

DRAFT

Ecological Communities of New York State

Second Edition

A revised and expanded
edition of Carol Reschke's
*Ecological Communities
of New York State*

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PREFACE

The first edition of *Ecological Communities of New York State* by Carol Reschke was published in 1990 and quickly became the primary source for community classification in the state. Its success and acceptance by a wide range of users was driven by its lofty goal to be an all-inclusive classification intending to fulfill a long-standing need. From communities as large as Lake Ontario to a room-sized vernal pool, from a 50,000 acre beech-maple mesic forest to a 40-acre maritime beech forest, from the highest alpine meadow to the deepest terrestrial cave, the original, and continued, goal of this classification is to include *all* ecological communities of the state, even those created by humans. Since the first edition, several neighboring states and Canadian provinces have published community classifications including Pennsylvania (Fike 1999), Massachusetts (Swain and Kearsly 2000), Vermont (Thompson and Sorenson 2001), New Hampshire (Sperduto 1997, 2000), Maine (Gawler 2000), and Ontario (Chambers et al. 1997, Harris et al. 1996). During that same time, The Nature Conservancy and the Heritage Network have made significant progress toward the publication of a national community classification over the last decade (Grossman et al. 1998, Sneddon et al. 1998). Most of these classifications have benefitted from *Ecological Communities of New York State*, a few are modeled after it, and nearly all of them refer to Reschke (1990). While all of these classifications are impressive works in their own right, and are referred to in this publication, none are intended to be as all inclusive as this classification is for New York State. Some classifications exclude aquatic communities (e.g., riverine and lacustrine), and some exclude subterranean communities. Others may focus on one system, such as wetlands or forests while excluding other systems. Most of the other classifications exclude fauna from their descriptions. And despite the prevalence of human land use in the northeast, *Ecological Communities of New York State* remains the only classification that includes a comprehensive treatment of cultural communities along with the natural types. This allows users of this classification to describe and map nearly any ecological community encountered in the state.

Although this edition includes over two dozen new communities (see Table 1), and revised descriptions for most of the remainder, it is impressive to see how much of the first edition remains unchanged. This attests to the fact that *Ecological Communities of New York State* was thoroughly researched and ahead of its time. The New York Natural Heritage Program was very fortunate to have a published classification to build upon, and to collect data on individual occurrences. In 1989 there were only 480 community occurrences covering less than 100,000 acres in the NY Natural Heritage database, today there are nearly 1,500 occurrences totaling 1,000,000 acres! In that same time the ecology staff grew from one ecologist (Carol Reschke) to six ecologists. Together with our partners we continue to amass data to further refine our classification and describe new communities. As stated in the first edition, “this classification is our current working hypothesis; it will be refined as new data obtained from field surveys and literature review become available.” We have reached a time when the amount of additions and changes to the 1990 classification warranted the publication of this second edition. This edition retains much of the content and format of the original, and although there are a few noticeable changes, we have decided not to do a complete overhaul of the classification. Excellent ideas for improvement, such as the inclusion of photographs, distribution maps, and cross-walks to other classifications will likely be included in future editions.

The next edition of this classification will likely be even more comprehensive and designed to be readily accessible via the Internet. The NY Natural Heritage Program plans to have both editions of *Ecological Communities of New York State* posted on the worldwide web. Check the NYNHP web page for the latest information about the program and our classification (<http://www.nynhp.org>). In addition, we have plans to produce more informative community “fact pages” on the web, that will likely include digital photographs, statewide distribution maps, vegetation coverage data, cross-walks to other classifications, and more. Please send suggestions for improvement of this classification and ideas on what to include in the future to the NY Natural Heritage Program ecologist. No matter what technological means are used to present the information in the future, the descriptions and the classification will be based on the strong foundations of these earlier editions and the network of dedicated ecologists, botanists, and zoologists.

Lastly, this classification system has proven to be a very valuable tool to a wide array of conservation practitioners and land managers in New York. By using this classification to identify locations of high quality natural communities across the state we have raised awareness of their biodiversity significance. In addition, many of the occurrences identified by the NY Natural Heritage Program, and our partners, have resulted in their protection ensuring that a good portion of New York’s natural heritage will persist for future generations to enjoy, study, and appreciate.

Greg Edinger, Ecologist
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PREFACE

Table 1. Summary of new communities and name changes.

<u>System</u>	<u>Subsystem</u>	<u>New Name</u>	<u>Old Name (Reschke 1990)</u>	<u>Comments</u>
Estuarine	Estuarine intertidal	brackish interdunal swales	coast salt pond (in part)	new community differentiated from maritime freshwater interdunal swales
Estuarine	Estuarine cultural	estuarine submerged structure/reef	marine submerged structure/reef (in part)	new community, now recognize estuarine variant
Riverine	Natural streams	confined river	midreach and main channel stream (in part)	reflects current trend in river classification
Riverine	Natural stream	unconfined river	midreach and main channel stream (in part)	reflects current trend in river classification
Riverine	Natural stream	deepwater river	main channel stream	reflects current trend in river classification
Riverine	Natural stream	spring	none	springs were split as ne community from various stream communities
Riverine	Riverine cultural	riverine submerged structure	none	new community, now recognize riverine variant
Lacustrine	Lacustrine cultural	lacustrine submerged structure	none	new community, now recognize lacustrine variant
Palustrine	Open mineral soil	maritime freshwater interdunal swales	maritime interdunal swales	name change, added “freshwater” to split from brackish interdunal swales
Palustrine	Open peatlands	sliding fen	inland poor fen (in part)	new community, split from inland poor fen
Palustrine	Open peatlands	sea level fen	none	new community, freshwater peatland at upper margins of high salt marsh
Palustrine	Forested mineral soil wetlands	red maple-black gum swamp	red maple-hardwood swamp (in part)	new community split from red maple-hardwood swamp, black gum co-dominant
Palustrine	Forested mineral soil wetlands	red maple-sweetgum swamp	red maple-hardwood swamp (in part)	new community split from red maple-hardwood swamp, sweetgum co-dominant
Terrestrial	Open uplands	alvar shrubland	calcareous pavement barrens (in part)	reflects current classification of alvar communities
Terrestrial	Open uplands	alvar pavement-grassland	calcareous pavement barrens (in part)	reflects current classification of alvar communities
Terrestrial	Open uplands	erosional slope/bluff	cliff community (in part)	new community, now recognize unconsolidated substrate variant of cliff community
Terrestrial	Open uplands	successional northern sandplain grassland	successional old field (in part)	new community recognized as grassland bird habitat with sandy substrate and not in maritime setting
Terrestrial	Barrens and woodlands	maritime pitch pine dune woodland	none	new community
Terrestrial	Barrens and woodlands	alvar woodland	limestone woodland (in part)	reflects current classification of alvar communities
Terrestrial	Barrens and woodlands	red pine rocky summit	pitch pine-oak-heath summit (in part)	new community
Terrestrial	Forested uplands	maritime post oak forest	maritime oak forest	name change, added “post” oak to name, now more narrowly defined
Terrestrial	Forested uplands	maritime beech forest	none	new community

Terrestrial	Forested uplands	maritime holly forest	maritime oak-holly forest (in part)	name change and more narrowly defined, split holly dominated variant in maritime setting, compare to coastal oak-holly forest
Terrestrial	Forested uplands	coastal oak-heath forest	pitch pine-oak forest (in part) maritime oak forest (in part)	new community, heath shrubs abundant
Terrestrial	Forested uplands	coastal oak-hickory forest	Appalachian oak-hickory forest (in part), maritime oak forest (in part)	new community, hickory co-dominant
Terrestrial	Forested uplands	coastal oak-beech forest	beech-maple mesic forest (in part) maritime oak forest (in part)	new community, beech co-dominant, compare to maritime beech forest
Terrestrial	Forested uplands	coastal oak-laurel forest	maritime oak forest (in part)	new community mountain laurel abundant
Terrestrial	Forested uplands	coastal oak-holly forest	maritime oak-holly forest (in part)	new community, recognize mixed oak-holly variant in non-maritime setting, compare to maritime holly forest
Terrestrial	Terrestrial cultural	railroad	unpaved/road path (in part)	new community, now separately defined

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This classification has been developed in part from data collected by numerous field biologists. Some of these contributors have worked under contract to the Natural Heritage Program, including Caryl DeVries, Brian Fitzgerald, Jerry Jenkins, Al Schotz, Edith Schrot, Paul Sherwood, Nancy Slack, Dan Smith, Gordon Tucker, and F. Robert Wesley. Present and former Heritage staff who have contributed a significant portion of field data include Peter Zika, Robert E. Zaremba, Lauren Lyons-Swift, Steven Clemants, and the author. Chris Nadareski helped compile long species lists for many communities by entering data from field survey forms into computer files. Robert E. Zaremba provided preliminary draft descriptions of several estuarine intertidal and open upland communities; Raymond Curran provided a draft description of boreal heath barrens. John Ozard provided reliable assistance in resolving computer problems during the preparation of this manuscript, and he produced the county map. The staff of the New York State Museum's Biological Survey has been very helpful in identifying specimens of plants and animals collected during field surveys.

Earlier drafts of this classification have been reviewed by biologists from the Department of Environmental Conservation, Adirondack Park Agency, the Department of State's Coastal Zone Management Program, The Nature Conservancy, private environmental consulting firms, and from several academic institutions in New York State. Any remaining errors or omissions are the responsibility of the author. Thanks to Walt Sabin and Peter Zika for proofreading the final drafts of this manuscript, and to Frank Orsini for designing the cover. Thanks to all the people who reviewed and commented on various drafts of this manuscript, made suggestions regarding classification of communities, and provided a lot of encouragement, including:

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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 work allows us to maintain 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 Coarse Filter/Fine Filter Approach

Heritage inventory methodology works by focusing on the identification, documentation, and mapping of all occurrences of rare species and significant ecological communities. A “coarse filter/fine filter” approach is used to identify and prioritize the protection of these significant biological resources. Ecological communities represent a “coarse filter,” an analysis of biodiversity at a larger scale than the species level. Their identification and documentation can be used to describe whole assemblages of plant and animal species, both common and rare. The conservation of high quality examples of the natural communities assures the protection of most of the species that make up the biological diversity of the state. Rare animals and plants often have narrow or unusual habitat requirements. These species may “fall through” the coarse filter, and sometimes not protected in the representative communities. Identifying and documenting viable populations of each of the rare species serves as the “fine filter” for protecting the state's biological diversity. This coarse filter/fine filter approach to a natural resources inventory is an efficient means of identifying the most sensitive animals, plants, and communities of an area.

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 second edition represents the first major revision to Carol Reschke's *Ecological Communities of New York State* published in 1990.

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

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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 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.

Community Patch Size

Communities can also be classified by their patch size in the landscape as follows:

Matrix communities form extensive cover, often blanketing 80% of the undeveloped land, and covering 100 to 1 million contiguous acres. Important for wide ranging fauna such as large herbivores, predators, forest interior, and migratory birds. May include small and large patch communities.

Large Patch communities may form extensive cover, up to 1000 acres in some places, but usually their boundaries are correlated with single dominant local process such as hydrology or fire regime. Often have a set of characteristic fauna. Nested within matrix communities.

Small patch communities may range from less than one acre up to 50 -100 acres. They occur where a number of local conditions come together in a precise way. Serve as refuges for many rare species. Can be nested within large patch or matrix communities.

Linear communities are usually small patch communities that are many times longer than wide (e.g., shoreline outcrop, maritime beach, etc.).

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 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.

Table 2. Organisms and environmental characteristics used to describe communities within systems.

<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

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.

Community Rarity and Vulnerability (Global Rank and State Rank)

The New York Natural Heritage Program statewide inventory efforts revolve around lists of rare species and all types of natural communities known to occur, or to have historically occurred, in the state. These lists are based on a variety of sources including museum collections, scientific literature, information from state and local government agencies, regional and local experts and data from neighboring states.

Each natural community is assigned a rank based on its rarity and vulnerability. Like all state heritage programs, the New York Natural Heritage Program ranking system assesses rarity at two geographic scales. Each community is assigned a global rank and a state rank. The global rank reflects the rarity of the community throughout its range, whereas the state rank indicates its rarity within New York State. Both of these ranks are usually based on the range of the community, the number of occurrences, the viability of the occurrences, and the vulnerability of the community around the globe or across the state. As new data become available, the ranks may be revised to reflect the most current information. See Appendix A for definitions of global and state ranks used in classification.

Community Occurrence Quality

Community occurrences are assigned ranks based on quality and are evaluated within the context of the known or hypothesized distribution of that particular community. Several ecological and spatial factors must

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be considered when determining the element occurrence rank of a community. These include the occurrence size, maturity, evidence and degree of unnatural disturbance, continued existence of important ecological processes, overall landscape context, and existing and potential threats. A-ranked community occurrences are among the largest and highest quality of their type. These community occurrences should be large enough to provide reasonable assurance for long-term viability of component ecological processes. They are essentially undisturbed by humans or have nearly recovered from past human disturbance, typically exhibiting little or no unnatural fragmentation. Exotic or particularly invasive native species are usually lacking in high quality community occurrences, or, if present, are observed at very low levels.

There are three rank factors, each reflecting what is currently known (in an ideal situation) about an occurrence: size, condition, and landscape context. These factors are used as a basis for estimating the viability of an occurrence (i.e., its element occurrence rank. Thus:

$$\text{Size} + \text{Condition} + \text{Landscape Context} \Rightarrow \text{Estimated Viability} = \text{EO Rank}$$

Occurrence **size** varies as a function of both natural and anthropogenic factors. Larger occurrences are generally presumed to be more valuable for conservation purposes, all other rank factors being equal. Larger occurrences are typically less influenced by edge effects, and less susceptible to degradation or extirpation by stochastic events. Larger occurrences are generally more stable and resilient.

Condition is an integrated measure of the quality of biotic and abiotic factors, structures, and processes *within* the occurrence, and the degree to which they affect the continued existence of the occurrence.

Landscape context is an integrated measure of the quality of biotic and abiotic factors, structures, and processes *surrounding* the occurrence, and the degree to which they affect the continued existence of the occurrence.

These factor help determine an element occurrence rank which range from "A" for an outstanding or pristine example to "D" for a poor quality or degraded example.

Table 3. Explanation of element occurrence quality ranks used Natural Heritage database reports.

A	EXCELLENT
B	GOOD
C	MARGINAL
D	POOR

E	EXTANT
F	FAILED TO FIND. Not found at the previously documented site, or more thorough searching needed.
H	HISTORICAL. No recent field information.
X	EXTIRPATED. Believed to longer exist.

Significant Natural Community Occurrences

"Significant" natural communities are determined using occurrence quality ranks in conjunction with global and state rarity ranks (Table 3). In this way, communities are documented and mapped in the Heritage Program databases if they are either rare in New York State or are an outstanding example of a more common natural community. 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. Cultural communities are not considered significant and are therefore not tracked by the Heritage Program.

Table 4. Criteria used by Heritage programs to determine significant communities.

<u>Element Rarity Rank</u>	<u>Element Occurrence Rank</u>
G1, G2 or S1	all occurrences ranked A-D
G3 or S2	all occurrences ranked A-C
G3G4 or S3	all occurrences ranked A-BC
G4, G5 or S4, S5	all occurrences ranked A-B

For most 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 (NYNHP) 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 "NYNHP 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

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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 different spellings). This area is within the "Allegany 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 and Tucker (1997) 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 ecologist at the following address:

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INTRODUCTION

New York State Department of Environmental Conservation
George Pataki, *Governor* Erin Crotty, *Commissioner*

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COVER PHOTOGRAPHS (TO BE UPDATED)

Front cover:

Pines reflected in the glassy surface of Lowery Pond, a meromictic lake that is one of the Junius Ponds, Seneca County.

Back cover, top left:

A small patch of alpine krummholz in the alpine meadow near the summit of Algonquin Peak, Essex County.

Back cover, top right:

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

Back cover, bottom left:

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.

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 *benthic* substrate types (ranging from rock bottom to unconsolidated bottom), as well as the overlying water column, or *pelagic* component.

Fish typical of the nearshore zone of the Atlantic Ocean include Atlantic menhaden (*Brevoortia tyrannus*), weakfish (*Cynoscion regalis*), striped bass (*Morone saxatilis*), winter flounder (*Pleuronectes americanus*), summer flounder (*Paralichthys dentatus*), bluefish (*Pomatomus saltatrix*), tautog (*Tautoga onitis*), Atlantic mackerel (*Scomber scombrus*), black sea bass (*Centropomus striata*), Atlantic croaker (*Micropogonias undulatus*), northern kingfish (*Menticirrhus saxatilis*), spot (*Leiostomus xanthurus*), American sand lance (*Ammodytes americanus*), and silversides (*Menidia menidia*). Large quantities of surf clam (*Spisula solidissima*) inhabit the nearshore benthos. Marine sea turtles that use the nearshore zone during migration include Atlantic (Kemp's) ridley turtle (*Lepidochelys kempii*), leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), and loggerhead sea turtles (*Caretta caretta*). The nearshore zone provides winter habitat for harbor seal (*Phoca vitulina*), and gray seal (*Halichoerus grypus*). Other frequently observed marine mammals include finback (*Balaenoptera physalus*), minke (*B. acutorostrata*), and humpback (*Megaptera novaeangliae*) whales. Several dolphin species, including common (*Delphinus delphis*), bottlenosed (*Tursiops truncatus*), white-sided (*Lagenorhynchus acutus*), and striped (*Stenella coerulealba*), as well as pilot whales (*Globicephala melaena*), are often encountered. Ocean quahog (*Artica islandica*) is the dominant species in the deeper silty-sand area, and other dominant taxa include echinoderms, annelids, and arthropods (USFWS 1996).

Distribution: in the open ocean surrounding Long

Island, in the Coastal Lowlands ecozone.

Rank: G5 S5

Revised: 2001

Source: Brown 1993; Cowardin et al. 1979; USFWS 1996; Waller 1996.

2. Marine eelgrass meadow: a community of subtidal aquatic beds dominated or codominated by eelgrass (*Zostera marina*) and typically occurring in quiet shallow polyhaline (18 to 30 ppt salinity) waters of temperate tidal embayments below the lowest tide level where fluctuations in salinity are minor.

Characteristic associated plants include a diverse array of attached (rooted and epiphytic) and unattached (suspended) marine algae. Rooted red algae are especially common including graceful red weed (*Gracilaria tikvahiae*), tubed weed (*Polysiphonia denudata*), Grinnell's pink leaf (*Grinnellia americana*), Agardh's red weed (*Agardhiella subulata*), *Rhodomela confervoides*, pod weed (*Chondria baileyana*), *Spyridia filamentosa*, banded weed (*Ceramium* sp.), and rough tangle weed (*Stilophora rhizoides*). Abundant and characteristic epiphytic marine algae include barrel weed (*Champia parvula*), tubed weed (*Polysiphonia stricta*), *Cladophora sericea* and *Pneophyllum fragile*. Other associated marine algae include the green algae sea lettuce (*Ulva lactuca*), hollow green weed (*Enteromorpha* spp.), *Cladophora gracilis*, and the brown algae gulfweed (*Sargassum filipendula*). A common exotic species is the marine green algae, green fleece (*Codium fragile*).

Characteristic animals include fish such as fourspine stickleback (*Apeltes quadracus*), mummichog (*Fundulus heteroclitus*), northern pipefish (*Syngnathus fuscus*), threespine stickleback (*Gasterosteus aculeatus*), silversides (*Menidia* spp.), naked goby (*Gobiosoma boscii*), menhaden (*Brevoortia tyrannus*), winter flounder (*Pseudopleuronectes americanus*), and northern puffer (*Sphoeroides maculatus*), marine mollusks such as bay scallop (*Aequipecten irradians*), common Atlantic slippershell (*Crepidula fornicata*), and northern quahog (*Mercenaria mercenaria*), crustaceans such as nine-spine spider crab (*Libinia emarginata*), mud crabs (e.g., *Dyspanopeus sayi*, *Panopeus herbstii* and *Rithropanopeus harrisi*), and broken-back shrimp (*Hippolyte pleurocantha*), and other marine invertebrates such as short-spine brittle star (*Ophioderma brevispina*), bamboo worms (Polychaeta), and counterclockwise coiled worm (*Spirobis spirillum*). Comb jellies (*Beroe* sp., *Mnemiopsis leidyi*) are common plankton species. Waterfowl known to extensively feed on eelgrass include brant (*Branta bernicla*) and American black duck (*Anas rubripes*) (Good et al. 1978). Plant species

composition is known to vary with different rates of exchange with marine waters. As salinity decreases eelgrass beds may grade into brackish subtidal aquatic beds dominated by widgeon grass (*Ruppia maritima*) (Macomber et al. 1979). Eelgrass meadows are highly productive, provide habitat for a rich variety of marine organisms, and enhance sediment stability. They typically occur on sands to sandy loam soils at 0.6-4.5 m (2 to 15 ft) below mean sea level.

More data on other marine shallow water communities with very little or no eelgrass are needed (e.g., marine macroalgae beds).

Distribution: in the ocean surrounding Long Island, in the Coastal Lowlands ecozone. Known from the outer Peconic Estuary and multiple bays on the south shore of Long Island including Great South Bay and Shinnecock Bay. Small occurrences are suspected from bays on Staten Island and along the north shore of Long Island bordering Long Island Sound.

Rank: G5 S3

Revised: 2001

Example: Gardiners Bay Shelter Island, Suffolk County; Gardiners Island East Shore, Suffolk County; Shinnecock Bay, Suffolk County; Great South Bay, Suffolk County.

Sources: Briggs and O'Connor 1971; Brown 1993; Cashin Associates, P.C. 1996; Dumais et al. 1999; Good et al. 1978; Macomber et al. 1979; Muenscher 1939; Strieb et al. 1995; Thayer et al. 1984; Thorne-Miller et al. 1983; NYNHP field surveys.

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*, *Lumbrinereis 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

Revised: 1990

Sources: Brown 1993; Townes 1939; Whitlatch 1982.

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 *Acanthohaustrorius millsi*). 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

Revised: 1990

Examples: Mashomack Preserve, Suffolk County; Jones Beach, Nassau County; Fire Island, Suffolk County; Montauk Point, Suffolk County.

Sources: Brown 1993; Townes 1939; Whitlatch 1982.

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 can withstand 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

Revised: 1990

Examples: Fishers Island, Suffolk County; Montauk

Point and south shore of Montauk Peninsula, Suffolk County; Napeague Bay, Suffolk County; Huckleberry Island, Westchester County.

Sources: Brown 1993; Conard 1935; Künstler and Capainolo 1987; NYNHP field surveys.

C. MARINE CULTURAL

This subsystem includes communities that are either created and maintained by human activities, or 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, submerged bridge abutments, or any other introduced material that provides suitable habitat.

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

Rank: G5 S5

Revised: 1990

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

Revised: 1990

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 to reduce erosion.

Characteristic organisms are attached algae, mussels, and barnacles; percent cover and species diversity are low compared with a marine rocky intertidal community.

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

Rank: G5 S5

Revised: 1990

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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 2 m (6 ft) deep at low tide, the shallow zone includes submerged areas less than 2 m (6 ft) 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*). Rare deepwater species of the Hudson River include sturgeon (*Acipenser brevirostrum*, and *A. oxyrinchus*). 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*).

Smaller tidal rivers on Long Island flow into "tidal bays," or "backbarrier lagoons," before reaching the

ocean. Backbarrier lagoons are bodies of water that are protected from oceanic forces by barrier islands. Wave action is less significant in these enclosed water bodies than on the ocean beach, and the primary influences on backbarrier sediment are the rise and fall of the tides and activities of organisms (Leatherman 1979). Tidal bays and backbarrier lagoons may include various marine and estuarine communities, such as marine eelgrass meadow, marine intertidal mudflats, and salt marshes. More data on tidal bays and backbarrier lagoons are needed.

Distribution: in the Hudson Valley and Coastal Lowlands ecozones.

Rank: G4 S3

Revised: 2001

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

Source: Gladden et al. 1988; Leatherman 1979; Oertel 1985; Oertel et al. 1992.

2. Tidal creek: the aquatic community of a shallow, continuously semidiurnally tidally flooded creek with submerged areas averaging less than 2 m (6 ft) deep at low tide. The water is typically brackish to saline, but the community can range from freshwater (0 to 0.5 ppt salinity), to brackish (0.5 to 18 ppt), to saline (18 to 30 ppt or greater). Varying depth zones and flow microhabitats often result in a diverse array of ecological associations. Water levels fluctuate with the tides and two community depth zones are typically encountered: 1) the subtidal, permanently flooded, portion of the creek and 2) the intertidal portion including banks and midchannel bars or terraces exposed at low tide. Typical flow microhabitats in a fully-developed creek include abundant slow-flowing pools connected by runs with localized turbulent, fast-flowing riffles. Typical examples drain the waters of semidiurnally tidally flooded marshes and most of these marshes are coastal salt marshes of the back barrier or finger marsh type. Most tidal creeks flow in a very sinuous (i.e., meandering) pattern through a 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.

Widgeon-grass (*Ruppia maritima*) is abundant in brackish to saline tidal creeks. Common epiphytic plants include the marine red algae tubed weed

(*Polysiphonia stricta*) and banded weed (*Ceramium strictum*). Other characteristic plants are the marine red algae tubed weed (*Polysiphonia denudata*), graceful red weed (*Gracilaria tikvahiae*), and *Spyridia filamentosa* and several cyanobacteria including *Hydrocoleum lyngbaceum*, *Anabaena torulosa*, and *Agmenellum quadruplicatum*.

Fauna in tidal creeks are diverse. Several fishes that are resident in brackish to saline 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*). Brackish to saline tidal creeks are also utilized as nursery areas for several important marine fishes, including winter flounder (*Pseudopleuronectes americanus*), black sea bass (*Centropomus striata*), bluefish (*Pomatomus saltatrix*), and striped bass (*Morone saxatilis*). Great blue heron (*Ardea herodias*) and egrets commonly feed on the fish. Comb jellies (*Beroe* spp., *Mnemiopsis* spp.) are common plankton species. Common benthic epifauna include eastern mud snail (*Nassarius obsoletus*), daggerblade grass shrimp (*Palaemonetes pugio*), longwrist hermit crab (*Pagurus longicarpus*), and common Atlantic slippershell (*Crepidula crepidula*). Common benthic infauna include northern quahog (*Mercenaria mercenaria*), softshell clam (*Mya arenaria*), razor clam (*Ensis directus*), and bamboo worms (Polychaeta). Other characteristic marine invertebrates include blue crab (*Callinectes sapidus*), hairy sea cucumber (*Sclerodactyla briareus*), Atlantic horseshoe crab (*Limulus polyphemus*), acorn worm (Hemichordata) and terbelid worm (*Amphitrite* spp.).

Tidal creek pools have silty substrate with abundant beds of widgeon grass and tubed weed and the characteristic fauna hairy sea cucumber, American eel, grass shrimp, and eastern mud snail. Runs have sandy to gravelly substrate supporting the marine algae species tubed weed, graceful red weed, and green fleece (*Codium fragile*), a common exotic marine green algae, benthic marine fish such as naked goby (*Gobiosoma boscii*) and northern pipefish (*Syngnathus fuscus*), and many marine mollusks. Riffles have gravelly to cobbly bottoms with macroalgae beds of hollow green weed (*Enteromorpha* spp.), benthic marine fish such as naked goby and marine mollusks such as common Atlantic slippershell. Intertidal peaty banks of creeks in salt marshes, especially in pools and runs, are characterized by abundant ribbed mussel (*Modiolus demissus*), mummichog, and killifish.

Freshwater variants of tidal creeks, that drain

freshwater tidal marshes, such as those found along the Hudson River, are included here. More data on this community variant are needed.

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

Revised: 2001

Examples: Bass Creek, Suffolk County; Hubbard Creek Marsh, Suffolk County; Mashomack Creek, Suffolk County.

Sources: Kiviat and Stevens 2001; 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 2 m (6 ft) deep at low tide.

Characteristic species are sago pondweed (*Potamogeton pectinatus*), horned pondweed (*Zannichellia palustris*), waterweed (*Elodea nuttallii*), coontail (*Ceratophyllum demersum*), naiad (*Najas guadalupensis*), and widgeon grass (*Ruppia maritima*). A common weedy exotic is Eurasian milfoil (*Myriophyllum spicatum*).

As salinity increase downstream brackish subtidal aquatic beds may grade into marine eelgrass meadows dominated by eelgrass (*Zostera maritima*) (Macomber et al. 1979).

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

Revised: 2001

Examples: Piermont Marsh, Rockland County; Carmans River, Suffolk County.

Sources: Kiviat and Stevens 2001; Macomber et al. 1979; 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 2 m (6 ft) deep at low tide.

Characteristic species are tapegrass, or wild celery

(*Vallisneria americana*), pondweed (*Potamogeton perfoliatus*), waterweed (*Elodea nuttallii*), and naiads (*Najas guadalupensis*, and *N. minor*). Two exotic weeds, Eurasian milfoil (*Myriophyllum spicatum*) and water-chestnut (*Trapa natans*), are common in the Hudson River aquatic beds.

A characteristic bird that feeds on the subaquatic vegetation is the canvasback (*Aythya valisneria*). Other birds that feed on plants, fish and invertebrates in the vegetated shallows include bufflehead (*Bucephala albeola*), common goldeneye (*B. clangula*), common merganser (*Mergus merganser*), and greater scaup (*Aythya marila*). Wading birds such as snowy egret (*Egretta thula*), and great blue heron (*Ardea herodias*) have been frequently observed feeding in freshwater aquatic beds at low tide.

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

Rank: G4 S3

Revised: 1990

Sources: Findlay et al. 1997; Kiviat and Stevens 2001; Metzler and Rosza 1982; Muenscher 1937; Schmidt and Kiviat 1988.

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. Brackish meadow: a moist, moderately well-drained brackish (0.5-18 ppt) perennial grassland with occasional isolated shrubs that is typically situated in a belt at the upper edge of salt marshes bordering sandy uplands, but may occupy large portions of interdunal basins. The community usually develops in areas with a unique combination of soils and hydrology, on deep deposits of periodically windblown or overwashed gleyed sands that are usually flooded only during spring tides and during major coastal storms, approximately two to three times per year. Periodic sand deposition and volatilized saltwater deposition are thought to prevent dominance by tall shrubs via burial and top killing of shrubs. Soil salinity over long periods of time is relatively low but may show vast fluctuations over short periods of time, producing a constantly

stressed environment. Salinity is periodically raised by the regular cycling of tides, inundation during spring tides and storm surges, and volatilized saltwater deposition. Salinity is periodically lowered by dilution from rainwater and the presence of a thin fresh groundwater lens elevated over the underlying saltwater.

The meadow is dominated by halophytic wetland to facultative perennial graminoids and ephemeral herbs. Dominant species include switchgrass (*Panicum virgatum*), salt-meadow grass (*Spartina patens* "var. *monogyna*"), and sedge (*Carex silicea*). Other graminoids present may include little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardii*), spikegrass (*Distichlis spicata*), knotroot bristlegrass (*Setaria parviflora*), purple lovegrass (*Eragrostis spectabilis*), Virginia wild rye (*Elymus virginicus*), panic grass (*Panicum amarum*), twig-rush (*Cladium mariscoides*), cyperus (*Cyperus polystachyos*, *C. dentatus*), three-square (*Scirpus pungens*), and black grass (*Juncus gerardii*).

Characteristic herbs include whorled milkwort (*Polygala verticillata*), seaside goldenrod (*Solidago sempervirens*), buttonhead goldenrod (*Euthamia tenuifolia*), seaside gerardia (*Agalinis maritima*), pinks (*Sabatia* spp.), tall wormwood (*Artemisia campestris* ssp. *caudata*), asters (*Aster* spp.), and wild germander (*Teucrium canadense*). Indicator herbaceous species at low abundance may include New England blazing star (*Liatris scariosa* var. *novae-angliae*), sedge (*Fimbristylis castanea*), salt marsh plantain (*Plantago maritima* ssp. *juncoides*), evening primrose (*Oenothera parviflora* var. *oakesiana*), and crabgrass (*Digitaria filiformis*). Sparse dwarf shrubs may include groundsel-tree (*Baccharis halimifolia*), bayberry (*Myrica pensylvanica*), and beach-plum (*Prunus maritima*). The community is prone to weedy exotic species such as red fescue (*Festuca rubra*), and soapwort (*Saponaria officinalis*). Floristic composition can fluctuate dramatically over several years in response to the fluctuating soil salinities.

Characteristic fauna include fiddler crabs (*Uca pugnator* and *U. pugnax*). The community usually occurs in close association with salt shrub and at slightly higher elevation than high salt marsh. It may develop into high salt marsh after occupation by *Spartina patens* and development of a peat layer in response to a more regular tidal influence.

Distribution: Restricted to the estuarine portion of the Coastal Lowlands ecozone. Expected to be scattered along the shore of Long Island, concentrated on the south shore, especially the South Fork of Long Island. May also occur on Staten Island.

Rank: G2G3 S1S2

Revised: 2001

Examples: Walking Dunes, Suffolk County; Napeague Meadows, Suffolk County.

Sources: Johnson 1985; Nixon 1982; NYNHP field surveys.

2. 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 (soil pore salinity ranges 7 ppt to 27 ppt); and the elevation is higher. Salt shrub does not usually develop on deep peat. More often, it occurs on a thin (0-10 cm) layer of peat, and soils share characteristics of both estuarine and maritime terrestrial settings. 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*), black-grass (*Juncus gerardii*), and switchgrass (*Panicum virgatum*) are typical herbs. Salt shrub is almost always dominated by *Iva frutescens* on the marshward edge of the community, often forming a stunted leading edge of the community. *Baccharis halimifolia* only becomes more dominant in the older, more developed, landward side. The landward side of salt shrub is usually the most diverse. A characteristic animal is marsh wren (*Cistothorus palustris*).

Salt shrub is usually present as a linear feature at the upper edge of a salt marsh marking the limit of the highest spring and storm tides within a given estuarine basin. In areas where the local topography is nearly level an extensive shrubland or brackish meadow may occur.

Distribution: in sheltered areas of the seacoast in the Coastal Lowlands and Manhattan Hills ecozones. Best examples of salt shrub are within the Peconic Bay, but also along the south shore of Long Island where it is often invaded by *Phragmites australis*. Salt shrub is poorly developed along the north shore where tidal areas are steep.

Rank: G5 S4

Revised: 2001

Examples: Hubbard Creek Marsh, Suffolk County; Northwest Creek, Suffolk County; Orient Point Marsh, Suffolk County; Cow Neck Marsh, Suffolk County; Mashomack Point Marsh, Suffolk, County.

Sources: Clark 1985; Clark 1986a; Conard 1935; Hayden et al. 1995; MacDonald and Edinger 2000; Nixon 1982; Redfield 1972; NYNHP field surveys.

3. 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 (15 to 30 cm tall) of cordgrass (*Spartina alterniflora*); also common are large areas dominated by spikegrass (*Distichlis spicata*), black-grass (*Juncus gerardii*), and glassworts (*Salicornia* spp.), 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*), seaside gerardia (*Agalinus maritima*), 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 (*Sturnella 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 and brackish meadow at the upland border of the high marsh; sea level fen in rare cases associated with freshwater seepage at the landward edge; 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.

High salt marshes can be further classified by landform type following Oertel and Woo (1994) into mainland fringe-marshes, mid-lagoon marshes, and backbarrier fringe-marshes.

Distribution: in sheltered areas of the seacoast in the Coastal Lowlands and Manhattan Hills ecozones. High salt marsh is best developed in the Peconic Bay and along the south shore of Long Island.

Rank: G4 S3S4

Revised: 2001

Examples: Hubbard Creek Marsh, Suffolk County; Northwest Creek, Suffolk County; Fire Island Wilderness, Suffolk County; Orient Point Marsh, Suffolk County; Wading River Marsh, Suffolk County; Hempstead Bay Wetlands, Nassau County.

Sources: Clark 1985; Clark 1986a; Conard 1935;

MacDonald and Edinger 2000; Niedowski 2000; Nixon 1982; Oertel and Woo 1994; Redfield 1972; US ACE 1995, 1999; NYNHP field surveys.

4. 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. Salt pannes can be formed by ponding of water on the marsh surface, scouring of wrack or coverage by storm wrack, and possibly by ice scour. Salt panne formation appears to be favored by a mean tidal range of about 20-80 cm and are poorly developed in settings with a mean tidal range greater than 1.6 m.

Characteristic plants of a salt panne include the dwarf form (15 to 30 cm tall) of cordgrass (*Spartina alterniflora*), glassworts (*Salicornia europaea* and *S. virginica*), marsh fleabane (*Pluchea odorata*), salt marsh plantain (*Plantago maritima* ssp. *juncooides*), arrow-grass (*Triglochin maritimum*), spikegrass (*Distichlis spicata*), and salt marsh sand spurry (*Spergularia marina*). High salt marsh communities that are dominated by the dwarf form of *Spartina alterniflora* appear to support larger, better developed pannes than marshes dominated by *S. patens* and *Distichlis spicata*. 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*). The salt pannes on the south shore of Long Island are intensely used by feeding shorebirds.

More data on the pond-like variant dominated by *Ruppia maritima* are needed. Comparison of this community with coastal salt pond needs to be made.

Distribution: in salt marshes along the seacoast of the Coastal Lowlands ecozone. Salt pannes are best developed on the south shore of Long Island, especially in areas of low mean tidal range. They are poorly developed in the Peconic Bay and very poorly developed on the north shore of Long Island.

Rank: G3G4 S3

Revised: 2001

Examples: Gilgo Beach Backbarrier Marsh, Suffolk County; Hubbard Creek Marsh, Suffolk County; Northwest Creek, Suffolk County; Hempstead Bay Wetlands, Nassau County.

Sources: Egler 1950; MacDonald and Edinger 2000; Miller and Egler 1950; Niedowski 2000; Nixon 1982; Redfield 1972; NYNHP field surveys.

5. 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 2 m (6 ft) below mean high tide. It is regularly flooded by semidiurnal tides. The mean tidal range of low salt marshes on Long Island is about 80 cm, and they often form in basins with a depth of 1.6 m or greater.

The vegetation of the low salt marsh is a nearly monospecific stand of cordgrass (*Spartina alterniflora*), a coarse grass that grows up to about 3 m (10 ft) tall. Salt marshes with large tidal ranges are often dominated by the tall form of *Spartina alterniflora*, while those with more restricted tidal ranges will maintain a short form *Spartina alterniflora* zone and grade into high salt marsh (Niedowski 2000). 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 hollow green weeds (*Enteromorpha* spp.) 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 pugilator* and *U. pugnax*) nesting along creek banks, ribbed mussel (*Geukensia dimissa*), 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 into intertidal mudflats at slightly lower elevations. Tidal creeks that drain the salt marsh flow in a sinuous pattern through the marsh, with a narrow band of low marsh lining 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. Low salt marsh is well-developed on the south shore of Long Island, and within the small basins of the north shore where it is the dominant community type. Although it is very degraded, about one-half of the total marsh acreage at Jamaica Bay on the south shore is low salt marsh.

Rank: G4 S3S4

Revised: 2001

Examples: Hubbard Creek Marsh, Suffolk County; Northwest Creek, Suffolk County; Lloyd Neck Marsh, Suffolk County; Nissequogue River, Suffolk County; Westhampton Island-Tiana Beach, Suffolk County; Flax Pond, Suffolk County; Hempstead Bay Wetlands, Nassau County.

Sources: Clark 1985, 1986a; Conard 1935; Dreyer and Niering 1995; Houghton and Woodwell 1980; Joneja 1981; MacDonald and Edinger 2000; Niedowski 2000; Nixon 1982; Redfield 1972; Spinner 1969; Teal 1986; US ACE 1995, 1999; NYNHP field surveys.

6. Coastal salt pond: A community inhabiting marine shoreline lakes or ponds formed by sandspits that close off a lagoon or bay. The water typically averages brackish or slightly brackish over long periods of time, but may range rapidly from fresh to saline. 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. Two community microhabitats are typically encountered within one pond complex: 1) the “pond” or aquatic portion of the complex and 2) the “shore” or the non-aquatic part of the complex. These two microhabitats are likely to warrant separate communities and may soon be distinguished in a future version of the state community classification: the former retaining the name “coastal salt pond,” the latter designated as a “coastal salt pond shore.”

Dominant plants of the pond can vary considerably with the frequency of exchange of marine waters. Typical ponds are dominated by the submergent vascular plant widgeon grass (*Ruppia maritima*) and the marine red algae tubed weed (*Polysiphonia* spp.). Other characteristic plants of the pond include the marine green algae *Cladophora* spp. Marine algae are often less frequent in more saline examples. Needle spikerush (*Eleocharis acicularis*) is typical of temporarily flooded edges of ponds. Brackish ponds may contain flora typical of brackish subtidal aquatic beds including sago pondweed (*Potamogeton pectinatus*), clasping-leaved pondweed (*Potamogeton perfoliatus*), and horned pondweed (*Zannichellia palustris*). Four pond associations have been listed by

Thorne-Miller (1983) including widgeon grass beds, marine green algae beds, tubed weed beds and sago pondweed beds.

Characteristic pond fauna include multiple species of grass shrimp (e.g., *Palaemonetes* spp.), and the estuarine minnows mummichog (*Fundulus heteroclitus*), sheepshead minnow (*Cyprinodon variegatus*), silversides (*Menidia* spp.), and various killifish. Coastal waterbirds in the heron family (Ardeidae) including great blue heron (*Ardea herodias*) and egrets feed on the fish.

The pond shore typically consists of an assemblage of up to several narrow zones floristically resembling other estuarine community types. Along a wet to dry moisture gradient and low to high elevation gradient, these community types may include: intertidal mudflats, low salt marsh, high salt marsh, salt panne, salt shrub and brackish meadow. Similar zones resembling palustrine communities may occur in examples with freshwater.

Characteristic species of the pond shore are dwarf spikerush (*Eleocharis parvula*), switchgrass (*Panicum virgatum*), salt-meadow grass (*Spartina patens*), cordgrass (*Spartina alterniflora*), reedgrass (*Phragmites australis*), saltmarsh fleabane (*Pluchea odorata*), three-square (*Scirpus americanus*), rose-mallow (*Hibiscus moscheutos*), pigweeds (*Chenopodium* spp.), mock bishop's-weed (*Ptilimnium capillaceum*), spikegrass (*Distichlis spicata*), saltmarsh-elder (*Iva frutescens*), and groundsel-tree (*Baccharis halimifolia*). Abundant pondshore fauna include saltmarsh mosquitoes (*Aedes* spp.). Other characteristic pondshore fauna include green-headed fly (*Tabanus nigrovittatus*) and planthoppers (*Prokelisia marginata*).

Distribution: along the seacoast in the Coastal Lowlands ecozone.

Rank: G4 S1S2

Revised: 2001

Examples: Oyster Pond, Suffolk County; Tobaccot Pond, Suffolk County.

Source: Harlin et al. 1995; Thorne-Miller et al. 1983; NYNHP field surveys.

7. Brackish interdunal swales: temporarily tidally flooded temperate marshes in interdunal swales dominated by halophytic graminoids. Individual swales occur as small patches positioned between fore-, primary and secondary dunes in a maritime dunes system, typically on barrier islands. Swales experience dynamic fluctuations in water levels and salinity. Water levels are highest after infrequent and sporadic overwash that occurs when tides or waves overtop the

berm, transporting water and suspended sand through the foredune into low-lying areas within the dune system, usually during spring tides, full moons or major storms. Flood frequency can vary from several times per year to as little as once every 25 years. At this time groundwater levels rise, vegetation may float, and water pools into temporary ponds. During the driest times, ponds evaporate, surface sands are no longer saturated, salt concentrates then enters the groundwater, and salt deposits form on the surface. Salinity is typically mixohaline, water being derived from a mix of saline ocean overwash and freshwater groundwater lens. However, it can vary greatly at certain times of the year from oligohaline (0 ppt) to supersaline (70 ppt) in response to the salinity of the groundwater and accumulation of salt during evaporation.

The dominant flora are mostly grasses, sedges and rushes including salt-meadowgrass (*Spartina patens*), dwarf spikerush (*Eleocharis parvula*), three-square (*Scirpus pungens*), flatsedge (*Cyperus polystachyos*), and jointed rush (*Juncus articulatus*). The abundance of any one dominant can vary widely year to year in response to salinity fluctuations. Other characteristic flora includes halophytes such as salt-meadow grass (*Diplachne maritima*), seaside bulrush (*Scirpus maritimus*), toad-rush (*Juncus bufonius* var. *halophila*), sedge-rush (*Juncus scirpoides*), mock bishop's-weed (*Ptilimnium capillaceum*), golden dock (*Rumex maritimus*), saltmarsh aster (*Aster subulatus*), red pigweed (*Chenopodium rubrum*), saltmarsh fleabane (*Pluchea odorata*), rose-mallow (*Hibiscus moscheutos*), knotweed (*Polygonum ramosissimum*), and saltmarsh-elder (*Iva frutescens*). Seabeach amaranth (*Amaranthus pumilus*) is a characteristic plant at the upper edge of the community in drift lines. Reedgrass (*Phragmites australis*) is questionably native in this community.

The community is known for its importance to wildlife. Characteristic fauna include piping plovers (*Charadrius melodus*), American oyster catchers (*Haematopus palliatus*), yellowlegs (*Tringa melanoleuca* and *T. flavipes*), and Canada geese (*Branta canadensis*) (which use the community as a foraging ground), abundant salt marsh mosquitoes (*Aedes* spp.), fiddler crabs (*Uca* spp.), odonates and other insects. Eastern mud turtle (*Kinosternon subrubrum subrubrum*), and eastern spadefoot toad (*Scaphiopus holbrookii holbrookii*) reportedly use this habitat (US ACE 1995, 1999).

Soils are deep sands, often become anaerobic but lack peat accumulation. The surface is often rusty colored from a coating of blue-green algae. Community variants include semi-permanent pools, long-lived wet swales with perennial graminoids and newly-formed sparsely-vegetated damp swales with early successional

annual forbs. Occurrences of this community are sometimes ephemeral representing the early stages of salt marsh or coastal salt pond formation or rapidly transforming into reed grass marshes.

Distribution: Restricted to estuarine portion of Coastal Lowlands Ecozone, probably only on the south shore of Long Island. Known occurrences restricted to barrier islands from Jones Beach Island West to Westhampton Beach. Additional occurrences possible west to Gateway National Recreation Area and east to Montauk Point.

Rank: G3G4 S1S2

Revised: 1990

Examples: Jones Beach Island East, Suffolk County; Jones Beach Island West, Suffolk County.

Sources: US ACE 1995, 1999; NYNHP field surveys.

8. Brackish tidal marsh: a marsh community that occurs where water salinity ranges from 0.5 to 18.0 ppt, and water is less than 2 m (6 ft) 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*), rose-mallow (*Hibiscus moscheutos*), wild rice (*Zizania aquatica*), pickerel-weed (*Pontederia cordata*), arrowleaf (*Peltandra virginica*), water smartweed (*Polygonum punctatum*), reedgrass (*Phragmites australis*), marsh fern (*Thelypteris palustris*), bulrushes (*Scirpus americanus*, *S. fluviatilis*, *S. novae-angliae*, *S. robustus*, *S. tabernaemontani*), water-hemp (*Amaranthus cannabinus*), dwarf spikerush (*Eleocharis parvula*), arrowhead (*Sagittaria latifolia*), lilaeopsis (*Lilaeopsis chinensis*), hedge bindweed (*Calystegia sepium*), seaside goldenrod (*Solidago sempervirens*), 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 hollow green weeds (*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 advena*), sweetflag (*Acorus americanus*), and blue flag (*Iris versicolor*), and a decrease in cover of sedges (*Carex* spp. and *Cyperus* spp.). Brackish marshes that are dominated by reedgrass (*Phragmites australis*) as a result of anthropogenic disturbance should be classified as a cultural community, such as estuarine impoundment marsh or estuarine dredge spoil shore. Examples where the tidal influence is greatly diminished may be classified as reedgrass/purple loosestrife marsh, a palustrine cultural community.

Brackish tidal marshes may grade into “supratidal marshes” in areas above mean high water where salt can concentrate by evaporation (Buckley and Ristich 1977, Kiviat 1979, Kiviat and Stevens 2001). More data on supratidal communities are needed.

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

Revised: 2001

Examples: Constitution Marsh, Putnam County; Iona Island, Rockland County; Piermont Marsh, Rockland County; Nissequogue River, Suffolk County; Carmans River, Suffolk County.

Sources: Buckley and Ristich 1976; Dreyer and Niering 1995; Kiviat 1979; Kiviat and Stevens 2001; MacDonald and Edinger 2000; Metzler and Rosza 1982; Muenscher 1937; Odum et al. 1984; Senerchia-Nardone et al. 1985; Swift 1987; NYNHP field surveys.

9. 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: restricted to the Hudson River from New York City to Newburgh in the Triassic Lowlands and Hudson Valley ecozones.

Rank: G3G4 S1S2

Revised: 1990

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

Sources: MacDonald and Edinger 2000; Muenscher 1937; NYNHP field surveys.

10. 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

Revised: 1990

Example: Hands Creek, Suffolk County.

Source: Kiviat and Stevens 2001; NYNHP field surveys.

11. 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 quinquefolia*), 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 (*Amphicarpaea 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

Revised: 1990

Examples: Roger's Island, Columbia County; North Tivoli Bay, Dutchess County; Catskill Marsh, Greene County.

Sources: DeVries and DeWitt 1986; Kiviat 1983; Kiviat and Stevens 2001; Leonardi 1990; Leonardi and Kiviat 1990; McVaugh 1958; Westad 1987; Westad and Kiviat 1986; NYNHP field surveys.

12. 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 2 m (6 ft) 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 advena*), pickerel-weed (*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 species. Characteristic plants of sandflats include three-square bulrush (*Scirpus americanus*), water horsetail (*Equisetum fluviatile*), Pennsylvania bittercress (*Cardamine pensylvanica*), 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, and smaller examples on the tidal rivers of Long Island.

Rank: G3G4 S2

Revised: 1990

Examples: Stockport Creek Marshes, Columbia County; North Tivoli Bay, Dutchess County; Catskill Marsh, Greene County; Rogers Island, Columbia County.

Sources: DeVries and DeWitt 1986; Kiviat 1973; Kiviat 1979; Kiviat and Stevens 2001; Leck et al. 1988; Metzler and Rosza 1982; Muenscher 1937; Odum et al. 1984; Swift 1987; NYNHP field surveys.

13. 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 0.9 to 1.2 m (3 to 4 ft) 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

Revised: 1990

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

Sources: Kiviat and Stevens 2001; Muenscher 1937; NYNHP field surveys.

14. 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 pensylvanica*), 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

Revised: 1990

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

Sources: Kiviat and Stevens 2001; McVaugh 1958; Muenscher 1937; NYNHP 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 submerged structure: the aquatic community associated with an artificially introduced structure submerged in estuarine waters, such as a tidal river or creek, that provides habitat for fish and other organisms. This includes structures that have been intentionally sunk for the purpose of attracting fish, as well as sunken ships, disposed waste, submerged bridge abutments, or any other introduced material that provides suitable habitat.

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

Rank: G5 S5

Revised: 2001

2. 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

Revised: 1990

3. 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 by the effectiveness of the mosquito control efforts.

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

Rank: G5 S5

Revised: 1990

4. 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

Revised: 1990

5. 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. Several distinct types of dredge spoil habitats have been described (Kiviat and Stevens 2001).

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

Rank: G5 S5

Revised: 2001

Sources: Kiviat and Stevens 2001.

6. 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

Revised: 1990

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III. RIVERINE SYSTEM

The riverine system consists of linear aquatic communities of flowing, non-tidal waters with a discrete channel, with persistent emergent vegetation sparse or lacking, but may include areas with abundant 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 (i.e., “microhabitats”), such as *riffles* (which include waterfalls), *runs*, and *pools*; these habitats usually have distinctive species assemblages (i.e., “associations”). 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 (i.e., it is “turbulent”). 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 about 30 m (100 ft), medium streams are from about 3 to 30 m (10 ft to 100 ft) wide, and small streams have an average width less than about 3 m (10 ft).

This classification of riverine communities is based on a combination of NYNHP field surveys, literature review and discussions with aquatic ecologists. To date about 46 plots have been sampled statewide by NYNHP in riverine communities. Bob Daniels of the New York State Museum provided much of the initial information on fish communities. Although the Heritage program has focused inventory work on streams since 1995; we do not currently have sufficient field data for confidently undertaking any major restructuring of the 1990 riverine classification. However, field work has suggested that this classification works well for representing the coarse scale distinctions between both abiotic and biotic features of river types. Although physically based, it is meant to serve as a coarse filter emphasizing resident stream biota. Two new coarse-scale physical-based types have been added to the classification, segregated out from other more broadly defined types of the 1990 classification: spring and deepwater river, the former a very small perennial stream, the latter a very large stream with profundal areas.

Further refinement of the riverine classification to distinguish regional variants will likely be based on additional field surveys and analysis of existing data collected by various aquatic scientists and agencies statewide. Regional variation in many of the designated

riverine communities is evident, but we do not currently have enough information or have undertaken analyses to confidently split common and widespread stream types into more specific regional variants. A finer scale classification of streams that distinguishes types according to ecoregion and/or watershed is being evaluated. Preliminary conclusions suggest that vascular plant, bryophyte, algae, fish, mollusk, insect and plankton assemblages may follow different distribution patterns, some more closely correlated with ecoregion boundaries, some more closely with major ecological drainage units. The fish and mollusk assemblages in the riverine communities (especially in unconfined rivers and deepwater rivers) generally vary according to the watershed.

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, stocked or accidentally 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 perennial rocky stream typically with a moderate to steep gradient, and cold water that flows over eroded bedrock, boulders or cobbles in the area where a stream system originates. These streams are typically shallow, narrow, have a relatively small low flow discharge and usually represent a network of 1st to 2nd order stream segments. These streams typically include alternating riffle and pool sections. Most of the erosion is headward, and deposition is minimal. Waterfalls, chutes, flumes and cascades are typically 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 (these are allochthonous streams); trees shading the stream reduce primary productivity. These streams have high water clarity and are well oxygenated. They are typically surrounded by upland forests and situated in a confined valley.

Species assemblages characteristic of riffles and rocky substrate predominate the community. Characteristic fishes are coldwater species including eastern blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), slimy sculpin (*Cottus cognatus*) or mottled sculpin (*C. bairdi*), and brook trout (*Salvelinus fontinalis*). Additional characteristic fishes may include longnose dace (*Rhinichthys cataractae*), reddsides dace (*Clinostoma elongatus*), and,

in pools, white sucker (*Catostomus commersoni*). Common introductions are rainbow trout (*Salmo gairdneri*) and brown trout (*S. trutta*). Characteristic amphibians may include northern two-lined salamander (*Eurycea bislineata*) and green frog (*Rana clamitans*).

Characteristic macroinvertebrates are riffle and rocky bottom specialists as well as leaf and algae shredders such as stoneflies (Plecoptera including Chloroperlidae, Leuctridae, Acroneuria sp.), mayflies (Ephemeroptera including Heptageniidae, Isonychia sp.), caddisflies (Trichoptera, including Rhyacophila sp. and especially Hydropsychidae), midges (Chironomidae), crayfish (Cambaridae including *Cambarus robustus*, *C. bartonii*), water penny beetle (*Psephenus* sp.), crane flies (Tipulidae including *Hexatoma* sp.) and blackflies (Simuliidae). Freshwater sponges may be abundant and coating rocks in some examples.

Characteristic pool macroinvertebrates may include true bugs (Gerridae, Vellidae and Mesovellidae). Mollusks are typically lacking or very sparse and of low diversity. These streams typically have bryophytes and periphytic/epilithic algae present, but few larger rooted plants. Characteristic bryophytes include: *Brachythecium rivulare*, *B. plumosum*, *Eurhynchium riparioides*, *Hygroamblystegium tenax*, *Hygrohypnum ochraceum*, *Rhizomnium punctatum*, *Mnium hornum*, *Fontinalis* spp., and *Scapania* sp.

Four to six ecoregional variants (including Northern Appalachian, Lower New England, Alleghany Plateau and Great Lakes types) are suspected to differ in dominant and characteristic vascular plants, fishes, bryophytes, and insects as well as water chemistry, water temperature, underlying substrate type, and surrounding forest type. Major watershed may be a secondary factor in distinguishing streams lower in a drainage basin.

Additional species characteristic of streams in the Northern Appalachians may include fishes such as pearl dace (*Margariscus margarita*), and northern redbelly dace (*Phoxinus eos*); and macroinvertebrates such as caddisflies (*Parapsyche* sp., *Palegapetus* sp., *Symphitopsyche* sp.), stoneflies (Capniidae, *Taenionema* sp., *Peltoperla* sp.), mayfly (*Eurylophella* sp.), midges (*Eukiefferella* sp.), and fishfly (Corydalidae).

Additional species characteristic of streams in the Saint Lawrence River and Lake Champlain Valleys may include fishes such as common shiner (*Luxilus cornutus*), bluntnose minnow (*Pimephales notatus*), fathead minnow (*P. promelas*) and slimy sculpin (*Cottus cognatus*); and macroinvertebrates such as stonefly (*Neoperla* sp.), caddisfly (*Chimara* sp., *Dolophilodes* sp.), beetles (*Promeresia* sp., *Stenelmis* sp., *Dubiraphia* sp., *Oulimnius* sp.), odonate (*Ophiogomphus compressa*), and midge (*Polypedilum*

sp.).

Additional species characteristic of streams in the Alleghany Plateau may include fishes such as tonguetied minnow (*Exoglossum laurae*), variegated darter (*Etheostoma variegatum*), greenside darter (*E. blenniodes*), rainbow darter (*E. caeruleum*), mimic shiner (*Notropis volucellus*), bigmouth shiner (*N. dorsalis*), striped shiner (*Luxilus chrysocephalus*) golden redbreast (*Moxostoma erythrurum*) and log perch (*Percina caprodes*); the amphibian longtail salamander (*Eurycea longicauda*); and the macroinvertebrates mayflies (*Sweltsa* sp., *Leuctra* sp., *Stenacron* spp., *Paraleptophlebia* spp.), caddisflies (*Lepidostoma* sp., *Polycentropus* sp., *Diplectrona modesta*, *Goera sylata*), stoneflies (*Yugus* sp.), alderfly (*Sialis* sp.), water penny beetle (*Ectopria* sp.), odonates (*Lanthus parvulus*, *Calopteryx amata*, *C. angustipennis*), and caddisflies (*Neophylax* sp., *Hydropsyche* spp., *Pycnopsyche psilotreta*, *Glossoma nigror*).

More data on regional variants are needed.

Distribution: throughout upstate New York north of the Coastal Lowlands ecozone, especially at high elevations.

Rank: G4 S4

Revised: 2001

Examples: Opalescent River Headwaters, Essex County; Johns Brook, Essex County; East Branch Fish Creek, Lewis County; Poestenkill Headwaters, Rensselaer County; Beaverkill River, Ulster County; Quaker Run, Cattaraugus County; Chaumont River, Jefferson County.

Sources: Slack and Glime 1985; C. L. Smith 1985; NYNHP field surveys.

2. Marsh headwater stream: the aquatic community of a small, marshy perennial brook with a very low gradient, slow flow rate, and cool to warm water that flows through a marsh, fen, or swamp where a stream system originates. These streams usually have clearly distinguished meanders (i.e., high sinuosity) and are in unconfined landscapes. Marsh headwater streams are typically deep. These streams are typically dominated by runs with interspersed pool sections; they are typically shallow, narrow, have a relatively small low flow discharge and usually represent a network of 1st to 2nd order stream segments. Most of the erosion is headward, and deposition is minimal. The substrate is typically gravel or sand, but some examples or segments may be dominated by silt, muck, peat, marl deposits or woody or leafy debris. These streams may have high turbidity and be somewhat poorly

oxygenated and can vary in alkalinity and color.

Species assemblages characteristic of pools and soft bottoms dominate the community. Characteristic fishes are warmwater minnows including fathead minnow (*Pimephales promelas*), northern redbelly dace (*Phoxinus eos*), golden shiner (*Notemigonus crysoleucas*), and central mudminnow (*Umbra limi*). Additional characteristic fishes may include brook trout (*Salvelinus fontinalis*), white sucker (*Catostomus commersoni*), longnose sucker (*C. catostomus*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ameiurus nebulosus*), and bluntnose minnow (*Pimephales notatus*). A characteristic mammal is beaver (*Castor canadensis*). Pool and soft bottom invertebrate specialists are typically common. Characteristic macroinvertebrates include true bugs (Gerridae, Vellidae, Mesovellidae). Macroinvertebrates found in this stream near lake outlets include blackflies (Simuliidae), caddisflies (*Hydropsyche* sp., *Cheumatopsyche* sp., *Symphytopsyche* sp.) midges (Chironomidae such as *Tanytarsini* sp.), and fingernail clams (*Sphaerium* spp.).

Submergent vascular plants may be abundant; characteristic aquatic macrophytes include water milfoil (*Myriophyllum heterophyllum*), coontail (*Ceratophyllum demersum*), pondweeds (*Potamogeton epihydrus*, *P. natans*), duckweeds (*Lemna minor*, *L. trisulca*), water stargrass (*Heteranthera dubia*), tapegrass (*Vallisneria americana*), bladderworts (*Utricularia* spp.), bur-reeds (*Sparganium americanum*, *S. angustifolium*, *S. fluctuans*), waterweed (*Elodea nuttallii*), naiad (*Najas* spp.), white water-lily (*Nymphaea odorata*) and yellow pond-lily (*Nuphar lutea*). Algae are primarily epiphytic and suspended.

Four to seven ecoregional variants are suspected to differ in dominant and characteristic vascular plants, fishes, bryophytes, invertebrates, and algae as well as water chemistry, water temperature, underlying substrate type, and surrounding forest type. Major watershed may be a secondary factor in distinguishing streams lower in a drainage basin.

Fishes characteristic of streams in the Saint Lawrence River and Lake Champlain Valleys may include muskellunge (*Esox masquinongy*), mooneye (*Hiodon tergisus*), northern pike (*Esox lucius*), black crappie (*Pomoxis nigromaculatus*), walleye (*Stizostedion vitreum*), rock bass (*Ambloplites rupestris*), yellow perch (*Perca flavescens*), northern hog sucker (*Hypentelium nigricans*), cutlips minnow (*Exoglossum maxillingua*), fallfish (*Semotilus corporalis*), pugnose shiner (*Notropis anogenus*), blackchin shiner (*N. heterodon*), spottail shiner (*N. hudsonius*), common shiner (*Luxilus cornutus*), Iowa darter (*Etheostoma exile*), brook lamprey (*Ichthyomyzon fossor*), shorthead redhorse (*Moxostoma macrolepidotum*), and banded killifish (*Fundulus*

diaphanus).

Characteristic macroinvertebrates of these streams may include true flies (*Tipula* sp., *Atherix* sp., *Simulium* sp.), midges (*Apsectrotomyphus* sp., *Rheocricotopus* sp.), crustaceans (*Hyallela* sp.), clams (*Pisidium* sp.) and mayfly (*Stenonema* sp.). Characteristic plants of these streams may include water star-wort (*Callitriche hermaphroditica*), pondweeds (*Potamogeton hillii*, *P. filiformis*), milfoil (*Myriophyllum* spp.), and water marigold (*Megalodonta beckii*).

Species characteristic of examples in the Northern Appalachians may include the fishes blacknose dace (*Rhinichthys atratulus*), longnose dace (*R. cataractae*) and creek chub (*Semotilus atromaculatus*), the macroinvertebrates fingernail clam (*Sphaerium striatum*), caddisfly (*Polycentropus* sp.), mayfly (*Litobranchia* sp.) and odonate (*Cordulegaster* sp.), water scorpions (Nepidae), and water penny beetle (*Psephenus* sp.), and the vascular plants milfoil (*Myriophyllum farwellii*) and water-shield (*Brasenia schreberi*). More data on regional variants are needed.

Distribution: throughout New York State.

Rank: G4 S4

Revised: 2001

Examples: Campbell Marsh, Jefferson County; South Branch Mad River, Lewis County; North Branch Fish Creek, Lewis County; Swarte Kill, Ulster County; Poestenkill Headwaters, Rensselaer County; Main Branch Oswegatchie River, Herkimer, St. Lawrence and Hamilton Counties; Brandy Brook, St. Lawrence County.

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

3. Confined river: the aquatic community of relatively large, fast flowing sections of streams with a moderate to gentle gradient. The name of this community has been changed from “midreach stream” to better reflect the concept. These streams have well-defined pattern of alternating pools, riffles, and runs. Confined rivers usually have poorly defined meanders (i.e., low sinuosity), occur in confined valleys and are most typical of the midreaches of stream systems. These streams are typically of moderate depth, width and low flow discharge and usually represent a network of 3rd to 4th order stream segments. Most of the erosion is lateral, creating braids, channel islands, and bars, and deposition is moderate with a mix of coarse rocky to sandy substrate. Waterfalls are typically present; these are here treated as features of the more broadly defined community. The predominant source of energy is generated in the stream (these are autochthonous

streams). These streams have high water clarity and are well oxygenated. They are typically surrounded by open upland riverside communities including riverside sand/gravel bar, cobble shore or one of the shoreline outcrop communities.

Species assemblages characteristic of riffles and rocky bottoms dominate the community. Fish diversity is typically high to moderate. Characteristic fishes include creek chub (*Semotilus atromaculatus*), pumpkinseed (*Lepomis gibbosus*), common shiner (*Luxilus cornutus*), and trout-perch (*Percopsis omiscomaycus*) in pools; rosyface shiner (*Notropis rubellus*) at the head of pools; tessellated darter (*Etheostoma olmstedii*), 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 hogsucker (*Hypentelium nigricans*) in runs. Other characteristic fishes may include blacknose dace (*Rhinichthys atratulus*) and fantail darter (*Etheostoma flabellare*). Common introductions are rainbow trout (*Salmo gairdneri*), brown trout (*S. trutta*), and (in streams where it is not native) smallmouth bass (*Micropterus dolomieu*). Characteristic mollusks include eastern elliptio (*Elliptio complanta*), eastern floater (*Pyganodon cataracta*), fingernail clams (*Sphaerium* spp.). Other macroinvertebrates are diverse; characteristic macroinvertebrates include riffle and rocky bottom specialists as well as algae shredders such as crayfish (Cambaridae), mayflies (Ephemeroptera including Ephemeridae, Heptageniidae, *Isonychia* sp.), stoneflies (Plecoptera including Chloroperlidae, *Acroneuria* sp., *Neoperla* sp.), caddisflies (Trichoptera including Hydropsychidae, *Helicopsyche* sp., *Dolophilodes* sp., *Rhyacophila* sp.), cranefly (*Hexatoma* sp.), beetles (*Oulimnius* sp., *Psephenus* sp.), dobsonflies (Corydalidae), midge (*Polypedilum* sp.), craneflies (Tipulidae), and blackflies (Simuliidae). Odonate (Odonata including Calopterygidae) larvae may be characteristic of runs. True bugs (Gerridae, Vellidae, Mesovellidae) are characteristic of pools.

Epilithic algae are the predominate plant. Aquatic macrophytes are usually sparse; typical aquatic macrophytes include waterweed (*Elodea canadensis*) and linear-leaved pondweeds such as sago pondweed (*Potamogeton pectinatus*). An additional characteristic vascular plant may be *Podostemum ceratophyllum*. Bryophytes are often confined to shallows and the intermittently exposed channel perimeter.

Four to six variants associated with a combination of ecoregions (including Northern Appalachian, Great Lakes, Lower New England and Alleghany Plateau ecoregions) or major watersheds (including Great Lakes, Hudson River, Alleghany River, Susquehanna/Delaware Rivers) are suspected to differ

substantially in dominant and characteristic vascular plants, fishes, mollusks, insects, and algae as well as water chemistry (especially alkalinity and color), water temperature, underlying substrate type, and surrounding forest type. In addition, biota is suspected to differ among streams of moderate size (roughly 3rd to 4th order streams) and large size (roughly 5th to 6th order streams). Aquatic connectivity factors are thought to strongly influence the fish and mollusk composition. Species characteristic of Northern Appalachian streams may include the fishes brook trout (*Salvelinus fontinalis*), cutlips minnow (*Exoglossum maxillingua*), longnose sucker (*Catostomus catostomus*), and white sucker (*C. commersoni*); and the macroinvertebrates eastern pearlshell (*Margaritifera margaritifera*), and odonates (*Gomphus* spp., *Progomphus obscurus*).

Species characteristic of streams in the Saint Lawrence River and Lake Champlain Valley may include a diverse assemblage of mollusks such as heelsplitters (*Potamilus* sp. and *Lasmigona* sp.), lampmussels (*Lampsilus* spp. including *L. cariosa*), *Leptodea* sp., triangle floater (*Alasmidonta undulata*), creekmussel (*Strophitus* sp.), pondmussel (*Ligumia* sp.), *Anodontoides* sp., and pea clams (*Pisidium* spp.). Other macroinvertebrates characteristic of streams in this region may include beetles (*Promeresia* sp., *Stenelmis* sp., *Dubiraphia* sp.), caddisflies (*Chimara* sp., *Phylocentropus* sp.), mayfly (*Hexagenia* sp.), amphipod (*Gammarus* sp.), and true flies (*Sphaeromias* sp., *Culicoides* sp.).

Species characteristic of Alleghany Plateau and Great Lakes streams may include the fishes greenside darter (*E. blennioides*) and rainbow darter (*Etheostoma caeruleum*), central stoneroller (*Campostoma anomalum*), silverjaw minnow (*Ericymba buccata*), spotted darter (*Etheostoma maculatum*), golden redhorse (*Moxostoma erythrurum*) and shorthead redhorse (*M. macrolepidotum*); the mollusks mucket (*Actinonaias ligmentina*), Ohio pigtoe (*Pleurobema cordatum*), kidneyshell (*Ptychobranhus fasciolaris*), fluted-shell (*Lasmigona costata*), lampmussels (*Lampsilis fasciola*, *L. ventricosa*), and spike (*Elliptio dilitata*); and the other macroinvertebrates mayfly (*Stenonema* spp.), and caddisfly (*Cheumatopsyche* sp.).

More data on regional variants are needed.

Distribution: throughout New York State.

Rank: G4 S4

Revised: 2001

Examples: French Creek, Chautauqua County; Moose River, Herkimer, Lewis and Oneida Counties; Middle Branch Oswegatchie River, St. Lawrence, Herkimer and Lewis Counties; Hudson River, Essex, Warren and Saratoga Counties; East Branch Fish Creek, Lewis County; Rondout Creek; Ulster County; Shawangunk

Kill, Ulster County; Hoosic River; Rensselaer County.

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

4. Unconfined river: the aquatic community of large, quiet, base level sections of streams with a very low gradient. The name of this community has been changed from “main channel stream” to better reflect the concept. These streams are typically dominated by runs with interspersed pool sections and a few short or no distinct riffles. Unconfined rivers usually have clearly distinguished meanders (i.e., high sinuosity) and well developed levees, are in unconfined valleys and are most typical of the lowest reaches of stream systems. These streams are typically deep, wide, have a high low flow discharge, and usually represent a network of 5th to 6th order stream segments. They are characterized by considerable deposition, predominated by fine substrates such as silt, with a relatively minor amount of erosion. Waterfalls may be present; these are here treated as features of the more broadly defined community. The predominant source of energy is generated in the stream (these are autochthonous streams). These streams are usually warm water, may have high turbidity and be somewhat poorly oxygenated. They are typically surrounded by floodplain forest or eroded sand or clay banks or fine sediment bars.

Species assemblages characteristic of pools and soft bottoms dominate the community. Characteristic fishes are deep-bodied fishes such as suckers (Catostomids) - especially redhorses (*Moxostoma* spp.), sturgeon (*Acipenser* spp.), and shad (*Alosa* spp.). Many of the fishes are anadromous. Other characteristic fishes include warmwater fishes such as pickerel (*Esox americanus*), northern pike (*E. lucius*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieu*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ameiurus nebulosus*) and white sucker (*Catostomus commersoni*). Other characteristic vertebrates may include species of ducks. Characteristic macroinvertebrates may include numerous species of mollusks such as *Pisidium* sp., suspected to differ substantially among regional variants, as well as stoneflies (Plecoptera), beetle (*Dubiraphia* sp.), midge (*Polypedium* sp.), mayfly (Leptophlebiidae), clam, odonates (Aeshnidae, Calopterygidae, Coenargonidae, Gomphidae) and caddisfly (*Hydaphylax* sp.).

Although the middle of an unconfined river is usually too deep for aquatic macrophytes to occur, the shallow shores and backwaters typically have rooted macrophytes. Characteristic submergent vascular plants may include naiad (*Najas flexilis*), pondweeds (*Potamogeton epihydrus*, *P. perfoliatus*, *P. spirillus*),

burreed (*Sparganium fluctuans*), tategrass (*Vallisneria americana*), and spikerush (*Eleocharis robbinsii*). Floating aquatic macrophytes such as white water-lily (*Nymphaea* sp.) may be common in pools along shallow shores and in backwaters. Two exotic weeds, Eurasian milfoil (*Myriophyllum spicatum*) and water chestnut (*Trapa natans*) may also occur along shores and backwaters. Mosses in the genus *Fontinalis* may be characteristic of shallow areas. Plankton assemblages may be abundant.

Four to six variants associated with a combination of ecoregions (including Northern Appalachian, Great Lakes, Lower New England and Allegheny Plateau types) or major watersheds distinguished by C. L. Smith (1985) (the St. Lawrence River basin, Hudson River, Delaware River, Susquehanna River, and Allegheny River) are suspected to differ substantially in dominant and characteristic vascular plants, fishes, mollusks, and insects as well as water chemistry, water temperature, underlying substrate type, and surrounding forest type. For example, the species of fish genera present in any one stream varies between major watersheds. In addition, biota is suspected to differ among streams of moderate size (roughly 3rd to 4th order streams) and large size (roughly 5th to 6th order streams). Aquatic connectivity factors are thought to strongly influence the fish and mollusk composition. Fishes characteristic of the Saint Lawrence River and Lake Champlain Valley may include the fishes muskellunge (*Esox masquinongy*), yellow perch (*Perca flavescens*), white perch (*Morone americana*), walleye (*Stizostedion vitreum*), mooneye (*Hiodon tergisus*), longnose sucker (*Catostomus catostomus*), Iowa darter (*Etheostoma exile*), johnny darter (*Etheostoma nigrum*), banded killifish (*Fundulus diaphanus*), pugnose shiner (*Notropis anogenus*), spottail shiner (*N. hudsonius*) and blackchin shiner (*N. heterodon*). Characteristic fishes of the Northern Appalachians may include the fishes brook trout (*Salvelinus fontinalis*), slimy sculpin (*Cottus cognatus*), creek chub (*Semotilus atromaculatus*), longnose dace (*Rhinichthys cataractae*), tessellated darter (*Etheostoma olmsteadii*), fathead minnow (*Pimephales promelas*) and bluntnose minnow (*Pimephales notatus*).

More data on flora (macrophytes and algae) and invertebrate fauna, as well as regional variants, are needed.

Distribution: throughout the state north of the Coastal Lowlands ecozone, usually at low elevations.

Rank: G4 S4

Revised: 2001

Examples: Mohawk River from Utica to the Hudson River; Hudson River from Glens Falls to the Troy Dam; Rondout Creek, Ulster County; Raquette River,

Franklin County; Oswegatchie River, St. Lawrence County; Poultney River, Washington County; Black River, Lewis, Jefferson and Oneida Counties; Genessee River, Livingston and Monroe Counties.

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

5. Backwater slough: the aquatic community of quiet to stagnant waters in sloughs that form in embayments and old meanders that are cut off from an unconfined river or marsh headwater stream only at the upstream end by deposition of a levee. Many examples of this river type may be relatively short-lived in dynamic river complexes, transforming into an oxbow lake through permanent formation of a downstream levee, or into an associated river type through permanent breaching of the upstream levee. The water is typically warm. Although classified as a river type, many hydrological characteristics may resemble those of lacustrine communities.

Characteristic biota are pool specialists and may resemble those of lacustrine species assemblages or marsh headwater streams. Aquatic vegetation is usually abundant; characteristic aquatic plants include waterweed (*Elodea canadensis*), milfoil (*Myriophyllum* spp.), duckweed (*Lemna minor*), and pondweeds (*Potamogeton* spp.). Emergent aquatic plants may be abundant along the shores. Characteristic fishes are golden shiner (*Notemigonus crysoleucas*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ictalurus nebulosus*), and chain pickerel (*Esox niger*). Characteristic macroinvertebrates may include odonates (Odonata), stoneflies (Plecoptera), diving beetles (Dytiscidae), mosquitoes (Culicidae), true flies (*Tipula* sp., *Atherix* sp., *Simulium* sp.), midges (Chironomidae), crustaceans (*Hyalella* sp.), clams (*Pisidium* sp.) and mayflies (Stenonema). Wading birds and ducks such as pied-billed grebe (*Podilymbus podiceps*) and great blue heron (*Ardea herodias*) may be characteristic. A characteristic mammal may be muskrat (*Ondatra zibethicus*).

Four to seven ecoregional variants are suspected to differ in dominant and characteristic vascular plants, fishes, mollusks, insects, and birds as well as water chemistry, water temperature, underlying substrate type, surrounding forest type and associated stream type. Major watershed may be a secondary factor in distinguishing streams lower in a drainage basin. More data on this community are needed.

Distribution: throughout upstate New York north of the Coastal Lowlands ecozone, usually at low elevations.

Rank: G4 S2S3

Revised: 2001

Examples: Raquette River, Franklin County; North Branch Moose River; Log Flats, Livingston County; Ausable Delta, Clinton County; Little River, St. Lawrence County.

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

6. Intermittent stream: the community of a small, intermittent or ephemeral streambed in the uppermost segments of stream systems where water flows only during the spring or after a heavy rain and often remains longer, ponded in isolated pools. These streams typically have a moderate to steep gradient and hydric soils.

The streambed may be covered with diverse emergent and submergent bryophytes; characteristic bryophytes may include *Bryhnia novae-angliae*, *Bryum pseudotriquetrum*, *Chiloscyphus polyanthus*, *Hygrohypnum ochraceum*, *H. eugyrium*, *Hygroamblystegium tenax*, *Fontinalis* spp., *Brachythecium rivulare*, *B. plumosum*, *Eurhynchium ripariodes*, *Mnium affine*, *Scapania nemorosa* and *S. undulata*. Characteristic vascular plants are hydrophytic and may include water-carpet (*Chrysosplenium americanum*) and pennywort (*Hydrocotyle americana*). Fauna is diverse and limited to species that do not require a permanent supply of running water, that inhabit the streambed only during the rainy season, or that are pool specialists. Characteristic fauna include amphibians such as green frog (*Rana clamitans*) and northern two-lined salamander (*Eurycea bislineata*), and macroinvertebrates such as water striders (*Gerris* sp.), water boatman (Corixidae), caddisflies (Trichoptera), mayflies (Ephemeroptera), stoneflies (Plecoptera), midges (Chironomidae), blackflies (Simuliidae) and crayfish (*Cambarus bartoni*).

Four to seven ecoregional variants are suspected to differ in dominant and characteristic bryophytes and insects as well as water chemistry, water temperature, underlying substrate type, and surrounding forest type. In addition, there may be a unique alpine/subalpine variant and different variants associated with acidic versus calcareous substrates. Examples surveyed on the Alleghany Plateau are dominated by stoneflies in the family Perlodidae, and several mayflies (Heptageniidae, *Sweltsa* sp., *Clioperla* sp. and *Ameletus* sp.). Biota characteristic of this region may include northern pygmy clubtail (*Lanthus parvulus*), crane flies (*Hexatoma* sp.), caddisflies (*Pycnopsyche* sp., and *Neophylax* sp.) and stoneflies (*Peltoperla* sp.). More data on regional variants are needed.

Distribution: throughout New York State.

Rank: G4 S4

Revised: 2001

Examples: Carrollton Run, Cattaraugus County; Chicken Coop Brook, Essex County; Porter Mountain, Essex County; Waterman Brook Headwaters, Cattaraugus County; Chautauqua Gorge, Chautauqua County; Quackenkill Headwaters, Rensselaer County.

Sources: comments by Nancy Slack (of Russell Sage College); NYNHP field surveys.

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. epiphydrus*), naiads (*Najas flexilis*, *N. guadalupensis*), waterweeds (*Elodea nuttallii*, *E. canadensis*, *E. densa*), stonewort (*Nitella* sp.), bladderwort (*Utricularia vulgaris*), duckweed (*Lemna minor*), Tuckerman's quillwort (*Isoetes tuckermannii*) 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*), pumpkinseed (*Lepomis gibbosus*), banded sunfish (*Enneacanthus obesus*), and swamp darter (*Etheostoma fusiforme*). The exotic bivalve Asian clam (*Corbicula fluminea*) may have recently become a widespread invasive species throughout this stream type in the state.

Distribution: restricted to the Coastal Lowlands ecozone.

Rank: G3G4 S1 *Revised:* 2001

Examples: Carmans River, Suffolk County; Peconic River, Suffolk County.

Sources: Beitel 1976; Greeley 1939; Muenscher 1939; NYNHP field surveys.

8. Deepwater river: the aquatic community of very large, very deep, quiet, base level sections of streams with a very low gradient and where there are profundal areas. These streams are typically dominated by runs with interspersed pools and a few short or no distinct riffles. Deepwater rivers are restricted to the largest of stream systems, often corresponding to segments of 8th order or higher.

Species diversity is high, and assemblages characteristic of runs, pools and the pelagic zone dominate the community. Many of the fishes are

anadromous. Characteristic fishes include redhorses (*Moxostoma* spp.) and lake sturgeon (*Acipenser fulvescens*), northern pike (*E. lucius*), smallmouth bass (*M. dolomieu*), channel darter (*Percina copelandi*), Iowa darter (*Etheostoma exile*), eastern sand darter (*Ammocrypta pellucida*), walleye (*Stizostedion vitreum*), mooneye (*Hiodon tergisus*), and blackchin shiner (*Notropis heterodon*). Characteristic macroinvertebrates may include oligochaetes (Oligochaeta) and mollusks; oligochaetes may be abundant in the profundal zone. Many mollusks that were historically present in the Saint Lawrence River have presumably become extirpated. Although the middle of a deepwater river is too deep for aquatic macrophytes to occur, the shallow shores and backwaters may have rooted macrophytes. Plankton assemblages may be abundant. More data on this community are needed.

Distribution: restricted to Great Lakes drainage in the Great Lakes Plain ecozone.

Rank: G2G3? S1S2? *Revised:* 2001

Examples: Saint Lawrence River, St. Lawrence, Jefferson and Franklin Counties; Niagara River, Erie and Niagara Counties.

9. Spring: the aquatic community of very small, cold stream sources where the flow is perennial. Springs are characterized by water with constant cold temperature and rich in dissolved oxygen. These streams are typically very shallow and have a short length and relatively constant and very low discharge. Stream gradient, substrate and the proportion of flow microhabitats can vary greatly between examples. These streams may adjoin to any other aquatic community, but are typically found in association with headwater streams.

Species diversity may be high, and assemblages characteristic of riffles may dominate the community. They are known in the literature as "mediculous habitat" or "spring creeks." Fishes are absent. Characteristic amphibians may include dusky salamander (*Desmognathus fuscus fuscus*). Characteristic and dominant macroinvertebrates may include Tricladida, several caddisflies (Limnephilidae, *Lepidostoma* sp., *Rhyacophila* sp., *Dolophilodes distinctus*, *Pycnopsyche gentilis*), several stoneflies (Perlodidae, Chloroperlidae, *Peltoperla* sp., *Sweltsa* sp.), crane flies (Tipulidae), springtails (*Orchesella* sp.), mayflies (Ephemeroptera), clubtails (*Lanthus parvulus*, *L. vernalis*), and beetles (Coleoptera). Some low diversity examples studied by Sutton (1998) with cold alkaline water on the Great Lakes Plain are dominated

by the amphipod *Gammarus pseudolimnaeus*, the mayfly *Ephemerella* spp., and midges (Chironomidae). Characteristic vascular plants may include water-carpenter (*Chrysosplenium americanum*), wood nettle (*Laportea canadensis*), clearweed (*Pilea pumila*), sedge (*Carex scabrata*), and Pennsylvania bittercress (*Cardamine pennsylvanica*). Characteristic bryophytes may include *Brachythecium* spp. and *Fissidens* sp.

Four to seven ecoregional variants (including Northern Appalachian, Lower New England, Great Lakes and Alleghany Plateau types) are suspected to differ in dominant and characteristic vascular plants, fishes, mollusks, and insects as well as water chemistry, water temperature, underlying substrate type, and surrounding forest type. More data on this community are needed.

Distribution: throughout New York State.

Rank: G4G5? S3S4?

Revised: 2001

Examples: Murray Brook, Cattaraugus County; Caledonia Spring Creek, Livingston County; Cedar Springs, Monroe County; Mossy Brook Bank Spring, Ulster County; Zoar Valley, Cattaraugus County.

Sources: Sutton, 1998; NYNHP field surveys.

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. No biotic riverine cultural types have been noted. NYNHP is currently unaware of examples of streams without physical or chemical alterations that have become dominated by exotic biota such as water chestnut (*Trapa natans*) and Eurasian water milfoil (*Myriophyllum spicatum*).

1. Riverine submerged structure: the aquatic community associated with an artificially introduced structure submerged in riverine waters, such as a stream or river, that provides habitat for fish and other organisms. This includes structures that have been intentionally sunk for the purpose of attracting fish, as well as sunken ships, disposed waste, submerged bridge abutments, or any other introduced material that provides suitable habitat.

Distribution: throughout New York State.

Rank: G5 S5

Revised: 2001

2. 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

Revised: 1990

Source: Schindler 1988.

3. 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

Revised: 1990

4. 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 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.).

RIVERINE REFERENCES

Algae indicative of eutrophic conditions may be abundant.

Distribution: throughout New York State.

Rank: G5 S5

Revised: 1990

5. 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. Algae indicative of eutrophic conditions and iron fixing bacteria may be abundant.

Distribution: throughout New York State.

Rank: G5 S5

Revised: 1990

Source: Reash and Berra 1987.

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IV. LACUSTRINE SYSTEM

The lacustrine system consists of ponded waters situated in topographic depressions or dammed river channels, with persistent emergent vegetation sparse or lacking, but including any areas with abundant submerged or floating-leaved aquatic vegetation. The lacustrine communities in this classification are distinguished primarily by trophic state, alkalinity, annual cycles of thermal stratification, circulation, morphometry (size and shape of the lake basin and drainage area; water permanence), and water chemistry (including salinity).

The communities are described in terms of the free-floating organisms of the open water, or the limnetic or pelagic 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 (pelagic) 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 (or the metalimnion). The lake bottom or benthic zone may be divided into the peripheral, well-lit shallows or littoral zone, the slightly deeper and darker sublittoral zone, and (in summer-stratified lakes) the deep, cold region where currents are minimal and light is much reduced, called the profundal zone. Benthic zones may each have a distinctive resident biota; however, many of the plankton and fish move between pelagic zones on a regular basis. Deep lakes have an average depth greater than about 60 m (200 ft), moderately deep lakes are from about 6 to 60 m (20 ft to 200 ft) deep, and shallow lakes have an average depth less than about 6 m (20 ft). Large lakes are greater than about 80 ha (200 acres) and small lakes are less than this size.

This classification of lacustrine communities is based on a combination of NYNHP field surveys, literature review, and discussions with aquatic scientists. To date about 42 plots have been sampled statewide by NYNHP in lacustrine communities. Although the Heritage Program has focused inventory work on lakes since 1995; we do not currently have sufficient field data for confidently undertaking any major restructuring of the 1990 lacustrine classification. However, field work has suggested that this classification works well for representing the coarsest scale distinctions between both biotic and abiotic features of lacustrine community types.

The classification is intended to represent entire lake "macrohabitats." Although physically based, it is meant to serve as a coarse filter emphasizing resident lake biota. It is recognized that lakes may contain

numerous pelagic and benthic associations and that there is often much overlap in association distribution across lake macrohabitat types. For now, NYNHP is maintaining this macrohabitat classification while evaluating the utility and feasibility of replacing or supplementing this classification with an association classification. Further evaluation of the macrohabitat classification is underway to compare trophic state versus alkalinity as a factor more important in driving the distribution of biota and more resistant to human alteration of water chemistry. Tentatively, it is thought that alkalinity is a stronger driving force, thus suggesting a switch of the 1990 classification of common pond types from oligotrophic and eutrophic to acidic and alkaline, and common dimictic lake types from oligotrophic, mesotrophic, and eutrophic to acidic and alkaline, perhaps with trophic state as a secondary modifier.

Lastly, addition of three "intermittent pond" types to the 1990 classification is also recommended: vernal pool and pine barrens vernal pond (both previously treated under the palustrine system) and sinkhole pond (split from sinkhole wetland in the palustrine system). Other types under evaluation include "flow-through" or "fluvial pond," a potential split from the currently recognized oligotrophic pond and eutrophic pond, closely associated with riverine complexes rather than in the typical isolated basin setting.

Further refinement of the lacustrine classification to distinguish regional variants will likely be based on additional field surveys and analysis of data collected by various aquatic scientists and agencies statewide. Regional variation in many of the designated lacustrine communities is evident, but we do not currently have in our files enough information or have undertaken analyses to confidently split common and widespread lake types into more specific regional variants. A finer scale classification of lakes that distinguishes types according to ecoregion and/or watershed is being evaluated. Preliminary conclusions suggest that vascular plant, bryophyte, algae, fish, mollusk, insect, and plankton assemblages may follow different distribution patterns, some more closely correlated with ecoregion boundaries, some more closely with major ecological drainage units.

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, stock or accidentally 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. These lakes are primarily mesotrophic with eutrophic nearshore areas. Specialized habitats include nearshore fluvial deposits, deepwater reefs and trenches. 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. Lake Champlain is similar to this lake type, however, is classified as a summer-stratified monomictic lake.

Characteristic fishes of the epilimnion include alewife (*Alosa pseudoharengus*), rainbow smelt (*Osmerus mordax*), yellow perch (*Perca flavescens*), white sucker (*Catostomus commersoni*), lake chub (*Couesius plumbeus*), lake trout (*Salvelinus namaycush*), Atlantic salmon (*Salmo salar*), lake sturgeon (*Acipenser fulvescens*), lake herring (*Coregonus artedii*), deepwater sculpin (*Myoxocephalus thompsoni*), and walleye (*Stizostedion vitreum*).

Characteristic fishes of the hypolimnion also include slimy sculpin (*Cottus cognatus*), and round whitefish (*Prosopium cylindraceum*). Other characteristic fishes include cisco (*Coregonus artedii*), lake whitefish (*Coregonus clupeaformis*), sea lamprey (*Petromyzon marinus*), quillback (*Carpionides 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*).

A diverse set of diving birds use this community as a staging area during fall migration, and include oldsquaw (*Clangula hyemalis*), common goldeneye (*Bucephala clangula*), scaup (*Aythya* sp.), redhead (*Aythya americana*), bufflehead (*Bucephala albeola*), canvasbacks (*Aythya valisneria*), and scoters (*Melanitta* spp.).

Characteristic invertebrates include the oligochaetes *Potamothrix* sp., and *Aulodrilus* sp. Characteristic plankton include diatoms, green algae, dinoflagellates, flagellates, cladocerans, and, in the profundal zone, the zooplankton *Pontoporeia hoyi* and *Mysis relicta*.

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. Exotic fishes of Lake Ontario include rudd (*Scardinius erythrophthalmus*), bluebacked herring (*Alosa aestivalis*), and round goby (*Negobius melanostomus*). 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*), and spoonhead sculpin (*Cottus ricei*).

Distribution: restricted to the Great Lakes Plain ecozone.

Rank: G2G3 S1S2

Revised: 2001

Examples: Lake Ontario; Lake Erie.

Sources: Berg 1963; Croskery 1995; C. L. Smith 1985; U.S. Fish and Wildlife Service 1992.

2. Great Lakes aquatic bed: the aquatic community of the protected shoals of the Great Lakes or Lake Champlain that occur in quiet bays that are protected from extreme wave action by islands, shoals or barrier bars, and typically support large areas of "weeds" or aquatic macrophytes. These bays may freeze over in winter and become inversely stratified. They are warm, mesotrophic and alkaline. Substrate can vary among sand, silt, muck, and rock. Two variants are known: classical "aquatic beds" with abundant macrophytes and sparsely-vegetated or unvegetated bays.

This community serves as a spawning and nursery habitat for a wide variety of warmwater fishes. 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*), tadpole madtom (*Noturus gyrinus*), muskellunge (*Esox masquinongy*), white perch (*Morone americana*), white sucker (*Catostomus commersoni*), smallmouth bass (*Micropterus dolomieu*), brown bullhead (*Ameiurus nebulosus*), northern pike (*Esox lucius*), and common carp (*Cyprinus carpio*). Goldfish (*Carassius auratus*) is an introduced fish that is well-established in Great Lakes aquatic beds.

This community serves as feeding and resting habitat for dabbling ducks and other waterfowl during spring and fall migration, and also as an overwintering ground. Other characteristic fauna include a diverse mollusk assemblage, bryozoans, ostracods, and cyclopoid copepods.

Characteristic macrophytes include the algae

Cladophora and *Chara*, tape grass (*Vallisneria americana*), pondweeds (*Potamogeton richardsonii*, *P. pectinatus*, *P. gramineus*, *P. pusillus*, *P. freisii*), naiad (*Najas flexilis*), horned pondweed (*Zannichellia palustris*), water stargrass (*Heteranthera dubia*), coontail (*Ceratophyllum demersum*), waterweed (*Elodea canadensis*), duckweed (*Lemna trisulca*), and bladderwort (*Utricularia vulgaris*). Additional species in Lake Champlain examples include water-plantain (*Alisma gramineum*), pondweeds (*Potamogeton zosteriformis*, *P. natans*, *P. perfoliatus*, *P. spirillus*), white water-crowfoot (*Ranunculus trichophyllus*), and quillwort (*Isoetes tuckermanni*). Common exotic plants include Eurasian water milfoil (*Myriophyllum spicatum*) and curly pondweed (*Potamogeton crispus*). Growth of *Cladophora* has been related to point sources of nutrient enrichment, especially phosphorus enrichment.

Distribution: restricted to the Great Lakes Plain ecozone and Lake Champlain Valley of the Adirondack ecozone, in direct association with the Great Lakes (including downstream along the Saint Lawrence River to Chippewa Bay) and Lake Champlain.

Rank: G4 S3

Examples: Irondequoit Bay, Monroe County; North Pond, Oswego County; Chippewa Bay, St. Lawrence County; Braddock Bay, Monroe County; Sodus Bay, Wayne County; Kings Bay, Clinton County.

Sources: Clausen 1940; NYNHP field surveys.

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, typically associated with islands and points. The lake substrate may be sandy, gravelly, cobbly, bouldery, or with submerged bedrock outcrops.

Characteristic fishes include stonecat (*Noturus flavus*), freshwater drum (*Aplodinotus grunniens*), mottled sculpin (*Cottus bairdi*), lake chub (*Couesius plumbeus*), muskellunge (*Esox masquinongy*), and a diversity of minnows and small fish such as river herring (*Moxostoma carinatum*), greater herring (*M. valenciennesi*), channel darter (*Perca copelandi*), and pumpkinseed (*Notropis anogenus*). Lake sturgeon (*Acipenser fulvescens*) was once abundant in shoal waters in the Great Lakes, has declined sharply, but should recover.

Cormorant (*Phalacrocorax* sp.) is a characteristic bird. Zebra mussels (*Dreissena polymorpha*) have become abundant in this community.

Aquatic macrophytes are uncommon and include

milfoil (*Myriophyllum* sp.) and coontail (*Ceratophyllum* sp.). 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. More data on this community are needed.

Distribution: restricted to the Great Lakes Plain ecozone in direct association with the Great Lakes (including downstream along the Saint Lawrence River to about American Island).

Rank: G4 S4

Revised: 2001

Examples: Indian Chief Shoal, St. Lawrence County; Dana Point Shoals, St. Lawrence County; Gull Shoal, Jefferson County; Upper Shoal, Jefferson County.

Sources: Knutson et al. 1990; C. L. Smith 1985; NYNHP field surveys.

4. Bog lake: the aquatic community of a dystrophic lake that typically occurs in a small, shallow basin (e.g., a kettlehole) that is protected from wind and is poorly drained. These lakes occur in areas with non-calcareous bedrock or glacial till; many are fringed or surrounded 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 naturally low pH (less than 5.4); and the lake may have oxygen deficiencies in deeper water (the profundal zone). 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.

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.

A characteristic fish is brown bullhead (*Ameiurus nebulosus*). Characteristic invertebrates include larvae of midges (*Chironomus* spp.) and phantom midges (*Chaoborus* spp.) in the benthos. Other characteristic invertebrates may include the amphipod *Hyallela azteca*, the mollusks *Musculium* sp. and *Ferresia californica*, and the midges *Tribelos* sp., *Phaenopsectra* sp., and *Zalutschia* sp.

Characteristic macrophytes include water-shield (*Brasenia schreberi*), white water-lily (*Nymphaea*

odorata), yellow pond-lily (*Nuphar luteum* ssp. *pumilum*, and *N. luteum* ssp. *variegatum*), bladderworts (*Utricularia vulgaris*, *U. geminiscapa*, *U. purpurea*), pondweeds (*Potamogeton epihydrus*, *P. oakesianus*), bur-reeds (*Sparganium fluctuans*, *S. angustifolium*), and clubrush (*Scirpus subterminalis*). Characteristic zooplankton may include the rotifers *Keratella* sp. and *Brachionus* sp.

A common feature of bog lakes is the development of a false bottom at a depth of about 0.3 to 0.9 m (1 to 3 ft) 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. Up to four ecoregional variants (Northern Appalachian, Alleghany Plateau, Great Lakes and Lower New England types) are suspected to differ in dominant and characteristic vascular plants and insects. More data on ecoregional variants are needed.

Distribution: sparsely scattered throughout New York State north of the coastal lowlands ecozone; especially common in the Adirondacks.

Rank: G4 S3

Revised: 2001

Examples: Spring Pond, Franklin County; Pink Pond, Franklin County; Rolley Pond, Franklin County; Mud Lake, Rensselaer County; Hosford Pond, Rensselaer County; Joyce Bog, Oneida County; Louisa Pond, Ulster County; Emmons Pond, Delaware County.

Sources: Clausen 1940; Cole 1975; Maitland 1978; NYNHP field surveys.

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. A name change and slight conceptual change to acidic dimictic lake is being evaluated.

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. Alkalinity is typically low (less than 12.5 mg/l calcium carbonate).

Profundal and pelagic species assemblages are usually well developed. The profundal benthos includes many species, but the abundance of each species is very low. Characteristic fishes are warmwater species such as smallmouth bass (*Micropterus dolomieu*), redbreast sunfish (*Lepomis auritus*), pumpkinseed (*Lepomis gibbosus*), rock bass (*Ambloplites rupestris*), and yellow perch (*Perca flavescens*) in shallow areas, and coldwater species such as lake trout (*Salvelinus namaycush*) and round whitefish (*Prosopium cylindraceum*) in deep water, and either slimy sculpin (*Cottus cognatus*) or mottled sculpin (*C. bairdi*). Shiners and minnows are often diverse. Brown trout (*Salmo trutta*) and rainbow trout (*S. gairdneri*) are commonly introduced.

Characteristic mollusks may include the clams eastern lampmussel (*Lampsilis radiata*), eastern elliptio (*Elliptio complanata*), and eastern floater (*Pyganodon cataracta*), and the snails ramshorn snail (*Heliosoma trivolvis*), physid snail (*Physa heterostrophia*), amnicolas (*Amnicola* spp.), and mystery snail (*Campeloma decisum*).

Characteristic profundal invertebrates include midge larvae such as *Tanytarsus*; in contrast to bog lakes, oligotrophic lakes usually lack phantom midges (*Chaoborus* spp.). Other characteristic and dominant invertebrates may include alderfly (*Sialis* sp.), the midges *Procladius* sp. and *Heterotrissocladius* sp., the mayfly *Stenonoma* sp., caddisflies (Trichoptera), and oligochaetes (Oligochaeta).

Phytoplankton and zooplankton also have many species, with low abundance; characteristic phytoplankton include desmids (*Staurastrum* spp.), chrysophytes (*Dinobryum* spp.), the diatoms *Tabellaria*, *Cyclotella*, and *Asterionella*. Characteristic zooplankton may include cladocerans, rotifers, copepods, scuds, cyclopoids, and *Daphnia* spp.

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 1 to 3 m (3 to 10 ft) deep. Characteristic rosette-leaved aquatics include pipewort (*Eriocaulon aquaticum*), water lobelia (*Lobelia dortmanna*), and quillworts (*Isoetes echinospora* ssp. *muricata*, *I. lacustris*). Other characteristic vascular plants include milfoils (*Myriophyllum alterniflorum*, *M. tenellum*), bladderworts (*Utricularia purpurea*, *U. resupinata*), mud purslane (*Elatine minima*), creeping buttercup (*Ranunculus reptans*), pondweeds (*Potamogeton robbinsii*, *P. gramineus*, *P. perfoliatus*), and tapegrass

(*Vallisneria americana*). The macroalgae *Nitella flexilis* may be abundant in the sublittoral zone.

This lake type may contain numerous habitat features including underwater cliffs, talus slopes, boulder fields, pavement, sand flats, as well as differing vegetation associations at different depths and on different substrates. Four to seven ecoregional variants are suspected to differ in dominant and characteristic vascular plants, fishes, mollusks, and insects. More data on regional variants are needed.

Distribution: throughout New York State, usually at high elevations, especially common in the Adirondacks.

Rank: G4 S3

Examples: Lake George, Warren and Essex Counties; Schroon Lake, Essex and Warren Counties; Wolf Pond, Essex County; Lake Lila, Hamilton County; Pine Pond, Franklin County; Chubb Lake, St. Lawrence County; Shaver Pond, Rensselaer County; Skaneateles Lake, Onondaga and Cayuga Counties.

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

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. A conceptual change is being evaluated, splitting this lake type into acidic versus alkaline dimictic lakes.

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. Alkalinity is typically moderate (slightly greater than 12.5 mg/l calcium carbonate).

Profundal and pelagic species assemblages are usually well developed. Characteristic fishes are warmwater fishes such as yellow perch (*Perca flavescens*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), northern pike (*Esox lucius*), bluegill (*Lepomis macrochirus*), and pumpkinseed (*L. gibbosus*).

Characteristic invertebrates may include the clam *Pisidium* sp. and the mayfly *Hexagenia* sp..

These lakes typically have a diverse mixture of

submerged macrophytes, such as several species of pondweeds (*Potamogeton amplifolius*, *P. praelongus*, *P. robbinsii*), tapegrass (*Vallisneria americana*), and bladderworts (*Utricularia* spp.).

Characteristic plankton may include the phytoplankton *Asterionella* and the zooplankton *Daphnia dubia*. More data on this community are needed.

Distribution: throughout New York State.

Rank: G4 S3S4

Revised: 2001

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

Sources: Bloomfield 1978a; Cole 1975; Maitland 1978; NYNHP field surveys.

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. A name change and slight conceptual change to alkaline dimictic lake is being evaluated.

Characteristic features of a eutrophic lake include the following: yellow, green, or brownish-green water that is murky, with low transparency (Secchi disk depths typically less than 2.5 m, but up to 4 m in some cases); 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. Alkalinity is typically high (greater than 12.5 mg/l calcium carbonate).

Profundal and pelagic species assemblages are usually well developed. 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*), chain pickerel (*Esox niger*), bluegill (*Lepomis macrochirus*), pumpkinseed (*L. gibbosus*), yellow bullhead (*Ictalurus natalis*), brown bullhead (*I. nebulosus*), white sucker (*Catostomus commersoni*), golden shiner (*Notemigonus crysoleucas*), common shiner (*Luxilus cornutus*),

northern redbelly dace (*Phoxinus eos*) 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*).

The abundant profundal benthos is poor in species, including only species tolerant of low oxygen; characteristic profundal invertebrates are oligochaetes (Oligochaeta), larvae of midges (*Chironomus* spp.), and phantom midges (*Chaoborus* spp.). Phytoplankton and zooplankton are usually abundant, but there are only a few species present; characteristic phytoplankton are cyanobacteria (blue-green algae); other characteristic plankton may include the phytoplankton *Ceolospaerium*, *Dinobryon*, and *Asterionella*, and the zooplankton *Bosmina*, *Keratella*, *Diaptomus*, and *Daphnia dubia*.

Aquatic macrophytes are abundant in shallow water, and there are many species present, but species diversity is generally lower than in mesotrophic lakes. Characteristic plants include tapegrass (*Vallisneria americana*), pondweeds (*Potamogeton* spp.), bur-reeds (*Sparganium* spp.), and the floating aquatic plants white water-lily (*Nymphaea* sp.), yellow pond-lily (*Nuphar luteum*), and water-shield (*Brasenia schreberi*). 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*).

Three to six ecoregional variants are suspected to differ in dominant and characteristic fishes, mollusks, and insects. More data on aquatic macrophytes and macroinvertebrates, as well as regional variants, are needed.

Distribution: throughout New York State, usually at low elevations, especially common in the Great Lakes Plains ecozone.

Rank: G4 S3S4

Revised: 2001

Examples: Canadarago Lake, Otsego County; Honeoye Lake, Ontario County; Onondaga Lake, Onondaga County; Saratoga Lake, Saratoga County; Streeter Lake, St. Lawrence County; Chodikee Lake, Ulster County.

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

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) or form only a thin or sporadic ice cover during the coldest parts of midwinter, so the water circulates and is isothermal during the winter. These lakes are typically thermally stratified only in the summer; they are oligotrophic to mesotrophic and alkaline.

Profundal and pelagic assemblages are usually well developed. The dominant fishes include salmonids such as cisco (*Coregonus artedii*), and lake trout (*Salvelinus namaycush*) as well as yellow perch (*Perca flavescens*), rainbow smelt (*Osmerus mordax*), rock bass (*Ambloplites rupestris*), walleye (*Stizostedion vitreum*), brown bullhead (*Ameiurus nebulosus*), white sucker (*Catostomus commersoni*), and northern pike (*Esox lucius*). Other characteristic fishes may include gar (*Lepisosteus* sp.), bowfin (*Amia calva*), lampreys (Petromyzontidae), lake sturgeon (*Acipenser fulvescens*), burbot (*Lota lota*), sauger (*Stizostedion canadense*), and round whitefish (*Prosopium cylindraceum*).

Characteristic invertebrates may include the mollusks eastern elliptio (*Elliptio complanata*), eastern lampmussel (*Lampsilis radiata*), pocketbook (*L. ovata*), pink heelsplitter (*Potamilus alatus*), floaters (*Pyganodon cataracta*, *P. grandis*), and mud amnicola (*Amnicola limosa*).

A characteristic crustacean of the hypolimnion of Finger Lake examples is *Senecella calanoides*, which was named after Seneca Lake. Dominant invertebrates of the profundal zone of Lake Champlain are Spheriidae and the oligochaetes *Stylodrilus heringianus* and *Pelosclex variegatus*. Winter epilimnion plankton species assemblages are usually well developed.

Characteristic plankton may include the phytoplankton *Fragilaria* spp. and *Anabaena* spp. in summer, and *Melosira* spp. and *Cryptomonas ovata* in winter, and the zooplankton *Daphnia* spp., and *Diaptomus* spp. in summer, and *Limnocalanus macrurus*, and *Cyclops bicuspidatus* in winter.

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 Lake, Seneca Lake, and Lake Champlain. These lakes are very deep relative to their size, with mean depths of 54.5 m (179 ft), 88 m (290 ft), and over 18m (60 ft) respectively. The area of these three lakes are 172 k² (66.4 sq. mi.), 175 k² (67.7 sq. mi.), and 1,331 k² (514 sq. mi.) respectively. The Great Lakes (e.g., Lakes Ontario, and Lake Erie) are also summer-stratified monomictic lakes, 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.

Up to two ecoregional variants are possible (Saint Lawrence-Lake Champlain, and Finger Lakes types) with one to few examples of each, potentially differing in dominant, and characteristic vascular plants, fishes, mollusks, and insects.

Distribution: uncommon in upstate New York, north of the Coastal Lowlands ecozone; probably restricted to the Finger Lakes in the Great Lakes Plain ecozone, and Lake Champlain in the Adirondacks ecozone.

Rank: G3G4 S1S2

Revised: 2001

Examples: Cayuga Lake, Cayuga, Seneca, and Tompkins Counties; Seneca Lake, Seneca, Schuyler, and Yates Counties; Lake Champlain, Clinton, Essex, and Washington Counties.

Sources: Berg 1963; Bloomfield 1978a; Greeley 1930; Lake Champlain Basin Study 1979; Muenscher 1928.

9. Winter-stratified monomictic lake: the aquatic community of a large, shallow 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 6 m (20 ft), and surface area of approx. 200 k² (80 square miles), and is completely exposed to winds. These lakes continue to circulate throughout the summer; stratification becomes disrupted at some point during an average summer. These lakes typically never become thermally stratified in the summer, and are only stratified in the winter when they freeze over, and become inversely stratified (coldest water at the surface). They are eutrophic to mesotrophic.

Littoral, and epilimnion species assemblages predominate. Pelagic species assemblages are well developed. Characteristic fishes are walleye (*Stizostedion vitreum*), largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*), bullhead (*Ictalurus* sp.), white sucker (*Catostomus commersoni*), muskellunge (*Esox masquinongy*), and trout perch (*Percopsis omiscomaycus*).

Characteristic macroinvertebrates may include isopods (Isopoda), amphipods (Amphipoda), and ramshorn snails (Planorbidae). Characteristic phytoplankton may include *Dinobryon* sp., and *Ceratium* sp. Vascular plants are typically diverse. Characteristic aquatic macrophytes include water stargrass (*Heteranthera dubia*), coontail (*Ceratophyllum demersum*), waterweed (*Elodea* spp.), naiad (*Najas flexilis*), tapegrass (*Vallisneria americana*), and pondweeds (*Potamogeton perfoliatus*, *P. pectinatus*, *P. pusillus*, *P. richardsonii*, *P. nodosus*, *P. zosteriformis*). The macroalgae *Chara* may be

abundant.

Only two to three ecoregional variants are suspected (Great Lakes, Northern Appalachian, and possibly Lower New England types), potentially differing in dominant, and characteristic vascular plants, fishes, mollusks, and insects.

Distribution: uncommon in upstate New York, north of the Coastal Lowlands ecozone, and probably restricted to the Great Lakes Plains ecozone, and the St. Lawrence River valley of the Adirondacks ecozone.

Rank: G3G4 S2

Revised: 2001

Examples: Oneida Lake, Oneida, and Oswego Counties; Horseshoe Lake, St. Lawrence County; Black Lake, St. Lawrence County; Perch Lake, Jefferson County.

Sources: Berg 1963; Bloomfield 1978b; NYNHP field surveys.

10. Meromictic lake: the aquatic community of a relatively deep lake with small surface area that is so protected from wind-stirring that it has no annual periods of complete mixing, and remains chemically stratified throughout the year. These lakes may be protected from mixing by a sheltered surrounding landscape (e.g., a deep basin) or by adjacent tree cover. 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. Chemical stratification is most often measured by salinity gradients or total cation, and anion concentrations. Gradients may be present for chemicals such as hydrogen sulfide, ammonia, phosphorus or iron. Flushing rates are typically low. Some examples of this lake type may be dystrophic, and thus resemble bog lakes.

Species diversity is low because very few organisms can tolerate the extreme chemical conditions of the lower strata of a meromictic lake. Fishes are absent or sparse, and confined to the epilimnion. Characteristic fishes are warmwater species, and may include brown bullhead (*Ameiurus nebulosus*), perch, and white sucker (*Catostomus commersoni*).

Characteristic macroinvertebrates may include gastropods (six species of snails in Green Lake Fayetteville), crustaceans (Crustacea), dragonflies (Anisoptera), beetles (Coleoptera), true bugs

(Hemiptera), Megaloptera, and caddisflies (Trichoptera).

Freshwater sponge forms a dense cover in the littoral zone of one example, Potters Pond. Plankton is typically diverse, and dense. A purple sulfur bacterium (*Lamprocystis roseopersicina*) is characteristic of the hypolimnion of Green Lake Fayetteville. Other characteristic plankton may include cyanobacteria, the phytoplankton *Synura* sp., *Asterionella* sp., *Peridium* sp., and *Ceratium hirundinella*, and the zooplankton *Diaphanasoma brachyurium*, *Ceriodaphnia*, and cyclopoid copepods.

Characteristic vascular plants may include stoneworts (*Chara* spp.), waterweeds (*Elodea* spp.), and pondweeds (*Potamogeton* spp.).

The best-known example in New York is Green Lake Fayetteville. Two or more ecoregional variants (Great Lakes, Northern Appalachian types) are suspected, potentially differing in dominant, and characteristic vascular plants, insects, and plankton. More data on this community are needed.

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

Rank: G3G4 S1S2

Revised: 2001

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

Sources: Berg 1963; Bohannon et al. 1994; Eggleton 1956; Pendl, and Stewart 1986; NYNHP field surveys.

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 (CaCO₃). This calcium carbonate is deposited on the substrate, and forms a marl sediment. Calcium carbonate levels are typically greater than 50 ppm.

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, and abundant in marl ponds. Marl ponds have very low primary productivity, and sparse growth of aquatic macrophytes. Characteristic vascular plants may include the pondweeds *Potamogeton filiformis*, and *P. strictifolius*.

Certain diatoms may be abundant, but low levels of available plant nutrients restrict growth of other

algae, and cyanobacteria. A characteristic plankton in nearby states include calciphilic desmids, the cladoceran *Holopedium*, and calciphilic species of the rotifer *Brachionus* sp. More data on this community are needed.

Distribution: known only from the Finger Lakes Highlands subzone of the Appalachian Plateau ecozone; may be other examples in the Great Lakes Plain ecozone.

Rank: G3G4 S1

Revised: 2001

Examples: Cortland Marl Ponds, Cortland County.

Sources: Cole 1979; NYNHP 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 bottom, and shores of an inland salt pond are very mucky.

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.). Another characteristic plant is the pondweed *Potamogeton pectinatus*. More data on this community are needed.

Distribution: known only from the Great Lakes Plain ecozone.

Rank: G2 S1

Revised: 1990

Example: Carncross Salt Pond, Wayne County.

Sources: Catling, and McKay 1981; NYNHP field surveys.

13. Oxbow lake: the aquatic community of a small, shallow, usually stagnant lake or pond of fluvial origin that occurs in an old river meander or oxbow that has been cut off from an unconfined river or marsh headwater stream by deposition of a levee. The associated river typically overflows this levee periodically, replenishing hydrological, and biotic features of the river into this lake type. Many examples of this lake type may be relatively short-lived in

dynamic river complexes, transforming into a backwater slough through permanent breaching of the downstream levee, or into a riverine community through permanent breaching of the upstream levee. These are usually eutrophic lakes.

Characteristic biota are typically riverine species assemblages. Aquatic vegetation is abundant; characteristic aquatic macrophytes may include species typical of eutrophic ponds such as pondweeds (*Potamogeton* spp.), white water-lily (*Nymphaea odorata*), and water-shield (*Brasenia schreberi*).

Characteristic fauna may include odonates (Odonata). Four to seven ecoregional variants are suspected to differ in dominant, and characteristic vascular plants, fishes, mollusks, and insects. Up to three morphological variants are known: 1) classical oxbow lakes formed from old river channels, 2) small levee lakes formed as pools from levee overwash, and 3) floodplain lakes formed, and replenished during high annual water of the associated river. More data on this community are needed.

Distribution: throughout New York State north of the Coastal Lowlands ecozone, usually at low elevations.

Rank: G4 S3

Revised: 2001

Examples: Raquette River, Franklin County; North Branch Moose River, Herkimer County; Schroon River, Essex County; Little River, St. Lawrence County; Hemp Pond, Livingston County.

Source: NYNHP field surveys.

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. A series of coastal plain ponds are often hydrologically connected, either by groundwater, or sometimes by surface flow in a small coastal plain stream. Water is typically acidic, darkly stained, and has low transparency. The substrate is typically sand to muck.

Aquatic vegetation may be abundant; characteristic plants include water-shield (*Brasenia schreberi*), white water-lily (*Nymphaea odorata*), bayonet-rush (*Juncus militaris*), spikerush (*Eleocharis robbinsii*), bladderworts (*Utricularia purpurea*, *U. fibrosa*), water milfoil (*Myriophyllum humile*), naiad (*Najas flexilis*), waterweed (*Elodea* spp.), pondweed (*Potamogeton oakesianus*), pipewort (*Eriocaulon aquaticum*), brown-fruited rush (*Juncus pelocarpus*), golden-pert (*Gratiola*

aurea), and a peat moss (*Sphagnum macrophyllum*).

Characteristic fishes include chain pickerel (*Esox niger*), banded sunfish (*Enneacanthus obesus*), and eastern mudminnow (*Umbra pygmaea*). Coastal plain ponds are breeding ponds for tiger salamander (*Ambystoma tigrinum*). Other characteristic fauna may include painted turtle (*Chrysemys picta*), wood duck (*Aix sponsa*), and muskrat (*Ondatra zibethicus*). More data on this community are needed.

Distribution: in the Coastal Lowlands ecozone on Long Island.

Rank: G3G4 S2

Revised: 2001

Examples: Crooked Pond, Suffolk County; Scoys Pond, Suffolk County; Kents Pond, Suffolk County; Weeks Pond, Suffolk County.

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

15. Oligotrophic pond: the aquatic community of a small, shallow, nutrient-poor pond. The water is very clear, and the bottom is usually sandy or rocky. Oligotrophic ponds are too shallow to remain stratified throughout the summer; they are winter-stratified, monomictic ponds. Additional characteristic features of an oligotrophic pond include the following: blue or green water 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). Alkalinity is typically low (less than 12.5 mg/l calcium carbonate). A name change, and slight conceptual change to acidic pond is being evaluated.

Aquatic vegetation is typically sparse, and species diversity is low. Littoral, epilimnion, and acidic tolerant species assemblages usually predominate. Characteristic species are rosette-leaved aquatics such as pipewort (*Eriocaulon aquaticum*), water lobelia (*Lobelia dortmanna*), and quillwort (*Isoetes echinospora*). Additional characteristic aquatic macrophytes may include pondweed (*Potamogeton epiphydrus*), milfoil (*Myriophyllum farwellii*), bladderwort (*Utricularia vulgaris*), and burreed (*Sparganium fluctuans*).

Fish diversity is typically low, and fish assemblages are generally poorly developed. Oligotrophic ponds may have either coldwater or warmwater 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 coldwater ponds is brook trout (*Salvelinus fontinalis*). Native populations

of brook trout have been extirpated from most examples in the state. Additional characteristic fishes may include creek chub (*Semotilus atromaculatus*). Characteristic macroinvertebrates may include the clam *Pisidium* sp., several odonates (*Aeshna* spp., *Ischnura* spp., *Cordulia* spp., and *Leucorrhina* spp.), diving beetles (Dytiscidae), water boatman (Corixidae), and backswimmers (Notonectidae). Characteristic plankton may include the phytoplankton *Tabellaria*, and *Asterionella*, and the zooplankton *Keratella*, and *Nauplii*.

Three to four ecoregional variants (Northern Appalachian, Lower New England, Alleghany Plateau, and possibly North Atlantic Coast types) are suspected to differ in dominant, and characteristic vascular plants, fishes, mollusks, and insects.

Tarn pond, and flow-through or fluvial pond might be distinct variants worthy of recognition as separate communities, but need further evaluation. Tarn ponds occur in alpine to subalpine zones, and are typically frozen annually for extended periods. Characteristic vegetation of tarn ponds may include bladderwort (*Utricularia geminiscapa*), pondweed (*Potamogeton confervoides*), and floating-heart (*Nymphoides cordata*). Characteristic animals of tarn ponds may include lake trout (*Salvelinus alpinus*). Flow-through ponds are closely associated with riverine complexes (e.g., large natural widenings of rivers or large impoundments of river channels dammed by beaver), and have a high flushing rate. Characteristic animals of flow-through ponds may include beaver (*Castor canadensis*). More data on regional variants are needed.

Distribution: throughout New York State, usually at high elevations; more common in the Adirondacks, also occurs in the Appalachian Plateau, Taconic Highlands, and Tug Hill ecozones.

Rank: G4 S4

Revised: 2001

Examples: South Pond, Hamilton County; Kildare Pond, St. Lawrence County; Rensselaer Plateau, Rensselaer County; Tug Hill Plateau, Lewis, Oswego, and Jefferson Counties.

Source: NYNHP field surveys.

16. Eutrophic pond: the aquatic community of a small, shallow, nutrient-rich pond. The water is usually green with algae, and the bottom is mucky. Eutrophic ponds are too shallow to remain stratified throughout the summer; they are winter-stratified, monomictic ponds. Additional characteristic features of a eutrophic pond include the following: water that is murky, with

low transparency (Secchi disk depths typically less than 4 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); and a weedy shoreline. Alkalinity is typically high (greater than 12.5 mg/l calcium carbonate). A name change, and slight conceptual change to alkaline pond is being evaluated.

Species diversity is typically high. Aquatic vegetation is abundant. Littoral, and epilimnion species assemblages usually predominate. Characteristic plants include coontail (*Ceratophyllum demersum*), duckweeds (*Lemna minor*, *L. trisulca*), waterweed (*Elodea canadensis*), pondweeds (*Potamogeton* spp.), water starwort (*Heteranthera dubia*), bladderworts (*Utricularia* spp.), naiad (*Najas flexilis*), tapegrass (*Vallisneria americana*), algae (*Cladophora* spp.), yellow pond-lily (*Nuphar luteum*), and white water-lily (*Nymphaea odorata*). Characteristic fishes are usually warmwater fishes. Characteristic macroinvertebrates may include several types of odonates (*Aeshna* spp., *Ischnura* spp., *Gomphus* spp., and *Basiaeschna* spp.), and leeches (Hirundinae). Characteristic, and dominant plankton may include the phytoplankton *Chrysosphaerella longispina*, and *Ceratium* spp., and the zooplankton *Nauplii*, rotifers such as *Keratella*, cyclopoids, and cladocerans.

Three to seven ecoregional variants (including Northern Appalachian, Great Lakes, Lower New England types) are suspected to differ in dominant, and characteristic vascular plants, fishes, mollusks, and insects. Flow-through or fluvial pond might be a distinct variant worthy of recognition as a separate community type, but needs further evaluation. Flow-through ponds are closely associated with riverine complexes (e.g., large natural widenings of rivers or large beaver impoundments of river channels), and have a high flushing rate. Characteristic animals of flow-through ponds may include beaver (*Castor canadensis*). More data on this community are needed.

Distribution: throughout New York State, and is more common at low elevations, especially in the Great Lakes Plain ecozone, and St. Lawrence River Valley.

Rank: G4 S4

Revised: 2001

Examples: Black Pond, Jefferson County; Deer Pond, Essex County; Lima Ponds, Livingston County; Rogers Pond, Essex County; Sullivan Pond, Warren County; White Lily Pond, Rensselaer County.

Sources: Gilman 1979; NYNHP field surveys.

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. Lacustrine submerged structure: the aquatic community associated with an artificially introduced structure submerged in lacustrine waters, such as a pond or lake, that provides habitat for fish and other organisms. This includes structures that have been intentionally sunk for the purpose of attracting fish, as well as sunken ships, disposed waste, submerged bridge abutments, or any other introduced material that provides suitable habitat.

Distribution: throughout New York State.

Rank: G5 S5

Revised: 2001

2. Acidified lake: the aquatic community of a formerly alkaline (oligotrophic or mesotrophic), dimictic lake that has received so much acid deposition (pH less than 4.7; sulfate, and nitrate are now the 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. These lakes may be best distinguished from naturally acidic lakes (e.g., bog lake) through historical comparisons.

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

Revised: 1990

Example: Silver Lake Webb, Herkimer County.

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

3. 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

Revised: 1990

Sources: Bloomfield 1978a, 1980.

4. 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

Revised: 1990

5. 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

LACUSTRINE REFERENCES

(*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

Revised: 1990

6. 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

Revised: 1990

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

Revised: 1990

8. 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

Revised: 1990

9. 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

Revised: 1990

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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 plant composition (hydrophytes), substrate (hydric soils), and hydrologic regime (frequency of flooding) (Cowardin 1979).

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.

The most abundant emergent aquatic plants are cattails (*Typha angustifolia*, *T. latifolia*), wild rice (*Zizania aquatica*), bur-weeds (*Sparganium eurycarpum*, *S. angustifolium*), pickerel weed (*Pontederia cordata*), bulrushes (*Scirpus tabernaemontani*, *S. fluviatilis*, *S. heterochaetus*, *S. acutus*, *S. pungens*, *S. americanus*), arrowhead (*Sagittaria latifolia*), arrowleaf (*Peltandra virginica*), rice cutgrass (*Leersia oryzoides*), bayonet rush (*Juncus militaris*), water horsetail (*Equisetum fluviatile*) and bluejoint grass (*Calamagrostis canadensis*).

The most abundant floating-leaved aquatic plants are fragrant water lily (*Nymphaea odorata*), duckweeds (*Lemna minor*, *L. trisulca*), pondweeds (*Potamogeton natans*, *P. epiphydrus*, *P. friesii*, *P. oakesianus*, *P. crispus*, *P. pusillus*, *P. zosteriformis*, *P. strictifolius*), spatterdock (*Nuphar variegata*), frog's-bit (*Hydrocharis morus-ranae*), watermeal (*Wolffia* spp.), water-shield (*Brasenia schreberi*), and water-chestnut (*Trapa natans*).

The most abundant submerged aquatic plants are pondweeds (*Potamogeton richardsonii*, *P. amplifolius*, *P. spirillus*, *P. crispus*, *P. zosteriformis*), coontail (*Ceratophyllum demersum*), chara (*Chara globularis*), water milfoils (*Myriophyllum spicatum*, *M. sibiricum*), pipewort (*Eriocaulon aquaticum*), tapegrass (*Vallisneria spiralis*), liverwort (*Riccia fluitans*), naiad (*Najas flexilis*), water lobelia (*Lobelia dortmanna*), waterweed (*Elodea canadensis*), water stargrass (*Heteranthera dubia*), and bladderworts (*Utricularia vulgaris*, *U. intermedia*).

Animals that may be found in deep emergent marshes include red-winged blackbird (*Agelaius phoeniceus*), marsh wren (*Cistothorus palustris*), bullfrog (*Rana catesbeiana*), and painted turtle (*Chrysemys picta*). Rare species in some deep emergent marshes include American bittern (*Botaurus lentiginosus*), Virginia rail (*Rallus limicola*), and pied-billed grebe (*Podilymbus podiceps*).

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

Revised: 2001

Examples: Lake Champlain South Basin, Washington County; Lake Lila, Hamilton County; Chippewa Creek Marsh, St. Lawrence County; Upper and Lower Lakes, St. Lawrence County, Big Bay Swamp, Oswego County..

Sources: Bray 1915; Cowardin 1979; Gilman 1976; NYNHP field surveys.

2. Shallow emergent marsh: a marsh meadow community that occurs on mineral soil or deep muck soils (rather than true peat), 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 during an average year.

Most abundant herbaceous plants include bluejoint grass (*Calamagrostis canadensis*), cattails (*Typha latifolia*, *T. angustifolia*, *T. x glauca*), sedges (*Carex* spp.), marsh fern (*Thelypteris palustris*), manna grasses (*Glyceria pallida*, *G. canadensis*), spikerushes (*Eleocharis smalliana*, *E. obtusa*), bulrushes (*Scirpus cyperinus*, *S. tabernaemontani*, *S. atrovirens*), three-way sedge (*Dulichium arundinaceum*), sweetflag (*Acorus americanus*), tall meadow-rue (*Thalictrum pubescens*), marsh St. John's-wort (*Triadenum virginicum*), arrowhead (*Sagittaria latifolia*), goldenrods (*Solidago rugosa*, *S. gigantea*), eupatoriums (*Eupatorium maculatum*, *E. perfoliatum*), smartweeds (*Polygonum coccineum*, *P. amphibium*, *P. hydropiperoides*), marsh bedstraw (*Galium palustre*), jewelweed (*Impatiens capensis*), loosestrifes (*Lysimachia thyrsiflora*, *L. terrestris*, *L. ciliata*). Frequently in degraded examples reed canary grass (*Phalaris arundinacea*) and/or purple loosestrife (*Lythrum salicaria*) may become abundant.

Sedges (*Carex* spp.) may be abundant in shallow emergent marshes, but are not usually dominant. Marshes must have less than 50% cover of peat and tussock-forming sedges such as tussock sedges (*Carex stricta*), otherwise it may be classified as a sedge meadow. Characteristic shallow emergent marsh sedges include *Carex stricta*, *C. lacustris*, *C. lurida*, *C. hystricina*, *C. alata*, *C. vulpinoidea*, *C. comosa*, *C. utriculata*, *C. scoparia*, *C. gynandra*, *C. stipata*, and *C. crinita*.

Other plants characteristic of shallow emergent marshes (most frequent listed first) include blue flag iris (*Iris versicolor*), sensitive fern (*Onoclea sensibilis*), common skullcap (*Scutellaria galericulata*), begger-ticks (*Bidens* spp.), water-horehounds (*Lycopus uniflorus*, *L. americanus*), bur-weeds (*Sparganium*

americanum, *S. eurycarpum*), swamp milkweed (*Asclepias incarnata*), water-hemlock (*Cicuta bulbifera*), asters (*Aster umbellatus*, *A. puniceus*), marsh bellflower (*Campanula aparinoides*), water purslane (*Ludwigia palustris*), royal and cinnamon ferns (*Osmunda regalis*, *O. cinnamomea*), marsh cinquefoil (*Potentilla palustris*), rushes (*Juncus effusus*, *J. canadensis*), arrowleaf (*Peltandra virginica*), purple-stem angelica (*Angelica atropurpurea*), water docks (*Rumex orbiculatus*, *R. verticillatus*), turtlehead (*Chelone glabra*), water-parsnip (*Sium suave*), and cardinal flower (*Lobelia cardinalis*).

Shallow emergent marshes may have scattered shrubs including rough alder (*Alnus incana* ssp. *rugosa*), water willow (*Decodon verticillatus*), shrubby dogwoods (*Cornus amomum*, *C. sericea*), willows (*Salix* spp.), meadow sweet (*Spiraea alba* var. *latifolia*), and buttonbush (*Cephalanthus occidentalis*). Areas with greater than 50% shrub cover are classified as shrub swamps.

Amphibians that may be found in shallow emergent marshes include frogs such as eastern American toad (*Bufo a. americanus*), northern spring peeper (*Pseudoacris c. crucifer*), green frog (*Rana clamitans melanota*), and wood frog (*Rana sylvatica*); and salamanders such as northern redback salamander (*Plethodon c. cinereus*) (Hunsinger 1999). Birds that may be found include red-winged blackbird (*Agelaius phoeniceus*), marsh wren (*Cistothorus palustris*), and common yellowthroat (*Geothlypis trichas*) (Levine 1998).

Shallow emergent marshes typically occur in lake basins and along streams often intergrading with deep emergent marshes, shrub swamps and sedge meadows, and they may occur together in a complex mosaic in a large wetland.

Distribution: throughout New York State.

Rank: G5 S5

Revised: 2001

Examples: South Branch Grass River Colton, St. Lawrence County; West Branch Oswagatchie River Diana, Lewis County; East Branch Fish Creek, Lewis County; Jordan River, St. Lawrence/Franklin Counties; Lakeview Marshes, Jefferson County.

Sources: Bray 1915; Gilman 1976; Hotchkiss 1932; Hunsinger 1999; Levine 1998; Metzler and Tiner 1992; Tiner 1985; NYNHP field surveys.

3. Shrub swamp: an inland wetland dominated by tall 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. They may be codominated by a mixture of species, or have a single dominant shrub species.

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 and ponds there is a distinct zone dominated by water-willows (*Decodon verticillatus*) and/or buttonbush (*Cephalanthus occidentalis*) which can sometimes fill a shallow basin.

Characteristic shrubs that are common in these and other types of shrub swamps include meadow-sweet (*Spiraea alba* var. *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*), and arrowwood (*Viburnum recognitum*). More documentation and research is needed to distinguish the different types of shrub swamps in New York.

Birds that may be found in shrub swamps include common species such as common yellowthroat (*Geothlypis trichas*); and rare species such as American bittern (*Botaurus lentiginosus*), alder flycatcher (*Empidonax alnorum*), willow flycatcher (*E. trallii*), and Lincoln's sparrow (*Passerella lincolnii*) (Levine 1998).

Distribution: throughout New York State.

Rank: G5 S5 *Revised:* 2001

Examples: West Branch Oswagatchie River Diana, Lewis County; West Branch Sacandaga River, Hamilton County; Jordan River, St. Lawrence/Franklin Counties, Shingle Shanty Brook, Hamilton County, East Branch Fish Creek, Lewis County.

Sources: Bray 1915; Levine 1998; McVaugh 1958; Metzler and Tiner 1992; Shanks 1966; Tiner 1985; NYNHP field surveys.

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 *Campyllum stellatum* and *Drepanocladus* sp.

Distribution: apparently restricted to shores of Lake Champlain and the St. Lawrence River. Probably also occurs along Lake Ontario and possibly on a few large inland lakes such as the Finger Lakes.

Rank: G3? S2S3 *Revised:* 1990

Example: Valcour Island, Essex County.

Source: NYNHP 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 bulrush (*S. tabernaemontani*), 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

Revised: 1990

Examples: Song Lake, Cortland County; Ausable Delta, Clinton County; Eastern Lake Ontario, Oswego/Jefferson Counties.

Source: NYNHP 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 pensylvanicum*), 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

Revised: 1990

Example: Polliwog Pond, Franklin County.

Source: NYNHP 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, grasses, and herbs. Submerged and floating-leaved aquatic plants, such as fragrant waterlily (*Nymphaea odorata*) and pondweeds (*Potamogeton* spp.), may become “stranded” on the exposed shore. 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. A description of the aquatic component is included under the coastal plain pond community. The vegetation of this pond shore community can change dramatically from one year to the next depending on fluctuations in groundwater levels.

Coastal plain pond shores can be divided into four distinct zones following the proposed classification by Zaremba and Lamont (1993):

1. The *upper wetland shrub thicket* zone is treated as either pine barrens shrub swamp or the coastal

variant of highbush blueberry bog thicket. This zone may also grade into red maple-black gum swamp, coastal plain Atlantic white cedar swamp, or in pond shores with steeper slopes pitch pine-oak forest.

2. The *upper, low herbaceous fringe* zone is a narrow band of vegetation with peaty substrate mixed with sand. The dominant plants of this zone are peat moss (*Sphagnum* spp.), yellow-eyed grass (*Xyris difformis*), narrow-leaved goldenrod (*Euthamia tenuifolia*), bluejoint grass (*Calamagrostis canadensis*), clubmosses (*Lycopodiella inundata*, *L. appressa*). Other plants of this zone include (*Agalinis virgata*), sedge (*Carex striata*), sundews (*Drosera intermedia*, *D. filiformis*), creeping St. John's-wort (*Hypericum adpressum*), slender blue-flag (*Iris prismatica*), redroot (*Lacnanthes caroliniana*), Nuttall's lobelia (*Lobelia nuttallii*), water-horehound (*Lycopus amplexans*), panic grasses (*Panicum acuminatum*, *P. verrucosum*, *P. wrightianum*), and large cranberry (*Vaccinium macrocarpon*). Occasionally, scattered seedlings of Atlantic white cedar (*Chamaecyparis thyoides*) may be found in this zone.

3. The *sandy exposed pond bottom* zone is often very sandy and dominated by annual species. This zone may be extremely wide at ponds with very gradual pond bottom slopes. The dominant plants of this zone are beakrushes (*Rhynchospora capitellata*, *R. nitens*), and nutrush (*Scleria reticularis* var. *reticularis*). Other species of this zone include yellow-eyed grass (*Xyris difformis*), Canadian St. John's-wort (*Hypericum canadense*), rushes (*Juncus pelocarpus*, *J. canadensis*), rose coreopsis (*Coreopsis rosea*), spikerushes (*Eleocharis melanocarpa*, *E. tuberculosa*), umbrella-grass (*Fuirena pumila*), ludwigia (*Ludwigia spheerocarpa*), bald-rush (*Rhynchospora scirpoides*), white beakrush (*Rhynchospora alba*), Virginia meadow-beauty (*Rhexia virginica*), marsh St. John's-wort (*Triadenum virginicum*), bladderwort (*Utricularia subulata*).

4. The *organic exposed pond bottom* zone is more frequently flooded than the sandy zone, hence has a greater accumulation of organics. The dominant plants of this zone can be extremely variable from year to year depending on the degree of flooding. In high water years, annual species that cannot germinate underwater are usually absent and submerged and floating-leaved aquatic plants are more abundant. In contrast, annual species tend to flourish in low water years and the aquatic species become less prevalent. The dominant plants of this zone are bald-rush (*Rhynchospora scirpoides*¹), pipewort (*Eriocaulon aquaticum*^b), (*Eleocharis obtusa*¹, *E. olivacea*¹), gratiola (*Gratiola aurea*). Other species of this zone include twigrush (*Cladium mariscoides*), (*Eleocharis robbinsii*), bayonet rush (*Juncus militaris*), mermaid-weed (*Proserpinaca pectinata*), beaked rushes (*Rhynchospora*

macrostachya, *R. inundata*), quill-leaf arrowhead (*Sagittaria teres*^h), bladderworts (*Utricularia juncea*^l, *U. fibrosa*, *U. purpurea*^h, *U. striata*), yellow-eyed grasses (*Xyris smalliana*, *X. torta*).

^h = more abundant in high water years

^l = more abundant in low water years

Characteristic animals include eastern painted turtle (*Chrysemys picta picta*), muskrat (*Ondatra zibethica*), various dragonflies and damselflies, and chain pickerel (*Esox niger*). Rare animals of some coastal plain ponds and pond shores include bluets (*Enallagma recurvatum*, *E. laterale*, *E. pictum*), eastern mudminnow (*Umbra pygmaea*), tiger salamander (*Ambystoma tigrinum*), and banded sunfish (*Enneacanthus obesus*).

The primary disturbance in coastal plain pond shores is a periodic cycle of flooding and draw down. Hydrology of the ponds is controlled by a long term 2-3 year cycle of draw down and flooding tightly linked with local rainfall amounts and, in some ponds, local groundwater levels (Schneider 1992). The amount of groundwater influx for a given pond or pond system appears to be influenced by landscape position. For example, pond shores in proximity to topographical highs, such as kames and morainal hills, appear to have increased amounts of groundwater flow versus ponds in more level topography (Schneider 1992). Ponds positioned at higher elevations draw down faster than neighboring ponds at lower elevations. Secondary disturbances include fire, which influences vegetation at the pond shore shrub margin and may effect the amount of organic material in the pond substrate (Zaremba and Lamont 1993).

Because of the characteristic zones of vegetation that dominate a pond shore in any given year, ponds may have a number of different vegetation assemblages based on the extent of draw down, position within the pond shore, and overall composition of vegetation within a specific pond (Graham and Henry 1933, Zaremba and Lamont 1993, Schneider 1994). Coastal plain pond shores are a dynamic collection of vegetation and a well-zoned pond shore may display one or more vegetation associations in a single growing season. The vegetation associations that dominate New York pond shores probably should be recognized as stochastic, repeating vegetation “zones” that appear as a function of periodic fluctuation of hydrology (Zaremba and Lamont 1993, Schneider 1994).

Distribution: restricted to the Coastal Lowlands ecozone on Long Island.

Rank: G3G4 S2

Revised: 2001

Examples: Peasy's Pond, Suffolk County; Crooked Pond and Long Pond, Suffolk County; House Pond and

Division Pond, Suffolk County. The best examples are concentrated in three main areas on Long Island, the Peconic River Headwaters, Sears Bellows County Park, and the Long Pond Greenbelt.

Sources: Graham and Henry 1933; MacDonald and Edinger 2000; Parker 1946; Schneider 1992; Schneider 1994; Williams 2001; Zaremba and Lamont 1993; NYNHP field surveys.

8. Sinkhole wetland: a small wetland, with or without a pond (a sinkhole pond), that occurs in a poorly drained sinkhole, typically underlain by limestone in a region of karst topography. The substrate may be dark muck that is rich in organic matter or deep, calcareous, gleyed clay. Water levels fluctuate seasonally, and the water is usually intermittent, basic and eutrophic. 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. A split into sinkhole wetland and sinkhole pond, the latter as a lacustrine community, may be warranted and is being evaluated.

Well-developed examples of this community may consist of about four physiognomic zones. The open water area is characterized by submergent aquatic plants such as spikerush (*Eleocharis acicularis*), water-parsnip (*Sium suave*), water plantain (*Alisma plantago-aquatica*), and water purslane (*Ludwigia palustris*). Surrounding the open water is typically a zone of emergent aquatic plants; characteristic species in this zone include sedges (*Carex vulpinoidea*, *C. lacustris*, *C. canescens*), manna grass (*Glyceria acutiflora*), bulrush (*Scirpus cyperinus*), beak rush (*Rhynchospora capillacea*), bluejoint grass (*Calamagrostis canadensis*), and small beggar-ticks (*Biden discoidea*). Some sinkhole wetlands are encircled by a ring of shrubs; characteristic shrubs are willows (*Salix sericea*, *S. lucida*, *S. nigra*, *S. petiolaris*). The outer zone may be forested, dominated by the characteristic tree species red maple (*Acer rubrum*), American elm (*Ulmus americana*), green ash (*Fraxinus pensylvanica*), white ash (*F. americana*), bur oak (*Quercus macrocarpa*), and swamp white oak (*Quercus bicolor*). Most examples have been altered by grazing and other forms of agricultural and only the emergent aquatic zone may remain. The community provides breeding habitat for amphibians such as green frog (*Rana clamitans*) and damselflies (Zygoptera). There may also be characteristic nesting birds and beetles (Coleoptera).

Three broad scale topographic settings for sinkhole wetlands are suspected. Typical examples occur on broad flat calcareous lowland plains such as those on the Great Lakes Plain. Others occur on broad gently sloping valleys and hills sometimes associated with

these plains and also in mountainous areas with calcareous bedrock. In addition, three hydrological variants are suspected. Typical examples occur as a string of small wetland pockets often interconnected via surface hydrology by an intermittent stream. In other examples sinkholes are large and merge into a single continuous wetland with intruding upland fingers. A third hydrological variant has one or more wetland pockets connected via groundwater. Two to five ecoregional variants (including Great Lakes and Lower New England types) are suspected to differ in characteristic and dominant biota. Data on regional, topographic, and hydrological variants, as well as characteristic animals, are needed.

Distribution: scattered on limestone bedrock north of the Coastal Lowland ecozone; documented only from the Eastern Ontario Plains sub-zone of the Great Lakes Plain ecozone and the Saint Lawrence Plains sub-zone of the Adirondack ecozone.

Examples: Spile Bridge Road Wetlands, St. Lawrence County; Johnny Cake Road Sinkhole Wetlands, Jefferson County; Western Rensselaer Plateau Escarpment, Rensselaer County.

Rank: G3? S1 *Revised:* 2001

Source: Walz et al. 2001; Williams 2001; NYNHP field surveys.

9. Maritime freshwater 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 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*), sweet gale (*M. gale*), and highbush blueberry (*Vaccinium corymbosum*). Data on characteristic animals are needed.

The name of this community was changed from “maritime interdunal swales” (Reschke 1990) to distinguish this community from brackish interdunal swales. The term “maritime” is kept to distinguish this community from interdunal swales in the Great Lakes region.

Distribution: near the seacoast in the Coastal Lowlands ecozone.

Rank: G3G4 S2 *Revised:* 2001

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

Sources: Johnson 1985; NYNHP field surveys.

10. Pine barrens vernal pond: a seasonally fluctuating, groundwater-fed pond and associated wetland that typically occur in pine barrens, either in low kettlehole depressions of the coastal plain or inland outwash plains or in swales between dunes. The water is intermittent, typically vernal, ponded, and circumneutral. The substrate is coarse sand, however, development of a shallow floating peat layer is common. These ponds and wetlands may be small. A split into pine barrens vernal wetland (or pine barrens vernal pondshore) and pine barrens vernal pond (a lacustrine community) may be warranted and is being evaluated.

Well-developed examples of this community may consist of about four physiognomic zones. Ponds are characterized by submergent aquatic plants such as pondweeds (*Potamogeton* spp.). Surrounding ponds are typically a zone of emergent aquatic plants dominated by graminoids and herbs. Sedges such as *Carex canescens*, three three-way sedge (*Dulichium arundinaceum*), and woolgrass (*Scirpus cyperinus*) and soft rush (*Juncus effusus*) may be dominant in this zone. Other herbs include tussock sedge (*Carex stricta*), marsh St. John's-wort (*Triadenum virginicum*), cinnamon fern (*Osmunda cinnamomea*), marsh fern (*Thelypteris palustris*), and Virginia chain fern (*Woodwardia virginica*). Characteristic mosses include (*Sphagnum fallax*). Some sites these are ringed by a zone of low shrubs. Characteristic shrubs include scattered highbush blueberry (*Vaccinium corymbosum*), winterberry (*Ilex verticillata*) and patches of leatherleaf (*Chamaedaphne calyculata*). Other shrubs include buttonbush (*Cephalanthus occidentalis*), black chokeberry (*Aronia melanocarpa*), black huckleberry (*Gaylussacia baccata*), mountain holly (*Nemopanthus mucronatus*), and meadow sweet (*Spiraea latifolia*). Stunted trees may be present on

hummocks within the wetland or surround the wetland; characteristic trees include red maple (*Acer rubrum*), gray birch (*Betula populifolia*), pitch pine (*Pinus rigida*), and quaking aspen (*Populus tremuloides*).

Amphibians that may be found in pine barrens vernal ponds include frogs such as eastern American toad (*Bufo americanus*), northern spring peeper (*Pseudacris crucifer*), green frog (*Rana clamitans* subsp. *melanota*), and wood frog (*Rana sylvatica*). Less frequently occurring amphibians include eastern spadefoot toad (*Scaphiopus holbrookii*), Fowler's toad (*Bufo fowleri*), and Jefferson salamander (*Ambystoma jeffersonianum*). Reptiles that may be found include spotted turtle (*Clemmys guttata*) and common snapping turtle (*Chelydra serpentina*) (Hunsinger 1999). Birds that may be found include red-winged blackbird (*Agelaius phoeniceus*) and common yellowthroat (*Geothlypis trichas*). Characteristic macroinvertebrates may include beetles (Coleoptera), Lepidoptera and water striders (*Gerris* sp.). These ponds are too small and ephemeral to support fish populations.

Distribution: known only from sandplains in the Great Lakes Plain and Hudson Valley ecozones and in the Western Adirondack Foothills subzone of the Adirondack ecozone.

Rank: G3G4 S2

Revised: 2001

Examples: Albany Pine Bush, Albany County; Rome Sand Plains, Oneida County; Chase Lake Sandplain, Lewis County.

Source: Hunsinger 1999; Williams 2001; NYNHP field surveys.

11. Pine barrens shrub swamp: a shrub-dominated wetland that occurs in shallow depressions in the coastal plain, often as a linear transition zone between a coastal plain pond shore and either pitch pine-scrub oak barrens or pitch pine-oak forest.

Characteristic tall shrubs include highbush blueberry (*Vaccinium corymbosum*), inkberry (*Ilex glabra*), male-berry (*Lyonia ligustrina*), fetterbush (*Leucothoe racemosa*), sweet pepper-bush (*Clethra alnifolia*). Other tall shrubs include staggerbush (*Lyonia mariana*), red chokeberry (*Aronia arbutifolia*), bayberry (*Myrica pensylvanica*), swamp azalea (*Rhododendron viscosum*). Characteristic short shrubs include highbush blueberry, leatherleaf (*Chamaedaphne calyculata*), dwarf huckleberry (*Gaylussacia dumosa*), sheep laurel (*Kalmia angustifolia*). Other short shrubs include sweet pepperbush, large cranberry (*Vaccinium macrocarpon*), and dangleberry (*Gaylussacia frondosa*).

The herb layer is sparse and characteristic herbs include Virginia chain fern (*Woodwardia virginica*), cinnamon fern (*Osmunda cinnamomea*), marsh fern (*Thelypteris palustris*) and tussock sedge (*Carex stricta*). *Sphagnum* is a characteristic moss in the groundlayer.

The largest and most diverse examples of pine barrens shrub swamp are located on the Roanoke and Ronkonkoma moraines within fire prone forests. Most occur as small isolated segments, and large examples are rare. This community is linear in shape, often very thin (about 5-10 m) and typically less than 26 acres in size. The major ecological factors influencing this community include hydrology and fire. Pine barrens shrub swamps are best developed along the upper edges of coastal plain ponds that have variable hydrology, and are embedded in a fire prone forest, such as a pitch pine-oak forest.

Communities on Long Island with similar vegetation (i.e., dominated by tall shrubs such as *Vaccinium corymbosum*, *Leucothoe racemosa*, *Clethra alnifolia*, and *Chamaedaphne calyculata*) with deep peat deposits (20 cm-3 m) are treated as a coastal plain variety of highbush blueberry bog thicket. The two natural communities are separated by the fact that highbush blueberry bog thicket maintains a persistent hydrological regime, supports peat development, and often lacks "edge species" that are found in pine barrens shrub swamp such as *Lyonia mariana*, *Ilex glabra*, and *Myrica pensylvanica*. Pine barrens shrub swamp is essentially an edge community positioned between more persistent wetlands and a fire-prone upland. Consequently vegetation and soils reflect the constant tension between the contraction and expansion of adjacent wetlands and additional disturbances such as fire and frost. Peat develops only intermittently to a thin 5-10 centimeters layer, and vegetation consists of both wetland and upland species.

Distribution: restricted to the Coastal Lowlands ecozone.

Rank: G5 S3

Revised: 2001

Examples: Peconic Headwater Wetlands, Suffolk County; Sears Bellows Wetlands, Suffolk County.

Source: MacDonald and Edinger 2000; NYNHP 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. Peat layer should be at least 20 cm

deep.

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

Revised: 1990

Example: Carncross Salt Pond, Wayne County.

Sources: Catling and McKay 1981; Faust and Roberts 1983; Muenscher 1927; NYNHP 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, but must have deep enough peat (usually at least 20 cm) to be treated as a peatland, otherwise it may be classified as a mineral soil wetland such as shallow emergent marsh. Peats are usually fibrous, not sphagnum, and are usually underlain by deep muck. The dominant herbs must be members of the sedge family (Cyperaceae), typically of the genus *Carex*.

Sedge meadows are dominated by peat and tussock-forming sedges such as tussock-sedge (*Carex stricta*), with at least 50% cover. They are often codominated by bluejoint grass (*Calamagrostis canadensis*) with less than 50% cover, and other sedges (*Carex* spp., including *C. utriculata*, *C. vesicaria*, and *C. canescens*). Other frequently occurring plants with low percent cover include marsh cinquefoil (*Potentilla palustris*), sensitive fern (*Onoclea sensibilis*) manna grasses (*Glyceria* spp., *G. canadensis*), swamp loosestrife (*Lysimachia terrestris*), hairgrass (*Agrostis scabra*), marsh St. John's-wort (*Triadenum virginicum*), water horsetail (*Equisetum fluviatile*), tall meadow-rue (*Thalictrum pubescens*), spike rushes (*Eleocharis acicularis*, *E. obtusa*), sweetflag (*Acorus americanus*), spotted joe-pye-weed (*Eupatorium maculatum*), purple-stem angelica (*Angelica purpurea*), three-way sedge (*Dulichium arundinaceum*), and bulrushes (*Scirpus* spp.). Sparse shrubs may be present, such as meadow sweet (*Spiraea alba* var. *latifolia*, *S. tomentosa*), leatherleaf (*Chamaedaphne calyculata*), sweet gale (*Myrica gale*), and alder (*Alnus* 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

Revised: 2001

Examples: Dutchess Meadows, Dutchess County; West Branch Sacandaga River, Hamilton County; Poestenkill Headwaters, Rensselaer County; Mad River Swamp, Lewis County.

Sources: Jeglum 1974; McVaugh 1958, NYNHP 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 *Revised:* 1990

Example: Cortland Marl Ponds, Cortland County.

Sources: Seischab 1984; Tufts 1976; NYNHP 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. Marl is a white colored precipitate that consists of calcium carbonate mixed with clay. Marl fens have at least some exposed marl precipitate at the surface. The marl substrate is always saturated and may be either seasonally flooded or permanently flooded (e.g., adjacent to seepage pools or streams) and has a very high pH, generally greater than 7.5. Vegetation is often sparse and stunted. Mosses colonize the marl, and may initiate hummock formation (Seischab 1984). Marl fens may occur as small patches within a rich graminoid fen.

The dominant species in marl fens are graminoid. Characteristic herbaceous species include the sedge *Carex flava*, spikerush (*Eleocharis rostellata*), twig-rush (*Cladium mariscoides*), beakrush (*Rhynchospora capillacea*), water-horehound (*Lycopus uniflorus*), grass-of-Parnassus (*Parnassia glauca*), pitcher-plant (*Sarracenia purpurea*), hard-stem bulrush (*Scirpus acutus*), nutrush (*Scleria verticillata*), Ohio goldenrod (*Solidago ohioensis*), arrow-grass (*Triglochin palustre*), variegated horsetail (*Equisetum variegatum*), jointed rush (*Juncus articulatus*), and Kalm's lobelia (*Lobelia kalmii*). Other herbaceous species found in marl fens include the sedges *Carex crawei*, and *C. eburnea*. Shrubs found in marl fens include prostrate juniper (*Juniperus horizontalis*), shrubby cinquefoil (*Potentilla fruticosa*), and northern white cedar (*Thuja occidentalis*). Shrubby cinquefoil and *Carex eburnea* commonly occur on hummocks.

Characteristic non-vascular species include the moss *Campyllum stellatum*, and the alga *Chara vulgaris*. *Chara vulgaris* is common in marl pools and along stream banks.

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 northern portion of the Hudson Valley ecozone.

Rank: G2G3 S1 *Revised:* 2001

Examples: Bergen Swamp, Genesee County; Junius Ponds Lowery Pond, Onondaga County.

Sources: Bernard *et al.* 1983; Godwin *et al.* 2000; Olivero 2001; Reschke *et al.* 1990; Seischab 1977, 1984; Seischab and Bernard 1985; NYNHP 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. Like other rich fens, their water sources have high concentrations of minerals and high pH values, generally from 6.0 to 7.8. Rich sloping fens are headwater wetlands with cold water constantly moving through them. They often have water flowing at the surface in small channels or rivulets. Rich sloping fens are often surrounded by upland forest and grade into other palustrine communities such as hemlock-hardwood swamp, shrub swamp, or shallow emergent marsh downslope.

The structure of rich sloping fens is variable; usually there are scattered trees and shrubs, and a nearly continuous groundlayer of herbs and bryophytes. They may be shrub-dominated or herb-dominated. Species diversity is usually very high and may include species from the surrounding forest.

Characteristic shrubs include red osier dogwood (*Cornus sericea*), the willows *Salix discolor*, *S. sericea*, and *S. bebbiana*, dwarf raspberry (*Rubus pubescens*), northern gooseberry (*Ribes hirtellum*), alder-leaf buckthorn (*Rhamnus alnifolia*), arrowwood (*Viburnum dentatum* var. *lucidum*), highbush blueberry (*Vaccinium corymbosum*), red maple (*Acer rubrum*), eastern red cedar (*Juniperus virginiana*), and hemlock (*Tsuga canadensis*). Other shrubs found in rich sloping fens include gray dogwood (*Cornus foemina*), poison sumac (*Toxicodendron vernix*), and shrubby cinquefoil (*Potentilla fruticosa*). Virgin's-bower (*Clematis virginiana*) is a characteristic vine.

Characteristic herbs include skunk-cabbage (*Symplocarpus foetidus*), marsh fern (*Thelypteris palustris*), spotted joe-pye-weed (*Eupatorium maculatum*), spreading goldenrod (*Solidago patula*), the sedges *Carex leptalea*, *C. flava*, *C. hystericina*, *C. interior*, *C. sterilis*, and *C. stricta*, golden ragwort (*Senecio aureus*), purple-stem aster (*Aster puniceus*),

cat-tails (*Typha latifolia* and *T. angustifolia*), swamp goldenrod (*Solidago uliginosa*), cotton-grass (*Eriophorum viridi-carinatum*), thoroughwort (*Eupatorium perfoliatum*), flat-top white aster (*Aster umbellatus*), purple avens (*Geum rivale*), tall meadow-rue (*Thalictrum pubescens*), common horsetail (*Equisetum arvense*), fowl mannagrass (*Glyceria striata*), field mint (*Mentha arvensis*), sundew (*Drosera rotundifolia*), water-horehound (*Lycopus americanus*), cinnamon fern (*Osmunda cinnamomea*), bulrush (*Scirpus atrovirens*), wild strawberry (*Fragaria virginiana*), water-horehound (*Lycopus uniflorus*), and bush goldenrod (*Euthamia graminifolia*). Other herbs found in rich sloping fens include the sedge *Carex prairea*, spike muhly (*Muhlenbergia glomerata*), turtle-heads (*Chelone glabra*), bog-candle (*Platanthera dilatata*), spreading globeflower (*Trollius laxis*), showy lady's slipper (*Cypripedium reginae*), and grass-of-Parnassus (*Parnassia glauca*).

Characteristic non-vascular species include the mosses *Campylium stellatum*, *Aulacomnium palustre*, *Calliergonella cuspidata*, *Bryum pseudotriquetrum*, *Fissidens adianthoides*, *Sphagnum warnstorffii*, and *Thuidium delicatulum*. Other non-vascular plants found in rich sloping fens include the mosses *Tomenthypnum nitens* and *Drepanocladus vernicosus*.

A rare animal of some rich sloping fens is bog turtle (*Clemmys muhlenbergii*). Data on characteristic animals are needed.

Distribution: sparsely scattered throughout upstate New York north of the Coastal Lowlands ecozone, mostly in the Central Appalachian and Finger Lake Highlands sub-zones of the Appalachian Plateau ecozone, and the Taconic Highlands ecozone but also in other parts of the state with calcareous glacial deposits.

Rank: G3 S1S2

Revised: 2001

Examples: Beaver Brook Fen Cortlandville, Cortland County; Dryden Slaterville Fir Swamp, Tompkins County; Dutchess Meadows, Dutchess County; East Malloryville Tamarack Swamp, Tompkins County; McClean Fen, Tompkins County; Ohio Fen, Livingston County.

Source: Godwin *et al.* 2000; Motzkin 1994; Olivero 2001; Reschke *et al.* 1990; NY Natural Heritage field surveys.

6. Rich graminoid fen: a strongly minerotrophic peatland in which the substrate is a predominantly graminoid peat that may or may not be underlain by marl. Rich fens are fed by waters that have high

concentrations of minerals and 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 in rich graminoid fens are sedges, although grasses and rushes may be common. Shrubs may be present, but collectively they have less than 50% cover. *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 herbs include spike muhly (*Muhlenbergia glomerata*), swamp goldenrod (*Solidago uliginosa*), the sedges *Carex flava*, *C. lasiocarpa*, *C. sterilis*, *C. aquatilis*, *C. prairea*, and *C. hystericina*, bog-rush (*Cladium mariscoides*), grass-of-parnassus (*Parnassia glauca*), sundew (*Drosera rotundifolia*), marsh fern (*Thelypteris palustris*), white beakrush (*Rhynchospora alba*), common cat-tail (*Typha latifolia*), spikerush (*Eleocharis rostellata*), royal fern (*Osmunda regalis*), blue flag (*Iris versicolor*), and hard-stem bulrush (*Scirpus acutus*). Other herbs found in rich graminoid fens include alpine bulrush (*Scirpus hudsonianus*), flat-top white aster (*Aster umbellatus*), cotton-grass (*Eriophorum viridi-carinatum*), thoroughwort (*Eupatorium perfoliatum*), spotted joe-pye-weed (*Eupatorium maculatum*), buckbean (*Menyanthes trifoliata*), Ohio goldenrod (*Solidago ohioensis*), the sedges *Carex stricta*, *C. buxbaumii*, *C. pellita*, and *C. leptalea*, spreading goldenrod (*Solidago patula*), fringed brome (*Bromus ciliatus*), marsh St. John's wort (*Triadenum virginicum*), common horsetail (*Equisetum arvense*), marsh cinquefoil (*Potentilla palustris*), field mint (*Mentha arvensis*), arrow-grass (*Triglochin maritimum*), milfoil bladderwort (*Utricularia intermedia*), grass pink (*Calopogon tuberosus*), water-horehound (*Lycopus uniflorus*), rose pogonia (*Pogonia ophioglossoides*), golden ragwort (*Senecio aureus*), and Kalm's lobelia (*Lobelia kalmii*).

Characteristic shrubs include shrubby cinquefoil (*Potentilla fruticosa*), bayberry (*Myrica pensylvanica*), speckled alder (*Alnus incana* ssp. *rugosa*), poison sumac (*Toxicodendron vernix*), red maple (*Acer rubrum*), alder-leaf buckthorn (*Rhamnus alnifolia*), red osier dogwood (*Cornus sericea*), and hoary willow (*Salix candida*). Other shrubs found in rich graminoid fens include northern white cedar (*Thuja occidentalis*), dwarf raspberry (*Rubus pubescens*), tamarack (*Larix laricina*), sweet-gale (*Myrica gale*), and swamp fly honeysuckle (*Lonicera oblongifolia*).

Characteristic non-vascular species include the mosses *Campylium stellatum* and *Drepanocladus revolvens*, and the liverwort *Aneura pinguis*. Other non-vascular plants found in rich graminoid fens include the mosses *Bryum pseudotriquetrum*, *Sphagnum warnstorffii*, *Fissidens adianthoides*, *Sphagnum teres*, *Scorpidium*

scorpioides, and *Aulacomnium palustre*.

A rare animal of some rich graminoid fens is bog turtle (*Clemmys muhlenbergii*). Data on characteristic animals are needed.

Distribution: Scattered throughout upstate New York north of the Coastal Lowlands ecozone in the Appalachian Plateau, Great Lakes Plain, Mohawk Valley, Hudson Valley, Taconic Highlands, Tug Hill and St. Lawrence, and Adirondacks ecozones.

Rank: G3 S1S2

Revised: 2001

Examples: Bergen Swamp, Genesee County; Hidden Lake, Herkimer County; Junius Ponds, Seneca County; Newcomb Swamp, Essex County; Quaker Pond Fen, Monroe County; Zurich Bog, Wayne County.

Sources: Andrus 1980; Godwin *et al.* 2000; Goodwin 1943; Motzkin 1994; Olivero 2001; Reschke *et al.* 1990; Seischab 1984; Shanks 1966; NY Natural Heritage 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 have high concentrations of minerals and high pH values, generally from 6.0 to 7.8.

The dominant species in rich shrub fens are shrubs, which form a canopy and overtop most herbs. Some rich 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 rich shrub fens are dominated by taller shrubs (over 4 ft or 1.2 m) that collectively have 50 to 70% cover in the community with low shrubs and graminoids locally dominant in openings. The rich shrub fen community is somewhat broadly defined to include both the low shrub and taller shrub examples as well as regional variants distinguished by variations in their flora such as the lack of shrubby cinquefoil (*Potentilla fruticosa*) in northern examples. More data could lead to the elevation of these variants to community types. In rich shrub fens, *Sphagnum* is either absent, or a minor component, with only the most minerotrophic species present. Other mosses may be common.

Characteristic shrubs include red maple (*Acer rubrum*), red osier dogwood (*Cornus sericea*), speckled alder (*Alnus incana* ssp. *rugosa*), sweet-gale (*Myrica gale*), shrubby cinquefoil (*Potentilla fruticosa*), swamp fly honeysuckle (*Lonicera oblongifolia*), black chokeberry (*Aronia melanocarpa*), alder-leaf buckthorn (*Rhamnus alnifolia*), and poison sumac (*Toxicodendron vernix*). Other shrubs found in rich shrub fens include hoary willow (*Salix candida*), dwarf raspberry (*Rubus pubescens*), tamarack (*Larix laricina*), highbush

blueberry (*Vaccinium corymbosum*), bog birch (*Betula pumila*), bayberry (*Myrica pensylvanica*), meadow-sweet (*Spiraea alba*), and northern white cedar (*Thuja occidentalis*).

Characteristic herbs include marsh fern (*Thelypteris palustris*), royal fern (*Osmunda regalis*), the sedges *Carex stricta* and *C. interior*, common cat-tail (*Typha latifolia*), bluejoint grass (*Calamagrostis canadensis*), tall meadow-rue (*Thalictrum pubescens*), water horsetail (*Equisetum fluviatile*), and marsh St. John's wort (*Triadenum virginicum*). Other herbs found in rich shrub fens include the sedge *Carex aquatilis*, skunk-cabbage (*Symplocarpus foetidus*), flat-top white aster (*Aster umbellatus*), spreading goldenrod (*Solidago patula*), blue flag (*Iris versicolor*), and spike muhly (*Muhlenbergia glomerata*).

Characteristic non-vascular species include the mosses *Calliergonella cuspidata*, *Aulacomnium palustre*, *Thuidium delicatulum*, *Campyllum stellatum*, *Fissidens adianthoides*, *Sphagnum warnstorffii*, and *S. fimbriatum*.

Data on characteristic animals are needed.

Distribution: Scattered throughout upstate New York north of the Coastal Lowlands ecozone in the Appalachian Plateau, Great Lakes Plain, Mohawk Valley, Hudson Valley, Taconic Highlands, Tug Hill and St. Lawrence, and Adirondacks ecozones.

Rank: G3G4 S1S2

Revised: 2001

Examples: Bear Swamp Sempronius, Cayuga County; Bonaparte Swamp, Lewis County; Great Swamp Pawling; Dutchess County; Lisbon Swamp, Saint Lawrence County; Summit Lake Swamp, Otsego County.

Sources: Andrus 1980; Godwin *et al.* 2000; Johnson and Leopold 1994; Motzkin 1994; Olivero 2001; Reschke *et al.* 1990; NY Natural Heritage 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. 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.

In medium fens, the herbaceous layer, dominated by the sedge *Carex lasiocarpa* typically forms a canopy that overtops the shrub layer. The physiognomy of medium fens may range from a dwarf shrubland to a perennial grassland, and be either shrub-dominated, herb

dominated or have roughly equal amounts of shrubs and herbs.

The dominant species in medium fens are usually the sedge *Carex lasiocarpa* and sweet-gale (*Myrica gale*). Other characteristic shrubs include leatherleaf (*Chamaedaphne calyculata*), bog rosemary (*Andromeda glaucophylla*), speckled alder (*Alnus incana* ssp. *rugosa*), cranberry (*Vaccinium macrocarpon*), and red maple (*Acer rubrum*). Other shrubs found in medium fens include black chokeberry (*Aronia melanocarpa*), bog willow (*Salix pedicellaris*), meadow-sweet (*Spiraea alba*), hardhack (*Spiraea tomentosa*), and swamp rose (*Rosa palustris*).

Other characteristic herbs include marsh St. John's wort (*Triadenum virginicum*), pitcher-plant (*Sarracenia purpurea*), milfoil bladderwort (*Utricularia intermedia*), sundew (*Drosera rotundifolia*), white beakrush (*Rhynchospora alba*), marsh fern (*Thelypteris palustris*), arrowleaf (*Peltandra virginica*), rose pogonia (*Pogonia ophioglossoides*), swamp goldenrod (*Solidago uliginosa*), royal fern (*Osmunda regalis*), three-way sedge (*Dulichium arundinaceum*), buckbean (*Menyanthes trifoliata*), common cat-tail (*Typha latifolia*), and sundew (*Drosera intermedia*). Other herbs found in medium fens include blue flag (*Iris versicolor*), marsh cinquefoil (*Potentilla palustris*), twig-rush (*Cladium mariscoides*), the sedges *Carex rostrata*, *Carex leptalea*, *Carex stricta*, *Carex limosa*, and *Carex interior*, tufted loosestrife (*Lysimachia thyrsiflora*), and narrow-leaf cat-tail (*Typha angustifolia*).

Characteristic non-vascular plants include the moss *Calliergonella cuspidata*. Other non-vascular plants found in medium fens include the mosses *Campylium stellatum*, *Calliergon giganteum*, *Aulacomnium palustre*, *Sphagnum magellanicum*, *S. contortum*, and *S. warnstorffii*, and the liverwort *Aneura pinguis*.

A rare moth of some medium fens is bog buckmoth (*Hemileuca* sp.1), which feeds on buckbean. A rare turtle of some medium fens is bog turtle (*Clemmys muhlenbergii*). Data on characteristic animals are needed.

Distribution: sparsely scattered throughout upstate New York north of the Coastal Lowlands ecozone, mostly in the Great Lakes Plain, Tug Hill and St. Lawrence, and Adirondacks ecozones.

Rank: G3G4 S2S3

Revised: 2001

Examples: Brennan Beach Fen, Oswego County; Deer Creek Marsh, Oswego County; Dunham Bay Marsh, Warren County; Fort Drum Mud Lake Fen, Lewis County; Long Pond, Oswego County; St. Mary's Pond, Oswego County; Newcomb Swamp Essex County; South Pond Amboy, Oswego County; South Pond Fen,

Oswego County.

Sources: Andrus 1980; Bailey and Bedford 1999; Godwin *et al.* 2000; Johnson and Leopold 1994; Olivero 2001; Podniesinski 1994; Reschke *et al.* 1990; NY Natural Heritage 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. cuspidatum*, *S. fuscum*, *S. angustifolium*, *S. fallax*, and *S. russowii*.

Characteristic herbs include sedges (*Carex oligosperma*, *C. exilis*, *C. limosa*, *C. trisperma*, *C. utriculata*, *C. paupercula*, *C. canescens*), 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 (i.e., not dominated by shrubs as in dwarf shrub bog).

Characteristic shrubs include cranberry (*Vaccinium oxycoccos*, *V. macrocarpon*), bog laurel (*Kalmia polifolia*), sheep laurel (*K. angustifolia*), sweet-gale (*Myrica gale*), black chokeberry (*Aronia melanocarpa*), leatherleaf (*Chamaedaphne calyculata*), bog rosemary (*Andromeda glaucophylla*), and Labrador tea (*Rhododendron groenlandicum*). Scattered stunted trees such as tamarack (*Larix laricina*), black spruce (*Picea mariana*) 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.

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

Rank: G4 S3

Revised: 2001

Examples: Massawepie Mire, St. Lawrence County; Willis Brook Bog, Franklin County; Kildare Peatlands St. Lawrence County; Cranberry Vly, Rensselaer County; Harris Bay Marsh.

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

10. Sliding fen: shallow peat bogs on 5-35 degree slopes on brow of alpine or subalpine cliffs. Pickering's reedgrass (*Calamagrostis pickeringii*), *Sphagnum compactum*, and other bog plants are found in these peatlands. Sliding fens presumably become supersaturated from major rain events and slide off the cliff before peat build-up resumes (Sperduto and Cogbill 1999). Water is derived from runoff and seeps at higher elevation. Reportedly the peat will accumulate until a critical mass is built up and the large areas of peat mat slides to the bottom of the steep slope, a phenomenon that may occur once about every 500 years. Sliding fens may provide habitat for several uncommon *Sphagnum* spp., such as *S. lindbergii*, *S. tenellum*, and *S. pylaesii*, that are often found on the steep, bare, smooth, wet rock slides present on most of the higher mountains (Andrus 1980).

Short shrub layer includes leatherleaf (*Chamaedaphne calyculata*), small cranberry (*Vaccinium oxycoccus*), bog bilberry (*V. uliginosum*), bog laurel (*Kalmia polifolia*), and green alder (*Alnus viridis*). Other small trees and shrubs include tamarack (*Larix laricina*) and Labrador tea (*Rhododendron groenlandicum*).

Characteristic herbs include Pickering's reedgrass (*Calamagrostis pickeringii*), bulrush (*Scirpus cespitosus*), closed gentian (*Gentiana linearis*), round-leaved sundew (*Drosera rotundifolia*), and sedge (*Carex bigelowii*). Other low-growing herbs include creeping snow-berry (*Gaultheria hispidula*), mountain firmoss (*Huperzia appalachiana*).

Characteristic mosses include peat mosses such as *Sphagnum angustifolium*, *S. fuscum*, *S. rubellum*, *S. pylaesii*, and *S. russowii*; other mosses such as *Andraea* sp. and *Scapania nemorosa*. Various crustose lichens grow on the open bedrock areas.

The sliding fen can be distinguished from the relatively more common inland poor fen by having more alpine flora, a much steeper slope, high elevation mountain setting, and peat sliding process. Microhabitats include herb-dominated patches, shrub clusters, moss carpets, plus wet and dry exposed bedrock. Data from more examples are needed to refine the description.

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

Rank: G3G4 S1S2

Revised: 2001

Examples: Macintyre Range, Essex County, White Face Mountain, Essex County.

Sources: Andrus 1980; Sperduto and Cogbill 1999; Sperduto et al. 2000; Sperduto and Nichols 2000; Sperduto 2000.

11. 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 shrubs include hardhack (*Spiraea tomentosa*), leatherleaf (*Chamaedaphne calyculata*), large cranberry (*Vaccinium macrocarpon*), water willow (*Decodon verticillatus*), sweet gale (*Myrica gale*) and dwarf huckleberry (*Galussacia dumosa*). Small patches within the fen may be dominated by dwarf shrubs and may be classified as dwarf shrub bog.

Characteristic herbs include twig-rush (*Cladium mariscoides*), sedges (*Carex rostrata* var. *utriculata*, *C. lasiocarpa*, *C. striata*, *C. exilis*), beakrushes (*Rhynchospora alba*, *R. fusca*), rushes (*Juncus canadensis*, *J. pelocarpus*), cottongrass (*Eriophorum virginicum*), sundews (*Drosera intermedia*, *D. rotundifolia*), marsh St. John's-wort (*Triadenum virginicum*), bladderworts (*Utricularia fibrosa*, *U. purpurea*), knotted spikerush (*Eleocharis equisetoides*), swamp loosestrife (*Lysimachia terrestris*), rose pogonia (*Pogonia ophioglossoides*), grass pink (*Calopogon tuberosus*), meadow beauty (*Rhexia virginica*), white water-lily (*Nymphaea odorata*). Sedges and rushes often overtop short shrubs by mid to late summer. Scattered stunted trees such as Atlantic white cedar (*Chamaecyparis thyoides*) and red maple (*Acer rubrum*) may also be present.

Animals observed using coastal plain poor fen include common snipe (*Gallinago gallinago*), great blue heron (*Ardea herodias*), green frog (*Rana clamitans melanota*), bull frog (*Rana catesbeiana*), and spotted turtle (*Clemmys guttata*).

On Long Island, coastal plain poor fens occur from the Nissequogue River and the central south shore to Montauk Point. They are best developed on the Roanoke Point Moraine outwash plain and the Ronkonkoma Moraine. Coastal plain poor fen appears to form best in small "delta-like" areas of organic deposits near the small stream outlets of coastal plain pond basins. Major ecological factors influencing this community include groundwater discharge combined with one or more of the following hydrological influences: coastal plain pond shore draw down, stream flow, or an abbreviated freshwater tide. Fire regime may influence poor fens situated within fire prone landscapes. Coastal plain poor fen vegetation appears to form readily behind stream impoundments.

PALUSTRINE COMMUNITIES

Distribution: restricted to the Coastal Lowlands ecozone.

Rank: G3? S1

Revised: 2001

Examples: Jones Pond, Suffolk County; Cranberry Bog, Suffolk County; Fresh Pond, Suffolk County; Quogue Wetland, Suffolk County; Bow Drive Marsh, Suffolk County.

Sources: Andrus 1980; MacDonald and Edinger 2000; NYNHP field surveys.

12. Sea level fen: a small patch, sedge-dominated fen community that occurs at the upper edge of salt marsh complexes just above sea level where there is adjoining freshwater seepage. These fens are fed by acidic and oligotrophic freshwater seepage which mixes with salt or brackish water from tidal overwash at infrequent intervals, reportedly only during unusually high tides. Thus, by definition this fen is a palustrine, rather than an estuarine, community. Soils are those of a peatland with deep sedge peat underlain by deep sand or gravel. The soil pore salinity is moderate at 2-5 ppt. The fen is herb dominated but can have trees and shrubs at low percent cover. There is usually nearly 100% cover of herbaceous plants with high species diversity.

Dominant plants include spikerush (*Eleocharis rostellata*), twig-rush (*Cladium mariscoides*) and three-square (*Scirpus pungens*). Other characteristic species in include sedge (*Carex hormathodes*), slender blue flag (*Iris prismatica*), Canada rush (*Juncus canadensis*), white beakrush (*Rhynchospora alba*), Canadian burnet (*Sanguisorba canadensis*), wild germander (*Teucrium canadense*), poison ivy (*Toxicodendron radicans*) and large cranberry (*Vaccinium macrocarpon*).

Typical trees and shrubs include scattered individuals of red cedar (*Juniperus virginiana*), pitch pine (*Pinus rigida*), bayberry (*Myrica pensylvanica*), groundsel-tree (*Baccharis halimifolia*) and salt marsh-elder (*Iva frutescens*). The invasion of reedgrass (*Phragmites australis*) is a serious threat to this community.

Distribution: Restricted to the upper estuarine portion of Coastal Lowlands Ecozone. Known examples confined to a small area in the Peconic Bay Estuary Region. Other examples expected from the large bays on the south shore of Long Island.

Rank: G1G2 S1

Revised: 2001

Examples: Northwest Creek, Suffolk County; Little Northwest Creek, Suffolk County; Hubbard Creek Marsh, Suffolk County; Napeague Meadow, Suffolk County; Heckscher State Park, Suffolk County.

Sources: Ludwig 1995, MacDonald and Edinger 2000; NYNHP field surveys.

13. 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

Revised: 1990

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

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

14. 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 (*Maianthemum trifolium*), meadow-sweet (*Spiraea alba* var. *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 (*Rhododendron groenlandicum*), bog laurel (*Kalmia polifolia*), sheep laurel (*Kalmia angustifolia*), and bog rosemary (*Andromeda 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

Revised: 1990

Example: Bay Pond Bog, Franklin County, Spring Pond Bog, Franklin County.

Source: Worley 1982; NYNHP field surveys.

15. Dwarf shrub bog: an ombrotrophic or weakly minerotrophic peatland dominated by low-growing, evergreen, ericaceous shrubs and peat mosses (*Sphagnum* spp.). The surface of the peatland is typically a mosaic of hummock/hollow microtopography. The hummocks tend to have a higher abundance of shrubs than the hollows; however, 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. Shrubs are typically taller than the herb layer which is usually graminoid, and generally the shrub heights are 1 m or less. Other prominent shrubs and herbs are sheep laurel (*Kalmia angustifolia*), bog laurel (*K. polifolia*), Labrador tea (*Rhododendron groenlandicum*), cranberry (*Vaccinium oxycoccos*, *V. macrocarpon*), the sedge *Carex trisperma*, and tawny cottongrass (*Eriophorum virginicum*).

Other characteristic, but less common plants are round-leaf sundew (*Drosera rotundifolia*), pitcher plant

(*Sarracenia purpurea*), bog rosemary (*Andromeda glaucophylla*), huckleberry (*Gaylussacia baccata*), black chokeberry (*Aronia melanocarpa*), highbush blueberry (*Vaccinium corymbosum*), water-willow (*Decodon verticillatus*), meadow sweet (*Spiraea alba* var. *latifolia*, *S. tomentosa*), marsh St. John's-wort (*Triadenum virginicum*), and the sedges *Carex canescens*, *Carex pauciflora*, 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. fuscum*, *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 a highbush blueberry bog thicket, inland poor fen, or a black spruce-tamarack bog.

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

Rank: G4 S3

Revised: 2001

Examples: Bay Pond Bog, Franklin County; Massawepie Mire, St. Lawrence County; Sunday Swamp, Lewis County; Rome Sand Plains, Oneida County, Little Cedar Pond, Orange County.

Sources: Andrus 1980; Bray 1921; Damman and French 1987; Johnson 1985; Karlin and Andrus 1986; Karlin and Lynn 1988; Sperduto and Cogbill 1999; Sperduto et al. 2000; Sperduto and Nichols 2000; Sperduto 2000; NYNHP field surveys.

16. 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*). At least three regional variants may be recognized in New York. The first is found throughout central and western New York, the second is primarily a northern variant, and the third is a

southern variant with coastal plain species.

Species characteristic of all three varieties, and typical of the central and western New York examples, include highbush blueberry, winterberry (*Ilex verticillata*), cinnamon fern (*Osmunda cinnamomea*), marsh fern (*Thelypteris palustris*), and *Sphagnum* spp. Stunted trees may be present at a low density and with less than 50% cover; red maple (*Acer rubrum*) occurs in many bog thickets. Other characteristic shrubs and herbs include black huckleberry (*Gaylussacia baccata*), false Solomon's-seal (*Smilacina trifolia*), and pitcher plant (*Sarracenia purpurea*).

Additional characteristic species in northern examples include mountain holly (*Nemopanthus mucronatus*) which may be codominant, sedge (*Carex trisperma*), and calla (*Calla palustris*). Scattered small trees include larch (*Larix laricina*), black spruce (*Picea mariana*), and white pine (*Pinus strobus*).

The southern New York variant of this community contains substantially fewer northern taxa and numerous coastal indicator species such as swamp azalea (*Rhododendron viscosum*) which may become codominant, red chokeberry (*Aronia arbutifolia*), maleberry (*Lyonia ligustrina*), fetterbush (*Leucothoe racemosa*), sweet pepperbush (*Clethra alnifolia*), water willow (*Decodon verticillatus*), buttonbush (*Cephalanthus occidentalis*), marsh St. John's-wort (*Triadenum virginicum*), sedges (*Carex trisperma*, *C. striata*), three way sedge (*Dulichium arundinaceum*), and Virginia chain fern (*Woodwardia virginica*). Scattered small trees may include pitch pine (*Pinus rigida*) or Atlantic white cedar (*Chamaecyparis thyoides*) (MacDonald and Edinger 2000; Damman and French 1987).

Communities on Long Island with similar vegetation (i.e., dominated by tall shrubs such as *Vaccinium corymbosum*, *Leucothoe racemosa*, *Clethra alnifolia*, and *Chamaedaphne calyculata*) with shallow peat deposits (<20 cm) are treated as pine barrens shrub swamps. The two natural communities are separated by the fact that highbush blueberry bog thicket maintains a persistent hydrological regime, supports peat development, and often lacks "edge species" that are found in pine barrens shrub swamp, such as *Lyonia mariana*, *Ilex glabra*, and *Myrica pensylvanica*.

Characteristic peat mosses for all variants 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

Revised: 2001

Examples: Brayton Marsh, Warren County; Sears Bellows Wetlands, Suffolk County; Protection Bog, Erie County; Harriman, Rockland County.

Source: Damman and French 1987; MacDonald and Edinger 2000; NYNHP field surveys.

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 characteristically 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.

The most abundant trees include silver maple (*Acer saccharinum*), ashes (*Fraxinus pensylvanica*, *F. nigra*, *F. americana*), cottonwood (*Populus deltoides*), red maple (*Acer rubrum*), box elder (*Acer negundo*), elms (*Ulmus americana*, *U. rubra*), hickories (*Carya cordiformis*, *C. ovata*, *C. laciniata*), butternut and black walnut (*Juglans cinerea*, *J. nigra*), sycamore (*Platanus occidentalis*), oaks (*Quercus bicolor*, *Q. palustris*), and river birch (*Betula nigra*). Other less frequently occurring trees include hackberry (*Celtis occidentalis*), tulip tree (*Liriodendron tulipifera*), basswood (*Tilia americana*), and sugar maple (*Acer saccharum*). Introduced trees, such as white willow (*Salix alba*) and black locust (*Robinia pseudo-acacia*), have become established in some floodplain forests.

The most abundant shrubs include spicebush (*Lindera benzoin*), ironwood (*Carpinus carolinianus*), bladdernut (*Staphylea trifoliata*), speckled alder (*Alnus incana* spp. *rugosa*), dogwoods (*Cornus sericea*, *C. foemina* spp. *racemosa*, *C. amomum*), viburnums (*Viburnum cassinoides*, *V. prunifolium*, *V. dentatum*, *V. lentago*), and sapling canopy trees. Invasive exotic shrubs that may be locally abundant include shrub honeysuckles (*Lonicera tatarica*, *L. morrowii*), and

multiflora rose (*Rosa multiflora*). Other less frequently occurring shrubs include meadowsweet (*Spiraea alba* var. *latifolia*) and winterberry (*Ilex verticillata*).

The most abundant vines include poison ivy (*Toxicodendron radicans*), wild grapes (*Vitis riparia*, *Vitis* spp.), Virginia creeper (*Parthenocissus quinquefolia*), virgin's bower (*Clematis virginiana*), and less frequently, moonseed (*Menispermum canadense*). Vines may form a dense liana in tree canopy and/or dominate the groundcover.

The most abundant herbs include sensitive fern (*Onoclea sensibilis*), jewelweeds (*Impatiens capensis*, *I. pallida*), ostrich fern (*Matteuccia struthiopteris*), white snakeroot (*Eupatorium rugosum*), wood nettle (*Laportea canadensis*), false nettle (*Boehmeria cylindrica*), goldenrods (*Solidago gigantea*, *S. canadensis*, *Solidago* spp.), lizard's tail (*Saururus cernuus*), and jumpseed (*Polygonum virginianum*). Invasive exotic herbs that may be locally abundant include moneywort (*Lysimachia nummularia*), garlic mustard (*Alliaria petiolata*), dame's rockets (*Hesperis matronalis*), and stilt grass (*Microstegium vimineum*). Other less frequently occurring herbs include skunk cabbage (*Symplocarpus foetidus*), enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), bluejoint grass (*Calamagrostis canadensis*), white avens (*Geum canadense*), clearweed (*Pilea pumila*), jack-in-the-pulpit (*Arisaema triphyllum*), rice cutgrass (*Leersia oryzoides*), sedges (*Carex lacustris*, *C. intumescens*, *C. lupulina*), and many others.

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. Neighboring states recognize several floodplain forest variants based on dominant plants, flood regime, and topographic position (Fike 1999, Kearsley 1999, Sorenson et al. 1998). 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

Revised: 2001

Examples: Raquette River, Franklin County; Howland Island, Cayuga County; Catskill Creek, Greene County; Doyles Islands, Delaware County; South Bay Creek Wetlands, Washington County.

Sources: Barrett and Enser 1997; Bechtel and Spurduto 1998; Fike 1999; Gordon 1940; Kearsley 1999; Metzler

and Damman 1985; Nichols et al. 2000; Sorenson et al. 1998; Veneman and Tiner 1990; NYNHP 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 ashes (*Fraxinus pennsylvanica*, *F. nigra*, and *F. americana*), elms (*Ulmus americana* and *U. rubra*), yellow birch (*Betula alleghaniensis*), and swamp white oak (*Quercus bicolor*). Other trees with low percent cover include butternut (*Juglans cinerea*), bitternut hickory (*Carya cordiformis*), black gum (*Nyssa sylvatica*), ironwood (*Carpinus carolinianus*), and white pine (*Pinus strobus*).

The shrublayer is usually well-developed and may be quite dense. Characteristic shrubs are winterberry (*Ilex verticillata*), spicebush (*Lindera benzoin*), alders (*Alnus incana* ssp. *rugosa* and *A. serrulata*), viburnums (*Viburnum recognitum*, and *V. cassinoides*), highbush blueberry (*Vaccinium corymbosum*), common elderberry (*Sambucus canadensis*), and various shrubby dogwoods (*Cornus sericea*, *C. racemosa*, and *C. amomum*). Swamp azalea (*Rhododendron viscosum*) is more common in southern examples, and poison sumac (*Toxicodendron vernix*) and black ash are more common in richer (higher pH) examples.

The herbaceous layer may be quite diverse and is often dominated by ferns, including sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*O. regalis*), and marsh fern (*Thelypteris palustris*), with much lesser amounts of crested wood fern (*Dryopteris cristata*), and spinulose wood fern (*Dryopteris carthusiana*). Characteristic herbs include skunk cabbage (*Symplocarpus foetidus*), white hellebore (*Veratrum viride*), sedges (*Carex stricta*, *C. lacustris*, and *C. intumescens*), jewelweed (*Impatiens capensis*), false nettle (*Boehmeria cylindrica*), arrow arum (*Peltandra virginica*), tall meadow rue (*Thalictrum pubescens*), and marsh marigold (*Caltha palustris*). Open patches within the swamp may contain other herbs characteristic of shallow emergent marsh.

Examples of wetland fauna that occur in the glaciated northeast red maple-hardwood swamps include wood duck (*Aix sponsa*), American black duck (*Anas rubripes*), northern waterthrush (*Seiurus noveboracensis*), beaver (*Castor canadensis*), river otter (*Lutra canadensis*), and mink (*Mustela vison*). These swamps provide breeding habitat for many wetland-dependent species, such as spring peeper (*Pseudacris crucifer*), American toad (*Bufo americanus*), wood frog (*Rana sylvatica*), and spotted salamander (*Ambystoma maculatum*) (Golet et al. 1993). More data on

characteristic animals, especially invertebrates, are needed.

Distribution: throughout New York State.

Rank: G5 S4S5

Revised: 2001

Example: Great Swamp Pawling, Dutchess County; Deer Creek Marsh, Oswego County; Toad Harbor Swamp; Oswego County; Orange Lake, Orange/Ulster County; Joralemon Woods, Albany County.

Sources: Cain and Penfound 1939; Golet et al. 1993; McVaugh 1958.

3. Red maple-black gum swamp: a maritime, coastal, or inland hardwood swamp that occurs in poorly drained depressions, sometimes in a narrow band between a stream and upland. Coastal plain examples have a shallow layer of acidic, well decomposed peat over saturated sandy loam or loamy sand. Inland examples usually occur on an acidic silt loam. Hummock-hollow microtopography is evident.

Red maple (*Acer rubrum*) and black gum (*Nyssa sylvatica*) are often codominant or black gum (*Nyssa sylvatica*) may be the dominant tree. Pitch pine (*Pinus rigida*) may occur on drier hummock islands in pine barrens settings.

The shrub layer is usually well developed. Characteristic shrubs are sweet pepperbush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), swamp azalea (*Rhododendron viscosum*), fetterbush (*Leucothoe racemosa*), dangleberry (*Gaylussacia frondosa*), and on the Atlantic coastal plain inkberry (*Ilex glabra*). Vines such as greenbrier (*Smilax rotundifolia*), sawbrier (*Smilax glauca*), Virginia creeper (*Parthenocissus quinquefolia*), and poison ivy (*Toxicodendron radicans*) are present at low amounts in the understory. The herbaceous layer is not particularly diverse, characterized by cinnamon fern (*Osmunda cinnamomea*), skunk cabbage (*Symplocarpus foetidus*), and on the Atlantic coastal plain by netted chain fern (*Woodwardia areolata*). The nonvascular layer may or may not be well developed.

Characteristic nonvascular species are *Sphagnum girghensonii* and other *Sphagnum* spp.

More data on characteristic fauna are needed.

Distribution: limited to the North Atlantic Coast and Lower New England/Northern Piedmont Nature Conservancy Ecoregions. Known examples range from Connetquot River State Park, Islip east to Montauk Point, East Hampton in Suffolk County. Other examples with limited data are at Sunken Forest on Fire Island in Suffolk County and upstate in Rensselaer County. Most

occurrences are apparently concentrated in Suffolk County but small patches are present farther west in Nassau County and upstate New York.

Rank: G3G4 S2

Revised: 2001

Examples: Connetquot River Watershed, Suffolk County; Lower Peconic River, Suffolk County; Shawangunk Mountains, Sullivan County.

Sources: Breden 1989; Cain and Penfound 1939; Golet et al. 1993; Greller 1977, Reschke 1990, Sneddon et al. 1998; McCormick 1979, NYNHP field surveys.

4. Red maple-sweetgum swamp: a hardwood swamp that occurs on somewhat poorly drained seasonally wet flats, usually on somewhat acidic gleyed to mottled clay loam or sandy loam. Red maple-sweetgum swamps often occur as a mosaic with upland forest communities.

Sweetgum (*Liquidambar styraciflua*) is often the dominant tree or may be codominant with red maple (*Acer rubrum*). Other codominant trees include pin oak (*Quercus palustris*) and black gum (*Nyssa sylvatica*). Other trees occurring at lower densities include swamp white oak (*Quercus bicolor*), red oak (*Quercus rubra*) and black ash (*Fraxinus nigra*). Willow oak (*Quercus phellos*) and sweet-bay (*Magnolia virginiana*) are often present in larger occurrences where they may occur at very low density. Trees often have buttressed trunks and exposed roots from hydrological influences.

The shrublayer is usually fairly well-developed. Characteristic shrubs are sweet pepperbush (*Clethra alnifolia*), swamp azalea (*Rhododendron viscosum*), arrowwood (*Viburnum recognitum*), spicebush (*Lindera benzoin*), highbush blueberry (*Vaccinium corymbosum*), black chokeberry (*Aronia melanocarpa*) and possibly fetterbush (*Leucothoe racemosa*). Vines such as greenbrier (*Smilax rotundifolia*), sawbrier (*S. glauca*), grape (*Vitis* spp.), Virginia creeper (*Parthenocissus quinquefolia*) and poison ivy (*Toxicodendron radicans*), are present at low amounts in the understory.

The herbaceous layer is often dominated by ferns, including netted chain fern (*Woodwardia aereolata*), cinnamon fern (*Osmunda cinnamomea*), and sensitive fern (*Onoclea sensibilis*). Characteristic herbs include lizard's-tail (*Saururus cernuus*), Canada mayflower (*Maianthemum canadense*), jumpseed (*Polygonum virginianum*), skunk cabbage (*Symplocarpus foetidus*) and jewelweed (*Impatiens capensis*). State-reported southern red oak (*Quercus falcata*) and state-extirpated mistletoe (*Phoradendron flavescens*) occur in this community south of New York and may have been historically present in this community in New York.

More data on characteristic fauna are needed.

Distribution: Probably restricted to Manhattan Hills Ecozone and western part of Coastal Lowlands Ecozone (Bray, 1915). At least one example in the Triassic Lowlands Ecozone. Known examples range from Hylan Boulevard and Bedell Avenue in the Tottenville portion of Staten Island (southernmost point in New York) north to Quaker Ridge Woods Scarsdale, Westchester County. Most occurrences are apparently concentrated in Richmond County. The community may occur or was historically present in very small patches farther east in Queens, Kings and Nassau Counties. Also likely to have been present historically in Bronx and New York Counties.

Rank: G4G5 S1S2

Revised: 2001

Example: Magnolia Swamp, Richmond County; Tallman Mountain, Rockland County.

Sources: Greller 1977, Sneddon, et. al. 1996, Golet et al. 1993; Grossman, et. al. 1994, Reschke 1990, Breden 1986, Stevens 1992, Robichaud and Buell 1973, Bray 1915; NYNHP field surveys.

5. Silver maple-ash swamp: a hardwood basin swamp that typically occurs in poorly-drained depressions or along the borders of large lakes, and less frequently in poorly drained soils along rivers. These sites are characterized by uniformly wet conditions with minimal seasonal fluctuations in water levels.

The dominant trees are usually silver maple (*Acer saccharinum*) and green ash (*Fraxinus pennsylvanica*). American elm (*Ulmus americana*) is often present and probably was a codominant prior to the onset of Dutch elm disease and elm yellows. Other trees include black ash (*F. nigra*), white ash (*F. americana*), swamp white oak (*Quercus bicolor*), red maple (*Acer rubrum*), and occasionally the silver maple-red maple hybrid "Freeman's maple" (*Acer x freemanii*). Many of the canopy trees occur in the subcanopy along with ironwood (*Carpinus carolinianus*).

Characteristic shrubs include winterberry (*Ilex verticillata*), spicebush (*Lindera benzoin*), various shrubby dogwoods (*Cornus foemina* ssp. *racemosa*, *C. amomum*, and *C. sericea*), various viburnums (*Viburnum recognitum*, *V. lentago*, and *V. cassinoides*), speckled alder (*Alnus incana* ssp. *rugosa*), gooseberries (*Ribes* spp.), and sapling canopy trees. Characteristic vines include Virginia creeper (*Parthenocissus quinquefolia*) and poison ivy (*Toxicodendron radicans*).

Characteristic herbs include sensitive fern (*Onoclea sensibilis*), skunk cabbage (*Symplocarpus foetidus*), false nettle (*Boehmeria cylindrica*), wood-nettle (*Laportea canadensis*), cinnamon fern (*Osmunda cinnamomea*),

royal fern (*O. regalis*), marsh fern (*Thelypteris palustris*), jewelweed (*Impatiens capensis*), manna grasses (*Glyceris striata*, *G. grandis*), and various sedges (*Carex lupulina*, *C. crinita*, *C. bromoides*, and *C. lacustris*). Other herbs in wetter examples include arrow arum (*Peltandra virginica*), arrowheads (*Sagittaria* spp.), wild calla (*Calla palustris*), cattail (*Typha latifolia*), and duckweeds (*Lemna* spp.). A few examples are dominated by reed canary grass (*Phalaris arundinacea*) and/or lizard's tail (*Saururus cernuus*).

Silver maple-ash swamps are often underlain by calcareous bedrock and may contain a few calciphilic species, such as northern white cedar (*Thuja occidentalis*) and alder-leaf buckthorn (*Rhamnus alnifolia*). Ash-elm dominated swamps with little or no maple are tentatively included here until more data are collected on this variant.

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

Revised: 2001

Examples: Kings Bay Wetlands, Clinton County; Beaver Creek Swamp, St. Lawrence County; Black Creek Swamp, Monroe County; Cicero Swamp, Onondaga County; Conesus Wetlands, Livingston County.

Source: Huenneke 1982; NYNHP field surveys.

6. Vernal pool: an aquatic community of one or more associated intermittently to ephemerally ponded, small, shallow depressions typically within an *upland* forest, but also within various palustrine and other terrestrial communities. Vernal pools are typically flooded in spring or after a heavy rainfall, but are usually dry during summer. Many vernal pools are filled again in autumn. Substrate is typically dense leaf litter over hydric soils. Substrate type is known to vary from deep sands to loam to sandstone pavement. Vernal pools typically occupy a confined basin (i.e., a standing waterbody without a flowing outlet), but may have an intermittent stream flowing out of it during high water. Several hydrologic types of vernal pools have been identified including natural isolated basins, floodplain basins, in-stream basins, swamp pools, and marsh pools (Barbour 1999).

This community includes a diverse group of invertebrates and amphibians that depend upon temporary pools as breeding habitat. Since vernal pools cannot support fish populations, there is no threat of fish predation on amphibian eggs or invertebrate larvae. Characteristic animals of vernal pools include species of amphibians, reptiles, crustaceans, mollusks, annelids, and

insects. Vernal pool species can be categorized as either *obligate* (species that depend upon vernal pool habitat for their survival), or *facultative* (species that are often found in vernal pools, but are not dependent on them and can successfully reproduce elsewhere) (Colburn 1997).

Obligate vernal pool amphibians include spotted salamander (*Ambystoma maculatum*), blue-spotted salamander (*A. laterale*), Jefferson's salamander (*A. jeffersonianum*), marbled salamander (*A. opacum*) and wood frog (*Rana sylvatica*). Fairy shrimp (Anostraca) are obligate vernal pool crustaceans, with *Eubbranchipus* spp. being the most common.

Facultative vernal pool amphibians include four-toed salamander (*Hemidactylum scutatum*), red-spotted newt (*Notophthalmus viridescens*), spring peeper (*Pseudacris crucifer*), gray tree frog (*Hyla versicolor*), green frog (*Rana clamitans*), American toad (*Bufo americanus*), and Fowler's toad (*B. woodhousei fowleri*). Facultative vernal pool reptiles include painted turtle (*Chrysemys picta*), spotted turtle (*Clemmys guttata*), and snapping turtle (*Chelydra serpentina*). Facultative vernal pool mollusks include freshwater fingernail clams (*Sphaerium* sp., *Musculium* sp., and *Pisidium* sp.) and aquatic amphibious snails (*Physa* sp., *Lymnaea* sp., and *Helisoma* sp.). Facultative vernal pool insects include water scorpions (), predacious diving beetles (Dytiscidae), whirligig beetles (Gyrinidae), dobsonflies (Corydalidae), caddisflies (Trichoptera), dragonflies (Anisoptera), damselflies (Zygoptera), mosquitoes (Cuculidae), springtails (Collembola) and water striders (*Gerris* sp.). Leeches (Hirudinea) are a facultative vernal pool annelid.

Plants are predominantly hydrophytic, typically with a combination of obligate and facultative wetland species. Floating and submergent plants may be common, but emergent plants should be sparse or lacking. Characteristic vascular plants may include manna grass (*Glyceria* sp.), spikerush (*Eleocharis acicularis*), water purslane (*Ludwigia palustris*), naiad (*Najas* sp.), duckweed (*Lemna minor*), and water-hemlock (*Cicuta maculata*). Characteristic bryophytes may include *Brachythecium rivulare*, *Calliergon* sp. and *Sphagnum* spp. A characteristic rare plant of examples on the coastal plain may be featherfoil (*Hottonia inflata*).

Five to seven ecoregional variants (including Northern Appalachian, Great Lakes, Lower New England, Alleghany Plateau and North Atlantic Coast types) are suspected to differ in characteristic and dominant vascular plants, amphibians and invertebrates, as well as water chemistry, water temperature, substrate type, and surrounding forest type. More data on regional variants are needed.

Distribution: throughout New York State.

Rank: G4 S3S4

Revised: 2001

Examples: River Road North Creek, Warren County; Shawangunk Mountains, Ulster County; Perigo Hill, Rensselaer County.

Sources: Barbour, S. 1999; Colburn, E.A. 1997; Huth and Smiley 1981; Swain and Kearsley 2000; Williams 2001; NYNHP field surveys.

7. 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*), manna grass (*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

Revised: 1990

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

Sources: Tufts 1976; NYNHP field surveys.

8. Hemlock-hardwood swamp: a mixed swamp that occurs on mineral soils and deep muck 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 tree canopy is typically dominated by hemlock

(*Tsuga canadensis*), and co-dominated by yellow birch (*Betula alleghaniensis*), and red maple (*Acer rubrum*). Other less frequently occurring tree include white pine (*Pinus strobus*), black gum (*Nyssa sylvatica*), and green ash (*Fraxinus pennsylvanica*).

Characteristic shrubs include saplings of canopy trees plus highbush blueberry (*Vaccinium corymbosum*) often dominant, with great rhododendron (*Rhododendron maximum*) and sweet pepperbush (*Clethra alnifolia*) becoming more common in Lower Hudson Valley examples. Other less frequently occurring shrubs include various viburnums (*Viburnum cassinoides*, *V. lentago*, and *V. lanatanoides*), winterberry (*Ilex verticillata*), and mountain holly (*Nemopanthus mucronatus*).

Characteristic herbs are cinnamon fern (*Osmunda cinnamomea*) and sensitive fern (*Onoclea sensibilis*). Groundcover may also be fairly sparse. Other less frequently occurring herbs include sedges (*Carex trisperma*, *C. folliculata*, and *C. bromoides*), goldthread (*Coptis trifolia*), Canada mayflower (*Maianthemum canadense*), mountain sorrel (*Oxalis montana*), foamflower (*Tiarella cordifolia*), and sarsaparilla (*Aralia nudicaulis*).

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 R

revised: 2001

Examples: Tamarack Swamp Delaware, Sullivan County; Protection Bog, Wyoming/Erie Counties; Vly Swamp, Ulster County; Tamarack Swamp Boylston, Oswego County; Harriman, Rockland County.

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

9. Spruce-fir swamp: a conifer swamp that typically occurs in a drainage basin, in some cases filling the basin, but also can occur at the edge of a lake or pond, or along gentle slopes of islands where there is some nutrient input from groundwater discharge or subsurface flow. In the Adirondacks and the Tug Hill these swamps are often found in drainage basins occasionally flooded by beaver (*Castor canadensis*). These swamps are usually dense, with a fairly closed canopy (80 to 90% cover). The dominant tree is usually red spruce (*Picea rubens*). Codominant trees include balsam fir (*Abies balsamea*) and red maple (*Acer rubrum*). In the Catskills, balsam fir may be absent, and in the Adirondacks, black

spruce (*Picea mariana*) or white spruce (*P. glauca*) may replace red spruce as a dominant tree. Other less frequently occurring trees include yellow birch (*Betula alleghaniensis*), white pine (*Pinus strobus*), and hemlock (*Tsuga canadensis*).

The shrublayer is often sparse; characteristic and dominant shrubs include mountain holly (*Nemopanthus mucronatus*) along with sapling canopy trees. Other less frequently occurring shrubs include alders (*Alnus viridis* ssp. *crispus*, *A. incana* ssp. *rugosa*), blueberries (*Vaccinium corymbosum*, *V. myrtilloides*), wild raisin (*Viburnum cassinoides*), mountain ash (*Sorbus americana*), and winterberry (*Ilex verticillata*).

Characteristic herbs are cinnamon fern (*Osmunda cinnamomea*), sedges (*Carex trisperma*, *C. folliculata*), gold thread (*Coptis trifolia*), bunchberry (*Cornus canadensis*), starflower (*Trientalis borealis*), wood sorrel (*Oxalis acetosella*), creeping snowberry (*Gaultheria hispidula*), and dewdrop (*Dalibarda repens*).

The non-vascular layer is often dominated by *Sphagnum* spp., including *S. girgensohnii*, *S. centrale*, and *S. angustifolium*. Other characteristic bryophytes include *Bazzania trilobata* and *Pleurozium schreberi*.

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.

A characteristic bird of spruce-fir swamps is the northern waterthrush (*Seiurus noveboracensis*).

Distribution: mostly found in the Adirondacks, Tug Hill, and Catskills ecozones, but also in Rensselaer Hill section of the Taconic Highland ecozone and extending south into the Appalachian Plateau ecozone.

Rank: G3G4 S3

Revised: 2001

Examples: Black Pond Swamp, Franklin County; Marion River, Hamilton County; Blue Swamp, Lewis County; Page Swamp, Lewis County; Brandy Brook, Ulster County; Poestenkill Headwaters, Rensselaer County; Mad River Swamp, Lewis County; Whetstone Creek Swamp, Lewis County..

Sources: Braun 1950; Zon 1914; NYNHP field surveys.

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 and along pond edges in southeastern New York 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*), highbush blueberry (*Vaccinium corymbosum*), smooth winterberry (*Ilex laevigata*), rosebay (*Rhododendron maximum*), swamp azalea (*Rhododendron viscosum*), sweet pepperbush (*Clethra alnifolia*), mountain holly (*Nemopanthus mucronatus*), and red chokeberry (*Aronia arbutifolia*).

In a dense stand of *Chamaecyparis*, 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*), royal fern (*O. regalis*), skunk cabbage (*Symplocarpus foetidus*), wild calla (*Calla palustris*), and starflower (*Trientalis borealis*). Data on characteristic animals are needed.

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

Rank: G2G3 S1 *Revised:* 2001

Example: Little Cedar Bog, Orange County

Sources: Eyre 1980; Karlin 1997; Laderman 1989; Lynn 1984; NYNHP 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. Other less frequently occurring trees include black gum (*Nyssa sylvatica*) and pitch pine (*Pinus rigida*) on higher hummock islands within the swamp.

Characteristic shrubs include canopy trees along

with sweet pepperbush (*Clethra alnifolia*), highbush blueberry (*Vaccinium corymbosum*), swamp azalea (*Rhododendron viscosum*), inkberry (*Ilex glabra*), dangleberry (*Gaylussacia frondosa*), black huckleberry (*G. baccata*), sheep laurel (*Kalmia angustifolia*), and bayberry (*Myrica pensylvanica*), and black chokeberry (*Aronia melanocarpa*).

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*), sundews (*Drosera intermedia*, *D. rotundifolia*), bladderworts (*Utricularia* spp.) marsh St. John's-wort (*Triadenum virginicum*), Virginia chain fern (*Woodwardia virginica*), and sedges such as *Carex striata*. 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.

The bryophyte layer is dominated by several species of *Sphagnum* moss.

A rare moth of some Atlantic white cedar swamps is Hessel's hairstreak (*Mitoura hesseli*), which feeds on Atlantic white cedar. More data on characteristic animals are needed.

Distribution: restricted to the Coastal Lowlands ecozone.

Rank: G3G4 S1 *Revised:* 2001

Example: Cranberry Bog County Park, Suffolk County.

Sources: Bicknell 1968; Ehrenfeld & Schneider 1991; Eyre 1980; Laderman 1987; Laderman 1989; Motzkin et al. 1993; Motzkin 1991; Schroeder and Taras 1985; Zampella et al. 1999; NYNHP 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 (50 to 70% cover) with numerous small openings dominated by shrubs or sedges. Other less frequently occurring trees include black spruce (*Picea mariana*), white pine (*Pinus strobus*), black ash (*Fraxinus nigra*), ironwood (*Carpinus carolinianus*), and northern white cedar (*Thuja occidentalis*).

Characteristic shrubs are alders (*Alnus incana* ssp. *rugosa*, *A. serrulata*), winterberry (*Ilex verticillata*),

various shrubby dogwoods especially red osier dogwood (*Cornus sericea*), willows (*Salix* spp.), highbush blueberry (*Vaccinium corymbosum*), dwarf raspberry (*Rubus pubescens*), along with many rich shrub fen species such as swamp birch (*Betula pumila*), alder-leaf buckthorn (*Rhamnus alnifolia*), poison sumac (*Toxicodendron vernix*), swamp fly honeysuckle (*Lonicera oblongifolia*), and shrubby cinquefoil (*Potentilla fruticosa*). Other less frequently occurring shrubs include black chokeberry (*Aronia melanocarpa*) and mountain holly (*Nemopanthus mucronatus*).

The herb layer is often very diverse and usually includes calcium rich indicator species. Characteristic herbs are sedges such as *Carex trisperma*, *C. interior*, *C. stricta*, *C. lacustris*, and *C. leptalea*. and ferns such as royal fern (*Osmunda regalis*), cinnamon fern (*O. cinnamomea*), marsh fern (*Thelypteris palustris*), and crested wood fern (*Dryopteris cristata*), along with skunk cabbage (*Symplocarpus foetidus*), marsh marigold (*Caltha palustris*), and water horehound (*Lycopus uniflorus*). Other less frequently occurring herbs include cattail (*Typha latifolia*), goldthread (*Coptis trifolia*), flat-topped aster (*Aster umbellatus*), fowl manna grass (*Glyceria striata*), water horsetail (*Equisetum fluviatile*), buckbean (*Menyanthes trifoliata*), starflower (*Trientalis borealis*), goldenrods (*Solidago patula*, *S. uliginosa*), golden ragwort (*Senecio aureus*), marsh cinquefoil (*Potentilla palustris*).

The bryophyte layer is dominated by several species of *Sphagnum* moss, including *S. magellanicum*, *S. angustifolium*, and *S. warnstorffii*.

Data on characteristic animals are needed. These swamps are closely related to and often grade into rich shrub fens and rich graminoid fens.

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

Rank: G3G4 S2S3 *Revised:* 2001

Examples: Deer Creek Marsh, Oswego County; Vly Swamp, Ulster County; Perch River Swamp, Jefferson County; Lisbon Swamp, St. Lawrence County; Drowned Lands Swamp, Columbia County; Brennen Beach Fen, Oswego County.

Sources: McVaugh 1958; NYNHP 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*), swamp dewberry (*Rubus hispida*), 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. Examples were sought but not found on Long Island (MacDonald and Edinger 2000). Communities with a similar composition have been described from the New Jersey Pine Barrens.

Rank: G3? S1 *Revised:* 1990

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

Sources: Breden 1987; Leimanis 1993; MacDonald and Edinger 2000; NYNHP 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 northern waterthrush (*Seiurus noveboracensis*), winter wren (*Troglodytes troglodytes*), white-throated sparrow (*Zonotrichia albicollis*), and golden-crowned kinglet (*Regulus satrapa*).

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

Rank: G3G4 S2S3

Revised: 1990

Examples: Bergen Swamp, Genesee County; Toad Harbor Swamp, Oswego County; Marion River, Hamilton County; Carley Swamp, Lewis County; Dunham Bay Marsh, Warren County; Ninemile Swamp, Madison/Oneida Counties; Nelson Swamp, Madison County; Summit Lake Swamp, Otsego County.

Sources: Seischab 1984; Shanks 1966; Sorensen et al. 1998; Sperduto and Engstrom 1998; NYNHP 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. warnstorffii*, *S. centrale*, *Aulacomnium palustre*, and *Campylium stellatum*. Data on characteristic animals are needed.

Distribution: Most occurrences located in the Central Appalachians and Finger Lake Highlands sub-zones of the Appalachian Plateau ecozone.

Rank: G3G4 S2S3

Revised: 1990

Examples: Bear Swamp Sempronius, Cayuga County; Perkins Swamp, Chautauqua County; Alder Bottom Wetlands, Chautauqua County; Malloryville Swamp, Tompkins County; Michigan Hollow Swamp, Tompkins County.

Sources: Tufts 1976; NYNHP field surveys.

7. Black spruce-tamarack bog: a conifer 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 woodlands with as little as 20% cover of evenly spaced canopy trees to closed canopy forests with 80 to 90% cover.

In the more open canopy stands there is usually a well-developed shrublayer characterized by several shrubs typical of bogs: leatherleaf (*Chamaedaphne calyculata*), sheep laurel (*Kalmia angustifolia*), highbush blueberry (*Vaccinium corymbosum*), Labrador tea (*Rhododendron groenlandicum*), mountain holly (*Nemopanthus mucronatus*), and wild raisin (*Viburnum nudum* var. *cassinoides*). In closed canopy stands the shrublayer is usually sparse; however the species composition is similar. The dominant groundcover consists of several species of *Sphagnum* moss, including *S. fimbriatum*, *S. girgensohnii*, and *S. magellanicum*, with scattered sedges and forbs.

Characteristic herbs are the sedge *Carex trisperma*, cotton grass (*Eriophorum* spp.), pitcher plant (*Sarracenia purpurea*), bunchberry (*Cornus canadensis*), and cinnamon fern (*Osmunda cinnamomea*). In shady areas where the canopy is dense, gold thread (*Coptis trifolia*) and creeping snowberry (*Gaultheria hispida*) may be found. Vascular plant diversity is usually low in these forested peatlands; 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 (*Hemidactylum scutatum*).

A black spruce-tamarack bog may imperceptibly grade into and form a mosaic with a dwarf shrub bog. As the peat substrate thins and the wetland transitions to terrestrial communities, the black spruce-tamarack bog may grade into spruce flats.

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

Rank: G4G5 S3

Revised: 2001

Examples: Bolton Swamp, Warren County; Massawepie Mire, St. Lawrence County; Spring Pond Bog, Franklin County; Cicero Swamp, Oneida County; Bay Pond Bog, Franklin County; Kildare Peatlands, Franklin/St. Lawrence Counties; Sunday Swamp, Lewis County.

Sources: Bray 1921; Shanks 1966; NYNHP 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 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

Revised: 1990

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

Revised: 1990

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

Revised: 1990

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

Revised: 1990

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

Revised: 1990

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

Revised: 1990

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

Revised: 1990

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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 usually present at very low percent cover include various grasses such as beachgrass (*Ammophila breviligulata*, *A. champlainensis*), freshwater cordgrass (*Spartina pectinata*), common hairgrass (*Deschampsia flexuosa*), Canada wild-rye (*Elymus canadensis*), reed canary-grass (*Phalaris arundinacea*), Pickering's reedgrass (*Calamagrostis pickeringii*), poverty-grass (*Danthonia spicata*), sand dropseed (*Sporobolus cryptandrus*), and panic grasses (*Panicum* spp., *Panicum virgatum*). Other species present at low percent cover include common cocklebur (*Xanthium strumarium*), beach-pea (*Lathyrus japonicus* var. *glaber*), sea-rocket (*Cakile edentula* ssp. *lacustris*), silverweed (*Potentilla anserina*), tall wormwood (*Artemisia campestris* ssp. *caudata*), cyperus (*Cyperus* spp., *C. dentatus*), beggar-ticks (*Bidens* spp.), and knotweeds (*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

Revised: 2001

Example: Ausable Delta, Clinton County; Southwick Beach State Park, Jefferson County.

Source: Bonano 1998; NYNHP 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, whereas the vegetation of stable dunes is more dense, and can eventually become forested. Great Lake dunes can be divided into six physiographic zones: 1) beach (see sand beach), 2) foredune front, 3) foredune back and swale, 4) secondary dunes, 5) last lee face of high dune, and 6) last lee face of low dune. Each of these zones may develop any one to several vegetation associations or "community types" (Bonano 1992). The species listed below are not necessarily restricted to a specific vegetation association. For example, beachgrass (*Ammophila breviligulata*) and dune grape (*Vitis riparia*) may occur in more than one of the listed associations, but their abundance will vary accordingly.

The first, and largest vegetation association is dominated by beachgrass (*Ammophila breviligulata*) and tall wormwood (*Artemisia campestris* var. *caudata*). Other characteristic species with low percent cover include cottonwood (*Populus deltoides*), heart-leaf sand dune willow (*Salix cordata*), sand dropseed (*Sporobolus cryptandrus*), beach-pea (*Lathyrus japonicus* var. *glaber*), and dune grape (*Vitis riparia*). In more natural settings this association usually occurs on the more active parts of the beach, foredune, and swale zones.

The second association is dominated by poison ivy (*Toxicodendron radicans*), dune grape (*Vitis riparia*), and cottonwood (*Populus deltoides*). Other characteristic shrubs and vines with low percent cover include red osier dogwood (*Cornus sericea*), silky dogwood (*C. amomum*), sand cherry (*Prunus pumila*), sand-dune willow (*Salix cordata*), poison ivy (*Toxicodendron radicans*), and bittersweet (*Celastrus scandens*). Other characteristic herbs with low percent cover include (*Ammophila breviligulata*), tall wormwood (*Artemisia campestris* var. *caudata*), Canada wild-rye (*Elymus canadensis*), spotted knapweed (*Centaurea maculosa*), starry Solomon's seal (*Smilacina stellata*), jointweed (*Polygonella articulata*), seaside spurge (*Euphorbia polygonifolia*),

and common hairgrass (*Deschampsia flexuosa*). In more natural settings this association occurs mostly on the moderately stabilized dune crests and occasionally in swales and on secondary dunes. This association may be split out as a new community (e.g., “Great Lakes dune shrubland”) in future versions of this classification.

The third association is an open forest canopy dominated by red oak (*Quercus rubra*) and (*Acer rubrum*). Other characteristic species of the forested dunes sugar maple (*Acer saccharum*), striped maple (*Acer pensylvanicum*), shad bush (*Amelanchier* spp.), American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), chokecherry (*Prunus virginiana*), blackberry (*Rubus allegheniensis*), red raspberry (*Rubus idaeus*), nannyberry (*Viburnum lentago*), arrowwood (*V. recognitum*), wild sarsparilla (*Aralia nudicaulis*), and wreath goldenrod (*Solidago caesia*). In more natural settings this association occurs on very stabilized secondary dunes and the leeward side of the last high dune. This association may be split out as a new community (e.g., “Great Lakes dune woodland”) in future versions of this classification.

A fourth association dominated by speckled alder (*Alnus incana* ssp. *rugosa*) that is often found in wet dune swales is tentatively included under shrub swamp. See the appropriate palustrine communities for the classification of other wetland swales found within Great Lakes dunes. More data the physiognomic variants of 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

Revised: 2001

Examples: Southwick Beach, Jefferson County; El Dorado Beach, Jefferson County; Lakeview Wildlife Management Area, Jefferson County; Deer Creek Dunes, Oswego County.

Source: Bonano 1998; Significant Habitat Unit files; NYNHP field surveys.

3. Maritime beach: a community with extremely sparse vegetation 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 (*Chamaesyce 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.

Rank: G5 S5

Revised: 1990

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

Sources: Art 1976; Johnson 1985; Significant Habitat Unit files, NYNHP field surveys.

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 submissis* and *Cetraria arenaria*. Seabeach amaranth (*Amaranthus pumilus*) is a federally threatened plant that is found on the dynamic foredune of some maritime dunes. A few stunted pitch pines (*Pinus rigida*) or post oaks (*Quercus stellata*) may be present in the dunes.

Distribution: along the seacoast of the Coastal Lowlands ecozone.

Rank: G4 S3

Revised: 2001

Examples: Napeague Dunes, Suffolk County; Fire

Island National Seashore, Suffolk County.

Sources: Andrle and Carroll 1988; Art 1976; Hancock 1995; Johnson 1985; Leatherman 1979; Robichaud and Buell 1983; Zaremba 1990, NYNHP field surveys.

5. Maritime shrubland: a shrubland community that occurs on dry seaside bluffs and headlands that are exposed to offshore winds and salt spray. This community typically occurs as a tall shrubland (2-3 m), but may include areas under 1m shrub height, to areas with shrubs up to 4 m tall forming a shrub canopy in shallow depressions. These low areas may imperceptibly grade into shrub swamp if soils are sufficiently wet. Trees are usually sparse or absent (ideally less than 25% cover).

Characteristic shrubs and sapling trees include shadbush (*Amelanchier canadensis*), bayberry (*Myrica pensylvanica*), black cherry (*Prunus serotina*), arrowwood (*Viburnum dentatum*), and shining sumac (*Rhus copallinum*). Other shrubs and stunted trees include beach-plum (*Prunus maritima*), sand-rose (*Rosa rugosa*), wild rose (*R. virginiana*), eastern red cedar (*Juniperus virginiana*), American holly (*Ilex opaca*), black oak (*Quercus velutina*), and sassafras (*Sassafras albidum*). Small amounts of highbush blueberry (*Vaccinium corymbosum*), sweet pepperbush (*Clethra alnifolia*), red maple (*Acer rubrum*), and black chokeberry (*Aronia melanocarpa*) are found in moister low areas, often grading to small patches of shrub swamp.

Characteristic vines include poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quiquefolius*), greenbrier (*Smilax rotundifolia*), oriental bittersweet (*Celastrus orbiculatus*), and Japanese honeysuckle (*Lonicera japonica*).

The herb layer is very sparse and may contain a few scattered flat-topped goldenrod (*Euthamia graminifolia*), wild indigo (*Baptisia tinctoria*), white-topped aster (*Aster paternus*), and little bluestem (*Schizachyrium scoparium*).

Maritime shrublands may form a patchy mosaic and grade into other maritime communities. For example, if trees become more prevalent it may grade into one of the maritime forest communities, such as successional maritime forest. If a severe storm reduces shrub cover and deposits sand into the community it may be converted to a maritime dune. This community shares many shrub species with maritime dunes, but typically lacks the maritime dune herb species. More data on possible landscape variants are needed (e.g., maritime shrublands on morainal headland vs. outwash barrier dune).

Birds that may be found in maritime shrublands

include black-crowned night-heron (*Nycticorax nycticorax*), fish crow (*Corvus ossifragus*), yellow-breasted chat (*Icteria virens*), and migratory songbirds (especially in fall) (Levine 1998).

Distribution: along the seacoast of the Coastal Lowlands ecozone.

Rank: G4 S4

Revised: 2001

Example: Montauk Point, Suffolk County; Fire Island, Suffolk County.

Sources: Clark 1986b; Levine 1998; Robichaud and Buell 1983; Taylor 1923, Thompson 1997; NYNHP field surveys.

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 Greenei*), 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

Revised: 1990

Example: Napeague Dunes, Suffolk County; Montauk Mountain, Suffolk County.

Sources: Dunwiddie et al. 1996; Thompson 1997; NYNHP 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 greenii*), 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 patens*), 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 *Cladonia rangiferina*.

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

Rank: G2G3 S1 *Revised:* 1990

Examples: Conscience Point, Suffolk County; Shinnecock Hills, Suffolk County; Sayville Grasslands, Suffolk County.

Source: Taylor 1923; Dunwiddie et al. 1996; Thompson 1997; NYNHP 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 about 15,000 hectares (approximately 38,000 acres) of western Long Island; less than 12 hectares (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 greenii*), 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 *Revised:* 1990

Example: Mitchell Field, Nassau County.

Sources: Cain et al. 1937; Seyfert 1973; NYNHP 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 (*Cornus 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 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 *Revised:* 1990

Example: South of The Glen, Warren County.

Source: NYNHP field surveys.

10. Riverside sand/gravel bar: a meadow community that occurs on sand and gravel bars deposited within, or adjacent to, 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 *Revised:* 1990

Examples: Ausable River, Clinton County; Deer River Gorge, Lewis County; Upper Schroon River, Essex County.

Sources: NYNHP 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 *Revised:* 2001

Examples: Lake Lila, Hamilton County; Twin Hill, Essex County.

Source: NYNHP 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 S2 *Revised:* 1990

Examples: Valcour Island, Clinton County; Hudson River Gorge, Essex and Hamilton Counties.

Source: NYNHP 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*), beggar-ticks (*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

Revised: 1990

Example: South of the Glen, Warren County; Schuyler Island, Essex County; Doyles Islands, Delaware County.

Source: NYNHP field surveys.

Alvar Communities: Alvar ecosystems are grasslands, shrublands, woodlands, and sparsely vegetated rock barrens that develop on flat limestone or dolostone where soils are very shallow. Almost all of North America's alvars occur within the Great Lake basin, primarily in an arc from northern Lake Michigan across northern Lake Huron and along the southern edge of the Canadian Shield to include eastern Ontario and northwestern New York state. In New York, alvar ecosystems may include up to six different communities recognized by the International Alvar Conservation Initiative (Gilman 1998, Reschke et al. 1999). Communities in this classification that may be considered part of the alvar ecosystem include alvar shrubland, alvar grassland, alvar pavement-grassland, and alvar woodland.

14. Alvar shrubland: a shrub-dominated community that has over 25% cover of tall, short, and dwarf shrubs. There are often deep crevices or grikes in the limestone pavement; trees and shrubs are often rooted in the grikes. Characteristic small trees and tall shrubs are eastern red cedar (*Juniperus virginiana*), northern white cedar (*Thuja occidentalis*), and bur oak (*Quercus macrocarpa*). Other less common trees include shagbark hickory (*Carya ovata*), rock elm (*Ulmus thomasi*), and white ash (*Fraxinus americana*).

Many of the shrubs occur in dense thickets; they are rooted either in rock crevices or in shallow soil over bedrock. Characteristic short shrubs include common juniper (*Juniperus communis*), gray dogwood (*Cornus foemina* spp. *racemosa*), fragrant sumac (*Rhus*

aromatica), chokecherry (*Prunus virginiana*), downy arrow-wood (*Viburnum rafinesquianum*), round-leaf dogwood (*Cornus rugosa*), juneberry (*Amelanchier* spp.), meadow rose (*Rosa blanda*), wild honeysuckle (*Lonicera dioica*), and buffalo-berry (*Shepherdia canadensis*). Some dwarf shrubs are usually present including bearberry (*Arctostaphylos uva-ursi*) and snowberry (*Symphoricarpos albus*). Characteristic vines include poison ivy (*Toxicodendron radicans*) and river grape (*Vitis riparia*).

The herb layer forms a dry, grassy meadow between the shrubs. The most abundant herbs are poverty grass (*Danthonia spicata*), upland white aster (*Solidago ptarmicoides*), and the sedge *Carex umbellata*. Less than 50% of the ground surface is exposed limestone bedrock, which is usually covered with lichens, mosses, and algae. This community often forms a patchy mosaic with other alvar communities and may succeed to alvar woodland. A more detailed description of this community and an explanation of its global distribution can be found in Conserving Great Lake Alvars (Reschke et al. 1999) where it is called "juniper alvar shrubland." More data on this community are needed in New York.

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

Rank: G3 S2S3

Revised: 2001

Example: Chaumont Barrens, Jefferson County; Three Mile Creek Road Barrens, Jefferson County; Lucky Star Alvar, Jefferson County.

Sources: Gilman 1998; Reschke et al. 1999; NYNHP field surveys.

Alvar grasslands and pavement communities: Five distinct alvar grassland types have been described in Conserving Great Lakes Alvars (Reschke 1999) as follows: tufted hairgrass wet alvar grassland, little bluestem alvar grassland, annual alvar pavement-grassland, alvar nonvascular pavement, poverty grass dry alvar grassland. These five types have been tentatively lumped into two broader defined communities below, alvar grassland and alvar pavement-grassland, based on moisture regime and amount of bedrock pavement outcrop. It is suspected that some of these types occur as very small patch examples at New York's alvar sites, and in some cases imperceptibly grade into each other. More data are needed on patch size and distribution of these grassland types in New York before they are recognized as distinct community types.

15. 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 0.8 hectares (2 acres) to 20 hectares (50 acres) or more.

The typical variant is the “tufted hairgrass wet alvar grassland” (Reschke et al. 1999). The dominant grasses and sedges are tufted hairgrass (*Deschampsia cespitosa*), Craw’s sedge (*Carex crawei*), prairie dropseed (*Sporobolus heterolepis*), and flat-stemmed spikerush (*Eleocharis elliptica* var. *elliptica*).

Other characteristic grasses and herbs include balsam ragwort (*Senecio pauperculus*), small rush grass (*Sporobolus neglectus*), sheathed rush grass (*S. vaginiflorus*), false pennyroyal (*Trichostema brachiatum*), and wild chives (*Allium schoenoprasum*).

Typically there are several turf and weft mosses forming a patchy mat at the base of grasses and forbs; typical mosses are marsh bryum (*Bryum psuedotriquetrum*), fern moss (*Abietinella abietinum*), twisted moss (*Tortella tortuosa*), and sickle-leaf feathermoss (*Drepanocladus* spp.). There are usually few shrubs in this grassland community (usually less than 1% cover). This grassland occurs a patchy mosaic with other alvar communities and usually occupies the lowest, wettest positions. Soils are very shallow (<10 cm) and organic. This community has a characteristic soil moisture regime of alternating wet and dry seasons; many of them have flooded or saturated soils in early spring and late fall, combined with summer drought in most years.

A second variant that is suspected in New York is the “little bluestem alvar grassland” (Reschke 1999). Characteristic species include prairie dropseed (*Sporobolus heterolepis*), little bluestem (*Schizachyrium scoparium*), northern single spike sedge (*Carex scirpoidea*), tufted hairgrass (*Deschampsia cespitosa*), balsam ragwort (*Senecio pauperculus*), Craw’s sedge (*Carex crawei*), and creeping juniper (*Juniperis horizontalis*) in examples outside of New York.

Soils are shallow (<20 cm) loams high in organic matter. This community has a characteristic soil moisture regime of alternating wet and dry seasons; many of them have flooded or saturated soils in early spring and late fall, combined with summer drought in most years.

Other characteristic alvar grassland species include sedges (*Carex 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. *glaucus*), Indian paintbrush (*Castilleja coccinea*), prairie-smoke (*Geum triflorum*), and the mosses *Bryum pseudotriquetrum* and *Ditrichum flexicaule*.

Within the grassland are small patches of rock outcrop with a distinctive assemblage of mosses, lichens, and small herbs, much like the rock outcrops in alvar pavement-grassland. These outcrops have dry, very shallow soils (less than an inch deep). Characteristic species of these outcrops include the mosses *Tortella tortuosa* and *Bryum cespitium*, 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 with other alvar communities. Patches of the dry grass-savanna assemblage of alvar 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 alvar 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

Revised: 1990

Example: Chaumont Barrens, Jefferson County; Three Mile Creek Road Barrens, Jefferson County; Lucky Star Alvar, Jefferson County.

Sources: Catling et al. 1975; Reschke and Gilman 1988; Slack et al. 1988; Gilman 1998; Reschke et al. 1999; NYNHP field surveys.

16. Alvar pavement-grassland: Three of the drier alvar grassland and pavement types described in Conserving Great Lakes Alvars (Reschke et al. 1999) are tentatively included here.

The first type is the “annual alvar pavement-grassland.” This community consists of a mosaic of pavement and grassland areas dominated by characteristic species, such as small rush grass

(*Sporobolus neglectus*), sheathed rush grass (*S. vaginiflorus*), Philadelphia panic grass (*Panicum philadelphicum*), Canada bluegrass (*Poa compressa*), upland white aster (*Solidago ptarmicoides*), poverty grass (*Danthonia spicata*), false pennyroyal (*Trichostema brachiatum*), balsam ragwort (*Senecio pauperculus*), Craw's sedge (*Carex crawei*), and wiry panic grass (*Panicum flexile*).

There may be nearly equal cover of grassy vegetation, and exposed rock covered with nonvascular plants. Lichens and mosses are common on "pavement" rock outcrops that occur as patches within this mosaic. Soils are very shallow (<10 cm) and organic. This community has a characteristic soil moisture regime of alternating wet and dry seasons; many of them have flooded or saturated soils in early spring and late fall, combined with summer drought in most years. Due to very shallow soils, and often saturated conditions during freeze-thaw cycles in early and late winter, needle ice often forms in the soils, causing frost-heaving of the shallow soils.

The second variant is the "alvar nonvascular pavement." This community consists of exposed, flat limestone or dolostone pavement that is sparsely vegetated with a mosaic of mossy patches and exposed bedrock that is covered with crustose and foliose lichens. In the mossy patches, characteristic mosses are twisted moss (*Tortella tortuosa* and other *Tortella* spp.) and tortula moss (*Tortula ruralis*), and a characteristic lichen is cup lichen (*Cladonia pocillum*). Other characteristic mosses include *Ceratodon purpureus*, *Grimmia apocarpa*, and *Bryum argenteum*.

On exposed pavement patches, characteristic lichens are blackthread lichen (*Placynthium nigrum*) and silver skin lichen *Dernatocarpon cf. minutum*.

Very small herbs (<15 cm) grow in the mossy patches, including early saxifrage (*Saxifraga virginensis*), hairy beardtongue (*Penstemon hirsutus*), Norwegian cinquefoil (*Potentilla norvegica*), false pennyroyal (*Trichostema brachiatum*), wild strawberry (*Fragaria virginiana*), Michaux's stitchwort (*Minuartia michauxii*), and longleaf summer bluet (*Houstonia longifolia*). Some taller herbs and low shrubs grow primarily in rock crevices that crisscross the pavement, including gray goldenrod (*Solidago nemoralis*), snowberry (*Symphoricarpos albus*), river grape (*Vitis riparia*), red columbine (*Aquilegia canadensis*), southern hairgrass (*Agrostis hiemalis*), small skullcap (*Scutellaria parvula* var. *leonardii*), and tall hawkweed (*Hieracium piloselloides*).

There is usually less than 15% cover of herbs. A few trees and shrubs are usually rooted in deep crevices of the pavement; characteristic trees and shrubs that occur sparsely northern white cedar (*Thuja occidentalis*), common juniper (*Juniperus communis*), white birch (*Betula papyrifera*), eastern red cedar

(*Juniperus virginianus*), butternut (*Juglans cinerea*), and white pine (*Pinus strobus*).

The third type is the "poverty grass dry alvar grassland." This dry grass land is dominated by poverty grass (*Danthonia spicata*), Canada bluegrass (*Poa compressa*), and sometimes little bluestem (*Schizachyrium scoparium*).

Other characteristic species that may be found in each variant include panic grasses (*Panicum flexile*, *P. philadelphicum*), sedges (*Carex pensylvanica*, *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*.

There is usually about 50% cover of herbs and up to 50% cover of nonvascular plants growing on exposed pavement areas. Soils are very shallow (<10 cm) loam and have a characteristic soil moisture regime of summer drought in most years. These grasslands are sometime disturbed by grazing and may include non-native species such as timothy (*Phleum pratense*).

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

Distribution: only known from Jefferson County, in the Eastern Ontario Plain ecozone.

Rank: G3 S2S3

Revised: 2001

Example: Chaumont Barrens, Jefferson County; Three Mile Creek Road Barrens, Jefferson County; Lucky Star Alvar, Jefferson County.

Sources: Gilman 1998; Reschke et al. 1999; NYNHP field surveys.

16. 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 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 (*Cornus 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 *Revised:* 1990

Examples: MacIntyre Range (includes Algonquin Peak, Wright Peak, Boundary Peak, and Iroquois Peak) Essex County; Haystack Mountains, Essex County; Mount Marcy, Essex County.

Sources: DiNunzio 1972; LeBlanc 1981; Slack Bell 1993, 1995; Sperduto and Cogbill 1999; NYNHP field surveys.

17. 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? *Revised:* 1990

Examples: Wallface Mountain, Essex County; Poke O Moonshine Mountain, Essex County; Catskill Escarpment, Greene County; Smiley Cliff, Ulster County; Palisades Orangetown, Rockland County.

Source: NYNHP field surveys.

18. 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 small trees and shrubs include eastern red cedar (*Juniperus virginiana*), hop hornbeam (*Ostrya virginiana*), round-leaf dogwood (*Cornus rugosa*), Canada yew (*Taxus canadensis*), black cherry (*Prunus serotina*), downy arrow-wood (*Viburnum rafinesquianum*), and northern white cedar (*Thuja*

occidentalis).

Characteristic herbs growing in cracks and on ledges include bulblet fern (*Cystopteris bulbifera*), sedge (*Carex eburnea*), herb robert (*Geranium robertianum*), zig-zag goldenrod (*Solidago flexicaulis*), Campanula rotundifolia, purple cliff brake (*Pellaea atropurpurea*), early saxifrage (*Saxifraga virginiana*), and red columbine (*Aquilegia canadensis*).

Characteristic nonvascular species include lichens and mosses, such as *Thuidium* sp., *Anomodon attenuatus*, *A. rostratus*, and *Brachythecium* sp.

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

Rank: G4 S3S4

Revised: 2001

Examples: The Diameter, Washington County; Helderberg Escarpment at Thatcher State Park, Albany County; Deer Leap, Warren County; Rogers Rock and Slide, Essex and Warren Counties.

Source: NYNHP field surveys.

19. 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 pensylvanica*), 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

Revised: 1990

Examples: Chautauqua Gorge, Chautauqua County; Lorraine Gulf, Jefferson County; Cattaraugus Creek Zoar Valley, Cattaraugus and Erie Counties; Neversink Guymard Cliffs, Orange County; Whetstone Gulf, Lewis County.

Sources: Hotchkiss 1932; NYNHP field surveys.

20. Erosional slope/bluff: a sparsely vegetated community that occurs on vertical exposures of unconsolidated material, such as small stone, gravel, sand and clay, that is exposed to erosional forces, such as water, ice, or wind. Several regional and edaphic variants are known: the “maritime bluff” variant is adjacent to maritime and marine communities and is actively eroded by the oceanic forces; the “Great Lakes bluff” variant is adjacent to, and is exposed to erosional forces of, one of the Great Lakes; other variants may be more generally identified as “riverside bluff” or “lakeside bluff” depending on landscape setting.

The “maritime bluff” is comprised of areas of unvegetated, near vertical morainal sand cliffs, and less steep (about 45 degrees) areas of slumped bluff-face at the base of the bluff that support beach grass (*Ammophila breviligulata*), seaside goldenrod (*Solidago sempervirens*), and bayberry (*Myrica pensylvanica*). More data are needed for this community and its variants.

Distribution: Maritime variant known from Coastal Lowland ecozone. Great Lakes variant known from the drumlins region of the Great Lakes Plain ecozone. Other variants likely occur throughout New York.

Rank: G4 S4

Revised: 2001

Examples: Montauk Peninsula (south shore), Suffolk County; Chimney Bluffs State Park, Wayne County.

Sources: Office of Parks, Recreation and Historic Preservation 1988; NYNHP field surveys.

21. Rocky summit grassland: a grassland community that occurs on rocky summits and exposed rocky slopes of hills. Woody plant are sparse and may be scattered near the margin of the community. Small trees and shrubs at low percent cover include eastern red cedar (*Juniperus virginiana*) and red oak (*Quercus rubra*).

Characteristic and dominant grasses include little bluestem (*Schizachyrium scoparium*), tufted hairgrass (*Deschampsia flexuosa*), poverty-grass (*Danthonia spicata*, *D. compressa*), and Indian grass (*Sorghastrum*

nutans). Other grasses and sedges include Pennsylvania sedge (*Carex pennsylvanica*), big bluestem (*Andropogon gerardii*), and deer-tongue grass (*Panicum clandestinum*).

Other herbs include ebony spleenwort (*Asplenium platyneuron*), dittany (*Cunila origanoides*), fragrant goldenrod (*Solidago odora*), bush-clover (*Lespedeza violacea*), and whorled loosestrife (*Lysimachia quadrifolia*). Characteristic nonvascular species include lichens and mosses on scattered rock outcrops.

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

Rank: G3G4 S3 *Revised:* 2001

Example: Rocky Peak Ridge, Essex County; Bigelow Mountain, Essex County; Cranberry Mountain, Orange County; Sugarloaf Mountain, Orange County.

Source: NYNHP field surveys.

22. 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 *Revised:* 1990

Example: Brandon Burn, Franklin County.

Sources: NYNHP field surveys.

23. 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 *Revised:* 2001

Example: Brandon Burn, Franklin County. Finger Lakes National Forest, Schuyler County.

Source: NYNHP field surveys.

24. Successional northern sandplain grassland: a meadow community that occurs on open sandplains that have been cleared and plowed (for farming or development), and then abandoned. This community is usually dominated by low, dry turf of sedges and grasses less than 30 cm (12 inches) tall, and include patches of open sand, and patches of soil covered with mosses and lichens.

These grasslands are dominated by Pennsylvania sedge (*Carex pensylvanica*), common hairgrass (*Deschampsia flexuosa*), and haircap moss (*Polytrichum juniperinum*), with substantial amounts of poverty panic grass (*Panicum depauperatum*), poverty grass (*Danthonia spicata*), bracken fern (*Pteridium aquilinum*), sedge (*Carex rugosperma*), stiff-leaf aster (*Aster linariifolius*), and pale bluets (*Hedyotis longifolia*). They have relatively few other herbs, but include small amounts of characteristic sandplain species, such as bitter milkwort (*Polygala polygama*), panic grass (*Panicum xanthophysum*), and jointweed (*Polygonella articulata*). Adjacent areas of disturbed sands occasionally have Houghton umbrella-sedge (*Cyperus houghtonii*). These grasslands consist primarily of native species, although in some areas near roads they are invaded by exotic weeds such as St. Johns-wort (*Hypericum perforatum*) and common milkweed (*Asclepias syriaca*). There are essentially no exotic grasses, and thus they are very different from abandoned pastures and old fields on heavier soils. Shrubs may be present, but collectively they have less than 50% cover in the community.

Characteristic birds include upland sandpiper (*Bartramia longicauda*), grasshopper sparrow (*Ammodramus savannarum*), savannah sparrow (*Passerculus sandwichensis*), and vesper sparrow (*Pooecetes gramineus*). These grasslands provide important habitat for grassland birds.

Characteristic butterflies include meadow fritillary and black swallowtail. Some of these grasslands probably originate from anthropogenic disturbances such as trampling by vehicles. It is also possible that fire is an important part of the disturbance regime.

Ecoregional variants of sandplain grassland within the state may be recognized and are included here until further inventory warrants separation. This is a relatively short-lived community that succeeds to a shrubland, woodland, or forest community.

Distribution:

Rank: G4? S3

Revised: 2001

Example: Brandon Burn, Franklin County; Fort Drum, Jefferson County.

Source: NYNHP field surveys.

25. 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.

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

Revised: 1990

Example: Chippewa Creek Plains, St. Lawrence County; Finger Lakes National Forest, Schuyler County.

Sources: Mellinger and McNaughton 1975; NYNHP field surveys.

26. 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*).

Birds that may be found in successional shrublands brown thrasher, blue-winged warbler, golden-winged warbler, chestnut-sided warbler, yellow-breasted chat, eastern towhee, field sparrow, song sparrow, and indigo bunting (Levine 1998).

Distribution: throughout New York State.

Rank: G4 S4

Revised: 1990

Example: Chippewa Creek Plains, St. Lawrence County; Finger Lakes National Forest, Schuyler County.

Source: NYNHP 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 (*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 *Revised:* 1990

Examples: Heyerdahl Hill, Richmond County; Seaview, Richmond County.

Sources: Reed 1986; NYNHP 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 rupestris*, *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 (*Toxostoma 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 *Revised:* 1990

Example: Dwarf Pine Barrens, Suffolk County.

Sources: Jordan 1998; Kerlinger and Doremus 1981; Olsvig 1980; Olsvig et al. 1979; NYNHP 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 4.9 m (16 ft) tall are classified as dwarf pine ridges.

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

Rank: G1G2 S1

Revised: 1990

Example: Sam's Point, Ulster County.

Sources: Olsvig 1980; Thompson 1996; NYNHP field surveys.

4. Maritime pitch pine dune woodland: a maritime woodland that occurs on stabilized parabolic dunes. The substrate is wind and wave deposited sand that is usually excessively well-drained and nutrient poor. The litter layer is shallow. The community is subject to high winds, sand-blasting, salt spray, and shifting substrate.

Trees are stunted (10-12 m high) and salt pruned. The canopy is sparse with some openings. Pitch pine (*Pinus rigida*) is the dominant tree and may have lower branches that grow out horizontally like aprons. Tree oaks including black oak (*Quercus velutina*), white oak (*Quercus alba*) and post oak (*Quercus stellata*) may also occur and can be codominant with pitch pine in more developed examples.

The shrub layer is usually well developed. Characteristic shrubs are bearberry (*Arctostaphylos uva-ursi*), black huckleberry (*Gaylussacia baccata*), highbush blueberry (*Vaccinium corymbosum*), beach heather (*Hudsonia tomentosa*), bayberry (*Myrica pennsylvanica*), and scrub oak (*Quercus ilicifolia*). The vine layer is often well developed. Characteristic vines are greenbrier (*Smilax rotundifolia*) and poison ivy (*Toxicodendron radicans*).

The herbaceous layer is dominated by hairgrass (*Deschampsia flexuosa*). Other characteristic herbaceous species include Pennsylvania sedge (*Carex pensylvanica*), little bluestem (*Schizachyrium scoparium*), starflower (*Trientalis borealis*), panic grass (*Panicum* spp.), jointweed (*Polygonella articulata*), and pine barren sandwort (*Minuartia caroliniana*).

The non-vascular layer is often well developed. Characteristic species are *Cladonia uncialis*, *Cladonia rangiferina*, *Cladonia arbuscula*, *Geaster*

hygrometricus, *Leucobryum glaucum*, *Polytricum juniperinum*, and *Tortella tortuosa*.

Distribution: currently known only from the Coastal Lowlands ecozone.

Rank: G2G3 S1

Revised: 2001

Examples: Napeague Woods, Suffolk County; Walking Dunes, Suffolk County.

Source: Johnson 1981, 1985; Robichaud-Collins and Anderson 1994; Thompson 1997; NYNHP field surveys.

5. 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*).

Rare butterflies of some northern Hudson Valley pitch pine-scrub oak barrens 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.

Birds that may be found in pitch pine-scrub oak barrens include eastern towhee (*Pipilo erythrophthalmus*), brown thrasher (*Toxostoma rufum*), pine warbler (*Dendroica pinus*), prairie warbler (*D.*

discolor), ovenbird (*Seiurus aurocapillus*), common yellowthroat (*Geothlypis trichas*), field sparrow (*Spizella pusilla*), chipping sparrow (*S. passerina*), and gray catbird (*Dumetella carolinensis*) (Levine 1998, Drennan 1981). 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 *Revised:* 2001

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

Sources: Cryan and Turner 1981; Drennan 1981; Forman 1979; Kerlinger and Doremus 1981; Levine 1998; Olsvig 1980; NYNHP field surveys.

6. 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 *Revised:* 1990

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

Source: NYNHP field surveys.

7. Post oak-blackjack oak barrens: open barrens on upper slopes and low ridges characterized by the presence of stunted individuals of post oak (*Quercus stellata*), scarlet oak (*Q. coccinea*), and blackjack oak (*Q. marilandica*). Other trees at low cover include white oak (*Q. alba*), black oak (*Q. velutina*), sassafras (*Sassafras albidum*), American chestnut (*Castanea dentata*), gray birch (*Betula populifolia*), red maple (*Acer rubrum*), pitch pine (*Pinus rigida*), and black gum (*Nyssa sylvatica*). There is a sparse heath and grass ground cover growing in very dry, deep, exposed sand overlying a clay subsoil.

The shrub layer includes sapling canopy trees along with blueberries (*Vaccinium corymbosum*, *V. pallidum*), and black huckleberry (*Gaylussacia baccata*). Characteristic vines are carrion flower (*Smilax herbacea*) and greenbrier (*S. glauca*).

The herb layer has low percent cover of old field toadflax (*Linaria canadensis*), bracken fern (*Pteridium aquilinum*), bastard toadflax (*Commandra umbellata*), switch grass (*Panicum virgatum*), little bluestem (*Schizachyrium scoparium*), gray goldenrod (*Solidago nemoralis*), and wild indigo (*Baptisia tinctoria*).

This community is may be adapted to periodic fires; the fire frequency has not been documented.

Distribution: currently only known from the Manhattan Hills ecozone.

Rank: G2G3 S1 *Revised:* 2001

Examples: Clay Pit Ponds, Richmond County.

Source: NYNHP field surveys.

8. 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 S1S2 *Revised:* 1990

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

Source: NYNHP field surveys.

9. 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 *Revised:* 1990

Example: Oswegatchie Plains, St. Lawrence County; Chase Lake Sandplain, Lewis County.

Sources: Bray 1915; Bray 1921; Curran 1974.

10. 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 *Cladonia* 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

Revised: 2001

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

Source: NYNHP field surveys.

11. 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

Revised: 1990

Example: Rush Oak Openings, Monroe County.

Sources: Shanks 1966; NYNHP field surveys.

Note: **Calcareous pavement barrens** has been split into the following component community types: alvar shrubland, alvar grassland, alvar pavement-grassland, and alvar woodland.

12. 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

Revised: 1990

Examples: MacIntyre Range (includes Algonquin Peak, Wright Peak, Boundary Peak, and Iroquois Peak) Essex County; Haystack Mountains, Essex County; Mount

Marcy, Essex County; Whiteface Mountain, Essex County.

Source: Slack Bell 1993, 1995; Sperduto and Cogbill 1999; NYNHP field surveys.

13. Limestone woodland: a woodland that occurs on shallow soils over limestone bedrock in non-alvar settings, 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 idaeus*, *R. occidentalis*), bladdernut (*Staphylea trifolia*), juneberry (*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. pensylvanica*, *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 regional variants and 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

Revised: 1990

Examples: Skene Mountain, Washington County; Valcour Island, Clinton County, Split Rock Mountain, Clinton County; Rush Oak Opening, Monroe County.

Sources: Reschke and Gilman 1988; NYNHP field surveys.

14. Alvar woodland: a subset of the limestone woodland community restricted to the alvar region in Jefferson County, New York. The woodland tree canopy consists of a variable mixture of 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*), balsam fir (*Abies balsamea*), basswood (*Tilia americana*), American elm (*Ulmus americana*), rock elm (*U. thomasi*), and pin-cherry (*Prunus pensylvanica*). Jack pine (*Pinus banksiana*) is characteristic of alvar woodlands outside of New York.

The understory is a mosaic of shrubby patches, exposed pavement, and grassy patches. The most abundant shrub is common juniper (*Juniperus horizontalis*), buffaloberry (*Shepherdia canadensis*), and bearberry (*Arctostaphylos uva-ursi*).

Characteristic herbs include false pennyroyal (*Trichostema brachiatum*), Craw's sedge (*Carex crawei*), balsam ragwort (*Senecio pauperculus*), ebony sedge (*Carex eburnea*), Richardson's sedge (*C. richardsonii*), and sheathed rush grass (*Sporobolus vaginiflorus*).

Areas of exposed limestone or dolostone pavement are common, usually with a cover of mosses such as twisted moss *Tortella* spp.) and grimmia (*Schistidium* spp.), lichens such as reindeer 'moss' (*Cladina rangiferina*) and dog lichen (*Peltigera canina*), and rock surface algae (*Gloeocapsa alpina*). This community is related to alvar shrubland and may represent a later successional stage of that community. This woodland often forms a mosaic with other alvar communities and may include patches of alvar shrubland, alvar grassland, and alvar pavement-grassland.

A more detailed description this community and an explanation of its global distribution can be found in *Conserving Great Lake Alvares* (Reschke et al. 1999) where it is called "mixed conifer/comon juniper alvar

woodland.” Another type in that classification that may occur in New York is the “red cedar/early buttercup alvar woodland.” More data on alvar woodland communities are needed in New York.

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

Rank: G2? S2

Revised: 2001

Example: Chaumont Barrens, Jefferson County; Three Mile Creek Road Barrens, Jefferson County; Lucky Star Alvar, Jefferson County.

Sources: Gilman 1998; Reschke et al. 1999; NYNHP field surveys.

15. 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

Revised: 1990

Examples: Shingle Gully, Ulster County; Moss Lake Mountain, Herkimer County; Indian Pass, Essex County; Sam's Point, Ulster County.

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

16. Calcareous talus slope woodland: An open or closed canopy community 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*), eastern red cedar (*Juniperus virginiana*), northern white cedar (*Thuja occidentalis*), basswood (*Tilia americana*), slippery elm (*Ulmus rubra*) and butternut (*Juglans cinerea*).

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*). Common vines include bittersweet (*Celastrus scandens*), Virginia creeper (*Parthenocissus quinquefolia*), and climbing fumitory (*Adlumia fungosa*).

Herbaceous vegetation may be quite diverse; characteristic species include bulblet fern (*Cystopteris bulbifera*), lady fern (*Athyrium filix-femina* var. *asplenoides*), oak fern (*Gymnocarpium dryopteris*), bottlebrush grass (*Elymus hystrix*), herb-robert (*Geranium robertianum*), 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*), blue cohosh (*Caulophyllum thalictroides*), lyre-leaved rock cress (*Arabis lyrata*), white wood aster (*Aster divaricatus*) and ricegrass (*Oryzopsis racemosa*). Rock outcrops may have ferns such as walking fern (*Asplenium rhizophyllum*) and maidenhair spleenwort (*Asplenium trichomanes*). Bryophytes on wet forested talus can include *Hylocomium splendens*.

Physiognomic variants range from northern white cedar-dominated to hardwood-dominated forest to non-vegetated talus.

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

Rank: G3G4 S3

Revised: 2001

Example: Warner Hill, Washington County; The Diameter, Washington County; Deer Leap, Warren County; Clarence Escarpment, Erie County.

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

17. 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 include chestnut oak (*Quercus montana*), red oak (*Q. rubra*), white oak (*Q. alba*), white pine (*Pinus strobus*), red pine (*P. resinosa*), paper birch (*Betula papyrifera*), black birch (*B. lenta*), and mountain paper birch (*B. cordifolia*); striped maple (*Acer pensylvanicum*) and mountain maple (*A. spicatum*) are common subcanopy trees.

Characteristic groundlayer species include many ferns: rock polypody (*Polypodium virginianum*), Christmas fern (*Polystichum acrostichoides*), marginal wood fern (*Dryopteris marginalis*), and rusty woodsia (*Woodsia ilvensis*). Other common herbs include wild sarsaparilla (*Aralia nudicaulis*). Crustose lichens are abundant on the talus.

Rare snakes of some acidic talus slope woodlands include copperhead (*Agkistrodon contortrix*) and timber rattlesnake (*Crotalus horridus*).

Regional variants are known. Species characteristic of the Hudson River Valley may include witch hazel (*Hamamelis virginiana*), mountain laurel (*Kalmia latifolia*), scrub oak (*Quercus ilicifolia*), black huckleberry (*Gaylussacia baccata*), blueberry (*Vaccinium pallidum*), and Pennsylvania sedge (*Carex pensylvanica*).

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

Rank: G4? S3S4 *Revised:* 2001

Examples: Black Rock Forest, Orange County; The Trapps, Ulster County; Catamount Mountain, Warren County; Chapel Pond Valley, Essex County; West Point Bull Hill, Orange County.

Sources: McVaugh 1958; NYNHP field surveys.

18. 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 *Revised:* 1990

Example: Chemung Shale Slope, Chemung County; Poyic Mountain, Greene County.

Sources: McVaugh 1958; NYNHP field surveys.

Summit communities: Summit communities typically occur on ridgetops and upper slopes, but can also occur midslope. They are typically variable in physiognomy with much clustering of woody and herbaceous vegetation and occurrences should be evaluated over broad areas. Included associations are often numerous: woodland, dwarf woodland, tall shrubland, dwarf heathland, herbaceous patches, rock outcrops. Trees are often stunted/dwarfed, or contorted. Extreme fluctuations in the dominant species within an occurrence over time is possible. Ecological processes that influence the distribution of these associations and determines dominant species include fire regime, wind events, and ice damage.

19. 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. This community is broadly defined and includes examples that may lack pines and are dominated by scrub oak and/or heath shrubs apparently related to fire regime. This community is often surrounded by chestnut oak forest.

Characteristic species include pitch pine (*Pinus rigida*), chestnut oak (*Quercus montana*), red oak (*Q. rubra*), and scarlet oak (*Q. coccinea*). Other trees may include black cherry (*Prunus serotina*), red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*), gray birch (*Betula populifolia*), choke-cherry (*Prunus virginiana*),

serviceberry (*Amelanchier arborea*), and white pine (*Pinus strobus*).

Characteristic shrubs include scrub oak (*Q. ilicifolia*), common juniper (*Juniperus communis*), blueberry (*Vaccinium angustifolium*, *V. pallidum*), sweet-fern (*Comptonia peregrina*), and black huckleberry (*Gaylussacia baccata*). Other shrubs include highbush blueberry (*Vaccinium corymbosum*), sheep laurel (*Kalmia angustifolia*), mountain laurel (*Kalmia latifolia*), chokeberry (*Aronia* spp), and deerberry (*Vaccinium stamineum*).

Characteristic herbs include Pennsylvania sedge (*Carex pensylvanica*), poverty-grass (*Danthonia spicata*), common hairgrass (*Deschampsia flexuosa*), three-toothed cinquefoil (*Potentilla tridentata*), and cow-wheat (*Melampyrum lineare*). Other herbs include bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), little bluestem (*Schizachyrium scoparium*), and pink corydalis (*Corydalis sempervirens*).

Characteristic lichens include various crustose, foliose, and fruticose lichens, such as *Cetraria arenaria* and *Cladonia* spp. Characteristic mosses include hair cap moss (*Polytrichum* spp.) and pincushion moss (*Leucobryum glaucum*).

Examples dominated by white pine (*Pinus strobus*) or other oaks (e.g., *Quercus rubra* and *Q. montana*) are tentatively included here until further evaluation warrants the recognition of new community types.

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

Revised: 2001

Examples: Shawangunk Mountains, Ulster County; Schunnemunk Mountain, Orange County; Bellvale Mountain, Orange County; Crane and Huckleberry Mountains, Warren County.

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

20. Red pine 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. Red pine (*Pinus resinosa*) is typically dominant, but may also be codominant with red oak, (*Quercus rubra*) and/or white pine (*Pinus strobus*).

Characteristic shrubs include blueberry (*Vaccinium angustifolium*) and bearberry (*Arctostaphylos uva-ursi*).

Characteristic herbs include trailing arbutus (*Epigaea repens*), wintergreen (*Gaultheria procumbens*), tufted hairgrass (*Deschampsia flexuosa*), poverty-grass (*Danthonia spicata*), and Pennsylvania sedge (*Carex pensylvanica*).

Rock outcrops dominated by various crustose, foliose, and fruticose lichens. More data on this community are needed.

Distribution: primarily in the Adirondack Mountains and possibly in the Catskill mountains.

Rank: G S

Revised: 2001

Examples: Crane and Huckleberry Mountains, Warren County; White Face Mountain, Essex County; Peaked Hill, Essex County.

Sources: NYNHP field surveys.

21. 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 and rock slides. The species have predominantly boreal distributions.

Characteristic trees include red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), mountain ash (*Sorbus americana*), and mountain paper birch (*Betula cordifolia*). Eastern hemlock (*Tsuga canadensis*) may be an associate in examples in the Catskill Mountains. The shrub layer includes sapling canopy trees along with blueberry (*Vaccinium angustifolium*, *V. myrtilloides*).

Characteristic herbs include harebell (*Campanula rotundifolia*), three-toothed cinquefoil (*Potentilla tridentata*), mountain goldenrod (*Solidago spathulata* ssp. *randii*), large-leaf goldenrod (*S. macrophylla*), common hairgrass (*Deschampsia flexuosa*), bunchberry (*Cornus canadensis*), whorled aster (*Aster acuminatus*), and small ricegrass (*Oryzopsis pungens*). There are usually many mosses and crustose lichens growing on rock outcrops. More data on this community are needed.

Distribution: primarily in the Adirondack and Catskill mountains.

Rank: G4 S3S4

Revised: 2001

Example: East Dix Mountain, Essex County; Pitchoff Mountain, Essex County; Giant Mountain, Essex County.

Source: NYNHP field surveys.

22. 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, but also marble, amphibolite, and calcsilicate rock), and the soils are more or less calcareous. The vegetation may be sparse or patchy, with numerous lichen covered rock outcrops. This community is often surrounded by Appalachian oak-hickory forest.

Characteristic trees include eastern red cedar (*Juniperus virginiana*), red oak (*Quercus rubra*), shagbark hickory (*Carya ovata*), white ash (*Fraxinus americana*), eastern hop hornbeam (*Ostrya virginiana*), and serviceberry (*Amelanchier* spp.). In many examples many dead or dying red cedars may be evident which is often associated with severe heat stress characteristic of this community.

Characteristic shrubs include sapling canopy trees along with common juniper (*Juniperus communis*), downy arrow-wood (*Viburnum rafinesquianum*), prickly ash (*Zanthoxylum americanum*), fragrant sumac (*Rhus aromatica*), and snowberry (*Symphoricarpos albus*). Other shrubs with low percent cover include blueberry (*Vaccinium pallidum*, *V. angustifolium*) and scrub oak (*Quercus ilicifolia*).

The herb layer can be quite diverse. Characteristic herbs include little bluestem (*Schizachyrium scoparium*), sedge (*Carex eburnea*), tufted hairgrass (*Deschampsia flexuosa*), buttercups (*Ranunculus fasciculatus*, *R. micranthus*) maidenhair spleenwort (*Asplenium trichomanes*), upland white aster (*Solidago ptarmicoides*), rockcress (*Arabis missouriensis*, *A. lyrata*), knotweed (*Polygonum douglasii*), bluets (*Houstonia caerulea*), and dittany (*Cunila organoides*).

Other herbs include Pennsylvania sedge (*Carex pensylvanica*), rock cap fern (*Polypodium virginianum*), marginal wood fern (*Dryopteris marginalis*), and everlasting (*Antennaria plantaginifolia*). Larger grass dominated areas (e.g., > 0.5 acres) with little or no woody vegetation may be better classified as rocky summit grassland.

Nonvascular species include lichens such as *Cladonia furcata* and *C. stellaris*, and mosses such as hair cap moss (*Polytrichum* spp.), *Hypnum cupressiforme*, *Anomodon attenuatus*, and *Hedwegia ciliata*.

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

Revised: 2001

Example: Neversink Glade, Orange County; Split Rock Mountain, Essex County; Tongue Mountain, Warren County; Black Rock Forest, Orange County; Nellie Hill, Dutchess County.

Source: NYNHP field surveys.

23. 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. This community is often surrounded by other calcareous communities, such as limestone woodland, calcareous talus slope woodland, and calcareous cliff community.

Characteristic species include northern white cedar (*Thuja occidentalis*), American basswood (*Tilia americana*), and eastern hop hornbeam (*Ostrya virginiana*). Other trees at low percent cover include sugar maple (*Acer saccharum*), American beech (*Fagus grandifolia*), and red pine (*Pinus resinosa*).

Characteristic herbs include upland white aster (*Solidago ptarmicoides*), sedge (*Carex eburnea*), red columbine (*Aquilegia canadensis*), bulblet fern (*Cystopteris bulbifera*), 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

Revised: 1990

Examples: Valcour Island, Clinton County; Hudson River Gorge, Hamilton and Essex Counties; Little Nose, Montgomery County.

Source: NYNHP field surveys.

24. 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

Revised: 1990

Examples: Champlain Valley Essex, Essex County; Crown Point, Essex County; Beaver Brook Valley, Essex County; NY State Thruway at Cauterskill, Greene County.

Source: NYNHP 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.

Maritime forests: areas generally in immediate proximity to marine communities. Heavily influenced by coastal processes including strong salt spray, high winds and dune deposition, shifting and overwash processes. Forests generally contain stunted “salt pruned” trees with contorted branches and wilted leaves plus usually have a dense vine layer. Communities often occur as narrow bands under 50 meters wide. Greller (1977) has referred to maritime forests as “strand forest.”

1. Maritime post oak forest: an oak-dominated forest that borders salt marshes or occurs on exposed bluffs and sand spits within about 200 meters of the seacoast. The trees may be somewhat stunted and flat-topped because the canopies are pruned by salt spray and exposed to winds.

The forest is usually dominated by two or more species of oaks. Characteristic canopy trees include post oak (*Quercus stellata*), black oak (*Q. velutina*), scarlet oak (*Q. coccinea*) and white oak (*Q. alba*). A small number of eastern red cedar (*Juniperus virginiana*) may be present.

The understory usually contains a dense shrub thicket dominated by bayberry (*Myrica pensylvanica*) and black huckleberry (*Gaylussacia baccata*), with saplings of black cherry (*Prunus serotina*) as a

common associate. In most stands the understory is a dense thicket of catbrier (*Smilax rotundifolia*). The presence of catbrier is not well understood. They are likely to be favored from natural disturbances of exposure to salt spray and windthrow. However, other less natural disturbances such as insect infestations, heavy browsing by deer, clear-cutting and fires may produce similar effect. Other vines are common including poison ivy (*Toxicodendron radicans*), summer grape (*Vitis aestivalis*), and Virginia creeper (*Parthenocissus quinquefolia*). The sparse groundlayer under this shrub and vine thicket is dominated by common hairgrass (*Deschampsia flexuosa*).

Characteristic animals include eastern towhee (*Pipilo erythrophthalmus*) and white-tailed deer (*Odocoileus virginianus*).

Three topoedaphic variants of this community are known. The typical post oak-catbrier forest variant, experiencing the most extreme degree of salt spray, is most widespread. A post oak-basswood variant on windswept sands forming dunes on top of morainal bluffs is known along Long Island Sound (Lamont 1997). A post oak-blackjack oak variant on reddish sandy clay loam ridges is known from Staten Island.

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

Rank: G3G4 S2S3

Revised: 2001

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

Sources: Greller 1977; Lamont 1997; Rosza and Metzler 1982; Taylor 1923; NYNHP field surveys.

2. Maritime beech forest: A hardwood forest with beech (*Fagus grandifolia*) dominant that usually occurs on north-facing exposed bluffs and the back portions of rolling dunes in well-drained fine sands. Black oak (*Quercus velutina*) and red maple (*Acer rubrum*) may be present at low density. Occurrences are often associated with coastal oak-beech forest. Wind and salt spray cause the trees to be stunted (average height 4 m to 15 m) and multiple-stemmed with contorted branches, especially on the exposed bluffs. Trees are notably taller on the more protected dunes. Shrub, vine, and herb layers are not well developed. A characteristic vine is greenbrier (*Smilax rotundifolia*).

Characteristic herbs are wild sarsaparilla (*Aralia nudicaulis*), and beech drops (*Epifagus virginiana*). The non-vascular layer may or may not be well developed.

Distribution: Currently known only from the town of Riverhead, Suffolk County. Historically, may have occurred along the north-facing coastal bluffs of Long Island, in the Coastal Lowland Ecozone of Suffolk County.

Rank: G2 S1

Revised: 2001

Examples: Friars Head Forest, Suffolk County, Roanoke Point, Suffolk County.

Sources: Good and Good 1970; Greller 1977; Grossman et al. 1994; Lamont 1998; NYNHP field surveys.

3. Maritime holly forest: a broadleaf evergreen maritime strand forest that occurs in low areas on the back portions of maritime dunes. The dunes protect these areas from overwash and salt spray enough to allow forest formation. In New York State this forest is best developed and probably restricted to the barrier islands off the south shore of Long Island. The trees are usually stunted and flat-topped because the canopies are pruned by salt spray and exposed to winds; the canopy of a mature stand may be only 16 to 23 ft (5 to 7 m) tall.

The dominant tree is holly (*Ilex opaca*). Other characteristic trees at lower abundance include sassafras (*Sassafras albidum*), shadbush (*Amelanchier canadensis*), post oak (*Quercus stellata*) and black oak (*Quercus velutina*). Vines such as Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Toxicodendron radicans*), 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*), bayberry (*Myrica pensylvanica*) 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: Restricted to southern fringe of Coastal Lowlands Ecozone, concentrated on maritime dunes of barrier islands. Known and suspected examples limited to Fire Island. Very unlikely to be found elsewhere.

Rank: G1G2 S1

Revised: 2001

Examples: Sunken Forest, Suffolk County.

Sources: Art 1976; Greller 1977; Sneddon et al. 1998; NYNHP field surveys.

4. 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. Red cedar is usually present all tree and shrub layers. Other characteristic trees include post oak (*Quercus stellata*) and black cherry (*Prunus serotina*).

Characteristic shrubs and vines include bayberry (*Myrica pensylvanica*), groundsel-tree (*Baccharis halimifolia*), poison ivy (*Toxicodendron radicans*), and Virginia creeper (*Parthenocissus quinquefolia*).

Characteristic herbs include eastern prickly pear (*Opuntia humifusa*), common hairgrass (*Deschampsia flexuosa*), little bluestem (*Schizachyrium scoparium*), switch grass (*Panicum virgatum*), and seaside goldenrod (*Solidago sempervirens*). More data on this community are needed.

Distribution: only known from the Coastal Lowlands ecozone.

Rank: G3G4 S1

Revised: 1990

Example: Orient Point, Suffolk County.

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

Coastal forests: intended to mean non-maritime areas within the Coastal Plain. Areas on the Coastal Plain generally not in immediate proximity to marine communities. At most lightly influenced by coastal processes including minor salt spray associated with severe storms (e.g., hurricanes), and lacking dune deposition, shifting and overwash processes. Forests generally contain trees of normal stature with uncontroverted branches and unwilted leaves plus usually have at most a sparse vine layer.

5. Coastal oak-heath forest: a large patch to matrix low diversity hardwood forest that typically occurs on dry, well-drained, sandy soils of glacial outwash plains or moraines of the Atlantic Coastal Plain.

The forest is usually codominated by two or more species of oaks: scarlet oak (*Quercus coccinea*), white oak (*Q. alba*) and black oak (*Q. velutina*). Chestnut oak

(*Quercus montana*) is also a common associate. Pitch pine (*Pinus rigida*) and trees of other genera, if present, typically occur at less than 1% cover each in the canopy. American chestnut (*Castanea dentata*) may have been a common associate in these forests prior to the chestnut blight; chestnut sprouts are still found in some stands. The shrublayer is well-developed typically with a low nearly continuous cover of dwarf heaths such as blueberries (*Vaccinium pallidum*, *V. angustifolium*) and black huckleberry (*Gaylussacia baccata*).

The herbaceous layer is very sparse; characteristic species are bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), and Pennsylvania sedge (*Carex pensylvanica*). Herb diversity is greatest in natural and artificial openings with species such as frostweed (*Helianthemum canadense*), false-foxglove (*Aureolaria* spp.), bearberry (*Arctostaphylos uva-ursi*), goat's-rue (*Tephrosia virginiana*), bush-clovers (*Lespedeza* spp.), and pinweeds (*Lechea* spp.).

Characteristic animals include eastern towhee (*Pipilo erythrophthalmus*) and white-tailed deer (*Odocoileus virginianus*). This community can occur with several types of barrens and woodland communities as part of the broadly defined ecosystem known as the Pine Barrens.

Distribution: Restricted to the interior portions of Coastal Lowlands Ecozone, concentrated on outwash plains and possibly knolls and mid to upper slopes of moraines. Known examples range from Hither Hills and Montauk Mountain west probably to the morainal hills of northwestern Suffolk County. Numerous examples occur in the central portion of this range (the periphery of the Long Island Pine Barrens) south of the Ronkonkoma Moraine (Greller 1977). Occurrences are more sparse in the eastern and western portions of the range. The community range possibly extends westward into eastern Nassau County on the end moraine of western Long Island and has been reported from a narrow strip of outwash on the north shore of Long Island.

Rank: G4 S3

Revised: 2001

Examples: Long Pond Greenbelt, Hither Woods, Suffolk County.

Sources: Brodo 1968; Greller 1977; Sneddon et al. 1998; NYNHP field surveys.

6. Coastal oak-hickory forest: a hardwood forest with oaks (*Quercus* spp.) and hickories (*Carya* spp.) codominant that occurs in dry well-drained, loamy sand

of knolls, upper slopes, or south-facing slopes of glacial moraines of the Atlantic Coastal Plain. The forest is usually codominated by two or more species of oaks, usually white oak (*Q. alba*), black oak (*Quercus velutina*) and chestnut oak (*Q. montana*). Scarlet oak (*Quercus coccinea*) is also a common associate. Mixed with the oaks, usually at moderate densities, are one or more of the following hickories: pignut (*Carya glabra*), mockernut (*C. tomentosa*), and sweet pignut (*C. ovalis*). These hickories can range from nearly pure stands to as little as about 25% cover. There is typically a subcanopy stratum of small trees and tall shrubs including flowering dogwood (*Cornus florida*) and highbush blueberry (*Vaccinium corymbosum*). The shrublayer and groundlayer flora may be diverse. Common low shrubs include maple-leaf viburnum (*Viburnum acerifolium*), blueberries (*Vaccinium angustifolium*, *V. pallidum*) and huckleberry (*Gaylussacia baccata*).

Characteristic groundlayer herbs are Swan's sedge (*Carex swanii*), panic grass (*Panicum dichotomum*), poverty grass (*Danthonia spicata*), cow-wheat (*Melampyrum lineare*), spotted wintergreen (*Chimaphila maculata*), rattlesnake weed (*Hieracium venosum*), white wood aster (*Aster divaricatus*), false Solomon's seal (*Smilacina racemosa*), Pennsylvania sedge (*Carex pensylvanica*), and white goldenrod (*Solidago bicolor*).

Characteristic animals include eastern towhee (*Pipilo erythrophthalmus*), vireos (*Vireo* spp.), woodpeckers, and white-tailed deer (*Odocoileus virginianus*). Two or more topoedaphic variants are possible.

Distribution: Restricted to the interior portions of Coastal Lowlands Ecozone, concentrated on knolls and mid to upper slopes of the moraines. Known examples range from Mashomack west to the morainal hills of northwestern Suffolk County. Numerous examples occur in the western portion of this range while occurrences are sparse in the eastern portion. The community range possibly extends westward into northeastern Nassau County and on the end moraine of western Long Island (Greller 1977).

Rank: G4 S3

Revised: 2001

Examples: Mashomack, Wildwood State Park, Caleb Smith State Park, Suffolk County.

Sources: Greller 1977; Rosza and Metzger 1982; Sneddon et al. 1998, NYNHP field surveys.

7. Coastal oak-beech forest: a hardwood forest with oaks (*Quercus* spp.) and beech (*Fagus grandifolia*)

codominant that occurs in dry well-drained, loamy sand of morainal coves of the Atlantic Coastal Plain. Some occurrences are associated with maritime beech forest. Beech can range from nearly pure stands to as little as about 25% cover. The forest is usually codominated by two or more species of oaks usually black oak (*Quercus velutina*) and white oak (*Q. alba*). Scarlet oak (*Quercus coccinea*) and chestnut oak (*Q. montana*) are common associates. Red oak (*Quercus rubra*) may be present at low density and is a key indicator species along with sugar maple (*Acer saccharum*) and paper birch (*Betula papyrifera*).

There are relatively few shrubs and herbs. Characteristic groundlayer species are Swan's sedge (*Carex swanii*), Canada mayflower (*Maianthemum canadense*), white wood aster (*Aster divaricatus*), beech-drops (*Epifagus virginiana*), and false Solomon's seal (*Smilacina racemosa*). Typically there is also an abundance of tree seedlings, especially of beech; beech and oak saplings are often the most abundant 'shrubs' and small trees.

Characteristic fauna include white-tailed deer (*Odocoileus virginianus*).

Distribution: restricted to interior portions of Coastal Lowlands Ecozone, concentrated on north-facing slopes on the moraines. Known examples range from Montauk Point (Brodo 1968) west to the Big Woods along the south shore of Long Island and from Route 48 Southold to Camp Baiting Hollow along the north shore of Long Island. Numerous examples occur in the Riverhead portion of the north shore. The community is also reported from necks of Long Island Sound (Greller 1977). It may occur in small patches farther west on Long Island to western Suffolk, Nassau and eastern Queens Counties (cf. Greller 1977). The community was also apparently reported from New York City by Harper (1917) (cf Brodo 1968).

Rank: G4 S3

Revised: 2001

Examples: Mashomack, Friars Head, Wildwood State Park, Suffolk County.

Sources: Brodo 1968; Greller 1977; Rosza and Metzler 1982; Sneddon et al. 1998; Taylor 1923; NYNHP field surveys.

8. Coastal oak-laurel forest: a large patch low diversity hardwood forest with broadleaf canopy and evergreen subcanopy that typically occurs on dry well-drained, sandy and gravelly soils of morainal hills of the Atlantic Coastal Plain. This forest is similar to the chestnut oak forest of the Appalachian Mountains; it is distinguished by lower abundance of chestnut oak

(*Quercus montana*) and absence of red oak (*Quercus rubra*), probably correlated with the difference between the sand and gravel of glacial moraines versus the bedrock of mountains.

The dominant tree is typically scarlet oak (*Quercus coccinea*). Common associates are white oak (*Q. alba*), black oak (*Q. velutina*), and chestnut oak.

The shrub layer is well-developed typically with a tall, often nearly continuous cover of the evergreen heath, mountain laurel (*Kalmia latifolia*). Other characteristic shrubs include black huckleberry (*Gaylussacia baccata*) and blueberry (*Vaccinium pallidum*).

The herbaceous layer is very sparse; characteristic species are bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), and Pennsylvania sedge (*Carex pensylvanica*).

Characteristic animals include white-tailed deer (*Odocoileus virginianus*). This forest is often associated with coastal oak-heath forest forming a forest complex on morainal hills.

Distribution: Restricted to interior portions of Coastal Lowlands Ecozone, concentrated on knolls and mid to upper slopes of moraines. Known examples range from Hither Hills west possibly to the morainal hill of northwestern Suffolk County. Several examples occur along the eastern half of the Ronkonkoma Moraine. The community range possibly extends westward into eastern Nassau County on the end moraine of western Long Island.

Rank: G3G4 S3

Revised: 2001

Examples: Hither Woods, Suffolk County.

Sources: Greller 1977; Sneddon et al. 1998; Thompson 1997; NYNHP field surveys.

9. Coastal oak-holly forest: a semi-deciduous to mixed deciduous-evergreen broadleaf forest that occurs on somewhat moist and moderately well drained silt and sandy loams in low areas on morainal plateaus. The elevation afforded by the raised plateau protects these areas from overwash and salt spray. In New York State this forest is best developed on the narrow peninsulas of eastern Long Island. The trees are usually not stunted, and are far enough removed from the pruning effects of severe salt spray. The canopy of a mature stand is usually up to about 65 ft (20 m) tall.

The dominant canopy trees are black oak (*Quercus velutina*), black gum (*Nyssa sylvatica*), red maple (*Acer rubrum*) and beech (*Fagus grandifolia*). Holly (*Ilex opaca*) is abundant in the subcanopy and tall shrub layers. Other characteristic trees at lower density

include sassafras (*Sassafras albidum*), shadbush (*Amelanchier canadensis*), and white oak (*Quercus alba*).

Shrubs such as highbush blueberry (*Vaccinium corymbosum*), witch hazel (*Hamamelis virginiana*), mountain laurel (*Kalmia latifolia*) and arrowwood (*Viburnum recognitum*) are common in the understory. Vines such as Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Toxicodendron radicans*), and greenbrier (*Smilax rotundifolia*), sawbrier (*S. glauca*), and grape (*Vitis* spp.) are at very low abundance in the understory, and usually do not grow up into the canopy.

Characteristic groundlayer herbs include New York fern (*Thelypteris noveboracensis*), star flower (*Trientalis borealis*) and Swan's sedge (*Carex swanii*). 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*).

Characteristic fauna include white-tailed deer (*Odocoileus virginianus*) and red-eyed vireo (*Vireo olivaceus*).

Distribution: Restricted to eastern extreme of Coastal Lowlands Ecozone, concentrated on Montauk Peninsula, a morainal plateau. Known and suspected examples limited to this peninsula. Very unlikely to be found elsewhere.

Rank: G2 S1

Revised: 2001

Examples: Montauk Point, Suffolk County.

Sources: Greller 1977; Sneddon et al. 1998; Taylor 1923; NYNHP field surveys.

10. 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*).

At least two potential regional variants are known or suspected. The typical coastal variant on Long Island and the inland variant of upstate New York. More data on these regional variants are needed. 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

Revised: 2001

Example: Long Island Pine Barrens, Suffolk County.

Sources: Bernard and Seischab 1995; Greller 1977; Kerlinger and Doremus 1981; Olsvig 1979; Reiners 1967; Seischab and Bernard 1996; NYNHP field surveys.

11. 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 (*Cornus 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 (*Cornus 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

Revised: 1990

Examples: Bristol Hills, Ontario County; Finger Lakes National Forest, Schuyler County; Storm King Mountain, Orange County; Long Eddy, Delaware County.

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

12. Allegheny oak forest: a hardwood forest that occurs on well-drained sites in the unglaciated portion of southwestern New York. This is a narrowly defined community distinguished by a more diverse canopy and a richer ground flora than other mid to high elevation oak communities in the state. These mixed oak forests are characteristic of the rounded ridgetops and upper south-facing slopes of the unglaciated Allegheny Plateau. In New York, they occur from 1345 to 2313 feet above sea level and grade into rich mesophytic forests that occur directly below them on west-facing, east-facing slopes and sometimes north-facing aspects.

Codominant trees are white oak (*Q. alba*), red oak (*Q. rubra*), chestnut oak (*Q. montana*), black oak (*Q. velutina*) and red maple (*Acer rubrum*). American chestnut (*Castanea dentata*) was a significant canopy codominant prior to the chestnut blight; chestnut sprouts are still very common in the understory. Other common canopy trees are pignut hickory (*Carya glabra*), black birch (*Betula lenta*), black cherry (*Prunus serotina*), and big-tooth aspen (*Populus grandidentata*).

The shrub-layer is a mixed heath with blueberries (*Vaccinium angustifolium*, *V. pallidum*), black huckleberry (*Gaylussacia baccata*), maple-leaved

viburnum (*Viburnum acerifolium*), and occasionally pinkster (*Rhododendron periclymenoides*) and mountain laurel (*Kalmia latifolia*).

Common groundlayer herbs are bracken fern (*Pteridium aquilinum*), Pennsylvania sedge (*Carex pensylvanica*), wintergreen (*Gaultheria procumbens*), wild sarsaparilla (*Aralia nudicaulis*), starflower (*Trientalis borealis*), barren strawberry (*Waldsteinia fragarioides*), flowering wintergreen (*Polygala paucifolia*), rough-leaved rice-grass (*Oryzopsis asperifolia*) and rattlesnake weed (*Hieracium venosum*). The rare, southern *Clintonia umbellulata* is restricted to Allegheny oak forest and rich mesophytic forest communities in New York State.

Allegheny oak forest can be distinguished from rich mesophytic forest by the presence of chestnut oak or the codominance of typically three to four oak species, and by the heath-dominated low shrub layer. It is distinguished from chestnut oak forest by codominance of four to five oak species, in contrast to dominance of chestnut oak or codominance of chestnut oak and red maple typical of chestnut oak forests.

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

Rank: G3G4 S2

Revised: 1990

Example: Allegany State Park, Cattaraugus County; Robinson Run Hill, Cattaraugus County.

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

13. 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*.

At least three edaphic variants with different understory dominants are known: 1) a tall shrub-dominated understory with 60-90% mountain laurel, 2) a short shrub-dominated understory with dense dwarf heaths, such as black huckleberry, and 3) a herb-dominated understory with Pennsylvania sedge.

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

Revised: 2001

Example: Hudson Highlands, Orange and Rockland Counties; Northern Shawangunk Mountains, Ulster County.

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

14. 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

Revised: 1990

Examples: Black Rock Forest, Orange County; Breakneck-Scofield-Fishkill Ridge, Dutchess and Putnam Counties; Staten Island Greenbelt, Richmond County.

Source: Greller 1977; Rosza and Metzler 1982; NYNHP field surveys.

15. 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.

Although Appalachian oak-pine forest currently includes white pine forests of the Coastal Lowlands, the latter may be distinctive enough to be designated as "coastal white pine-oak forest." Appalachian oak-pine forest would be distinguished from a "coastal white pine-oak forest" by the presence of bedrock and large rocks (instead of sand and gravel), and by the presence and dominance of red oak instead of dominance by scarlet oak (*Quercus coccinea*) with red oak lacking. More data on the coastal variant and characteristic animals are needed.

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

Rank: G4G5 S4

Revised: 2001

Example: Tongue Mountain, Warren County; Steege Hill, Chemung County; Catskill Escarpment, Greene County; Rome Sand Plains, Oneida County.

Sources: McVaugh 1958; NYNHP field surveys.

16. Rich mesophytic forest: A hardwood or mixed forest that resembles the mixed mesophytic forests of the Allegheny Plateau south of New York but is less diverse. It occurs on rich, fine-textured, well-drained soils that are favorable for the dominance of a wide variety of tree species. A canopy with a relatively large number of codominant trees characterizes this forest.

Canopy codominants include five or more of the following species: red oak (*Quercus rubra*), red maple (*Acer rubrum*), white ash (*Fraxinus americana*), American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), black cherry (*Prunus serotina*), cucumber tree (*Magnolia acuminata*), and black birch (*Betula lenta*). American 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 oak (*Quercus alba*), white pine (*Pinus strobus*), basswood (*Tilia americana*), bitternut hickory (*Carya cordiformis*), Black oak (*Quercus velutina*), Eastern hop hornbeam (*Ostrya virginiana*), and striped maple (*Acer pensylvanicum*).

This forest has a well-developed shrublayer with a variety of characteristic species including muscledwood (*Carpinus caroliniana*), arrow-wood (*Viburnum acerifolium*), witch hazel (*Hamamelis virginiana*), pinkster (*Rhododendron periclymenoides*), red-berried elderberry (*Sambucus pubens*), American fly-honeysuckle (*Lonicera canadensis*), round-leaved dogwood (*Cornus rugosa*), alternate-leaved dogwood (*C. alternifolia*), smooth service-berry (*Amelanchier laevis*), and blueberry (*Vaccinium pallidum*).

The groundlayer is fairly rich in species. Characteristic herbs are interrupted fern (*Osmunda claytoniana*), yellow mandarin (*Disporum lanuginosum*), white baneberry (*Actaea pachypoda*), jack-in-the-pulpit (*Arisaema triphyllum*), early meadow rue (*Thalictrum dioicum*), princess pine (*Lycopodium obscurum* var. *obscurum*), 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*), and the grass *Brachyelytrum erectum*. The rare, southern *Clintonia umbellulata* is restricted to rich mesophytic forest and Allegheny oak forest communities in New York State.

In New York, rich mesophytic forests are best developed in the unglaciated portions of the Allegheny Plateau. In Cattaraugus County, this forest typically occurs at mid- to upper 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 and

lack of, or only very rarely present, black oak. The short shrub layer of Allegheny oak forest is typically dominated by heaths such as blueberry (*Vaccinium pallidum*), whereas the shrub layer of rich mesophytic forest is a mix of tree seedlings and saplings and tall shrub species such as red-berried elder (*Sambucus pubens*) and maple-leaved viburnum (*Viburnum acerifolium*). Rich mesophytic forest can be distinguished from maple-basswood rich mesic forest by the presence of rich herbs that include *Hydrophyllum canadense*, *Euonymus obovatus*, *Disporum lanuginosum* and *Cimicifuga racemosa*. It can be distinguished from beech-maple mesic forest by the predominance of rich herbs such as those listed above, and a soil pH range of about 4.5 to 5.0, in contrast to the generally more acidic soils of beech-maple mesic forest. Rich mesophytic forest soil typically contains more clay than other hardwood types, such as clay loam and silty clay loam.

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

Rank: G4 S2S3

Revised: 2001

Example: Allegany State Park, Cattaraugus County.

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

17. 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 yellow birch (*Betula alleghaniensis*), white ash (*Fraxinus americana*), eastern hop hornbeam (*Ostrya virginiana*), and red maple (*Acer rubrum*). There are relatively few shrubs and herbs.

Characteristic small trees or tall shrubs are hobblebush (*Viburnum lantanoides*), American hornbeam (*Carpinus caroliniana*), striped maple (*Acer pensylvanicum*), witch hazel (*Hamamelis virginiana*), and alternate-leaved dogwood (*Cornus alternifolia*).

Dominant groundlayer species are star flower (*Trientalis borealis*), common wood-sorrel (*Oxalis montana*), Canada mayflower (*Maianthemum canadense*), painted trillium (*Trillium undulatum*), purple trillium (*T. erectum*), shining clubmoss (*Lycopodium lucidulum*) and intermediate wood fern (*Dryopteris intermedia*). Associated herbs include Christmas fern (*Polystichum acrostichoides*), jack-in-the-pulpit (*Arisaema triphyllum*) and false

Solomon's seal (*Smilacina racemosa*). 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 associated small patches of hemlock-northern hardwood forest in steep ravines and gullies where hemlock is locally dominant.

Distribution: throughout New York State.

Rank: G4 S4

Revised: 2001

Examples: Five Ponds Wilderness Area, Herkimer and Hamilton Counties; West Canada Lakes Wilderness Area, Herkimer and Hamilton Counties; Central Tug Hill Forest, Lewis and Oswego Counties; Slide Mountain, Sullivan and Ulster Counties.

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

18. Maple-basswood rich mesic forest: a species rich hardwood forest that typically occurs on well-drained, moist soils of circumneutral pH. Rich herbs are predominant in the ground layer and are usually correlated with calcareous bedrock, although bedrock does not have to be exposed. Where bedrock outcrops are lacking, surficial features such as seeps are often present.

The dominant trees are sugar maple (*Acer saccharum*), basswood (*Tilia americana*), and white ash (*Fraxinus americana*). Associate tree species can include ironwood (*Ostrya virginiana*), yellow birch (*Betula alleghaniensis*), red oak (*Quercus rubra*), American beech (*Fagus grandifolia*), bitternut hickory (*Carya cordiformis*), shagbark hickory (*Carya ovata*), tulip tree (*Liriodendron tulipifera*), butternut (*Juglans cinerea*), and American hornbeam (*Carpinus caroliniana*).

Characteristic tall shrubs are alternate-leaved dogwood (*Cornus alternifolia*), mountain maple (*Acer spicatum*), and witch hazel (*Hamamelis virginiana*);

the shrub layer is typically patchy and can be quite sparse in herb rich areas.

Spring ephemerals are usually abundant in the groundlayer. Characteristic species are wild leek (*Allium tricoccum*), troutlily (*Erythronium americanum*), dutchman's breeches (*Dicentra cucullaria*), squirrel-corn (*Dicentra canadensis*), purple trillium (*Trillium erectum*), nodding trillium (*Trillium cernuum*), spring beauty (*Claytonia virginica*), maidenhair fern (*Adiantum pedatum*), bulbet fern (*Cystopteris bulbifera*), Goldie's fern (*Dryopteris goldiana*), lady fern (*Athyrium filix-femina*), silvery glade fern (*Athyrium thelypteroides*), glade fern (*Athyrium pycnocarpon*), blue cohosh (*Caulophyllum thalictroides*), Herb Robert (*Geranium robertianum*), wild ginger (*Asarum canadense*), early meadow-rue (*Thalictrum dioicum*), false Solomon's seal (*Maianthemum racemosum*), white baneberry (*Actaea pachypoda*), eastern waterleaf (*Hydrophyllum virginianum*), toothwort (*Dentaria diphylla*), bloodroot (*Sanguinaria canadensis*), foam flower (*Tiarella cordifolia*), and the sedges *Carex plantaginea*, *Carex platyphylla* and *Carex albursina*.

Maple-basswood rich mesic forest can be distinguished from beech-maple mesic forest by the predominance of rich herbs in the herbaceous layer and the high species diversity of this layer, which often supports a variety of fern species and a strong component of spring ephemerals.

Distribution: primarily known from the Great Lakes Plain ecozone.

Rank: G4 S3

Revised: 2001

Example: Allegany State Park, Cattaraugus County; Pitcarin Forest, St. Lawrence and Lewis Counties; Great Gully, Cayuga County.

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

19. 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 virens*).

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

Revised: 1990

Examples: Ampersand Mountain, Franklin County; Five Ponds Wilderness Area, Herkimer and Hamilton Counties; Slide Mountain, Sullivan and Ulster Counties; 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; NYNHP field surveys.

20. 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 (*Dryocopus pileatus*). More data are needed on characteristic animals.

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

Rank: G4 S4

Revised: 1990

Examples: Five Ponds Wilderness Area, Herkimer and Hamilton Counties; Black Brook Forest, Clinton and Essex Counties; Pine Orchard, Hamilton County.

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

21. 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, loamy to sandy, and seasonally moist, but not saturated and not peaty.

Typically, the dominant trees are red spruce (*Picea rubens*) and red maple (*Acer rubrum*) mixed with smaller numbers of yellow birch (*Betula*

alleghaniensis), black cherry (*Prunus serotina*), and hemlock (*Tsuga canadensis*). 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 beech (*Fagus grandifolia*) may also be present. The shrublayer is sparse or patchy.

Characteristic shrubs are 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*).

A more restricted variant codominated by black spruce (*Picea mariana*) and tamarack (*Larix laricina*) and with only low abundance of red spruce is known from dry to moist, well-drained sandy outwash plains of the Adirondacks. White spruce (*P. glauca*) and Labrador tea (*Ledum groenlandicum*) may be characteristic of this variant. This variant apparently develops in association with boreal heath barrens in areas which experience fire or cold air accumulation.

Distribution: primarily known from the Adirondacks ecozone.

Rank: G4? S3S4

Revised: 2001

Examples: Five Ponds Wilderness Area, Herkimer and Hamilton Counties; West Canada Lakes Wilderness Area, Herkimer and Hamilton Counties; Moose River Plains, Hamilton County.

Sources: Braun 1950; Eyre 1980; Heimbürger 1934; NYNHP field surveys.

22. 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

Revised: 1990

Examples: Blue Ridge Wilderness, Hamilton County; Deer Pond Marsh, Franklin County; Cold Brook Plains, Essex County.

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

23. 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 S4

Revised: 1990

Examples: Five Ponds Wilderness Area, Herkimer and Hamilton Counties; Slide Mountain, Ulster County; Kildare Forest, St. Lawrence County.

Sources: Eyre 1980; Heimbürger 1934; Irland, L.C. 1993; Leopold et al. 1988; Roman 1980; Zon 1914; NYNHP field surveys.

24. 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 *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 rare bird of some mountain spruce-fir forests is Bicknell's Thrush (*Catharus bicknelli*) (Rimmer et al. 2001).

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 S2S3

Revised: 1990

Examples: Street Mountain, Essex County; Whiteface Mountain, Essex County; Phelps Brook, Essex County; Hunter Mountain, Greene County; Slide Mountain, Ulster County.

Sources: Eyre 1980; Holway and Scott 1969; Leopold et al. 1988; McIntosh and Hurley 1964; McLaughlin et al. 1987; Nicholson 1965; Rimmer et al. 2001; Sabo 1980; Slack 1977; NYNHP field surveys.

25. 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*), bluebells (*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*). A rare bird of some mountain fir forests is Bicknell's Thrush (*Catharus bicknelli*) (Rimmer et al. 2001).

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 downhill 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

Revised: 1990

Examples: High Peaks Wilderness Area, Essex County; Whiteface Mountain, Essex County; Slide Mountain, Ulster County; Blackhead Mountains, Greene County.

Sources: McIntosh and Hurley 1964; Nicholson 1965; Rimmer et al. 2001; Slack 1977; Sprugel 1976; NYNHP field surveys..

Successional forests: includes forests that develop on sites that have been cleared (for farming, logging, etc.) or otherwise disturbed (by fire, ice scour, wind throw, flooding, etc.). Successional forests generally have the following characteristics: 1) dominated by light-

requiring, wind-dispersed species that are well-adapted to establishment following disturbance, 2) lack of reproduction of the canopy species, 3) have tree seedlings and saplings that are more shade-tolerant than the canopy species, 4) 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, 5) have canopy trees with small diameter (generally less than 10 to 15 cm dbh), 6) have canopy trees of young age (generally less than about 25 to 50 years old), 7) have evidence of recent logging (e.g., presence of stumps and brush), and 8) have relatively low canopy height with poor tree diversity and poor development of multiple strata.

26. Successional northern hardwoods: a hardwood or mixed forest that occurs on sites that have been cleared or otherwise disturbed.

Characteristic trees and shrubs include any of the following: quaking aspen (*Populus tremuloides*), big-tooth aspen (*P. grandidentata*), balsam poplar (*P. balsamifera*), paper birch (*Betula papyrifera*), or gray birch (*B. populifolia*), pin cherry (*Prunus pensylvanica*), black cherry (*P. serotina*), red maple (*Acer rubrum*), white pine (*Pinus strobus*), with lesser amounts of white ash (*Fraxinus americana*), green ash (*F. pensylvanica*), and American elm (*Ulmus americana*). Northern indicators include aspens, birches, and pin cherry. This is a broadly defined community and several seral and regional variants are known.

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.

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

Rank: G5 S5

Revised: 2001

Example: Chase Lake Sandplain, Lewis County.

Source: Mellinger and McNaughton 1975; NYNHP field surveys..

27. Successional southern hardwoods: a hardwood or mixed forest that occurs on sites that have been cleared or otherwise disturbed.

Characteristic trees and shrubs include any of the following: American elm (*Ulmus americana*), slippery

elm (*U. rubra*), white ash (*Fraxinus americana*), red maple (*Acer rubrum*), box elder (*Acer negundo*), silver maple (*A. saccharinum*), sassafras (*Sassafras albidum*), gray birch (*Betula populifolia*), hawthorns (*Crataegus* spp.), eastern red cedar (*Juniperus virginiana*), and choke-cherry (*Prunus 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. Southern indicators include American elm, white ash, red maple, box elder, choke-cherry, and sassafras. This is a broadly defined community and several seral and regional variants are known.

A characteristic bird is chestnut-sided warbler (*Dendroica pensylvanica*).

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

Rank: G5 S5 *Revised:* 2001

Example: Chippewa Creek Plains, St. Lawrence County.

Sources: Eyre 1980; NYNHP field surveys.

28. 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.).

Shrublayer and groundlayer dominants are variable. Bayberry (*Myrica pensylvanica*) is a common shrub. Certain introduced species are commonly found in this forest, including black locust (*Robinia pseudoacacia*), privet (*Ligustrum* spp.), Asiatic

bittersweet (*Celastrus orbiculatus*), Japanese honey suckle (*Lonicera japonica*), multiflora rose (*Rosa multiflora*), and wineberry (*Rubus phoenicolasius*). Any of these may be dominant or codominant in a successional maritime forest.

Characteristic animals include gray gatbird (*Dumetella carolinensis*), eastern towhee (*Pipilo erythrophthalmus*) and white-tailed deer (*Odocoileus virginianus*). This forest represents an earlier seral stage of other maritime forests, such as maritime post oak forest, maritime holly forest, maritime red cedar forest, and probably others. Soil and moisture regime will usually determine which forest type succeeds from this community. A few disturbance-climax examples occur, maintained by severe and constant salt spray.

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

Rank: G4 S3S4 *Revised:* 2001

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

Sources: Clark 1986b; Greller 1977; NYNHP field surveys.

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 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 *Revised:* 1990

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 (*Pooecetes gramineus*), bobolink (*Dolichonyx*

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oryzivorous), mourning dove (*Zenaida macroura*), and upland sandpiper (*Bartramia longicauda*).

Distribution: throughout New York State.

Rank: G5 S5

Revised: 1990

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

Revised: 1990

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

Revised: 1990

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

Revised: 1990

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

Revised: 1990

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

Revised: 1990

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 (*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

Revised: 1990

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

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(*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

Revised: 1990

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

Revised: 1990

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

Revised: 1990

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

Revised: 1990

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

Revised: 1990

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.

Distribution: throughout New York State.

Rank: G5 S5

Revised: 1990

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

Revised: 1990

16. Railroad: a permanent road having a line of steel rails fixed to wood ties and laid on a gravel roadbed that provides a track for cars or equipment drawn by locomotives or propelled by self-contained motors. There may be sparse vegetation rooted in the gravel substrate. The railroad right of way may be maintained by mowing or herbicide spraying.

Distribution: throughout New York State.

Rank: G5 S5 *Revised:* 2001

17. 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 *Revised:* 1990

18. 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 *Revised:* 1990

19. 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 *Revised:* 1990

20. 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 *Revised:* 1990

21. 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 *Revised:* 1990

22. 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 *Revised:* 1990

23. 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 *Revised:* 1990

24. 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 *Revised:* 1990

25. Riprap/artificial lake shore: a lake shore or pond shore that is covered with coarse stones, cobbles, concrete slabs, etc. placed for erosion control. The vegetation is usually sparse.

Distribution: throughout New York State.

Rank: G5 S5 *Revised:* 1990

26. 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

Revised: 1990

27. 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

Revised: 1990

28. 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

Revised: 1990

29. 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

Revised: 1990

30. 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

Revised: 1990

31. 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

Revised: 1990

32. 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

Revised: 1990

33. 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*).

Distribution: throughout New York State.

Rank: G5 S5

Revised: 1990

34. 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

Revised: 1990

35. 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

Revised: 1990

36. 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

Revised: 1990

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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 within an inorganic matrix. Different subterranean communities are distinguished by hydrology and substrate characteristics. The communities are described in terms of three to four light intensity zones. The entrance zone has about 50 to 100% of the light intensity of the subterranean/terrestrial interface and is well lit by direct natural light. This zone often supports a characteristic suite of species including craneflies, microlepidoptera, geometrids, spiders, flies, mosquitoes and endogeans (soil organisms). Bryophytes and lichens may be common in this zone. The twilight zone (or threshold zone), a partially lit area of reflected light, may be divided into two parts: a moderately well-lit outer twilight zone, which has about 10 to 50% of the light intensity of the subterranean/terrestrial interface, and a dim inner twilight zone, which has up to about 10% of the light intensity of the subterranean/terrestrial interface. The dark zone (or deep zone) is an area of complete darkness. This zone contains organisms referred to as troglobites, troglones and troglaphiles which often include spiders and beetles. Fungi (predominantly mushrooms, molds and mildews) may be common in this zone. There are apparently only few obligate cave species in New York, unlike the diversity found in caves of the Interior Lowlands of the Eastern U.S. and the caves of the Southwest U.S.

Characteristic species have been derived from a combination of comments from the staff of DEC's Endangered Species Unit, based upon their knowledge of bat hibernacula and caves in New York, other subterranean scientists, literature review, and NYNHP field surveys. To date the Heritage Program has conducted preliminary inventory work on caves including 4 plots. Although the Heritage Program has focused inventory work on caves since 1995; we do not currently have in our files sufficient field data for confidently undertaking any major restructuring of the 1990 subterranean classification. However, field work has suggested that this classification works well for representing the coarsest scale distinctions between both biotic and abiotic features of subterranean community types.

Further refinement of the classification, especially to distinguish potential regional variants, will likely be based on additional field surveys and analysis of data collected by various subterranean scientists and agencies statewide. Regional variation in some cave types is evident, but we do not currently have in our files enough information or have undertaken analyses

to confidently split these common and widespread types into specific regional variants. A finer scale classification that distinguishes types according to ecoregion is being evaluated. Preliminary conclusions suggest that mammal, reptile and insect assemblages may be strongly correlated with ecoregion boundaries.

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.

Aquatic cave community: the aquatic community of a subterranean stream or pond. These caves vary in their water chemistry and substrate type. Well-developed examples contain all four light intensity zones. Habitat features may include riffles, runs and pools. These caves often occur in close association with non-aquatic cave types. Preliminary studies suggest that there are sufficient differences in the biota of subterranean streams and ponds, and a split of this community into riverine cave community (or subterranean stream) and lacustrine cave community (or subterranean pond) is being evaluated.

Characteristic fauna are poorly known; characteristic species may include individuals from adjacent connected above-ground aquatic communities such as crayfish (e.g., *Cambarus robustus*), mayflies (Ephemeroptera) and amphipods (Amphipoda) in subterranean streams and fish in subterranean lakes. Characteristic terrestrial species associated with subterranean streams may include ground beetles (Carabidae). Four ecoregional variants (Northern Appalachian, Great Lakes, Lower New England, and Alleghany Plateau types) are suspected to differ in biota, substrate type, water chemistry and water temperature. Major watershed may be a secondary factor in distinguishing caves based on biota. More data on this community are needed.

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

Rank: G4 S3S4

Revised: 2001

Examples: Burroughs Cave (in part), Essex County; Valcour Island, Clinton County; McFails Cave (in part), Schoharie County; Black River Bay, Jefferson County; Clarksville Cave, Albany County.

Sources: NYNHP surveys.

2. Terrestrial cave community: the terrestrial community of a cave with bedrock walls, including the biota of both solution caves (in limestone) and tectonic caves. Typical examples contain all four light intensity zones. 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. Habitat features may include bare rock, floors of pebble, gravel or soil, piles of terrestrial plant debris, carpets of bat guano, and piles of mammal scat, the latter three substrates which often promote growth of fungal colonies.

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*). Additional characteristic hibernating bats may include northern *Myotis* (*Myotis septentrionalis*). Characteristic and dominant invertebrates may include ground beetles (Carabidae), microlepidoptera, crickets, and a diverse array of spiders. Four to five ecoregional variants (including Northern Appalachian, Great Lakes, Lower New England, and Alleghany Plateau types) are suspected. More data on regional variants are needed.

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

Rank: G4 S3S4 *Revised:* 2001

Examples: Norton Range Cave, Franklin County; Burroughs Cave (in part), Essex County; McFails Cave (in part), Schoharie County; Pompeys Cave, Ulster County; Mystery Cave, Sullivan County; Clarksville Cave, Albany County.

Sources: NYNHP surveys. *Revised:* 2001

3. Talus cave community: the community that occurs in small crevices and caves with walls of boulders or cobbles, typically 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. Most examples are shallow and predominated by twilight zone. They may have small areas of dark zone.

Characteristic animals which may use this community as denning habitat include timber rattlesnake (*Crotalus horridus*), bobcat (*Lynx rufus*), North American porcupine (*Erethizon dorsatum*) and small mammals such as rock vole (*Microtus chrotorrhinus*). Bats may be present in larger examples, but at low abundance. Characteristic and dominant

invertebrates may include craneflies (Tipulidae) and a diverse array of spiders. Bryophytes, lichens and fungi may be abundant in these caves. Three to five ecoregional variants (including Northern Appalachian, Lower New England, and Alleghany Plateau types) are suspected to differ in characteristic and dominant mammals, reptiles, insects, lichens, bryophytes and fungi. More data on invertebrates, bryophytes and fungi, as well as regional variants, are needed.

Distribution: throughout upstate New York, north of the Coastal Lowlands ecozone, usually at high elevations.

Rank: G4 S3S4 *Revised:* 2001

Examples: Indian Pass, Essex County; Wilmington Notch, Essex County; Moss Lake Mountain, Hamilton County; Slide Mountain, Rensselaer County; Shawangunk Mountains, Ulster County.

Sources: NYNHP surveys.

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. Mines, like natural caves, may be terrestrial or aquatic. Wells are also included here.

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 *Revised:* 2001

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*).

SUBTERRANEAN COMMUNITIES

Distribution: throughout New York State.

Rank: G5 S5

Revised: 1990

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. Water-filled tunnels, such as aqueducts, and culverts are tentatively included here.

Distribution: throughout New York State.

Rank: G5 S5

Revised: 1990

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

Revised: 1990

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HERITAGE RANKS

APPENDIX A: HERITAGE PROGRAM ELEMENT RANKS

Explanation of ranks and codes used in Natural Heritage database reports.

Each element has a global and state rank as determined by the NY Natural Heritage Program. These ranks carry no legal weight but are believed to accurately reflect the relative rarity given of the species. The global rank reflects the rarity of the element throughout the world and the state rank reflects the rarity within New York State. Intraspecific taxa are also assigned a taxon rank to reflect the intraspecific taxon's rank throughout the world. The Taxon or T-ranks (T1 - T5) are defined like the Global ranks (G1 - G5), but the T-rank *only* refers to the rarity of the subspecific taxon of the species.

GLOBAL RANK

- G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences), or very few remaining acres, or miles of stream) or especially vulnerable to extinction because of some factor of its biology.
- G2 = Imperiled globally because of rarity (6 - 20 occurrences, or few remaining acres, or miles of stream) or very vulnerable to extinction throughout its range because of other factors.
- G3 = Either rare and local throughout its range (21 to 100 occurrences), or found locally (even abundantly at some of its locations) in a restricted range (e.g., a physiographic region), or vulnerable to extinction throughout its range because of other factors.
- G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.
- G5 = Demonstrably secure globally, though it may be quite rare in parts of its range, especially at the periphery.
- GH = Historically known, with the expectation that it might be rediscovered.
- GX = Species believed to be extinct.
- GU = Status unknown.

STATE RANK

- S1 = Typically 5 or fewer occurrences, very few remaining individuals, acres, or miles of stream, or some factor of its biology making it especially vulnerable in New York State.
- S2 = Typically 6 to 20 occurrences, few remaining individuals, acres, or miles of stream, or factors demonstrably making it very vulnerable in New York State.
- 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 = Historically known from New York State, but not seen in the past 15 years.
- SX = Apparently extirpated from New York State.
- SE = Exotic, not native to New York State.
- SR = State report only, no verified specimens known from New York State.
- SU = Status unknown.

TAXON RANK

- T1 - T5 = indicates a rank assigned to a subspecies following the Global Rank definitions above.
- Q = indicates a question exists whether or not the taxon is a good taxonomic entity.
- ? = indicates a question exists about the rank.

APPENDIX B: GLOSSARY

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.

carr: a wetland dominated by *Alnus* and/or *Salix* adjoining water courses, where periodic flooding precludes peat accumulation (Andrus 1980).

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

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.

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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.

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.

eskers: a winding, narrow ridge of sand or gravel deposited by a stream flowing in or under glacial ice.

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

GLOSSARY

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.

flarks: in patterned peatlands 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 flarks, or hollows (low, relatively wet areas) are more minerotrophic than stings.

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.

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.

grikes: fissures, cracks, and crevices in limestone pavement bedrock created by the dissolution of limestone, especially in alvar communities.

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

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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.

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.

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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.
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.

GLOSSARY

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*.

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.

strings: in patterned peatlands 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.

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 spiralis*).

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.

thermocline: the region of rapid temperature transition in a

GLOSSARY

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 described in this book. 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**
- 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**

KEY TO SYSTEMS AND SUBSYSTEMS

- 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**
- 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**

KEY TO SYSTEMS AND SUBSYSTEMS

- 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**
- 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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