179 ft and 290 ft respectively) relative to their size (66.4 sq. mi. and 67.7 sq. mi. respectively). The Great Lakes (e.g. Lakes Ontario and Lake Erie) are also summer-stratified monomictic lakes (except the extreme west end of Lake Erie), but they are not included in this community because of their larger size and access to estuarine biota through the St. Lawrence River and the Welland Canal.

Distribution: uncommon in upstate New York, north of the Coastal Lowlands ecozone.

Rank: G3G4 S2S3

Examples: Cayuga Lake, Cayuga, Seneca, and Tompkins Counties; Seneca Lake, Seneca, Schuyler, and Yates Counties.

Sources: Berg 1963; Bloomfield 1978a; Muenscher 1928.

9. Winter-stratified monomictic lake: the aquatic community of a lake that has only one period of mixing each year because it is very shallow in relation to its size (e.g. Oneida Lake, with a mean depth less than 20 ft and surface area of approx. 80 square miles), and is completely exposed to winds. These lakes continue to circulate throughout the summer; they never become thermally stratified in the summer. These lakes are only stratified in the winter when they freeze over and become inversely stratified (coldest water at the surface); they are eutrophic to mesotrophic. Characteristic fishes are walleye (*Stizostedion vitreum*), largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*), and trout perch (*Percopsis omiscomaycus*). Characteristic aquatic macrophytes include water stargrass (*Heteranthera dubia*), coontail (*Ceratophyllum demersum*), and pondweeds (*Potamogeton* spp.)

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Distribution: uncommon in upstate New York, north of the Coastal Lowlands ecozone.

Rank: G3G4 S2?

Example: Oneida Lake, Oneida and Oswego Counties.

Sources: Berg 1963; Bloomfield 1978b.

10. Meromictic lake: the aquatic community of a small and relatively deep lake that is so protected from wind-stirring that it has no annual periods of complete mixing, and remains chemically stratified throughout the year. Meromictic lakes in New York freeze over in winter, so they are thermally stratified in winter; they pass through spring and fall periods of isothermy without circulating. Meromictic lakes frequently have dichothermic stratification, meaning that the minimum temperature occurs in the middle stratum. The stagnant waters in the lower part of a meromictic lake become heavily loaded with dissolved salts and lack oxygen. Species diversity is low because very few organisms can tolerate the extreme chemical conditions of the lower strata of a meromictic lake. The best-known example in New York is Green Lake Fayetteville; characteristic species of this lake include a purple sulfur bacterium (*Lamprocystis roseopersicina*), stoneworts (*Chara* spp.), waterweeds (*Elodea* spp.), and numerous green algae and cyanobacteria. Benthic fauna consists primarily of gastropods (six species of snails), crustaceans, and insects. No fishes are known from Green Lake Fayetteville. More data on this community are needed.

Distribution: uncommon in upstate New York, north of the Coastal Lowlands ecozone.

Rank: G3G4 S1S2

Examples: Green Lake Fayetteville, Onondaga County; Lowery Pond, one of Junius Ponds, Seneca County.

Sources: Berg 1963; Eggleton 1956; Pendl and Stewart 1986.

11. Marl pond: the aquatic community of a small, shallow spring-fed pond in which the water has a high concentration of calcium; as a result of chemical or photosynthetic removal of carbon dioxide from the water, the calcium precipitates out of the water as calcium carbonate (CaCO_3).

This calcium carbonate is deposited on the substrate and forms a marl sediment. Stoneworts (*Chara* spp.), some other algae, cyanobacteria, and at least one species of moss (*Didymodon tophaceus*) can be involved in photosynthetic precipitation of calcium carbonate; stoneworts are usually present in marl ponds. Marl ponds have very low primary productivity and sparse growth of aquatic macrophytes. Certain diatoms may be abundant, but low levels of available plant nutrients restrict growth of other algae and cyanobacteria. More data on this community are needed.

Distribution: known only from the Finger Lakes Highlands subzone of the Appalachian Plateau ecozone.

Rank: G3G4 S1

Sources: Cole 1979; NHP field surveys.

12. Inland salt pond: the aquatic community of a small, spring-fed pond in which the water is salty from flowing through salt beds in the aquifer. These salt springs occur in central New York, and were once common around Onondaga Lake in Syracuse and near Montezuma. Most of the springs have been exploited for the production of salt, and are very disturbed or completely destroyed. The pond is permanently flooded, but the water levels fluctuate seasonally. The one example of this community that has remained least disturbed is dominated by ditch grass (*Ruppia maritima*), and has at least one species of small fish (probably a killifish, *Fundulus* sp.). The bottom and shores of an inland salt pond are very mucky. More data on this community are needed.

Distribution: known only from the Great Lakes Plain ecozone.

Rank: G2 S1

Example: Carncross Salt Pond, Wayne County.

Sources: Catling and McKay 1981; NHP field surveys.

13. Oxbow lake: the aquatic community of a small, shallow, usually stagnant lake or pond that occurs in an old river meander or oxbow that has been cut off from a main channel stream by deposition of a levee. These are usually

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eutrophic lakes with abundant aquatic vegetation. More data on this community are needed.

Distribution: throughout New York State.

Rank: G4 S3

14. Coastal plain pond: the aquatic community of the permanently flooded portion of a coastal plain pond with seasonally and annually fluctuating water levels. These are shallow, groundwater-fed ponds that occur in kettle-holes or shallow depressions in the outwash plains south of the terminal moraines of Long Island and New England. Aquatic vegetation may be abundant; characteristic plants include water-shield (*Brasenia schreberi*), white water-lily (*Nymphaea odorata*), bayonet-rush (*Juncus militaris*), spikerush (*Eleocharis robbinsii*), purple bladderwort (*Utricularia purpurea*), water milfoil (*Myriophyllum humile*), naiad (*Najas flexilis*), waterweed (*Elodea* spp.), pondweed (*Potamogeton oakesianus*), and a peat moss (*Sphagnum macrophyllum*). Characteristic fishes include chain pickerel (*Esox niger*) and banded sunfish (*Enneacanthus obesus*). Coastal plain ponds are breeding ponds for tiger salamander (*Ambystoma tigrinum*). A series of coastal plain ponds are often hydrologically connected, either by groundwater, or sometimes by surface flow in a small coastal plain stream. More data on this community are needed.

Distribution: in the Coastal Lowlands ecozone on Long Island.

Rank: G3G4 S2

Examples: Crooked Pond, Suffolk County; Scoy's Pond, Suffolk County.

Sources: Muenscher 1939; Theall 1983; NHP field surveys.

15. Oligotrophic pond: the aquatic community of a shallow, nutrient-poor pond. The water is very clear and the bottom is usually sandy or rocky. Oligotrophic ponds are too shallow to become stratified in the summer; they are winter-stratified, monomictic ponds. Aquatic vegetation is sparse, and species diversity is low. Characteristic species are rosette-leaved aquatics such as pipewort (*Eriocaulon aquaticum*), water lobelia (*Lobelia dortmanna*), and quillwort (*Isoetes echinospora*). Oligotrophic ponds may have either cold-water or warm-water fishes, depending upon summer

temperatures. Very small ponds with no inlet or outlet may lack fish and have an abundance of aquatic insects. A characteristic fish of the cold-water ponds is brook trout (*Salvelinus fontinalis*). More data on this community are needed.

Distribution: little information is available; common in the Adirondacks, may also occur in the Appalachian Plateau, Taconic Highlands, and Tug Hill ecozones.

Rank: G4 S4

Source: NHP field surveys.

16. Eutrophic pond: the aquatic community of a shallow, nutrient-rich pond. The water is usually green with algae and the bottom is mucky. Eutrophic ponds are too shallow to become stratified in the summer; they are winter-stratified, monomictic ponds. Aquatic vegetation is abundant. Characteristic plants include coontail (*Ceratophyllum demersum*), duckweeds (*Lemna minor*, *L. trisulca*), waterweed (*Elodea canadensis*), pondweeds (*Potamogeton* spp.), water starwort (*Heteranthera dubia*), algae (*Cladophora* spp.), yellow pond-lily (*Nuphar luteum*), and white water-lily (*Nymphaea odorata*). Characteristic fishes are usually warm-water fishes. More data on this community are needed.

Distribution: little information is available; probably occurs throughout New York State, and is more common at low elevations.

Rank: G4 S4

Example: Black Pond, Jefferson County.

Source: Gilman 1979.

B. LACUSTRINE CULTURAL

This subsystem includes communities that are either created and maintained by human activities, or are modified by human influence to such a degree that the trophic state, morphometry, water chemistry, or biological composition of the resident community are substantially different from the character of the lake community as it existed prior to human influence.

1. Acidified lake: the aquatic community of a formerly oligotrophic or mesotrophic, dimictic lake that has received so much acid deposition (pH less than 4.7; sulfate and nitrate are now the

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dominant anions in precipitation in the Northeast) that the pH of the lake has decreased significantly. The changes in diatom assemblages in sediment cores from a few of these lakes have been used to infer the pH history of these lakes. Acidified lakes show a large decrease in pH (with pH usually less than 5.25) during the last 30 years relative to pH changes during the previous centuries. Associated with the decrease in pH are significant changes in the biota of the lake, such as a decrease in the number of species of fishes, diatoms, and most aquatic macrophytes present, and a change in the composition of species assemblages. Typically there are blooms of benthic green algae and cyanobacteria, and an increase in the growth of peat mosses (*Sphagnum* spp.) or bladderworts (*Utricularia* spp.). One bladderwort (*Utricularia geminiscapa*) and one pondweed (*Potamogeton confervoides*) are reported to be restricted to lakes with pH less than 5.1.

Distribution: most common in the Adirondacks, but may also occur throughout eastern New York in the Appalachian Plateau, Taconic Highlands, and Hudson Valley ecozones.

Rank: G5 S5

Example: Silver Lake Webb, Herkimer County.

Sources: Charles 1984; Roberts et al. 1985; Schindler 1988; Singer et al. 1983; Whitehead et al. 1986.

2. Cultural eutrophic lake: the aquatic community of a formerly eutrophic to mesotrophic lake that has received an increase in nutrients (especially phosphorus and nitrogen) from sewage effluent, agricultural runoff, and other pollutants. This nutrient enrichment has resulted in a significant increase in productivity of the lake (especially in the phytoplankton); annual productivity of these lakes exceeds 300 g carbon/m²/yr. An extremely eutrophic lake is characterized by high amounts of photosynthetic pigment in the water and, consequently, low transparency; blooms of cyanobacteria are common from midsummer through fall. Characteristic macrophytes are weedy exotics such as Eurasian water milfoil (*Myriophyllum spicatum*), water chestnut (*Trapa natans*), and pondweed (*Potamogeton crispus*). These macrophytes may grow to high densities, excluding other species and thus severely reducing species diversity.

Distribution: throughout New York State.

Rank: G5 S5

Sources: Bloomfield 1978a, 1980.

3. Farm pond/artificial pond: the aquatic community of a small pond constructed on agricultural or residential property. These ponds are often eutrophic, and may be stocked with panfish such as bluegill (*Lepomis macrochirus*) and yellow perch (*Perca flavescens*). The biota are variable (within limits), reflecting the species that were naturally or artificially seeded, planted, or stocked in the pond.

Distribution: throughout New York State.

Rank: G5 S5

4. Reservoir/artificial impoundment: the aquatic community of an artificial lake created by the impoundment of a river with a dam. Reservoirs are constructed to collect water for municipal and/or agricultural water use, to provide hydroelectric power, and to improve opportunities for recreational activities (e.g. boating, swimming) and development. Characteristic fishes include chain pickerel (*Esox niger*) and other pikes (*Esocidae*); brown bullhead (*Ictalurus nebulosus*) or yellow bullhead (*I. natalis*) or both of these; bluegill (*Lepomis macrochirus*) or pumpkinseed (*L. gibbosus*) or both of these; golden shiner (*Notemigonus crysoleucas*), and fathead minnow (*Pimephales promelas*). Reservoirs are often stocked with rainbow trout (*Salmo gairdneri*).

Distribution: throughout New York State.

Rank: G5 S5

5. Quarry pond: the aquatic community of an excavated basin that is created as part of a rock quarrying operation. The sides of the basin are often very steep, thereby eliminating any shallow shoreline habitats. Water levels usually fluctuate, reflecting recent precipitation patterns.

Distribution: throughout New York State north of the Coastal Lowlands ecozone.

Rank: G5 S5

6. Artificial pool: the aquatic community of a small pool that is constructed for recreational activities (e.g. swimming) or as a decorative

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element in a landscape design. The water is typically chlorinated and flushed on a regular basis to reduce or eliminate the growth of algae and bacteria; there is minimal development of any aquatic biota.

Distribution: throughout New York State.

Rank: G5 S5

7. Industrial cooling pond: the aquatic community of an artificial pond constructed as a holding pond to allow for cooling of high temperature industrial effluents.

Distribution: throughout New York State.

Rank: G5 S5

8. Sewage treatment pond: the aquatic community of an artificial pond constructed for sewage treatment (chemical and biological decomposition of sewage) prior to release to a stream or aquifer.

Distribution: throughout New York State.

Rank: G5 S5

V. PALUSTRINE SYSTEM

The palustrine system consists of non-tidal, perennial wetlands characterized by emergent vegetation. The system includes wetlands permanently saturated by seepage, permanently flooded wetlands, and wetlands that are seasonally or intermittently flooded (these may be seasonally dry) if the vegetative cover is predominantly hydrophytic and soils are hydric. Wetland communities are distinguished by their composition, substrate, and hydrologic regime.

Peatlands are a special type of wetland in which the substrate primarily consists of accumulated peat (partly decomposed plant material such as mosses, sedges, and shrubs) or marl (organically derived calcium carbonate deposits), with little or no mineral soil. Stable water levels or constant water seepage allow little aeration of the substrate in peatlands, slowing decomposition of plant litter, and resulting in peat or marl accumulation. In this classification, peatlands are characterized by their hydrologic regime; water source and water chemistry are important factors. Minerotrophic peatlands (fens) are fed by groundwater that contains minerals obtained during passage through or over mineral soils or aquifers. Ombrotrophic peatlands (bogs) are fed primarily by direct rainfall, with little or no groundwater influence (Damman and French 1987). The vegetation of ombrotrophic peatlands is depauperate; plants in the families *Sphagnaceae* and *Ericaceae* are prominent. The vegetation of minerotrophic peatlands is comparatively rich in species; plants in the families *Cyperaceae* and *Poaceae* are prominent (Heinselman 1970).

In a natural landscape there are continuous gradients from ombrotrophic to strongly minerotrophic wetlands; there are also continuous gradients in soils from mineral soils to peat soils. The boundaries between different types of wetlands are not always discrete. Several different types of wetlands may occur together in a complex mosaic.

A. OPEN MINERAL SOIL WETLANDS

This subsystem includes wetlands with less than 50% canopy cover of trees. In this classification, a tree is defined as a woody plant usually having one principal stem or trunk, a definite crown shape, and characteristically reaching a mature height of at least 16 ft (5 m) (Driscoll et al. 1984). The dominant vegetation may include shrubs or herbs. Substrates range from mineral soils or bedrock to well-decomposed organic soils (muck). Fluctuating water levels allow enough aeration of the substrate to allow

plant litter to decompose, so there is little or no accumulation of peat.

1. Deep emergent marsh: a marsh community that occurs on mineral soils or fine-grained organic soils (muck or well-decomposed peat); the substrate is flooded by waters that are not subject to violent wave action. Water depths can range from 6 in to 6.6 ft (15 cm to 2 m); water levels may fluctuate seasonally, but the substrate is rarely dry, and there is usually standing water in the fall. Characteristic vegetation includes emergent aquatics such as yellow pond-lily (*Nuphar luteum*), white water-lily (*Nymphaea odorata*), cattails (*Typha latifolia*, *T. angustifolia*), soft-stem bulrush (*Scirpus tabernaemontanii*), hard-stem bulrush (*Scirpus acutus*), bur-reed (*Sparganium eurycarpum*), arrowleaf (*Peltandra virginica*), and wild rice (*Zizania aquatica*). Characteristic animals include American bittern (*Botaurus lentiginosus*), least bittern (*Ixobrychus exilis*), red-winged blackbird (*Agelaius phoeniceus*), marsh wren (*Cistothorus palustris*), Virginia rail (*Rallus limicola*), pied-billed grebe (*Podilymbus podiceps*), bullfrog (*Rana catesbeiana*), and painted turtle (*Chrysemys picta*).

Marshes that have been disturbed are frequently dominated by aggressive weedy species such as purple loosestrife (*Lythrum salicaria*) and reedgrass (*Phragmites australis*). Deep emergent marshes also occur in excavations that contain standing water (e.g. roadside ditches, gravel pits).

Distribution: throughout New York State.

Rank: G5 S5

Example: Chippewa Bay, St. Lawrence County.

Sources: Bray 1915; Gilman 1976.

2. Shallow emergent marsh: a marsh meadow community that occurs on mineral soil or muck soils that are permanently saturated and seasonally flooded. This marsh is better drained than a deep emergent marsh; water depths may range from 6 in to 3.3 ft (15 cm to 1 m) during flood stages, but the water level usually drops by mid to late summer and the substrate is exposed. Characteristic plants include bluejoint grass (*Calamagrostis canadensis*), reed canary grass (*Phalaris arundinacea*), rice cutgrass (*Leersia oryzoides*), manna grass (*Glyceria canadensis*), sedges (*Carex stricta*, *C. lacustris*), three-way sedge (*Dulichium arundinaceum*), bulrushes (*Scirpus cyperinus*, *S. atrovirens*), sweetflag (*Acorus*

americanus), wild iris (*Iris versicolor*), water smartweed (*Polygonum amphibium*), marsh bellflower (*Campanula aparinoides*), and tufted loosestrife (*Lythrum thysiflora*). Characteristic animals include pied-billed grebe (*Podilymbus podiceps*) and northern leopard frog (*Rana pipiens*).

Shallow emergent marshes typically occur in lake basins and along streams. Deep and shallow emergent marshes often intergrade, and they may occur together in a complex mosaic in a large wetland. A shallow emergent marsh has less than 50% cover of sedges (*Carex* spp.), distinguishing this marsh from a sedge meadow, which has at least 50% cover of sedges.

Distribution: throughout New York State.

Rank: G5 S5

Example: Black Pond, Jefferson County.

Sources: Bray 1915; Gilman 1976; Hotchkiss 1932.

3. Shrub swamp: an inland wetland dominated by shrubs that occurs along the shore of a lake or river, in a wet depression or valley not associated with lakes, or as a transition zone between a marsh, fen, or bog and a swamp or upland community. The substrate is usually mineral soil or muck. This is a very broadly defined type that includes several distinct communities and many intermediates. Shrub swamps are very common and quite variable; the data currently available are not sufficient for dividing shrub swamps into more discrete communities. In northern New York many shrub swamps are dominated by alder (*Alnus incana* ssp. *rugosa*); these swamps are sometimes called alder thickets. A swamp dominated by red osier dogwood (*Cornus sericea*), silky dogwood (*C. amomum*), and willows (*Salix* spp.) may be called a shrub carr. Along the shores of some lakes there is a distinct zone dominated by water-willows (*Decodon verticillatus*). Characteristic shrubs that are common in these and other types of shrub swamps include meadow-sweet (*Spiraea latifolia*), steeple-bush (*Spiraea tomentosa*), gray dogwood (*Cornus foemina* ssp. *racemosa*), swamp azalea (*Rhododendron viscosum*), highbush blueberry (*Vaccinium corymbosum*), male-berry (*Lyonia ligustrina*), smooth alder (*Alnus serrulata*), spicebush (*Lindera benzoin*), willows (*Salix bebbiana*, *S. discolor*, *S. lucida*, *S. petiolaris*), wild raisin (*Viburnum cassinoides*), buttonbush (*Cephalanthus occidentalis*), and arrowwood (*Viburnum recognitum*). More documentation and

research is needed to distinguish the different types of shrub swamps in New York. Characteristic birds include American bittern (*Botaurus lentiginosus*), alder flycatcher (*Empidonax alnorum*), and Lincoln's sparrow (*Melospiza lincolnii*).

Distribution: throughout New York State.

Rank: G5 S5

Sources: Bray 1915; McVaugh 1958; Shanks 1966.

4. Cobble shore wet meadow: a community that occurs on the cobble shores of lakes and streams where the substrate is moist from seepage or intermittent flooding. The substrate is a mixture of cobbles and sand. They are likely to be scoured by floods or winter ice floes, but there is apparently no significant accumulation of pack ice. Vegetation may be sparse. Characteristic species include water-plantain (*Alisma plantago-aquatica*), beggar-ticks (*Bidens frondosa*), spikerushes (*Eleocharis* spp.), common horsetail (*Equisetum arvense*), boneset (*Eupatorium perfoliatum*), silverweed (*Potentilla anserina*), creeping spearwort (*Ranunculus reptans*), and three-square (*Scirpus americanus*). Where seepage water is calcareous, characteristic species include sedges (*Carex aurea*, *C. flava*, *C. granularis*, *C. viridula*), variegated horsetail (*Equisetum variegatum*), brook lobelia (*Lobelia kalmii*), marsh fern (*Thelypteris palustris*), rushes (*Juncus nodosus*, *J. alpinus*, *J. pelocarpus*), and mosses such as *Campylium stellatum* and *Drepanocladus* sp. More data on this community are needed.

Distribution: not well known, reported from the Lake Champlain Valley sub-zone of the Champlain ecozone.

Rank: G3? S2S3

Example: Valcour Island, Essex County.

Source: NHP field surveys.

5. Inland calcareous lake shore: the gravelly, sandy, or muddy shore of an inland lake or pond with calcareous water and seasonally fluctuating water levels. The substrate is either saturated or flooded. Vegetative cover may be sparse; the dominant species are herbaceous. Characteristic species include spikerushes (*Eleocharis acicularis* and *E. palustris*), marsh rush (*Juncus canadensis*), hard-stem bulrush (*Scirpus acutus*), soft-stem

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bulrush (*S. tabernaemontanii*), water plantain (*Alisma plantago-aquatica*), water stargrass (*Heteranthera dubia*), creeping spearwort (*Ranunculus reptans*), white water-crowfoot (*Ranunculus longirostris*), and lake-cress (*Armoracia aquatica*). More data on this community are needed.

Distribution: not well known, probably throughout upstate New York north of the Coastal Lowlands ecozone. Occurrences are reported from the Appalachian Plateau, Taconic Highlands, and Champlain ecozones.

Rank: G4? S3S4

Example: Song Lake, Cortland County.

Source: NHP field surveys.

6. Inland non-calcareous lake shore: the gravelly, sandy or muddy shore of an inland lake or pond with seasonally fluctuating water levels where the water is not calcareous. The substrate is either saturated or flooded. Vegetative cover may be sparse; the dominant species are herbaceous. Characteristic species include smartweed (*Polygonum pennsylvanicum*), water lobelia (*Lobelia dortmanna*), cyperus (*Cyperus squarrosus*), sedge (*Fimbristylis autumnalis*), spikerush (*Eleocharis obtusa*), jointed rush (*Juncus articulatus*), mud-hyssop (*Gratiola neglecta*), and marsh purslane (*Ludwigia palustris*). More data on this community are needed.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G4G5 S4

Source: NHP field surveys.

7. Coastal plain pond shore: the gently sloping shore of a coastal plain pond with seasonally and annually fluctuating water levels. The substrate is sandy, gravelly, or mucky. Vegetative cover varies with the water levels. In dry years when water levels are low and the substrate is exposed, there is a dense growth of annual sedges and grasses. In wet years when the water level is high and the substrate is flooded, vegetation is sparse, and only a few emergents and floating-leaved aquatics are apparent. The vegetation of this pond shore community can change dramatically from one year to the next depending on fluctuations in groundwater levels. Characteristic species include

pipewort (*Eriocaulon aquaticum*), sedge (*Carex walteriana*), horned rush (*Rhynchospora macrostachya*), bald-rush (*Psilocarya scirpoides*), nutrush (*Scleria reticularis*), panic grasses (*Panicum acuminatum*, *P. verrucosum*), sundews (*Drosera intermedia*, *D. filiformis*), Canadian St. John's-wort (*Hypericum canadense*), bladderworts (*Utricularia juncea*, *U. fibrosa*), gratiola (*Gratiola aurea*), ludwigia (*Ludwigia sphaerocarpa*), rose coreopsis (*Coreopsis rosea*), and large yellow-eyed grass (*Xyris smalliana*). Data on characteristic animals are needed.

Distribution: in the Coastal Lowlands ecozone on Long Island.

Rank: G3G4 S2

Examples: Peasy's Pond, Suffolk County; Crooked Pond, Suffolk County.

Sources: Graham and Henry 1933; Parker 1946; NHP field surveys.

8. Sinkhole wetland: a small wetland that occurs in a poorly drained limestone sinkhole; in some areas there are many sinkholes in a group that are hydrologically connected underground, even though they are clearly separate at the ground surface. The substrate is a dark muck that is rich in organic matter. Some sinkhole wetlands are encircled by a ring of green ash (*Fraxinus pennsylvanica*) or willow (*Salix sericea* or *S. petiolaris*). Characteristic species include sedges (*Carex vulpinoidea*, *C. lacustris*), mannagrass (*Glyceria* spp.), bulrush (*Scirpus cyperinus*), beak rush (*Rhynchospora capillacea*), bluejoint grass (*Calamagrostis canadensis*), spikerush (*Eleocharis* sp.), water plantain (*Alisma plantago-aquatica*), water purslane (*Ludwigia palustris*), and water-parsnip (*Sium suave*). Data on characteristic animals are needed.

Distribution: not well known; reported from the Eastern Ontario Plain sub-zone of the Great Lakes Plain ecozone.

Rank: G3? S1

Source: NHP field surveys.

9. Maritime interdunal swales: a mosaic of wetlands that occur in low areas between dunes along the Atlantic coast; the low areas or swales are formed either by blowouts in the dunes that lower the soil surface to groundwater level, or by

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the seaward extension of dune fields. Soils are either sand or peaty sand; water levels fluctuate seasonally and annually, reflecting changes in groundwater levels. The dominant species are sedges and herbs; low shrubs are usually present, but they are never dominant. These wetlands may be quite small (less than 0.25 acre or 0.1 ha); species diversity is usually low. The composition may be quite variable between different interdunal swales. Characteristic species include twig-rush (*Cladium mariscoides*), cyperus (*Cyperus* spp.), beakrush (*Rhynchospora capitellata*), marsh rush (*Juncus canadensis*), round-leaf sundew (*Drosera rotundifolia*), threadleaf sundew (*D. filiformis*), cranberry (*Vaccinium macrocarpon*), stiff yellow flax (*Linum striatum*), bladderwort (*Utricularia subulata*), slender yellow-eyed grass (*Xyris torta*), bayberry (*Myrica pensylvanica*), and highbush blueberry (*Vaccinium corymbosum*). Data on characteristic animals are needed.

Distribution: near the seacoast in the Coastal Lowlands ecozone.

Rank: G3G4 S2

Examples: Napeague Dunes, Suffolk County; Atlantic Double Dunes, Suffolk County.

Sources: Johnson 1985; NHP field surveys.

10. Pine barrens vernal pond: a seasonally fluctuating, groundwater-fed pond that occurs in pine barrens, either in low areas of the coastal plain, or between dunes. The dominant species are graminoids and herbs; at some sites these are mixed with low shrubs. These wetlands may be small. Characteristic species include three-way sedge (*Dulichium arundinaceum*), woolgrass (*Scirpus cyperinus*), cinnamon fern (*Osmunda cinnamomea*), leatherleaf (*Chamaedaphne calyculata*), black chokeberry (*Aronia melanocarpa*), black huckleberry (*Gaylussacia baccata*), mountain holly (*Nemopanthes mucronatus*), and peat moss (*Sphagnum fallax*). Stunted trees may be present on hummocks within the wetland; characteristic trees include red maple (*Acer rubrum*), gray birch (*Betula populifolia*), pitch pine (*Pinus rigida*), and quaking aspen (*Populus tremuloides*). A characteristic animal is Fowler's toad (*Bufo woodhousii*). More data on this community are needed.

Distribution: only known from sandplains in the Great Lakes Plain and Hudson Valley ecozones.

Rank: G3G4 S2

Examples: Albany Pine Bush, Albany County; Rome Sand Plains, Oneida County.

Source: NHP field surveys.

11. Pine barrens shrub swamp: a shrub-dominated wetland that occurs in shallow depressions in the coastal plain, often as a transition zone between a coastal plain pond shore and either pitch pine-scrub oak barrens or pitch pine-oak forest. Characteristic species include leatherleaf (*Chamaedaphne calyculata*), highbush blueberry (*Vaccinium corymbosum*), sweet pepper-bush (*Clethra alnifolia*), male-berry (*Lyonia ligustrina*), fetterbush (*Leucothoe racemosa*), buttonbush (*Cephalanthus occidentalis*), and winterberry (*Ilex glabra*). Virginia chain fern (*Anchistea virginica*) and *Sphagnum* are common in the groundlayer. More data on this community are needed.

Distribution: only reported from the Coastal Lowlands ecozone.

Rank: G5 S3

Example: Jones Pond, Suffolk County.

Source: NHP field surveys.

B. OPEN PEATLANDS

This subsystem includes peatlands with less than 50% canopy cover of trees. The dominant vegetation may include shrubs, herbs, or mosses. Substrates range from coarse fibrous or woody peat, to fine-grained marl and organic muck.

1. Inland salt marsh: a wetland that occurs on saline mudflats associated with inland salt springs. The mucky substrate is permanently saturated and seasonally flooded. Vegetation is sparse, with less than 50% cover. Species diversity is low. Characteristic species are salt-tolerant plants including salt marsh bulrush (*Scirpus maritimus*), seaside atriplex (*Atriplex patula*), salt marsh sand-spurry (*Spergularia marina*), creeping bent grass (*Agrostis stolonifera* var. *palustris*), salt-meadow grass (*Diplachne maritima*), dwarf spikerush (*Eleocharis parvula*), and narrow-leaf cattail (*Typha angustifolia*). These salt springs are rare, and they usually occur within a deep or shallow emergent marsh. In New York occurrences the surrounding marsh is usually dominated by purple

loosestrife (*Lythrum salicaria*); since purple loosestrife is not very salt-tolerant, it usually does not grow in the inland salt marsh. Data on characteristic animals are needed.

Small areas of inland salt marsh are reported from saline wetlands that were artificially created. One example is a wetland bordering Wolf Creek below an old salt factory in Wyoming County; plants reported from this site include salt-meadow grass (*Spartina patens*), black grass (*Juncus gerardii*), and glasswort (*Salicornia europaea*).

Distribution: historically a rare community, many sites have been destroyed or degraded by salt extraction operations, filling, and development. Remnants are currently known from a few sites in the Drumlin and Erie-Ontario Plain sub-zones of the Great Lakes Plain ecozone.

Rank: G2 S1

Example: Carncross Salt Pond, Wayne County.

Sources: Catling and McKay 1981; Faust and Roberts 1983; Muenscher 1927; NHP field surveys.

2. Sedge meadow: a wet meadow community that has organic soils (muck or fibrous peat). Soils are permanently saturated and seasonally flooded; there is usually little peat accumulation in the substrate. The dominant species is tussock-sedge (*Carex stricta*), usually with at least 50% cover. Other characteristic herbs include sedges (*Carex* spp.), bluejoint grass (*Calamagrostis canadensis*), sweetflag (*Acorus americanus*), spotted joe-pye-weed (*Eupatorium maculatum*), tall meadow-rue (*Thalictrum pubescens*), purple-stem angelica (*Angelica purpurea*), and bulrushes (*Scirpus* spp.). More data on this community are needed.

Sedge meadows typically occur along streams and near the inlets and outlets of lakes and ponds; they also occur in lake basins as a zone near the upland edge of a shallow emergent marsh. A sedge meadow does not form a floating mat, instead it is covered with water during flooding. When water levels are low, there is little or no open water.

Distribution: common in the Adirondacks, and sparsely scattered throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G5 S4

Sources: Jeglum 1974; McVaugh 1958, NHP field surveys.

3. Marl pond shore: the marly shore of an inland pond. In glaciated terrain, marl deposition occurs most often in depressions, lakes, or ponds in areas with morainic hills of coarse-textured outwash gravels. Marl pond shores typically occur on inactive lacustrine marl deposits in kettleholes. Water levels may fluctuate seasonally; the substrate is usually saturated. Vegetation is sparse. Characteristic species include tufted hairgrass (*Deschampsia cespitosa*), sedge (*Carex viridula*), spikerush (*Eleocharis palustris*), silverweed (*Potentilla anserina*), boneset (*Eupatorium perfoliatum*), cardinal flower (*Lobelia cardinalis*), water-horehound (*Lycopus virginicus*), field mint (*Mentha arvensis*), and water smartweed (*Polygonum amphibium*). Data on characteristic animals are needed.

Distribution: known only from the Finger Lakes Highlands sub-zone of the Appalachian Plateau ecozone, and from the Erie-Ontario Plain sub-zone of the Great Lakes Plain ecozone.

Rank: G3G4 S1

Example: Cortland Marl Ponds, Cortland County.

Sources: Seischab 1984; Tufts 1976; NHP field surveys.

4. Marl fen: a strongly minerotrophic wetland in which the substrate is a marl bed derived from either lacustrine marl deposits or actively accumulating marl that is exposed at the ground surface. The marl substrate is always saturated and may be either seasonally flooded or permanently flooded (e.g. adjacent to seepage pools or streams). Vegetation may be sparse, and there is usually some exposed bare marl. The dominant species are graminoid. Characteristic species include sedge (*Carex flava*), hard-stem bulrush (*Scirpus acutus*), variegated horsetail (*Equisetum variegatum*), twig-rush (*Cladium mariscoides*), beakrush (*Rhynchospora capillacea*), spikerush (*Eleocharis rostellata*), nutrush (*Scleria verticillata*), jointed rush (*Juncus articulatus*), panic grass (*Panicum flexile*), arrow-grass (*Triglochin palustris*), grass-of-Parnassus (*Parnassia glauca*), pitcher-plant (*Sarracenia purpurea*), water-horehound (*Lycopus uniflorus*), Kalm's lobelia (*Lobelia kalmii*), and Ohio goldenrod (*Solidago ohioensis*). The alga *Chara vulgaris* is common in marl pools and along stream banks. The mosses *Drepanocladus revolvens* and *Campylium stellatum* colonize the marl, and they may initiate hummock formation (Seischab 1984). Shrubby cinquefoil (*Potentilla*

PALUSTRINE COMMUNITIES

fruticosa) and sedge (*Carex eburnea*) commonly occur on hummocks. Data on characteristic animals are needed.

Distribution: known primarily from the Erie-Ontario Plain sub-zone of the Great Lakes Plain ecozone; also reported from the Hudson Valley ecozone.

Rank: G2G3 S1

Examples: Bergen Swamp, Genesee County; White Lake Swamp, Onondaga County.

Sources: Bernard et al. 1983; Seischab 1977, 1984; Seischab and Bernard 1985; NHP field surveys.

5. Rich sloping fen: a small, gently sloping, minerotrophic wetland, with shallow peat deposits, that occurs in a shallow depression on a slope composed of calcareous glacial deposits. Sloping fens are fed by small springs or groundwater seepage; these are headwater wetlands with cold water constantly flowing through them. The structure of the community is variable; usually there are scattered trees and shrubs, and a nearly continuous groundlayer of herbs and bryophytes. Species diversity is usually very high. Characteristic herbs include the sedges *Carex flava*, *C. interior*, *C. sterilis*, *C. leptalea*, *C. lacustris*, *C. hystericina*, and *C. aquatilis*, cottongrass (*Eriophorum viride-carinatum*), cattail (*Typha latifolia*), spike muhly (*Muhlenbergia glomerata*), marsh fern (*Thelypteris palustris*), crested wood fern (*Dryopteris cristata*), cinnamon fern (*Osmunda cinnamomea*), common horsetail (*Equisetum arvense*), black-eyed-Susan (*Rudbeckia laciniata*), spreading goldenrod (*Solidago patula*), golden ragwort (*Senecio aureus*), marsh-marigold (*Caltha palustris*), bog-candle (*Platanthera dilatata*), tall meadow-rue (*Thalictrum pubescens*), round-leaf sundew (*Drosera rotundifolia*), skunk-cabbage (*Symplocarpus foetidus*), flat-top white aster (*Aster umbellatus*), turtle-heads (*Chelone glabra*), purple avens (*Geum rivale*), showy lady's-slipper (*Cypripedium reginae*), spreading globeflower (*Trollius laxus*), and swamp goldenrod (*Solidago uliginosa*). Characteristic mosses include *Aulacomnium palustre*, *Sphagnum warnstorffii*, *Tomenthypnum nitens*, *Campylium stellatum*, and *Cratoneuron filicinum*. Trees and shrubs collectively have less than 50% cover in the community; characteristic species include red maple (*Acer rubrum*), hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*), red osier dogwood (*Cornus sericea*), alder-leaf buckthorn (*Rhamnus alnifolia*), highbush blueberry (*Vaccinium*

corymbosum), gray dogwood (*Cornus foemina* ssp. *racemosa*), smooth shadbush (*Amelanchier arborea* var. *laevis*), black chokeberry (*Aronia melanocarpa*), virgin's-bower (*Clematis virginiana*), northern gooseberry (*Ribes hirtellum*), and dwarf raspberry (*Rubus pubescens*).

Rich sloping fens may occur upstream (i.e. higher in the watershed) from and grade into rich hemlock-hardwood swamps; the swamps occur on more level ground and have greater than 50% canopy cover of trees. Data on characteristic animals are needed.

Distribution: only known from the Central Appalachian and Finger Lake Highlands sub-zones of the Appalachian Plateau ecozone. May also occur in other parts of the state with calcareous glacial deposits.

Rank: G3 S1S2

Examples: East Malloryville Tamarack Swamp, Tompkins County; Bear Swamp Sempronius, Cayuga County.

Source: NHP field surveys.

6. Rich graminoid fen: a strongly minerotrophic peatland in which the substrate is a predominantly graminoid peat which may or may not be underlain by marl. Rich fens are fed by waters that are rich in minerals, and have high pH values, generally from 6.0 to 7.8; rich graminoid fens are usually fed by water from highly calcareous springs or seepage. The dominant species are sedges, although grasses and rushes may be common. *Sphagnum* is either absent, or a minor component, with only the most minerotrophic species present. Other mosses, especially those requiring highly minerotrophic conditions, may be common. Characteristic species include the sedges *Carex aquatilis*, *C. lasiocarpa*, *C. flava*, *C. hystericina*, and *C. prairea*, twig-rush (*Cladium mariscoides*), cattails (*Typha latifolia* and *T. angustifolia*), spike muhly (*Muhlenbergia glomerata*), spikerush (*Eleocharis rostellata*), white beakrush (*Rhynchospora alba*), hard-stem bulrush (*Scirpus acutus*), sundew (*Drosera rotundifolia*), pitcher-plant (*Sarracenia purpurea*), wild iris (*Iris versicolor*), cranberry (*Vaccinium macrocarpon*), grass-of-Parnassus (*Parnassia glauca*), rose pogonia (*Pogonia ophioglossoides*), flat-top white aster (*Aster umbellatus*), bladderwort (*Utricularia minor*), marsh fern (*Thelypteris palustris*), and royal fern (*Osmunda regalis*). Shrubs may be present, but collectively they have less than 50% cover in the

community. Characteristic shrubs include red osier dogwood (*Cornus sericea*), shrubby cinquefoil (*Potentilla fruticosa*), hoary willow (*Salix candida*), gray dogwood (*Cornus foemina* ssp. *racemosa*), bayberry (*Myrica pensylvanica*), and alder-leaf buckthorn (*Rhamnus alnifolia*). Characteristic mosses include *Campylium stellatum*, *Drepanocladus revolvens*, *Scorpidium scorpioides*, *Tomenthypnum nitens*, *Sphagnum contortum*, *S. warnstorffii*, and *S. teres*. A characteristic animal is bog turtle (*Clemmys muhlenbergii*). More data on characteristic animals are needed.

Distribution: scattered throughout upstate New York; reported from the Appalachian Plateau, Great Lakes Plain, Mohawk Valley, Hudson Valley, and Taconic Highlands ecozones.

Rank: G3 S1S2

Examples: Bergen Swamp, Genesee County; Junius Ponds, Seneca County; Quaker Pond Fen, Monroe County.

Sources: Andrus 1980; Goodwin 1943; Seischab 1984; Shanks 1966; NHP field surveys.

7. Rich shrub fen: a strongly minerotrophic peatland in which the substrate is a woody peat, which may or may not be underlain by marl or limestone bedrock. Rich fens are fed by waters that are rich in minerals, and have high pH values, generally from 6.0 to 7.8. The dominant species are shrubs. Some shrub fens are dominated by low shrubs (under 4 ft or 1.2 m) that collectively have 80 to 90% cover in the community. Other shrub fens are dominated by tall shrubs (over 4 ft or 1.2 m) that collectively have 50 to 70% cover in the community; in these fens there are openings with low shrubs and graminoids locally dominant. *Sphagnum* is either absent, or a minor component, with only the most minerotrophic species present. Other mosses may be common. Characteristic shrubs are shrubby cinquefoil (*Potentilla fruticosa*), hoary willow (*Salix candida*), red osier dogwood (*Cornus sericea*), speckled alder (*Alnus incana* ssp. *rugosa*), poison sumac (*Toxicodendron vernix*), swamp birch (*Betula pumila*), swamp fly honeysuckle (*Lonicera oblongifolia*), and alder-leaf buckthorn (*Rhamnus alnifolia*). Red maple (*Acer rubrum*) and tamarack (*Larix laricina*) are often present as saplings or stunted trees. Characteristic herbs include the sedges *Carex aquatilis*, *C. lacustris*, and *C. lasiocarpa*, hard-stem bulrush (*Scirpus acutus*), marsh fern (*Thelypteris palustris*), royal fern (*Osmunda regalis*), wild iris (*Iris versicolor*),

and pitcher-plant (*Sarracenia purpurea*). Characteristic mosses include *Campylium stellatum* and *Sphagnum warnstorffii*. Data on characteristic animals are needed.

Distribution: scattered throughout upstate New York; reported from the Appalachian Plateau, Great Lakes Plain, Mohawk Valley, Taconic Highlands, Tug Hill and St. Lawrence, and Adirondacks ecozones.

Rank: G3G4 S1S2

Examples: Miller Pond, Columbia County; Summit Lake Swamp, Otsego County, Great Swamp Pawling, Dutchess County.

Sources: Andrus 1980; NHP field surveys.

8. Medium fen: a moderately minerotrophic peatland (intermediate between rich fens and poor fens) in which the substrate is a mixed peat composed of graminoids, mosses, and woody species. Medium fens are fed by waters that are moderately mineralized, with pH values generally ranging from 4.5 to 6.5. The dominant species are sedges; certain mosses, herbs, and woody plants are common associates. The dominant sedge is typically *Carex lasiocarpa*, and the dominant mosses may be *Sphagnum subsecundum*, *S. teres*, or *Calliergonella cuspidata*. Other characteristic species include twig-rush (*Cladium mariscoides*), tussock-sedge (*Carex stricta*), cattail (*Typha latifolia*), marsh fern (*Thelypteris palustris*), sweet-gale (*Myrica gale*), meadow-sweet (*Spiraea latifolia*), and cranberry (*Vaccinium macrocarpon*). More data on characteristic plants and animals are needed.

Medium fens often occur as a narrow transition zone between an aquatic community and either a swamp or an upland community, along the edges of streams and lakes.

Distribution: not well known, probably is sparsely scattered throughout upstate New York north of the Coastal Lowlands ecozone.

Rank: G3G4 S2S3

Examples: Dunham Bay Marsh, Warren County; Harris Lake Fen, Essex County.

Sources: Andrus 1980; NHP field surveys.

9. Inland poor fen: a weakly minerotrophic peatland that occurs inland from the coastal plain

in which the substrate is peat composed primarily of *Sphagnum*, with admixtures of graminoid or woody peat. The dominant species are *Sphagnum* mosses, with scattered sedges, shrubs, and stunted trees. Poor fens are fed by waters that are weakly mineralized, and have low pH values, generally between 3.5 and 5.0. Characteristic mosses include *Sphagnum rubellum*, *S. magellanicum*, *S. papillosum*, *S. nemoreum*, *S. fuscum*, *S. angustifolium*, *S. fallax*, and *S. russowii*. Characteristic herbs include sedges (*Carex oligosperma*, *C. exilis*, *C. limosa*), white beakrush (*Rhynchospora alba*), cottongrasses (*Eriophorum vaginatum* ssp. *spissum*, *E. virginicum*), round-leaf sundew (*Drosera rotundifolia*), and pitcher-plant (*Sarracenia purpurea*). Shrubs and dwarf shrubs usually have less than 50% cover; characteristic species include small cranberry (*Vaccinium oxycoccos*), bog laurel (*Kalmia polifolia*), sweet-gale (*Myrica gale*), black chokeberry (*Aronia melanocarpa*), leatherleaf (*Chamaedaphne calyculata*), bog rosemary (*Andromeda polifolia* var. *glaucophylla*), and Labrador tea (*Ledum groenlandicum*). Scattered stunted trees such as tamarack (*Larix laricina*) or red maple (*Acer rubrum*) may also be present. Many of our "kettlehole bogs" are inland poor fens, according to this classification, since they are weakly minerotrophic. Poor fens often include hummocks that are essentially ombrotrophic islands within a weakly minerotrophic peatland. More data on this community are needed.

Distribution: throughout upstate New York north of the Coastal Lowlands ecozone.

Rank: G4 S3

Examples: Massawepie Mire, St. Lawrence County; Brennan Beach Fen, Oswego County; Willis Brook Bog, Franklin County.

Sources: Andrus 1980; NHP field surveys.

10. Coastal plain poor fen: a weakly minerotrophic peatland that occurs on the coastal plain, in which the substrate is peat composed primarily of *Sphagnum*, with admixtures of graminoid and woody peat. The dominant species are *Sphagnum* mosses, with scattered sedges, shrubs, and stunted trees. Poor fens are fed by waters that are weakly mineralized, with low pH values, generally between 4.0 and 5.5 (Andrus 1980). Characteristic mosses include *Sphagnum bartlettianum*, *S. fallax*, *S. flavicomans*, *S. magellanicum*, *S. recurvum*, *S. papillosum*, *S. torreyanum*, and *S. henryense*. Characteristic herbs

and shrubs include twig-rush (*Cladium mariscoides*), sedge (*Carex exilis*), beakrushes (*Rhynchospora alba*, *R. fusca*), rushes (*Juncus* spp.), knotted spikerush (*Eleocharis equisetoides*), swamp loosestrife (*Lysimachia terrestris*), fibrous bladderwort (*Utricularia fibrosa*), rose pogonia (*Pogonia ophioglossoides*), grass pink (*Calopogon tuberosus*), meadow beauty (*Rhexia virginica*), marsh St. John's-wort (*Triadenum virginicum*), white water-lily (*Nymphaea odorata*), hardhack (*Spiraea tomentosa*), leatherleaf (*Chamaedaphne calyculata*), water willow (*Decodon verticillatus*), sweet pepper-bush (*Clethra alnifolia*), and sweet gale (*Myrica gale*). Scattered stunted trees such as Atlantic white cedar (*Chamaecyparis thyoides*) and red maple (*Acer rubrum*) may also be present.

Distribution: restricted to the Coastal Lowlands ecozone.

Rank: G3? S1

Examples: Bow Drive Marsh, Suffolk County; Sweezy Pond, Suffolk County.

Sources: Andrus 1980; NHP field surveys.

11. Perched bog: an ombrotrophic (or very weakly minerotrophic) peatland that occurs in shallow depressions in rock outcrops where there is a perched water table. Vegetation is dominated by peat mosses (*Sphagnum* spp.) and ericaceous shrubs, and the substrate is a shallow peat overlying bedrock. Water in a perched bog is usually very acid (pH less than 5.0), has low amounts of dissolved minerals, and is especially low in calcium ions. Species diversity is usually low. Characteristic species include several peat mosses (*Sphagnum fuscum*, *S. rubellum*, *S. nemoreum*, and *S. magellanicum*), leatherleaf (*Chamaedaphne calyculata*), sheep laurel (*Kalmia angustifolia*), steeple-bush (*Spiraea tomentosa*), cranberry (*Vaccinium macrocarpon*), and sedges (*Carex* spp.). More data on this community are needed.

Distribution: only known from the Lake Champlain Transition sub-zone of the Champlain ecozone and the Shawangunk Hills sub-zone of the Hudson Valley ecozone.

Rank: G3G4 S1S2

Examples: Altona Flat Rock, Clinton County; Sam's Point, Ulster County.

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Sources: Andrus 1980; Damman and French 1987; NHP field surveys.

12. Patterned peatland: a large peatland with a gentle slope or divide in which the vegetation consists of a mosaic of high and low areas (relative to water levels) that are called strings and flarks, respectively. The strings and flarks occur as narrow or broad bands of vegetation that extend perpendicular to the direction of water flow across the slope of the peatland. The strings or hummocks (high, relatively dry areas) are usually ombrotrophic or weakly minerotrophic, and the flarks or hollows (low, relatively wet areas) are more minerotrophic than the strings. Patterning in peatlands may occur regardless of the ombrotrophic or minerotrophic nature of the peatland; there are many types of patterns that can occur. In New York, the most pronounced patterning occurs on a very large (550 acre or 223 ha) bog that is primarily ombrotrophic and is slightly raised at the center. This bog has a subtle ladderform pattern of slightly raised linear hummocks (strings) and broad, shallow hollows (flarks) along one of the slopes, as well as several small ponds. In this peatland, the dominant peat moss is *Sphagnum rubellum*; this moss forms a nearly pure carpet in some areas of the bog, and it is common on the hummocks (strings). Other common mosses include *Sphagnum cuspidatum* and *S. majus* in hollows (flarks). Characteristic herbs of the flarks include pod-grass (*Scheuchzeria palustris*), white beakrush (*Rhynchospora alba*), sedges (*Carex exilis*, *C. oligosperma*), cottongrass (*Eriophorum vaginatum* ssp. *spissum*), and pitcher-plant (*Sarracenia purpurea*). Characteristic species of the strings include sedges (*Carex pauciflora*, *C. limosa*), false Solomon's-seal (*Smilacina trifolia*), meadow-sweet (*Spiraea latifolia*), lowbush blueberry (*Vaccinium angustifolium*), black chokeberry (*Aronia melanocarpa*), black spruce (*Picea mariana*), and tamarack (*Larix laricina*). The trees on the bog mat are stunted and are usually widely spaced on hummocks or strings. Low ericaceous shrubs such as leatherleaf (*Chamaedaphne calyculata*), Labrador tea (*Ledum groenlandicum*), bog laurel (*Kalmia polifolia*), sheep laurel (*Kalmia angustifolia*), and bog rosemary (*Andromeda polifolia* var. *glaucophylla*) are common in the strings, as well as in the flatter, unpatterned portions of the bog. Data on characteristic animals are needed.

Distribution: only known from the Western Adirondack Foothills ecozone.

Rank: G3G4 S1

Example: Spring Pond Bog, Franklin County.

Source: NHP field surveys.

13. Dwarf shrub bog: an ombrotrophic or weakly minerotrophic peatland dominated by low-growing, evergreen, ericaceous shrubs and peat mosses (*Sphagnum* spp.). These bogs have more than 50% cover of low-growing shrubs. Water is usually nutrient-poor and acidic. The dominant shrub is often leatherleaf (*Chamaedaphne calyculata*), which may have more than 50% cover. Other prominent shrubs and herbs are sheep laurel (*Kalmia angustifolia*), bog laurel (*K. polifolia*), huckleberry (*Gaylussacia baccata*), highbush blueberry (*Vaccinium corymbosum*), small cranberry (*Vaccinium oxycoccos*), and the sedge *Carex trisperma*. Other characteristic, but less common plants are round-leaf sundew (*Drosera rotundifolia*), tawny cottongrass (*Eriophorum virginicum*), pitcher plant (*Sarracenia purpurea*), cranberry (*Vaccinium macrocarpon*), bog rosemary (*Andromeda polifolia* var. *glaucophylla*), water-willow (*Decodon verticillatus*), arrowleaf (*Feltandra virginica*), marsh St. John's-wort (*Triadenum virginicum*), and the sedges *Carex canescens* and *Rhynchospora alba*. Scattered stunted trees may be present, including black spruce (*Picea mariana*), tamarack (*Larix laricina*), and red maple (*Acer rubrum*). Characteristic peat mosses that form a nearly continuous carpet under the shrubs include *Sphagnum magellanicum*, *S. rubellum*, *S. fallax*, *S. papillosum*, and *S. angustifolium*. Characteristic animals include common yellowthroat (*Geothlypis trichas*), song sparrow (*Melospiza melodia*), savannah sparrow (*Passerculus sandwichensis*), masked shrew (*Sorex cinereus*), meadow jumping mouse (*Zapus hudsonius*), southern bog lemming (*Synaptomys cooperi*), and wood frog (*Rana sylvatica*).

A dwarf shrub bog may form a floating mat around a bog lake or along the banks of an oligotrophic stream; it may also occur as a large or small mat completely filling a basin. A dwarf shrub bog may grade into either a highbush blueberry bog thicket or a black spruce-tamarack bog.

Distribution: occurs throughout upstate New York north of the Coastal Lowlands ecozone.

Rank: G4 S3

Examples: Bay Pond Bog, Franklin County; Massawepie Mire, St. Lawrence County; Little Cedar Pond, Orange County.

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Sources: Andrus 1980; Bray 1921; Damman and French 1987; Karlin and Andrus 1986; Karlin and Lynn 1988; NHP field surveys.

14. Highbush blueberry bog thicket: an ombrotrophic or weakly minerotrophic peatland dominated by tall, deciduous, ericaceous shrubs and peat mosses (*Sphagnum* spp.); the water is usually nutrient-poor and acidic. The dominant shrub is usually highbush blueberry (*Vaccinium corymbosum*), however in the southern part of New York, from the Appalachian Plateau to the Taconic Highlands, swamp azalea (*Rhododendron viscosum*) may be codominant. In the northern part of the state mountain holly (*Nemopanthus mucronatus*) may be codominant. Other characteristic shrubs and herbs include winterberry (*Ilex verticillata*), black huckleberry (*Gaylussacia baccata*), false Solomon's-seal (*Smilacina trifolia*), sedge (*Carex trisperma*), pitcher plant (*Sarracenia purpurea*), cinnamon fern (*Osmunda cinnamomea*), and wild calla (*Calla palustris*). Stunted trees may be present at a low density and with less than 50% cover; red maple (*Acer rubrum*) occurs in many bog thickets, less common are tamarack (*Larix laricina*), black spruce (*Picea mariana*), white pine (*Pinus strobus*), and pitch pine (*P. rigida*). Characteristic peat mosses include *Sphagnum magellanicum*, *S. centrale*, *S. nemoreum*, and *S. fimbriatum*. Characteristic animals include common yellowthroat (*Geothlypis trichas*), swamp sparrow (*Melospiza georgiana*), song sparrow (*Melospiza melodia*), meadow jumping mouse (*Zapus hudsonius*), masked shrew (*Sorex cinereus*), southern red-backed vole (*Clethrionomys gapperi*), and green frog (*Rana clamitans*).

Distribution: occurs throughout New York State.

Rank: G4 S3

Example: Cicero Swamp, Onondaga County.

Source: Damman and French 1987; Significant Habitat Unit files.

C. FORESTED MINERAL SOIL WETLANDS

This subsystem includes seasonally flooded forests, and permanently flooded or saturated swamps. These forests and swamps typically have at least 50% canopy cover of trees. For the purposes of this classification, a tree is defined as a woody plant usually having one principal stem or trunk, a definite crown shape, and character-

istically reaching a mature height of at least 16 ft (5 m) (Driscoll et al. 1984).

1. Floodplain forest: a hardwood forest that occurs on mineral soils on low terraces of river floodplains and river deltas. These sites are characterized by their flood regime; low areas are annually flooded in spring, and high areas are flooded irregularly. Some sites may be quite dry by late summer, whereas other sites may be flooded again in late summer or early autumn (these floods are caused by heavy precipitation associated with tropical storms). This is a broadly defined community; floodplain forests are quite variable and may be very diverse. Characteristic canopy trees are silver maple (*Acer saccharinum*), red maple (*A. rubrum*), sycamore (*Platanus occidentalis*), cottonwood (*Populus deltoides*), butternut (*Juglans cinerea*), black willow (*Salix nigra*), bitternut hickory (*Carya cordiformis*), swamp white oak (*Quercus bicolor*), white ash (*Fraxinus americana*), black ash (*F. nigra*), and basswood (*Tilia americana*). White willow (*Salix alba*), an introduced tree, has become established in some floodplain forests. Vines such as Virginia creeper (*Parthenocissus quinquefolia*), virgin's bower (*Clematis virginiana*), and poison ivy (*Toxicodendron radicans*) may be common in the understory. Characteristic groundlayer species include sensitive fern (*Onoclea sensibilis*), white snakeroot (*Eupatorium rugosum*), Canada goldenrod (*Solidago canadensis*), jewelweed (*Impatiens capensis*), jumpseed (*Polygonum virginianum*), and spicebush (*Lindera benzoin*). Characteristic birds include yellow-throated vireo (*Vireo flavifrons*), tufted titmouse (*Parus bicolor*), red-bellied woodpecker (*Melanerpes carolinus*), and pileated woodpecker (*Dryocopus pileatus*).

The composition of the forest apparently changes in relation to flood frequency and elevation of floodplain terraces along larger rivers. The composition of floodplain forests in New York State has not been studied in sufficient detail to characterize compositional variations and how they correlate with flood regime and terrace elevation.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G3G4 S2S3

Examples: Doyles Islands, Delaware County; South Bay Creek Wetlands, Washington County.

Sources: Gordon 1940; NHP field surveys.

2. Red maple-hardwood swamp: a hardwood swamp that occurs in poorly drained depressions, usually on inorganic soils. This is a broadly defined community with many regional and edaphic variants. In any one stand red maple (*Acer rubrum*) is either the only canopy dominant, or it is codominant with one or more hardwoods including black ash (*Fraxinus nigra*), American elm (*Ulmus americana*), swamp white oak (*Quercus bicolor*), butternut (*Juglans cinerea*), and bitternut hickory (*Carya cordiformis*). The shrublayer is usually well-developed and may be quite dense. Characteristic shrubs are spicebush (*Lindera benzoin*), winterberry (*Ilex verticillata*), black chokeberry (*Aronia melanocarpa*), red osier dogwood (*Cornus sericea*), arrowwood (*Viburnum recognitum*), wild raisin (*Viburnum cassinoides*), and highbush blueberry (*Vaccinium corymbosum*). In southeastern New York black gum (*Nyssa sylvatica*), sweet pepperbush (*Clethra alnifolia*), and swamp azalea (*Rhododendron viscosum*) are also characteristic. The herbaceous layer is often dominated by ferns, including cinnamon fern (*Osmunda cinnamomea*), royal fern (*O. regalis*), sensitive fern (*Onoclea sensibilis*), crested wood fern (*Dryopteris cristata*), and spinulose wood fern (*Dryopteris carthusiana*). Characteristic herbs include skunk cabbage (*Symplocarpus foetidus*), sedges such as *Carex intumescens* and *C. lacustris*, jewelweed (*Impatiens capensis*), and skullcap (*Scutellaria galericulata*). Characteristic animals include marbled salamander (*Ambystoma opacum*), Jefferson salamander (*Ambystoma jeffersonianum*), black-crowned night heron (*Nycticorax nycticorax*), and red-bellied woodpecker (*Melanerpes carolinus*).

Distribution: throughout New York State.

Rank: G5 S4S5

Example: Great Swamp Pawling, Dutchess County.

Sources: Cain and Penfound 1939; McVaugh 1958.

3. Silver maple-ash swamp: a hardwood swamp that occurs on poorly drained soils along rivers, lakeshores, and in poorly-drained depressions. These sites are characterized by uniformly wet conditions with minimal seasonal fluctuations in water levels. The dominant trees are silver maple (*Acer saccharinum*), with as much as 70% cover, mixed with smaller quantities (5 to 15% cover) of green ash (*Fraxinus pennsylvanica*), black ash (*F. nigra*), and white ash (*F. americana*). American elm (*Ulmus americana*) was a codominant prior

to the onset of Dutch elm disease and elm yellows. Characteristic shrubs and vines are spicebush (*Lindera benzoin*), gooseberries (*Ribes* spp.), Virginia creeper (*Parthenocissus quinquefolia*), and poison ivy (*Toxicodendron radicans*). These swamps generally have low herb diversity; characteristic herbs are skunk cabbage (*Symplocarpus foetidus*) and wood-nettle (*Laportea canadensis*). Data on characteristic animals are needed.

Distribution: in central and western New York in the Appalachian Plateau ecozone, and in the Champlain Valley sub-zone of the Lake Champlain ecozone.

Rank: G3G4 S2S3

Source: Huenneke 1982.

4. Vernal pool: a wetland in a small, shallow depression within an upland forest. Vernal pools are flooded in spring or after a heavy rainfall, but are usually dry during summer. Many vernal pools are filled again in autumn. This community includes a diverse group of invertebrates and amphibians that depend upon temporary pools as breeding ponds. Since vernal pools cannot support fish populations, there is no threat of fish predation on amphibian eggs or invertebrate larvae. Characteristic amphibians include wood frog (*Rana sylvatica*), mole salamanders (*Ambystoma* spp.), American toad (*Bufo americanus*), green frog (*Rana clamitans*), and red-spotted newt (*Notophthalmus viridescens*). More data on characteristic plants and invertebrates are needed.

Distribution: throughout New York State.

Rank: G4 S3S4

Source: Massachusetts Natural Heritage Program 1988.

5. Perched swamp white oak swamp: a swamp that occurs in a shallow depression on a forested hillside where the water table is locally perched above the surrounding groundwater level. The water level fluctuates seasonally; the swamp may be flooded in spring and nearly dry by late summer. The dominant tree is swamp white oak (*Quercus bicolor*), which may form a nearly pure, open canopy stand in areas that are permanently saturated. In better-drained areas where the soil is seasonally dry, the canopy cover is greater and

the canopy may include several other species such as scarlet oak (*Quercus coccinea*), white oak (*Q. alba*), red maple (*Acer rubrum*), white pine (*Pinus strobus*), and pitch pine (*P. rigida*). The understory is fairly open, with scattered ericaceous shrubs including black huckleberry (*Gaylussacia baccata*), highbush blueberry (*Vaccinium corymbosum*), lowbush blueberry (*V. angustifolium*), and pinkster (*Rhododendron periclymenoides*). The groundcover may be sparse, with scattered patches of *Sphagnum* where the canopy cover is closed. In areas with an open canopy and wet soils, *Sphagnum* may form extensive carpets, mixed with sedge (*Carex stipata*), woolgrass (*Scirpus cyperinus*), mannagrass (*Glyceria striata*), marsh fern (*Thelypteris palustris*), arrowwood (*Viburnum recognitum*), and poison ivy (*Toxicodendron radicans*). Data on characteristic animals are needed.

Distribution: not well known; reported from the Finger Lakes Highlands sub-zone of the Appalachian Plateau ecozone.

Rank: G3G4 S1S2

Examples: South Hill Swamp, Tompkins County; Blueberry Patch Swamp, Schuyler County.

Sources: Tufts 1976; NHP field surveys.

6. Hemlock-hardwood swamp: a mixed swamp that occurs on mineral soils in depressions which receive groundwater discharge, typically in areas where the aquifer is a basic or acidic substrate. These swamps usually have a fairly closed canopy (70 to 90% cover), sparse shrublayer, and low species diversity. The characteristic canopy trees are hemlock (*Tsuga canadensis*), yellow birch (*Betula alleghaniensis*), and red maple (*Acer rubrum*). The most common shrub is highbush blueberry (*Vaccinium corymbosum*). Characteristic herbs are cinnamon fern (*Osmunda cinnamomea*) and sensitive fern (*Onoclea sensibilis*). Groundcover may also be fairly sparse. A characteristic bird is golden-crowned kinglet (*Regulus satrapa*).

This is a common and widespread swamp community. Some occurrences are very small (1 to 2 acres). Water levels in these swamps typically fluctuate seasonally: they may be flooded in spring and relatively dry by late summer.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G4G5 S4

Sources: Bray 1915; McVaugh 1958; NHP field surveys.

7. Spruce-fir swamp: a conifer swamp that occurs along gentle slopes of islands or along the margins of drainage basins where there is some nutrient input from groundwater discharge or subsurface flow. In the Adirondacks these swamps are often found in drainage basins occasionally flooded by beaver (*Castor canadensis*), in the Tug Hill plateau they occur on mineral soils. These swamps are usually dense, with a fairly closed canopy (80 to 90% cover). The dominant trees are usually red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*); either one may be dominant in a stand, or they may be codominant. In the Adirondacks, black spruce (*Picea mariana*) or white spruce (*P. glauca*) may replace red spruce as a codominant tree. The shrublayer is sparse; characteristic shrubs include green alder (*Alnus viridis* ssp. *crispus*), mountain ash (*Sorbus americana*), and wild raisin (*Viburnum cassinoides*). Characteristic herbs are cinnamon fern (*Osmunda cinnamomea*), mountain wood fern (*Dryopteris campyloptera*), wood sorrel (*Oxalis acetosella*), and gold thread (*Coptis trifolia*); in northern New York, creeping snowberry (*Gaultheria hispidula*) and dewdrop (*Dalibarda repens*) are also common. Characteristic bryophytes are *Sphagnum* spp., *Bazzania trilobata*, *Pleurozium schreberi*, and *Brotherella recurvans*. A characteristic bird is olive-sided flycatcher (*Contopus borealis*).

Spruce-fir swamps occur in lowlands where they may grade into either spruce flats or balsam flats (upland forests). A spruce-fir swamp is distinguished from spruce flats by the lower elevation of the swamp, wetland soils, presence in the swamp of patches of *Sphagnum* spp., and the absence of black cherry (*Prunus serotina*), a characteristic species of spruce flats and balsam flats.

Distribution: most common in the Adirondacks ecozone, and extending south into the Appalachian Plateau ecozone.

Rank: G3G4 S3?

Sources: Braun 1950; Zon 1914.

D. FORESTED PEATLANDS

This subsystem includes peatlands with at least 50% canopy cover of trees. Substrates range from coarse woody or fibrous peat to fine-grained marl and organic muck.

1. Inland Atlantic white cedar swamp: a conifer or mixed swamp that occurs on organic soils (usually peat) in poorly drained depressions between hills of the Ridge and Valley Province of southeastern New York (i.e. the Hudson Highlands) and northern New Jersey. The characteristic tree is Atlantic white cedar (*Chamaecyparis thyoides*); the canopy cover of *Chamaecyparis* in these swamps is quite variable, ranging from nearly pure stands to as little as 30% of the canopy. In mixed stands the codominants are typically red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*), and hemlock (*Tsuga canadensis*). Characteristic small trees and shrubs are winterberry (*Ilex verticillata*), smooth winterberry (*I. laevigata*), rosebay (*Rhododendron maximum*), highbush blueberry (*Vaccinium corymbosum*), swamp azalea (*Rhododendron viscosum*), and sweet pepperbush (*Clethra alnifolia*). In a dense stand of *Chamaecyparis*, the groundlayer is very shaded, and the groundcover is predominantly bryophytes, including several species of *Sphagnum*, and at least one characteristic liverwort, *Palavicinia lyellii*. In mixed stands with a more open canopy some characteristic herbs are cinnamon fern (*Osmunda cinnamomea*), interrupted fern (*O. claytoniana*), wild calla (*Calla palustris*), and sedges such as *Carex disperma* and *Rhynchospora alba*. Data on characteristic animals are needed.

Distribution: only known from the Hudson Highlands ecozone, and the Mongaup Hills subzone of the Appalachian Plateau ecozone.

Rank: G2G3 S1

Example: Little Cedar Bog, Orange County.

Sources: Eyre 1980; Laderman 1989; Lynn 1984; NHP field surveys.

2. Coastal plain Atlantic white cedar swamp: a conifer or mixed swamp that occurs on organic soils along streams and in poorly drained depressions of the coastal plain of New England, Long Island, New Jersey, and southward. Atlantic white cedar (*Chamaecyparis thyoides*) makes up over 50% of the canopy cover. In mixed stands in New York, red maple (*Acer rubrum*) is the codominant tree. Characteristic shrubs are sweet pepperbush (*Clethra alnifolia*), winterberry (*Ilex glabra*), bayberry (*Myrica pensylvanica*), and swamp azalea (*Rhododendron viscosum*). The groundlayer dominants are several species of *Sphagnum* moss. Characteristic herbs, typically found in sunny openings in the swamp, include

cinnamon fern (*Osmunda cinnamomea*), marsh fern (*Thelypteris palustris*), wintergreen (*Gaultheria procumbens*), sundew (*Drosera intermedia*), pitcher plant (*Sarracenia purpurea*), and sedges such as *Carex walteriana*. Massachusetts fern (*Thelypteris simulata*) and two sedges (*Carex atlantica* and *C. collinsii*) are characteristic of these swamps in New England; these species occur in New York but they have not recently been reported from New York *Chamaecyparis* swamps. A characteristic butterfly is Hessel's hairstreak (*Mitoura hesseli*). More data on characteristic animals are needed.

Distribution: restricted to the Coastal Lowlands ecozone.

Rank: G3G4 S1

Example: Cranberry Bog County Park, Suffolk County.

Sources: Eyre 1980; Laderman 1987; Laderman 1989; NHP field surveys.

3. Red maple-tamarack peat swamp: a mixed swamp that occurs on organic soils (peat or muck) in poorly drained depressions. These swamps are often spring fed or enriched by seepage of minerotrophic groundwater resulting in a stable water table and continually saturated soil. Soils are often rich in calcium. The dominant trees are red maple (*Acer rubrum*) and tamarack (*Larix laricina*). These species usually form an open canopy (60 to 70% cover) with numerous small openings dominated by shrubs or sedges. Characteristic shrubs are poison sumac (*Toxicodendron vernix*), red osier dogwood (*Cornus sericea*), highbush blueberry (*Vaccinium corymbosum*), alders (*Alnus rugosa*, *A. serrulata*), shrubby cinquefoil (*Potentilla fruticosa*), alder-leaf buckthorn (*Rhamnus alnifolia*), meadow-sweet (*Spiraea latifolia*), black chokeberry (*Aronia melanocarpa*), and swamp birch (*Betula pumila*). Characteristic herbs are sedges such as *Carex leptalea*, *C. lacustris*, and *C. stricta*, cattail (*Typha latifolia*), crested wood fern (*Dryopteris cristata*), royal fern (*Osmunda regalis*), marsh fern (*Thelypteris palustris*), spreading goldenrod (*Solidago patula*), meadow-rue (*Thalictrum pubescens*), marsh marigold (*Caltha palustris*), and skunk cabbage (*Symplocarpus foetidus*). Data on characteristic animals are needed. These swamps are closely related to and often grade into rich shrub fens and rich graminoid fens.

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Distribution: scattered throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G3G4 S2S3

Examples: Drowned Lands Swamp, Columbia County; Quaker Pond Fen, Monroe County.

Sources: McVaugh 1958; NHP field surveys.

4. Pitch pine-blueberry peat swamp: a conifer swamp that occurs in shallow depressions in sand plains where peat has accumulated over a poorly drained sandy soil called an Ortstein. This soil has a horizon cemented by iron oxide; the cemented horizon impedes drainage, causing seasonal flooding. The dominant tree is pitch pine (*Pinus rigida*). Gray birch (*Betula populifolia*) and red maple (*Acer rubrum*) are present at a low density. The canopy is open, with about 50 to 60 percent cover. There is a dense shrublayer dominated by highbush blueberry (*Vaccinium corymbosum*), with small amounts of sheep laurel (*Kalmia angustifolia*), blueberry (*Vaccinium myrtilloides*), wild raisin (*Viburnum cassinoides*), and black chokeberry (*Aronia melanocarpa*). The groundcover is a hummocky carpet of peat mosses (*Sphagnum* spp.) with scattered herbs including wintergreen (*Gaultheria procumbens*), bracken fern (*Pteridium aquilinum*), bunchberry (*Cornus canadensis*), Canada mayflower (*Maianthemum canadense*), and bulrush (*Scirpus* sp.). More data on this community are needed.

Distribution: only known from the Erie-Ontario Plain sub-zone of the Great Lakes Plain ecozone. Communities with a similar composition have been described from the New Jersey Pine Barrens.

Rank: G3? S1

Example: Huckleberry Swamp in the Rome Sand Plains, Oneida County.

Sources: Breden 1987; NHP field surveys.

5. Northern white cedar swamp: a conifer or mixed swamp that occurs on organic soils in cool, poorly drained depressions in central and northern New York, and along lakes and streams in the northern half of the state. These swamps are often spring fed or enriched by seepage of cold, minerotrophic groundwater, resulting in a stable water table and continually saturated soils.

Soils are often rich in calcium. At some sites these soils have developed above a marl substrate. The characteristic tree is northern white cedar (*Thuja occidentalis*), which makes up more than 30% of the canopy cover. *Thuja* may form nearly pure stands, or it may be mixed with other conifers and hardwoods, including red maple (*Acer rubrum*), hemlock (*Tsuga canadensis*), balsam fir (*Abies balsamea*), tamarack (*Larix laricina*), yellow birch (*Betula alleghaniensis*), black ash (*Fraxinus nigra*), white pine (*Pinus strobus*), and black spruce (*Picea mariana*). The shrublayer is usually sparse; characteristic species are dwarf raspberry (*Rubus pubescens*), red osier dogwood (*Cornus sericea*), swamp fly honeysuckle (*Lonicera oblongifolia*), and highbush blueberry (*Vaccinium corymbosum*). The groundlayer is typically diverse, with many bryophytes and boreal herbs. There are typically many hummocks formed by decaying downed trees or tip-up mounds. Characteristic herbs on the hummocks are the sedges *Carex leptalea* and *C. eburnea*, oak fern (*Gymnocarpium dryopteris*), gold thread (*Coptis trifolia*), starflower (*Trientalis borealis*), bunchberry (*Cornus canadensis*), miterwort (*Mitella nuda*), Canada mayflower (*Maianthemum canadense*), blue bead lily (*Clintonia borealis*), snowberry (*Gaultheria hispidula*), and partridge berry (*Mitchella repens*). Characteristic herbs of hollows between the hummocks are the sedge *C. intumescens*, sensitive fern (*Onoclea sensibilis*), marsh fern (*Thelypteris palustris*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*O. regalis*), crested wood fern (*Dryopteris cristata*), showy lady's-slipper (*Cypripedium reginae*), yellow lady's-slipper (*Cypripedium calceolus*), and golden ragwort (*Senecio aureus*). Characteristic bryophytes are several species of *Sphagnum* moss, feathermosses such as *Hylocomium splendens* and *Ptilium crista-castrensis*, and leafy liverworts such as *Bazzania trilobata* and *Trichocolea tomentella*. Characteristic birds include white-throated sparrow (*Zonotrichia albicollis*), winter wren (*Troglodytes troglodytes*), and golden-crowned kinglet (*Regulus satrapa*).

Distribution: scattered across upstate New York, extending north from the Appalachian Plateau ecozone.

Rank: G3G4 S2S3

Examples: Bergen Swamp, Genesee County; Nelson Swamp, Madison County; Summit Lake Swamp, Otsego County.

Sources: Seischab 1984; Shanks 1966; NHP field surveys.

6. Rich hemlock-hardwood peat swamp: a mixed swamp that occurs in central New York in depressions or concave slopes which receive groundwater discharge, typically in areas where the groundwater flows through calcareous gravels of glacial deposits. These swamps usually have a fairly open canopy (50 to 70% cover), scattered shrubs, and a diverse groundlayer with sedges, mosses, and forbs. The characteristic canopy trees are hemlock (*Tsuga canadensis*) which usually has at least 20% cover, red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), black ash (*Fraxinus nigra*), tamarack (*Larix laricina*), white pine (*Pinus strobus*), smooth serviceberry (*Amelanchier arborea* var. *laevis*), balsam fir (*Abies balsamea*), and northern white cedar (*Thuja occidentalis*). In any one swamp there may be very few (if any) stems of *Abies* or *Thuja*. In the Cayuga Lake area, some of these swamps are locally known as "fir tree swamps", even if there are only a few balsam fir present, because these are the only places locally where native balsam fir can be found. Characteristic shrubs and vines are alder-leaf buckthorn (*Rhamnus alnifolia*), highbush blueberry (*Vaccinium corymbosum*), red osier dogwood (*Cornus sericea*), northern gooseberry (*Ribes hirtellum*), wild raisin (*Viburnum cassinoides*), virgin's bower (*Clematis virginiana*), and dwarf raspberry (*Rubus pubescens*). Characteristic herbs are the sedges *Carex bromoides*, *C. interior*, and *C. scabrata*, manna grass (*Glyceria striata*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*O. regalis*), sensitive fern (*Onoclea sensibilis*), marsh marigold (*Caltha palustris*), golden ragwort (*Senecio aureus*), meadow-rue (*Thalictrum pubescens*), miterwort (*Mitella nuda*), starry Solomon's seal (*Smilacina stellata*), spreading goldenrod (*Solidago patula*), white hellebore (*Veratrum viride*), swamp thistle (*Cirsium muticum*), purple avens (*Geum rivale*), globeflower (*Trollius laxus* ssp. *laxus*), and swamp saxifrage (*Saxifraga pensylvanica*). Characteristic mosses are *Sphagnum russowii*, *S. wamstorffii*, *S. centrale*, *Aulacomnium palustre*, and *Campylium stellatum*. Data on characteristic animals are needed.

Distribution: not well known; reported from the Central Appalachians and Finger Lake Highlands sub-zones of the Appalachian Plateau ecozone.

Rank: G3G4 S2S3

Example: Michigan Hollow Swamp, Tompkins County.

Sources: Tufts 1976; NHP field surveys.

7. Black spruce-tamarack bog: a conifer swamp or bog forest that occurs on acidic peatlands in cool, poorly drained depressions. The characteristic trees are black spruce (*Picea mariana*) and tamarack (*Larix laricina*); in any one stand, either tree may be dominant, or they may be codominant. Canopy cover is quite variable, ranging from open canopy swamps with as little as 50% cover of canopy trees to closed canopy swamps with 80 to 90% cover. In the more open canopy stands there is usually a well-developed shrublayer characterized by several bog shrubs: leatherleaf (*Chamaedaphne calyculata*), bog laurel (*Kalmia polifolia*), highbush blueberry (*Vaccinium corymbosum*), Labrador tea (*Ledum groenlandicum*), and mountain holly (*Nemopanthus mucronatus*). In closed canopy stands the shrublayer may be sparse. The dominant groundcover consists of several species of *Sphagnum* moss, with scattered sedges and forbs. Characteristic herbs are the sedge *Carex trisperma*, cotton grass (*Eriophorum* spp.), pitcher plant (*Sarracenia purpurea*), and small cranberry (*Vaccinium oxycoccus*). In shady areas where the canopy is dense, gold thread (*Coptis trifolia*) and creeping snowberry (*Gaultheria procumbens*) may be found. Vascular plant diversity is usually low in these swamps; however the bryophyte and epiphytic lichen flora may be relatively diverse. Characteristic animals include three-toed woodpecker (*Picoides tridactylus*), black-backed woodpecker (*Picoides arcticus*), olive-sided flycatcher (*Contopus borealis*), gray jay (*Perisoreus canadensis*), Lincoln's sparrow (*Melospiza lincolni*), white-throated sparrow (*Zonotrichia albicollis*), golden-crowned kinglet (*Regulus satrapa*), spruce grouse (*Dendragapus canadensis*), and four-toed salamander (*Hemidactylium scutatum*).

Distribution: scattered throughout upstate New York; more common to the north in the Adirondacks ecozone.

Rank: G4G5 S3

Examples: Bolton Swamp, Warren County; Massawepie Mire, St. Lawrence County; Spring Pond Bog, Franklin County.

Sources: Bray 1921; Shanks 1966; NHP field surveys.

C. PALUSTRINE CULTURAL

This subsystem includes communities that are either created and maintained by human activities, or are modified by human influence to such a

PALUSTRINE COMMUNITIES

degree that the physical conformation of the substrate, the hydrology, or the biological composition of the resident community is substantially different from the character of the substrate, hydrology, or community as it existed prior to human influence.

1. Reverted drained muckland: a wetland with muck soils that has been drained and cultivated (e.g. for vegetable crops), and subsequently allowed to flood and thereby revert to a wetland.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G5 S5

2. Impounded marsh: a marsh (with less than 50% cover of trees) in which the water levels have been artificially manipulated or modified, often for the purpose of improving waterfowl habitat. Purple loosestrife (*Lythrum salicaria*) may become dominant when water levels are low. Vegetation often consists of species planted to improve waterfowl habitat, such as proso millet (*Panicum milaceum*), foxtail millet (*Setaria italica*), sorghum (*Sorghum bicolor*), and buckwheat (*Fagopyrum esculentum*).

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G5 S5

Source: Giles 1969.

3. Impounded swamp: a swamp (with at least 50% cover of trees) where the water levels have been artificially manipulated or modified, often for the purpose of improving waterfowl habitat. Red maple (*Acer rubrum*) is a characteristic tree. Often there are many standing dead tree trunks. Purple loosestrife (*Lythrum salicaria*) and duckweed (*Lemna minor*) may become dominant in the understory.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G5 S5

4. Reedgrass/purple loosestrife marsh: a marsh that has been disturbed by draining, filling, road salts, etc. in which reedgrass (*Phragmites australis*) or purple loosestrife (*Lythrum salicaria*) has become dominant. This community is common along highways and railroads.

Distribution: throughout New York State.

Rank: G5 S5

5. Dredge spoil wetland: a wetland in which the substrate consists of dredge spoils; reedgrass (*Phragmites australis*) is a characteristic species.

Distribution: throughout New York State.

Rank: G5 S5

6. Mine spoil wetland: a sparsely vegetated wetland in which the substrate consists of mine spoils.

Distribution: scattered throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G5 S5

7. Water recharge basin: the aquatic community of a constructed depression near a road or development that receives runoff from paved surfaces and allows the water to percolate through to the groundwater, thereby recharging the groundwater. These basins are intermittently flooded during periods of heavy precipitation. On Long Island some of these are important as breeding habitat for amphibians such as tiger salamander (*Ambystoma tigrinum*).

Distribution: throughout New York State.

Rank: G5 S5

VI. TERRESTRIAL SYSTEM

The terrestrial system consists of upland habitats. These habitats have well-drained soils that are dry to mesic (never hydric), and vegetative cover that is never predominantly hydrophytic, even if the soil surface is occasionally or seasonally flooded or saturated. In other words, this is a broadly defined system that includes everything except aquatic, wetland, and subterranean communities.

A. OPEN UPLANDS

This subsystem includes upland communities with less than 25% canopy cover of trees; the dominant species in these communities are shrubs, herbs, or cryptogamic plants (mosses, lichens, etc.). Three distinctive physiognomic types are included in this subsystem. Grasslands include communities that are dominated by grasses and sedges; they may include scattered shrubs (never more than 50% cover of shrubs), and scattered trees (usually less than one tree per acre, or 3 trees per hectare). Meadows include communities with forbs, grasses, sedges, and shrubs codominant; they may include scattered trees. Shrublands include communities that are dominated by shrubs (more than 50% cover of shrubs); they may include scattered trees.

1. Sand beach: a sparsely vegetated community that occurs on unstable sandy shores of large freshwater lakes, where the shore is formed and continually modified by wave action and wind erosion. Characteristic species include beach-pea (*Lathyrus japonicus* var. *glaber*), sea-rocket (*Cakile edentula* ssp. *lacustris*), silverweed (*Potentilla anserina*), tall wormwood (*Artemisia campestris* ssp. *caudata*), sand dropseed (*Sporobolus cryptandrus*), panic grass (*Panicum* spp.), cyperus (*Cyperus* spp.), beggar-ticks (*Bidens* spp.), and knotweed (*Polygonum* spp.). Sand beaches provide feeding areas for migratory birds, and nesting habitat for shorebirds such as spotted sandpiper (*Actitis macularia*). Characteristic insects are tiger beetles (*Cincindela* spp.). More data on this community are needed.

Distribution: throughout New York State.

Rank: G5 S5

Example: Southwick Beach State Park, Jefferson County.

Source: NHP field surveys.

2. Great Lakes dunes: a community dominated by grasses and shrubs that occurs on active and stabilized sand dunes along the shores of the Great Lakes. The composition and structure of the community is variable depending on stability of the dunes, the amount of sand deposition and erosion, and distance from the lake. Unstable dunes are sparsely vegetated; characteristic species include beachgrass (*Ammophila breviligulata*), tall wormwood (*Artemisia campestris* var. *caudata*), beach-pea (*Lathyrus japonicus* var. *glaber*), red osier dogwood (*Cornus sericea*), silky dogwood (*C. amomum*), sand cherry (*Prunus pumila*), sand-dune willow (*Salix cordata*), and cottonwood (*Populus deltoides*). Vegetation of stable dunes is more dense, and can eventually become forested. Characteristic species of stable dunes include starry Solomon's seal (*Smilacina stellata*), jointweed (*Polygonella articulata*), seaside spurge (*Euphorbia polygonifolia*), common hairgrass (*Deschampsia flexuosa*), poison ivy (*Toxicodendron radicans*), and bitterweet (*Celastrus scandens*). More data on this community are needed.

Distribution: only known from the eastern shore of Lake Ontario, in the Eastern Ontario Plain subzone of the Great Lakes Plain ecozone.

Rank: G3G4 S1S2

Examples: El Dorado Beach, Jefferson County; Lakeview Wildlife Management Area, Jefferson County.

Source: Significant Habitat Unit files; NHP field surveys.

3. Maritime beach: a sparsely vegetated community that occurs on unstable sand, gravel, or cobble ocean shores above mean high tide, where the shore is modified by storm waves and wind erosion. Characteristic species include beachgrass (*Ammophila breviligulata*), sea-rocket (*Cakile edentula* ssp. *edentula*), seaside atriplex (*Atriplex patula*), seabeach atriplex (*A. arenaria*), seabeach sandwort (*Honkenya peploides*), salsola (*Salsola kali*), seaside spurge (*Charaesyce polygonifolia*), and seabeach knotweed (*Polygonum glaucum*). This community is an important nesting ground for birds such as piping plover (*Charadrius melodus*), least tern (*Sterna antillarum*), common tern (*S. hirundo*), and roseate tern (*S. dougallii*).

Distribution: along the seacoast of the Coastal Lowlands ecozone.

TERRESTRIAL COMMUNITIES

Rank: G5 S5

Examples: Fire Island National Seashore, Suffolk County; Napeague Beach, Suffolk County.

Sources: Art 1976; Johnson 1985; Significant Habitat Unit files.

4. Maritime dunes: a community dominated by grasses and low shrubs that occurs on active and stabilized dunes along the Atlantic coast. This community consists of a mosaic of vegetation patches. This mosaic reflects past disturbances such as sand deposition, erosion, and dune migration. The composition and structure of the vegetation is variable depending on stability of the dunes, amounts of sand deposition and erosion, and distance from the ocean. Characteristic species of the active dunes, where sand movement is greatest, include beachgrass (*Ammophila breviligulata*), dusty-miller (*Artemisia stelleriana*), beach pea (*Lathyrus japonicus*), sedge (*Carex silicea*), seaside goldenrod (*Solidago sempervirens*), and sand-rose (*Rosa rugosa*). Characteristic species of stabilized dunes include beach heather (*Hudsonia tomentosa*), bearberry (*Arctostaphylos uva-ursi*), beachgrass (*Ammophila breviligulata*), cyperus (*Cyperus polystachyos* var. *macrostachyus*), seaside goldenrod (*Solidago sempervirens*), beach pinweed (*Lechea maritima*), jointweed (*Polygonella articulata*), sand-rose (*Rosa rugosa*), bayberry (*Myrica pensylvanica*), beach-plum (*Prunus maritima*), poison ivy (*Toxicodendron radicans*), and the lichens *Cladina submitis* and *Cetraria arenaria*. A few stunted pitch pines (*Pinus rigida*) or post oaks (*Quercus stellata*) may be present in the dunes. Characteristic birds are gadwall (*Anas strepera*) and short-eared owl (*Asio flammeus*).

Distribution: along the seacoast of the Coastal Lowlands ecozone.

Rank: G4 S3

Examples: Napeague Dunes, Suffolk County; Fire Island National Seashore, Suffolk County.

Sources: Andrie and Carroll 1988; Art 1976; Johnson 1985; Robichaud and Buell 1983; Zaremba 1989.

5. Maritime shrubland: a shrubland community that occurs on dry seaside bluffs and headlands that are exposed to offshore winds and salt spray.

This is usually a low diversity community dominated by one or more species of shrubs or stunted trees. Characteristic species include beach-plum (*Prunus maritima*), sand-rose (*Rosa rugosa*), wild rose (*R. virginiana*), bayberry (*Myrica pensylvanica*), eastern red cedar (*Juniperus virginiana*), shining sumac (*Rhus copallinum*), poison ivy (*Toxicodendron radicans*), black cherry (*Prunus serotina*), highbush blueberry (*Vaccinium corymbosum*), American holly (*Ilex opaca*), and shadbush (*Amelanchier canadensis*). Characteristic birds include great egret (*Casmerodius albus*) and black-crowned night-heron (*Nycticorax nycticorax*).

Distribution: along the seacoast of the Coastal Lowlands ecozone.

Rank: G4 S4

Example: Fire Island, Suffolk County.

Sources: Clark 1986b; Robichaud and Buell 1983; Taylor 1923.

6. Maritime heathland: a dwarf shrubland community that occurs on rolling outwash plains and moraine of the glaciated portion of the Atlantic coastal plain, near the ocean and within the influence of offshore winds and salt spray. This community is dominated by low heath or heath-like shrubs that collectively have greater than 50% cover. Characteristic shrubs include bearberry (*Arctostaphylos uva-ursi*), beach heather (*Hudsonia tomentosa*), blueberry (*Vaccinium angustifolium*), black huckle-berry (*Gaylussacia baccata*), bayberry (*Myrica pensylvanica*), and beach-plum (*Prunus maritima*). Grasses and forbs are present, but they do not form a turf; characteristic species include common hairgrass (*Deschampsia flexuosa*), little bluestem (*Schizachyrium scoparium*), Pennsylvania sedge (*Carex pensylvanica*), rush (*Juncus greenii*), asters (*Aster dumosum*, *A. linariifolius*, *A. solidagineus*), bushy rockrose (*Helianthemum dumosum*), and New England blazing star (*Liatris scariosa* var. *novae-angliae*). A characteristic bird in winter is yellow-rumped warbler (*Dendroica coronata*). This community intergrades with maritime grassland, and the two communities may occur together in a mosaic.

Distribution: along the seacoast of the Coastal Lowlands ecozone, in eastern Long Island.

Rank: G3 S1

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Example: Montauk Mountain, Suffolk County.

Sources: Zaremba 1989; NHP field surveys.

7. Maritime grassland: a grassland community that occurs on rolling outwash plains of the glaciated portion of the Atlantic coastal plain, near the ocean and within the influence of offshore winds and salt spray. This community is dominated by grasses that usually form a turf; the grasses collectively have greater than 50% cover. Low heath shrubs may be present, with less than 50% cover. The dominant grasses are little bluestem (*Schizachyrium scoparium*), common hairgrass (*Deschampsia flexuosa*), and poverty-grass (*Danthonia spicata*). Other characteristic species include Pennsylvania sedge (*Carex pensylvanica*), rush (*Juncus greenei*), Indian grass (*Sorghastrum nutans*), Atlantic golden aster (*Pityopsis falcata*), bushy rockrose (*Helianthemum dumosum*), hoary frostweed (*H. propinquum*), flat-top goldenrod (*Euthamia graminifolia*), white-topped aster (*Aster paternus*), pussy's-toes (*Antennaria plantaginifolia*), bitter milkwort (*Polygala polygama*), bayberry (*Myrica pensylvanica*), shining sumac (*Rhus copallinum*), and northern dewberry (*Rubus flagellaris*). A characteristic lichen is *Cladina rangiferina*.

Distribution: along the seacoast of the Coastal Lowlands ecozone, in eastern Long Island.

Rank: G2G3 S1

Example: Conscience Point, Suffolk County; Shinnecock Hills, Suffolk County.

Source: Taylor 1923; NHP field surveys.

8. Hempstead Plains grassland: a tall grassland community that occurs on rolling outwash plains in west-central Long Island. This community occurs inland, beyond the influence of offshore winds and salt spray. Historically this community covered approximately 38,000 acres (about 15,000 hectares) of western Long Island; less than 30 acres remain today, and most of these are severely degraded. This community was dominated by species characteristic of midwestern tallgrass prairie: big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), and switchgrass (*Panicum virgatum*). These species are present in today's remnants, but they are not always dominant. Other characteristic

species that still occur in this community include rush (*Juncus greenei*), wild indigo (*Baptisia tinctoria*), dwarf cinquefoil (*Potentilla canadensis*), rough goldenrod (*Solidago nemoralis*), early goldenrod (*Solidago juncea*), butterfly-weed (*Asclepias tuberosa*), stargrass (*Hypoxis hirsuta*), fringed violet (*Viola fimbriatula*), bird's-foot violet (*V. pedata*), stiff-leaf aster (*Aster linariifolius*), boneset (*Eupatorium hyssopifolium*), and northern dewberry (*Rubus flagellaris*). Characteristic birds include vesper sparrow (*Pooecetes gramineus*), savannah sparrow (*Passerculus sandwichensis*), grasshopper sparrow (*Ammodramus savannarum*), and bobolink (*Dolichonyx oryzivorus*).

Distribution: only known from the Coastal Lowlands ecozone, in western Long Island.

Rank: G1Q S1

Sources: Cain et al. 1937; Seyfert 1973; NHP field surveys.

9. Riverside ice meadow: a meadow community that occurs on gently sloping cobble shores and rock outcrops along large rivers in areas where winter ice floes are pushed up onto the shore, forming an ice pack that remains until late spring. The ice scours the meadow, cutting back woody plants. The late-melting ice pack, which is up to 8 ft (2.4 m) deep in late April or early May (in the southern Adirondacks), creates a cool microclimate in late spring, and shortens the growing season. The ice pack deposits organic matter that has accumulated in the ice during the winter, apparently enriching the sandy soils of the cobble and rocky shores. Within this community there is a gradient of two to three vegetation zones that vary with elevation above the river and soil moisture. Along the river there is often a narrow zone of seepy, wet meadow; characteristic species of this riverside seep include sweet-gale (*Myrica gale*), twig-rush (*Cladium mariscoides*), Canadian burnet (*Sanguisorba canadensis*), stiff willow (*Salix rigida*), silky dogwood (*Comus amomum*), three-way sedge (*Dulichium arundinaceum*), slender spikerush (*Eleocharis elliptica*), beakrush (*Rhynchospora capitellata*), cranberry (*Vaccinium macrocarpon*), brook lobelia (*Lobelia kalmii*), and rose pogonia (*Pogonia ophioglossoides*). Where the cobble shores are broad and the soil is coarse and dry, there is a zone of grassy meadow. The dominant grasses include big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and Indian grass (*Sorghastrum nutans*); in at least one

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location, nutrush (*Scleria triglomerata*) is codominant. Characteristic species of the dry meadow include sweet-fern (*Comptonia peregrina*), woodland sunflower (*Helianthus divaricatus*), meadow-sweet (*Spiraea latifolia*), sand-cherry (*Prunus pumila*), butterfly-weed (*Asclepias tuberosa*), wild rose (*Rosa virginiana*), frostweed (*Helianthemum canadense*), and bush-clover (*Lespedeza capitata*). Farthest from the river there may be a shrubby zone that includes some tree saplings and seedlings. Characteristic species of the shrubby zone include hazelnut (*Corylus americana*), virgin's-bower (*Clematis virginiana*), bush honeysuckle (*Diervilla lonicera*), ostrich fern (*Matteuccia struthiopteris*), interrupted fern (*Osmunda claytoniana*), red raspberry (*Rubus idaeus*), deer-tongue grass (*Panicum clandestinum*), and flat-top white aster (*Aster umbellatus*). Data on characteristic animals are needed.

Distribution: along upper reaches of large rivers, reported from the Hudson River in the Adirondacks ecozone, Delaware River in the Appalachian Plateau ecozone, and St. Regis River in the St. Lawrence Plains subzone.

Rank: G2G3 S1

Example: South of The Glen, Warren County.

Source: NHP field surveys.

10. Riverside sand/gravel bar: a meadow community that occurs on sand and gravel bars deposited within a river channel. The community may be very sparsely vegetated, depending on the rates of deposition and erosion of the sand or gravel. Characteristic species include sandbar willow (*Salix exigua*), sand-cherry (*Prunus pumila*), dogbane (*Apocynum cannabinum*), switchgrass (*Panicum virgatum*), and poison ivy (*Toxicodendron radicans*). More data on this community are needed.

Distribution: throughout New York State.

Rank: G5 S5

Sources: NHP field surveys.

11. Shoreline outcrop: a community that occurs along the shores of lakes and streams on outcrops of non-calcareous rocks such as anorthosite, granite, quartzite, sandstone, gneiss, or schist.

The shoreline is exposed to wave action and ice scour. The vegetation is sparse; most plants are rooted in rock crevices. Characteristic species include blueberries (*Vaccinium angustifolium*, *V. pallidum*), black huckleberry (*Gaylussacia baccata*), poverty-grass (*Danthonia spicata*), and common hairgrass (*Deschampsia flexuosa*). Crustose and foliose lichens may be common on the rocks. More data on this community are needed.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G5 S5

Source: NHP field surveys.

12. Calcareous shoreline outcrop: a community that occurs along the shores of lakes and streams on outcrops of calcareous rocks such as limestone and dolomite. The vegetation is sparse, most plants are rooted in rock crevices. Mosses and lichens may be common on the rocks. Characteristic species include wild columbine (*Aquilegia canadensis*), sedges (*Carex eburnea*, *C. granularis*), silky dogwood (*Cornus amomum*), red osier dogwood (*Cornus sericea*), and meadow-rue (*Thalictrum* spp.). Characteristic mosses include *Tortella tortuosa* and *Tortula ruralis*. More data on this community are needed.

Distribution: throughout upstate New York north of the Coastal Lowlands ecozone, at sites where the bedrock is calcareous.

Rank: G3G4 S3?

Examples: El Dorado Beach, Jefferson County; Valcour Island, Clinton.

Source: NHP field surveys.

13. Cobble shore: a community that occurs on the well-drained cobble shores of lakes and streams. These shores are usually associated with high-energy waters (such as high-gradient streams), and they are likely to be scoured by floods or winter ice floes. This community includes both active and stable shores. Active cobble shores have loose cobbles that are moved by waves or river currents; these shores are sparsely vegetated, and they have comparatively few species. Stable cobble shores have cobbles embedded in sand or peat, usually with vegetation

rooted between the cobbles, and are generally more diverse than active cobble shores. Characteristic species include Indian grass (*Sorghastrum nutans*), big bluestem (*Andropogon gerardii*), dogbane (*Apocynum androsaemifolium*), deer-tongue grass (*Panicum clandestinum*), flat-top goldenrod (*Euthamia graminifolia*), beggarticks (*Bidens frondosa*), silverweed (*Potentilla anserina*), and bluejoint grass (*Calamagrostis canadensis*). More data on this community are needed.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G4G5 S4

Example: Doyles Islands, Delaware County.

Source: NHP field surveys.

14. Alvar grassland: a grassland community that occurs on shallow soils over level outcrops of calcareous bedrock (limestone or dolomite). Apparently alvar grasslands are restricted to areas that are seasonally flooded in spring or after heavy rainfall, as well as seasonally dry by late summer. Alvar grasslands range in size from 2 acres (0.8 ha) to 50 acres (20 ha) or more. This community may include two or three species assemblages that seem to be correlated with soil moisture and soil depth.

Wet alvar grassland areas are closest to the water table, with soils about an inch deep. Codominant species are slender spikerush (*Eleocharis elliptica* var. *elliptica*), balsam groundsel (*Senecio pauperculus*), Crawe's sedge (*Carex crawei*), and the mosses *Bryum cespiticium*, and *Drepanocladus* spp.

Moist alvar grassland areas have slightly deeper soils than the wet alvar areas, and they are apparently somewhat higher above the water table. The dominant species are tufted hairgrass (*Deschampsia cespitosa*) and prairie dropseed (*Sporobolus heterolepis*). Other characteristic species include sedges (*Carex crawei*, *C. molesta*, *C. castanea*, *C. vulpinoidea*, *C. granularis*), slender wheatgrass (*Agropyron trachycaulum*), brome grass (*Bromus kalmii*), spike muhly (*Muhlenbergia glomerata*), balsam groundsel (*Senecio pauperculus*), upland white aster (*Solidago ptarmicoides*), golden Alexanders (*Zizia aurea*), white camas (*Zigadenus elegans* ssp. *glauca*), Indian paintbrush (*Castilleja coccinea*), prairie-smoke (*Geum triflorum*), and the mosses *Bryum pseudotriquetrum* and *Ditrichum flexicaule*.

Within the grassland are patches of rock outcrop with a distinctive assemblage of mosses, lichens, and small herbs, much like the rock outcrops in calcareous pavement barrens. These outcrops have dry, very shallow soils (less than an inch deep). Characteristic species of these outcrops include the mosses *Tortella tortuosa* and *Bryum cespiticium*, which form a mat at the borders of the outcrop, and herbs including southern hairgrass (*Agrostis hiemalis*), false pennyroyal (*Trichostema brachiatum*), early saxifrage (*Saxifraga virginensis*), harebell (*Campanula rotundifolia*), small skullcap (*Scutellaria parvula* var. *leonardii*), rock sandwort (*Minuartia michauxii*), thyme-leaf sandwort (*Arenaria serpyllifolia*), rough cinquefoil (*Potentilla norvegica*), and sleepy catch-fly (*Silene antirrhina*).

A characteristic bird is upland sandpiper (*Bartramia longicauda*). More data on characteristic animals are needed.

This community is usually surrounded by, or in a mosaic with calcareous pavement barrens. Patches of the dry grass-savanna assemblage of calcareous pavement barrens may occur within moist alvar grassland. The term "alvar" has been used for similar communities on limestone outcrops in Ontario and Sweden, and on dolomite outcrops in Michigan. In Ontario this community and related communities (such as calcareous pavement barrens) are collectively called "alvar".

Distribution: only known from a few outcrops of Chaumont limestone in Jefferson County, in the Eastern Ontario Plain ecozone.

Rank: G2 S1

Example: Chaumont Barrens, Jefferson County.

Sources: Catling et al. 1975; Reschke and Gilman 1988; Slack et al. 1988; NHP field surveys.

15. Alpine meadow: a meadow community that is similar to arctic tundra. Alpine meadows occur above timberline (about 4900 ft or 1620 m) on the higher mountain summits and exposed ledges of the Adirondacks. This community consists of a mosaic of small grassy meadows, dwarf shrublands, small boggy depressions, and exposed bedrock covered with lichens and mosses. The flora includes arctic-alpine species that are restricted (in New York) to these meadows, as well as boreal species that occur in forests and bogs at lower elevations. The soils are thin and organic, primarily composed of sphagnum peat or black muck. The soils are often saturated

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because they can be recharged by atmospheric moisture. Characteristic species of the grassy meadows include deer's hair sedge (*Scirpus cespitosus*), Bigelow's sedge (*Carex bigelowii*), bluejoint grass (*Calamagrostis canadensis*), alpine sweetgrass (*Hierochloa alpina*), common hairgrass (*Deschampsia flexuosa*), mountain woodrush (*Luzula parviflora*), arctic rush (*Juncus trifidus*), three-toothed cinquefoil (*Potentilla tridentata*), bunchberry (*Comus canadensis*), mountain sandwort (*Minuartia groenlandica*), and dwarf rattlesnake-root (*Prenanthes nana*). Characteristic species of the low shrublands are bog bilberry (*Vaccinium uliginosum*), leatherleaf (*Chamaedaphne calyculata*), Labrador tea (*Ledum groenlandicum*), dwarf birch (*Betula glandulosa*), black crowberry (*Empetrum nigrum*), lapland rosebay (*Rhododendron lapponicum*), diapensia (*Diapensia lapponica*), and bearberry willow (*Salix uva-ursi*). On a few mountains there are distinctive patches of low shrublands consisting of dwarf birches including *Betula glandulosa*, *B. minor*, and stunted *B. cordifolia*. Characteristic species of the small boggy depressions include the peat mosses *Sphagnum nemoreum* and *S. fuscum*, cottongrass (*Eriophorum vaginatum* var. *spissum*), bog laurel (*Kalmia polifolia*), and small cranberry (*Vaccinium oxycoccos*). Rock outcrops that are relatively undisturbed by trampling are covered with arctic-alpine lichens such as map lichen (*Rhizocarpon geographicum*) and may have scattered cushions of diapensia. Characteristic birds include dark-eyed junco (*Junco hyemalis*) and white-throated sparrow (*Zonotrichia albicollis*).

This community is very sensitive to trampling because of the thin, often saturated soils and the very slow growth rate of the vegetation in the stressful alpine environment. Every effort should be made to minimize off-trail trampling by the many hikers who climb to these meadows in the High Peaks.

Distribution: restricted to the Adirondack High Peaks subzone of the Adirondacks ecozone.

Rank: G3G4 S1

Examples: Algonquin Peak, Essex County; Haystack Mountains, Essex County.

Sources: DiNunzio 1972; LeBlanc 1981; NHP field surveys.

16. Cliff community: a community that occurs on vertical exposures of resistant, non-calcareous

bedrock (such as quartzite, sandstone, or schist) or consolidated material; these cliffs often include ledges and small areas of talus. There is minimal soil development, and vegetation is sparse. Different types of cliffs may be distinguished based on exposure and moisture; these variations are not well-documented in New York, therefore the assemblages associated with these variations (sunny, shaded, moist, or dry areas) are combined in one community. Characteristic species include rock polypody (*Polypodium virginianum*), marginal wood fern (*Dryopteris marginalis*), common hairgrass (*Deschampsia flexuosa*), mountain laurel (*Kalmia latifolia*), and hemlock (*Tsuga canadensis*). A characteristic bird that nests on cliffs is the common raven (*Corvus corax*). More data on this community are needed.

Distribution: throughout upstate New York north of the Coastal Lowlands ecozone, where bedrock is not calcareous.

Rank: G5 S4?

Examples: Wallface Mountain, Essex County; Smiley Cliff, Ulster County.

Source: NHP field surveys.

17. Calcareous cliff community: a community that occurs on vertical exposures of resistant, calcareous bedrock (such as limestone or dolomite) or consolidated material; these cliffs often include ledges and small areas of talus. There is minimal soil development, and vegetation is sparse. Different types of calcareous cliffs may be distinguished based on exposure and moisture; these variations are not well-documented in New York, therefore the assemblages associated with these variations (sunny, shaded, moist, or dry areas) are combined in one community. Characteristic species include purple cliff brake (*Pellaea atropurpurea*), bulblet fern (*Cystopteris bulbifera*), early saxifrage (*Saxifraga virginiana*), eastern red cedar (*Juniperus virginiana*), and northern white cedar (*Thuja occidentalis*). More data on this community are needed.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone, where bedrock is calcareous.

Rank: G4 S3S4

Examples: Thatcher State Park, Albany County; Tony's Nose, Columbia County.

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Source: NHP field surveys.

18. Shale cliff and talus community: a community that occurs on nearly vertical exposures of shale bedrock and includes ledges and small areas of talus. Talus areas are composed of small fragments that are unstable and steeply sloping; the unstable nature of the shale results in uneven slopes and many rock crevices. There is minimal soil development, and vegetation is sparse. Different types of shale cliffs may be distinguished based on exposure and moisture; these variations are not well-documented in New York, therefore the assemblages associated with these variations (sunny, shaded, moist, or dry areas) are combined in one community. Characteristic species include blunt-lobed woodsia (*Woodsia obtusa*), rusty woodsia (*W. ilvensis*), penstemon (*Penstemon hirsutus*), herb-robert (*Geranium robertianum*), cyperus (*Cyperus filiculmis*), little bluestem (*Schizachyrium scoparium*), panic grass (*Panicum linearifolium*), Pennsylvania sedge (*Carex pennsylvanica*), and eastern red cedar (*Juniperus virginiana*). A characteristic invertebrate is the silvery blue butterfly (*Glaucopsyche lygdamus lygdamus*), which feeds on wood-vetch (*Vicia caroliniana*). More data on this community are needed.

Distribution: scattered throughout upstate New York, north of the Coastal Lowlands ecozone, where bedrock is shale.

Rank: G4 S3?

Examples: Neversink Guymard Cliffs, Orange County; Whetstone Gulf, Lewis County.

Sources: Hotchkiss 1932; NHP field surveys.

19. Rocky summit grassland: a grassland community that occurs on rocky summits and exposed rocky slopes of hills. Characteristic species include little bluestem (*Schizachyrium scoparium*), poverty-grass (*Danthonia spicata*), Indian grass (*Sorghastrum nutans*), ebony spleenwort (*Asplenium platyneuron*), dittany (*Cunila organoides*), and eastern red cedar (*Juniperus virginiana*). More data on this community are needed.

Distribution: not well known; currently reported from the Hudson Valley, Hudson Highlands, Triassic Lowlands ecozones.

Rank: G3G4 S3

Example: Sugarloaf Mountain, Orange County.

Source: NHP field surveys.

20. Successional fern meadow: a meadow dominated by ferns that occurs on sites that have been cleared (for logging, farming, etc.) or otherwise disturbed. Characteristic ferns that may be dominant include bracken fern (*Pteridium aquilinum*) and hay-scented fern (*Dennstaedtia punctilobula*); blueberries (*Vaccinium angustifolium*, *V. pallidum*) are common associates. This community may be relatively short-lived; it gradually succeeds to a blueberry heath or a forest community. More data on this community are needed.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G4 S4

Sources: NHP field surveys.

21. Successional blueberry heath: a shrubland dominated by ericaceous shrubs that occurs on sites with acidic soils that have been cleared (for logging, farming, etc.) or otherwise disturbed. Characteristic species include blueberries (*Vaccinium corymbosum*, *V. pallidum*, *V. myrtilloides*, *V. stamineum*), black huckleberry (*Gaylussacia baccata*), wintergreen (*Gaultheria procumbens*), trailing arbutus (*Epigaea repens*), poverty-grass (*Danthonia spicata*), and common hairgrass (*Deschampsia flexuosa*). This community may be relatively short-lived; it gradually succeeds to a forest community. More data on this community are needed.

Distribution: throughout New York State.

Rank: G4 S4

Example: Finger Lakes National Forest, Schuyler County.

Source: NHP field surveys.

22. Successional old field: a meadow dominated by forbs and grasses that occurs on sites that have been cleared and plowed (for farming or development), and then abandoned.

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Characteristic herbs include goldenrods (*Solidago altissima*, *S. nemoralis*, *S. rugosa*, *S. juncea*, *S. canadensis*, and *Euthamia graminifolia*), bluegrasses (*Poa pratensis*, *P. compressa*), timothy (*Phleum pratense*), quackgrass (*Agropyron repens*), smooth brome (*Bromus inermis*), sweet vernal grass (*Anthoxanthum odoratum*), orchard grass (*Dactylis glomerata*), common chickweed (*Cerastium arvense*), common evening primrose (*Oenothera biennis*), old-field cinquefoil (*Potentilla simplex*), calico aster (*Aster lateriflorus*), New England aster (*Aster novae-angliae*), wild strawberry (*Fragaria virginiana*), Queen-Anne's-lace (*Daucus corota*), ragweed (*Ambrosia artemisiifolia*), hawkweeds (*Hieracium* spp.), dandelion (*Taraxacum officinale*), and ox-tongue (*Picris hieracioides*). Shrubs may be present, but collectively they have less than 50% cover in the community. Characteristic shrubs include gray dogwood (*Cornus foemina* ssp. *racemosa*), silky dogwood (*Cornus amomum*), arrowwood (*Viburnum recognitum*), raspberries (*Rubus* spp.), sumac (*Rhus typhina*, *R. glabra*), and eastern red cedar (*Juniperus virginiana*). A characteristic bird is the field sparrow (*Spizella pusilla*). This is a relatively short-lived community that succeeds to a shrubland, woodland, or forest community.

Distribution: throughout New York State.

Rank: G4 S4

Example: Finger Lakes National Forest, Schuyler County.

Sources: Mellinger and McNaughton 1975; NHP field surveys.

23. Successional shrubland: a shrubland that occurs on sites that have been cleared (for farming, logging, development, etc.) or otherwise disturbed. This community has at least 50% cover of shrubs. Characteristic shrubs include gray dogwood (*Cornus foemina* ssp. *racemosa*), eastern red cedar (*Juniperus virginiana*), raspberries (*Rubus* spp.), hawthorne (*Crataegus* spp.), serviceberries (*Amelanchier* spp.), choke-cherry (*Prunus virginiana*), wild plum (*Prunus americana*), sumac (*Rhus glabra*, *R. typhina*), nanny-berry (*Viburnum lentago*), arrowwood (*Viburnum recognitum*), and multiflora rose (*Rosa multiflora*). Characteristic animals include American robin (*Turdus migratorius*), willow flycatcher (*Empidonax traillii*), blue-winged warbler (*Vermivora pinus*), and rat snake (*Elaphe obsoleta*).

Distribution: throughout New York State.

Rank: G4 S4

Example: Finger Lakes National Forest, Schuyler County.

Source: NHP field surveys.

B. BARRENS AND WOODLANDS

This subsystem includes upland communities that are structurally intermediate between forests and open canopy uplands. Several physiognomic types are included in this subsystem. Savannas are communities with a sparse canopy of trees (25 to 60% cover), and a groundlayer that is predominantly either grassy or shrubby (these will be called, respectively, grass-savanna and shrub-savanna). Woodlands include communities with a canopy of stunted or dwarf trees (less than 16 ft or 4.9 m tall), and wooded communities occurring on shallow soils over bedrock with numerous rock outcrops. The term "barrens" is commonly applied to both savannas and woodlands (e.g. pine barrens).

1. Serpentine barrens: a grass-savanna community that occurs on shallow soils over outcrops of serpentine bedrock. The appearance and composition of vegetation on serpentine soils is often striking because it represents an abrupt change from surrounding vegetation on non-serpentine soils. In New York this community is known only from Staten Island, where the remnants are relatively disturbed. The best examples of this community occur in southeastern Pennsylvania and northeastern Maryland. On Staten Island, the open grassland areas are dominated by little bluestem (*Schizachyrium scoparium*), panic grasses (such as *Panicum virgatum* and *P. philadelphicum*), Indian grass (*Sorghastrum nutans*), and poverty-grass (*Danthonia spicata*). Characteristic forbs in the grassy areas are heath aster (*Aster ericoides*), calico aster (*A. lateriflorus*), small white snakeroot (*Eupatorium aromaticum*), old-field cinquefoil (*Potentilla simplex*), and green milkweed (*Asclepias viridiflora*). Trees and shrubs are scattered in the barrens; usually there is roughly 20 to 40% cover of trees and 15 to 30% cover of shrubs. On Staten Island, the characteristic woody plants are gray birch (*Betula populifolia*), black oak (*Quercus velutina*), sassafras (*Sassafras albidum*), quaking aspen (*Populus tremuloides*), bayberry (*Myrica pensylvanica*), shining sumac

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(*Rhus copallinum*), sawbrier (*Smilax glauca*), arrowwood (*Viburnum recognitum*), and blueberries (*Vaccinium corymbosum*, *V. pallidum*). A characteristic butterfly is the arogos skipper (*Atrytone arogos arogos*).

The remnant serpentine barrens of Staten Island are currently lacking many of the species that characterize the serpentine barrens of Pennsylvania and Maryland, such as Virginia pine (*Pinus virginiana*), blackjack oak (*Quercus marilandica*), fameflower (*Talinum teretifolium*), and chickweed (*Cerastium arvense* var. *villosum*).

Distribution: only known from the Manhattan Hills ecozone.

Rank: G2 S1

Sources: Reed 1986; NHP field surveys.

2. Dwarf pine plains: a woodland community dominated by dwarf individuals of pitch pine (*Pinus rigida*) and scrub oak (*Quercus ilicifolia*) that occurs on nearly level outwash sand and gravel plains in eastern Long Island. The soils are infertile, coarse textured sands that are excessively well-drained. The canopy of dwarf pitch pines and scrub oaks is generally from 4 to 8 ft (1.2 to 2.4 m) tall, and it may form a dense thicket. The community includes very few species of vascular plants. The majority of the biomass in the community consists of seven woody plant species: pitch pine, scrub oak, black huckleberry (*Gaylussacia baccata*), blueberry (*Vaccinium pallidum*), hudsonia (*Hudsonia ericoides*), bearberry (*Arctostaphylos uva-ursi*), and wintergreen (*Gaultheria procumbens*). The huckleberries and blueberries form a low shrub canopy under the pines and oaks. The groundcover under the oaks and pines includes many foliose and fruticose lichens; the lichen flora is probably more diverse than the vascular plant flora in this community. Characteristic lichens include *Cetraria arenaria*, *Cladonia mitis*, *C. submitis*, *Cladonia alpestris*, *C. cristatella*, *Parmelia rudecta*, *P. saxatilis*, and *Peltigera canina*. There are numerous sandy openings in the shrub thicket with scattered bearberry, wintergreen, hudsonia, and a few low herbs such as jointweed (*Polygonella articulata*), stiff-leaf aster (*Aster linariifolius*), and orange-grass (*Hypericum gentianoides*). This community is a favored nesting area for prairie warbler (*Dendroica discolor*) and brown thrasher (*Taxostoma rufum*); pine warbler (*Dendroica pinus*) and ovenbird (*Seiurus aurocapillus*) are also characteristic birds.

This community also provides prime habitat for the buck moth (*Hemileuca maia*); the largest and most dense population of buck moths in New York occurs in the dwarf pine plains.

Distribution: restricted to the Coastal Lowlands ecozone.

Rank: G1G2 S1

Example: Dwarf Pine Barrens, Suffolk County.

Sources: Kerlinger and Doremus 1981; Olsvig 1980; Olsvig et al. 1979; NHP field surveys.

3. Dwarf pine ridges: a woodland community dominated by dwarf individuals of pitch pine (*Pinus rigida*) and black huckleberry (*Gaylussacia baccata*), which occurs on flat-topped summits of rocky ridges. The bedrock is a white quartzite conglomerate; soils are very thin, and they are rich in organic matter from litter that has accumulated on the bedrock. Characteristic woody plants associated with the dwarf pines in the tall shrub "canopy" are wild raisin (*Viburnum cassinoides*), black chokeberry (*Aronia melanocarpa*), and stunted gray birch (*Betula populifolia*). There is also a low shrub stratum with blueberries (*Vaccinium angustifolium* and *V. pallidum*), sweet-fern (*Comptonia peregrina*), and sheep laurel (*Kalmia angustifolia*). Characteristic groundlayer species are wintergreen (*Gaultheria procumbens*), bunchberry (*Cornus canadensis*), Canada mayflower (*Maianthemum canadense*), moccasin flower (*Cypripedium acaule*), and cow-wheat (*Melampyrum lineare*). More data on characteristic animals are needed.

The dwarf pine ridges community grades into the pitch pine-oak-heath rocky summit community, which occurs on the top and upper slopes of ridges. The dwarf pine ridges are distinguished primarily by the height of the canopy pines: stands with pines less than 16 ft (4.9 m) tall are classified as dwarf pine ridges.

Distribution: only known from the Shawangunk Hills sub-zone of the Hudson Valley ecozone.

Rank: G1G2 S1

Example: Sam's Point, Ulster County.

Sources: Olsvig 1980; NHP field surveys.

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4. Pitch pine-scrub oak barrens: a shrub-savanna community that occurs on well-drained, sandy soils that have developed on sand dunes, glacial till, and outwash plains. Pitch pine (*Pinus rigida*) is the dominant tree; the percent cover of pitch pine is variable, ranging from 20 to 60%. The shrublayer dominants are scrub oaks (*Quercus ilicifolia* and *Q. prinoides*), which often form dense thickets. Beneath this tall shrub canopy is a low shrublayer primarily composed of sweet-fern (*Comptonia peregrina*), blueberries (*Vaccinium angustifolium* and *V. pallidum*), and black huckleberry (*Gaylussacia baccata*). These scrub oak thickets cover 60 to 80 percent of the community; pitch pines are scattered through the shrub thicket, occurring as emergent trees within an extensive shrubland. Within the shrub thickets are small patches of grassland dominated by the following prairie grasses: big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and Indian grass (*Sorghastrum nutans*). These grassy areas are usually found near ant mounds, along trails, and in some of the low areas between dunes where the water table may be very close to the soil surface. This community can be rich in species. Characteristic forbs include bush-clovers (*Lespedeza capitata*, *L. hirta*, *L. procumbens*, and *L. stuevii*), pinweed (*Lechea villosa*), milkwort (*Polygala nuttallii*), goat's-rue (*Tephrosia virginiana*), and wild lupine (*Lupinus perennis*). Characteristic butterflies in the barrens of the northern Hudson Valley include Karner blue butterfly (*Lycaeides melissa samuelis*) and frosted elfin (*Incisalia irus*). Buck moth (*Hemileuca maia*) is a characteristic species throughout the range of the community, but the density of buck moths is usually low. Characteristic birds include rufous-sided towhee (*Pipilo erythrophthalmus*), common yellowthroat (*Geothlypis trichas*), field sparrow (*Spizella pusilla*), prairie warbler (*Dendroica discolor*), brown-headed cowbird (*Molothrus ater*), indigo bunting (*Passerina cyanea*), brown thrasher (*Toxostoma rufum*), and whip-poor-will (*Caprimulgus vociferus*).

This community is adapted to and maintained by periodic fires; frequency of fires ranges from 6 to 15 years.

Distribution: mainly known from the Coastal Lowlands ecozone and the Central Hudson subzone of the Hudson Valley ecozone; small examples are reported from the Appalachian Plateau ecozone.

Rank: G2 S1

Examples: Albany Pine Bush, Albany County; Edgewood Oak Brush Plains, Suffolk County.

Sources: Cryan and Turner 1981; Forman 1979; Kerlinger and Doremus 1981; Olsvig 1980; NHP field surveys.

5. Pitch pine-oak-heath woodland: a pine barrens community that occurs on well-drained, infertile, sandy soils in eastern Long Island (and possibly on sandy or rocky soils in upstate New York). The structure of this community is intermediate between a shrub-savanna and a woodland. Pitch pine (*Pinus rigida*) and white oak (*Quercus alba*) are the most abundant trees, and these form an open canopy with 30 to 60% cover. Scarlet oak (*Quercus coccinea*) and black oak (*Q. velutina*) may also occur in the canopy. The shrublayer is dominated by scrub oaks (*Quercus ilicifolia*, *Q. prinoides*), and includes a few heath shrubs such as huckleberry (*Gaylussacia baccata*) and blueberry (*Vaccinium pallidum*). The density of the shrublayer is inversely related to the tree canopy cover; where the trees are sparse, the shrubs form a dense thicket, and where the trees form a more closed canopy, the shrublayer may be relatively sparse. Stunted, multiple-stemmed white oaks may be present in the shrublayer if the site has burned regularly. Characteristic species of the groundcover include bearberry (*Arctostaphylos uva-ursi*), Pennsylvania sedge (*Carex pensylvanica*), golden heather (*Hudsonia ericoides*), beach heather (*Hudsonia tomentosa*), and pinweed (*Lechea villosa*). Like other closely related pine barrens communities, the woodland provides habitat for buck moth (*Hemileuca maia*) and prairie warbler (*Dendroica discolor*).

This community is adapted to periodic fires; the fire frequency has not been documented, but it probably burns less frequently than pitch pine-scrub oak barrens (i.e. more than 15 years between fires). This community may have a fairly low species richness: it is more diverse than dwarf pine plains, but less diverse than pitch pine-scrub oak barrens.

Distribution: currently known only from the Coastal Lowlands ecozone.

Rank: G3G4 S2S3

Examples: Rocky Point Pine Barrens, Suffolk County; Dwarf Pine Barrens, Suffolk County.

Source: NHP field surveys.

6. Pitch pine-heath barrens: a shrub-savanna community that occurs on well-drained, sandy or rocky soils. This is a broadly defined community with several regional variants. The most abundant tree is pitch pine (*Pinus rigida*); in some stands there is an admixture of one or more species including big tooth aspen (*Populus grandidentata*), white pine (*Pinus strobus*), or jack pine (*P. banksiana*). The percent cover of trees is variable, ranging from 30 to 60%. The shrublayer is dominated by heath shrubs such as black huckleberry (*Gaylussacia baccata*), blueberries (*Vaccinium angustifolium*, *V. pallidum*, and *V. myrtilloides*), and sheep-laurel (*Kalmia angustifolia*), as well as sweet-fern (*Comptonia peregrina*). This shrublayer may be quite diverse. Characteristic groundlayer species include wintergreen (*Gaultheria procumbens*), wild sarsaparilla (*Aralia nudicaulis*), Canada mayflower (*Maianthemum canadense*), cow-wheat (*Melampyrum lineare*), wild strawberry (*Fragaria virginiana*), moccasin flower (*Cypripedium acaule*), Pennsylvania sedge (*Carex pensylvanica*), and bracken fern (*Pteridium aquilinum*). Characteristic birds include ovenbird (*Seiurus aurocapillus*), veery (*Catharus fuscescens*), common yellowthroat (*Geothlypis trichas*), chestnut-sided warbler (*Dendroica pensylvanica*), and wood thrush (*Hylocichla mustelina*).

This community is distinguished from pitch pine-scrub oak barrens by the dominance in the shrublayer of heath shrubs rather than scrub oaks (*Quercus ilicifolia* and *Q. prinoides*). Scrub oaks may be present, but they are never abundant or dominant in the shrublayer of pitch pine-heath barrens.

Distribution: known from sandplains in northern and north-central New York, from the Great Lakes Plain ecozone, Western Adirondack Foothills subzone, and the Champlain Valley subzone.

Rank: G4 S2S3

Examples: Clintonville Pine Barrens, Clinton County; Rome Sand Plains, Oneida County.

Source: NHP field surveys.

7. Boreal heath barrens: a dwarf shrubland or shrub-savanna dominated by heath or heath-like shrubs. Boreal heath barrens occur on nearly level outwash plains of the Adirondacks, in frost pockets lying in valleys. Soils are sandy, dry, and poor in nutrients. Boreal heath barrens are

seasonally flooded because the soils have a discontinuous subsurface layer of podzolized soil (an ortstein), which impedes water drainage. The dominant shrubs are blueberries (*Vaccinium myrtilloides*, *V. angustifolium*, *V. vacillans*), black chokeberry (*Aronia melanocarpa*), meadow-sweet (*Spiraea latifolia*), and mountain fly honeysuckle (*Lonicera villosa*). Other characteristic plants include spreading ricegrass (*Oryzopsis asperifolia*), small ricegrass (*Oryzopsis pungens*), swamp dewberry (*Rubus hispidus*), Canada goldenrod (*Solidago canadensis*), flat-top goldenrod (*Euthamia graminifolia*), northern tree clubmoss (*Lycopodium dendroideum*), running-pine (*Lycopodium digitatum*), lichens (*Cladonia alpestris*, *C. pyxidata*, *Cladina rangiferina*), and mosses (*Pleurozium schreberi*, *Polytrichum commune*, and *Dicranum* spp.). Trees may be scattered through the barrens, or they may be confined to the edges of open shrublands. Characteristic trees are black spruce (*Picea mariana*), white pine (*Pinus strobus*), black cherry (*Prunus serotina*), and tamarack (*Larix laricina*). More data are needed on characteristic animals of this community.

Distribution: only known from the Adirondacks ecozone.

Rank: G3G4 S1

Example: Oswegatchie Plains, St. Lawrence County.

Sources: Bray 1915; Bray 1921; Curran 1974.

8. Sandstone pavement barrens: an open canopy woodland that occurs on very shallow soils over sandstone bedrock; this community is best developed where the bedrock is nearly level, thus forming a pavement. In New York the dominant tree is jack pine (*Pinus banksiana*), although white pine (*P. strobus*) or red pine (*P. resinosa*) are reported as locally dominant in some sites in southern Quebec. Other characteristic trees include red maple (*Acer rubrum*), paper birch (*Betula papyrifera*), red oak (*Quercus rubra*), and scarlet oak (*Q. coccinea*). The shrublayer is dominated by heath shrubs including blueberry (*Vaccinium angustifolium*), black huckleberry (*Gaylussacia baccata*), black chokeberry (*Aronia melanocarpa*), and sweet-fern (*Comptonia peregrina*). The groundcover includes many lichens and mosses, which may form a continuous cover in some areas. Characteristic lichens include *Cladina* spp., *Cladonia* spp., *Stereocaulon*

sp., and *Xanthoparmelia* sp.; characteristic mosses include *Polytrichum* spp. and *Pleurozium schreberi*. Herbs are scattered through this mossy carpet; common herbs include bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), poverty-grass (*Danthonia spicata*), and common hairgrass (*Deschampsia flexuosa*). More data on characteristic animals are needed.

This community is only known from the northernmost counties of New York, north of the Adirondacks and from southern Quebec; its distribution outside of this range is unknown, however similar communities may occur in Ontario, Maine, Minnesota, and Iowa.

Distribution: only known from the Champlain Transition and Champlain Valley sub-zones of the Lake Champlain ecozone.

Rank: G2? S1

Examples: Altona Flat Rock, Clinton County; Gadway Road Flat Rock, Clinton County.

Source: NHP field surveys.

9. Oak openings: a grass-savanna community that occurs on well-drained soils. In New York, these savannas originally occurred as openings within extensive oak-hickory forests. They were restricted to excessively well-drained sites such as on knobs or hilltops with shallow soil over dolomite outcrops, sandy to gravelly soils of kames and eskers, or gravelly glacial deltas and terraces. The best remnants occur on dolomite knobs. Characteristic trees in New York occurrences are chinquapin oak (*Quercus muhlenbergii*), white oak (*Q. alba*), and black oak (*Q. velutina*); these oaks typically occur as open-grown trees with broadly spreading canopies. The oaks are sparsely distributed amidst a grassy groundlayer dominated by Indian grass (*Sorghastrum nutans*), little bluestem (*Schizachyrium scoparium*), and big bluestem (*Andropogon gerardii*). Characteristic forbs in the grassy groundlayer include thimbleweed (*Anemone cylindracea*), butterfly-weed (*Asclepias tuberosa*), tick-trefoils (*Desmodium glabellum*, *D. paniculatum*), wild bergamot (*Monarda fistulosa*), everlasting (*Antennaria* sp.), heath aster (*Aster ericoides*), early goldenrod (*Solidago juncea*), and black-eyed-Susan (*Rudbeckia hirta*). Shrubs are scattered through the grassy area, and they may be locally dominant under the shade of larger trees. Characteristic shrubs include gray dogwood (*Cornus foemina* ssp. *racemosa*), which typically

grows in small clones, and northern dewberry (*Rubus flagellaris*). More data on characteristic animals are needed.

Distribution: only known from the Erie-Ontario Plain subzone of the Great Lakes Plain ecozone.

Rank: G2 S1

Example: Rush Oak Openings, Monroe County.

Sources: Shanks 1966; NHP field surveys.

10. Calcareous pavement barrens: a savanna community that occurs on nearly level outcrops of calcareous bedrock (limestone and dolomite). The community consists of a mosaic of shrub-savanna, grass-savanna, and rock outcrop vegetation. The trees are either widely spaced or in small clusters; they are usually rooted in rock crevices. Characteristic trees include eastern red cedar (*Juniperus virginiana*), northern white cedar (*Thuja occidentalis*), bur oak (*Quercus macrocarpa*), white ash (*Fraxinus americana*), paper birch (*Betula papyrifera*), white pine (*Pinus strobus*), shagbark hickory (*Carya ovata*), eastern hop hornbeam (*Ostrya virginiana*), white spruce (*Picea glauca*), basswood (*Tilia americana*), American elm (*Ulmus americana*), rock elm (*U. thomasi*), and pin-cherry (*Prunus pennsylvanica*).

Many of the shrubs occur in dense thickets; they are rooted either in rock crevices or in shallow soil over bedrock. Characteristic shrubs include gray dogwood (*Cornus foemina* ssp. *racemosa*), fragrant sumac (*Rhus aromatica*), downy arrowwood (*Viburnum rafinesquianum*), common juniper (*Juniperus communis*), round-leaf dogwood (*Cornus rugosa*), juneberry (*Amelanchier* spp.), poison ivy (*Toxicodendron radicans*), meadow rose (*Rosa blanda*), wild honeysuckle (*Lonicera dioica*), buffalo-berry (*Shepherdia canadensis*), and snowberry (*Symphoricarpos albus*).

The groundlayer in the grass-savanna areas is quite diverse. Characteristic herbs include poverty-grass (*Danthonia spicata*), panic grasses (*Panicum flexile*, *P. philadelphicum*), sedges (*Carex pennsylvanica*, *C. eburnea*, *C. aurea*), slender spikerush (*Eleocharis elliptica* var. *elliptica*), bastard-toadflax (*Comandra umbellata*), harebell (*Campanula rotundifolia*), wild strawberry (*Fragaria virginiana*), pale bluets (*Hedyotis longifolia*), penstemon (*Penstemon hirsutus*), upland white aster (*Solidago ptarmicoides*), balsam groundsel (*Senecio pauperculus*), wild columbine (*Aquilegia canadensis*), blue phlox (*Phlox divaricata*), aster (*Aster ciliolatus*), and goldenrod

(*Solidago hispida*). Fruticose and foliose lichens are locally common in the grassy areas, including *Cladina rangiferina*, *C. mitis*, *Peltigera canina*, and *Cetraria arenaria*.

The numerous small exposures of bedrock have a distinctive flora of lichens, mosses, and small herbs, much like the outcrops in an alvar grassland. Characteristic species of rock outcrops include the lichens *Cladonia pocillum* and *Placynthium nigrum*; the mosses *Tortella tortuosa*, *Tortula ruralis*, *Ceratodon purpureus*, *Grimmia apocarpa*, and *Bryum argenteum*; and several herbs: southern hairgrass (*Agrostis hiemalis*), early saxifrage (*Saxifraga virginensis*), small skullcap (*Scutellaria parvula* var. *leonardii*), and false pennyroyal (*Trichostema brachiatum*).

Characteristic birds include prairie warbler (*Dendroica discolor*) and upland sandpiper (*Barrtramia longicauda*). Characteristic butterflies include Olympia marble butterfly (*Euchloe olympia*), an elfin (*Incisalia polios*), and a dusky wing (*Erynnis lucilius*).

This community has been described from Ontario, where this and related communities are called "alvar".

Distribution: mainly known from the Great Lakes Plain ecozone; small examples also occur on limestone in the Appalachian Plateau and Champlain ecozones.

Rank: G2G3 S1S2

Examples: Limerick Cedars, Jefferson County; Chaumont Barrens, Jefferson County.

Sources: Catling et al. 1975; Reschke and Gilman 1988; NHP field surveys.

11. Alpine krummholz: a dwarf woodland dominated by balsam fir (*Abies balsamea*) that occurs at or near the summits of the high peaks of the Adirondacks at elevations of 3500 to 4900 ft (1067 to 1494 m). Approximately 85% of the canopy consists of balsam fir; common associates include mountain paper birch (*Betula cordifolia*) and black spruce (*Picea mariana*). Less common are red spruce (*Picea rubens*), old-field juniper (*Juniperus communis*), tamarack (*Larix laricina*), and northern white cedar (*Thuja occidentalis*). The trees form dense stands of stunted trees; at the uppermost elevations below timberline the trees are under 5 ft (1.5 m) tall, with branches extending to the ground (i.e. there is no self-pruning of lower branches), and an average dbh of 3 in (7.6 cm). The groundlayer is densely

shaded; the groundcover consists of a thick carpet of mosses, with scattered lichens and herbs. The dominant bryophytes are *Sphagnum nemoreum*, *Pleurozium schreberi*, *Dicranum scoparium*, *Polytrichum juniperinum*, *P. strictum*, *Ptilidium ciliare*, and *Paraleucobryum longifolium*. *Cladina rangiferina* and *Cetraria islandica* are the most common lichens. Characteristic herbs include bunchberry (*Cornus canadensis*), large-leaf goldenrod (*Solidago macrophylla*), common wood-sorrel (*Oxalis acetosella*), goldthread (*Coptis trifolia*), and Canada mayflower (*Maianthemum canadense*). Characteristic birds include blackpoll warbler (*Dendroica striata*), white-throated sparrow (*Zonotrichia albicollis*), dark-eyed junco (*Junco hyemalis*), yellow-rumped warbler (*Dendroica coronata*), and gray-cheeked thrush (*Catharus minimus*).

Distribution: restricted to the Adirondack High Peaks.

Rank: G3G4 S2

Examples: Algonquin Peak, Essex County; Haystack Mountains, Essex County.

Source: NHP field surveys.

12. Limestone woodland: a woodland that occurs on shallow soils over limestone bedrock, and usually includes numerous rock outcrops. The tree canopy may be open or closed. There are usually several codominant trees, although one species may become dominant in any one stand. Characteristic canopy trees in some stands are primarily conifers such as northern white cedar (*Thuja occidentalis*), white pine (*Pinus strobus*), white spruce (*Picea glauca*), and balsam fir (*Abies balsamea*). In other stands the characteristic canopy trees are primarily hardwoods such as eastern hop hornbeam (*Ostrya virginiana*), sugar maple (*Acer saccharum*), shagbark hickory (*Carya ovata*), white oak (*Quercus alba*), bur oak (*Q. macrocarpa*), red oak (*Q. rubra*), and basswood (*Tilia americana*). There are also stands that include mixtures of these conifers and hardwoods. More data are needed on these variations in canopy composition and related changes in understory composition. The shrublayer is variable, becoming more dense where the canopy is open and soils are deeper. Characteristic shrubs include gray dogwood (*Cornus foemina* ssp. *racemosa*), wild honeysuckle (*Lonicera dioica*), alder-leaf buckthorn (*Rhamnus alnifolia*), prickly gooseberry (*Ribes cynos-bati*), raspberries (*Rubus*

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idaeus, *R. occidentalis*), bladdernut (*Staphylea trifolia*), junberry (*Amelanchier* spp.), and poison ivy (*Toxicodendron radicans*). The groundlayer may be quite diverse, with many grasses, sedges, and forbs. Characteristic herbs include sedges (*Carex eburnea*, *C. pennsylvanica*, *C. platyphylla*), marginal wood fern (*Dryopteris marginalis*), rattlesnake fern (*Botrychium virginianum*), bracken fern (*Pteridium aquilinum*), barren strawberry (*Waldsteinia fragarioides*), big-leaf aster (*Aster macrophyllus*), wild strawberry (*Fragaria virginiana*), black snakeroot (*Sanicula marilandica*), herb-robert (*Geranium robertianum*), Canada mayflower (*Maianthemum canadense*), false Solomon's-seal (*Smilacina racemosa*), early meadow-rue (*Thalictrum dioicum*), white trillium (*Trillium grandiflorum*), and blue-stem goldenrod (*Solidago caesia*). Shaded rock surfaces and crevices often support ferns such as rock polypody (*Polypodium virginianum*) and maidenhair spleenwort (*Asplenium trichomanes*). More data on characteristic animals are needed.

Distribution: scattered throughout upstate New York north of the Coastal Lowlands ecozone, at sites where the bedrock is limestone.

Rank: G3G4 S2S3

Examples: Chaumont Barrens, Jefferson County; Valcour Island, Clinton County.

Sources: Reschke and Gilman 1988; NHP field surveys.

13. Ice cave talus community: a community that occurs on rocks and soil at the base of talus slopes that emit cold air. The emission of cold air results from air circulation among the rocks of the talus slope where winter ice remains through the summer. The air is cooled by the ice deep in the talus, and settles; gravity eventually forces the air out along the face of rocks at the base of the slope (Core, 1968). The vegetation is distinctive because it includes species characteristic of climates much cooler than the climate of the area where the ice caves occur. For example, at the ice caves of the Shawangunks in southeastern New York, there are northern species such as black spruce (*Picea mariana*), hemlock (*Tsuga canadensis*), mountain ash (*Sorbus americana*), and creeping snowberry (*Gaultheria hispidula*); the surrounding communities are mostly pine barrens and oak forests. Some rare bryophytes have been collected from these talus slopes, including *Mylia taylori* from the Shawangunks and *Anastrophyllum*

saxicola and *Mnium hymenophylloides* from Wilmington Notch in the Adirondacks. A characteristic animal is the rock vole (*Microtus chrotorrhinus*).

In the midwest, similar cold air producing talus slopes have been called "algific talus slopes", and they are the habitat of a rare species of snail. In New York these communities need to be surveyed; special attention should be paid to their invertebrate fauna.

Distribution: not well known, reported from the Adirondacks ecozone and the Shawangunk Hills subzone of the Hudson Valley ecozone.

Rank: G3? S1S2

Examples: Indian Pass, Essex County; Sam's Point, Ulster County.

Sources: Core 1968; comments by Norton Miller (of the New York State Museum Biological Survey); NHP field surveys.

14. Calcareous talus slope woodland: an open or closed canopy woodland that occurs on talus slopes composed of calcareous bedrock such as limestone or dolomite. The soils are usually moist and loamy; there may be numerous rock outcrops. Characteristic trees include sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), eastern hop hornbeam (*Ostrya virginiana*), white oak (*Quercus alba*), eastern red cedar (*Juniperus virginiana*), and northern white cedar (*Thuja occidentalis*). Shrubs may be abundant if the canopy is open; characteristic shrubs include round-leaf dogwood (*Cornus rugosa*), downy arrowwood (*Viburnum rafinesquianum*), prickly ash (*Zanthoxylum americanum*), and bladdernut (*Staphylea trifolia*). Herbaceous vegetation may be quite diverse; characteristic species include bulblet fern (*Cystopteris bulbifera*), lady fern (*Athyrium asplenoides*), bottlebrush grass (*Elymus hystrix*), Solomon's-seal (*Polygonatum pubescens*), wild ginger (*Asarum canadense*), white baneberry (*Actaea pachypoda*), early meadow-rue (*Thalictrum dioicum*), bloodroot (*Sanguinaria canadensis*), blue-stem goldenrod (*Solidago caesia*), and white wood aster (*Aster divaricatus*). Rock outcrops may have ferns such as walking fern (*Camptosorus rhizophyllus*) and maidenhair spleenwort (*Asplenium trichomanes*).

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Distribution: throughout upstate New York north of the Coastal Lowlands ecozone, at sites where the bedrock is calcareous.

Rank: G3G4 S3

Example: Clarence Escarpment, Erie County.

Sources: McVaugh 1958; Zenkert 1934; NHP field surveys.

15. Acidic talus slope woodland: an open to closed canopy woodland that occurs on talus slopes composed of non-calcareous bedrock such as granite, quartzite, or schist. Characteristic trees (in Columbia County) include sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), chestnut oak (*Quercus montana*), red oak (*Q. rubra*), and white oak (*Q. alba*); striped maple (*Acer pensylvanicum*) and mountain maple (*A. spicatum*) are common subcanopy trees. Characteristic groundlayer species (in Columbia County) include many ferns: bulblet fern (*Cystopteris bulbifera*), fragile fern (*Cystopteris fragilis*), christmas fern (*Polystichum acrostichoides*), marginal wood fern (*Dryopteris marginalis*), silvery spleenwort (*Athyrium thelypteroides*), and maidenhair fern (*Adiantum pedatum*). Other common herbs include ricegrass (*Oryzopsis racemosa*), bloodroot (*Sanguinaria canadensis*), blue cohosh (*Caulophyllum thalictroides*), ginseng (*Panax quinquefolius*), and zig-zag goldenrod (*Solidago flexicaulis*). Characteristic animals include copperhead (*Agkistrodon contortrix*) and timber rattlesnake (*Crotalus horridus*). More data on this community are needed.

Distribution: scattered throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G4? S3S4

Sources: McVaugh 1958; Significant Habitat Unit files.

16. Shale talus slope woodland: an open to closed canopy woodland that occurs on talus slopes composed of shale. These slopes are rather unstable, and they are usually very well-drained, so the soils are shallow and dry. The canopy cover is usually less than 50%, due to the instability of the substrate. Characteristic trees include chestnut oak (*Quercus montana*), pignut hickory (*Carya glabra*), red oak (*Quercus rubra*),

white oak (*Q. alba*), white pine (*Pinus strobus*), white ash (*Fraxinus americana*), and eastern red cedar (*Juniperus virginiana*). Characteristic shrubs and herbs include smooth sumac (*Rhus glabra*), scrub oak (*Quercus prinoides*), poison ivy (*Toxicodendron radicans*), penstemon (*Penstemon hirsutus*), everlasting (*Antennaria plantaginifolia*), and Pennsylvania sedge (*Carex pensylvanica*). More data on this community are needed.

Distribution: scattered throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G3G4 S3

Example: Chemung Shale Slope, Chemung County.

Sources: McVaugh 1958; NHP field surveys.

17. Pitch pine-oak-heath rocky summit: a community that occurs on warm, dry, rocky ridgetops and summits where the bedrock is non-calcareous (such as quartzite, sandstone, or schist), and the soils are more or less acidic. The vegetation may be sparse or patchy, with numerous rock outcrops. Characteristic species include pitch pine (*Pinus rigida*), chestnut oak (*Quercus montana*), scrub oak (*Q. ilicifolia*), common juniper (*Juniperus communis*), blueberry (*Vaccinium angustifolium*), sweet-fern (*Comptonia peregrina*), black huckleberry (*Gaylussacia baccata*), Pennsylvania sedge (*Carex pensylvanica*), poverty-grass (*Danthonia spicata*), common hairgrass (*Deschampsia flexuosa*), three-toothed cinquefoil (*Potentilla tridentata*), and cow-wheat (*Melampyrum lineare*). Characteristic lichens include *Cetraria arenaria* and *Cladonia* spp. More data on this community are needed.

Distribution: common in the Hudson Valley ecozone, also occurs in the Appalachian Plateau ecozone, and along the St. Lawrence River in the St. Lawrence Plains subzone.

Rank: G4 S3S4

Examples: Minnewaska State Park, Ulster County; Mohonk Preserve, Ulster County; Shunnemunk Mountain, Orange County.

Sources: McVaugh 1958; Olsvig 1980; NHP field surveys.

18. Spruce-fir rocky summit: a community that occurs on cool, dry, rocky ridgetops and summits where the bedrock is non-calcareous (such as anorthosite, quartzite, or sandstone), and the soils are more or less acidic. The vegetation may be sparse or patchy, with numerous rock outcrops. The species have predominantly boreal distributions. Characteristic species include red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), mountain ash (*Sorbus americana*), harebell (*Campanula rotundifolia*), three-toothed cinquefoil (*Potentilla tridentata*), mountain goldenrod (*Solidago spathulata* ssp. *randii*), common hairgrass (*Deschampsia flexuosa*), and small ricegrass (*Oryzopsis pungens*). There are usually many mosses and lichens growing on rock outcrops. More data on this community are needed.

Distribution: primarily in the Adirondack and Catskill mountains.

Rank: G4 S3S4

Example: Pitchoff Mountain, Essex County.

Source: NHP field surveys.

19. Red cedar rocky summit: a community that occurs on warm, dry, rocky ridgetops and summits where the bedrock is calcareous (such as limestone or dolomite), and the soils are more or less calcareous. The vegetation may be sparse or patchy, with numerous rock outcrops. Characteristic species include eastern red cedar (*Juniperus virginiana*), shagbark hickory (*Carya ovata*), eastern hop hornbeam (*Ostrya virginiana*), serviceberry (*Amelanchier* spp.), little bluestem (*Schizachyrium scoparium*), sedge (*Carex eburnea*), and everlasting (*Antennaria plantaginifolia*). More data on this community are needed.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone, where bedrock is calcareous; more common in the southern part of this range.

Rank: G3G4 S3

Example: Nellie Hill, Dutchess County.

Source: NHP field surveys.

20. Northern white cedar rocky summit: a community that occurs on cool, dry, rocky

ridgetops and summits where the bedrock is calcareous (such as limestone or dolomite), and the soils are more or less calcareous. The vegetation may be sparse or patchy, with numerous rock outcrops. The species have predominantly boreal distributions. Characteristic species include northern white cedar (*Thuja occidentalis*), eastern hop hornbeam (*Ostrya virginiana*), red pine (*Pinus resinosa*), upland white aster (*Solidago ptarmicoides*), sedge (*Carex eburnea*), and oatgrass (*Trisetum triflorum*). More data on this community are needed.

Distribution: in upstate New York north of the Hudson Highlands ecozone, where bedrock is calcareous; more common in the northern part of this range.

Rank: G3G4 S3

Source: NHP field surveys.

21. Successional red cedar woodland: a woodland community that commonly occurs on abandoned agricultural fields and pastures, usually at elevations less than 1000 ft (305 m). The dominant tree is eastern red cedar (*Juniperus virginiana*), which may occur widely spaced in young stands and may be rather dense in more mature stands. Smaller numbers of gray birch (*Betula populifolia*), hawthorn (*Crataegus* spp.), buckthorn (*Rhamnus cathartica*), and other early successional hardwoods may be present. On slopes along the Finger Lakes, red cedar is commonly found mixed with white ash (*Fraxinus americana*) and black walnut (*Juglans nigra*). Shrubs and groundlayer vegetation are similar to a successional old field; in some stands the groundcover consists of a nearly pure stand of non-native bluegrasses such as *Poa compressa* and *P. pratensis*. A characteristic bird is the prairie warbler (*Dendroica discolor*).

Distribution: throughout New York State.

Rank: G5 S5

Source: NHP field surveys.

C. FORESTED UPLANDS

This subsystem includes upland communities with more than 60% canopy cover of trees; these communities occur on substrates with less than 50% rock outcrop or shallow soil over bedrock.

1. Maritime oak-holly forest: a hardwood forest that occurs in low areas on the back portions of maritime dunes; the dunes protect these areas from overwash and salt spray. In New York State this forest is best developed on the narrow peninsulas of eastern Long Island and on the barrier islands off the south shore. The trees are usually stunted and flat-topped because the canopies are pruned by salt spray; the canopy of a mature stand may be only 16 to 23 ft (5 to 7 m) tall. The dominant trees are either holly (*Ilex opaca*), black oak (*Quercus velutina*), or beech (*Fagus grandifolia*). Other characteristic trees include sassafras (*Sassafras albidum*), shadbush (*Amelanchier canadensis*), and post oak (*Quercus stellata*). Vines such as Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Toxicodendron radicans*), and greenbrier (*Smilax rotundifolia*), sawbrier (*S. glauca*), and grape (*Vitis* spp.) are common in the understory, and they often grow up into the canopy. Shrubs such as highbush blueberry (*Vaccinium corymbosum*) and black huckleberry (*Gaylussacia baccata*) are common in the understory, especially at the margins of the forest. Characteristic groundlayer herbs include wild sarsaparilla (*Aralia nudicaulis*), starflower (*Smilacina stellata*), and Canada mayflower (*Maianthemum canadense*). There may be small, damp depressions that are somewhat boggy; species found in these depressions include black gum (*Nyssa sylvatica*), shadbush, highbush blueberry, and chokeberry (*Aronia melanocarpa*). More data on characteristic animals are needed.

Distribution: only known from the Coastal Lowlands ecozone.

Rank: G2G3 S1

Example: Sunken Forest, Fire Island National Seashore, Suffolk County.

Sources: Art 1976; Greller 1977; NHP field surveys.

2. Maritime oak forest: a hardwood forest that occurs on exposed bluffs near the coast of eastern Long Island. In sites exposed to wind and salt spray, the understory may be a dense shrub thicket dominated by black huckleberry

(*Gaylussacia baccata*), with bayberry (*Myrica pensylvanica*) and saplings of black cherry (*Prunus serotina*) as common associates. The sparse groundlayer under this shrub thicket is dominated by poison ivy (*Toxicodendron radicans*). In some stands the understory is a dense thicket of catbrier (*Smilax rotundifolia*). The presence of catbrier thickets is not well understood; they may become established or be favored following disturbances such as insect infestations, heavy browsing by deer, clear-cutting, fires, windthrow, or exposure to salt spray. More data on this community are needed.

Distribution: apparently restricted to eastern Long Island and islands in Block Island Sound, in the Coastal Lowlands ecozone.

Rank: G3G4 S2S3

Examples: Jessup's Neck, Suffolk County; Mashomack Preserve, Suffolk County.

Sources: Greller 1977; Rosza and Metzler 1982; Taylor 1923; NHP field surveys.

3. Maritime red cedar forest: a conifer forest that occurs on dry sites near the ocean. Eastern red cedar (*Juniperus virginiana*) is the dominant tree, often forming nearly pure stands. A characteristic groundlayer plant is eastern prickly pear (*Opuntia humifusa*). More data on this community are needed.

Distribution: only known from the Coastal Lowlands ecozone.

Rank: G3G4 S1

Example: Orient Point, Suffolk County.

Sources: Conard 1935; Greller 1977; Robichaud and Buell 1983; NHP field surveys.

4. Pitch pine-oak forest: a mixed forest that typically occurs on well-drained, sandy soils of glacial outwash plains or moraines; it also occurs on thin, rocky soils of ridgetops. The dominant trees are pitch pine (*Pinus rigida*) mixed with one or more of the following oaks: scarlet oak (*Quercus coccinea*), white oak (*Q. alba*), red oak (*Q. rubra*), or black oak (*Q. velutina*). The relative proportions of pines and oaks are quite variable within this community type. At one extreme are stands in which the pines are widely spaced amidst the oaks, in which case the pines

are often emergent above the canopy of oak trees. At the other extreme are stands in which the pines form a nearly pure stand with only a few widely spaced oak trees. The shrublayer is well-developed with scattered clumps of scrub oak (*Quercus ilicifolia*) and a nearly continuous cover of low heath shrubs such as blueberries (*Vaccinium pallidum*, *V. angustifolium*) and black huckleberry (*Gaylussacia baccata*). The herbaceous layer is relatively sparse; characteristic species are bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), and Pennsylvania sedge (*Carex pensylvanica*). Characteristic birds include rufous-sided towhee (*Pipilo erythrophthalmus*), common yellowthroat (*Geothlypis trichas*), field sparrow (*Spizella pusilla*), prairie warbler (*Dendroica discolor*), pine warbler (*Dendroica pinus*), blue jay (*Cyanocitta cristata*), and whip-poor-will (*Caprimulgus vociferus*).

This community combined with several types of barrens and woodland communities make up the broadly defined ecosystem known as the Pine Barrens.

Distribution: known from the Coastal Lowlands and Hudson Valley ecozones.

Rank: G4G5 S4

Example: Sears Bellows County Park, Suffolk County.

Sources: Greller 1977; Kerlinger and Doremus 1981; Olsvig 1979; NHP field surveys.

5. Appalachian oak-hickory forest: a hardwood forest that occurs on well-drained sites, usually on ridgetops, upper slopes, or south- and west-facing slopes. The soils are usually loams or sandy loams. This is a broadly defined forest community with several regional and edaphic variants. The dominant trees include one or more of the following oaks: red oak (*Quercus rubra*), white oak (*Q. alba*), and black oak (*Q. velutina*). Mixed with the oaks, usually at lower densities, are one or more of the following hickories: pignut (*Carya glabra*), shagbark (*C. ovata*), and sweet pignut (*C. ovalis*). Common associates are white ash (*Fraxinus americana*), red maple (*Acer rubrum*), and Eastern hop hornbeam (*Ostrya virginiana*). There is typically a subcanopy stratum of small trees and tall shrubs including flowering dogwood (*Comus florida*), witch hazel (*Hamamelis virginiana*), shadbush (*Amelanchier arborea*), and choke cherry (*Prunus virginiana*). Common low shrubs include maple-leaf viburnum

(*Viburnum acerifolium*), blueberries (*Vaccinium angustifolium*, *V. pallidum*), red raspberry (*Rubus idaeus*), gray dogwood (*Comus foemina* ssp. *racemosa*), and beaked hazelnut (*Corylus cornuta*). The shrublayer and groundlayer flora may be diverse. Characteristic groundlayer herbs are wild sarsaparilla (*Aralia nudicaulis*), false Solomon's seal (*Smilacina racemosa*), Pennsylvania sedge (*Carex pensylvanica*), tick-trefoil (*Desmodium glutinosum*, *D. paniculatum*), black cohosh (*Cimicifuga racemosa*), rattlesnake root (*Prenanthes alba*), white goldenrod (*Solidago bicolor*), and hepatica (*Hepatica americana*). Characteristic animals include red-bellied woodpecker (*Melanerpes carolinus*), whip-poor-will (*Caprimulgus vociferus*), and wild turkey (*Meleagris gallopavo*).

Distribution: throughout upstate New York north of the Coastal Lowlands ecozone; most common south of the Adirondacks ecozone.

Rank: G4G5 S4

Examples: Finger Lakes National Forest, Schuyler County; Long Eddy, Delaware County.

Sources: McIntosh 1972; Ross 1958; NHP field surveys.

6. Allegheny oak forest: a hardwood forest that occurs on well-drained sites in the unglaciated portion of the Allegheny plateau in southwestern New York. This is a narrowly defined community (compared to the preceding) distinguished by a more diverse canopy and a richer groundlayer flora that includes several southern Appalachian species at the northern end of their range. These oak forests are characteristic of ridgetops, upper slopes, and south- and west-facing slopes; they grade into rich mesophytic forests that occur on north- and east-facing slopes as well as on the more protected hollows and middle elevations of hillsides with south and west aspects. Codominant trees are white oak (*Q. alba*), red oak (*Q. rubra*), chestnut oak (*Q. montana*), and black oak (*Q. velutina*). American chestnut (*Castanea dentata*) was a significant canopy codominant prior to the chestnut blight; chestnut sprouts are still common in the understory. Other common canopy trees are white ash (*Fraxinus americana*), red maple (*Acer rubrum*), pignut hickory (*Carya glabra*), black birch (*Betula lenta*), and big-tooth aspen (*Populus grandidentata*). The shrub-layer is a mixed heath with blueberries (*Vaccinium angustifolium*, *V. pallidum*), pinxter (*Rhododendron*

periclymenoides), black huckleberry (*Gaylussacia baccata*), maple-leaf viburnum (*Viburnum acerifolium*), and mountain laurel (*Kalmia latifolia*). Common groundlayer herbs are black cohosh (*Cimicifuga racemosa*), wintergreen (*Gaultheria procumbens*), bracken fern (*Pteridium aquilinum*), Pennsylvania sedge (*Carex pensylvanica*), wild sarsaparilla (*Aralia nudicaulis*), barren strawberry (*Waldsteinia fragarioides*), white clintonia (*Clintonia umbellulata*), three-lobed violet (*Viola triloba*), and rattlesnake weed (*Hieracium venosum*).

Distribution: only known from the Alleghany Hills subzone of the Appalachian Plateau ecozone.

Rank: G3G4 S2

Example: Robinson Run Hill, Cattaraugus County.

Sources: Eaton and Schrot 1987; Gordon 1940; NHP field surveys.

7. Chestnut oak forest: a hardwood forest that occurs on well-drained sites in glaciated portions of the Appalachians, and on the coastal plain. This forest is similar to the Allegheny oak forest; it is distinguished by fewer canopy dominants and a less diverse shrublayer and groundlayer flora. Dominant trees are typically chestnut oak (*Quercus montana*) and red oak (*Q. rubra*). Common associates are white oak (*Q. alba*), black oak (*Q. velutina*), and red maple (*Acer rubrum*). American chestnut (*Castanea dentata*) was a common associate in these forests prior to the chestnut blight; chestnut sprouts are still found in some stands. The shrublayer is predominantly ericaceous; characteristic shrubs are black huckleberry (*Gaylussacia baccata*), mountain laurel (*Kalmia latifolia*), and blueberry (*Vaccinium pallidum*). Common groundlayer plants are Pennsylvania sedge (*Carex pensylvanica*), wild sarsaparilla (*Aralia nudicaulis*), wintergreen (*Gaultheria procumbens*), and cushions of the moss *Leucobryum glaucum*.

Distribution: most common on mid-elevation slopes of the Hudson Highlands ecozone, also occurs in the Manhattan Hills and Coastal Lowlands ecozones, and in the southeastern portion of the Appalachian Plateau ecozone.

Rank: G3G4 S4

Sources: Cain 1936; Conard 1935; Eyre 1980; Greller 1977; McIntosh 1972; McVaugh 1958; Ross 1958.

8. Oak-tulip tree forest: a mesophytic hardwood forest that occurs on moist, well-drained sites in southeastern New York. The dominant trees include a mixture of five or more of the following: red oak (*Quercus rubra*), tulip tree (*Liriodendron tulipifera*), beech (*Fagus grandifolia*), black birch (*Betula lenta*), red maple (*Acer rubrum*), scarlet oak (*Quercus coccinea*), black oak (*Q. velutina*), and white oak (*Q. alba*). There is typically a subcanopy stratum of small trees and tall shrubs dominated by flowering dogwood (*Cornus florida*); common associates include witch-hazel (*Hamamelis virginiana*), sassafras (*Sassafras albidum*), red maple, and black cherry (*Prunus serotina*). Common low shrubs include maple-leaf viburnum (*Viburnum acerifolium*), northern blackberry (*Rubus allegheniensis*), and blueberries (*Vaccinium angustifolium*, *V. pallidum*). The shrublayer and groundlayer flora may be diverse. Characteristic groundlayer herbs are white wood aster (*Aster divaricatus*), New York fern (*Thelypteris noveboracensis*), Virginia creeper (*Parthenocissus quinquefolia*), Jack-in-the-pulpit (*Arisaema triphyllum*), wild geranium (*Geranium maculatum*), Solomon's-seal (*Polygonatum biflorum*), and false Solomon's-seal (*Smilacina racemosa*).

Distribution: most common on the northern half of Long Island in the Coastal Lowlands ecozone, probably also occurs in the Manhattan Hills, Hudson Highlands, and Triassic Lowlands ecozones.

Rank: G4 S2S3

Source: Greller 1977; Rosza and Metzler 1982.

9. Appalachian oak-pine forest: a mixed forest that occurs on sandy soils, sandy ravines in pine barrens, or on slopes with rocky soils that are well-drained. The canopy is dominated by a mixture of oaks and pines. The oaks include one or more of the following: black oak (*Quercus velutina*), chestnut oak (*Q. montana*), red oak (*Q. rubra*), white oak (*Q. alba*), and scarlet oak (*Q. coccinea*). The pines are either white pine (*Pinus strobus*) or pitch pine (*P. rigida*); in some stands both pines are present. Red maple (*Acer rubrum*), hemlock (*Tsuga canadensis*), beech (*Fagus grandifolia*), and black cherry (*Prunus serotina*) are common associates occurring at low densities. The shrublayer is predominantly ericaceous, usually with blueberries (*Vaccinium angustifolium*, *V. pallidum*) and black huckleberry (*Gaylussacia baccata*). The groundlayer is relatively sparse, and species diversity is low.

More data on composition and characteristic animals are needed.

Distribution: occurs in the Appalachian Plateau, Hudson Valley, and Taconic Highlands ecozones.

Rank: G4G5 S4

Example: Rome Sand Plains, Oneida County.

Sources: McVaugh 1958; NHP field surveys.

10. Rich mesophytic forest: a hardwood or mixed forest that resembles the mixed mesophytic forests of the central Appalachians (south of New York), but is less diverse. It occurs on rich, moist, well-drained soils which are favorable for the dominance of a wide variety of tree species. This forest is characterized by a canopy with a relatively large number of codominant trees. The codominants include five or more of the following species: red oak (*Quercus rubra*), beech (*Fagus grandifolia*), red maple (*Acer rubrum*), black birch (*Betula lenta*), white ash (*Fraxinus americana*), black cherry (*Prunus serotina*), cucumber tree (*Magnolia acuminata*), and white oak (*Quercus alba*). Chestnut (*Castanea dentata*) was a characteristic tree before it was eliminated by chestnut blight. Less common in the canopy and subcanopy are tulip tree (*Liriodendron tulipifera*), white pine (*Pinus strobus*), basswood (*Tilia americana*), bitternut hickory (*Carya cordiformis*), sugar maple (*Acer saccharum*), Eastern hop hornbeam (*Ostrya virginiana*), and striped maple (*Acer pensylvanicum*). This forest has a well-developed shrublayer with a variety of characteristic species including arrow-wood (*Viburnum acerifolium*), witch hazel (*Hamamelis virginiana*), pinkster (*Rhododendron perichlymenoides*), American fly-honeysuckle (*Lonicera canadensis*), round-leaved dogwood (*Cornus rugosa*), alternate-leaved dogwood (*C. alternifolia*), smooth service-berry (*Amelanchier laevis*), bush honeysuckle (*Diervilla lonicera*), and blueberry (*Vaccinium pallidum*). The groundlayer is fairly rich in species. Characteristic herbs are interrupted fern (*Osmunda claytoniana*), white clintonia (*Clintonia umbellulata*), yellow mandarin (*Disporum lanuginosum*), white baneberry (*Actaea pachypoda*), early meadow rue (*Thalictrum dioicum*), partridge berry (*Mitchella repens*), round-leaf violet (*Viola rotundifolia*), black cohosh (*Cimicifuga racemosa*), stoneroot (*Collinsonia canadensis*), black snakeroot (*Sanicula marilandica*), large-leaf aster (*Aster macrophyllus*), blue-stem goldenrod (*Solidago caesia*), and tall rattlesnake root (*Prenanthes trifoliolata*). A

characteristic bird is wild turkey (*Meleagris gallopavo*).

In New York, rich mesophytic forests are best developed in the unglaciated portions of the Appalachian Plateau. In Cattaraugus County this forest typically occurs on north- and east-facing slopes, at middle elevations between Allegheny oak forest on upper slopes and hemlock-northern hardwood forest on lower slopes and in ravines. The rich mesophytic forest can be distinguished from Allegheny oak forest by the lack of chestnut oak, black oak, and big-tooth aspen; and it can be distinguished from hemlock-northern hardwood forest by the lack of yellow birch and American hornbeam.

Distribution: only known from the western part of the Appalachian Plateau ecozone, primarily in the Allegheny Hills and Finger Lakes Highlands subzones.

Rank: G4 S2S3

Example: Allegheny State Park, Cattaraugus County.

Sources: Braun 1950; Gordon 1940; Shanks 1966; NHP field surveys.

11. Beech-maple mesic forest: a hardwood forest with sugar maple (*Acer saccharum*) and beech (*Fagus grandifolia*) codominant. This is a broadly defined community type with several regional and edaphic variants. These forests occur on moist, well-drained, usually acid soils. Common associates are basswood (*Tilia americana*), American elm (*Ulmus americana*), white ash (*Fraxinus americana*), yellow birch (*Betula alleghaniensis*), Eastern hop hornbeam (*Ostrya virginiana*), and red maple (*Acer rubrum*). There are relatively few shrubs and herbs. Characteristic small trees or tall shrubs are American hornbeam (*Carpinus caroliniana*), striped maple (*Acer pensylvanicum*), witch hazel (*Hamamelis virginiana*), hobblebush (*Viburnum lantanoides*), and alternate-leaved dogwood (*Cornus alternifolia*). Characteristic groundlayer species are blue cohosh (*Caulophyllum thalictroides*), christmas fern (*Polystichum acrostichoides*), jack-in-the-pulpit (*Arisaema triphyllum*), white baneberry (*Actaea pachypoda*), wild leek (*Allium tricoccum*), wild ginger (*Asarum canadense*), false Solomon's seal (*Smilacina canadensis*), and bloodroot (*Sanguinaria canadensis*). There are many spring ephemerals which bloom before the canopy trees leaf out. Typically there is also an abundance of tree

seedlings, especially of sugar maple; beech and sugar maple saplings are often the most abundant "shrubs" and small trees. Hemlock (*Tsuga canadensis*) may be present at a low density. In the Adirondacks a few red spruce (*Picea rubens*) may also be present. Characteristic birds include American redstart (*Setophaga ruticilla*), red-eyed vireo (*Vireo olivaceus*), ovenbird (*Seiurus aurocapillus*), black-throated blue warbler (*Dendroica caerulescens*), least flycatcher (*Empidonax minimus*), Acadian flycatcher (*Empidonax virescens*), and red-bellied woodpecker (*Melanerpes carolinus*).

Within extensive areas of beech-maple mesic forest, there are often steep ravines and gullies where hemlock is locally dominant; these hemlock ravines (actually small patches of hemlock-northern hardwood forest) are here considered a feature or subtype within the broadly defined beech-maple mesic forest.

Distribution: throughout New York State.

Rank: G4 S4

Examples: Smith Woods, Tompkins County; Ampersand Mountain, Franklin County.

Sources: Eyre 1980; Gordon 1940; Heimburger 1934; Holmes et al. 1986; Leopold et al. 1988; McIntosh 1972; Shanks 1966; NHP field surveys.

12. Maple-basswood rich mesic forest: a hardwood forest that typically occurs on middle to lower elevation, concave slopes with north or east aspects (but not in ravines). Soils are rich, moist, well-drained, and usually have a circumneutral pH. The dominant trees are sugar maple (*Acer saccharum*), basswood (*Tilia americana*), and white ash (*Fraxinus americana*). Common associates are bitternut hickory (*Carya cordiformis*), tulip tree (*Liriodendron tulipifera*), and American hornbeam (*Carpinus caroliniana*). Characteristic tall shrubs are alternate-leaved dogwood (*Cornus alternifolia*) and witch hazel (*Hamamelis virginiana*); the shrublayer is usually sparse. Spring ephemerals are usually abundant in the groundlayer. Characteristic species are false Solomon's seal (*Smilacina racemosa*), white baneberry (*Actaea pachypoda*), spring beauty (*Claytonia virginica*), toothwort (*Dentaria diphylla*), dutchman's breeches (*Dicentra cucullaria*), squirrel-corn (*Dicentra canadensis*), troutlily (*Erythronium americanum*), bloodroot (*Sanguinaria canadensis*), foamflower (*Tiarella cordifolia*), and purple trillium (*Trillium erectum*). Hemlock ravines may be present as occasional features of

this forest. A characteristic bird is wild turkey (*Meleagris gallopavo*).

Distribution: primarily known from the Great Lakes Plain ecozone.

Rank: G4 S2S3

Example: Great Gully, Cayuga County.

Sources: Braun 1950; Eyre 1980; NHP field surveys.

13. Hemlock-northern hardwood forest: a mixed forest that typically occurs on middle to lower slopes of ravines, on cool, mid-elevation slopes, and on moist, well-drained sites at the margins of swamps. In any one stand, hemlock (*Tsuga canadensis*) is codominant with any one to three of the following: beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), red maple (*A. rubrum*), black cherry (*Prunus serotina*), white pine (*Pinus strobus*), yellow birch (*Betula alleghaniensis*), black birch (*B. lenta*), red oak (*Quercus rubra*), and basswood (*Tilia americana*). The relative cover of hemlock is quite variable, ranging from nearly pure stands in some steep ravines to as little as 20% of the canopy cover. Striped maple (*Acer pensylvanicum*) is often prominent as a mid-story tree. The shrublayer may be sparse; characteristic shrubs are hobblebush (*Viburnum lantanoides*), maple-leaf viburnum (*Viburnum acerifolium*), and raspberries (*Rubus* spp.). In some ravines, especially in the southern part of the state, rosebay (*Rhododendron maximum*) forms a dense subcanopy or tall shrublayer. Canopy cover can be quite dense, resulting in low light intensities on the forest floor and hence a relatively sparse groundlayer. Characteristic groundlayer plants are Indian cucumber-root (*Medeola virginiana*), Canada mayflower (*Maianthemum canadense*), shining clubmoss (*Lycopodium lucidulum*), common wood fern (*Dryopteris intermedia*), mountain wood fern (*Dryopteris campyloptera*), christmas fern (*Polystichum acrostichoides*), star flower (*Trientalis borealis*), bellwort (*Uvularia sessilifolia*), common wood-sorrel (*Oxalis acetosella*), partridge berry (*Mitchella repens*), foamflower (*Tiarella cordifolia*), round-leaf violet (*Viola rotundifolia*), twisted stalk (*Streptopus roseus*), purple trillium (*Trillium erectum*), and the moss *Leucobryum glaucum*. In forests that have beech as a codominant, beech-drops (*Epifagus virginiana*) is a common herb. Characteristic birds include wild turkey (*Meleagris gallopavo*), pileated woodpecker (*Dryocopus pileatus*), golden-crowned kinglet (*Regulus*

satrapa), black-throated green warbler (*Dendroica virens*), and Acadian flycatcher (*Empidonax virescens*).

This is a broadly defined and very widespread community, with many regional and edaphic variants. For example, in the Hudson Valley, hemlock is sometimes codominant with red oak; in the Adirondacks, yellow birch and sugar maple are sometimes codominant, with a relatively small number of hemlocks as well as a few red spruce (*Picea rubens*). More data on the shrublayer and groundlayer composition are needed before these regional variants can be distinguished as separate types.

Distribution: throughout New York State.

Rank: G4G5 S4

Examples: Ampersand Mountain, Essex County; Big Basin in Allegany State Park, Cattaraugus County.

Sources: Eyre 1980; Heimburger 1934; Leopold et al. 1988; McIntosh 1972; McVaugh 1958; Ross 1958; Shanks 1966; NHP field surveys.

14. Pine-northern hardwood forest: a mixed forest that occurs on gravelly outwash plains, delta sands, eskers, and dry lake sands in the Adirondacks. The dominant trees are white pine (*Pinus strobus*) and red pine (*P. resinosa*); these are mixed with scattered paper birch (*Betula papyrifera*) and quaking aspen (*Populus tremuloides*). In some stands there is an admixture of other northern hardwoods and conifers such as yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), and red spruce (*Picea rubens*); these are never common in a pine-northern hardwood forest. Characteristic shrubs are blueberries (*Vaccinium angustifolium*, *V. myrtilloides*), sheep laurel (*Kalmia angustifolia*), wild raisin (*Viburnum cassinoides*), and shadbush (*Amelanchier canadensis*). Characteristic herbs are bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), trailing arbutus (*Epigaea repens*), cow-wheat (*Melampyrum lineare*), Canada mayflower (*Maianthemum canadense*), bunchberry (*Cornus canadensis*), star flower (*Trientalis borealis*), bluebeads (*Clintonia borealis*), painted trillium (*Trillium undulatum*), spreading ricegrass (*Oryzopsis asperifolia*), and Pennsylvania sedge (*Carex pensylvanica*). Mosses and lichens may be common to abundant, especially the mosses *Pleurozium schreberi*, *Brachythecium* spp., and *Dicranum polysetum*.

Characteristic animals include pine warbler (*Dendroica pinus*) in mature, well-spaced pines, pileated woodpecker (*Drycopus pileatus*), and eastern box turtle (*Terrapene carolina*).

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone, more common to the north.

Rank: G4 S4

Examples: Five Ponds Wilderness Area, Herkimer County; Pine Orchard, Hamilton County.

Sources: Eyre 1980; Heimburger 1934; Roman 1980; NHP field surveys.

15. Spruce flats: a mixed forest that occurs on moist sites along the borders of swamps and in low flats along lakes and streams in the Adirondacks. Soils are strongly podzolized, sandy, and seasonally moist, but not saturated and not peaty. The dominant trees are red spruce (*Picea rubens*) or black spruce (*P. mariana*), mixed with smaller numbers of yellow birch (*Betula alleghaniensis*), black cherry (*Prunus serotina*), and hemlock (*Tsuga canadensis*). In some places in the Adirondacks, white spruce (*Picea glauca*) replaces red spruce. Spruce and yellow birch, or sometimes these and hemlock, make up about 75% of the canopy cover. Smaller numbers of other northern hardwoods, such as red maple (*Acer rubrum*) and beech (*Fagus grandifolia*) may also be present. The shrublayer is sparse or patchy. Characteristic shrubs are Labrador tea (*Ledum groenlandicum*), sheep laurel (*Kalmia angustifolia*), and blueberries (*Vaccinium angustifolium*, *V. myrtilloides*). Typically the groundcover consists of a luxuriant carpet of mosses and herbs, with an abundance of feather mosses. Some common bryophytes are *Pleurozium schreberi*, *Hylocomium splendens*, *Ptilium crista-castrensis*, *Dicranum* spp., and *Bazzania trilobata*; characteristic herbs are creeping snowberry (*Gaultheria hispidula*), goldthread (*Coptis trifolia*), dewdrop (*Dalibarda repens*), bunchberry (*Cornus canadensis*), and Canada mayflower (*Maianthemum canadense*). A characteristic bird is golden-crowned kinglet (*Regulus satrapa*).

Distribution: primarily known from the Adirondacks ecozone.

Rank: G4? S3S4

Sources: Braun 1950; Eyre 1980; Heimbürger 1934;

16. Balsam flats: a conifer forest that occurs on moist, well-drained soils of low flats adjoining swamps, gentle low ridges, and knolls within swamps. The dominant tree is balsam fir (*Abies balsamea*), which occurs either in pure stands or in mixed stands with red spruce (*Picea rubens*) or black spruce (*P. mariana*), and possibly a few yellow birch (*Betula allegheniensis*), red maple (*Acer rubrum*), and black cherry (*Prunus serotina*). The shrublayer is patchy and sparse; characteristic tall shrubs include hobblebush (*Viburnum lantanoides*), wild raisin (*V. cassinoides*), and mountain ash (*Sorbus americana*). The groundlayer is typically a dense carpet of feather mosses, especially *Hylocomium splendens*. Characteristic herbs include wood sorrel (*Oxalis acetosella*), bunchberry (*Cornus canadensis*), creeping snowberry (*Gaultheria hispidula*), bluebeads (*Clintonia borealis*), wild sarsaparilla (*Aralia nudicaulis*), dewdrop (*Dalibarda repens*), spinulose wood fern (*Dryopteris carthusiana*), and lady fern (*Athyrium asplenoides*). More data on this community are needed.

Distribution: only known from the Adirondacks ecozone.

Rank: G4 S2S3

Example: Cold Brook Plains, Essex County.

Sources: Eyre 1980; Zon 1914; NHP field surveys.

17. Spruce-northern hardwood forest: a mixed forest that occurs on lower mountain slopes and upper margins of flats on glacial till, primarily in the Adirondack and Catskill mountains, and in the Tug Hill plateau. This is a broadly defined community with several regional and edaphic variants; it is one of the most common forest types in the Adirondacks. Codominant trees are red spruce (*Picea rubens*), sugar maple (*Acer saccharum*), beech (*Fagus grandifolia*), yellow birch (*Betula alleghaniensis*), and red maple (*Acer rubrum*), with scattered balsam fir (*Abies balsamea*). Striped maple (*Acer pensylvanicum*) and mountain maple (*A. spicatum*) are common subcanopy trees. Characteristic shrubs are hobblebush (*Viburnum lantanoides*), American fly honeysuckle (*Lonicera canadensis*), and Canada yew (*Taxus canadensis*). Characteristic groundlayer plants are common wood-sorrel (*Oxalis acetosella*), common wood fern (*Dryopteris*

intermedia), shining clubmoss (*Lycopodium lucidulum*), wild sarsaparilla (*Aralia nudicaulis*), bluebeads (*Clintonia borealis*), goldthread (*Coptis trifolia*), bunchberry (*Cornus canadensis*), Canada mayflower (*Maianthemum canadense*), Indian cucumber-root (*Medeola virginiana*), and twisted stalk (*Streptopus roseus*). Characteristic birds include yellow-bellied flycatcher (*Empidonax flaviventris*), white-throated sparrow (*Zonotrichia albicollis*), golden-crowned kinglet (*Regulus satrapa*), pileated woodpecker (*Dryocopus pileatus*), and gray jay (*Perisoreus canadensis*).

Distribution: primarily known from the Adirondacks ecozone and the Tug Hill Plateau; small examples may also occur in the Catskill Peaks.

Rank: G3G4 S3S4

Example: Five Ponds Wilderness Area, Herkimer County.

Sources: Eyre 1980; Heimbürger 1934; Leopold et al. 1988; Roman 1980; Zon 1914; NHP field surveys.

18. Mountain spruce-fir forest: a conifer forest that occurs at high elevations in the Catskill and Adirondack mountains, usually at elevations ranging from 3000 to 4000 ft (about 900 to 1200 m). This forest occurs on upper slopes that are somewhat protected from the prevailing westerly winds, usually at elevations above spruce-northern hardwood forests, and below mountain fir forests. Soils are strongly podzolized, and they tend to be highly organic. The dominant trees are red spruce (*Picea rubens*) and balsam fir (*Abies balsamea*). Common associates are mountain paper birch (*Betula cordifolia*) and yellow birch (*B. alleghaniensis*). Subcanopy trees that are usually present at a low density include mountain ash (*Sorbus americana*), mountain maple (*Acer spicatum*), pin cherry (*Prunus pensylvanica*) and striped maple (*Acer pensylvanicum*). The shrublayer may consist primarily of seedlings and saplings of canopy trees; other shrubs that are present in some stands include red elderberry (*Sambucus racemosa*), mountain holly (*Nemopanthus mucronatus*), American fly honeysuckle (*Lonicera canadensis*), and dwarf raspberry (*Rubus pubescens*). In the Catskills, hobblebush (*Viburnum lantanoides*) and mountain azalea (*Rhododendron prinophyllum*) are also common. Typically there is a dense layer of feather mosses and other bryophytes carpeting the forest floor; common bryophytes include

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Pleurozium schreberi, *Ptilium crista-castrensis*, *Bazzania trilobata*, *Brotherella recurvans*, *Dicranum scoparium*, *Hypnum pallescens*, *Hylocomium splendens*, and *Drepanocladus uncinatus*. Characteristic herbs are common wood-sorrel (*Oxalis acetosella*), mountain wood fern (*Dryopteris campyloptera*), bluebeads (*Clintonia borealis*), Canada mayflower (*Maianthemum canadense*), bunchberry (*Cornus canadensis*), large-leaf goldenrod (*Solidago macrophylla*), mountain aster (*Aster acuminatus*), goldthread (*Coptis trifolia*), and shining clubmoss (*Lycopodium lucidulum*). Characteristic birds include white-throated sparrow (*Zonotrichia albicollis*), winter wren (*Troglodytes troglodytes*), golden-crowned kinglet (*Regulus satrapa*), yellow-rumped warbler (*Dendroica coronata*), blackpoll warbler (*Dendroica striata*), Swainson's thrush (*Catharus ustulatus*), boreal chickadee (*Parus hudsonicus*), and yellow-bellied flycatcher (*Empidonax flaviventris*).

A significant disturbance that is currently affecting mountain spruce-fir forests in the eastern U.S. is spruce decline, a phenomenon that retards the growth of red spruce and eventually kills many trees. The causes of spruce decline have not been substantiated, but atmospheric deposition of pollutants (acid rain) is likely a contributing factor.

Distribution: on high-elevation slopes of the Adirondack High Peaks and the Catskill Peaks.

Rank: G2G3 S1

Examples: Phelps Brook, Essex County; Cornell Mountain, Ulster County.

Sources: Eyre 1980; Holway and Scott 1969; Leopold et al. 1988; McIntosh and Hurley 1964; McLaughlin et al. 1987; Nicholson 1965; Sabo 1980; Slack 1977; NHP field surveys.

19. Mountain fir forest: a conifer forest that occurs at high elevations in the Catskill and Adirondack mountains, usually at elevations ranging from 3500 to 4500 ft (about 1100 to 1400 m). This forest typically occurs on cool upper slopes that are exposed to wind, at elevations above spruce-northern hardwood forests, usually above mountain spruce-fir forest, and below alpine krummholz. Soils are typically thin (less than 20 in or 50 cm), and they tend to be highly organic and strongly acidic. The vegetation typically has a low species diversity; the tree layer is almost entirely balsam fir (*Abies balsamea*), with a small amount of mountain paper birch

(*Betula cordifolia*) and occasional individuals of red spruce (*Picea rubens*) and mountain ash (*Sorbus americana*). The shrublayer is predominantly seedlings and saplings of balsam fir, with occasional individuals of green alder (*Alnus viridis* ssp. *crispa*) and Labrador tea (*Ledum groenlandicum*). Red raspberry (*Rubus idaeus*) and skunk currant (*Ribes glandulosum*) occur in recently disturbed areas. Characteristic herbs are common wood-sorrel (*Oxalis acetosella*), bluebeads (*Clintonia borealis*), Canada mayflower (*Maianthemum canadense*), mountain wood fern (*Dryopteris campyloptera*), bunchberry (*Cornus canadensis*), large-leaf goldenrod (*Solidago macrophylla*), mountain aster (*Aster acuminatus*), goldthread (*Coptis trifolia*), and bristly clubmoss (*Lycopodium annotinum*). The forest floor is typically carpeted with mosses, including *Pleurozium schreberi*, *Dicranum fuscescens*, *Drepanocladus uncinatus*, *Polytrichum ohioense*, *Dicranum scoparium*, and *Plagiothecium laetum*. Characteristic birds include white-throated sparrow (*Zonotrichia albicollis*), winter wren (*Troglodytes troglodytes*), blackpoll warbler (*Dendroica striata*), yellow-rumped warbler (*Dendroica coronata*), gray-cheeked thrush (*Catharus minimus*), yellow-bellied flycatcher (*Empidonax flaviventris*), magnolia warbler (*Dendroica magnolia*), purple finch (*Carpodacus purpureus*), and Nashville warbler (*Vermivora ruficapilla*).

In certain areas mountain fir forests exhibit a distinctive pattern of disturbance and regrowth that is called "wave-regeneration". From a distance the forest appears to be very patchy, with large areas of green canopy interspersed with roughly crescent-shaped bands of dead trees. The "waves" consist of "troughs" of dead and windthrown trees, grading uphill first into a zone of vigorous fir seedlings, then into a dense stand of fir saplings, and then to a "crest" of mature fir trees that border another band of standing dead and windthrown trees.

Distribution: on high-elevation slopes of the Adirondack High Peaks and Catskill Peaks.

Rank: G3G4 S2S3

Example: Whiteface Mountain, Essex County.

Sources: McIntosh and Hurley 1964; Nicholson 1965; Slack 1977; Sprugel 1976.

20. Successional northern hardwoods: a hardwood or mixed forest that occurs on sites that have been cleared (for farming, logging, etc.)

or otherwise disturbed. The dominant trees are usually any two or more of the following: quaking aspen (*Populus tremuloides*), big-tooth aspen (*P. grandidentata*), balsam poplar (*P. balsamifera*), pin cherry (*Prunus pensylvanica*), black cherry (*P. serotina*), red maple (*Acer rubrum*), white pine (*Pinus strobus*), paper birch (*Betula papyrifera*), gray birch (*B. populifolia*), white ash (*Fraxinus americana*), green ash (*F. pensylvanica*), or American elm (*Ulmus americana*). This is a broadly defined community dominated by light-requiring, wind-dispersed species that are well-adapted to establishment following disturbance. Characteristic birds include chestnut-sided warbler (*Dendroica pensylvanica*), Nashville warbler (*Vermivora ruficapilla*) in young forests with aspen and birch seedlings, and yellow-bellied sapsucker (*Sphyrapicus varius*) in mature aspen forests.

A characteristic feature of successional forests is the lack of reproduction of the canopy species. Most of the tree seedlings and saplings in a successional forest are species that are more shade-tolerant than the canopy species. Shrublayer and groundlayer dominants may include many species characteristic of successional old fields, or they may include species that occurred on or near the site prior to disturbance.

Distribution: throughout upstate New York north of the Coastal Lowlands ecozone.

Rank: G5 S5

Source: Mellinger and McNaughton 1975.

21. Successional southern hardwoods: a hardwood or mixed forest that occurs on sites that have been cleared (for farming, logging, etc.) or otherwise disturbed. The dominant trees are usually any of the following: gray birch (*Betula populifolia*), hawthorns (*Crataegus* spp.), sassafras (*Sassafras albidum*), box elder (*Acer negundo*), American elm (*Ulmus americana*), slippery elm (*U. rubra*), red maple (*Acer rubrum*), silver maple (*A. saccharinum*), and eastern red cedar (*Juniperus virginiana*). Certain introduced species are commonly found in successional forests, including black locust (*Robinia pseudo-acacia*), tree-of-heaven (*Ailanthus altissima*), and buckthorn (*Rhamnus cathartica*). Any of these may be dominant or codominant in a successional southern hardwood forest. This is a broadly defined community dominated by light-requiring species that are well-adapted to establishment following disturbance. A characteristic bird is chestnut-sided warbler (*Dendroica pensylvanica*).

A characteristic feature of successional forests is the lack of reproduction of the canopy species. Most of the tree seedlings and saplings in a successional forest are species that are more shade-tolerant than the canopy species. Shrublayer and groundlayer dominants may include many species characteristic of successional old fields, or they may include species that occurred on or near the site prior to disturbance.

Distribution: primarily in the southern half of New York, south of the Adirondacks.

Rank: G5 S5

Sources: Eyre 1980; NHP field surveys.

22. Successional maritime forest: a successional hardwood forest that occurs in low areas near the seacoast. This forest is a variable type that develops after vegetation has burned or land cleared (such as pastureland or farm fields). The trees may be somewhat stunted and flat-topped because the canopies are pruned by salt spray. The forest may be dominated by a single species, or there may be two or three codominants. Characteristic canopy trees include black oak (*Quercus velutina*), post oak (*Quercus stellata*), shadbush (*Amelanchier canadensis*), white oak (*Quercus alba*), black cherry (*Prunus serotina*), black gum (*Nyssa sylvatica*), sassafras (*Sassafras albidum*), and red maple (*Acer rubrum*). A small number of eastern red cedar (*Juniperus virginiana*) may be present. Vines that are common in the understory and subcanopy include riverbank grape (*Vitis riparia*), poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), and greenbrier (*Smilax* spp.). Data on groundlayer composition and characteristic animals are not available.

Distribution: in the Coastal Lowlands ecozone, in low areas near the coast of Long Island.

Rank: G4 S3S4

Example: William Floyd Estate (Fire Island National Seashore), Suffolk County.

Sources: Clark 1986b; Greller 1977.

D. TERRESTRIAL CULTURAL

This subsystem includes communities that are either created and maintained by human activities, or are modified by human influence to such a degree that the physical conformation of the

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substrate, or the biological composition of the resident community is substantially different from the character of the substrate or community as it existed prior to human influence.

1. Cropland/row crops: an agricultural field planted in row crops such as corn, potatoes, and soybeans. This community includes vegetable gardens in residential areas.

Distribution: throughout New York State.

Rank: G5 S5

2. Cropland/field crops: an agricultural field planted in field crops such as alfalfa, wheat, timothy, and oats. This community includes hayfields that are rotated to pasture. Characteristic birds include grasshopper sparrow (*Ammodramus savannarum*), vesper sparrow (*Poocetes gramineus*), bobolink (*Dolichonyx oryzivorus*), mourning dove (*Zenaida macroura*), and upland sandpiper (*Bartramia longicauda*).

Distribution: throughout New York State.

Rank: G5 S5

3. Pastureland: agricultural land permanently maintained (or recently abandoned) as a pasture area for livestock. Characteristic birds include grasshopper sparrow (*Ammodramus savannarum*), vesper sparrow (*Poocetes gramineus*), horned lark (*Eremophila alpestris*), killdeer (*Charadrius vociferus*), and upland sandpiper (*Bartramia longicauda*).

Distribution: throughout New York State.

Rank: G5 S5

4. Flower/herb garden: residential, commercial, or horticultural land cultivated for the production of ornamental herbs and shrubs. This community includes gardens cultivated for the production of culinary herbs. Characteristic birds include American robin (*Turdus migratorius*) and mourning dove (*Zenaida macroura*).

Distribution: throughout New York State.

Rank: G5 S5

5. Orchard: a stand of cultivated fruit trees (such as apples, cherries, peaches, pears, etc.), often with grasses as a groundcover. An orchard may be currently under cultivation or recently abandoned. Staghorn sumac (*Rhus typhina*), goldenrods (*Solidago* spp.), and poison ivy (*Toxicodendron radicans*) may be common in abandoned orchards. Characteristic birds include American robin (*Turdus migratorius*), eastern kingbird (*Tyrannus tyrannus*), mourning dove (*Zenaida macroura*), and in mature orchards with a minimum dbh of 10 in (about 25 cm), yellow-bellied sapsucker (*Sphyrapicus varius*).

Distribution: throughout New York State at low elevations.

Rank: G5 S5

6. Vineyard: a stand of cultivated vines (such as grapes, or raspberries), often with grasses as a groundcover.

Distribution: throughout New York State at low elevations.

Rank: G5 S5

7. Hardwood plantation: a stand of commercial hardwood species planted for the cultivation and harvest of timber products. These plantations are usually monocultures: more than 90% of the canopy cover consists of one species. Species typically planted in New York are: black cherry (*Prunus serotina*), red oak (*Quercus rubra*), white oak (*Q. alba*), black walnut (*Juglans nigra*), hybrid poplars (*Populus* spp.), and black locust (*Robinia pseudo-acacia*).

Distribution: throughout New York State.

Rank: G5 S3

8. Pine plantation: a stand of pines planted for the cultivation and harvest of timber products, or to provide wildlife habitat, soil erosion control, windbreaks, or landscaping. These plantations may be monocultures with more than 90% of the canopy cover consisting of one species, or they may be mixed stands with two or more codominant species (in which case more than 50% of the cover consists of one or more species of pine). Pines that are typically planted in New York include white pine (*Pinus strobus*), red pine (*P. resinosa*), Scotch pine (*P. sylvestris*), pitch pine

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(*P. rigida*), and jack pine (*P. banksiana*). Groundlayer vegetation is usually sparse, apparently because of the dense accumulation of leaf litter. Speedwell (*Veronica officinalis*) is a characteristic groundlayer plant. More data on this community are needed.

Distribution: throughout New York State.

Rank: G5 S5

9. Spruce/fir plantation: a stand of softwoods planted for the cultivation and harvest of timber products, or to provide wildlife habitat, soil erosion control, windbreaks, or landscaping. These plantations may be monocultures with more than 90% of the canopy cover consisting of one species, or they may be mixed stands with two or more codominant species (in which case more than 50% of the cover consists of one or more species of spruce or fir). Softwoods that are typically planted in New York include Norway spruce (*Picea abies*), white spruce (*P. glauca*), balsam fir (*Abies balsamea*), and Douglas fir (*Pseudotsuga menziesii*). Groundlayer vegetation is usually sparse, apparently because of the dense accumulation of leaf litter. Speedwell (*Veronica officinalis*) is a characteristic groundlayer plant. A characteristic bird is golden-crowned kinglet (*Regulus satrapa*). More data on this community are needed.

Distribution: throughout New York State.

Rank: G5 S5

10. Conifer plantation: a stand of softwoods planted for the cultivation and harvest of timber products, or to provide wildlife habitat, soil erosion control, windbreaks, or landscaping. This is a broadly defined community that excludes stands in which pine, spruce, or fir are dominant, although they may be present at low densities. These plantations may be monocultures, or they may be mixed stands with two or more codominant species. Softwoods that are typically planted in these plantations include European larch (*Larix decidua*), Japanese larch (*Larix kaempferi*), and northern white cedar (*Thuja occidentalis*). Groundlayer vegetation is usually sparse, apparently because of the dense accumulation of leaf litter. Speedwell (*Veronica officinalis*) is a characteristic groundlayer plant. More data on this community are needed.

Distribution: throughout New York State.

Rank: G5 S5

11. Mowed lawn with trees: residential, recreational, or commercial land in which the groundcover is dominated by clipped grasses and forbs, and it is shaded by at least 30% cover of trees. Ornamental and/or native shrubs may be present, usually with less than 50% cover. The groundcover is maintained by mowing. Characteristic animals include gray squirrel (*Sciurus carolinensis*), American robin (*Turdus migratorius*), mourning dove (*Zenaida macroura*), and mockingbird (*Mimus polyglottos*).

Distribution: throughout New York State.

Rank: G5 S5

12. Mowed lawn: residential, recreational, or commercial land, or unpaved airport runways in which the groundcover is dominated by clipped grasses and there is less than 30% cover of trees. Ornamental and/or native shrubs may be present, usually with less than 50% cover. The groundcover is maintained by mowing. Characteristic birds include American robin (*Turdus migratorius*), upland sandpiper (*Bartramia longicauda*), and killdeer (*Charadrius vociferus*).

Distribution: throughout New York State.

Rank: G5 S5

13. Mowed roadside/pathway: a narrow strip of mowed vegetation along the side of a road, or a mowed pathway through taller vegetation (e.g. meadows, old fields, woodlands, forests), or along utility right-of-way corridors (e.g. power lines, telephone lines, gas pipelines). The vegetation in these mowed strips and paths may be dominated by grasses, sedges, and rushes; or it may be dominated by forbs, vines, and low shrubs that can tolerate infrequent mowing.

Distribution: throughout New York State.

Rank: G5 S5

14. Herbicide-sprayed roadside/pathway: a narrow strip of low-growing vegetation along the side of a road, or along utility right-of-way corridors (e.g. power lines, telephone lines, gas pipelines) that is maintained by spraying herbicides.

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Distribution: throughout New York State.

Rank: G5 S5

15. Unpaved road/path: a sparsely vegetated road or pathway of gravel, bare soil, or bedrock outcrop. These roads or pathways are maintained by regular trampling or scraping of the land surface. The substrate consists of the soil or parent material at the site, which may be modified by the addition of local organic material (woodchips, logs, etc.) or sand and gravel. One characteristic plant is path rush (*Juncus tenuis*). A characteristic bird is killdeer (*Charadrius vociferus*).

Distribution: throughout New York State.

Rank: G5 S5

16. Paved road/path: a road or pathway that is paved with asphalt, concrete, brick, stone, etc. There may be sparse vegetation rooted in cracks in the paved surface.

Distribution: throughout New York State.

Rank: G5 S5

17. Roadcut cliff/slope: a sparsely vegetated cliff or steep slope, along a road, that was created by blasting or digging during road construction.

Distribution: throughout New York State.

Rank: G5 S5

18. Riprap/erosion control roadside: a sparsely vegetated slope along a road that is covered with coarse stones, cobbles, or gabions placed for erosion control.

Distribution: throughout New York State.

Rank: G5 S5

19. Rock quarry: an excavation in bedrock from which building stone (e.g. limestone, sandstone, slate) has been removed. Vegetation may be sparse; plants may be rooted in crevices in the rock surface.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G5 S5

20. Gravel mine: an excavation in a gravel deposit from which gravel has been removed. Often these are dug into glacial deposits such as eskers or kames. Vegetation may be sparse if the mine is active; there may be substantial vegetative cover if the mine has been inactive for several years. Near-vertical slopes are used by bank swallows (*Riparia riparia*) for nesting sites.

Distribution: throughout New York State.

Rank: G5 S5

21. Sand mine: an excavation in a sand deposit or sand dune from which sand has been removed. Vegetation is usually sparse. A characteristic bird is bank swallow (*Riparia riparia*).

Distribution: throughout New York State.

Rank: G5 S5

22. Brushy cleared land: land that has been clearcut or cleared by brush-hog. There may be a lot of woody debris such as branches and slashings from trees that were logged. Vegetation is patchy, with scattered herbs, shrubs, and tree saplings. The amount of vegetative cover probably depends on soil fertility and the length of time since the land was cleared.

Distribution: throughout New York State.

Rank: G5 S5

23. Artificial beach: a sand beach constructed on a lake or river shore by depositing sand from outside the site onto the natural substrate; a sandy beach neither created nor maintained by natural lake shore or river processes. These beaches often provide nesting habitat for turtles.

Distribution: throughout New York State.

Rank: G5 S5

24. Riprap/artificial lake shore: a lake shore or pond shore that is covered with coarse stones,

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cobbles, concrete slabs, etc. placed for erosion control. The vegetation is usually sparse.

Distribution: throughout New York State.

Rank: G5 S5

25. Dredge spoil lake shore: a lake shore or pond shore that is composed of dredge spoils. The vegetation may be sparse.

Distribution: throughout New York State.

Rank: G5 S5

26. Construction/road maintenance spoils: a site where soil from construction work and/or road maintenance materials have been recently deposited. There is little, if any, vegetation.

Distribution: throughout New York State.

Rank: G5 S5

27. Dredge spoils: an upland site where dredge spoils have been recently deposited. On sandy dredge spoils along the Hudson River, characteristic species of early successional deposits include winged pigweed (*Cycloloma atriplicifolium*), lovegrass (*Eragrostis pectinacea*), purple sandgrass (*Triplasis purpurea*), tall crabgrass (*Digitaria sanguinalis*), and field sandbur (*Cenchrus longispinus*); cottonwood (*Populus deltoides*) is common on late successional deposits. Maritime dredge spoil islands along the seacoast of Long Island provide nesting habitat for herring gull (*Larus argentatus*), least tern (*Sterna antillarum*), and piping plover (*Charadrius melodus*).

Distribution: throughout New York State, especially near large rivers, lakes, or the ocean.

Rank: G5 S5

28. Mine spoils: a site where mine spoils have been deposited. These sites may be extensive. Mine spoils may include tailings, crushed rock, and overburden deposits.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G5 S5

29. Landfill/dump: a site that has been cleared or excavated, where garbage is disposed. The bulk of the material in the landfill or dump is organic and biodegradable; although some inorganic material (plastic, glass, metal, etc.) is usually present.

Distribution: throughout New York State.

Rank: G5 S5

30. Junkyard: a site that has been cleared for disposal or storage of primarily inorganic refuse, including discarded automobiles, large appliances, mechanical parts, etc.

Distribution: throughout New York State.

Rank: G5 S5

31. Urban vacant lot: an open site in a developed, urban area, that has been cleared either for construction or following the demolition of a building. Vegetation may be sparse, with large areas of exposed soil, and often with rubble or other debris. Characteristic trees are often naturalized exotic species such as Norway maple (*Acer platanoides*), white mulberry (*Morus alba*), and tree of heaven (*Ailanthus altissima*), a species native to northern China and introduced as an ornamental. Tree of heaven is fast growing and tolerant of the harsh urban environment; it can dominate a vacant lot and form dense stands.

Distribution: throughout New York State.

Rank: G5 S5

32. Urban structure exterior: the exterior surfaces of metal, wood, or concrete structures (such as commercial buildings, apartment buildings, houses, bridges) or any structural surface composed of inorganic materials (glass, plastics, etc.) in an urban or densely populated suburban area. These sites may be sparsely vegetated with lichens, mosses, and terrestrial algae; occasionally vascular plants may grow in cracks. Nooks and crannies may provide nesting habitat for birds and insects, and roosting sites for bats. Characteristic birds include common nighthawk (*Chordeiles minor*) on rooftops, American robin (*Turdus migratorius*) on porches or under shelter, and exotic birds such as rock dove (*Columba livia*) and house sparrow (*Passer domesticus*).

TERRESTRIAL COMMUNITIES

Distribution: throughout New York State.

Rank: G5 S5

33. Rural structure exterior: the exterior surfaces of metal, wood, or concrete structures (such as commercial buildings, barns, houses, bridges) or any structural surface composed of inorganic materials (glass, plastics, etc.) in a rural or sparsely populated suburban area. These sites may be sparsely vegetated with lichens, mosses, and terrestrial algae; occasionally vascular plants may grow in cracks. Nooks and crannies may provide nesting habitat for birds and insects, and roosting sites for bats. Characteristic birds include American robin (*Turdus migratorius*) on porches or under shelter, barn swallow (*Hirundo rustica*) under shelter, and exotic birds such as rock dove (*Columba livia*), house sparrow (*Passer domesticus*), and European starling (*Sturnus vulgaris*).

Distribution: throughout New York State.

Rank: G5 S5

34. Interior of barn/agricultural building: the interior spaces of a barn or other agricultural building which provides shelter for livestock or storage space for agricultural products (hay, straw, silage, etc.). Characteristic animals besides the livestock are small rodents, bats, cats, native and exotic birds such as barn swallow (*Hirundo rustica*) and rock dove (*Columba livia*).

Distribution: throughout New York State.

Rank: G5 S5

35. Interior of non-agricultural building: the interior spaces of a house, garage, commercial building, or industrial building that is used primarily by people for living space, work space, or storage space. A characteristic bird is chimney swift (*Chaetura pelagica*) which nests in chimneys and inner walls of buildings.

Distribution: throughout New York State.

Rank: G5 S5

SUBTERRANEAN COMMUNITIES

VII. SUBTERRANEAN SYSTEM

The subterranean system consists of both aquatic and non-aquatic habitats beneath the earth's surface, including air-filled cavities with openings to the surface (caves), water-filled cavities and aquifers, and interstitial habitats in small crevices. The Heritage Program has done ~~limited inventory work on caves; we do not~~ currently have in our files sufficient field data for evaluating the subterranean classification. For the characteristic species, I have relied upon comments from the staff of DEC's Endangered Species Unit, based upon their knowledge of bat hibernacula and caves in New York.

A. NATURAL CAVES

This subsystem includes caves and cavities in which the structure and hydrology have not been substantially modified by human activities, and the native biota are dominant.

1. Aquatic cave community: the aquatic community of a subterranean stream or pond. More data on this community are needed.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G4 S3S4

2. Terrestrial cave community: the terrestrial community of a cave, including the biota of both solution caves (in limestone) and tectonic caves. Temperatures are stable in deep caves. Small or shallow caves may have a temperature gradient ranging from cold (below freezing) to cool (up to 50° F). Although many caves have ice on the cave floor in winter, the ceiling is warm enough for a bat hibernaculum. Characteristic bats that hibernate in our caves include little brown bat (*Myotis lucifugus*), Keen's bat (*Myotis keenii*), big brown bat (*Eptesicus fuscus*), and Eastern pipistrelle (*Pipistrellus subflavus*).

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G4 S3S4

3. Talus cave community: the community that occurs in small crevices and caves in a talus slope at the base of a cliff. This includes talus slopes that are cool enough to allow winter ice to

remain within the talus through all or part of the summer; these are known as ice caves. Characteristic animals include timber rattlesnake (*Crotalus horridus*) and small mammals.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G4 S3S4

B. SUBTERRANEAN CULTURAL

This subsystem includes communities that are either created and maintained by human activities, or are modified by human influence to such a degree that the physical conformation of the substrate, or the biological composition of the resident community is substantially different from the character of the substrate or community as it existed prior to human influence.

1. Mine/artificial cave community: the biota of an abandoned mine or artificial underground excavation. Abandoned mines that are deep enough to maintain stable winter temperatures are important bat hibernacula. Characteristic bats include little brown bat (*Myotis lucifugus*), Keen's bat (*Myotis keenii*), big brown bat (*Eptesicus fuscus*), and Eastern pipistrelle (*Pipistrellus subflavus*).

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone.

Rank: G4 S3S4

2. Sewer: the biota of a subterranean conduit constructed to carry off sewage and sometimes runoff from an urban or developed area. A characteristic rodent is the Norway rat (*Rattus norvegicus*).

Distribution: throughout New York State.

Rank: G5 S5

3. Tunnel: the biota of a subterranean passageway constructed to allow transportation routes to pass through rock or earth obstructions or underground, including tunnels for roads, footpaths, highways, railroads, and subways.

Distribution: throughout New York State.

Rank: G5 S5

SUBTERRANEAN COMMUNITIES

4. Basement/building foundation: the biota of an underground structure that was built primarily as a support structure for a house, commercial building, or industrial building. This includes foundations of abandoned structures, as well as those that are actively used. Characteristic

animals include a wide variety of insects and small vertebrates.

Distribution: throughout New York State.

Rank: G5 S5

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HERITAGE RANKS

APPENDIX A: HERITAGE PROGRAM ELEMENT RANKS

Communities and rare species are the mapping units or "elements" of the Heritage inventory. Each community and species element is assigned an "element rank" consisting of a combined global and state rank. ~~The global rank reflects the~~ rarity of the element throughout the world and the state rank reflects the rarity within New York State (The Nature Conservancy 1982). Global ranks for communities are not currently standardized by The Nature Conservancy, so the ranks listed in the community descriptions are estimated global ranks.

GLOBAL RANKS

- G1 = Critically imperiled throughout its range due to extreme rarity (5 or fewer occurrences, or very few remaining individuals, acres, or miles of stream) or extremely vulnerable to extinction due to biological factors.
- G2 = Imperiled throughout its range due to rarity (6 - 20 occurrences, or few remaining individuals, acres, or miles of stream) or highly vulnerable to extinction due to biological factors.
- G3 = Either very rare throughout its range (21 - 100 occurrences), with a restricted range (but possibly locally abundant), or vulnerable to extinction due to biological factors.
- G4 = Apparently secure throughout its range (but possibly rare in parts of its range).

G5 = Demonstrably secure throughout its range (however it may be rare in certain areas).

GU = Status unknown.

STATE RANKS

S1 = ~~Typically 5 or fewer occurrences, very few~~ remaining individuals, acres, or miles of stream, or especially vulnerable to extirpation in New York State for other reasons.

S2 = Typically 6 to 20 occurrences, few remaining individuals, acres, or miles of stream, or very vulnerable to extirpation in New York State for other reasons.

S3 = Typically 21 to 100 occurrences, limited acreage, or miles of stream in New York State.

S4 = Apparently secure in New York State.

S5 = Demonstrably secure in New York State.

SH = No extant sites known in New York State but it may still exist.

SU = State status unknown.

"Q" added to the rank indicates a question exists whether or not the taxon is a distinct taxonomic entity.

"?" added to the rank indicates uncertainty about the rank.

APPENDIX B: GLOSSARY

abundance: term referring to the the number of individuals of a single species present in a community.

abundant: a species with a relatively high number of individuals in a community.

acidic: describes water or soil with a pH less than 5.5.

alkaline: describes water or soil with a pH greater than 7.4.

alluvium: unconsolidated material deposited by running water, including gravel, sand, silt, clay, and various mixtures of these.

alpine: characteristic of any lofty mountain or mountain system; implies high elevation, near or above tree line, and a cold, windy climate.

alvar: a Swedish term to describe barrens and grassland vegetation that grows on thin soils over level outcrops of limestone or dolomite bedrock.

aquatic bed: a wetland or deepwater habitat dominated by plants that grow principally on or below the surface of the water for most of the growing season in most years.

aquatic macrophyte: an aquatic plant that is large enough to be visible without magnification by a microscope or handlens.

assemblage: a non-committal term for a group of organisms that live together and can be studied; does not imply any particular scale.

associate: any species that commonly occurs in the same community or assemblage with one particular species, is an associate of that species.

bar: an elongated landform generated by waves and currents and usually running parallel to the shore, composed predominantly of unconsolidated sand, gravel, cobbles, or stones, and with water on two sides.

barrens: a depauperate community with either a low canopy coverage or with stunted individuals of species which elsewhere reach considerable size; this term is applied to both savannas and woodlands.

barrier beach: a narrow, elongate sand ridge rising slightly above the high-tide level and

extending generally parallel with the shore, but separated from it by a lagoon or marsh; it is rarely more than a few miles (or several kilometers) long.

base level: the theoretical limit or lowest level toward which erosion of the earth's surface constantly progresses; especially the level below which a stream cannot erode its bed.

bedrock: the solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

benthos: organisms living in or on the bottom of an aquatic system such as a lake or a river.

biota: the complete flora and fauna of an area from the taxonomic point of view.

bog: a nutrient-poor, acidic peatland that receives water primarily from direct rainfall, with little or no influence of groundwater or runoff; vegetation consists primarily of peat mosses (*Sphagnum* spp.) and ericaceous shrubs.

boreal: describes the circumpolar forest region in the northern hemisphere that is generally dominated by conifer tree species; the boreal forest extends north to the treeless tundra and south to the mixed conifer/deciduous forests or temperate grasslands.

brackish: describes marine and estuarine waters with moderate salinity, in the range of 0.5 to 18.0 ppt dissolved salts.

bryophyte: a collective term referring to mosses and liverworts.

calcareous: formed of calcium carbonate or magnesium carbonate by biological deposition or inorganic precipitation in sufficient quantities to effervesce carbon dioxide visibly when treated with cold 0.1 normal hydrochloric acid.

canopy: the aerial branches of terrestrial plants (usually trees or shrubs), and their complement of leaves, that form the uppermost layers of vegetation in a community; a canopy is said to be complete (or have 100% cover) when the ground is completely hidden by the leaves when viewed from above the canopy.

channel: the bed of a single or braided watercourse that commonly is barren of vegetation and is formed of modern alluvium.

GLOSSARY

characteristic species: a species that commonly occurs in a particular community, although it is not necessarily abundant; it may not occur in all examples of that community, but it may be expected to occur in at least half the examples.

circumneutral: describes water or soil with a pH of 5.5 to 7.4.

clay: soil composed of very fine particles (with particle sizes less than 0.002 mm).

closed canopy: a forest canopy that has a high percent cover; where the ground is completely or almost completely shaded by the canopy.

coarse woody debris: describes the dead woody material in a forested community, such as standing dead trees, dead branches and twigs, logs, and stumps.

coastal plain: any plain of unconsolidated fluvial or marine sediment which had its margin on the shore of a large body of water, particularly the ocean.

cobble: rock fragments 3 to 10 inches (7.6 to 25.4 cm) in diameter.

codominant: a species with relatively high abundance or percent cover in a community; two or more species providing roughly equal cover, abundance, or influence in a community, and which in combination control the environment of the community.

community: an assemblage of plants and animals interacting with one another, occupying a habitat, and often modifying the habitat; a variable assemblage of plant and animal populations sharing a common environment and occurring repeatedly in the landscape.

composition: a term that refers to all the species that comprise a community and their relative abundances.

conifer: a cone-bearing tree of the pine family (*Pinaceae*), usually evergreen.

cover: the amount of ground surface that is covered or shaded by the leaves and stems of a plant species or a group of species in a community.

cultivated: planted and maintained by people.

cyanobacteria: organisms once known as "bluegreen algae".

d.b.h.: abbreviation for "diameter at breast height", which describes the diameter of a tree at a height of 4.5 ft (about 1.4 meters) above the ground; this measurement is used to estimate basal area (cross-sectional area of a tree at the same height), which is a measure of dominance in forests.

density: term to indicate the number of individuals per unit area.

deposition: the laying down of potential rock-forming or soil-forming materials; sedimentation.

desiccation: the process of becoming completely dry.

dimictic: describes a lake that has two periods of mixing or turnover each year (spring and fall); these lakes are thermally stratified in summer, and they freeze over and become inversely stratified in winter.

discharge: total volume of water per unit time flowing through a channel.

disturbance regime: describes a repeating pattern of natural disturbance in a community, such as seasonal flooding, daily tidal flooding, periodic fires, windthrow, erosion, and ice scouring.

dominant: a species with the greatest abundance or percent cover in a community; a species with so much cover, abundance, or influence in a community that it controls the environment of the community; a species of great importance in a community through size, number, or other characters which enable it to receive the brunt of external environmental forces and modify them before they affect the other members of the community; for example, the dominant tree in a forest receives the most sunlight and produces the most shade, thus modifying the environment of the forest.

dwarf: a stunted growth form; for example, dwarf trees are less than 16 ft (4.9 m) tall.

dystrophic: describes lake water with a high content of organic matter; brown-water lakes.

ecosystem: living organisms and their environment functioning as an interacting unit.

ecotone: the edge or transition between two different communities or ecosystems.

effluent: liquid outflow from sewage works, factories, farms, etc.

GLOSSARY

embayment: a bay or a formation resembling a bay.

emergent: upright, rooted, herbaceous plants that may be temporarily to permanently flooded at the base while the upper portions of the plant grow erect above the water surface; these plants do not tolerate prolonged inundation of the entire plant; for example, cattail (*Typha latifolia*).

ephemeral: something temporary; used to describe intermittently wet areas; see also: spring ephemeral.

epilimnion: the upper, warm, circulating layer of water in a stratified lake.

epiphytic: describes organisms (especially plants) that live on the surface of a plant; for example, an alga living on an aquatic plant, or a moss living on the bark of a tree.

ericaceous: describes plants belonging to the heath family, the *Ericaceae*.

erosion: the wearing away of the land surface by running water, waves, moving ice and wind, or by other geological processes.

eutrophic: relatively rich in nutrients; generally referring to a habitat more nutrient rich than oligotrophic or mesotrophic habitats; especially used for an aquatic system that has a high concentration of plant nutrients such as nitrogen and phosphorus, and supports high plant productivity.

exemplary: an excellent example.

exotic: an introduced species that is not native to New York State.

fauna: all of the animal species that grow in a particular site or area.

feather mosses: term for large mosses that are pinnately branched and look like feathers or miniature ferns.

fen: an open peatland, sometimes with scattered trees, occurring on minerotrophic sites that receive groundwater which has been in contact with soil or bedrock, and is richer in mineral-nutrient elements than rainwater; a peatland that is richer in nutrients and less acidic than a bog; vegetation consists primarily of sedges, grasses, mosses and shrubs.

flat: a nearly level landform composed of unconsolidated sediments such as mud or sand, or nearly level expanses of sedimentary rock.

floating plant: a plant that floats freely in the water or on the water surface and is not anchored in the substrate; for example, duckweed (*Lemna minor*).

floating-leaved aquatic: an herbaceous plant that is rooted in the substrate with some leaves floating on the water surface; for example, white water lily (*Nymphaea odorata*). Plants such as yellow water lily (*Nuphar luteum*) that sometimes have leaves raised above the water surface are considered either floating-leaved or emergent, depending on their growth habit in a particular site or community.

flora: all of the plant species that grow spontaneously in a particular area; a taxonomic list of species; the size of a flora is determined by the number of species and is not influenced by the number of individuals of each species.

forb: an herbaceous plant that is not grass-like, especially used for broad-leaved herbaceous plants, and may include ferns and fern-allies.

forest: communities formed by trees with a canopy cover of at least 61 percent or more at maturity, with tree crowns usually interlocked.

frequency: a measure of the commonness and widespread distribution of plant or animal individuals in a single example of a community.

fresh: describes water with salinity less than 0.5 ppt dissolved salts.

gradient: a gradually changing factor; especially used for environmental variables, for example, a gradient from wet to dry soils.

graminoid: general term for any grass-like plant; including grasses (*Poaceae*), sedges (*Cyperaceae*), rushes (*Juncaceae*), and cattails (*Typhaceae*), as well as some plants in other families.

grass: a plant in the grass family (*Poaceae*).

grassland: an open canopy community dominated by graminoids; forbs may be common, but there are relatively few shrubs and less than one tree per acre.

GLOSSARY

grass-savanna: an upland community with a sparse canopy of trees (from 25 to 60% cover), and a groundlayer dominated by graminoids and forbs (with less than 50% cover of shrubs).

gravel: a mixture composed primarily of small rock fragments 0.1 to 3 inches (2 mm to 7.6 cm) in diameter.

groundlayer: the herbs, shrubs, and woody vines found beneath the trees in a forest; or the lowest layer of vegetation in an open-canopy community.

groundwater: water found underground in porous rock strata and soils.

hardwood: deciduous trees that are not conifers.

headward erosion: erosion moving towards the headwaters or source of a stream.

heath shrub: a shrub in the heath family (*Ericaceae*); an ericaceous shrub.

heath-like shrub: shrubs that are similar in habit and growth form to heath shrubs but not in the heath family (*Ericaceae*); broad-leaved, often evergreen shrubs with leathery leaves and a compact growth form.

heathland: a low shrubland dominated by heath or heath-like shrubs.

herb: a plant with no persistent woody stem above ground, as distinct from shrubs and trees; includes graminoids and forbs.

herbaceous layer: the layer or stratum of vegetation in a community in which herbs are common or dominant; usually the groundlayer.

high-energy waves: rough waves; waves that have enough energy to move large objects or modify landforms.

hollow: a microtopographic depression in a peatland; these can be of various sizes, and intermittently with standing water.

hummock: a moss-covered mound in a peatland, usually less than 40 cm high, and varying from less than 1 to more than 10 square meters in area; vegetation usually includes some dwarf shrubs, and sometimes includes tall shrubs or trees.

hydric: term describing areas with wet soils.

hydrology: describes the way water is distributed in the landscape, moves on the ground surface and underground, and cycles by evaporation, precipitation, and flow.

hydrophyte, hydrophytic: describes any plant adapted to growing in water or on a very wet substrate (one that is at least periodically deficient in oxygen as a result of excessive water content).

hypolimnion: the deep, cold, lower layer of water in a stratified lake.

impoundment: a pond caused by a dam across a stream and used for purposes such as water supply or water power.

introduced: describes an exotic species that became established in New York State by human activities, either intentionally (such as many cultivated plants) or accidentally; not native.

levee: and artificial or natural embankment built along the margin of a watercourse or an arm of the sea, to protect land from inundation, or an embankment that confines streamflow to its channel.

limnetic zone: the open water area of lakes.

litter layer: the uppermost layer of soil; it usually consists of fresh or partly decomposed organic debris such as fallen leaves, twigs, fruits, etc.

littoral zone: the shallow water zone at the interface between the drainage basin land surrounding a lake and the open water of the lake.

macrophyte: a plant (especially an aquatic plant) large enough to be visible without magnification by a hand lens or microscope.

maritime: describes sites or communities near the ocean and influenced by coastal processes.

marl: an earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions (35 to 65% of each); formed primarily under freshwater lacustrine conditions, but also deposited by decomposing algae in very alkaline wetlands.

marsh: a wet area, periodically inundated with standing or slow-moving water, that has a grassy or herbaceous vegetation and often little peat accumulation.

GLOSSARY

meadow: an open canopy community with forbs, graminoids and shrubs codominant; meadows may have scattered trees, but there is less than 25% canopy cover of trees.

mean high tide: the average height of the high tide water over 19 years.

meander: one of a series of sinuous loops, with sine-wave form, in the course of a stream channel.

meromictic: describes a lake that has no annual periods of mixing and remains chemically stratified throughout the year.

mesic: term describing areas with moist, well-drained soils; intermediate between xeric (dry) soils and hydric (wet) soils.

mesophytic: term describing vegetation characteristic of moist, well-drained soils.

mesotrophic: having moderate levels of nutrients; referring to a habitat intermediate in richness between eutrophic and oligotrophic.

microtopography: the fine scale topography of a site.

mineral soil: soil with less than 20% organic matter if the mineral fraction contains no clay; or less than 30% organic matter if the mineral fraction contains 50% or more clay. For more information see Appendix D in: Cowardin et al. (1979).

minerotrophic: groundwater-fed; areas influenced by water that has been in contact with soil or bedrock, and is richer in mineral-nutrient elements than rainwater.

monomictic: describes a lake that has one period of mixing or turnover each year.

morphometry: describes morphological features of a lake or stream and its included water mass; includes water depth, surface area, length of shore line, water volume, and slope and topography of the basin.

mosaic: in a landscape, a complex pattern composed of different types of communities or assemblages that are intermingled.

muck: highly decomposed organic material in which the original plant parts are not recognizable; contains more mineral matter and is usually darker in color than peat.

mudflats: a level landform associated with shores that is composed of unconsolidated mud sediments; mudflats may be irregularly shaped or elongate and continuous with the shore.

native: describes species that naturally occur in New York State, and were not introduced by human activities; indigenous.

naturalized: describes species that were introduced into New York State by human activities, and are successfully established and reproducing naturally without cultivation.

nutrient-poor: providing low levels of plant nutrients.

nutrient-rich: providing high levels of plant nutrients.

oligotrophic: poor to extremely poor in nutrients; referring to a habitat less nutrient-rich than eutrophic or mesotrophic.

ombrotrophic: rain-fed; used especially to indicate peatlands or portions of peatlands which receive water only from precipitation.

open canopy: with very sparse cover of canopy trees; with less than 25% canopy cover.

organic matter: material derived from the decay of living organisms.

organic soil: soil with at least 20% organic matter if the mineral fraction contains no clay, or with at least 30% organic matter if the mineral fraction contains 50% or more clay. For more details see Appendix D in Cowardin et al. (1979).

outcrop: that part of a geologic formation or structure that appears at the surface of the earth.

oxbow: a closely looping stream meander having an extreme curvature such that only a neck of land is left between the two parts of the stream.

pack ice: ice formed from ice floes that were washed onto the shore of a river or lake.

panne: a low area within a salt marsh (usually in high salt marsh) that is permanently saturated or includes a small pond hole that is permanently filled with water.

peat: the partially-decayed remains of plant material accumulating on wet sites because of water-logging; unconsolidated soil material consisting of accumulated, undecomposed (or only slightly decomposed) organic matter.

GLOSSARY

peat moss: any moss in the genus *Sphagnum*.

peatland: a wet area in which peat has accumulated; in this classification, wetlands with marl substrates are included in peatlands.

perched water table: a water table held above the regional level by an impermeable or slowly permeable layer.

periphytic: describes organisms living on the surfaces of submerged plants.

pH: symbol for units in the measurement of acidity or alkalinity of soil, water, or other substrates.

podzolized: describes a type of soil in which organic matter, iron, aluminum, a small amount of phosphorus, and sometimes clay, have been translocated from the upper part of the mineral soil layers to the lower part.

polychaetes: a class of segmented marine worms including bristleworms, tube-worms, and fan-worms.

pond hole: a deep panne or low area within a salt marsh that is permanently filled with water; pond holes have nearly vertical walls of salt marsh turf.

pool: in a stream, a portion of the stream that is deep and has a slow current (relative to shallower portions of the stream); the water surface is calm unless disturbed by wind.

poor: describes a nutrient-poor environment; can also be used to describe communities with low species diversity.

ppt: abbreviation for "parts per thousand".

profundal zone: the deep, central area of a lake.

prominent: describes a species with a relatively high percent cover or abundance in a community.

quiet water: calm water, not subject to violent wave action.

relic: a disjunct community, separated by other communities from its main geographical range.

relict: pertaining to surface landscape features that have never been buried and are products of past environments no longer operative in a given area.

remnant: a portion or fragment of a pre-settlement ecological community remaining after the destruction of the bulk of the community by human activities such as agricultural, residential, or commercial development.

rich: describes a nutrient-rich environment; can also be used to describe communities with high species diversity.

riffle: a portion of a stream that is shallow and has a fast current (relative to adjacent deeper portions of the stream). The water surface is disturbed by the current and may form standing waves.

rosette-leaved aquatic: a low-growing aquatic plant with leaves arranged in a circular cluster.

rubble: an accumulation of loose angular rock fragments, commonly overlying a rock outcrop.

run: a portion of a stream that has a moderate to fast current; the water is deep enough that the water surface is smooth and unbroken by the water current (although it may be disturbed by wind).

saline: general term for waters containing various dissolved salts.

salinity: the total amount of solid material in grams contained in 1 kg of water when all the carbonate has been converted to oxide, the bromine and iodine replaced by chlorine, and all the organic matter completely oxidized; here expressed in parts per thousand (ppt) dissolved salts.

sand: composed primarily of coarse-grained mineral sediments with diameters larger than 0.074 mm and smaller than 2 mm.

sandspit: a small point or narrow embankment of land, consisting of sand deposited by longshore drifting and having one end attached to the mainland and the other terminating in open water, usually the sea; a fingerlike extension of the beach.

Secchi disk depth: a measure of the transparency of lake water determined by lowering a round, white or black-and-white disk into the water until it is not visible from above the water.

sedge: a grasslike herbaceous plant in the family *Cyperaceae*, especially a species of the genus *Carex*.

GLOSSARY

seepage: lateral water flow through the soil; it represents an important source of minerotrophic water to a peatland.

semidiurnal tides: tides that occur about every twelve hours, or twice in each tidal day.

shallows: a relatively shallow place in an estuary or other body of water.

shoal: a relatively shallow place in a stream, lake, sea, or other body of water; a shallows.

shrub: a perennial, woody plant that differs from a tree by its low growth form and presence of multiple stems or several branches starting at or near the ground; a shrub is usually less than 16 feet (5 meters) tall at maturity, and usually has several erect, spreading, or prostrate stems and a more or less bushy appearance.

shrubland: a community dominated by woody perennial shrubs, with more than 50% canopy cover of shrubs, and less than 25% canopy cover of trees.

shrublayer: the layer of vegetation in a community that is dominated by shrubs.

shrub-savanna: an upland community with a sparse canopy of trees (from 25 to 60% cover), and a groundlayer that is predominantly shrubby (at least 50% cover of shrubs).

silt: soil composed of fine-grained mineral sediments; particles are intermediate in size between sand and clay (particle sizes between 0.074 and 0.002 mm), and they were carried or laid down as sediment by moving water.

site: a place or location; not used here in the special sense employed by foresters.

slough: a swamp or marsh that is part of an inlet or backwater.

species diversity: the number of species that occur in an area or in a community; species richness; not used in this classification to describe species equitability or the relative abundances of species.

spring ephemeral: spring-flowering plants that emerge and flower in a forest before the leaves of canopy trees are fully grown, and then wither after the canopy leaves shade the forest floor.

spring tide: tides occurring near the time of full or new moon, when the range of tides is greater

than the mean range; the highest high and lowest low tides during the lunar month.

stand: a particular example of a community.

stone: rock fragments larger than 10 inches (25.4 cm) but less than 24 inches (60.4 cm).

stratified: a term that describes the condition of many temperate lakes during summer and winter when layers of water within a lake have different temperatures and different circulation patterns; for example, a summer-stratified lake has an upper, circulating layer of warm water that overlays a lower, cold layer; these layers are separated by a relatively thin transition zone or thermocline.

structure: the spatial arrangement of vegetation layers within a community.

subcanopy: in a forest community, the tops and branches of small trees and tall shrubs that form a distinct layer beneath the tree canopy and above the shrublayer.

sublittoral: the portion of a lake bottom that is intermediate between the peripheral shallows or littoral zone and the deep, cold, dark profundal zone.

submerged aquatic: an aquatic plant, either rooted or non-rooted, which grows entirely beneath the surface of the water, except for the flowering parts in some species; for example, wild celery (*Vallisneria americana*).

substrate: the base material (soil or rocks) in which plants are rooted and from which they obtain nutrients.

subtidal: in tidal wetlands, the permanently flooded area below the lowest tide.

successional: describes communities that are changing relatively quickly as new species, usually more shade-tolerant species, replace the more sun-loving species that initially become established after a site is disturbed.

swamp: a wooded wetland; an area intermittently or permanently covered with water, that has shrubs and/or trees.

talus: rock fragments of any size or shape (usually coarse and angular) derived from and lying at the base of a cliff or very steep, rock slope; the accumulated mass of this loose broken rock formed chiefly by falling, rolling, or sliding.

GLOSSARY

thermocline: the region of rapid temperature transition in a stratified lake.

topography: configuration of the land surface.

tree: a woody perennial plant, usually having one principal stem or trunk, that has a definite crown of branches and leaves, and characteristically reaches a mature height of at least 16 ft (5 m); some species of oak (*Quercus*), juniper (*Juniperus*), willow (*Salix*) and other plants may grow as either trees or shrubs.

tree line: the upper limit of tree growth at high latitudes or at high elevations in mountains; timberline.

upland: sites with well-drained soils that are dry to mesic (never hydric).

understory: the lower layers of vegetation in a community; in a forest community, all the vegetation layers beneath the tree canopy and subcanopy.

vascular plant: plants with a vascular system, including trees, shrubs, and herbs, but not including mosses, lichens, or algae.

vernal: occurring in the spring.

vine: any woody or herbaceous plant which trails, climbs, or creeps as contrasted to those which stand without support.

washover: a deposit of sand caused by storms; washovers occur in low areas along the coast where a barrier usually protects the area from the full force of ocean waves and where storms occasionally cause masses of sand to be carried over the barrier and onto the protected area (such as a marsh, interdunal swale, or lagoon).

watershed: the area drained by a river or river system.

woodland: communities composed of trees with a canopy cover of 26 to 60 percent at maturity. A herbaceous and/or shrub understory is usually present.

xeric: term describing areas with dry, well-drained soils.

APPENDIX C: KEY TO SYSTEMS AND SUBSYSTEMS

The following key is a tool for identification of communities. This key is designed to help you find the appropriate system and subsystem in the classification for an unknown community. The key is arranged as a series of pairs of choices, and each pair is identified by a letter. Starting with the first pair (A and AA), read both choices of the pair, and select the description that most closely fits the community in question. At the end of each choice is the letter that identifies the next pair of choices to consider, or the name of the subsystem. Continue selecting from each subsequent pair of choices until you reach a subsystem.

After you have identified the system and subsystem using this key, read the community descriptions in the main text following the subsystem and select the description that most closely fits the community in question. Keep in mind that there are continuous ecological gradients in the landscape. If an unknown community does not fit well within any one community type described in this classification, it might be best described as intermediate between two community types.

- A. Underground communities that are never exposed to sunlight (SUBTERRANEAN SYSTEM) B
- AA. Above-ground communities that are usually exposed to some sunlight C
- B. Natural caves and cavities in which the structure and hydrology have not been substantially modified by human activities and native species are dominant NATURAL CAVES
- BB. Artificial underground structures or cavities that are either created and maintained by human activities, or are modified by human influence to such a degree that the physical structure, hydrology, and species composition are substantially different from the structure, hydrology, and species composition of the site as it existed prior to human influence SUBTERRANEAN CULTURAL
- C. Aquatic or wetland communities: communities that are in water all year; or have wet soils all year; or are regularly flooded every day (such as flooded by tidal waters); or are regularly flooded at one or more seasons of the year (such as flooded in spring) and have predominantly hydrophytic vegetation and hydric soils D
- CC. Upland communities: communities on soils that are well-drained and never regularly flooded; or on soils that are usually well-drained and not hydric, lack predominantly hydrophytic vegetation, but may be regularly flooded for a short time each year (TERRESTRIAL SYSTEM) R
- D. Tidal aquatic or wetland communities with some direct hydrological connection to the open ocean, and with regular, daily water level fluctuations caused by ocean tides E
- DD. Non-tidal aquatic or wetland communities that are not directly connected to the open ocean, or if directly connected, then upstream from the influence of regular, daily water level fluctuations caused by ocean tides J
- E. Marine communities: aquatic or wetland communities of the open ocean overlying the continental shelf, its associated high-energy coastline, and shallow coastal indentations or bays lacking significant inflow of fresh water, with water salinity exceeding 18.0 parts per thousand (ppt) ocean-derived salts (MARINE SYSTEM) F
- EE. Estuarine communities: aquatic or wetland communities of deepwater tidal habitats and adjacent tidal wetlands that are usually semienclosed but have open, partly obstructed, or sporadic access to open ocean or tidal fresh waters, with water salinity usually less than 18.0 ppt ocean-derived salts (ESTUARINE SYSTEM) H

KEY TO SYSTEMS AND SUBSYSTEMS

- F. Natural marine communities in which the substrate, hydrology, and species composition have not been substantially modified by human activities, or where native species are dominant G
- FF. Disturbed or artificial marine communities that are either created and maintained by human activities, or are modified by human influence to such a degree that the physical structure, hydrology, and species composition are substantially different from the structure, hydrology, and species composition of the site as it existed prior to human influence MARINE CULTURAL
- G. Aquatic marine communities of the subtidal zone, which is permanently flooded with tidal ocean waters, and occurs in the area below the lowest tide where the substrate is continuously submerged by ocean waters MARINE SUBTIDAL
- GG. Marine communities of the intertidal zone, which is located between the highest tide level and the lowest tide level where the substrate is periodically exposed and flooded by semidiurnal tides (two high tides and two low tides per tidal day) MARINE INTERTIDAL
- H. Natural estuarine communities in which the substrate, hydrology, and species composition have not been substantially modified by human activities, or where native species are dominant I
- HH. Disturbed or artificial estuarine communities that are either created and maintained by human activities, or are modified by human influence to such a degree that the physical structure, hydrology, and species composition are substantially different from the structure, hydrology, and species composition of the site as it existed prior to human influence ESTUARINE CULTURAL
- I. Aquatic estuarine communities of the subtidal zone, which is permanently flooded with tidal waters, and occurs in the area below the lowest tide where the substrate is continuously submerged by tidal waters ESTUARINE SUBTIDAL
- II. Estuarine communities of the intertidal zone, which is located between the highest tide level and the lowest tide level where the substrate is periodically exposed and flooded by semidiurnal tides (two high tides and two low tides per tidal day) ESTUARINE INTERTIDAL
- J. Aquatic communities of streams, lakes, or ponds, in those portions of the streams, lakes, or ponds that are characterized by lack of persistent emergent vegetation, although they may have submerged or floating-leaved aquatic vegetation K
- JJ. Wetland communities that are characterized by persistent emergent vegetation, including wetlands that are permanently saturated by seepage, permanently flooded wetlands, and wetlands that are seasonally or intermittently flooded (these may be seasonally dry) if the vegetative cover is predominantly hydrophytic and soils are hydric (PALUSTRINE SYSTEM) N
- K. Aquatic communities of a flowing, non-tidal stream, in portions of the stream that lack persistent emergent vegetation, but may include areas with submerged or floating-leaved aquatic vegetation (RIVERINE SYSTEM) L
- KK. Aquatic communities of a lake or pond in a topographic depression or dammed river channel, in portions of the lake or pond that lack persistent emergent vegetation, but may include areas with submerged or floating-leaved aquatic vegetation (LACUSTRINE SYSTEM) M

KEY TO SYSTEMS AND SUBSYSTEMS

- L. Aquatic communities of streams in which the stream flow, morphometry, and water chemistry have not been substantially modified by human activities, or native species are dominant NATURAL STREAMS
- LL. Aquatic communities of disturbed streams or artificial channels that are either created and maintained by human activities, or are modified by human influence to such a degree that the stream flow, morphometry, and water chemistry are substantially different from the flow, morphometry, and chemistry of the site as it existed prior to human influence RIVERINE CULTURAL
- M. Aquatic communities of lakes and ponds in which the trophic state, morphometry, and water chemistry have not been substantially modified by human activities, or native species are dominant NATURAL LAKES AND PONDS
- MM. Aquatic communities of disturbed or artificial lakes and ponds that are either created and maintained by human activities, or are modified by human influence to such a degree that the trophic state, morphometry, and water chemistry are substantially different from the trophic state, morphometry, and chemistry of the site as it existed prior to human influence LACUSTRINE CULTURAL
- N. Natural wetland communities in which the physical structure of the substrate, hydrology, or species composition is not substantially modified by human activities, or wetlands where native species are dominant O
- NN. Disturbed or artificial wetland communities that are either created and maintained by human activities, or are modified by human influence to such a degree that the physical structure of the substrate, hydrology, and species composition are substantially different from the substrate, hydrology, and composition of the site as it existed prior to human influence; exotic species may be dominant PALUSTRINE CULTURAL
- O. Peatlands: wetlands in which the substrate primarily consists of accumulated peat (partly decomposed plant material such as mosses, sedges, and shrubs) or marl (organically derived or chemically precipitated calcium carbonate deposits), with little or no mineral soil; characterized by continuous saturation of the peat (despite water table fluctuations) caused by either capillary action of the peat or constant water seepage; continuous saturation allows little aeration of the substrate, slowing decomposition of plant litter, and resulting in accumulation of peat or a mixture of peat and marl P
- OO. Wetlands in which the substrate primarily consists of mineral soil, bedrock, or fine-grained organic soils (muck or well-decomposed peat); fluctuating water levels allow enough aeration of the substrate to allow plant litter to decompose, so there is little or no accumulation of peat Q
- P. Peatlands with less than 50% canopy cover of trees; the dominant vegetation may include shrubs, herbs, or mosses OPEN PEATLANDS
- PP. Peatlands with at least 50% canopy cover of trees; the understory may include shrubs, herbs, and mosses FORESTED PEATLANDS

KEY TO SYSTEMS AND SUBSYSTEMS

- Q. Wetlands with less than 50% canopy cover of trees; the dominant vegetation may include shrubs or herbs; substrates range from mineral soils or bedrock, to well-decomposed organic muck OPEN MINERAL SOIL WETLANDS
- QQ. Wetlands with at least 50% canopy cover of trees; the understory may include shrubs, herbs, and mosses; substrates range from mineral soils or bedrock, to well-decomposed organic muck FORESTED MINERAL SOIL WETLANDS
- R. Natural upland communities in which the physical structure of the substrate, or species composition have not been substantially modified by human activities, or where native species are dominant S
- RR. Disturbed or artificial upland communities that are either created and maintained by human activities, or are modified by human influence to such a degree that the physical structure of the substrate, or species composition are substantially different from the substrate and composition of the site as it existed prior to human influence; exotic species may be dominant TERRESTRIAL CULTURAL
- S. Open communities with less than 25% canopy cover of trees; the dominant species are shrubs, herbs, or cryptogammic plants (mosses, lichens, etc.) OPEN UPLANDS
- SS. Wooded communities, with at least 25% canopy cover of trees T
- T. Forests: communities with more than 60% canopy cover of trees; substrates are deep to shallow soils that include less than 50% rock outcrop or very shallow soil over bedrock FORESTED UPLANDS
- TT. Wooded upland communities that are structurally intermediate between forested uplands and open canopy uplands; includes communities with a sparse canopy of trees (25 to 60% cover) and a groundlayer that is predominantly either grassy or shrubby; wooded communities dominated by stunted or dwarf trees (less than 16 ft or 4.9 m tall); and wooded communities with soils that include at least 50% rock outcrop or very shallow soil over bedrock BARRENS AND WOODLANDS

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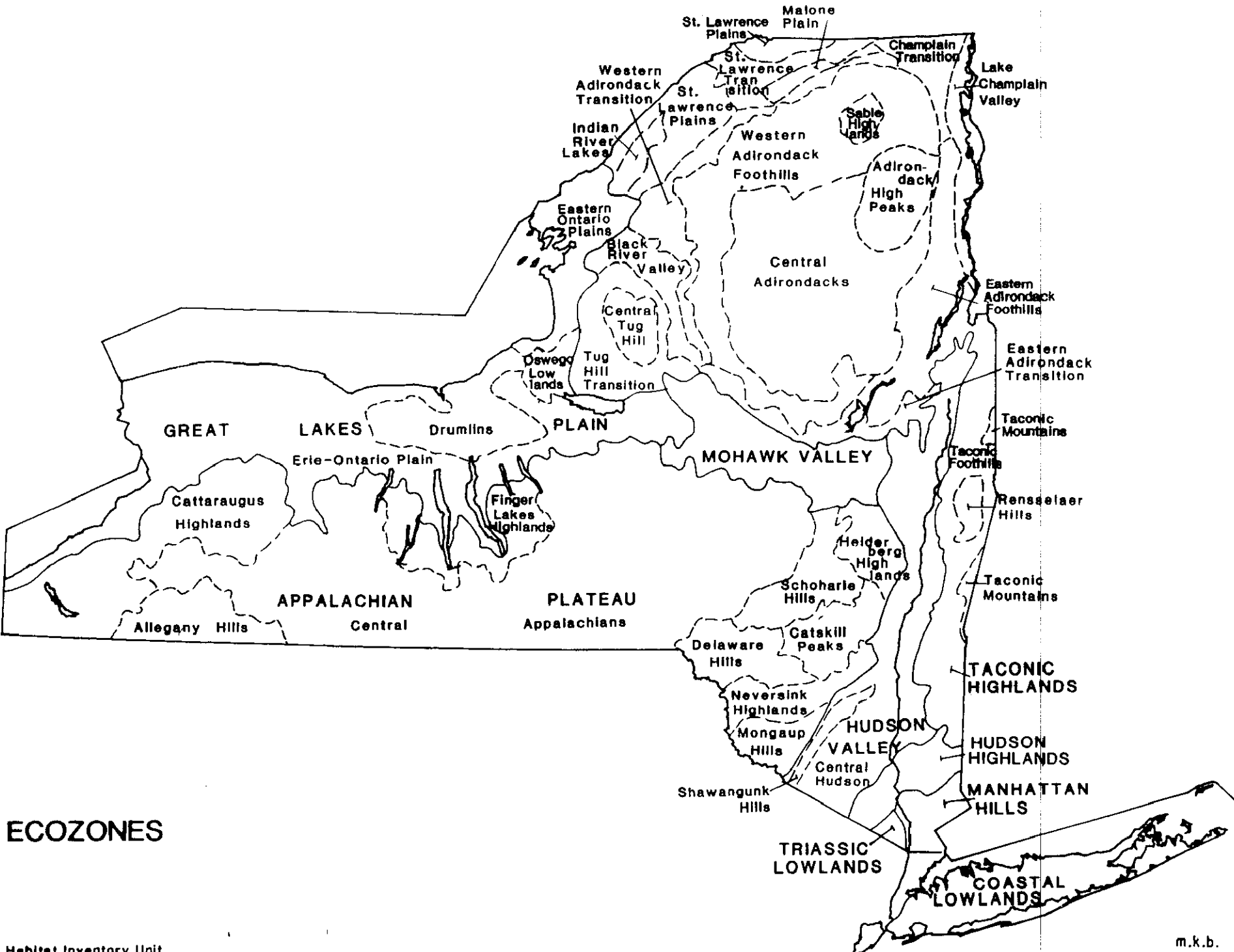
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ECOZONES



COUNTIES OF NEW YORK STATE