Classification of the Natural Communities of Massachusetts

Including a Key to the Natural Communities

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MASSWILDLIFE

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Table of Contents

Introduction

The main purpose of this classification is to provide a framework for describing, inventorying, and tracking natural communities for conservation in Massachusetts. The community types identified in this classification are intended to be recognizable in the field and meaningful to a broad conservation audience, including writers of municipal open space plans, land managers, environmental reviewers and consultants, and ecologists doing field studies.

What is a Natural Community?

Natural communities are defined as groups of species that are found together over and over again, usually in particular environmental conditions. Occurrences of a community type tend to be in sites with similar chemistry, soils, moisture, slopes, temperature ranges, and other physical conditions. In a given community type, certain species, especially plants, occur together in similar structures and proportions. A particular community type may have species that occur only or primarily in that type of community. When those species are present, they are indicative of the presence of that type of community and are therefore called indicator species.

Natural communities have structural attributes that affect what plant and animal species are part of them. The physical environment, geology, and regional climate are the most controlling features of any community, governing what species grow in different areas. Vertical diversity is provided by different layers of vegetation. Trees, shrubs, and tall herbaceous plants have different shapes and shade the lower layers differently. Different tree species also affect nutrient movement differently, influencing their co-occurrence with other species. Communities have horizontal diversity produced by variation in sunlight, moisture, rock, soil exposure, and other physical and biological variables. Past disturbances, including glaciation thousands of years ago, and more recent hurricanes and human land use—particularly the extensive land clearing, cultivation, and reforestation that occurred after European settlement—influence the species mixes and community structure seen today.

Diversity is an attribute of natural communities; the number of species and their relative abundances affect communities in different ways. A particular species may be abundant and dominant in one community and barely present in another. Not all natural community types have a wide diversity of species; native diversity may be low in certain, generally stressful, conditions. For example, a dry site on sand with low nutrient availability on acidic soils may support a naturally low-diversity Pitch Pine - Scrub Oak Community.

For organizational purposes in this classification, community types are differentiated first by ecological processes, then by structure (growth form of the dominant species), and finally by species composition and physical substrate. The system type—Terrestrial (upland), Palustrine (wetlands, not including aquatic systems), or Estuarine (affected by tides or ocean waters)—is the first division in this classification. The systems are then each subdivided into forested, shrub-dominated, and open (herbaceous or sparsely vegetated) communities.

Naming Conventions

Natural communities are vegetation types: the names of these natural communities were thought to need to include the fact that they are vegetation, as opposed to a physical or geological feature. When geological features were used to delineate communities, the word "community" was added to the names to stress the fact that it is vegetation that is actually being classified.

Community names ending in terns for vegetation (the word "community" was not added to these natural community names):

- Bog
- Fen
- Forest (and Forest/Woodland)
- Grassland
- Heathland
- Marsh
- Meadow
- Shrubland
- Swamp
- Thicket
- Woodland (and Woodland/Shrubland)

Names of natural communities where the word "community" is part of the name because the name is not a term for vegetation or because the type (shrubland, for example) or traditional term ("barrens," for example) would be confusing:

- Alluvial Hardwood Flat Community
- Coastal Salt Pond Community
- Forest Seep Community
- High-energy Riverbank Community
- Low-energy Riverbank Community
- Marine Intertidal Gravel/Sand Beach Community
- Marine Intertidal Rocky Shore Community
- Maritime Beach Strand Community
- Maritime Dune Community
- Maritime Erosional Cliff Community
- Maritime Erosional Cliff Community
- Mud Flat Community
- Open Talus/Coarse Boulder Community
- Pitch Pine - Scrub Oak Community
- Pondshore Community
- Ridgetop Pitch Pine - Scrub Oak Community
- River and Lake Drawdown Community
- Riverine Pointbar and Beach Community

Riverside Rock Outcrop Community
Riverside Seep Community
Rock Cliff
Rocky Summit / Rock Outcrop Community
Seagrass Community

The names of the natural communities in this classification are intended to be descriptive labels that highlight important species or features of that particular type of natural community. Sometimes a physical characteristic such as a rock outcrop, cliff, or riverbank controls what species will be present. In those cases, the name often includes the feature. Examples include Calcareous Rock Cliff and Low-energy Riverbank Communities. Other community types are characterized by and named for one or more dominant species (e.g., Mixed Oak Forest or Hemlock Swamp). When a community name includes species names, the intent is to use the names of the most dominant species. Naming the dominant species may lead to inclusion of characteristic, but not diagnostic, species such as Red Maple. This version of the classification has changed the names of several forested wetlands in previous versions to Red Maple – [*Other Species*] Swamps to emphasize the importance of Red Maple in these community types. Examples include Red Maple - Black Gum Swamp and Red Maple - Black Ash Swamp. *Cultural* is used in a community name or in its attributes to indicate that the community was overtly created by human management activities (e.g., River and Lake Drawdown Community or Cultural Grasslands) or that the community developed on an anthropogenic physical feature (Acidic Graminoid Fen – Spillway Fen). Each of these named cultural community types provides habitats for species of conservation interest, although the community itself may not be a focus for conservation. Sometimes, community types of conservation focus may be actively managed to impede succession to forest, but are dominated by native rather than non-native species (e.g., Sandplain Grasslands or Sandplain Heathlands). In these cases, the main differentiating feature of natural versus cultural communities is the intent of the land management. We recognize that this differentiation may, sometimes, be arbitrary.

Purpose of the Classification

This natural community classification describes vegetation at a scale that is meaningful for conservation and land protection. A classification provides a convenient mechanism for reducing the complexity of natural vegetation to a relatively small number—106 natural community types in this case—of somewhat homogeneous and relatively easily understood, but abstract and artificial, groups. Any classification requires somewhat arbitrary categories and lines between types; classifications differ on where the lines are drawn. Vegetation classifications are influenced by their intended use; the use of this one is for conservation, and, indeed, focuses on the uncommon.

One way the Natural Heritage and Endangered Species Program (NHESP, a program within MassWildlife, the Massachusetts Division of Fisheries and Wildlife) works to protect biodiversity is to evaluate the distribution and condition of natural communities across the state. Evaluating natural communities requires knowing what they are. A first step in acquiring knowledge of natural communities is to classify them: to name and describe what is known and establish a common parlance for discussion. The

classification framework also identifies what is not well known and encourages the gathering of missing information.

The intent of this classification is to describe communities that can be accurately identified in the field. Terrestrial, Palustrine, and Estuarine communities are included, whereas Aquatic and Marine communities are not addressed in this classification.

In defining the composition and structure of each natural community type, a range of variation within the community type is often identified. As a practical matter when conducting field work, small patches of non-conforming vegetation are generally not differentiated from the prevailing community; occasionally, large, mappable patches of variation are identified as different community types. For example, very small patches of rocky outcrops in a forest may be considered to be part of the expected structure of the forest, but outcrops large enough to have full sun or other distinct conditions would be considered to be communities separate from the surrounding forest. Age of a community occurrence (that is, the time since a major disturbance) and its state of succession also lead to variation. Some vegetation types in early successional stages, generally in relatively open conditions with a distinct species mix, are identified as community types in this classification. However, successional forests are generally lumped into very broadly defined community types, with successional patches included as part of the variation of the prevailing community type. Many communities co-occur in landscape mosaics that share conditions and processes, such as water flowing through a wetland complex with a mix of inter-connected community types. High-quality complexes of natural communities at sites where the controlling ecological processes can be maintained or restored are often conservation priorities. Identifying communities in the functional systems of which they are a part is a step in their conservation. In this classification, these ideas are addressed in the Environmental Setting part of the community description.

Many community occurrences have been disturbed, by humans or other natural events, and thus some are in climatic, topographic, or geological conditions different from the idealized community type. Some occurrences occupy a middle ground between described communities. Because communities are made up of plant species that have individual responses to environmental variables, the described communities occur on a continuum and may grade into other community types. In addition, land use history has an important influence on the location and composition of natural communities in Massachusetts. Over four hundred years of intense use of the land in the state appears to have had a homogenizing effect that overrides some of the influences of climate and landscape position (see Foster et al. 1998 and other papers from the Harvard Forest). Some of this homogenization is reflected in the difficulty of defining distinct community types and in the prevalence of mid-successional species in many of the community descriptions.

Relationship to Other Classifications

This classification focuses on the natural communities of Massachusetts, which are closely related to the natural communities of the region and particularly the surrounding states. All of the surrounding states have published natural community classifications; most are available online and all are cited in the

reference list. NatureServe (with the Ecological Society of America and the US Federal Geographic Vegetation Subcommittee) has developed the United States National Vegetation Classification (USNVC). The Massachusetts Classification descriptions include the USNVC/NatureServe synonyms for those who want more finely divided community types, although the accuracy of the cross-walks is variable.

Organization of the Classification

This classification divides natural community types into three major systems: Terrestrial, Palustrine, and Estuarine. Keys are provided for each system. Within each system, the structural dominance—the growth form or physiognomy, such as forest, shrubland, herbaceous, and open or sparsely vegetated—is used as a division of types. The forested categories in the Terrestrial and Palustrine sections are subdivided into coniferous (evergreen), deciduous, and mixed.

The presence of significant water is used to define the Palustrine system, and the presence of water with salinity or tides defines the Estuarine category. All tidally influenced communities are in the Estuarine category whether the tide water is saline or fresh. Upland salt spray communities not influenced by tides are treated as Terrestrial.

Terrestrial: The vegetation of terrestrial communities is not significantly influenced by standing or moving water. Forested community types have more than about 25% tree canopy, which includes woodlands in the USNVC/NatureServe and other classifications. If mature trees are absent and shrubs cover exceeds 25%, then the community is considered to be a shrubland. Herbaceous communities are relatively open with neither forest nor shrub canopies. Many of the open herbaceous or sparsely vegetated communities are divided by substrate (rock or sand) for convenience.

Palustrine: The palustrine section of the Massachusetts natural community classification includes all freshwater, non-tidal wetlands that are dominated by trees, shrubs, or persistent emergents (including mosses and lichens). This definition is slightly different from Cowardin (1979) who also included small, shallow aquatic beds with submersed and floating-leaved aquatics, and tidal wetlands where salinity due to ocean-derived salts was less than 0.5%. In this Massachusetts classification, submersed and floating-leaved aquatics are not included (other organizations are working on aquatic classifications), and all tidal wetlands are included in the estuarine section. The palustrine section does include riverside communities that receive annual or semi-annual overbank flooding, e.g., floodplain forests. High-terrace Floodplain Forests are included in the palustrine section in order to group them with other floodplain forest communities. In this classification, the term *wetlands* is not used in the sense of a legally defined jurisdictional wetland. The ideas certainly overlap, but jurisdictional wetlands and their boundaries are determined by legally defined techniques not included in this classification.

Estuarine: Estuarine communities are subject to varying salinity, tidal actions, and wind. Estuaries include tidal habitats and adjacent tidal wetlands in which ocean water is at least occasionally diluted by freshwater from the land. Estuarine areas extend landward and up streams to where oceanic salts (formally defined as above 0.5 ppt salinity in an annual average low-flow period) or tides (including freshwater tidal areas) have an influence on the vegetation. Hyper-salinity (compared to the ocean) may

occur temporarily in some areas from evaporation, such as in salt ponds. The estuarine area extends offshore to areas with freshwater influence on the seawater, subtidal communities that include seagrass beds. Many estuarine and marine (with no freshwater influence) communities are outside of the jurisdiction of the Massachusetts Division of Fisheries and Wildlife and are not included in this classification, which is generally limited to communities defined by vascular plants. As with the aquatic communities, other organizations have taken responsibility for developing regional or national marine classifications.

Species Nomenclature

The scientific and common names of organisms are intended to be consistent with the following:

Vascular plants:

- Haines, A. 2011. *New England Wild Flower Society's Flora Novae Angliae: A Manual for the Identification of Native and Naturalized Higher Vascular Plants of New England*. Yale University Press, New Haven (CT).

Fishes:

- Page, L. M., et al. 2013. *Common and Scientific Names of Fishes from the United States, Canada, and Mexico*. 7th ed. American Fisheries Society, Bethesda (MD). Accessed at https://fisheries.org/bookstore/all-titles/special-publications/51034c/.

Amphibians and Reptiles:

- Crother, B. I. (committee chair). 2017. Scientific and standard English names of amphibians and reptiles of North America north of Mexico, with comments regarding confidence in our understanding. 8th ed. *SSAR Herpetological Circular* 39: 1–92. Accessed at https://ssarherps.org/wp-content/uploads/2017/10/8th-Ed-2017-Scientific-and-Standard-English-Names.pdf

Birds:

- American Ornithologists' Union. 1998. *Check-list of North American Birds*. 7th ed. American Ornithologists' Union, Washington, DC. Accessed at http://www.americanornithology.org/content/checklist-north-and-middle-american-birds

Mammals:

- Wilson, D. E., and D. M. Reeder (editors). 2005. *Mammal Species of the World. A Taxonomic and Geographic Reference.*3rd ed. Johns Hopkins Press, Baltimore (MD). Accessed at http://www.departments.bucknell.edu/biology/resources/msw3/browse.asp.

Odonates:

- Paulson, D. R., and S. W. Dunkle. 2009. *A Checklist of North American Odonata: Including English Name, Etymology, Type Locality, and Distribution*. 2009 ed. University of Puget Sound, Seattle (WA) Accessed at https://www.odonatacentral.org/docs/NA_Odonata_Checklist_2009.pdf.

Lepidoptera (butterflies only):

- North American Butterfly Association. 2016. Checklist of North American Butterflies Occurring North of Mexico, Edition 2.3. North American Butterfly Association, Morristown (NJ). Accessed at http://www.naba.org/pubs/enames2_3.html.
- Pelham, J. 2008. Catalogue of the Butterflies of the United States and Canada. *Journal of Research on the Lepidoptera* 40: xiv + 658 pp.

The common and scientific names for two marine crustaceans (crabs), one marine echinoderm (sea star), two beetles, one hemipteran, one scale insect, eleven moths, two marine bivalves, and four marine gastropods were taken from NatureServe Explorer http://explorer.natureserve.org/.

Request for Information

This classification identifies sites where examples of the community types can be found on lands with public access in Massachusetts. The NHESP continues to incorporate records of good occurrences of all community types into its database, with the most common (types generally categorized as low priority for conservation) being tracked only by exemplary occurrences, and the rarest (Priority types) being tracked by all known occurrences. There is a sliding scale for inclusion in the NHESP database for the less rare types.

Evaluation of the proportion of occurrences on conservation land and identification of which types need further protection have been incorporated into MassWildlife's conservation planning projects as the natural community classification has been developed. The NHESP is always interested in reports of additional locations of uncommon or exemplary community occurrences; this will not necessarily result in those locations becoming published information.

Management needs of communities are seldom well known; however, management and restoration knowledge developed and collected on the various community types may help increase the protection of the biodiversity of Massachusetts. The descriptions of the community types in the Classification include some of the management issues identified by field biologists who have been to occurrences of the communities described. The understanding of the management needs of natural communities can always be improved and refined.

This classification represents the best knowledge about Massachusetts' communities from the field data and literature compiled to date. It is by no means complete or absolute. Instead, it should be regarded as a framework that can be field-tested and revised. Communities can be added, deleted, divided, or combined with increased knowledge of Massachusetts' natural communities. There are inconsistencies, some fields are incomplete, some community descriptions overlap. All comments, feedback, and community information are welcome and appreciated.

Massachusetts Ecoregions

Ecoregions (or ecological regions) are broad areas of relatively homogeneous vegetation, soils, climate, geology, and patterns of human use. Ecoregions have been described for the United States to provide an ecological framework for inventorying and assessing environmental resources. Different agencies and organizations have developed somewhat different ecoregions and have called them by different names to indicate hierarchy of scale and to avoid confusion. The United States Department of Agriculture Forest Service (USFS) hierarchical framework of ecological units divides the United States into provinces, sections, and subsections. Massachusetts falls within three sections of two USFS Provinces of the United State: Lower New England Section (221A) of the Eastern Broadleaf Forest Province (221); and the New England Piedmont Section (M211B) and Green, Taconic, Berkshire Mountains Section (M211C) of the Adirondack-New England Mixed Forest - Coniferous Forest - Alpine Meadow Province (M211). The USFS sub-sections are called Ecoregions of Massachusetts in this classification; they are particularly useful for statewide ecological inventory and assessment activities, including vegetation classification.

The USFS sections and sub-sections in Massachusetts are regional and extend into surrounding states; the apparently unconnected parts of 221Ag on the Connecticut border are actually connected in Connecticut, as are the two parts of 221Ae. However, in this Massachusetts classification of natural communities, the eastern and western parts of 221Ae are described separately and treated as separate ecoregions because the uncommon natural communities and rare species of the areas are distinct, although the overall upland forest types are more similar to each other than to forests in the higher elevation M211Cc that occurs between them in Massachusetts.

The USFS and the US Environmental Protection Agency (EPA) have each developed versions of ecoregions for New England that include Massachusetts. The core areas of both sets of ecological regions are similar, although the boundaries vary in detail.

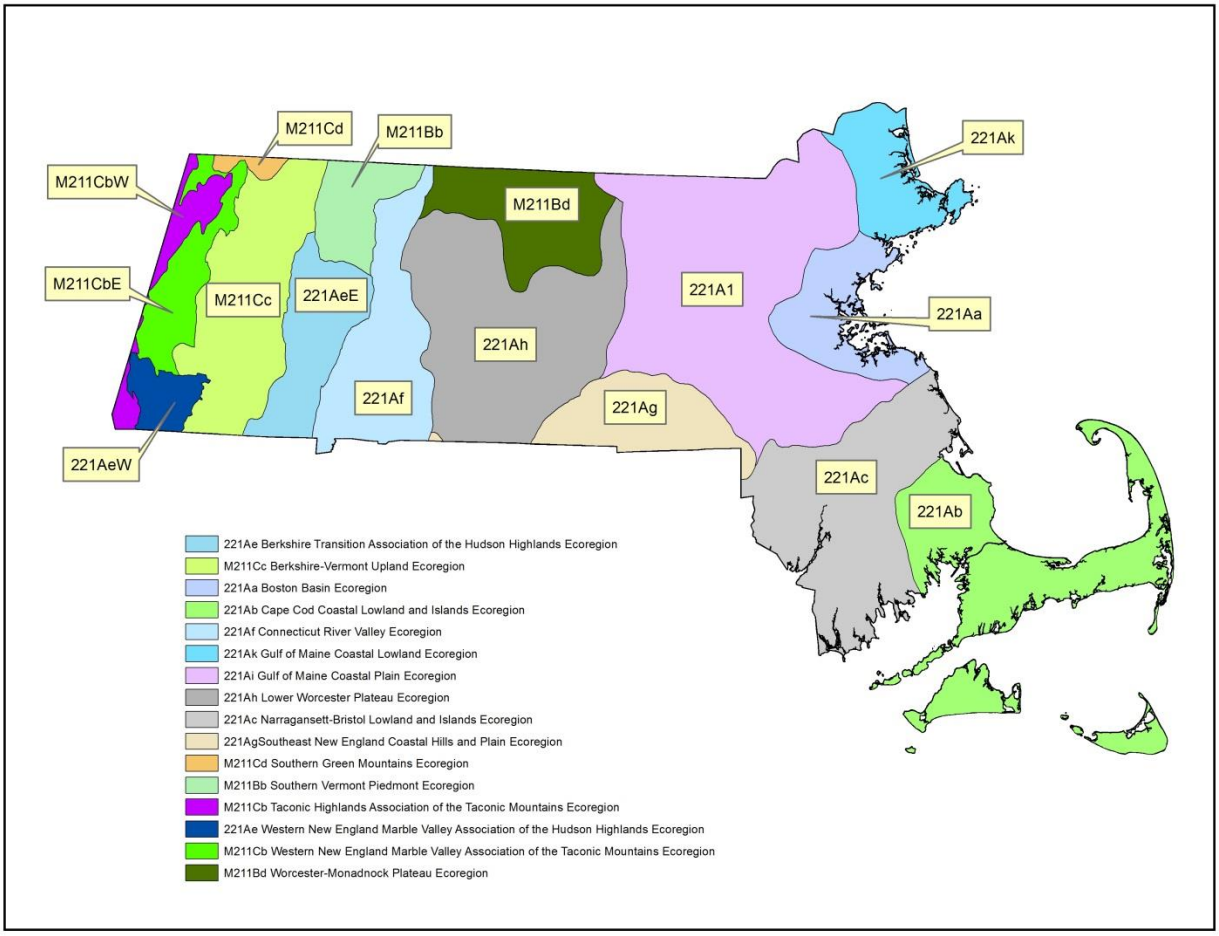


Fig. 1. MassWildlife ecoregions of Massachusetts. Boundaries are based on USFS Ecological Subsections (Cleland, et al. 2007; McNab, et al. 2007), with refinements west of the Connecticut River (de la Cretaz & Kelty 2008).

An earlier version of the *Classification of Natural Communities of Massachusetts* used a now outdated map of Massachusetts ecoregions, prepared by the EPA in 1994. Since then, the EPA and the USFS have each produced updated maps showing variously named ecoregions (EPA Level IV, Griffith et al. 2009; USFS, McNab et al. 2007). Additional finer descriptions and boundary adjustments for the USFS subsections west of the Connecticut River were compiled by a team at the University of Massachusetts Amherst (de la Cretaz and Kelty 2008). During the time that these ecoregion boundaries and descriptions were being revised, MassWildlife's Forestry Project incorporated the USFS ecoregions (subsections) into planning for habitat management. As a result, the USFS-based ecoregions (USFS subsections) were used as the basis for the distribution maps of the natural communities in this classification. The USFS and US EPA Level IV (2009) ecoregions primarily differ in their boundaries; the core areas of identified subsections /sub-ecoregions are generally similar. The differences reflect both that different approaches were taken to delineating the ecoregional lines, and also that most changes in vegetation, climate, and geology are gradual and the actual boundaries among types are somewhat arbitrary and fuzzy (as shown in 'fuzzy boundaries' between types in the 1994 EPA ecoregions). The

USFS has descriptions of their sections, but not of the subsections. West of the Connecticut Valley, there are descriptions of the subsections and Land Type Associations (LTAs) (more finely defined areas within the subsections) from de la Cretaz and Kelty (2008). The 2009 EPA descriptions of their ecoregions are at the scale used in this classification. Because the core areas described by the EPA are similar to the USFS areas, language from the EPA descriptions was incorporated as seemed useful. LTA language was also used where it clarified the description of the MassWildlife ecoregion. However, because the LTAs are more finely divided than the MassWildlife ecoregions, those descriptions were combined and edited to inform the final MassWildlife ecoregion description. In addition, the original 1994 EPA ecoregion descriptions as synopsized in the 2000 edition of the *Classification of Natural Communities of Massachusetts* continue to describe the core areas of the MassWildlife ecoregions and informed many of the new descriptions. (The main differences between the MassWildlife ecoregions and the 1994 EPA ecoregions used in the earlier versions of the natural community classifications, besides relatively minor differences in boundary locations, are: the 1994 EPA ecoregions did not separate the coastal areas as distinctly as do the MassWildlife, USFS, and 2009 EPA maps so that the Worcester area extended to the ocean; 221Ag Southeast New England Coastal Hills and Plain, an area that extends through Rhode Island and Connecticut was not recognized in the original EPA ecoregions; the Berkshire Highlands were separated into two parts not separated in the MassWildlife ecoregions; the MassWildlife ecoregions include Southern Green Mountain lobes not recognized in the EPA ecoregions; and the western New England Marble Valleys were seen as one unit.)

MassWildlife Ecoregions

The **Lower New England Section of the Eastern Broadleaf Forest Province (221A)** (close to the EPA Level III Northeastern Coastal Zone (59)) covers most of southern New England and the coastal areas to the north, including most of eastern and central Massachusetts. Appalachian oak forests and northeastern oak-pine forests are the natural vegetation types, growing on relatively nutrient-poor soils. It includes the following ecoregions:

- The **Boston Basin Ecoregion (221Aa)** has low, rolling topography that is dominated by urban and suburban land. Most natural vegetation has been removed, leaving patches of oak and white pine-oak forests, maritime shrubland and dunes, and salt marshes. Nearly half of the plant species in the ecoregion are non-native.

- The **Cape Cod Coastal Lowland and Islands Ecoregion (221Ab)** (EPA Level III Atlantic Coastal Pine Barren (84) is characterized by coastal deposits and by terminal moraines and outwash plains left by glaciers. Much of the surface water is naturally acidic with limited available nutrients. This ecoregion is distinguished by a moderate maritime climate, stunted pine and oak forests, numerous kettle ponds, salt and freshwater wetlands, and sand dunes.

- The **Narragansett-Bristol Lowland and Islands Ecoregion (221Ac)** has flat to gently rolling irregular plains where bedrock outcrops are uncommon, and thick glacial till and outwash deposits cover the area. There are low-gradient streams and numerous wetlands. The

vegetation is coastally influenced oak and oak-pine forests with various combinations of central hardwood species.

- Branches of the Westfield River join in the center of the **Berkshire Transition Ecoregion (Association) of the Hudson Highlands (221AeE)** and flow east to the Connecticut River. The vegetation is dominated by a mix of northern, transition, and oak-conifer forests, with oaks more common southwards. Soils are acidic, although there is calcareous bedrock in the central area, supporting species of rich forests that also occur in enriched alluvial sites.

- The floodplain and valley of the Housatonic River occupy a large portion of the **Western New England Marble Valley Ecoregion (Association) of the Hudson Highlands (221AeW)** with smaller areas of floodplain and outwash to the east. Low hills with limestone outcrops and soils formed in calcareous glacial till support species-rich communities in a prevailing transition hardwood forest.

- The **Connecticut River Valley Ecoregion (221Af)** is characterized by a mild climate, low rolling topography with some high hills and ridges, and rich soils. Central hardwoods (oak-hickory) and transition hardwoods are the major forest types.

- The **Southeast New England Coastal Hills and Plains Ecoregion (221Ag)** is on irregular plains with some low hills including numerous glacial drumlins. Wetlands, including red maple swamps, are abundant. Streams are low to moderate gradient. The prevailing central hardwoods forest has various combinations of oaks and pines with a few areas of transition and northern hardwoods species including sugar maple.

- The **Lower Worcester Plateau Ecoregion (221Ah)** is generally higher elevation than to the south and east, but has relatively moderate relief compared to northern and western parts of the state. The soils developed primarily on glacial till. The major forest types are transition hardwoods (maple-beech-birch, oak-hickory) with some central hardwoods (oak-hickory). Lakes, ponds, and acidic wetlands are common.

- The large **Gulf of Maine Coastal Plain Ecoregion (221Ai)** has higher elevations and greater relief than the coastal area to its east, but is less hilly and lower than to the west. Low and moderate gradient streams and large rivers drain the area. Mesic to dry oak-pine forests with various combinations of oaks and white pine prevail with some hemlock-hardwood-pine forest and areas of northern hardwood forest in northern areas.

- The **Gulf of Maine Coastal Lowland Ecoregion (221Ak)** is a 10- to 20-mile-wide coastal strip extending north from the Boston Basin. The ecoregion has relatively low relief, and elevations are mostly from sea level to 250 feet. Extensive glacial deposits blanket this region, with sand beaches that front large salt marshes. The vegetation mosaic includes oak forests, extensive post-settlement white pine, pitch pine in sandy areas, and saltmarsh.

The **Adirondack-New England Mixed Forest-Coniferous Forest-Alpine Meadow Province (M211)** (close to the EPA Level III Northeastern Highlands (58)) has a modified continental climatic regime with long, cold winters and warm summers. The landscape is mountainous and was previously glaciated. Forest vegetation is a transition between boreal on the north and broadleaf deciduous to the south. This Province has two Sections in Massachusetts that are subdivided into subsections called ecoregions in this Classification. This province includes the following sections and ecoregions:

- The **New England Piedmont Section (M211B)** occurs east and west of the Connecticut River Valley along Massachusetts' northern border. It has open, low mountains and monadnocks, and northern hardwoods forests.

- **The Southern Vermont Piedmont Ecoregion (M211Bb)** drains occasionally steep hills via moderate to high-gradient streams to the Deerfield and Connecticut Rivers. Marble and limestone bedrock underlie much of the area, supporting rich vegetation where glacial sediments or ground water have produced calcium-enriched soils. Northern and transition hardwood forests predominate.

- The **Worcester – Monadnock Plateau (M211Bd)** (or Hillsboro Inland Hills and Plains Subsection in the USFS maps) includes the most hilly areas of the central upland with a few high monadnocks and mountains. Transition hardwoods with oaks, hemlock, and white pines are common, but northern hardwoods also occur. Forested wetlands are common, and forested and non-forested peatlands are abundant. Surface waters are acidic.

- The **Green, Taconic, Berkshire Mountains Section (M211C)** occurs on the Berkshire Plateau and to the west except for the lower Housatonic Valley (Western New England Marble Valley Ecoregion (Association) of the Hudson Highlands (221AeW). It includes the eastern edge of the Taconic Mountains, the northern New England Marble Valley, the very southern edge of the Green Mountains, and the Berkshire Plateau.

- The **Western New England Marble Valley Association of the Taconic Mountain Ecoregion (M21CbE)** includes the river valleys and floodplains of the Hoosic, Green, and northern portions of the Housatonic Rivers, the rolling hills at the edges of the valleys, and some lower slopes of the surrounding mountains. Marble bedrock and large areas of calcareous outwash deposits are found in the river valleys, producing calcium-rich soil and water in the ecoregion that supports species found few other places in the state. The predominance of northern hardwoods separates this marble valley from the lower Housatonic valley directly south.

- The **Taconic Highlands Association of the Taconic Mountains Ecoregion (M211CbW)** includes the mid-and upper slopes of the Taconics and Mt. Greylock in this hilly and mountainous region. Streams are generally small and high-gradient. The forests are predominantly northern hardwoods with some transition hardwoods to the south, both with hemlock and white pine. Red spruce and balsam fir mix with northern hardwoods in the upper elevations.

- The **Berkshire-Vermont Upland Ecoregion (M211Cc)** has low mountains with steep slopes down to narrow river valleys. Acidic soils from acidic bedrock and glacially derived materials occur throughout. Spruce mixes with northern hardwood forests in the higher northern areas, with transition forests to the south, where spruce is lacking even at higher elevations.

- Two small lobes of the **Southern Green Mountain Ecoregion (M211Cd)** extend into Massachusetts from its northern expanse. These mountainous areas are on acidic bedrock; the two parts of the ecoregion are separated by the Hoosic River (in M211CbW) that is on calcareous bedrock generally covered with acidic glacial till. The eastern predominantly high elevation part of M211Cd has northern hardwoods and hemlock forests with red spruce and balsam fir at the highest elevations. A history of fires in the western part of M211Cd has promoted the establishment of mid-elevation oak forests, with northern hardwoods above them.

List of Natural Community Types Found in Massachusetts

State ranks (S1 through S5) are provided for each named community. See the following section for definitions of these state ranks.

TERRESTRIAL COMMUNITIES

FOREST/WOODLAND (greater than 25% tree cover)

Deciduous Forest: broad-leaved (generally deciduous) trees >75% of the cover

- Black Oak - Scarlet Oak Forest/Woodland (S3S4)
- Chestnut Oak Forest/Woodland (S4)
- Coastal Forest/Woodland (S4)
- Dry, Rich Oak Forest/Woodland (S4)
- Forest Seep Community (S4)
- Hickory - Hop Hornbeam Forest/Woodland (S2)
- Maritime Forest/Woodland (S2)
- Mixed Oak Forest/Woodland (S5)
- Northern Hardwoods - Hemlock - White Pine Forest (S5)
- Oak - Hemlock - White Pine Forest (S5)
- Oak - Hickory Forest (S4)
- Oak - Tulip Tree Forest (S1)
- Open Oak Forest/Woodland (S3)
- Red Oak - Sugar Maple Transition Forest (S4)
- Rich, Mesic Forest (S3)
- Successional Northern Hardwood Forest (S5)
- Sugar Maple - Oak - Hickory Forest (S3)
- Yellow Oak Dry Calcareous Forest (S1)

Conifer Forest/Woodland: conifer trees >75% of the cover and broad-leaved trees <25% of the cover

- Forest Seep Community (S4)
- Hemlock Forest (S4)
- High Elevation Spruce - Fir Forest/Woodland (S1)
- Maritime Juniper Woodland/Shrubland (S1)
- Maritime Pitch Pine Woodlands on Dunes (S1)
- Spruce - Fir - Northern Hardwood Forest (S4)
- Successional White Pine Forest (S5)

Mixed Coniferous - Deciduous Forest/Woodland: mixed conifer trees 25-75% of the cover and deciduous trees 75-25% of the cover

- Coastal Forest/Woodland (S4)
- Forest Seep Community (S4)
- Maritime Forest/Woodland (S2)
- Northern Hardwoods - Hemlock - White Pine Forest (S5)
- Oak - Hemlock - White Pine Forest (S5)
- Pitch Pine - Oak Forest /Woodland (S4)
- Spruce - Fir - Northern Hardwood Forest (S4)

White Pine - Oak Forest (S5)

SHRUBLANDS: Shrubs (<~15 ft. tall) are dominant with >25% cover; trees <25%

Maritime and coastal shrublands in the regular salt spray zone (See also Estuarine Section)

Maritime Erosional Cliff Community (S2)
Maritime Juniper Woodland/Shrubland (S1)
Maritime Pitch Pine Woodlands on Dunes (S1)
Maritime Shrubland (S3)
Pitch Pine - Scrub Oak Community (may be > 25% pitch pine) (S2)
Ridgetop Pitch Pine - Scrub Oak Community (may be > 25% pitch pine) (S2)
Sandplain Heathland (S1)
Scrub Oak Shrubland (S2)

Shrublands inland away from the coast

Acidic Rocky Summit/Rock Outcrop Community (S4)
Calcareous Rocky Summit /Rock Outcrop Community (S2)
Circumneutral Rocky Summit /Rock Outcrop Community (S2S3)
Ridgetop Heathland (S2)
Sandplain Heathland - Inland Variant (S2)

HERBACEOUS and OPEN: Not dominated by trees or tall shrubs; cover of woody vegetation - trees <25%; tall shrubs <25%

Herbaceous and sparse vegetation in the regular salt spray zone, daily or storm (See also Estuarine Section)

Abutting ocean

Maritime Beach Strand Community (S3)
Maritime Erosional Cliff Community (S2)
Maritime Rock Cliff Community (S2)

Not usually abutting ocean but receiving regular storm winds with sand and salt, not directly affected by daily salt spray from tides

Cultural Grassland (SNR)
Maritime Dune Community (S3)
Sandplain Grassland (S1)
Sandplain Heathland (S1)

Herbaceous and sparse vegetation inland from regular, including storm, salt spray

Cultural Grassland (SNR)
Riverside Rock Outcrop Community (S3)
Sandplain Grassland - Inland Variant (S2)
Sandplain Heathland - Inland Variant (S2)

Summits and Rock Outcrops

Acidic Rocky Summit/Rock Outcrop Community (S4)
Calcareous Rocky Summit /Rock Outcrop Community (S2)
Circumneutral Rocky Summit /Rock Outcrop Community (S2S3)
Open Talus/Coarse Boulder Community (S2)
Riverside Rock Outcrop Community (S3)

Rock Cliffs

Acidic Rock Cliff Community (S4)
Calcareous Rock Cliff Community (S3)

Circumneutral Rock Cliff Community (S3)

PALUSTRINE COMMUNITIES

FOREST/WOODLAND: Swamps, greater than about 25% tree cover

Deciduous Forest: broad-leaved (generally deciduous) trees >75% of the cover

Deciduous Forests/Swamps along rivers

Alluvial Hardwood Flat Community (S3)
Alluvial Red Maple Swamp (S3)
Cobble Bar Forest (S2)
High-terrace Floodplain Forest (S2)
Major-river Floodplain Forest (S2)
Small-river Floodplain Forest (S2)
Transitional Floodplain Forest (S2)

Deciduous Forests/Swamps not along rivers

Black Gum - Pin Oak - Swamp White Oak Perched Swamp (S1)
Red Maple - Black Ash - Bur Oak Swamp (S2)
Red Maple - Black Ash - Tamarack Calcareous Seepage Swamp (S2)
Red Maple - Black Ash Swamp (S2)
Red Maple - Black Gum Swamp (S2)
Red Maple Swamp (S5)

Conifer and Mixed Forest: needle-leaved (generally evergreen) trees >25% of the cover

Alluvial Atlantic White Cedar Swamp (S2)
Coastal Atlantic White Cedar Swamp (S2)
Hemlock Swamp (S4)
Inland Atlantic White Cedar Swamp (S2)
Northern Atlantic White Cedar Swamp (S1)
Red Spruce Swamp (S3)
Rich Conifer Swamp (S3)
Spruce - Tamarack Bog (S2)

SHRUBLANDS: wetlands dominated by shrubs (<~15 ft. tall); total woody cover >25%, trees <25%

Acidic Shrub Fen (S3)
Highbush Blueberry Thicket (S4)
Shrub Swamp (S5)

OPEN: Sparsely vegetated, herbaceous, or low shrub wetland communities

Acidic Peatlands

Acidic Graminoid Fen - Spillway Fen (SNR)
Acidic Graminoid Fen (S3)
Atlantic White Cedar Bog (S2)
Kettlehole Level Bog (S2)
Level Bog (S3)
Sea-level Fen (S1)

Calcareous wetlands/peatlands

Calcareous Basin Fen (S1)
Calcareous Pondshore/Lakeshore Community (S2)
Calcareous Seepage Marsh (S2)

Calcareous Sloping Fen (S2)

Other sparse, herbaceous/graminoid, or low shrub wetland communities, neither acidic sphagnum peatlands nor calcareous fens

Deep Emergent Marsh (S4)
Interdunal Marsh/Swale (S2)
Kettlehole Wet Meadow (S3)
Shallow Emergent Marsh (S4)
Wet Meadow (S4)

Open wetland vegetation associated with ponds or lakes (not aquatic)

Acidic Pondshore/Lakeshore Community (S4)
Calcareous Pondshore/Lakeshore Community (S2)
Coastal Plain Pondshore - Inland Variant (S1)
Coastal Plain Pondshore Community (S3)
Freshwater Mud Flat Community (S4)
River and Lake Drawdown Community (SNR)

Open wetland vegetation associated with river or streams (not aquatic)

High-energy Riverbank Community (S3)
High-energy Rivershore Meadow (S2)
Low-energy Riverbank Community (S4)
River and Lake Drawdown Community (SNR)
Riverine Pointbar and Beach Community (S4)
Riverside Seep Community (S2)

ESTUARINE COMMUNITIES

FOREST/WOODLAND: Swamps, greater than about 25% tree cover

Fresh/Brackish Tidal Swamp (S1)

SHRUBLAND: Shrubs dominate (multiple trunks, <~15 ft. tall); total woody cover >25%, trees <25%)

Fresh/Brackish Tidal Shrubland (S1)

OPEN: Sparsely vegetated, herbaceous or low shrub wetland communities

Open vegetation along tidal rivers and streams in areas where fresh and salt water mix

Brackish Tidal Marsh (S2)
Freshwater Tidal Marsh (S1)

Open vegetation covered twice daily in salt water by tides or submerged

Coastal Salt Pond Community (S2)
Marine Intertidal Gravel/Sand Beach Community (S4)
Marine Intertidal Rocky Shore Community (S4)
Salt Marsh (S3)
Seagrass Community (S3)

Guide to Understanding the Natural Community Classification Descriptions

Community Name: Name used to describe the community in Massachusetts

Community Code: Unique ten digit alphanumeric element code (ELCODE) assigned to the community by NatureServe.

State Rank: Community state rank (SRANK) that reflects the community's rarity and threat within Massachusetts, with regard to its regional rarity and threat. The SRank system was developed for Natural Heritage programs by The Nature Conservancy. The SRANKs are as follows:

S1 = Critically imperiled in the state due to extreme rarity. Typically 5 or fewer occurrences, very few remaining acres or miles of stream, or especially vulnerable to extirpation in Massachusetts for other reasons.

S2 = Imperiled in the state due to rarity. Typically 6-20 occurrences, very restricted range, few remaining acres or miles of stream, or very vulnerable to extirpation in Massachusetts for other reasons.

S3 = Vulnerable in the state due to a restricted range, relatively few occurrences (typically 21-100), limited acreage or miles of stream, recent and widespread declines, or vulnerable to extirpation in Massachusetts for other reasons.

S4 = Apparently secure in Massachusetts. Uncommon, but not rare.

S5 = Demonstrably secure in Massachusetts. Common, widespread, and abundant.

SU = Status unknown in Massachusetts.

SNR = Status not ranked in Massachusetts.

Map of Ecoregions where the community is known, from the NHESP database: Each community description is accompanied by a line map showing the ecoregion boundaries used by MassWildlife. Ecoregions in which the community type has been documented to occur (i.e., NHESP has field data for the community including vegetation descriptions and/or plot data) are shaded in gray. The community ecoregion maps are intended to give the user an idea of where a certain community type might be encountered and also to identify ecoregions for which community data are needed.

Concept: Brief general description or word-picture of the community.

Environmental setting: Detailed description of the landscape setting, soils, water chemistry, and other physical characteristics of the community.

Vegetation description: Detailed description of the vegetation structure and characteristic plant species of the community.

Differentiating occurrences: Discussion that highlights distinct features of the community type with lists of related types that it might be confused with and brief notes on their distinctive features.

Associated fauna: Description of the habitat that the community provides for animals, including representative birds, small mammals, amphibians, reptiles, and invertebrates.

Public access: List of representative examples of the community in areas with public access. For particularly sensitive communities, specific examples are not listed.

Threats: A description of known threats to the community.

Management needs: A description of management activities that may be necessary to maintain community occurrences and the quality of those occurrences, when known.

USNVC/NatureServe: Synonyms in the National Vegetation Classification. Crosswalk updated in 2015-2016 from USNVC.org. [Association codes are written in brackets.]

Terrestrial Communities Descriptions

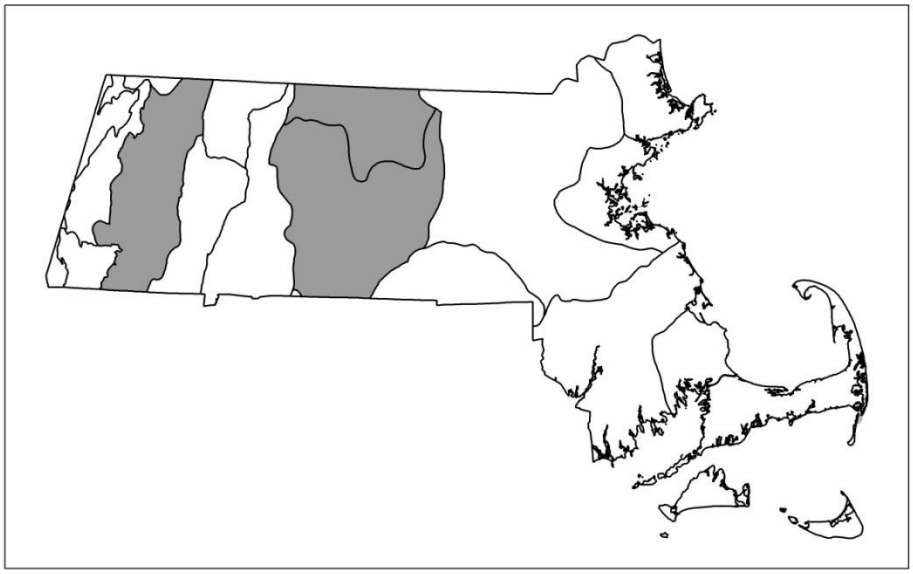
These are upland natural communities on predominantly well-drained soils that are dry to mesic. The vegetation is never hydrophytic even if the soil surface is seasonally flooded or saturated.

Sandplain Grassland, Frances Crane, WMA, Falmouth, MA, photo by Patricia Swain, NHESP

Acidic Rock Cliff Community

Community Code: CT2A2A2000

State Rank: S4



Concept: An open community of extremely sparse scattered vascular plants on ledges and in crevices, within a sparsely vegetated vertical substrate of acidic rocks and open talus at the base of the cliff. Lichens are occasionally dense on the cliff face.

Environmental Setting: Acidic Rock Cliffs form on resistant bedrock, such as granite. Little soil and few nutrients are available to support plants on the acidic cliff faces or large talus at the base. Although often cooler and moister than Acidic Rocky Summit/Rock Outcrop Communities because of aspect or shading from surrounding forests, there is a continuum of conditions and Acidic Rock Cliff Communities may be physically below Acidic Rocky Summit/Rock Outcrop Communities. Cliffs less than about 5000 sq. ft. should be considered to be inclusions in the surrounding communities.

Vegetation Description: Rock cliff communities are sparsely vegetated. Acidic Rock Cliff Communities are the least diverse of the cliff communities: the vascular vegetation is sparse, the plant association is not distinctive, and there are few specialized plant species. Acidic Rock Cliffs support species of dry, low-nutrient openings from the surrounding forests, such as Virginia creeper (*Parthenocissus quinquefolia*), common polypody (*Polypodium virginianum*), and rusty cliff-fern (*Woodsia ilvensis*). Harebell (*Campanula rotundifolia*) and fringed bindweed (*Fallopia cilinodis*) are often in crevices on acidic cliffs, as well as in other sterile acidic conditions. Bearberry (*Arctostaphylos uva-ursi*), bristly sarsaparilla (*Aralia hispida*), and stout goldenrod (*Solidago squarrosa*) may occur on ledges in the cliff face. Purple-flowering raspberry (*Rubus odoratus*) occurs on acidic cliffs in the northern and western parts of the state. Lichens, including rock tripe (*Umbilicaria* spp.), may be

abundant on the rock face. Trees from the surrounding forest may shade the cliff face; shaded cliffs have less vegetation than sunny occurrences. Cliffs are small areas within surrounding forest and reflect the vegetation of the surroundings.

Differentiating Occurrences: Three types of very sparsely vegetated plant communities have been identified on rock cliff faces, depending on the chemistry of the rock: Acidic, Circumneutral, and Calcareous (alkaline, named for calcium availability). Circumneutral and Calcareous Rock Cliff Communities have species that don't occur on Acidic Rock Cliffs, which are less distinctive vegetationally. Presence of columbine (*Aquilegia canadensis*), pink corydalis (*Capnoides sempervirens*), marginal wood-fern (*Dryopteris marginalis*), ebony spleenwort (*Asplenium platyneuron*), maidenhair spleenwort (*Asplenium trichomanes*), or purple cliff brake (*Pellaea atropurpurea*) usually indicates less acidic conditions. Red cedar (*Juniperus virginiana*) is also less likely to be present in the vicinity of Acidic Rock Cliffs than on less acidic cliffs and rock outcrops. Rocky summit/rock outcrop and Open Talus/Coarse Boulder Communities also have bare rock and could be confused with Acidic Rock Cliff Communities. The differentiation between cliffs and rock outcrops and summits is arbitrary: cliffs are defined as vertical to near vertical (~60% slope). Open Talus communities have broken rock rather than continuous, near-vertical rock faces.

Associated Fauna: All types of cliffs provide nesting habitat for Ravens (*Corvus corax*) and, increasingly, Peregrine Falcons (*Falco peregrinus*), as the offspring of Peregrine Falcons released in urban areas since 1984 have begun to return to the natural habitat to breed. Cliffs were probably the native habitat of the Eastern Phoebe (*Sayornis phoebe*). No mammals, reptiles, or amphibians would be expected on the steep cliff faces.

Public Access: Mt. Tekoa WMA, Russell; Mt. Everett State Reservation, Mt. Washington; Wendell State Forest, Wendell.

Threats: Rock climbing can break plants off of the cliff face, remove small pockets of soil, and wear lichens off of the rocks. Distinct trails appear on heavily used cliffs. A threat to Acidic Rock Cliff communities throughout the state is granite quarrying that removes existing vegetation along with underlying rocks. This causes changes in future vegetation, habitat characteristics, and hydrology. When quarries are abandoned, they are often left bare of all but planted grass and invasive weeds, land that is ripe for residential or commercial development.

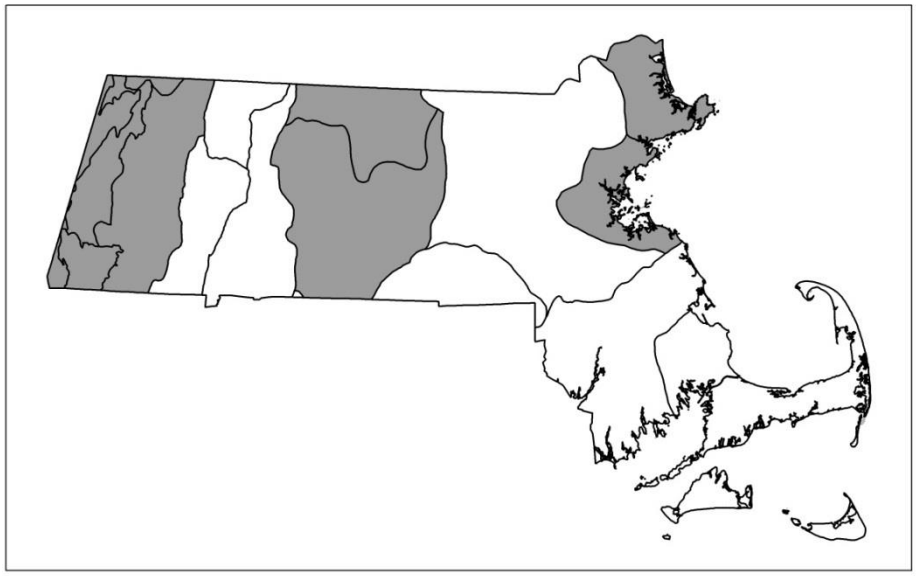
Management Needs:

USNVC/NatureServe: Includes: *Asplenium montanum* sparsely vegetated alliance - *Asplenium montanum* sparse vegetation [CEGL004391] includes: Lichen vegetation - *Umbilicaria mammulata* nonvascular alliance - *Umbilicaria mammulata* nonvascular vegetation [CEGL004387].

Acidic Rocky Summit/Rock Outcrop Community

Community Code: CT2A1A0000

State Rank: S4



Concept: A widespread open community of low shrubs, scattered grasses, mosses, lichens, and occasional trees, found on rocky summits with exposed acidic bedrock or on rock outcrops where bedrock is acidic.

Environmental Setting: This community is found on rocky summits (balds) or ridge tops with exposed acidic bedrock or on rock outcrops derived from acidic bedrock. These areas are characteristically dry, with little or no soil, and can often be found as open patches within ridgetop pitch pine or dry, mixed oak communities. Although it can be found on flat surfaces, it is more typically found on steep slopes with aspects varying from southeast through southwest. Vegetation is concentrated around the edges or is found in pockets of soil within the outcrop. Ridgetop Pitch Pine - Scrub Oak Communities and other ridgetop communities are often around the open patches of the Acidic Rocky Summit/Rock Outcrop Community. Examples of the Acidic Rock Cliff Community may occur below rocky summits, sometimes with intervening ridgetops or other forest/woodlands.

Vegetation Description: Low shrubs and scattered clumps of grass dominate this community. Vegetation is discontinuous. The exposed rocks often have extensive patches of lichen and moss. Canopy cover is largely absent but trees commonly found near the margin of the bedrock areas include pitch pine (*Pinus rigida*), white pine (*Pinus strobus*), and red oak (*Quercus rubra*), and occasionally may include red pine (*Pinus resinosa*, native in this habitat). The dominant shrubs include scrub oak (*Quercus ilicifolia*), huckleberry (*Gaylussacia baccata*), early sweet blueberry (*Vaccinium pallidum*), low sweet blueberry (*V. angustifolium*), bearberry (*Arctostaphylos uva-ursi*), black

chokecherry (*Aronia melanocarpa*), and running shadbush (*Amelanchier spicata*). Dwarf chestnut oak (*Q. prinoides*) can also be found, but not as commonly. Herbaceous species include little bluestem (*Schizachyrium scoparium*), poverty grass (*Danthonia spicata*), common hair grass (*Deschampsia flexuosa*), Pennsylvania sedge (*Carex pensylvanica*), and cow wheat (*Melampyrum lineare*).

Differentiating Occurrences: Rocky Summit/Rock Outcrop communities are dominated by bare rock. Three rocky summit/rock outcrop community types are named depending on whether the exposed bedrock is acidic (pH < 6.0), circumneutral (pH 6.0 - 7.5), or basic (alkaline, named calcareous for calcium availability) (pH > 7.5). These communities would not be expected to co-occur since the type of bedrock determines the type of natural community. Circumneutral and Calcareous Rocky Summit/Rock Outcrop Communities have species that do not occur on Acidic Rocky Summit/Rock Outcrops, which has a less distinctive flora. Columbine (*Aquilegia canadensis*), climbing fumitory (*Adlumia fungosa*), red cedar (*Juniperus virginiana*), and pink corydalis (*Capnoides sempervirens*) are more likely on circumneutral or calcareous outcrops than on acidic occurrences. In the eastern part of the state, Acidic Rocky Summit/Rock Outcrop Communities are often associated with a dry oak and pitch pine forest, while Circumneutral Rocky Summit/Rock Outcrop Communities are often associated with hickory-hop hornbeam, oak-hickory, or forests with sugar maple. Calcareous outcrops may be near or above patches of Rich, Mesic Forest or enriched northern hardwood forests. The Acidic Rocky Summit/Rock Outcrop Community is often dominated by low shrubs, with grasses, sedges, and a few herbaceous species forming a secondary component. In the Circumneutral Rocky Summit/Rock Outcrop Community, grasses, sedges, and a variety of herbaceous species dominate the vegetation. The Calcareous Rocky Summit/Rock Outcrop Community is dominated by both shrubs and herbaceous plants, with steeper, moister ledges supporting a rich community of ferns. Acidic Rocky Summits/Rock Outcrops can be difficult to separate from other ridgetop communities that may be present at the same site in a mosaic of communities. These include all types of rock cliff communities, Ridgetop Pitch Pine - Scrub Oak Community, Scrub Oak Shrublands, and Ridgetop Heathland Community. When mapping communities on a rock outcrop or summit, the size of the various patches should be considered. One site could have multiple types of these communities or, if one community type is predominant and the others are in small areas (patches of less than 5000 sq. ft.) within it, the dominant community type would be named with notes on the variation. Rock cliffs are vertical to near vertical (more than about 60% slope); rock outcrops are not. The difference is arbitrary. Scrub Oak Shrublands have dominant, dense shrub oaks, no pines and few other trees, and little bare rock. Ridgetop Pitch Pine - Scrub Oak Communities have multiple but scattered stunted pitch pine trees and dense scrub oak, and usually little bare rock. There need to be abundant shrub oaks and pitch pines for the community to be Ridgetop Pitch Pine - Scrub Oak or Scrub Oak Shrubland. Ridgetop Heathland has large areas dominated by lowbush blueberry, and little exposed bedrock.

Associated Fauna: Most animals of rock outcrop communities are not sensitive to the chemistry of the rock, but rather are responding to the elevation and dryness of the habitat. Any differences in resident fauna between outcrop types are most likely due to geographical differences in species distributions. Outcrops tend to be fairly small, and only a part of the habitat of most vertebrate animals. Small mammals of rock outcrop communities include those of dry habitats such as white-footed mouse (*Peromyscus leucopus*), short-tailed shrew (*Blarina brevicauda*) and, in grassy/sedgy areas with some soil accumulation, meadow voles (*Microtus pennsylvanicus*). Acid Rocky Summit/Rock Outcrop Communities with their open, south-facing slopes provide good habitat for snakes of dry areas, such as north American racer (*Coluber constrictor*), northern ring-necked snake (*Diadophis punctatus*), and northern red-bellied snake (*Storeria occipitomaculata*). No turtles, frogs or toads would be expected. Ravens (*Corvus corax*) are all around high elevations, especially near cliffs where they nest.

Public Access: Greylock State Reservation, Adams; Watatic Mtn., Ashburnham; Middlesex Fells Reservation, Winchester/Stoneham.

Threats: The major threat is probably the use of the areas as viewpoints. This can destroy the vegetation by trampling. The larger and steeper areas where the community occurs are probably stable and not likely to be overgrown by trees. Smaller areas may be overgrown during succession.

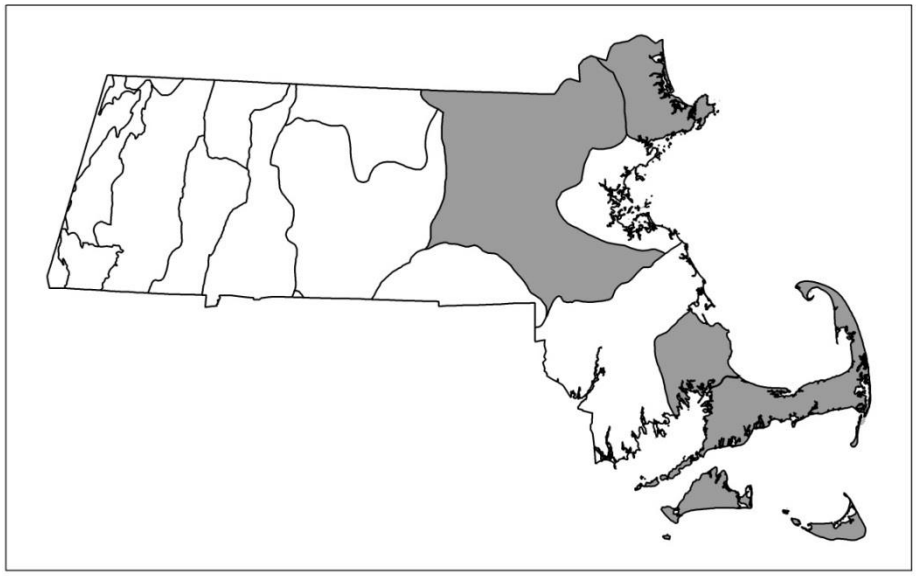
Management Needs: Build trails to avoid these areas and/or educate the public, so they understand how to protect the fragile areas. Controlled burns may be useful in keeping areas open.

USNVC/NatureServe: Part of NatureServe System Northern Appalachian-Acadian Rocky Heath Outcrop (CES201.571). In part A4110 *Vaccinium* (*angustifolium*, *myrtilloides*, *pallidum*) Dwarf - shrubland Alliance - *Vaccinium angustifolium* - *Sorbus americana* Dwarf - shrubland [CEGL005094); included in A3314 *Picea rubens* / *Vaccinium angustifolium* Northern Rocky Woodland Alliance - *Picea rubens* / *Vaccinium angustifolium* / *Sibbaldiopsis tridentata* [CEGL006053].

Black Oak - Scarlet Oak Forest/Woodland

Community Code: CT1A3B0000

State Rank: S3S4



Concept: A fairly open oak/heath woodland maintained by regular light fire. Without fire, the community becomes a closed forest with more diversity of trees and a denser understory flora.

Environmental Setting: Black Oak - Scarlet Oak Woodland is a fairly open, short (<20m, ~60 ft., tall) oak / heath community maintained by regular light fire or other disturbance. The woodland occurs on dry sites, often sandy, gravelly, or rocky slopes. Without fire, there tends to be a deep accumulation of oak leaf litter that impedes germination of seeds that need mineral soil, restricting such species to small patches of disturbance. Except on the driest sites, without regular fire, the woodland community tends to succeed to more diverse, denser and taller Oak - Hemlock - White Pine Forest or one of its variants.

Vegetation Description: In Black Oak - Scarlet Oak Woodlands, black oak (*Quercus velutina*) is the dominant canopy species, with a high proportion of scarlet oak (*Q. coccinea*). White oak (*Q. alba*) and red maple (*Acer rubrum*) are common associates. A sparse subcanopy may have species of recent disturbance such as grey birch (*Betula populifolia*), black cherry (*Prunus serotina*), and sassafras (*Sassafras albidum*), as well as species less tolerant of fire such as flowering dogwood (*Benthamidia florida*) or shadbush (*Amelanchier spp.*). Lowbush blueberries (*Vaccinium angustifolium* and *V. pallidum*), huckleberry (*Gaylussacia baccata*), and scrub oak (*Quercus ilicifolia*) form a low shrub layer, with scattered sheep laurel (*Kalmia angustifolia*), maple-leaved viburnum (*Viburnum acerifolium*) and American hazelnut (*Corylus americana*). A sparse herbaceous layer includes scattered patches of Pennsylvania sedge (*Carex*

pensylvanica), bracken fern (*Pteridium aquilinum*), and pink lady's slipper (*Cypripedium acaule*). Wintergreen (*Gaultheria procumbens*) may be dense in areas with little past soil disturbance.

Differentiating Occurrences: Black Oak - Scarlet Oak Woodlands are part of a continuum of dry, acidic communities that contain a variety of tree oak and pine species. Many of the types of oak communities grade into one another in time and space and are difficult to differentiate both in a classification and on the ground. They all have tree oaks and a low shrub layer dominated by plants of the blueberry family. Black Oak - Scarlet Oak Woodlands are overtly woodlands: most canopy trees are relatively short (<20m, ~60 ft.) and the canopy is generally interrupted rather than continuous (~60% cover). Abundant scarlet oak with black oak is the key indicator of the type. Open Oak Woodlands occur on upper hill slopes with short red (and black or hybrid) and white oak trees scattered over a low shrub or graminoid (grass and sedge) understory around small rock outcrops. Mixed Oak Forests/Woodlands have more oak species (black, scarlet, and white plus red oak (*Q. rubra*) and chestnut oak (*Q. montana*)) than Black Oak - Scarlet Oak Woodlands, as well as black birch (*Betula lenta*). The type is broadly defined and Black Oak - Scarlet Oak Woodlands could be considered as a defined subtype. Coastal Forests/Woodlands are within a few miles of the coast at < ~60 ft. elevation and receive storm winds and spray. The diverse canopy includes oaks and often has American holly, sassafras, and black gum. Oak - Hemlock - White - Pine Forests are the most broadly defined in the continuum of oak dominated forests; specific types are split out from this matrix type. Oak - Hemlock - White - Pine Forests are dominated by a mix of tree oaks with scattered white pine and hemlock, either of which may be in local dense patches. White Pine - Oak Forests have >25% cover of white pine overall (not just local patches).Pitch Pine - Oak Forests have >25% cover of pitch pine overall (not just local patches).

Associated Fauna: Black Oak - Scarlet Oak Woodlands would be part of the habitat of wide-ranging or large animals. Acorns are important food for white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), grey squirrels (*Sciurus carolinensis*), other small rodents, Wild Turkeys (*Meleagris gallopavo*), and other birds. The understory of blueberries and huckleberries is used by many of these same species in areas with sufficiently large forests to provide all the habitat needs. Passerine birds of oak forests include Red-eyed Vireo (*Vireo olivaceus*), White-breasted Nuthatch (*Sitta carolinensis*), Ovenbird (*Seiurus aurocapillus*), Black-and-white Warbler (*Mniotilta varia*), Scarlet Tanager (*Piranga olivacea*), Great Crested Flycatcher (*Miarchus crinitus*), and Downy Woodpecker (*Picoides pubescens*). Orange Sallow Moth (*Pyrrhia aurantiago*) may be present when either of its host plants, smooth and fern-leaf false fox glove (*Aureolaria flava* and *A. pedicularia*), are present in sufficient abundance.

Public Access: Salisbury Marsh WMA, Salisbury; Clinton Bluff WMA, Clinton; Green Hill Park, Worcester; Cape Cod National Seashore, Truro.

Threats: Fire suppression, severe wildfire, and exotics. ATV trails.

Management Needs: Prescribed fire, exotic removal.

USNVC/NatureServe: A4209 *Quercus velutina - Quercus falcata - Pinus rigida* Coastal Plain Forest Alliance - *Quercus coccinea - Quercus velutina* / *Sassafras albidum* / *Vaccinium pallidum* Forest [CEGL006375].

Calcareous Rock Cliff Community

Community Code: CT2A2C0000

State Rank: S3

Concept: Extremely sparse vegetation, in cracks and small ledges of nearly vertical cliff faces and any open talus at the base of the cliff. A more diverse community than found on acidic cliffs.

Environmental Setting: Rock cliff communities all occur on more or less vertical bedrock cliff faces. They have extremely sparse scattered vascular plants on ledges and in crevices. Lichens may be dense on the rock face. Calcareous Rock Cliff Communities occur on exposures of resistant limestone, dolomite, or other calcareous bedrock; cliffs often include ledges and open talus slopes below. There is minimal soil development. Surroundings tend to be northern hardwood forest, or sometimes Rich, Mesic Forests. Calcareous Rocky Summit/Rock Outcrop Communities may occur above calcareous cliffs, although much calcareous rock in Massachusetts is overlain by more resistant acidic rock. Rock cliffs less than about 5000 sq. ft. should be considered inclusions in the surrounding forest, or combined with larger talus or rock outcrops as appropriate.

Vegetation Description: The sparse vegetation of Calcareous Rock Cliff Communities is distinct and specific to the habitat. Purple cliff-brake (*Pellaea atropurpurea*), bulblet fern (*Cystopteris bulbifera*), maidenhair spleenwort (*Asplenium trichomanes*), blunt-lobed cliff-fern (*Woodsia obtusa*), walking fern (*Asplenium rhizophyllum*), and columbine (*Aquilegia canadensis*) are characteristic species of vascular plants. Harebell (*Campanula rotundifolia*) grow in drier open sites, and moister, shaded sites have early saxifrage (*Micranthes virginiensis*), rock-pellitory (*Parietaria pensylvanica*), small enchanter's nightshade (*Circaea alpina*), and several rock-cresses (hairy rock-cress, *Arabis*

pycnocarpa; lyre-leaved rock-cress, *Arabidopsis lyrata*; and smooth rock-cress, *Boechera laevigata*). Lichen and moss grow on the rock face and in small cracks. Surrounding forest often includes sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), basswood (*Tilia americana*), butternut (*Juglans cinerea*), and black and yellow birches (*Betula lenta* and *B. alleghaniensis*). Trees from the surrounding forest may shade the cliff face; shaded cliffs have less vegetation than sunny occurrences.

Differentiating Occurrences: Three types of very sparsely vegetated plant communities have been identified on rock cliff faces, depending on the chemistry of the rock: Acidic, Circumneutral, and Calcareous (alkaline, named for calcium availability). Circumneutral and Calcareous Rock Cliff Communities have species that don't occur on Acidic Rock Cliff Communities, which vegetationally are less distinctive. In distribution, Circumneutral Rock Cliff Communities overlap with and are more widespread than Calcareous Rock Cliff Communities, which are restricted to the Marble Valleys and Connecticut Valley ecoregions. Circumneutral Rock Cliff Communities would be expected to have some of the following characteristic species: columbine, pink corydalis, marginal wood-fern, ebony spleenwort, herb Robert, and/or green rock-cress. Red cedar is more likely to be present in the vicinity of Circumneutral or Calcareous Rock Cliff Communities and associated outcrops than on Acidic Rock Cliff Communities and their associated rock outcrops. Calcareous Rock Cliff communities include species requiring high nutrient levels (nutrient richness) or high pH such as rock pellitory, smooth rock-cress, lyre-leaved rock-cress, fragile rock-brake, purple cliff brake, and bulblet-fern, that are not usually found in Circumneutral Rock Cliff Communities. Rocky summits, rock outcrops, and Open Talus/Coarse Boulder Communities also have bare rock and could be confused with Circumneutral Rock Cliff Communities. The differentiation between cliffs and rock outcrops/summits is arbitrary: cliffs are defined as vertical to near vertical (~60% slope). Open Talus/Coarse Boulder communities have broken rock rather than continuous, near-vertical rock faces. Ridgetop Pitch Pine - Scrub Oak and Ridgetop Heathland Communities occur on rock ridges but are more densely vegetated than Circumneutral Cliff Communities, and are not near vertical overall.

Associated Fauna: All types of cliffs provide nesting habitat for Ravens (*Corvus corax*). In the past, Peregrine Falcons (*Falco peregrinus*) nested on cliffs before being extirpated from Massachusetts in 1955, and the offspring of Peregrine Falcons released in urban areas since 1984 have begun to return to the natural habitat to breed in the state. Cliffs were probably the native habitat of the Eastern Phoebe (*Sayornis phoebe*). No mammals, reptiles, or amphibians would be expected on the steep cliff faces.

Public Access: Calcareous cliffs are easily damaged by visitation. Most landowners do not want their sites publicized.

Threats: Rock climbing can break plants off of the cliff face, remove small pockets of soil, and wear lichens off of the rocks. Distinct trails appear on heavily used cliffs. Natural nest sites that Peregrine Falcons used in the past are being re-colonized as

Peregrine numbers increase. However, at some cliff sites it is likely that rock-climbers disturb prospecting pairs of falcons sufficiently to keep the birds from nesting, either just for that season or as a possible nest site at all. Ridgetops and tops of rock cliffs often have recreational trails along them that are eroded, lead to trampling of vegetation, or generally create disturbances that alter habitat for animals as well as plants. Calcareous Rock Cliffs are quarried for limestone and marble in the Berkshires. Quarrying removes existing vegetation along with underlying rocks, changing habitat characteristics, hydrology, and future vegetation. When quarries are abandoned, what is left is often bare of all but planted grass and invasive weeds.

Management Needs:

USNVC/NatureServe: Includes: *Cystopteris bulbifera* sparsely vegetated alliance - *Cystopteris bulbifera* sparse vegetation [provisional] [CECL004394]; includes some of: Laurentian-Acadian-Great Lakes Alkaline Cliff Alliance A4006 - *Pellaea atropurpurea* cliff sparse vegetation (CEGL006527).

Calcareous Rocky Summit/Rock Outcrop Community

Community Code: CT2A1C0000

State Rank: S2

Concept: An open community of shrubs and herbaceous plants, occurring on open calcareous ridgetops of the low hills edging the valleys in the Western New England Marble Valleys eco-region, as well as on steep, mid-slope calcareous ledges found in the same region.

Environmental Setting: Ridgetop calcareous outcrops are dry and typically are found on the ridgetops of low hills in the calcareous regions of Berkshire County. Their open aspect is maintained by trees uprooting and pulling away from the steep ridgetop areas. Because most calcareous bedrock in Massachusetts is overlain by more resistant acidic rocks, the community tends to be found on rock outcrops rather than actual rocky summits. The substrate grades from rock outcrops to steeper, but moister, shaded cliff faces that support Calcareous Rock Cliff Communities.

Vegetation Description: The ridgetop community supports relatively sparse herbaceous vegetation that includes ivory sedge (*Carex eburnea*), purple clematis (*Clematis occidentalis*), long-leaved bluet (*Houstonia longifolia*), balsam-ragwort (*Packera paupercula*) and lyre-leaved rock-cress (*Arabidopsis lyrata*). Shrubs include round-leaved dogwood (*Swida rugosa*) and roundleaf shadbush (*Amelanchier sanguinea*), as well as the less common northern prickly rose (*Rosa acicularis*), hairy honeysuckle (*Lonicera hirsuta*), and downy arrow-wood (*Viburnum rafinesquianum*). Calcareous rock outcrops off the summit ridges tend to be moister and are lightly shaded by trees characteristic of Rich, Mesic Forests, including sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), and hop-hornbeam (*Ostrya virginiana*). The herbaceous layer can include species characteristic of Rich, Mesic Forests, but typically has a

high proportion of ferns such as bulblet fern (*Cystopteris bulbifera*), fragile fern (*C. tenuis*), ebony spleenwort (*Asplenium platyneuron*), maidenhair spleenwort (*A. trichomanes*), walking fern (*Asplenium rhizophyllum*), and blunt-lobed wood-fern (*Woodsia obtusa*), along with the rarer ferns purple cliff-brake (*Pellaea atropurpurea*) and wall-rue spleenwort (*Asplenium ruta-muraria*). Other plants that are frequently found on these ledges include Pennsylvania sedge (*Carex pensylvanica*), harebell (*Campanula rotundifolia*), peduncled sedge (*Carex pedunculata*), early saxifrage (*Micranthes virginiensis*), smooth rock-cress (*Arabidopsis laevigata*), and columbine (*Aquilegia canadensis*). This community also has a number of non-native invasives, including Morrow's honeysuckle (*Lonicera morrowii*), Japanese barberry (*Berberis thunbergii*), and multiflora rose (*Rosa multiflora*).

Differentiating Occurrences: Calcareous Rocky Summit/Rock Outcrop Communities often include plantain-leaf sedge (*Carex plantaginea*), maidenhair spleenwort (*Asplenium trichomanes*), walking fern (*Asplenium rhizophyllum*), or herbaceous species typical of Rich, Mesic Forests. Columbine (*Aquilegia canadensis*), climbing fumitory (*Adlumia fungosa*), red cedar (*Juniperus virginiana*), pink corydalis (*Capnoides sempervirens*), broad-leaved woodland-sedge (*Carex platyphylla*), ebony spleenwort (*Asplenium platyneuron*}, bulblet fern (*Cystopteris bulbifera*), or fragile fern (*C. tenuis*) may be in either Calcareous or Circumneutral Rocky Summit/Rock Outcrop Communities, but not in Acidic Rocky Summit/Rock Outcrop Communities. The differentiation between cliffs and rock outcrops/summits is arbitrary: cliffs are vertical to near vertical (about 60% slope). The assignment to type would be based on overall conditions: it is expected that small (< 5000 sq. ft.) patches would be considered to be variation of the surrounding type and would be included in that type. Rocky summit/rock outcrop communities are dominated by bare rock. Ridgetop Pitch Pine - Scrub Oak Communities also occur on rocky ridges, with pitch pine (*Pinus rigida*) and scrub oak (*Quercus ilicifolia*), but usually have less bare rock (this may not be true where abundant visitation has caused loss of plant and soil cover). In Scrub Oak Shrublands, scrub oak is dominant and dense, with few trees and little bare rock. Ridgetop Heathland communities are dominated by heaths, usually low-bush blueberry (*Vaccinium angustifolium*). Depending on size, one site could have multiple types of these communities: if one community type is predominant and the others are in small patches within it, the dominant community type would be named with notes on the variation. Forested ridgetops on calcareous bedrock may include yellow oak (*Quercus muehlenbergii*). These ridgetops are then classified as Yellow Oak Dry Calcareous Forest, a calcareous equivalent of Hickory - Hop Hornbeam Forest/Woodland.

Associated Fauna: Most animals of rock outcrop communities are not sensitive to the chemistry of the rock, but rather are responding to the elevation and dryness of the habitat. Any differences in resident fauna between calcareous and acidic outcrops are most likely due to geographical differences in species distribution rather than to qualitative differences among the types of outcrops. Calcareous outcrops are in the western part of Massachusetts, and so have the species that don't occur in coastal

areas, such as deer mouse (*Peromyscus maniculatus*), woodland jumping mouse (*Napaeozapus insignis*), and smoky shrew (*Sorex fumeus*), as well as other, more widespread small mammals of dry habitats, such as white-footed mouse (*Peromyscus leucopus*), short-tailed shrew (*Blarina brevicauda*) and, in grassy/sedgy areas with some soil accumulation, meadow voles (*Microtus pennsylvanicus*). Outcrops tend to be fairly small and only a part of the habitat of most vertebrate animals. Snakes would be those of dry areas, such as black racer (*Coluber constrictor*), ringneck (*Diadophis punctatus*), and redbelly snake (*Storeria occipitomaculata*). No turtles, frogs or toads would be expected. Ravens (*Corvus corax*) are all around high elevations, especially near cliffs where they nest. Invertebrates include tiger beetles.

Public Access: Bartholomew's Cobble, The Trustees of Reservations, Sheffield; Rounds Rock, Mt. Greylock State Reservation, New Ashford/Cheshire.

Threats: These communities can be threatened by development and by invasive species. This community has a number of non-native invasives, including Morrow's honeysuckle (*Lonicera morrowii*), Japanese barberry (*Berberis thunbergii*), and multiflora rose (*Rosa multiflora*).

Management Needs: Control of invasive species.

USNVC/NatureServe: Includes: CEGL006180 *Juniperus virginiana - Ostrya virginiana*/*Carex eburnea* Woodland.

Chestnut Oak Forest/Woodland

Community Code: CT1A3A0000

State Rank: S4

Concept: Oak forest of dry ridgetops and upper slopes, dominated by chestnut oak with an often dense understory of scrub oak, heaths, or mountain laurel.

Environmental Setting: Chestnut Oak Forests/Woodlands occur as long narrow bands along dry ridges and upper slopes with thin soil over acidic bedrock. They may extend down steep, convex, rocky, often west- or south-facing slopes where soil is shallow and dry. The canopy is closed to partially open (>25% cover). There tends to be deep oak leaf litter with slow decomposition. Often many trees have multiple fire scars and charred bases; fire appears to play a role in maintaining the community occurrences. Chestnut Oak Forests/Woodlands often occur in a mosaic with closed oak or pine - oak forests down slope and more open communities above.

Vegetation Description: The canopy of Chestnut Oak Forests/Woodlands is dominated, often completely, by chestnut oak (*Quercus montana*). Less abundant associates include other oaks (black (*Q. velutina*), red (*Q. rubra*), and/or white (*Q. alba*), and less commonly, scarlet (*Q. coccinea*)), with red maple (*Acer rubrum*), and white or pitch pines (*Pinus strobus*, *P. rigida*). The subcanopy layer is sparse and consists of canopy species, black birch (*Betula lenta*), and sassafras (*Sassafras albidum*). Tall shrubs are lacking or the shrub layer may have scattered tree saplings, mountain laurel (*Kalmia latifolia*), striped maple (*Acer pensylvanicum*), American chestnut (*Castanea dentata*), and witch hazel (*Hamamelis virginiana*). Short shrubs are dense in patches dominated by black huckleberry (*Gaylussacia baccata*) and lowbush blueberries (*Vaccinium angustifolium* and *V. pallidum*), with scattered sheep laurel (*K. angustifolia*). The herbaceous layer is sparse and dominated by wintergreen

(*Gaultheria procumbens*), with occasional false foxgloves (*Aureolaria flava*, *A. pedicularia*, and *A. virginica*), sedges (particularly *Carex pensylvanica*), and bracken fern (*Pteridium aquilinum*).

Differentiating Occurrences: Although distinctive because of the dominance of chestnut oak and its usual upper slope and ridgetop position, Chestnut Oak Forest/Woodland is part of a continuum of dry, acidic communities that contain a variety of tree oak and pine species. Mixed Oak Forests/Woodlands have more oak species (black, scarlet, white, red, and chestnut oak) than most other types of oak forests and birches and lack abundant pines or hemlock. Chestnut Oak is not dominant. Oak - Hemlock - White Pine Forests are dominated by a mix of tree oaks with scattered white pine and hemlock, either of which may be in local dense patches. Abundant scarlet oak with black oak is the key indicator of Black Oak - Scarlet Oak Woodlands. Open Oak Woodlands occur on hill slopes with short red and white oak trees scattered over a grassy or low shrub understory around small rock outcrops. Coastal Forests/Woodlands are within a few miles of the coast at <~60 ft. elevation and receive storm winds and spray. The diverse canopy includes oaks and often has American holly, sassafras, and black gum. White Pine - Oak Forests and Pitch Pine- Oak Forests have >25% cover of pines overall (not just local patches) and a mix of oak species where black oak is particularly important.

Associated Fauna: Mature upland forest types provide valuable structural attributes such as tree cavity den sites (used by a variety of bird and mammal species) and large woody material (used by various amphibian, reptile, and invertebrate species). Because chestnut oak acorns are particularly sought after by wildlife, Chestnut Oak Forests/Woodlands provide seasonally preferred foraging habitat for large and small mammals and birds, including turkeys. The understory of blueberries and huckleberries is used by many of these same species. Song birds, moths, butterflies, and other insects of the oak forest continuum occur in Chestnut Oak Forests.

Public Access: Copicut WMA, Fall River; Leadmine Mtn. Conservation Area, Sturbridge; Tekoa Mountain WMA, Russell/Montgomery.

Threats:

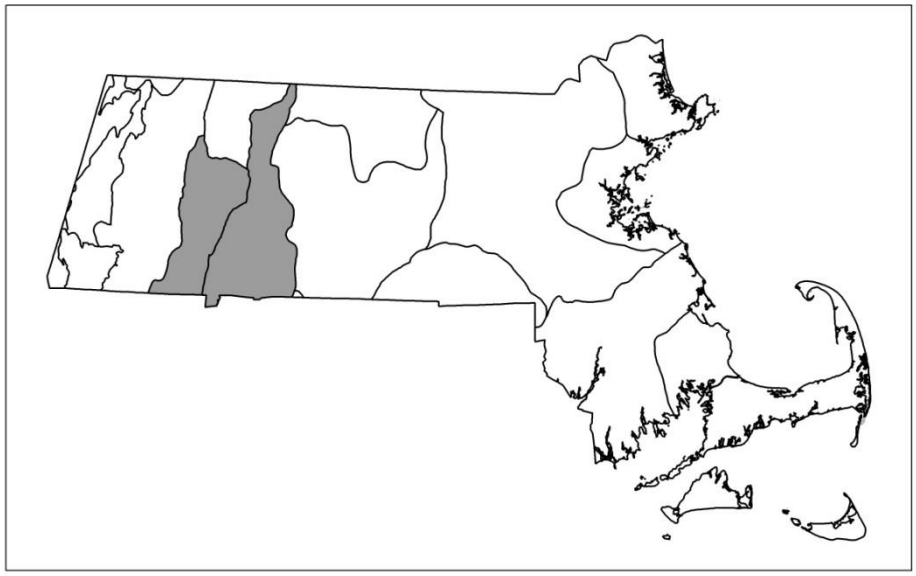
Management Needs:

USNVC/NatureServe: A0248 *Quercus prinus* - *Quercus coccinea* Forest Alliance -- *Quercus prinus* - *Quercus* (*rubra*, *velutina*)/*Gaylussacia baccata* forest [CEGL006282].

Circumneutral Rock Cliff Community

Community Code: CT2A2B0000

State Rank: S3



Concept: A community of extremely sparse scattered vascular plants on small ledges and in crevices within a vertical substrate of rocks and any open talus at the base of the cliff. Lichens are occasionally dense. Circumneutral Rock Cliff Communities tend to have a greater diversity of vascular plants than found in Acidic Rock Cliff Communities.

Environmental Setting: Rock cliff communities all occur on more or less vertical bedrock cliff faces. They have extremely sparse scattered vascular plants on ledges and in crevices. Lichens may be dense on the rock face. Circumneutral Rock Cliff Communities develop on sandstone, traprock, conglomerate or other non-acidic, non-calcareous rock. Included with Circumneutral Rock Cliffs are sandstone cliffs and associated very steep sandstone-derived slopes that support dry, grassy communities with scattered shrubs. Plants in the sparsely vegetated Circumneutral Rock Cliff Communities grow on small ledges and in crevices on a circumneutral cliff face in dry to moist conditions. There is often circumneutral talus below the cliff, and sometimes rocky summits or rock outcrops above. Rock cliffs less than about 5000 sq. ft. should be considered inclusions in the surrounding forest, or combined with larger talus or rock outcrops as appropriate.

Vegetation Description: The sparse vegetation of Circumneutral Rock Cliff Communities includes species of dry, open areas such as pink corydalis (*Capnoides sempervirens*), bearberry (*Arctostaphylos uva-ursi*), plantain-leaved pussytoes (*Antennaria plantaginifolia*), columbine (*Aquilegia canadensis*), marginal wood-fern (*Dryopteris marginalis*), little bluestem grass (*Schizachyrium scoparium*), ebony spleenwort (*Asplenium*

platyneuron), rusty cliff-fern (*Woodsia ilvensis*), and lichens and mosses. Red cedar (*Juniperus virginiana*) is typically in the area or on adjoining rock outcrops, and red elderberry (*Sambucus racemosa*) may grow in moist cracks in talus below. Trees from the surrounding forest may shade the cliff face; shaded cliffs have less vegetation than sunny occurrences. Cliffs are small areas within surrounding forest, and reflect the vegetation of the surroundings.

Differentiating Occurrences: Three types of very sparsely vegetated plant communities have been identified on rock cliff faces, depending on the chemistry of the rock: Acidic, Circumneutral, and Calcareous (alkaline, named for calcium availability). Circumneutral and Calcareous Rock Cliff Communities have species that don't occur on Acidic Rock Cliffs, which vegetationally are less distinctive. In distribution, Circumneutral Rock Cliffs overlap with and are more widespread than Calcareous Rock Cliff Communities which are restricted to the Marble Valley and Connecticut Valley ecoregions. Circumneutral Rock Cliff communities would be expected to have some of the following characteristic species: columbine, pink corydalis, marginal wood-fern, ebony spleenwort, herb Robert, green rock-cress and/or and rock pellitory. Red cedar is more likely to be present in the vicinity of Circumneutral Rock Cliffs and associated outcrops than on either Acidic or Calcareous Cliffs and their associated rock outcrops. Calcareous Rock Cliff Communities include species requiring high nutrient levels (nutrient richness) or high pH, such as smooth rock-cress, lyre-leaved rock-cress, fragile rock-brake, purple cliff brake, and bulblet fern, that are not usually found in Circumneutral Rock Cliff Communities. Rocky summits, rock outcrops, and Open Talus/Coarse Boulder Communities also have bare rock and could be confused with Circumneutral Rock Cliff Communities. The differentiation between cliffs and rock outcrops/summits is arbitrary: cliffs are defined as vertical to near vertical (~60% slope). Open Talus/Coarse Boulder Communities have broken rock rather than continuous near-vertical rock faces. Ridgetop Pitch Pine - Scrub Oak and Ridgetop Heathland Communities occur on rock ridges, but are more densely vegetated than Circumneutral Cliff Communities, and are not near vertical overall.

Associated Fauna: All types of cliffs provide nesting habitat for Ravens (*Corvus corax*) and, increasingly, Peregrine Falcons (*Falco peregrinus*), as the offspring of Peregrine Falcons released in urban areas since 1984 have begun to return to the natural habitat to breed. Cliffs were probably the native habitat of the Eastern Phoebe (*Sayornis phoebe*). No mammals, reptiles, or amphibians would be expected on the steep cliff faces.

Public Access: Rocky Mountain Park, Greenfield; Mt. Tom State Reservation, Easthampton/ Holyoke; Mt. Sugarloaf State Reservation, Deerfield.

Threats: Rock climbing can break plants off of the cliff face, remove small pockets of soil, and wear lichens off of the rocks. Distinct trails appear on heavily used cliffs. Development in the vicinity of cliffs can be a threat, although most cliffs themselves are seldom directly threatened by development.

Management Needs:

USNVC/NatureServe: Includes some of: *Asplenium ruta-muraria - Pellaea atropurpurea* sparsely vegetated alliance -- *Asplenium ruta-muraria - Pellaea atropurpurea* sparse vegetation [CEGL004476]; *Juniperus virginiana - Corydalis sempervirens* cliff sparse vegetation (CEGL006422).

Circumneutral Rocky Summit/Rock Outcrop Community

Community Code: CT2A1B0000

State Rank: S2S3

Concept: A sparsely vegetated open community of grasses, sedges, and herbaceous plants occurring on rocky summits, ridges, or outcrops where the exposed bedrock is circumneutral.

Environmental Setting: This community is found on traprock ridges where it occurs on open ridgetops or steep slopes on exposed traprock. It is found on slopes facing southeast through southwest. These relatively small open areas are often found within an oak-forest matrix near hickory-hop hornbeam communities, with which it shares a number of herbaceous species. The community is also found on other types of circumneutral substrates such as conglomerate. The Circumneutral Rocky Summit/Rock Outcrop Community grades into the Circumneutral Rock Cliff Community near cliffs. Both types of sites are dry with soil confined to cracks in the rock.

Vegetation Description: Grasses, sedges, and forbs dominate this community. Occasional isolated trees of eastern red cedar (*Juniperus virginiana*), shagbark hickory (*Carya ovata*), sweet pignut hickory (*Carya glabra*), and white ash (*Fraxinus americana*) can also be found, so that some examples have an open, savanna-like appearance. The exposed rock is often covered with lichen and mosses (*Polytrichum* sp.). Except for the Carolina rose (*Rosa carolina*) and bearberry (*Arctostaphylos uva-ursi*), which are found on a number of sites, shrubs, including the less common hackberry (*Celtis occidentalis*), are usually restricted to the edge of the openings. The herbaceous layer can be patchy, occupying area between outcrops of rocks, or can be almost continuous where rocks are broken. Dominant species include Pennsylvania sedge (*Carex pensylvanica*), parasol-sedge (*C. umbellata*), poverty grass (*Danthonia*

spicata), and little bluestem grass (*Schizachyrium scoparium*). Other species typically encountered include rusty cliff fern (*Woodsia ilvensis*), rock spikemoss (*Selaginella rupestris*), early saxifrage (*Micranthes virginiensis*), arrow-leaved violet (*Viola sagittata*), small-flowered bittercress (*Cardamine parviflora*), skunk meadow-rue (*Thalictrum revolutum*), strawberry (*Fragaria virginiana*), dwarf dandelion (*Krigia virginica*), pink corydalis (*Capnoides sempervirens*), sleepy catchfly (*Silene antirrhina*), Venus's looking glass (*Triodanis perfoliata*), blue curls (*Trichostema dichotoma*), several species of goldenrods (*Solidago bicolor*, *S. nemoralis*), and other grasses (such as *Aristida dichotoma*, *Panicum* spp., and *Sorghastrum nutans*).

Differentiating Occurrences: Acidic and Calcareous Rocky Summit/Rock Outcrop communities: Presence of columbine (*Aquilegia canadensis*), climbing fumitory (*Adlumia fungosa*), red cedar (*Juniperus virginiana*), pink corydalis (*Capnoides sempervirens*), broad-leaved woodland-sedge (*Carex platyphylla*), ebony spleenwort (*Asplenium platyneuron*), bulblet fern (*Cystopteris bulbifera*), or fragile fern (*C. tenuis*) usually indicates less acidic conditions since these species typically occur in circumneutral outcrops. Presence of plantain-leaf sedge (*Carex plantaginea*), maidenhair spleenwort (*Asplenium trichomanes*), or walking fern (*Asplenium rhizophyllum*) more firmly indicate calcareous conditions. Acidic, Circumneutral, and Calcareous Rock Cliffs: the differentiation between cliffs and rock outcrops/summits is arbitrary. Cliffs are vertical to near vertical (about 60% slope). The assignment to type would be based on overall conditions; it is expected that small (less than about 5000 sq. ft.) patches would be considered to be variation of the surrounding type and would be included in that type. Rocky summit/rock outcrop communities are dominated by bare rock. Ridgetop Pitch Pine - Scrub Oak Communities also occur on rocky ridges, with pitch pine (*Pinus rigida*) and scrub oak (*Quercus ilicifolia*), but usually have less bare rock (this may not be true where abundant visitation has caused loss of plant and soil cover). In Scrub Oak Shrublands, scrub oak is dominant and dense, with few trees, but little bare rock is present. Ridgetop Heathland Community is dominated by heaths, usually lowbush blueberry (*Vaccinium angustifolium*). Depending on size, one site could have multiple types of these communities; if one community type is predominant and the others are in small areas within it, the dominant community type would be named with notes on the variation.

Associated Fauna: Most animals of rock outcrop communities are not sensitive to the chemistry of the rock, but rather are responding to the elevation and dryness of the habitat. Any differences in resident fauna between calcareous and acidic outcrops are most likely due to geographical differences in species distribution rather than to qualitative differences among the types of outcrops. Outcrops tend to be fairly small, and only a part of the habitat of most vertebrate animals. Small mammals of rock outcrop communities include those of dry habitats such as white-footed mouse (*Peromyscus leucopus*), short-tailed shrew (*Blarina brevicauda*) and, in grassy/sedgy areas with some soil accumulation, meadow voles (*Microtus pennsylvanicus*). Snakes would be those of dry areas, such as black racer (*Coluber constrictor*), ringneck (*Diadophis punctatus*), and redbelly snake (*Storeria*

occipitomaculata). No turtles, frogs or toads would be expected. Ravens (*Corvus corax*) are all around high elevations, especially near cliffs where they nest. Invertebrates include tiger beetles.

Public Access: Palmer WMA, Palmer; Mt. Holyoke Range State Park, Amherst/South Hadley/Granby; Mt. Tom State Reservation, Holyoke; Middlesex Fells, Stoneham.

Threats: The major threats are trampling and other uses by people including use of the outcrops as viewpoints. Succession appears to be proceeding slowly, if at all, on many of these sites. However, grazing and possibly fire may contribute to helping keep the areas open. Most sites that are not too steep have evidence of deer browse.

Management Needs: Trails should be kept away from these areas because readily accessible sites are used as viewpoints and picnic areas. Planning of trails should take the fragility of the sites into consideration.

USNVC/NatureServe: *Juniperus virginiana* Woodland Alliance -- *Juniperus virginiana - Fraxinus americana*/*Danthonia spicata - Poa compressa* Woodland [CEGL006002]; Related to: Central Appalachian Pine-Oak Rocky Woodland (CES202.600) *Schizachyrium scoparium - Danthonia spicata - Carex pensylvanica*/*Cladonia* spp. Herbaceous Vegetation (not cross-walked to MA from NVC).

Coastal Forest/Woodland

Community Code: CT1A2A2000

State Rank: S4

Concept: Coastal Forest/Woodlands are often shorter than forests further inland, but taller than Maritime Forest/Woodlands. There is often a dense shrub layer and vines, particularly near the edges.

Environmental Setting: Coastal Forest/Woodlands occur in protected areas along the coast, such as behind dunes and on slopes away from the ocean, and behind Maritime Forest/Woodlands. They are sheltered from direct daily maritime influences (they are not in the daily salt spray zone), but receive wind and salt during storms. The coastal climate has more moisture and warmer winters and cooler summers than more inland areas. The heights of Coastal Forest/Woodlands are variable but often 10-20m (~ 30 to 60 ft.) - not as tall as further inland, but taller than Maritime Forest/Woodlands. The deciduous canopy is often closed (>75% cover) with a dense to open shrub layer, some vines in openings and along edges, and a typically scattered herbaceous layer.

Vegetation Description: The Coastal Forest/Woodland is a variant of the widespread broadly defined Oak - Hemlock - White Pine Forest that includes a continuum of communities dominated by tree oaks and pines. Coastal Forest/Woodlands occur in the coastally moderated, moister part of the habitat spectrum and include multiple species with primarily southern distributions, such as American holly (*Ilex opaca*), black gum (*Nyssa sylvatica*), and sassafras (*Sassafras albidum*), all of which are regular associates. Tree oaks (scarlet oak (*Quercus coccinea*), black oak (*Q. velutina*), white oak (*Q. alba*), and chestnut oak (*Q. montana*)) are the dominant species of the Coastal Forest/Woodland, with post oak (*Q. stellata*) important in occurrences

along Buzzards Bay and on Martha's Vineyard. Red maple (*Acer rubrum*), black cherry (*Prunus serotina*), beech (*Fagus grandifolia*), pitch pine (*Pinus rigida*), and white pine (*P. strobus*) commonly occur in low percentages, but are occasionally abundant. American holly is a regular associate in southeastern occurrences. Red cedar (*Juniperus virginiana*) can be scattered in the forests, and sometimes is a dominant in woodland thickets. Sweet pepper-bush (*Clethra alnifolia*) is abundant in many sites. A low-shrub heath layer dominated by lowbush blueberries (*Vaccinium pallidum*, *V. angustifolium*) and black huckleberry (*Gaylussacia baccata*) is characteristic. The herbaceous layer is usually sparse, with Pennsylvania sedge (*Carex pensylvanica*), bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), and wild sarsaparilla (*Aralia nudicaulis*) being typical. Most occurrences of coastal forests have many vines on forest edges and in openings. Poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), grape (*Vitis* spp.), and greenbriers (*Smilax* spp.) can be locally abundant.

Differentiating Occurrences: Coastal Forest/Woodlands grade into Maritime Forest/Woodlands along the coast in the areas of daily salt spray; they grade into forests of the oak and oak-pine continuum on the inland side. Edges of communities on the ground may be difficult to differentiate, requiring arbitrary determinations of boundaries. Small patches (<5000 sq. ft.) of different types should be noted in descriptions, but considered as part of the variation of the prevailing community. Coastal Forest/Woodlands are within a few miles of the coast at <~60 ft. elevation. They are not affected by salt spray on a daily basis, but receive storm winds and spray. They are predominantly deciduous forests with canopies usually at about 10-20m (~30-60 ft.) and an often dense shrub layer consisting primarily of lowbush blueberry (*Vaccinium angustifolium*) and black huckleberry (*Gaylussacia baccata*).Maritime Forests/Woodlands are very near the ocean, receive regular salt spray, and have stunted canopies of mixed tree species. Oak - Hemlock - White Pine Forests and its named variants, including but not limited to Pitch Pine - Oak Forest/Woodlands, White Pine - Oak Forests, and Mixed Oak Forest/Woodlands abut and grade into Coastal Forest/Woodlands. They receive much less storm spray and mature examples are taller than 20m (~60 ft.). Forests dominated by pines are identified as those forest types.

Associated Fauna: No animal species are restricted to Coastal Forest/Woodlands. Animal are those of typical coastal oak areas such as the birds Eastern Towhee (*Pipilo erythrophthalmus*), Gray Catbird (*Dumetella carolinensis*), Common Yellowthroat (*Geothlypis trichas*), Ovenbird (*Seiurus aurocapillus*), and Black-and-white Warbler (*Mniotilta varia*). Small mammals, such as meadow voles (*Microtus pennsylvanicus*), and white-footed mice (*Peromyscus leucopus*), are common, with gray squirrels (*Sciurus carolinensis*) abundant in mainland forests. Eastern box turtles (*Terrapene carolina*) use Coastal Forest/Woodlands as parts of their habitats. Moths, butterflies, and other insects of the southeastern oak and oak-pine forest occur in Coastal Forest/Woodlands, including some uncommon species. High white-tailed deer (*Odocoileus virginianus*) densities may have an impact on the abundance of

native species, particularly woody seedlings such as oaks, as well as on herbaceous plants.

Public Access: William Forward WMA, Rowley; Acushnet WMA, Freetown; Nasketucket Bay State Reservation, Mattapoisett; Moraine Trail, Falmouth; Provincetown Beech Forest, Provincetown; Manuel F. Correllus State Forest, West Tisbury.

Threats: Invasive exotics, development.

Management Needs:

USNVC/NatureServe: A4209 *Quercus velutina - Quercus falcata - Pinus rigida* Coastal Plain Forest Alliance - *Quercus velutina - Quercus coccinea - Quercus prinus/Kalmia latifolia* Forest [CEGL006374]; *Quercus coccinea - Quercus velutina/Sassafras albidum/Vaccinium pallidum* Forest [CEGL006375]; *Quercus velutina/Ilex opaca* Forest [CEGL006378]; in part, *Pinus strobus - Quercus alba/Ilex glabra* Forest [CEGL006382].

Cultural Grassland

Community Code: CT2B2A1000

State Rank: SNR

Map: No Cultural Grasslands are documented in the NHESP database.

Concept: Requiring high maintenance, these communities usually result from plowing and sowing non-native grasses. They are normally maintained by frequent mowing and are primarily of conservation interest for the grassland bird community. The concept ideal for this community is pastures and hayfields: fields that are, or were recently, cultivated. Old fields, lands that were cleared and left to succession, usually contain more broad-leaved species than are intended in this concept.

Environmental Setting: Cultural Grasslands as a classification unit are intended to be grasslands that are cultivated or the results of cultivation, dominated by non-native agricultural grasses, maintained for pasture or hayfields; some airport grasslands and cemeteries with planted grasses would be included in the type. Cultural Grasslands occur in all areas of the state on a variety of soils, and surroundings reflect the regional variations. Most Cultural Grasslands are mowed at least annually to maintain the grassland stage. Hayfields have fewest native species, but some support grassland birds which are the primary conservation interest in Cultural Grasslands.

Vegetation Description: Cultural Grasslands are dominated by planted, non-native grasses such as timothy (*Phleum pratense*), orchard grass (*Dactylis glomerata*), smooth brome (*Bromus inermis*), and redtop (*Agrostis gigantea*). Pastures and hayfields provide different habitats and support different species of plants and animals.

Differentiating Occurrences: Cultural Grasslands as a classification unit are intended to be grasslands that are cultivated or the results of cultivation dominated by non-native agricultural grasses. Old fields, lands that were cleared and cultivated, then left to succession, usually contain more broad-leaved species than are intended in the cultural grassland concept (pastures and hayfields were the models). Sandplain Grasslands - Inland Variant and Sandplain Grasslands are dominated by native grasses, often the distinctive little bluestem (*Schizachyrium scoparium*). Sandplain Heathlands and Sandplain Heathlands - Inland Variant are dominated by native shrubs and look shrubbier than grasslands, with a shrub layer comprised of scrub oak (*Quercus ilicifolia*), black huckleberry (*Gaylussacia baccata*), and/or lowbush blueberry (*Vaccinium angustifolium* and/or *V. pallidum*) which may be dominant.

Associated Fauna: Distance to the coast and size of the grassland strongly affect the species that use pastures and hayfields. Many species of birds that use grasslands are more common in the midwestern prairies and agricultural fields. Grassland birds are found in a variety of habitats: for example, Bobolinks (*Dolichonyx oryzivorus*) in taller grasses found in hayfields and Eastern Meadowlarks (*Sturnella magna*) in shorter grasses

found in pastures. Other grassland birds include Killdeer (*Charadrius vociferus*) and Horned Larks (*Eremophila alpestris*). Meadow voles (*Microtus pennsylvanicus*), meadow jumping mice (*Zapus hudsonius*), and northern short-tailed shrews (*Blarina brevicauda*) would be expected in most grasslands. They would be hunted by garter snakes (*Thamnophis sirtalis*), long-tailed weasels (*Mustela frenata*), American Kestrels (*Falco sparverius*), and wintering Northern Harriers (*Circus cyaneus*), Snowy Owls (*Nyctea scandiaca*), and Short-eared Owls (*Asio flammeus*). Some of the lepidopteran fauna of Sandplain Grasslands would make use of Cultural Grasslands. Hayfields may attract grassland birds, but depending on the mowing schedule, may be population sinks when young are not able to fledge before mowing.

Public Access: Not tracked by NHESP.

Threats: Mowing too early for birds to fledge.

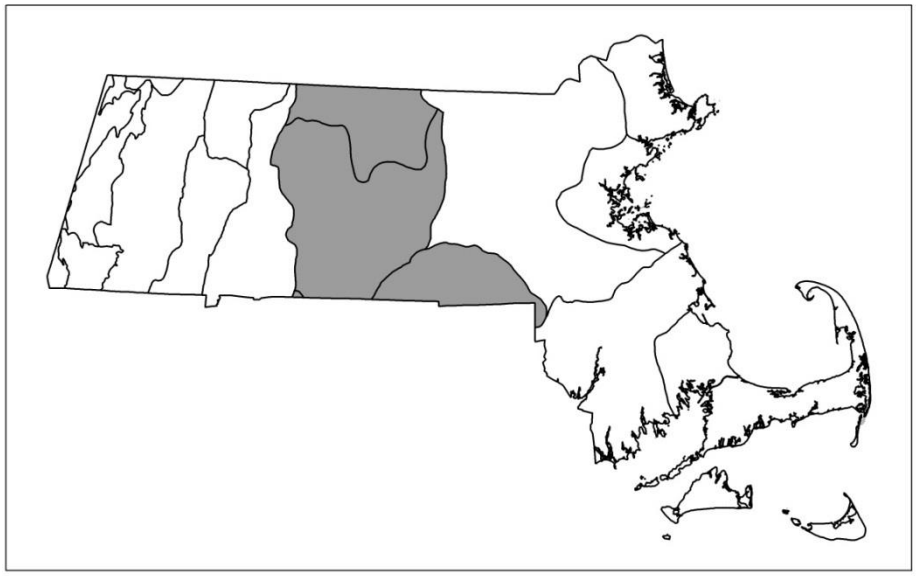
Management Needs:

USNVC/NatureServe: Related to: System: Semi-natural/Altered Vegetation and Conifer Plantations (CES203.074): Northeastern Old Field: CEGL006107 - *Dactylis glomerata* - *Phleum pratense* - *Festuca* spp. - *Solidago* spp. Herbaceous Vegetation.

Dry, Rich Oak Forest/Woodland

Community Code: CT1B1B0000

State Rank: S4



Concept: Deciduous, predominantly oak, forest with a rich understory of herbaceous plants and graminoids. The shrub layer has fewer ericaceous plants than other oak forests.

Environmental Setting: The oak-dominated canopy of Dry, Rich Oak Forest is somewhat open (50 - 75% cover) to mostly closed. This forest occurs on southwest-facing mid-slopes and coves, with well-drained, slightly acidic, often rocky soils of intermediate fertility. The steep slopes may include open rocky glades or occur near rock outcrop communities. A rich understory often includes legumes and false foxgloves. Most occurrences show evidence of recurrent fires (i.e., charred bases of trees, dead blackened shrubs or sprouts, burned duff) that maintain the open conditions.

Vegetation Description: In Dry, Rich Oak Forests, the tree canopy is dominated by a mixture of oaks (including red (*Quercus rubra*), black (*Q. velutina*), and white (*Q. alba*)), with lower amounts of sugar and red maple (*Acer saccharum* and *A. rubrum*), American beech (*Fagus grandifolia*), white ash (*Fraxinus americana*), and shagbark and other hickories (*Carya ovata*, *C. glabra*, and *C. tomentosa*). Eastern hemlock (*Tsuga canadensis*) is an occasional part of the canopy. Scattered hop-hornbeam (*Ostrya virginiana*) and flowering dogwood (*Benthamidia florida*) form an open subcanopy. A fairly sparse shrub layer includes saplings of canopy tree species, witch hazel (*Hamamelis virginiana*), and maple-leaved viburnum (*Viburnum acerifolium*). A rich herbaceous flora includes blunt-lobed hepatica (*Anemone americana*), perfoliate bellwort (*Uvularia perfoliata*), four-leaved milkweed (*Asclepias quadrifolia*), early meadow-rue (*Thalictrum dioicum*), false foxgloves (*Aureolaria flava*, *A. pedicularia*, and *A. virginica*), wild coffee (*Triosteum aurantiacum*), bush clovers (including

Lespedeza procumbens), tick-trefoils (*Desmodium rotundifolium* and others), and sedges such as reflexed sedge (*Carex retroflexa*), ribbed sedge (*Carex virescens*), and big star-sedge (*Carex rosea*).

Differentiating Occurrences: Dry, Rich Oak Forests are on the richer, less acidic end of a continuum of oak-dominated forests. The addition of occasional maples in the canopy, flowering dogwoods and hop-hornbeams in the subcanopy, and a shrub layer lacking abundant heaths distinguishes this from more acidic oak forests and woodlands, such as Mixed Oak, Open Oak, and Black Oak - Scarlet Oak Forests/Woodlands. On the rich end of the continuum, Dry, Rich Oak Forests are related to Sugar Maple - Oak - Hickory Forests that are moister and have a greater abundance of northern hardwoods (primarily sugar maple, basswood, and white ash). The herbaceous layer of Sugar Maple - Oak - Hickory Forests has fewer legumes and more spring ephemerals than Dry, Rich Oak Forests, and herbaceous species indicative of rich conditions such as herb Robert, wild geranium, and baneberry . Red Oak – Sugar Maple Transition Forests have a greater dominance of red oak and sugar maple than Dry, Rich Oak Forests, and they have a less dense and rich herbaceous layer, particularly lacking the legumes and false foxgloves. Dry, Rich Oak Forests may be an open, early successional variant of Oak - Hickory Forests that is maintained by regular or severe disturbance, particularly fire. They both lack abundant sugar maple, basswood, and white ash, and lack spring ephemerals and herbaceous species indicative of rich conditions. Both include a mix of tree oak species and prominent but not dominant hickories. Oak - Hickory Forests tend to have more closed canopies and less of an herbaceous layer. Flowering dogwood is more common in the subcanopy of Oak - Hickory Forests than in Dry, Rich Oak Forests, where it also occurs.

Associated Fauna: Dry oak forests support a smaller mix of animal species than are found in moister communities. There are no species known to be restricted to the Dry, Rich Oak Forest community. Common species of dry sites include short-tailed shrew (*Blarina brevicauda*), white-footed mouse (*Peromyscus leucopus*), and chipmunks (*Tamias striatus*). Snakes of dry forest sites include garter snakes (*Thamnophis sirtalis*) and redbelly snakes (*Storeria occipitomaculata*). Birds that nest in dry oak forests include Eastern Wood-Pewee (*Contopus virens*), Red-eyed Vireo (*Vireo olivaceus*), Scarlet Tanager (*Piranga olivacea*), and Ovenbird (*Seiurus aurocapillus*).

Public Access: Northfield State Forest, Northfield.

Threats: Exotics; Japanese barberry (*Berberis thunbergii*) is reported from several sites.

Management Needs: Removal of exotics in exemplary cases.

USNVC/NatureServe: No direct equivalents: related to A3303 *Quercus rubra - Acer saccharum - Betula lenta* Forest Alliance -- *Acer saccharum - Quercus rubra*/*Hepatica nobilis* var. *obtusa* Forest [CEGL006046] which is better crosswalked to Sugar Maple - Oak - Hickory Forest. Other descriptions are close to various Oak - Hickory Forest associations, including *Quercus rubra - Carya* (*glabra*, *ovata*)/*Ostrya virginiana Carex lucorum*

Forest (Oak-Hickory/Hop hornbeam/Sedge Forest) [CEGL006301] in A2053 *Quercus alba* - *Carya* spp. - *Fraxinus americana* Forest Alliance.

Forest Seep Community

Community Code: CT1C2B1000

State Rank: S4

Concept: Small (usually <0.25 ac) pockets in forests on slopes, with small springs and seeps on mucky soils. The canopy is from or similar to the surrounding forest, but shrub and herbaceous layers species are typical of wetlands or moist areas.

Environmental Setting: Forest Seep Communities are very small (often <<1 ac) wetlands in upland forests. They occur where groundwater emerges, often on a slope or at the base of one, as patches or linear areas perpendicular to slopes. Seeps may produce or be near stream headwaters, or may be isolated with the water absorbed into the surroundings. Upland trees rooted in the surrounding forest form the canopy, but species of the shrub and herbaceous layers are predominantly those of wetlands or moist areas. Seeps support diverse herbaceous layers suggesting nutrient enrichment relative to the surroundings. Downed logs are common due to the slopes and wet soils promoting periodic windthrow. The ground surface is generally dominated by plant litter, though there may be areas of bare soil and scattered stones. The soils are generally mineral, although a shallow organic layer may form.

Vegetation Description: In Forest Seep Communities, the canopy is primarily (>75% cover) from trees from the surrounding forest that are rooted outside the seep. Because Forest Seep Communities occur statewide in all types of forest, the canopy cover trees may be northern hardwoods, conifers, oak, or mixed. The shrub layer is variable, dense, or barely present, and may include mixed wetland and upland plants including (depending on location) highbush blueberry (*Vaccinium corymbosum*), mountain laurel (*Kalmia latifolia*), hobble-bush (*Viburnum lantanoides*), swamp dewberry (*Rubus hispidus*), silky dogwood (*Swida amomum*), winterberry (*Ilex verticillata*),

and, in coastal areas, sweet pepperbush (*Clethra alnifolia*). Many Forest Seep Communities have dense herbaceous layers, with species dependent on location in the state. Golden saxifrage (*Chrysosplenium americanum*) primarily occurs in seeps. Jewelweeds (*Impatiens* spp.), golden ragwort (*Packera aurea*), and crooked-stemmed aster (*Symphyotrichum prenanthoides*) are typical, but not restricted to seeps. Scouring rush (*Equisetum hyemale*), water avens (*Geum rivale*), and an assortment of sedges, including eastern rough sedge (*Carex scabrata*), bladder sedge (*Carex intumescens*), and three-seeded sedge (*Carex trisperma*), are among the other plants regularly found at seeps. A mix of wetland and upland ferns may also be present, including cinnamon fern (*Osmundastrum cinnamomeum*), ostrich fern (*Matteuccia struthiopteris*), silvery spleenwort (*Deparia acrostichoides*), rattlesnake fern (*Botrychium virginianum*), and Christmas fern (*Polystichum acrostichoides*). Some Forest Seep Communities have dense, shallow patches of sphagnum or other non-vascular plants. Invasive species can include multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), and common buckthorn (*Rhamnus cathartica*).

Differentiating Occurrences: The intention of defining Forest Seep Communities is to identify small areas that retain the overstory of the surrounding upland forest, but are wet and may not show up as wetlands on wetlands maps. Sites where wetland trees rooted in a seep contribute >25% of the canopy cover are defined as swamps. Swamps may receive seepage waters at upland edges; however, the vegetation of such areas is considered to be a variation in the swamp community and not separated out as separate community types. Seeps in forested edges of streams or stream corridors, including intermittent streams, can produce linear versions of this community, or grade into floodplain or alluvial forests dominated by wetland tree species. Riverside Seep Communities occur at the base of steep riverbanks where groundwater emerges out of the upland slope; they are generally not forested and are associated with High-energy Riverbank Communities along high-gradient, fast-flowing rivers. Many calcareous wetland communities receive seepage waters, but are defined as separate communities with distinct floras. Rich, Mesic Forests on slopes can have seasonally seepy patches that are included in the forest variation and not separated as distinct communities.

Associated Fauna: These small communities provide parts of the habitats of the species of surrounding communities. Most tree-dwelling species would not be affected by the presence of small seeps below. Star-nosed moles (*Condylura cristata*) would be expected in seeps of any kind. If the water from the seeps stays in topographic low areas, those may function as vernal pools and support vernal pool breeding species. Where mounds of sphagnum moss build up, four-toed salamanders (*Hemidactylium scutatum*) may be found, and in larger patches, southern bog lemmings (*Synaptomys cooperi*) may be present.

Public Access: Russell Millpond Conservation Area, Plymouth; Southeast Mass Bioreserve, Fall River; Warwick State Forest, Warwick; Hiram Fox WMA, Huntington.

Threats: Invasive exotic species include multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), common buckthorn (*Rhamnus cathartica*), water-cress (*Nasturtium officinale*), forget-me-not (*Myosotis scorpioides*), and yellow iris (*Iris pseudacorus*). Water flow needs to be maintained (could be impacted by large wells). Several locations have had natural mud or rock slides

Management Needs: Exotic removals in sites where practical.

USNVC/NatureServe: A1685 *Carex scabrata - Chrysosplenium americanum* Herbaceous Seep Alliance -- *Chrysosplenium americanum* Herbaceous Vegetation [CEGL006193]; and A3374 *Impatiens capensis - Symplocarpus foetidus - Tiarella cordifolia* Herbaceous Seep Alliance -- *Symplocarpus foetidus - Impatiens capensis* Herbaceous Vegetation [CEGL006567] and *Symplocarpus foetidus* - Mixed Forbs Seep [CEGL002385]. Calcareous seeps are explicitly within definition of Rich, Mesic Forest *Acer saccharum - Fraxinus americana - Tilia americana/Acer spicatum/Caulophyllum thalictroides* Forest [CEGL005008].

Hemlock Forest

Community Code: CT1C1C0000

State Rank: S4

Concept: Dense canopies dominated by hemlocks, with 80 to 100% closure. Little understory grows in the shade of the hemlocks.

Environmental Setting: Hemlock Forests are broadly defined in Massachusetts. A dense canopy with at least 50% cover of eastern hemlock is the key characteristic. The closed conifer canopy allows little light through and restricts growth in lower layers. Hemlock Forests are often on rocky north or north-west facing slopes in sheltered ravines, and along high-gradient streams. The soils are usually acidic and nutrient-poor, with a thick, poorly decomposed duff layer. The forest floor is covered by needles, twigs, and small branches.

Vegetation Description: Hemlock Forests are dominated by eastern hemlock (*Tsuga canadensis*). In this widespread community, associated species, all occurring at very low percentages, vary with location: red spruce (*Picea rubens*) or white pine (*Pinus strobus*) may be present with maples (*Acer rubrum*, *A. saccharum*), American beech (*Fagus grandifolia*), yellow or black birch (*Betula alleghaniensis* and *lenta*), or oaks (scarlet, chestnut, red, white, and black) (*Quercus coccinea*, *prinus*, *rubra*, *alba*, and *velutina*). The shrub layer is sparse with saplings of the canopy species and small patches of mountain laurel (*Kalmia latifolia*), witch hazel (*Hamamelis virginiana*), striped maple (*Acer pensylvanicum*), or hobblebush (*Viburnum lantanoides*) growing in occasional canopy gaps created by windthrows. Eastern hemlock saplings may persist in the understory for many decades, to be released to grow into maturity when canopy gaps occur. The herbaceous layer is essentially non-existent except in scattered opening that may have Canada mayflower (*Maianthemum canadense*),

starflower (*Lysimachia borealis*), wild sarsaparilla (*Aralia nudicaulis*), rock polypody (*Polypodium virginianum*), hay-scented fern (*Dennstaedtia punctilobula*), intermediate wood fern (*Dryopteris intermedia*), or mountain wood fern (*D. campyloptera*), with occasional patches of shining fir-moss (*Huperzia lucidula*). Non-vascular plants may form dense patches. The non-native invasive species hemlock woolly adelgid (*Adelges tsugae*) is killing eastern hemlock across the state; black birch is common following the death of hemlocks.

Differentiating Occurrences: Many forests have eastern hemlock as a component of the canopy but Hemlock Forests are differentiated by having eastern hemlock as the dominant canopy species (>50% canopy cover) throughout the community. Forests with scattered patches of hemlock that are functionally variations in the surrounding forest include Oak - Hemlock - White Pine Forest and Northern Hardwoods - Hemlock - White Pine Forest. These mixed forests have much greater diversity in all layers than do Hemlock Forests. Hemlock Swamps are also dominated by eastern hemlock, but are wetlands; Hemlock Forests are upland communities.

Associated Fauna: Birds that nest or forage in canopies or mid sections of conifers don't differentiate between wet or dry sites: many birds of upland conifer forest also use conifer swamps. Acadian Flycatchers (*Empidonax virescens*) are a near-obligate of Hemlock Forests in Massachusetts, although their habitats are broader to the north. Other species that use Hemlock Forest tend to be northern or conifer-preferring forest species, including birds such as Black-throated Green Warbler (*Dendroica virens*), Blackburnian Warbler (*D. fusca*), Louisiana Waterthrush (*Parkesia motacilla*), and Winter Wren (*Troglodytes hiemalis*). In the winter, mixed flocks are common with chickadees (*Poecile atricapillus*), kinglets (*Regulus* spp.), and nuthatches (*Sitta* spp.). Mammals include those that are widespread and typical of northern and coniferous forests: red squirrels (*Tamiasciurus hudsonicus*), red-backed voles (*Clethrionomys gapperi*), smoky shrews (*Sorex fumeus*), and white-footed mice (*Peromyscus leucopus*).

Public Access: Mt. Everett State Reservation, Mount Washington; Otis State Forest, Sandisfield; Windsor State Forest, Windsor; Monroe State Forest, Monroe.

Threats: Hemlock hosts the non-native hemlock woolly adelgid (*Adelges tsugae*), which usually kills a hemlock tree after it is fully infested. Elongate hemlock scale (*Fiorinia externa*) is another non-native insect that can cause death to hemlocks.

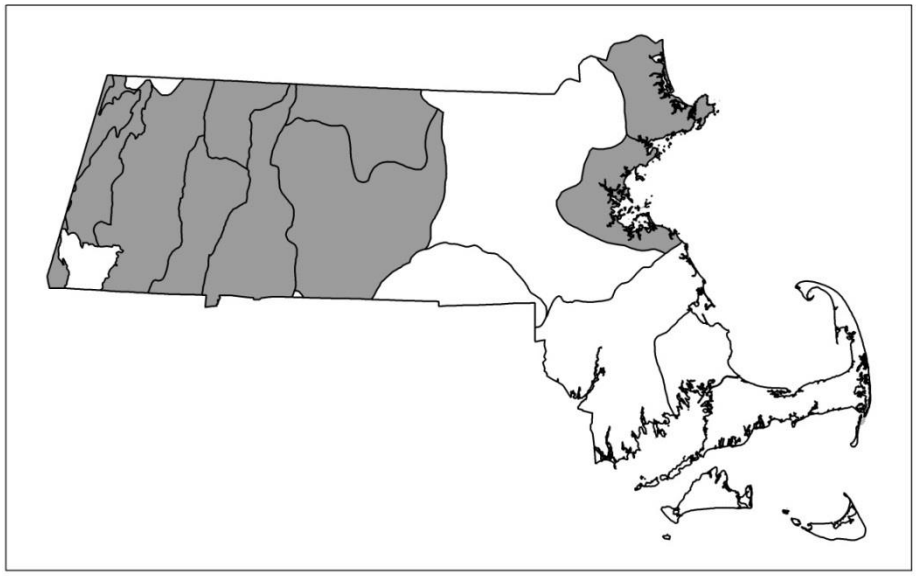
Management Needs:

USNVC/NatureServe: A3251 *Pinus strobus - Tsuga canadensis* Forest Alliance - *Tsuga canadensis* - (*Betula alleghaniensis*) - *Picea rubens*/*Cornus canadensis* Forest [CEGL006129] and *Tsuga canadensis - Betula alleghaniensis - Acer saccharum*/*Dryopteris intermedia* Forest [CEGL006638]; A3302-*Tsuga canadensis - Betula lenta - Betula alleghaniensis* Forest Alliance - *Pinus strobus - Tsuga canadensis* Lower New England, Northern Piedmont Forest [CEGL006328].

Hickory – Hop Hornbeam Forest/Woodland

Community Code: CT1B2B1000

State Rank: S2



Concept: Mixed-hardwood, open forests with a sparse shrub layer. A nearly continuous cover of graminoids includes a rich diversity of herbaceous flora.

Environmental Setting: Hickory - Hop Hornbeam Forests/Woodlands are typically short with a variable canopy cover, often ~ 60%, contributing to a characteristic park-like appearance, produced by a sparse shrub layer and a nearly continuous graminoid cover. In Massachusetts, many Hickory - Hop Hornbeam Forest/Woodlands are associated with traprock (basaltic) ridges of the Connecticut River Valley Highlands where they are found on mid-slopes (15-20 degrees) with southern or eastern exposures. Occurrences of the community tend to be very small patches (< 10 acres, with some notable exceptions), often clustered within the surrounding matrix forest on thin, well-drained soils, generally on somewhat flattish midslopes with steeper slopes above and below. They are often below balds and rock outcrops of somewhat nutrient-enriched rock. There is great variation in environmental conditions among sites, perhaps reflecting past land use that included sheep pasturing.

Vegetation Description: Hickory - Hop Hornbeam Forests/Woodlands typically have shagbark, pignut, and mockernut hickories (*Carya ovata*, *C. glabra*, and *C. tomentosa*) as the dominant overstory trees, mixed with red oak (*Quercus rubra*) and white ash (*Fraxinus americana*). Red and sugar maples (*Acer rubrum* and *A. saccharum*) can also be present in lower numbers. Hop hornbeam (*Ostrya virginiana*) is a regular and abundant subcanopy tree. The shrub layer is generally sparse. The forest floor is characteristically covered by patches of long-beaked Pennsylvania sedge (*Carex lucorum*) with Pennsylvania sedge (*C. pensylvanica*), other sedges such as

long-stalked sedge (*C. pedunculata*) and loose-flowered woodland-sedge (*C. laxiflora*), and grasses including bottlebrush grass (*Elymus hystrix*), poverty grass (*Danthonia spicata*), and the non-native Canada bluegrass (*Poa compressa*), with scattered violets (*Viola palmata*), blunt-lobed hepatica (*Anemone americana*), wood sorrels (*Oxalis* spp.), and several species of tick-trefoils (including *Hylodesmum glutinosum* and *Desmodium paniculatum*). Some sites have dense late summer forbs including asters (such as big-leaved and white wood asters (*Eurybia macrophylla* and *E. divaricata*), blue heart-leaf aster (*Symphyotrichum cordifolium*), and stiff aster (*Ionactis linariifolia*)), goldenrods (*Solidago* spp.), and bonesets (*Eupatorium* spp.).

Differentiating Occurrences: Hickory - Hop Hornbeam Forests/Woodlands have a park-like appearance with sparse shrub layer and a distinctive sedge understory. Hickories dominate the canopy with hop hornbeam forming a subcanopy. Oak - Hickory Forest canopies are generally closed or almost closed, with white and black oaks, rather than primarily red oak. Hickories are consistently present but not dominant. Flowering dogwood is characteristic. Shrubs are sparse but more abundant and more diverse than in Hickory - Hop Hornbeam Forests/Woodlands. Dry, Rich Oak Forests are dominated by oaks rather than hickories, the subcanopy is not dominated by hop hornbeam, and they lack the extensive sedge lawn of Hickory - Hop Hornbeam Forests/Woodlands. Mixed Oak Forests/Woodlands and other oak-dominated woodlands have a continuous low shrub layer formed by members of the blueberry family which are not characteristic of the Hickory - Hop Hornbeam Forests/Woodlands.

Associated Fauna: These are small community occurrences and tend to be part of the habitat of species using the surrounding forests. Species of dry sites are most likely to occur in the community occurrences.

Public Access: Catamount WMA, Colrain; Walnut Hill WMA, Middlefield; Joseph Skinner State Park, Hadley; Palmer WMA, Palmer; Wachusett Meadow Wildlife Sanctuary (Massachusetts Audubon Society), Princeton; Middlesex Fells, Medford.

Threats: Exotics: black swallow-wort (*Cynanchum louiseae*), common buckthorn (*Rhamnus cathartica*).

Management Needs: Control exotics where possible. Limit trails.

USNVC/NatureServe: A2053 *Quercus alba* - *Carya* spp. - *Fraxinus americana* Forest Alliance -- *Quercus rubra* - *Carya* (*glabra*, *ovata*)/*Ostrya virginiana*/*Carex lucorum* Forest [CEGL006301].

High Elevation Spruce – Fir Forest/Woodland

Community Code: CT1D300000

State Rank: S1

Concept: Forest/woodland with trees dwarfed from wind on the ridgeline of the tallest, most exposed mountain in Massachusetts. Conifers (balsam fir and red spruce) dominate and often form dense thickets.

Environmental Setting: High Elevation Spruce - Fir Forests/Woodlands are very uncommon in Massachusetts, occurring only above 915 m (3000 ft.) at the highest elevations in the state on the upper and often very steep northern slopes of the Mt. Greylock massif. Strong winds and heavy winter snow and ice sculpt and stunt plant growth producing a dense, short (approximately 5-10m (15-33 ft.)), and often patchy tree canopy. The soils are generally thin, acidic, and nutrient-poor and often there are areas of exposed granite, schist, or gneiss bedrock. The evergreen canopy trees and their associates are adapted to severe weather conditions with a relatively short growing season and low average temperatures. Species diversity is naturally low, but includes plants and animals that, like the community, are very rare here but more common to the north. Due to the cold temperatures and acidity of the habitat and conifer needles, decomposition of the organic matter is slow, resulting in a thick humus layer.

Vegetation Description: High Elevation Spruce - Fir Forests/Woodlands are low-diversity coniferous forest of high elevations, usually on steep stony, upper slopes or level ridgetops. Balsam fir (*Abies balsamea*) is dominant, associated with red spruce (*Picea rubens*). Paper birch, heart-leaf paper birch (*Betula papyrifera* and *B. cordifolia*), and yellow birch (*B. alleghaniensis*) occur in lower numbers. Where there is light, shrubs such as mountain maple (*Acer spicatum*), mountain holly (*Ilex mucronata*), American

mountain ash (*Sorbus americana*), and hobblebush (*Viburnum lantanoides*) may grow. A few sedges are present in low amounts, including northern stalked sedge (*Carex debilis* var. *rudgei*) and New England sedge (*C. novae-angliae*). Bluebead lily (*Clintonia borealis*), mountain wood-sorrel (*Oxalis montana*), bunchberry (*Chamaepericlymenum canadense*), bristly clubmoss (*Spinulum annotinum*), and shining fir-moss (*Huperzia lucidula*) grow scattered on a thick layer of needles or on mosses that form thick mats on fallen logs and on the forest floor.

Differentiating Occurrences: In Massachusetts, High Elevation Spruce - Fir Forest/Woodland occurs only on the Greylock massif at the very highest elevations in the state. It has short, sculpted trees with >75% spruce and fir combined, with the rest of the canopy dominated by birches with other northern hardwoods. Downslope they grade into Spruce - Fir - Northern Hardwoods Forests that occur at slightly lower elevations in the Berkshires and also in the higher elevation areas of the northern Worcester Plateau. Spruce - Fir - Northern Hardwoods Forest has taller, less windswept trees; red spruce is a dominant or at least present with other conifers including balsam fir and eastern hemlock, as well as northern hardwoods. If spruce or fir is present in Northern Hardwoods - Hemlock - White Pine Forests or Successional Northern Hardwood Forests, it is as scattered individuals, <25% cover.

Associated Fauna: The top of Massachusetts's highest, most exposed mountain provides habitat for some northern animals such as Swainson's Thrush (*Catharus ustulatus*) and Yellow-bellied Flycatcher (*Empidonax flaviventris*), as well as several state-protected species. Also expected would be more widespread species that use conifer forests, such as snowshoe hare (*Lepus americanus*), porcupine (*Erethizon dorsatum*), northern flying squirrel (*Glaucomys sabrinus*), deer mouse (*Peromyscus maniculatus*), and birds such as Olive-sided Flycatcher (*Contopus cooperi*).

Public Access: Mt. Greylock State Reservation, Adams.

Threats: Development of the summit, clearing for paving, trails, ski lift facilities, or communications towers. In these areas, some non-native invasive grasses such as sweet vernalgrass (*Anthoxanthum odoratum*) and other graminoid species can be a problem. Climate change is expected to affect the community in Massachusetts, as they only occur at our coolest, highest elevations now. The forest pests and fungi that affect red spruce and balsam fir may be more vigorous in a warmer climate, further damaging trees that have other environmental stresses as well.

Management Needs: Due to the rarity of this forest type in the state, efforts to remove non-native invasive species should be pursued. It is very important to protect the remaining acreage of this community from avoidable disturbances, such as increased clearing for parking and road work and ongoing problems of siltation and sedimentation from existing roadways and parking lots. Long-term monitoring of the species composition of this community would be helpful in order to increase understanding and protection efforts.

USNVC/NatureServe: A0150 *Picea rubens* - *Abies balsamea* Forest Alliance -- *Abies balsamea*- (*Betula papyrifera* var. *cordifolia*) Forest [CEGL006112]; A3314 *Picea rubens* Woodland Alliance -- *Picea rubens*/*Vaccinium angustifolium* - *Sibbaldiopsis tridentata* Woodland [CEGL006053].

Maritime Beach Strand Community

Community Code: CT2B1A0000

State Rank: S3

Concept: Sparsely vegetated, long, narrow community between wrack line of high tide and foredunes.

Environmental Setting: Usually part of a barrier beach system, seaward of dunes, but above the daily high tides. Beach strands are subject to overwash during storms and spring tides. Sand is the primary substrate for the community, but cobble substrate is included in the community type.

Vegetation Description: Sparsely vegetated community with scattered cover of sea-rocket (*Cakile edentula* ssp. *edentula*) and dunegrass (*Ammophila breviligulata* ssp. *breviligulata*). Beach pea (*Lathyrus japonicus*), seabeach orache (*Atriplex cristata*), seabeach sandwort (*Honckenya peploides*), seaside-flatsedge (*Cyperus filicinus*), seabeach saltwort (*Salsola kali* ssp. *kali*) and seaside goldenrod (*Solidago sempervirens*) occasionally occur at the foot of the dunes or on protected beaches, along with the non-native Russian thistle (*Salsola tragus*). The wrack line has seed sources for (re)establishment of plants on the beach.

Differentiating Occurrences: Maritime Beach Strand Communities are above the daily high tides, between the wrack line and the dunes, and have scattered vascular plants. Marine Intertidal Gravel/Sand Beach Communities are below the wrack line and submerged twice daily by tides. Any vegetation in the Marine Intertidal Gravel/Sand Beach Community is non-vascular.

Associated Fauna: Several species of shorebird are beach specialists, nesting and foraging on beach strands, including Least Terns (*Sterna antillarum*), Piping Plover (*Charadrius*

melodus), and American Oystercatcher (*Haematopus palliatus*). Beach strands are important shorebird staging areas: migratory shorebirds use barrier beach systems, including the beach strand community, for resting and congregating before and during migration. Merlins (*Falco columbarius*) and Peregrine Falcons (*Falco peregrinus*) forage on beaches during migrations. No amphibians or reptiles regularly occur on beaches. Mammal use of beaches tends to be for feeding, often on debris brought in with wrack and invertebrates under the wrack line, by species such as red fox (*Vulpes vulpes*), gray fox (*Urocyon cinereoargenteus*), striped skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), and coyote (*Canis latrans*). Generalist small mammals feed on debris, seeds, and invertebrates in the wrack line. Seals (mostly *Phoca vitulina*) haul out on beaches to rest. Invertebrate specialists include several species of tiger beetles, beach flies, and, on the south side of the Cape, ghost crabs at their northern limit of distribution.

Public Access: Cape Cod National Seashore; Monomoy National Wildlife Refuge, Orleans/ Chatham; Horseneck Beach State Reservation, Westport; Parker River National Wildlife Refuge, Newbury; Boston Harbor Islands, Boston area.

Threats: Recreational use, foot and vehicular traffic. Invasive species: seabeach poppy (*Glaucium flavum*). Raking. Sea-level rise will swamp existing beach strand communities.

Management Needs: Allow natural disturbances: deposition and erosion, and exposure to overwash and salt spray with wrack material left in place. Restrict or eliminate vehicle traffic.

USNVC/NatureServe: Includes: Sand Flats- *Cakile edentula* Sparsely Vegetated Alliance -- *Cakile edentula* ssp. *edentula* - *Chamaesyce polygonifolia* Sparse Vegetation [CEGL004400]. (Park name at Cape Cod National Seashore - North Atlantic Upper Ocean Beach). In Ecological Systems: Northern Atlantic Coastal Plain Sandy Beach (CES203.301) Central Atlantic Coastal Plain Sandy Beach (CES203.064)

Maritime Dune Community

Community Code: CT2B1B0000

State Rank: S3

Concept: This is the classic community of dynamic sand dunes, with patches of herbaceous plants interspersed with areas of bare sand and shrubs, often part of a barrier beach system.

Environmental Setting: Maritime Dune Communities are usually in barrier beach systems in a mosaic with other communities on the dynamic system's shifting sands in an extremely harsh physical environment. Winds move and carry salt; wind-blown sands prune and bury plants. Together, the salt and sand limit species diversity. The dunes behind the beachfront may occur as a single ridge or a series of parallel ridges that extend back through shrub and forest thickets to salt marsh and tidal flats associated with the protected bay or estuarine system. The dunes directly behind the beach are the most severely stressed by wind and airborne salt. These shifting foredunes are stabilized by colonies of beachgrass. Few other plants in the beach/dune community grow out into the unprotected foredunes. On back dunes, Maritime Dune Communities are sparsely vegetated with patches of herbaceous or low shrubby plants interspersed with areas of bare sand, and often grade into shrubland or woodland communities in more sheltered areas. Vegetation in wet areas between dunes is classified separately as a distinct Interdunal Marsh/Swale community. Ability of dunes to move is an important part of the habitat they provide.

Vegetation Description: The Maritime Dune Community is characterized by expanses of dunegrass (*Ammophila breviligulata* ssp. *breviligulata*) and beach heather (*Hudsonia tomentosa*), with seaside goldenrod (*Solidago sempervirens*) and beach pea

(*Lathyrus japonicus*). Poison ivy (*Toxicodendron radicans*) is often dense. Shrubs such as bearberry (*Arctostaphylos uva-ursi*), bayberry (*Morella pensylvanica*), lowbush blueberry (*Vaccinium angustifolium*), sweet fern (*Comptonia peregrina*), and beach plum (*Prunus maritima*) grow on protected slopes and some interdunal areas; shrubs can become abundant and form extensive shrublands. Salt hay (*Spartina patens*), common hairgrass (*Deschampsia flexuosa*), little bluestem (*Schizachyrium scoparium*), and poverty grass (*Danthonia spicata*) can be common grasses in protected areas of the community. Beach pinweed (*Lechea maritima*), and jointweed (*Polygonum articulatum*) grow mixed with beach heather. Scattered pitch pines (*Pinus rigida*) occur in some dune systems. Actual composition and structure of the vegetation depends upon recent dune stability (deposition and erosion) and distance from the ocean.

Differentiating Occurrences: Barrier beach and dune communities occur in mosaics that shift location over time as the dunes move. Even in stable situations, the community edges may not be clear. Sandplain Heathlands are structurally similar to Maritime Dune Communities in that they have low shrubby herbaceous and grassy plants with patches of bare soil. Along the edges of dunes, Sandplain Heathlands and Maritime Dune Communities may overlap: Maritime Dune Communities are on dunes and dominated by beach grass and beach heather, which are much less dominant in the mix of species in Sandplain Heathlands. However, the communities may be so similar or change so gradually that it may be necessary to arbitrarily assign to a type based on the land form or the prevailing type. Maritime Dune Communities are the most sparsely vegetated communities on the dune systems, with scattered patches of low shrubs, including red cedar, pitch pines, bayberry, herbaceous species, and grasses with bare sand. The various maritime shrubland, woodland, and forest communities all have dominance of woody plants in larger areas than occur in the dune community, but may also be on dunes and could be considered to be subtracted from the broad definition of maritime communities on dunes. These include Maritime Juniper Woodland/Shrubland, Maritime Pitch Pine Woodlands on Dunes, and Maritime Shrubland communities. Very small patches of any type within another community should be considered to be part of the variation of the other community.

Associated Fauna: A variety of seabirds, shorebirds, and songbirds nest at the base and sides of dunes and in the interdunal area. The particular species depend upon topography, hydrologic regime, and the amount and type of plant cover. Vernal pools occur in some dune systems, serving as important feeding and breeding areas for a variety of reptiles and amphibians, invertebrates, and birds and mammals. Diamondback terrapins (*Malaclemys terrapin*) use dunes for nesting. The state-listed dune noctuid moth (*Sympistis riparia*, Special Concern) occurs in dunes.

Public Access: Sandy Neck Beach Conservation Area, Barnstable; Cape Cod National Seashore, Wellfleet; Boston Harbor Islands, Hingham; Parker River National Wildlife Refuge, Newburyport.

Threats: Exotics (*Lonicera morrowii*, *Lythrum salicaria*, *Artemisia stelleriana*). Traffic (foot as well as vehicular) breaks the surface structure and removes vegetation. Road cuts change wind patterns and so alter deposition, erosion, and vegetation.

Management Needs: Removal of exotics at the best sites. An important threat to dunes is direct disturbance to the integrity of dunes from off-road vehicles, mountain bicycle, or even foot traffic. Loss of vegetation accelerates erosion, and rapid sand loss may not be balanced by new sand from the beach. Protection from damaging access is essential. Although measures to address unusual erosion may be needed to restore disturbed sites, some erosion is a normal part of dune systems and provides important habitat for specialized species.

USNVC/NatureServe: NVC System includes: CES203.264 Northern Atlantic Coastal Plain Dune and Swale. Includes multiple associations (others are wooded and not part of MA Dune community): (*Morella pensylvanica*)/*Schizachyrium littorale- Aristida tuberculosa* Shrub Herbaceous Vegetation (CEGL006161, GNR); *Ammophila breviligulata - Lathyrus japonicus* Herbaceous Vegetation (CEGL006274, G4?); *Deschampsia flexuosa* Herbaceous Vegetation (CEGL006621, GNR); *Hudsonia tomentosa - Arctostaphylos uva-ursi* Dwarf-shrubland (CEGL006143, G2G3); *Morella pensylvanica/Schizachyrium littorale- Danthonia spicata* Shrub Herbaceous Vegetation (CEGL006067, G2); *Smilax glauca - Toxicodendron radicans* Vine-Shrubland (CEGL003886, G1G2).

Maritime Erosional Cliff Community

Community Code: CT2B1E0000

State Rank: S2

Concept: Extremely sparse vegetation on cliffs being actively eroded by the sea.

Environmental Setting: The Maritime Erosional Cliff Community occurs on cliffs being actively eroded by the sea; storms particularly cause dramatic changes. The seaward-facing unconsolidated cliff faces above beach strand communities are in the salt spray zone where wind and salt spray constantly dry the vegetation. The cliffs themselves may be glacial deposits, best developed on terminal moraines usually with mixed material, including boulders, gravel, sand, and lenses of clay. There are also cliffs of sand from glacial outwash or dunes. The unconsolidated cliff material generally does not hold water which, combined with the wind, produces a very dry environment. Freshwater flowing through the cliff material may emerge as seepage at the base. With the constant erosion there is little soil development on the cliff face. Maritime Erosional Cliffs may be 100 ft. (~33m) or more high above the ocean and beach below.

Vegetation Description: The Maritime Erosional Cliff Community generally has extremely sparse vegetation that is typical of surrounding areas: shrubs and vines may include poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), wild roses (*Rosa carolina* and *R. rugosa*), bayberry (*Morella pensylvanica*), sweet fern (*Comptonia peregrina*), beach plum (*Prunus maritima*), black cherry (*Prunus serotina*), huckleberry (*Gaylussacia baccata*), bearberry (*Arctostaphylos uva-ursi*), catbriar (*Smilax rotundifolia*) or the non-native bush honeysuckles (*Lonicera* spp.) or multiflora rose (*Rosa multiflora*). Scattered herbaceous plants include native seaside yarrow and non-native yarrow (*Achillea millefolium* ssp. *lanulosa* and *A.*

millefolium ssp. *millefolium*), non-native mugwort (*Artemisia vulgaris*), and other species typical of disturbed areas. Vegetation is densest on less steep areas, especially steps in the cliff face that may support dunegrass (*Ammophila breviligulata* ssp. *breviligulata*) and non-native grasses. Some sites have dense non-native vegetation. The base of erosional cliffs is often moist from seeps. In areas with freshwater seepage common horsetail (*Equisetum arvense*) and the non-native orache (*Atriplex patula*) often grow.

Differentiating Occurrences: Maritime Erosional Cliff Communities are made of mixed unconsolidated material. Maritime Rock Cliff Communities are bedrock. Both are in the salt spray zone next to the ocean. The vegetation of the Maritime Erosional Cliff Community is sparse and species are typically weedy species from the surroundings. The substrate is steep and close to vertical in places, and usually is actively eroding.

Associated Fauna: Bank Swallows (*Riparia riparia*) nest in the top parts of the cliffs. Migrating Peregrine Falcons (*Falco peregrinus*) regularly perch on and hunt from the upper part of sea cliffs during the fall migration.

Public Access: Maritime Erosional Cliffs are extremely fragile and visitation is discouraged due to potential for erosion from disturbance.

Threats: Bank stabilization interferes with natural processes of erosion. But erosion becomes severe with added human-induced disturbance, including from foot traffic and climbing.

Management Needs: Naturally disturbed, but don't want to enhance the disturbances. Continue to keep pedestrian traffic off cliff faces.

USNVC/NatureServe: A3992 Erosional Bluffs Alliance Maritime Erosional Cliffs CEGL006618. (described for BoHa); inclusions of *Smilax glauca* - *Toxicodendron radicans* Vine-Shrubland (CEGL003886). In Ecological system: Northeastern Erosional Bluff (CES203.498). Sand Cliffs are similar to Sand Dunes with *Ammophila breviligulata* - *Lathyrus japonicus* Herbaceous Vegetation (Beachgrass Dune) and *Cakile edentula* ssp. *edentula* - *Chamaesyce polygonifolia* Sparse Vegetation.

Maritime Forest/Woodland

Community Code: CT1A2A1000

State Rank: S2

Concept: Deciduous or mixed deciduous/evergreen forest/woodland within the salt spray zone near the ocean. The trees tend to be short, <10 m (~ 30 ft.).

Environmental Setting: Maritime communities occur near the ocean on exposed bluffs, the back or inland side of dunes, interdunal areas, and salt marsh borders, in mosaics of vegetation structure and species mixes. Strong winds, shifting sands, and flooding with saltwater create a dynamic system that maintains a variety of stages of early successional vegetation. Maritime Forest/Woodlands have a mixture of deciduous and evergreen trees in the canopy that is lower than typical in more inland areas, averaging about 30 feet (10m) tall. Many trees are multiple-stemmed and contorted from pruning by winds carrying salt and sand. Soils are usually sands with a surface layer of organic material that can slow moisture infiltration and keep the areas moister than more exposed surroundings. In addition, groundwater may be close to the surface in some low interdunal areas. Such low interdunal areas may be quite mesic and support relatively high species diversity. Where groundwater is lower, plant species are limited to those with deep-delving root systems. While sandy soils are generally acidic and low in nutrients, these soils may have higher pH and nutrient levels than expected due to the accumulation of leaf litter, fragments of sea shells, and input from salt spray (which can, of course, produce conditions too salty for many plants).

Vegetation Description: Trees are usually short relative to interior forests. Black oak (*Quercus velutina*), scarlet oak (*Q. coccinea*), white oak (*Q. alba*), other oaks, hickories (*Carya* spp.), American holly (*Ilex opaca*), sassafras (*Sassafras albidum*), black gum (*Nyssa*

sylvatica), black cherry (*Prunus serotina*), and red maple (*Acer rubrum*) are commonly present. American beech (*Fagus grandifolia*) is often present and occasionally dominant, sometimes in almost mono-dominant stands on moraines or areas near freshwater ponds. Basswood (*Tilia americana*) is in several occurrences. Pitch pine (*Pinus rigida*) and red cedar (*Juniperus virginiana*) occur in variable, generally low, amounts. One occurrence is dominated by hackberry (*Celtis occidentalis*) and sassafras. Vines may be dense, especially on the edges of openings; vines include greenbrier (*Smilax rotundifolia*), poison ivy (*Toxicodendron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), grape (*Vitis aestivalis*), and the non-native Oriental bittersweet (*Celastrus orbiculatus*). The shrub and herbaceous components can be diverse and include species usually found in less acidic areas. Shrubs include bayberry (*Morella pensylvanica*), inkberry (*Ilex glabra*), winged sumac (*Rhus copallinum*), shadbush (*Amelanchier spp.*) and sweet pepper-bush (*Clethra alnifolia*). The understory often includes non-native shrubs that can form dense thickets of Japanese barberry (*Berberis thunbergii*), Japanese honeysuckle (*Lonicera japonica*), Morrow honeysuckle (*L. morrowii*), common buckthorn (*Rhamnus cathartica*), and/or multiflora rose (*Rosa multiflora*). The herbaceous layer is also highly variable and includes bracken fern (*Pteridium aquilinum*), Canada mayflower (*Maianthemum canadense*), partridgeberry (*Mitchella repens*), starflower (*Lysimachia borealis*), Pennsylvania sedge (*Carex pensylvanica*), and other sedges and grasses. Microtopography and local conditions strongly influence the species assemblage. Low (but not as wet as swales) interdunal areas often include species of wetlands such as swamp azalea (*Rhododendron viscosum*), viburnums (*Viburnum* spp.), winterberry (*Ilex verticillata*), and highbush blueberry (*Vaccinium corymbosum*). The herbaceous layer of these wetter areas sometimes includes species usually associated with rich, moist sites such as columbine (*Aquilegia canadensis*), starry Solomon's seal (*Maianthemum stellatum*), painted trillium (*Trillium undulatum*), and skunk meadow-rue (*Thalictrum revolutum*).

Differentiating Occurrences: Maritime Forests/Woodlands usually occur in a mosaic with other barrier beach, maritime, and/or coastal communities. Communities grade into other types in the mosaic, maturing and being reset to earlier successional stages by disturbance from storms, movement of sand, flooding, and drought. Maritime Forests/Woodlands are very near the ocean, receive regular salt spray, and have stunted canopies of mixed tree species. Maritime Pitch Pine Woodlands on Dunes are dominated by pitch pine, have sparser canopies, and are usually more exposed and closer to the ocean. Maritime Juniper Woodland/Shrublands are dominated by red cedar, and also usually closer to the ocean. Maritime Shrublands are dominated by shrubs and have <25% tree canopy. Coastal Forest/Woodlands are further from the coast and are not affected by salt spray on a daily basis. They have taller trees and a shrub layer consisting primarily of lowbush blueberry (*Vaccinium angustifolium*) and black huckleberry (*Gaylussacia baccata*). Determining actual boundaries among the communities in a maritime mosaic is difficult and may require arbitrary assignments. Patches that are <5000 sq. ft. should be noted in descriptions, but considered to be part of the variation of the surrounding community.

Associated Fauna: There are no animal species known to be restricted to Maritime Forests/Woodlands. Animal species are those of typical coastal oak areas such as the birds Eastern Towhee (*Pipilo erythrophthalmus*), Gray Catbird (*Dumetella carolinensis*), Common Yellowthroat (*Geothlypis trichas*), Ovenbird (*Seiurus aurocapillus*), and Black-and-white Warbler (*Mniotilta varia*). Small mammals such as meadow voles (*Microtus pennsylvanicus*), white-footed mice (*Peromyscus leucopus*), and gray squirrels (*Sciurus carolinensis*) are common in Massachusetts forests. Moths, butterflies, and other insects of the southeastern oak and oak-pine forest occur in maritime forests. Generally, in more salt-influenced environments, fewer animals will be expected. As in all communities on peninsulas such as Cape Cod or on islands, the more remote occurrences have fewer species than those closer to the mainland sources. High white-tailed deer (*Odocoileus virginianus*) densities may have an impact on the abundance of native species, particularly woody seedlings such as oaks, as well as on herbaceous plants.

Public Access: Cape Cod National Seashore, Wellfleet; Sandy Neck Beach Conservation Area, Barnstable; Demarest Lloyd State Park, Dartmouth; Salisbury Salt Marsh WMA and Carr Island Wildlife Sanctuary, Salisbury; Parker River National Wildlife Refuge, Newburyport.

Threats: Exotics, such as Morrow's honeysuckle (*Lonicera morrowii*), dune stabilization, roads through the dunes. Over-abundant deer populations can strongly impact which species survive to reproduce.

Management Needs: Exotic control on the best examples.

USNVC/NatureServe: A2032 *Quercus velutina - Fagus grandifolia - Ilex opaca* Maritime Forest Alliance - *Quercus stellata - Quercus velutina*/*Morella pensylvanica*/*Deschampsia flexuosa* Forest (CEGL006373); A0237 *Prunus serotina - Amelanchier* spp. - *Juniperus virginiana* Maritime Scrub Forest Alliance - *Prunus serotina - Sassafras albidum - Amelanchier canadensis - Quercus velutina*/*Smilax rotundifolia* Forest (CEGL006145).

Maritime Juniper Woodland/Shrubland

Community Code: CT1A2A1100

State Rank: S1

Concept: Predominantly evergreen woodland/shrubland within the coastal salt spray zone, often on dunes or bluffs over the ocean. The trees tend to be short (less than 5 m (about 15 feet)) and scattered. Tops of trees and shrubs are sculpted by winds and salt spray.

Environmental Setting: Maritime communities occur along the coast within the area of direct influence of the ocean and salt spray, but not in areas flooded by saltwater. They are usually somewhat protected from direct spray by the crests of dunes. Juniper-dominated maritime communities tend to occur on the sand of interdunal areas, backs of dunes, exposed bluffs, and salt marsh borders, and, to a lesser extent, on rocky headlands.

Vegetation Description: Trees are usually short relative to interior forests. The Maritime Juniper Woodland/Shrubland community occurs as part of a continuum of sparse shrubland to forest, and deciduous to evergreen dominants, in areas of continuous changes of levels of salt spray and substrate types. Virginia juniper, also called red cedar (*Juniperus virginiana*), dominates but occurs in variable, usually low, densities in association with scattered trees and shrubs typical of the surrounding forest such as pitch pine (*Pinus rigida*), various oaks (*Quercus* spp.), American holly (*Ilex opaca*), black cherry (*Prunus serotina*), red maple (*Acer rubrum*), bayberry (*Morella pensylvanica*), and winged sumac (*Rhus copallinum*). Greenbriar (*Smilax rotundifolia*) can be abundant in more established woodlands, particularly along open edges. The herbaceous layer is highly variable, with little bluestem grass (*Schizachyrium scoparium*), dunegrass (*Ammophila breviligulata* ssp. *breviligulata*),

and sedges, often with scattered beach heather (*Hudsonia tomentosa*) or seabeach sandwort (*Honckenya peploides*). Microtopography and local conditions strongly influence the species assemblage.

Differentiating Occurrences: Maritime Juniper Woodland/Shrubland intergrades and interdigitates with Maritime Pitch Pine Woodland on Dunes, Maritime Forest/Woodland (behind stable dunes in low protected interdunal moist areas), and Interdunal Marshes/Swales. The Maritime Juniper Woodland/Shrubland community grades from sparse shrubland to woodland, in a continuum of other communities with deciduous to evergreen dominants, in areas of constant changes of levels of salt spray and substrate stability. Even in stable situations, community edges may not be clear. Different types of communities grade into and interdigitate with each other. Very small patches of any type within another community should be considered to be part of the variation of the other community. Maritime Pitch Pine Woodlands on Dunes communities share species with the Maritime Juniper Woodland/Shrubland community, but are dominated by pitch pine. Maritime Shrubland communities are dominated by a dense mixture of primarily deciduous shrubs, but may include red cedar. Bare sand dominates Maritime Dune Communities, which are only sparsely vegetated with very scattered patches of low shrubs, including red cedar, pitch pines, herbaceous species, and grasses. The most similar vegetation to Maritime Juniper Woodland/Shrubland is old-field red cedar (which is not separated out as a community type in this classification). These are successional woodlands dominated by red cedar growing in abandoned pastures and fields and along major highways. Oldfield red cedar shrublands may be quite difficult to separate from nearby Maritime Juniper Woodland/Shrublands; they may be extensions of them, but are not maintained by salt spray, are not on steep slopes, would be expected to succeed to more forested communities, and are often more diverse. Outside of the maritime salt spray zone, some rocky outcrops with non-acidic bedrock support a shrub community that may include red cedar; in the Massachusetts classification of natural communities these are included in Circumneutral Rocky Summit/Rock Outcrop and Calcareous Rocky Summit/Rock Outcrop communities.

Associated Fauna: There are no animal species known to be restricted to maritime woodlands/shrublands. As with all maritime shrublands and woodlands, these habitats are important feeding and resting/roosting areas for migrating birds. Animal species are those of typical coastal oak areas such as the birds Eastern Towhee (*Pipilo erythrophthalmus*), Gray Catbird (*Dumetella carolinensis*), Common Yellowthroat (*Geothlypis trichas*), Ovenbird (*Seiurus aurocapillus*), and Black-and-white Warbler (*Mniotilta varia*). Small mammals such as meadow voles (*Microtus pennsylvanicus*), white-footed mice (*Peromyscus leucopus*), and gray squirrels (*Sciurus carolinensis*) are common in Massachusetts forests. Moths, butterflies, and other insects of the southeastern oak and oak-pine forest occur in maritime forests. Generally, in more salt-influenced environments, fewer animals will be expected. As in all communities on peninsulas such as Cape Cod or on

islands, the more remote occurrences have fewer species than those closer to the mainland sources.

Public Access: Sandy Neck Beach Conservation Area, Barnstable; Cape Cod National Seashore, Wellfleet; Boston Harbor Islands, Hingham.

Threats: Exotics, including Oriental bittersweet (*Celastrus orbiculatus*); dune stabilization; roads through the dunes. As with other communities on dunes, these communities are sensitive to disturbance and easily damaged even by foot traffic.

Management Needs: Exotic control on the best examples. Because this is a dynamic community that moves or changes size, shape, and composition as the dunes move, large properties where natural changes can be accommodated provide long-term protection. Dune communities will be best maintained where they are part of a complex of beach and dune, woodland and shrubland, which have adequate buffers and connections between and among patches. Changes in climate that result in higher sea levels or increased severity of storms also pose direct, long-term threats.

USNVC/NatureServe: Includes: *Prunus serotina - Amelanchier spp. - Juniperus virginiana* Maritime Scrub Forest Alliance -- *Juniperus virginiana* var. *virginiana*/*Morella pensylvanica* Woodland [CEGL006212].

Maritime Pitch Pine Woodlands on Dunes

Community Code: CT2A1A1200

State Rank: S1

Concept: Scattered pitch pines on sand dunes, many with trunks at least partially buried. Open canopy, with bare ground and scattered shrubs, herbaceous plants, and patches of lichen.

Environmental Setting: Occurring as small patch communities on sand dunes on barrier beaches and other sandy shores, Maritime Pitch Pine Woodlands on Dunes tend to have linear occurrences on back dunes just beyond the reach of daily salt spray. The moderately stabilized back dunes, and thus the communities on them, are created and maintained by the movement of sand by wind; boundaries or an entire dune can change as sand is moved. During storms, back dunes receive windblown sand and salt that prune trees. The community appearance is open, with scattered, partially buried but living, pitch pine trees separated by bare sand with lichens and pine needles. On older, fairly stable dunes, a sedge lawn may cover the ground between trees. The pitch pine patches are in a mosaic of communities on dunes, with open dune communities in exposed areas, Maritime Juniper Woodland/Shrublands interdigitating in areas with more salt spray, denser deciduous shrublands and woodlands forming in stable moist swales, and open interdunal swales in exposed areas with regular active sand movement. The woodland communities are not in areas normally subject to saltwater flooding, which kills the pine trees.

Vegetation Description: Maritime Pitch Pine Woodland on Dunes is an open woodland community with short, scattered individuals of pitch pine (*Pinus rigida*) dominating the low tree layer. Pines that are very exposed may be short, with taller trees in more protected

areas where grasses and sedges may cover the ground. Between the pines, scattered beach heather (*Hudsonia tomentosa*) and bearberry (*Arctostaphylos uva-ursi*) form a patchy, very low shrub layer among areas of bare sand with lichens and earth star fungus.

Differentiating Occurrences: Maritime forests, woodlands, and shrublands on dunes grade into each other and into more open dry shrubby or shrubless dunes, as well as into wetland communities in interdunal swales. Differentiating between open-canopy Maritime Pitch Pine Woodland on Dunes and closed-canopy Pitch Pine - Oak Forests or Maritime Forests/Woodlands would be based on the canopy openness and dominance of pitch pine, and on the paucity of other species. Active sand movement would be much less in closed woodlands, which have little bare ground, more soil development, a litter layer composed of more than pine needles, and more species diversity. The pines having skirts is typical of the dune community; in more established woodlands, even if the pine trunks are partially buried, shaded lower branches are unlikely to remain alive. Related open communities include the Maritime Juniper Woodland/Shrubland, in which red cedar dominates with about 25-75% of the cover. Pitch pine and other widespread early successional shrubs and trees, such as red maple and black cherry, are usually present in lower abundances. Bare sand dominates Maritime Dune Communities that are only sparsely vegetated with very scattered patches of low shrubs, herbaceous plants, and grasses. Maritime Pitch Pine Woodland on Dunes occur in a complex of these and other barrier beach communities in a shifting mosaic as storm winds move sand, burying vegetation and restarting communities. Maritime Pitch Pine Woodland on Dunes intergrades and interdigitates with Maritime Juniper Woodland/Shrubland, Maritime Forest/Woodland (behind stable dunes in low protected interdunal moist areas), and Interdunal Swales. Occurrences of small patches within another community would be considered to be part of the variation of the other community. Areas of temporary stability allow succession to more mixed forests.

Associated Fauna: There are no animal species known to be restricted to maritime forests. The open pitch pine areas are particularly harsh and exposed, and support fewer animals than more closed communities. Generally, in more salt-influenced environments, fewer animals will be expected. As in all communities on peninsulas such as Cape Cod or on islands, the more remote occurrences have fewer species than those closer to the mainland sources. Moths, butterflies, and other insects of the southeastern oak-pine forest occur in maritime forests.

Public Access: Cape Cod National Seashore, Wellfleet; Sandy Neck Beach Conservation Area, Barnstable; Horseneck Beach State Reservation, Westport; Parker River National Wildlife Refuge, Newbury.

Threats: As with other communities on dunes, these communities are sensitive to disturbance and easily damaged even by foot traffic.

Management Needs:

USNVC/NatureServe: *Pinus rigida* woodland alliance -- *Pinus rigida*/*Hudsonia tomentosa* Woodland [CEGL006117] *Pinus rigida* - *Quercus* (*coccinea*, *velutina*) Woodland Alliance -- *Pinus rigida* - *Quercus velutina*/*Hudsonia tomentosa* Woodland [CEGL006120].

Maritime Rock Cliff Community

Community Code: CT2A4B0000

State Rank: S2

Concept: Sparsely vegetated rock areas with plants in cracks and ledges where soil collects, within the salt spray zone, but above normal high tides.

Environmental Setting: Maritime Rock Cliff Communities occur on the ocean side of rocky headlands and coastal bedrock outcrops, above the rocky intertidal, but within the salt spray zone where they are very exposed to storms. Vegetation grows in small pockets where the soil is augmented by droppings from gulls, cormorants, and other cliff-perching birds.

Vegetation Description: The Maritime Rock Cliff Community is sparsely vegetated by low, scattered, salt- and wind-hardy, often somewhat weedy plants, such as knotted pearlwort (*Sagina nodosa* ssp. *nodosa*), saltworts (*Salicornia* spp.), common rush (*Juncus effusus*), seaside plantain (*Plant ago maritima*), poison ivy (*Toxicodendron radicans*), blue toadflax (*Nuttallanthus canadensis*), seaside goldenrod (*Solidago sempervirens*), Scotch lovage (*Ligusticum scothicum*), common hairgrass (*Deschampsia flexuosa*), and native and non-native red fescues (*Festuca rubra*). Species from the top of the headland, often from a Maritime Shrubland community, occur in less exposed ledges. Plants of extremely exposed maritime rock cliffs and outcrops, such as on the outer Boston Harbor Islands, tend to be tough, non-native herbaceous perennials including mugwort (*Artemisia vulgaris*), black mustard (*Brassica nigra*), smartweed (*Persicaria lapathifolia*), and curly dock (*Rumex crispus*).

Differentiating Occurrences: Rock cliffs are arbitrarily defined as near vertical (>60% slope). Maritime Rock Cliff Communities derive from bedrock of a variety of different types, but are consolidated material. Maritime Erosional Cliff Communities are made of mixed unconsolidated material. Both are steep shores in the salt spray zone above the intertidal shores. The vegetation of both communities is sparse and typically composed of weedy species from the surroundings. They are next to the ocean in the salt spray zone, above the twice-daily flooded area of the Marine Intertidal Rocky Shore Community. The Maritime Beach Strand Community is not on bedrock and is not close to vertical. Maritime Shrubland Communities occur outside of the daily salt spray zone and are generally flatter; they share species with Maritime Rock Cliff Communities, but are much more densely covered.

Associated Fauna: Harbor seals (*Phoca vitulina*) use the rocks below the cliffs to haul out and rest. The exposed rock face itself does not provide habitat for specialized fauna.

Public Access: Maritime Rock Cliffs are sensitive to visitation; care should be taken not to disturb plants during a visit. Slate Island, Boston Harbor Islands, Weymouth.

Threats: Exotics; Oriental bittersweet and Scotch lovage being abundant with mullein, Morrow's honeysuckle, sow thistle, yarrow, and sheep fescue.

Management Needs:

USNVC/NatureServe: Maritime Rock Cliffs (CEGL006619).

Maritime Shrubland

Community Code: CT2A4A1000

State Rank: S3

Concept: Shrub community, dominated by patches of dense shrubs with scattered more open areas of low growth or bare ground. Cover of tree canopy is less than about 25%.

Environmental Setting: Maritime Shrubland communities occur along the coast within the area of direct influence of the ocean and salt spray, such as on barrier beach dunes, next to tidal marshes or on bluffs or rocky headlands. Maritime Shrublands often occur on sand or bedrock that does not hold water. They may extend inland in areas with droughty soils or extreme exposure to ocean winds that inhibit tree growth. Offshore islands can have extensive areas of Maritime Shrublands. They are dominated by patches of dense shrubs with scattered areas of more open low growth or bare ground, and have less than about 25% tree canopy. Plants in these communities are exposed to the direct influences of salt and constant ocean wind, which select for stress-tolerant species. The species of Maritime Shrublands do not withstand flooding by saltwater, but they tolerate or recover from salt deposits on their leaves. Fire was an important part of this environment prior to the establishment of fire suppression regimes in settled areas. Without regular disturbance, the community may succeed to forest.

Vegetation Description: Maritime Shrublands are within the northeastern oak and oak-pine forest region; species of these communities are species of oak forests. They often have dense patches of shrubs, up to about 3m (10 ft.) tall, with various species dominating in different areas. Huckleberry (*Gaylussacia baccata*), bayberry (*Morella pensylvanica*), or red cedar (*Juniperus virginiana*) areas are often distinctive. Large areas with dense red cedar are separated out as Maritime Juniper

Woodland/Shrubland. Black cherry (*Prunus serotina*), beach plum (*Prunus maritima*), chokeberry (*Aronia melanocarpa*), lowbush blueberry (*Vaccinium angustifolium*), and bearberry (*Arctostaphylos uva-ursi*) may be abundant. Catbrier (*Smilax rotundifolia*) and poison ivy (*Toxicodendron radicans*) often cover other plants or grow in dense patches on their own. Non-native species are often abundant including Oriental bittersweet (*Celastrus orbiculatus*) and Morrow's honeysuckle (*Lonicera morrowii*). The herbaceous layer is usually sparse.

Differentiating Occurrences: Maritime Shrublands are intended to be large, relatively continuous areas of shrublands in the salt spray zone. Large patches of scrub oak are separated out as their own community type. When shrub cover is less than 40%, the community is considered to be something else, often Sandplain Heathland. Tree cover should be less than 25% overall. The differences among the communities and associations are often gradual, making differentiation on the ground difficult at times. Maritime Dune Communities include patches of shrubs in areas protected from winds and salt spray. When large and continuous, such patches might be considered to be Maritime Shrublands.

Associated Fauna: Shrub thickets provide nesting areas for Northern Harriers (*Circus cyaneus*), Eastern Towhee (*Pipilo erythrophthalmus*), and Song Sparrow (*Melospiza melodia*). Maritime shrublands are heavily used during fall migrations for cover and forage; many of the plants have fruit attractive to migrants. White-tailed deer (*Odocoileus virginianus*) maintain large populations in shrubland habitats. In such shrub areas, white-footed mice (*Peromyscus leucopus*) are also very abundant, and in the openings meadow voles (*Microtus pennsylvanicus*) are common. Eastern moles (*Scalopus aquaticus*) have an affinity to the sand substrate in the southern part of the state. Long-tailed weasels (*Mustela frenata*) occur in the grass-dominated areas where they hunt meadow voles. Eastern hognose snakes (*Heterodon platirhinos*) occur in sandy, open areas of shrubland community areas. Coastal plain shrublands are habitat to the state-listed moth, chain dot geometer (*Cingilia catenaria*, Special Concern), whose larvae feed on a variety of the typical shrubs.

Public Access: Halibut Point State Park, Rockport; Boston Harbor Islands, Weymouth; Demarest Lloyd Memorial State Park, Dartmouth; Quivett Creek/Paines Creek Marsh (town conservation area), Brewster.

Threats: Invasive exotics in many occurrences. Shrubby honeysuckle (*Lonicera morrowii*) and Oriental bittersweet (*Celastrus orbiculatus*) are invasive in many of the locations. Japanese barberry (*Berberis thunbergii*), glossy buckthorn (*Frangula alnus*), and Japanese black pine (*Pinus thunbergiana*) are locally dense.

Management Needs: Removal of invasive exotics.

USNVC/NatureServe: Includes: *Prunus serotina - Amelanchier canadensis - Quercus* spp. Shrubland Alliance -- *Prunus serotina - Rhus typhina*/*Cakile edentula* Shrubland [CEGL006399]; *Myrica pensylvanica* - (*Prunus maritima*) Shrubland Alliance -- *Myrica pensylvanica-Rosa rugosa* Shrubland [CEGL006295].

Mixed Oak Forest/Woodland

Community Code: CT1A300000

State Rank: S5

Concept: A broadly defined forest community of tree oaks that grades into other more narrowly defined communities. Includes areas with open canopies that could be considered woodlands.

Environmental Setting: Mixed Oak Forest/Woodland is a deciduous forest or woodland community, dominated by multiple species of tree oak that occurs on dry soils and exposed acidic talus or rocky slopes. The canopy may be closed or somewhat open (typically having ~70% cover) at ~20m (~60 ft.). More mature forest examples tend to have denser canopy cover. Trees in many examples are small (young or stunted with broken tops) with diameters 6-8", and only occasionally are there larger trees >10" diameter. The tall shrub layer may be patchy, over an often extensive lower shrub layer. The herbaceous cover is variable. The litter layer is predominantly undecomposed oak leaves.

Vegetation Description: In Mixed Oak Forest/Woodland, the canopy has a variable mix of oak species (black (*Quercus velutina*), white (*Q. alba*), red (*Q. rubra*), scarlet (*Q. coccinea*), and chestnut (*Q. montana*)), with birches (black (*Betula lenta*) and white (*B. papyrifera*)), and red maple (*Acer rubrum*). White pine (*Pinus strobus*), if present, typically makes up much <25% of the canopy. The canopy is generally somewhat open. An understory of saplings of canopy species with (depending on location) gray birch (*Betula populifolia*), striped maple (*Acer pensylvanicum*), mountain maple (*A. spicatum*), witch hazel (*Hamamelis virginiana*), shadbush (*Amelanchier spp.*) and/or chestnut (*Castanea dentata*) is dense in patches. The shrub layer may be extensive or at least also dense, with patches of blueberries (*Vaccinium*

angustifolium and *V. pallidum*), huckleberry (*Gaylussacia baccata*), and mountain laurel (*Kalmia latifolia*). A scattered herbaceous layer is often primarily wild sarsaparilla (*Aralia nudicaulis*) and Pennsylvania sedge (*Carex pensylvanica*).

Differentiating Occurrences: Mixed Oak Forests/Woodlands are part of a continuum of dry, acidic communities that contain a variety of tree oak and pine species. Mixed Oak Forests/Woodlands have more oak species than most other oak forests (black, scarlet, white, red, and chestnut oak), and birches. They lack abundant pines or hemlock, and lack hop-hornbeam and indicators of rich sites. Oak - Hemlock - White - Pine Forests are the most broadly defined in the continuum of oak-dominated forests; specific types are split out from this matrix type. Oak - Hemlock - White - Pine Forest is dominated by a mix of tree oaks with scattered white pine and hemlock, either of which may be in locally dense patches. Black Oak - Scarlet Oak Woodlands are woodlands. Abundant scarlet oak with black oak is the key indicator of the type. Open Oak Woodlands occur on hill slopes with short red and white oak trees scattered over a grassy or low shrub understory around small rock outcrops. They often occur between a rocky summit and the surrounding taller forest. Coastal Forests/Woodlands are within a few miles of the coast at <~60 ft. elevation and receive storm winds and spray. The diverse canopy includes oaks and often has American holly, sassafras, and black gum. White Pine - Oak Forests have >25% cover of white pine overall (not just local patches). Pitch Pine - Oak Forest/Woodlands have>25% cover of pitch pine overall (not just local patches).

Associated Fauna: Mature upland forest types provide valuable structural attributes, such as tree cavity den sites (used by a variety of bird and mammal species) and large woody material (used by various amphibian, reptile, and invertebrate species). Mixed Oak Forests/Woodlands may constitute only parts of the habitats of many animals found in them. Acorns in all oak forests are important for wildlife, including white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), grey squirrels (*Sciurus carolinensis*), and other small rodents. Birds include Wild Turkeys (*Meleagris gallopavo*). The understory of blueberries and huckleberries is used by many of these same species in areas with sufficiently large forests to provide all the habitat needs. Passerine birds of oak forests include Red-eyed Vireo (*Vireo olivaceus*), Ovenbird (*Seiurus aurocapillus*), Black-and-white Warbler (*Mniotilta varia*), Scarlet Tanager (*Piranga olivacea*), Great Crested Flycatcher (*Miarchus crinitus*), Downy Woodpecker (*Picoides pubescens*), Hairy Woodpecker (*P. villosus*) and Red-bellied Woodpecker (*Melanerpes carolinus*). Amphibians expected include northern redback salamanders (*Plethodon cinereus*) and spotted salamanders (*Ambystoma maculatum*). Ringneck snakes (*Diadophis punctatus*) and redbelly snakes (*Storeria occipitomaculata*) would be expected. Moths, including the orange sallow moth (*Pyrrhia aurantiago*), butterflies, and other insects of the southeastern oak and oak-pine forest occur in Mixed Oak Forest/Woodlands.

Public Access: Mt. Tekoa WMA, Russell; Minute Man National Historical Park, Lexington; Douglas State Forest, Douglas; Palmer WMA, Palmer.

Threats: This widespread acidic community has few exotics, but could be susceptible to those adapted to acidic conditions. Lack of light fire is more of a threat than fire itself.

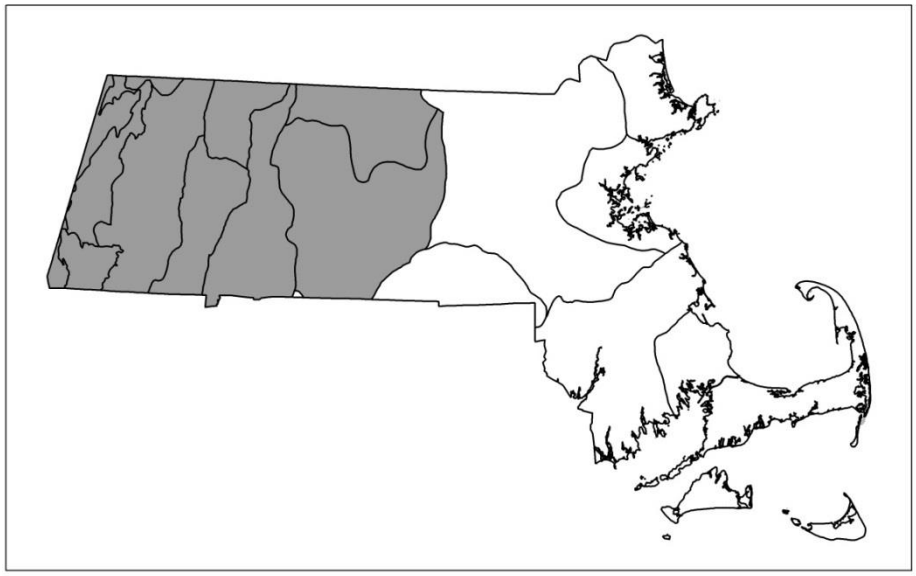
Management Needs: This mid-successional forest is currently widespread and most occurrences are maturing: management for the type is not necessary. However, without very occasional disturbance, the oaks could be replaced by more shade-tolerant, fire-sensitive species.

USNVC/NatureServe: NatureServe related to: A0624 *Quercus rubra* - *Quercus prinus* Woodland Alliance *Quercus rubra* - (*Quercus prinus*)/*Vaccinium* spp./*Deschampsia flexuosa* Woodland (CEGL006134); *Quercus rubra* - *Betula lenta*/*Polypodium virginianum* Woodland [CEGL006585]; A2048 *Quercus velutina* - *Quercus alba* Eastern Forest Alliance - *Quercus* (*velutina*, *alba*)/*Vaccinium pallidum*/*Pteridium aquilinum* High Allegheny Plateau, Western Allegheny Plateau Forest [CEGL006018].

Northern Hardwoods – Hemlock – White Pine Forest

Community Code: CT1C000000

State Rank: S5



Concept: A matrix forest of northern areas, with a closed canopy dominated by a mix of deciduous and evergreen trees, with sparse shrub and herbaceous layers.

Environmental Setting: The Northern Hardwoods - Hemlock - White Pine Forest is the prevailing, or matrix, forest in higher elevations of western and north-central Massachusetts, with smaller occurrences throughout on north-facing slopes and in ravines. It is an uneven-aged forest with a closed canopy dominated by a mix of long-lived deciduous and evergreen trees, with sparse shrub and herbaceous layers. The forest structure is dominated by single tree falls and replacements, with occasional small to medium blowdown events; stand replacement events are uncommon. The community occurs on neutral to moderately acidic soils with moderate levels of nutrients that retain some moisture except during extreme droughts. Sugar maple leaf litter is relatively high in nitrogen and decomposes rapidly which leads to a shallow layer of leaf litter and rapid turnover of nutrients.

Vegetation Description: Dominant and characteristic species of Northern Hardwoods - Hemlock - White Pine Forests occur in different combinations between and within occurrences: occurrences are generally predominantly deciduous with scattered hemlocks and white pines, but may have internal patches of nearly pure conifers. Canopies include variable combinations of sugar maple (*Acer saccharum*), white ash (*Fraxinus americana*), yellow birch (*Betula alleghaniensis*), American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), red oak (*Quercus rubra*), bitternut hickory (*Carya cordiformis*), eastern hemlock (*Tsuga canadensis*), and, usually, emergent white pine (*Pinus strobus*). There are often scattered red maple (*Acer*

rubrum), paper birch (*Betula papyrifera*), and aspen (*Populus tremuloides*). A subcanopy may include any of the tree species, particularly the successional species, as well as hop-hornbeam (*Ostrya virginiana*) or striped maple (*Acer pensylvanicum*). The shrub layer is usually open, but often has scattered clumps of hobblebush (*Viburnum lantanoides*), striped maple, red-berried elderberry (*Sambucus racemosa*), or fly-honeysuckle (*Lonicera canadensis*). The herbaceous layer is sparse, but fairly diverse, with intermediate wood fern (*Dryopteris intermedia*), Christmas fern (*Polystichum acrostichoides*), clubmosses (*Dendrolycopodium*, *Diphasiastrum*, *Huperzia*, and *Lycopodium* spp.), Canada mayflower (*Maianthemum canadense*), white wood aster (*Eurybia divaricata*), and wild oats (*Uvularia sessilifolia*). Occasional spring herbaceous species include painted or purple trilliums (*Trillium undulatum* and *T. erectum*), early yellow violet (*Viola rotundifolia*), broad-leaved spring beauty (*Claytonia caroliniana*), and trout-lily (*Erythronium americanum*).

Differentiating Occurrences: Northern Hardwoods - Hemlock - White Pine Forests are the generalized northern deciduous forests. They lack the abundant spruce and/or fir found to the north and upslope in Spruce - Fir - Northern Hardwoods Forests. Red spruce (*Picea rubens*) and/or balsam fir are abundant in Spruce - Fir - Northern Hardwoods Forests, and white pine uncommon. Within the matrix of Northern Hardwoods - Hemlock - White Pine Forest, subtypes with distinct species assemblages that occur in specialized conditions are named separately. All types of northern hardwood forests, including Northern Hardwoods - Hemlock - White Pine Forest, are dominated by sugar maple with white ash, yellow birch, American beech, and red oak, with low cover of white pine and hemlock. Successional Northern Hardwood Forests are best distinguished by the abundance of white birch and / or aspens in the canopy and northern hardwood species generally occurring in the subcanopy or shrub layer, not the canopy. Rich, Mesic Forest is a nutrient- and species-rich large-patch community, usually within the Northern Hardwoods - Hemlock - White Pine Forest area. Rich, Mesic Forests lack conifers, beech, and red oak. The understory has dense spring ephemerals and very little evergreen wood fern, Christmas fern, or wild sarsaparilla. Red Oak - Sugar Maple Transition Forest has red oak as a dominant, with sugar maple, American beech, and black birch (*Betula lenta*). Other northern hardwoods are occasional associates. Spring ephemerals are not abundant. Oak - Hemlock - White Pine Forests occur to the south and in warmer areas; they are dominated by a mix of oak species that except for red oak do not occur in Northern Hardwoods - Hemlock - White Pine Forest, plus sugar maple is lacking. Blueberry and huckleberry usually are significant in the understory of Oak - Hemlock - White Pine Forests, but absent or nearly so in Northern Hardwoods - Hemlock - White Pine Forest.

Associated Fauna: Northern Hardwoods - Hemlock - White Pine Forests are the common type of forest in the cooler parts of the state and provide habitat for many common wide-ranging species. Geographical variation, structure, size, and local conditions will affect which actual species are present. The best occurrences of Northern Hardwoods - Hemlock - White Pine Forest are large and incorporate variation in

species and structure, including multiple layers of vegetation, snags, tree cavity den sites (used by a variety of bird and mammal species), and fallen large woody material (used by various amphibian, reptile, and invertebrate species). Covering large areas means inclusions of variation such as interior forest, dense conifer stands, beech seed production, seeps, pockets of wetland, and small patches of dense, earlier successional shrub species. Many species of neo-tropical migrant songbirds nest in large numbers in larger occurrences, including a variety of warblers. Northern Goshawk (*Accipiter gentilis*), Barred Owl (*Strix varia*), and Pileated Woodpeckers (*Dryocopus pileatus*) are also to be expected. It is hard to overstate the wildlife value of beechnuts in Northern Hardwoods - Hemlock - White Pine Forest for black bear (*Ursus americanus*) and other seed-eating omnivores and herbivores. Mammals include red squirrel (*Tamiasciurus hudsonicus*), gray squirrel (*Sciurus carolinensis*), chipmunk (*Tamias striatus*), redbacked vole (*Clethrionomys gapperi*), short-tailed shrew (*Blarina brevicauda*), masked and smoky shrews (*Sorex cinereus* and *S. fumeus*), and white-footed mouse (*Peromyscus leucopus*). At elevation, deer mouse (*P. maniculatus*) and woodland jumping mouse (*Napaeozapus insignis*) also occur in the forest type. Amphibians include redbacked salamanders (*Plethodon cinereus*) and wood frogs (*Rana sylvatica*), and expected reptiles include redbelly snakes (*Storeria o. occipitomaculata*).

Public Access: Chalet WMA, Cheshire; Mohawk Trail State Forest, Charlemont; Three Mile Pond WMA, Sheffield; Tully Mtn. WMA, Orange.

Threats: Exotics do well in the community. Hemlock hosts the non-native wooly adelgid, which usually kills a hemlock tree after it is fully infested.

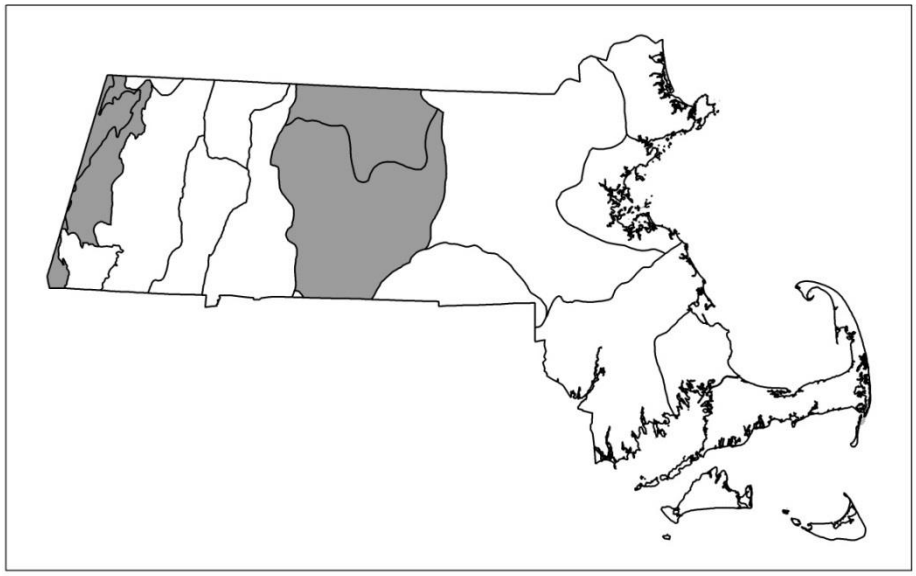
Management Needs: Exotic control where appropriate/possible.

USNVC/NatureServe: A4072 *Tsuga canadensis - Betula alleghaniensis - Acer saccharum* Forest Alliance - *Acer saccharum - Pinus strobus/Acer pensylvanicum* Forest [CEGL005005],*Tsuga canadensis - Fagus grandifolia* Forest [CEGL006088]; and *Tsuga canadensis - Betula alleghaniensis* Lower New England, Northern Piedmont Forest [CEGL006109]; A3301 *Acer saccharum - Fagus grandifolia - Tilia americana* Forest Alliance - *Acer saccharum - Fagus grandifolia - Fraxinus americana/Arisaema triphyllum* Forest [CEGL006632]; A3302 *Tsuga canadensis - Betula lenta - Betula alleghaniensis* Forest Alliance - *Pinus strobus - Tsuga canadensis* Lower New England/Northern Piedmont Forest [CEGL006328], *Tsuga canadensis - Acer saccharum - Fagus grandifolia/Dryopteris intermedia* Forest [CEGL006639]; A3224 *Acer saccharum - Fagus grandifolia - Betula alleghaniensis* Forest Alliance - *Acer saccharum - Betula alleghaniensis - Fagus grandifolia/Viburnum lantanoides* Forest [CEGL006631; A3240 *Acer saccharum - Tilia americana - Fraxinus americana* Forest Alliance - *Acer saccharum* - (*Fraxinus americana*)/*Arisaema triphyllum* Forest [CEGL006211].

Oak – Hemlock – White Pine Forest

Community Code: CT1B100000

State Rank: S5



Concept: A mixed conifer-hardwood forest normally occurring in the southern part of the state or on south-facing slopes, often on somewhat dry, acidic slopes. The matrix forest of much of the state.

Environmental Setting: The Oak - Hemlock - White Pine Forest is the broadly defined matrix forest of lower-elevation areas of eastern and south-central Massachusetts, with extensions north and west on warm south-facing slopes. Oak - Hemlock - White Pine Forests are commonly on mid- and upper slopes on acidic soils. Reforestation after farm abandonment and ongoing human land use establish and maintain early- and mid-successional forests, as well as blurring the line between the Oak - Hemlock - White Pine Forest and northern hardwoods-dominated forests in cooler areas. Within the general Oak - Hemlock - White Pine Forest type, specific recurrent variants are named: many are successional stages, some are distinct species mixes of particular conditions. Many of the sites called Oak - Hemlock - White Pine Forest lack distinctive characteristics of named subtypes.

Vegetation Description: Oaks (*Quercus alba*, *Q. coccinea*, *Q. montana*, *Q. velutina*, *Q. rubra*), black birch (*Betula lenta*), American beech (*Fagus grandifolia*), black cherry (*Prunus serotina*), and red maple (*Acer rubrum*), in association with scattered hemlock (*Tsuga canadensis*) and white pine (*Pinus strobus*). Relative proportions of the species vary greatly among sites. Either conifer may occur in small patches. In pre-settlement forests, white pine would have been present in lower numbers than today. Some white pines emerge above the deciduous canopy. American chestnut (*Castanea*

dentata) sprouts are common. The shrub layer is generally patchy and sparse, with witch-hazel (*Hamamelis virginiana*), mountain laurel (*Kalmia latifolia*), lowbush blueberry (*Vaccinium angustifolium*), huckleberry (*Gaylussacia baccata*), and maple-leaved viburnum (*Viburnum acerifolium*) characteristically present. The herbaceous layer also tends to be somewhat sparse with little diversity. Indian cucumber (*Medeola virginiana*), wintergreen (*Gaultheria procumbens*), wild sarsaparilla (*Aralia nudicaulis*), wild oats (*Uvularia sessilifolia*), starflower (*Lysimachia borealis*), fringed bindweed (*Fallopia cilinodis*), and Canada mayflower (*Maianthemum canadense*) are typical.

Differentiating Occurrences: Oak - Hemlock - White Pine Forest is the most broadly defined of a continuum of oak-dominated forests, with more specific types split out from this matrix type. Oak - Hemlock - White Pine Forest is dominated by a mix of tree oaks with scattered white pine and hemlock, either of which may be in local dense patches. Occurrences have a large amount of internal variation. White Pine - Oak Forest has >25% cover of white pine overall (not just local patches). The rest of the related forest types in the oak continuum lack significant conifer presence. Oak - Hickory Forest is on the less acidic and moister end of the continuum of oak communities; it has hickories in at least low percentages in the canopy. Flowering dogwood and hop hornbeam are often present in the subcanopy. It generally has diverse shrub and herbaceous layers. Dry, Rich Oak Forest/Woodland is also on the less acidic end of the continuum of oak-dominated communities; it includes low percentages of sugar maple and white ash, and has a diverse herbaceous layer that includes false foxgloves and multiple legumes. Mixed Oak Forest/Woodland tends to be on dry, acidic soils and exposed slopes, with an open canopy (<75% cover) and an understory dominated by heath species. Coastal Forest/Woodland is within a few miles of the coast at <~60 ft. elevation and receives storm winds and spray. The diverse canopy includes oaks, but also often has American holly, sassafras, and black gum. In the northern part of its range, the Oak - Hemlock - White Pine Forest tends to be on south-facing slopes and is surrounded by Northern Hardwood - Hemlock- White Pine Forest that is dominated by sugar maple and white ash. In Northern Hardwood - Hemlock- White Pine Forest, the only oak is red oak and the only hickory is bitternut hickory, which is not common in Oak - Hemlock - White Pine Forest.

Associated Fauna: The fauna of this community is richer than but overlaps with that of the mixed oak communities. There is a large suite of neotropical migrant birds that are more likely to be found here, in some of the larger sites, including about 15-16 species of warblers, Eastern Wood-Pewee (*Contopus virens*), and Great Crested Flycatcher (*Miarchus crinitus*). Where mountain laurel occurs with beech trees, Black-throated Blue Warblers (*Setophaga caerulescens*) may occur, and if there are low spots with large trees and fairly dense shrubs, Canada Warblers (*Wilsonia canadensis*) often occur. In large sites, large mammals, such as bear and moose, occur with the forest as part of their habitat. Common small mammals include smoky shrew (*Sorex fumeus*), masked shrew (*S. cinereus*), short-tailed shrew (*Blarina brevicauda*), woodland jumping mouse (*Napaeozapus insignis*), white-footed mouse

(*Peromyscus leucopus*), gray squirrel (*Sciurus carolinensis*), chipmunk (*Tamias striatus*), and red squirrel (*Tamiasciurus hudsonicus*), where hemlock are dominant. Amphibians would include the ubiquitous northern redback salamanders (*Plethodon cinereus*) and red efts, the juvenile stage of red-spotted newts (*Notophthalmus v. viridescens*). All of the upland forest types provide valuable structural attributes, such as tree cavity den sites (which are utilized by a variety of bird and mammal species) and large woody material (which is utilized by various amphibian, reptile, and invertebrate species). Perhaps the biggest difference in wildlife habitat between forest types in Massachusetts is that oak acorn production, an important source of wildlife food, is substantially greater in oak forest types than in northern forest types, while beech nut production is greater in northern hardwood types. Oaks and acorns play a fundamental role in the organization and dynamics of eastern wildlife communities.

Public Access: Hiram Fox WMA, Worthington; East Brimfield Lake Flood Risk Management Project (US Army Corps of Engineers), Brimfield; Conant Brook Dam Flood Risk Management Project (US Army Corps of Engineers), Monson; Wolf Swamp WMA, Brookfield; 19th Hill WCE, Winchendon.

Threats: Exotic invasives, including insects such as gypsy moth. Red maple has become more abundant in the forest type with reduction of fires and from being a less desirable wood for human use.

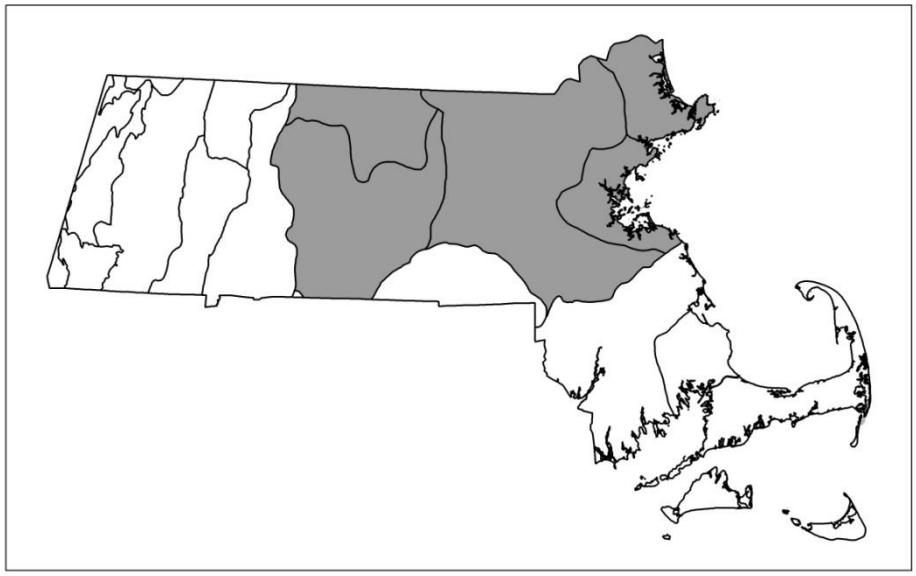
Management Needs:

USNVC/NatureServe: A2080 *Pinus strobus* - *Quercus prinus* Appalachian Forest Alliance - *Quercus* (*rubra*, *velutina*, *alba*) - *Betula lenta* - (*Pinus strobus*) Forest [CEGL006454] (mid successional); A4128 *Pinus strobus* - *Quercus alba* Allegheny Forest and Woodland Alliance - *Pinus strobus* - *Quercus* (*rubra*, *velutina*) - *Fagus grandifolia* Forest [CEGL006293].

Oak – Hickory Forest

Community Code: CT1B2B0000

State Rank: S4



Concept: A somewhat enriched hardwood forest dominated by a mixture of oaks, with hickories mixed in at a lower density.

Environmental Setting: Oak - Hickory Forest is a somewhat enriched hardwood forest dominated by a mixture of oaks, with hickories mixed in at a lower density. They occur on well-drained sites, such as ridgetops or slopes, often with southwest-, south-, or southeast-facing aspects. The canopy is closed to interrupted (~67% cover), the shrub layer diverse with dense patches, and the herbaceous layer diverse but scattered. The duff layer may be deep with undecomposed oak leaves. Many occurrences are rocky. A fire history is evident at some of these sites. The forest may include or surround small patches of rock outcrop or Hickory – Hop Hornbeam Woodland, and be surrounded itself by White Pine – Oak or Oak – Hemlock – White Pine Forests.

Vegetation Description: Oak - Hickory Forest is a broadly defined, variable forest type. The canopy is dominated by one or several oaks (*Quercus rubra*, *Q. alba*, and *Q. velutina* with *Q. coccinea* and/or *Q. montana*). Mixed in are lower densities of one or several hickories (*Carya ovata*, *C. tomentosa*, *C. glabra*, or *C. cordiformis*). Occasional other trees include white ash (*Fraxinus americana*), black birch (*Betula lenta*), sassafras (*Sassafras albidum*), and red maple (*Acer rubrum*). If present, conifers (white pine (*Pinus strobus*) and/or eastern hemlock (*Tsuga canadensis*)) constitute <25% cover. A subcanopy/tall shrub layer (usually 25-50% cover) commonly includes hop hornbeam (*Ostrya virginiana*), flowering dogwood (*Benthamidia florida*), downy shadbush (*Amelanchier arborea*), American chestnut (*Castanea dentata*), and

witch-hazel (*Hamamelis virginiana*). Low shrubs are often diverse and generally sparse, but dense in patches: maple-leaved viburnum (*Viburnum acerifolium*), blueberries (*Vaccinium angustifolium* and *V. pallidum*), beaked and American hazelnut (*Corylus cornuta* and *C. americana*), and gray dogwood (*Swida racemosa*) may be present. The herbaceous layer is also richer than in many oak forests. Plants typical of the herbaceous layer include silverrod (*Solidago bicolor*), tick-trefoils (*Desmodium glutinosum* and *D. paniculatum*), wild sarsaparilla (*Aralia nudicaulis*), rattlesnakeweed (*Hieracium venosum*), false Solomon's seal (*Maianthemum racemosum*), pink lady's slipper (*Cypripedium acaule*), and patches of long-beaked Pennsylvania sedge (*Carex lucorum*) or Pennsylvania sedge (*C. pensylvanica*).

Differentiating Occurrences: Oak - Hickory Forests are in the middle to moist end of a continuum of dry, acidic forests that are dominated by tree oaks. They are more diverse in all the forest layers than many oak forests/woodlands in the continuum. The canopies of Oak - Hickory Forests are generally closed or almost closed (averaging > 67% cover). White and black oaks usually dominate the canopy, with red or chestnut oaks producing additional canopy cover. Hickories and scarlet oaks are consistently present but not dominant. Hickory - Hop Hornbeam Forests/Woodlands have a park-like appearance, with a sparse shrub layer and a distinctive sedge understory. Hickories dominate the canopy with hop hornbeam forming a subcanopy. Dry, Rich Oak Forests might be an open, early successional variant of Oak - Hickory Forests that is maintained by regular or severe disturbance, particularly fire. Both lack abundant sugar maple, basswood, and white ash, and lack spring ephemerals and herbaceous species indicative of rich conditions found in Sugar Maple - Oak - Hickory Forests. Sugar Maple - Oak - Hickory Forest has fewer legumes and more spring ephemerals and herbaceous species indicative of rich conditions, such as herb Robert, wild geranium, and baneberry, than Oak - Hickory Forests. Red Oak - Sugar Maple Transition Forests have a greater dominance of red oak and sugar maple than Oak - Hickory Forests, and they have few hickories. Mixed Oak Forests/Woodlands lack abundant hickories and flowering dogwood and have a continuous low shrub layer formed by members of the blueberry family not found in Oak - Hickory Forests. Oak - Hemlock - White Pine Forests are the most broadly defined in the continuum of oak-dominated forests; Oak - Hickory Forests with abundant hickories are split out from this matrix type. White Pine - Oak Forests have >25% cover of white pine overall (not just local patches). Pitch Pine - Oak Forests have >25% cover of pitch pine overall (not just local patches).

Associated Fauna: There are no species known to be restricted to Oak - Hickory Forests. Wide-ranging species would include occurrences of this forest type as parts of their habitats, particularly when acorns are available. Wild Turkeys (*Meleagris gallopavo*) are found in primarily oak areas. Dry oak forests support a smaller mix of animal species than are found in moister communities. Common species of dry sites include short-tailed shrew (*Blarina brevicauda*), white-footed mouse (*Peromyscus leucopus*), and chipmunk (*Tamias striatus*). Snakes of dry forest sites include garter snakes (*Thamnophis sirtalis*) and redbelly snakes (*Storeria o. occipitomaculata*). Birds that nest in oak forests include Eastern Wood-Pewee (*Contopus virens*),

Red-eyed Vireo (*Vireo olivaceus*), Scarlet Tanager (*Piranga olivacea*), and Ovenbird (*Seiurus aurocapillus*). Moths, butterflies, and other insects of Oak - Hickory Forests include the orange sallow moth (*Pyrrhia aurantiago*, Special Concern).

Public Access: J.C. Phillips Sanctuary, Boxford; Wachusett Meadow Wildlife Sanctuary (Massachusetts Audubon Society), Princeton; Camels Hump, Quabbin Reservoir Watershed, Petersham; Palmer WMA, Palmer; Moose Hill Wildlife Sanctuary (Massachusetts Audubon Society), Sharon.

Threats: Invasive species, especially in richer areas. Many occurrences are remnants of formerly larger forests; further fragmentation would increase isolation.

Management Needs:

USNVC/NatureServe: A2053 *Quercus alba* - *Carya* spp. - *Fraxinus americana* Forest Alliance -- *Quercus* (*alba*, *rubra*, *velutina*) - *Carya* spp./*Viburnum acerifolium* Forest [CEGL006336]. Broadly includes (CEGL006301 in A2053) but that is more explicitly Dry, Rich Oak Forest and Hickory Hop Hornbeam (although the colloquial name is Oak-Hickory/Hop Hornbeam/Sedge Forest).

Oak – Tulip Tree Forest

Community Code: CT1B2C0000

State Rank: S1

Concept: A forest on gentle, moist, concave slopes (coves), or on well-drained flats at the base of the slopes. Soils are circumneutral to slightly acidic. One site is rocky.

Environmental Setting: Oak - Tulip Tree Forests are tall closed-canopy forests that occur from upper mid-slope to the bottom of moist, concave, north- or east-facing slopes. The forest grades into wetland forests on flats at the base of the slopes. Soils are moist and generally well-drained. They are circumneutral to acidic, with intermediate fertility. Some sites are very rocky. Leaf litter covers most of the ground with moss-covered rocks and a patchy diverse herbaceous layer.

Vegetation Description: Tulip trees (*Liriodendron tulipifera*) are emergent (over 100 ft.) above an already tall canopy dominated by red oak (*Quercus rubra*) with red and sugar maples (*Acer rubrum* and *saccharum*), black and yellow birches (*Betula lenta* and *alleghaniensis*), white and black oaks (*Quercus alba* and *velutina*), sassafras (*Sassafras albidum*), white ash (*Fraxinus americana*), and additional tulip trees. A subcanopy/tall shrub layer may include the same species with scattered white pine (*Pinus strobus*), eastern hemlock (*Tsuga canadensis*), striped maple (*A. pensylvanicum*), and witch-hazel (*Hamamelis virginiana*). Witch-hazel is often the most dominant shrub with abundant maple-leaf viburnum (*Viburnum acerifolium*). Other sites have patches of mountain laurel (*Kalmia latifolia*) and beaked hazelnut (*Corylus cornuta*) in the shrub layer. The diverse herbaceous layer covers about a third of the ground, with leaf litter covering the rest. Common herbaceous species include small jack-in-the-pulpit (*Arisaema triphyllum*), false Solomon's seal (*Maianthemum racemosum*), ground pine (*Dendrolycopodium obscurum*), New York fern

(*Parathelypteris noveboracensis*), Indian cucumber (*Medeola virginiana*), Christmas fern (*Polystichum acrostichoides*), white wood-aster (*Eurybia divaricata*), wild oats (*Uvularia sessilifolia*), and two-leaved toothwort (*Cardamine diphylla*). Wetland species such as skunk cabbage (*Symplocarpus foetidus*), sweet pepperbush (*Clethra alnifolia*), and highbush blueberry (*Vaccinium corymbosum*) can become common towards the base of the slopes when the community grades into wetlands.

Differentiating Occurrences: The key feature that differentiates Oak - Tulip Tree Forests from other communities is the presence of multiple mature tulip trees (not just occasional individuals) with a strong dominance of red oak (>25%) in association with both northern and central hardwoods. Red Oak - Sugar Maple Transition Forest is very similar but lacks the tulip trees, and lacks a strong mix of species of northern areas (sugar, mountain, and striped maples and bluebead lily) combined with more southern or coastal species (called central hardwoods), such as tulip tree and sassafras. Other types of oak forest lack large populations of tulip trees and sugar maples.

Associated Fauna: All upland forest types provide valuable structural attributes such as tree cavity den sites (used by a variety of bird and mammal species) and large woody material (used by various amphibian, reptile, and invertebrate species). These small patch communities would constitute only parts of the habitats of many animals found in them. Acorns are important for wildlife including white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), grey squirrel (*Sciurus carolinensis*), and other small rodents. Birds include Wild Turkeys (*Meleagris gallopavo*) in areas with sufficiently large forests to provide all the habitat needs. Passerine birds of oak forests include Red-eyed Vireo (*Vireo olivaceus*), Ovenbird (*Seiurus aurocapillus*), Black-and-white Warbler (*Mniotilta varia*), Scarlet Tanager (*Piranga olivacea*), Great Crested Flycatcher (*Miarchus crinitus*), Downy Woodpecker (*Picoides pubescens*), Hairy Woodpecker (*P. villosus*), and Red-bellied Woodpecker (*Melanerpes carolinus*). Likely amphibians include northern redback salamanders (*Plethodon cinereus*) and spotted salamanders (*Ambystoma maculatum*). Ringneck snake (*Diadophis punctatus*) and redbelly snake (*Storeria occipitomaculata*) would be expected.

Public Access: Robinson State Park, Agawam; Douglas State Forest, Douglas.

Threats: Major threat is invasive plants, particularly *Berberis thunbergii*. Exotic species, including *Rosa multiflora* and *Alliaria petiolata*, may be present in the shrub and herb layers of disturbed stands.

Management Needs:

USNVC/NatureServe: A3303 *Quercus rubra - Acer saccharum - Betula lenta* Forest Alliance High Allegheny Rich Red Oak - Sugar Maple Forest [CEGL006125]; A2054 *Fagus grandifolia - Quercus rubra/Cornus florida* Forest Alliance.

Open Oak Forest/Woodland

Community Code: CT1A3D0000

State Rank: S3

Concept: Open Oak Forests/Woodlands are savanna or park-like communities on mountain slopes, with short trees scattered over a grassy or low shrub understory around small rock outcrops. They often occur between a rocky summit and the surrounding taller forest.

Environmental Setting: Open Oak Forests/Woodlands are short (commonly <10m (~30 ft.), but up to <20m (~60 ft.) tall) oak/heath communities with interrupted or parklike tree canopies (commonly ~ 37%, but up to ~60% cover). These savanna-like areas are on slopes or near the summit of mountains with rock outcrops. The open oak area may include small areas of rocky summit or rock outcrop, which if larger (>~5000 sq. ft.) would be identified as separate community occurrences. Although often associated with rocky summit/rock outcrop communities, Open Oak Forests/Woodlands seem to need gradual rather than steep slopes below the summits. Soils are very shallow to bedrock. Surrounding landscape is forested. Fire may be important to maintaining the community; some sites have abundant charcoal, charred wood, and charring on the bases of sprouting oaks.

Vegetation Description: The short, interrupted canopies of Open Oak Forests/Woodlands are dominated by red oak (*Quercus rubra*), with a lower cover of white oak (*Q. alba*) and red maple (*Acer rubrum*). Many of the trees are multiple-stemmed. A sparse (<25% cover) subcanopy (<5m, < ~18 ft.)) has hop hornbeam (*Ostrya virginiana*) and striped maple (*A. pensylvanicum*). A slightly shorter tall shrub layer of approximately 30% cover is dominated by striped maple, red and white oaks, and maple-leaf viburnum (*Viburnum acerifolium*). A denser low shrub layer has patches of huckleberry

(*Gaylussacia baccata*), chokeberry (*Aronia melanocarpa*), mountain laurel (*Kalmia latifolia*), and early sweet lowbush blueberry (*Vaccinium pallidum*) with other scattered woody species. The herbaceous layer is continuous, except on the rock outcrops, with patches of different dominants. Lowbush blueberry (*Vaccinium angustifolium*) dominates (approx. 67% in patches) and seedlings of forest trees (oaks, maple, hemlock) with grasses and sedges, forbs, ferns, and mosses make up the rest of the layer. Common hairgrass (*Deschampsia flexuosa*) is common in the balds and in the Open Oak Forest/Woodland. Other species include pale corydalis (*Capnoides sempervirens)*, early goldenrod (*Solidago juncea*), spreading ricegrass (*Oryzopsis asperifolia*), fringed bindweed (*Fallopia cilinodis*), running shadbush (*Amelanchier spicata*), downy goldenrod (*Solidago puberula*), and wild columbine (*Aquilegia canadensis*).

Differentiating Occurrences: Open Oak Forests/Woodlands are part of a continuum of dry, acidic communities that contain a variety of tree oak and pine species. Many types of oak communities grade into one another in time and space and are difficult to differentiate both in a classification and on the ground. They all have tree oaks and a low shrub layer dominated by blueberry family plants. Open Oak Forests/Woodlands occur on hill slopes, with short red and white oak trees scattered over a grassy or low shrub understory around small rock outcrops. They often occur between a rocky summit and the surrounding taller forest. Black Oak - Scarlet Oak Forest/Woodlands are also predominantly woodlands, but not usually associated with rocky outcrops. Abundant scarlet oak with black oak is the key indicator of the type. Mixed Oak Forests/Woodlands have more oak species than Open Oak Forest/Woodlands (black, scarlet, and white, plus red oak (*Q. rubra*) and chestnut oak (*Q. montana*)), and black birch (*Betula lenta*). Coastal Forests/Woodlands are within a few miles of the coast at <~60 ft. elevation and receive storm winds and spray. The diverse canopy includes oaks and often has American holly, sassafras, and black gum. Oak – Hemlock – White - Pine Forests are the most broadly defined in the continuum of oak-dominated forests; specific types are split out from this matrix type. Oak – Hemlock – White - Pine Forest is dominated by a mix of tree oaks with scattered white pine and hemlock, either of which may be in local dense patches. White Pine - Oak Forests have >25% cover of white pine overall (not just local patches). Pitch Pine - Oak Forests have>25% cover of pitch pine overall (not just local patches).

Associated Fauna: Open Oak Forest/Woodlands are small patch communities of transition areas that would constitute only parts of the habitats of most animals found in them. Acorns are important foods for white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), grey squirrels (*Sciurus carolinensis*), other small rodents, as well as Wild Turkeys (*Meleagris gallopavo*) and other birds. The understory of blueberries and huckleberries is used by many of these same species. Passerine birds of oak forests include Red-eyed Vireo (*Vireo olivaceus*), White-breasted Nuthatch (*Sitta carolinensis*), Ovenbird (*Seiurus aurocapillus*), Black-and-white Warbler (*Mniotilta varia*), Scarlet Tanager (*Piranga olivacea*), Great Crested Flycatcher (*Miarchus crinitus*), and Downy Woodpecker (*Picoides pubescens*). Small

mammals would include those of dry habitats, such as white-footed mouse (*Peromyscus leucopus*) and short-tailed shrew (*Blarina brevicauda*). Snakes would be those of dry areas, such as black racer (*Coluber constrictor*), ringneck (*Diadophis punctatus*), and redbelly snake (*Storeria occipitomaculata*). No turtles, frogs, or toads would be expected.

Public Access: Little Watatic Mt., Ashburnham State Forest, Ashburnham; Wright's Pond, Middlesex Fells, Medford.

Threats: Trampling (Great Blue Hills and Watatic Mtn.). The Palmer site has invading white pine.

Management Needs:

USNVC/NatureServe: Related to but not the same as: CEGL006134 is Chestnut Oak and but CEGL006018 is closed canopy mixed oak forest: A0624 *Quercus rubra* - *Quercus prinus* Woodland Alliance - *Quercus rubra* - (*Quercus prinus*)/*Vaccinium* spp./*Deschampsia flexuosa* Woodland (CEGL006134); A2048 *Quercus velutina* - *Quercus alba* Eastern Forest Alliance - *Quercus* (*velutina*, *alba*)/*Vaccinium pallidum*/*Pteridium aquilinum* High Allegheny Plateau, Western Allegheny Plateau Forest [CEGL006018].

Open Talus/Coarse Boulder Community

Community Code: CT2A2D0000

State Rank: S2

Concept: Sparsely vegetated community of vines and scattered herbaceous plants on exposed moss- or lichen-covered boulders, with deciduous litter in crevices and little to no tree canopy.

Environmental Setting: Open Talus/Coarse Boulder Communities are usually below cliffs or rock outcrops or in boulder fields left by glaciers. Sparse vines and scattered herbaceous plants grow in dry, shallow soil or from moist, loamy, deciduous-litter-filled crevices among moss- or lichen-covered boulders. The Open Talus/Coarse Boulder Community may be replaced lower on the slope by a forest or woodland type, if tree canopy cover is greater than 25%. There may be a gradient from short, sparse vegetation on exposed rocks at the top of the talus slope, through scattered, clumped, somewhat dwarfed trees and tall shrubs, to forest at the base of the slope. Open talus occurs in Massachusetts where there are bedrock outcrops high enough to break off and fall to create talus slopes.

Vegetation Description: In unshaded, open talus communities, lichens often cover the exposed rocks. Growing from between rocks, rock polypody (*Polypodium virginianum*), Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Toxicodendron radicans*), and occasionally fringed bindweed (*Fallopia cilinodis*) contribute to the herbaceous and vine flora which can be quite sparse. Clematis (*Clematis* spp.), climbing fumitory (*Adlumia fungosa*), marginal wood fern (*Dryopteris marginalis*), and pink corydalis (*Capnoides sempervirens*) may be present, particularly when the talus is formed by less acidic rocks. Raspberries (*Rubus* spp.) and grapes vines (*Vitis* spp.) are

sometimes abundant. The plants of talus slopes reflect the regional vegetation where they occur.

Differentiating Occurrences: Rocky summits, rock outcrops, rock cliffs, and talus all support natural communities adjacent to and grading into each other, all within and reflecting the surrounding matrix forest. Forested areas lower in the talus slope/ boulder field are considered to be a different community, usually part of the prevailing forest. Acidic, Circumneutral, and Calcareous Rock Cliff Communities are on vertical to near vertical (~60% slope), with sparse vegetation that is similar to the vegetation of Open Talus/Coarse Boulder Communities. Open Talus/Coarse Boulder communities are on broken rocks on a slope rather than on near-vertical cliffs with continuous rock. Rocky summit/rock outcrop communities also have bare rock and could be confused with Open Talus/Coarse Boulder Communities which have broken rock rather than the smoother bedrock of outcrops. Small (<5000 sq. ft.) occurrences of Open Talus at the base of cliffs would be included with the cliff or surrounding forest as appropriate to the size and site. Or if the Open Talus is larger than the Cliff or outcrop, it might be named as the community type with the other small part as variation within it.

Associated Fauna: Most animals respond to the size of boulders, cover, moisture, and surroundings of the talus slope. Porcupines (*Erethizon dorsatum*) den in large boulder fields and turkey vultures (*Cathartes aura*) make nests in other large boulder fields, but snakes, for example, north American racer (*Coluber constrictor*), eastern milk snake (*Heterodon platirhinos*), eastern ratsnake (*Pantherophis alleghaniensis*) and timber rattlesnakes (*Crotalus horridus*), hibernate in dens in talus with smaller stones. For many animals associated with talus slopes, the talus is just part of their larger habitat that includes adjacent rock habitats and surrounding forests; the animals may move among them over the course of a day, a season, or a year. Songbirds of talus slopes tend to be those of the surrounding forests.

Public Access: Palmer WMA, Palmer; Blue Hills State Reservation, Milton.

Threats: Invasives including Oriental bittersweet (*Celastrus orbiculatus*) and black nightshade (*Solanum dulcamara*). Alteration of surrounding areas, such as by development, would fragment and reduce the overall habitat available for those species for which talus is only part of their habitats. Several of the species of talus slopes, such as some of the snakes, do best away from humans. Protecting areas around the talus slopes that provide their habitat is the best way to protect them and the other species that depend on these habitats.

Management Needs: The calcium enrichment and moistness of the lower areas of the circumneutral and calcareous talus slopes attract invasive exotic species as well as the native species. Because invasive exotic species often enter a natural community after some form of disturbance, restricting human-derived disturbances would help keep invasive species out. However, since natural disturbances are part of the normal processes in talus, the best occurrences need to be monitored for invasive species. They should be controlled and removed where practical. Although acidic talus is much

less attractive to invasive species than the richer areas, excellent occurrences should also be monitored.

USNVC/NatureServe: *Polypodium* (*virginianum*, *appalachianum*)/Lichen spp. Nonvascular Vegetation (CEGL006534); System: Laurentian-Acadian Acidic Cliff and Talus (CES201.569). Possibly *Quercus rubra* - *Betula lenta*/*Polypodium virginianum* Woodland CEGL006585 which is <50% canopy with large acidic talus boulders (but includes circumneutral species).

Pitch Pine – Oak Forest/Woodland

Community Code: CT1A200000

State Rank: S4

Concept: Dry oak/pine forests and woodlands of moraines, till, outwash, southerly exposures, and rocky slopes. Matrix forest of southeastern Massachusetts. The proportions of different species are variable, and range from predominantly pine with scattered oaks to predominantly oak with scattered pines. The structure ranges from open canopy with a thick understory, to closed canopy with scattered clumps of shrubs.

Environmental Setting: Pitch Pine - Oak Forests/Woodlands occur on dry, low-nutrient, acidic soils of southerly exposures, moraines, rocky slopes, and sandplains with only sporadic disturbances, inland away from regular oceanic influences. In southeastern Massachusetts, Pitch Pine - Oak Forests/Woodlands often form a matrix community surrounding and mixed with smaller patch Pitch Pine - Scrub Oak communities, coastal plain ponds, and Sandplain Grasslands and Heathlands. Near the ocean, Pitch Pine - Oak Forests/Woodlands grade into Coastal Forests/Woodlands. The forest structure ranges from open canopy with a dense understory to closed canopy with scattered clumps of shrubs. Without fire or other disturbances that favor pitch pines and oaks, the community succeeds to less fire-tolerant species. The time since disturbance is also a factor in the proportion of pitch pine to oaks, and which oak species are present and abundant.

Vegetation Description: Pitch Pine - Oak Forests/Woodlands have a canopy of pitch pine (*Pinus rigida*) and tree oaks (black (*Quercus velutina*), scarlet (*Q. coccinea*), chestnut (*Q. montana*), and white (*Q. alba*)). The proportions of canopy species differ among sites, ranging from predominantly pine with scattered oaks to predominantly oak with scattered pines (>25% cover). White pine (*Pinus strobus*) and red maple (*Acer rubrum*) are

occasional in the canopy, increasing with time since the last fire or other disturbance. Scattered patches of scrub oak (*Quercus ilicifolia*) and dwarf chinquapin oak (*Q. prinoides*) can be dense. Blueberries (*Vaccinium angustifolium* and *V. pallidum*), black huckleberry (*Gaylussacia baccata*), and other ericaceous shrubs form an often continuous low shrub layer. Catbrier and other briers (*Smilax rotundifolia* and *Smilax* spp.) often make dense barriers around low, damp openings. The herb layer is generally sparse, with bracken fern (*Pteridium aquilinum*), wild sarsaparilla (*Aralia nudicaulis*), wintergreen (*Gaultheria procumbens*), Pennsylvania sedge (*Carex pensylvanica*), and, less commonly, pink lady's-slipper (*Cypripedium acaule*).

Differentiating Occurrences: Pitch Pine - Oak Forest/Woodland is part of a continuum of dry, acidic communities dominated by a variety of tree oak and pine species. Related communities often mix on the ground, with successional stages present that are strongly influenced by historic and recent disturbances, with topography, soils, and local climate controlling the broader vegetation types. Pitch Pine - Oak Forest/Woodland has >25% pitch pine in the canopy, growing with tree oaks, producing a canopy of >40% cover. Pitch Pine - Scrub Oak Communities have ~<25% cover of trees and lack tree oaks. Neither White Pine - Oak Forest nor Successional White Pine Forest have >25% cover of pitch pine. Maritime Pitch Pine Woodlands on Dunes are on dunes. They are dominated by pitch pine and usually lack abundant tree oaks. Maritime Forests/Woodlands are very near the ocean, receive regular salt spray, and have stunted canopies of mixed tree species. Coastal Forest/Woodlands generally have a more diverse tree layer than Pitch Pine - Oak Forests, although it may include some pitch pine and many oaks with other trees.

Associated Fauna: Pitch Pine - Oak Forest/Woodland provides habitat for many common and listed moths dependent on the oaks, pine, and heath shrubs. Box turtles (*Terrapene carolina*) use these forests as well as others in the southeastern part of the state. The bird fauna is similar that of oak woodlands; Rufous -sided Towhee (*Pipilo erythrophthalmus*), Pine Warbler (*Dendroica pinus*), and Ruffed Grouse (*Bonasa umbellus*) are common. Most common species of mammals of Massachusetts have populations that make Pitch Pine – Oak Forests part of their habitat but none are particularly characteristic.

Public Access: Myles Standish State Forest, Plymouth; Hyannis Ponds WMA, Barnstable; Francis Crane WMA, Falmouth; Montague Plains WMA, Montague; Mt. Everett State Reservation, Mt. Washington.

Threats: Many acres have been lost resulting in fragmentation of occurrences. Fire exclusion is changing the character of the community, allowing less fire-tolerant species to establish, which sometimes results in more severe fires when they do occur.

Management Needs: Reintroduction of fire with prescribed fire in manageable conservation areas.

USNVC/NatureServe: A0524, *Pinus rigida* Woodland Alliance, *Pinus rigida*/*Vaccinium* spp. - *Gaylussacia baccata* Woodland, [CEGL005046]; *Pinus rigida*/*Quercus ilicifolia*/*Lespedeza*

capitata Woodland [CEGL006025]; *Pinus rigida*/*Carex pensylvanica* Woodland [CEGL006385]. A4209 *Quercus velutina* - *Quercus falcata* - *Pinus rigida* Coastal Plain Forest Alliance-- *Pinus rigida* - *Quercus* (*velutina*, *prinus*) Forest [CEGL006290].

Pitch Pine – Scrub Oak Community

Community Code: CT2B1F0000

State Rank: S2

Concept: Shrub-dominated communities with scattered to dense trees and scattered openings. Shrubs are usually very dense.

Environmental Setting: Pitch Pine - Scrub Oak Communities are dominated by dense shrubs with scattered to patchily dense trees and occasional openings. They occur on droughty, acidic, low-nutrient soils, usually deep, coarse, well-drained sands derived from glacial outwash, in the coastal plain, the Connecticut River Valley, and other scattered areas throughout the state. Pitch Pine - Scrub Oak Communities are fire-maintained and fire-dependent communities; most species in the community recover well from fire. Prescribed burns that remove accumulated dead needles and leaves on a regular basis help maintain the natural community and reduce the danger from wildfires. The community succeeds to Pitch Pine - Oak Forests/Woodlands without fire or other site disturbances. The openings grade into Sandplain Heathland and Grassland communities, which are separated out as distinct community occurrences when larger than about an acre. In pitted outwash plains or rolling moraines, some low bowls, or kettles, are frost pockets that have more heath and lichen and less oak and pine. Deeper kettles that intersect the water table may have a coastal plain pond or a small peatland.

Vegetation Description: Pitch Pine - Scrub Oak Communities are not very diverse floristically; the combination of few species plus the physical structure of the vegetation is characteristic of the natural community. Scattered (to patchily dense) pitch pine (*Pinus rigida*) trees form an open canopy (from about 10% to about 25%, although there can be denser patches). This canopy is over an often continuous understory of

scrub oak (*Quercus ilicifolia*) and dwarf chinquapin oak (*Q. prinoides*) 2-4 meters (7-15 feet) tall, with shorter huckleberry (*Gaylussacia baccata*) about a meter (3 feet) tall in a mosaic with lowbush blueberries (*Vaccinium angustifolium* and *V. pallidum*), bearberry (*Arctostaphylos uva-ursi*), and large patches of lichens, intermixed with sedges (primarily *Carex pensylvanica* with others) or little bluestem (*Schizachyrium scoparium*) in openings between the taller shrubs. Other species regularly occurring in low numbers include golden heather (*Hudsonia ericoides*), cow wheat (*Melampyrum lineare*), and mayflower (*Epigaea repens*). Inland occurrences of Pitch Pine - Scrub Oak Communities have successional areas with trembling aspen (*Populus tremuloides*), gray birch (*Betula populifolia*), black cherry (*Prunus serotina*), and pin (or fire) cherry (*Prunus pensylvanica*). Areas with tree oaks or more than 40% canopy cover by pitch or white pine trees are considered to be woodland or forest.

Differentiating Occurrences: The Pitch Pine - Scrub Oak Community grades into Pitch Pine - Oak Forest/Woodlands, which have >40% canopy and tree oaks that do not occur in the Pitch Pine - Scrub Oak Community. Scrub oak is much less abundant and less dense in the forest/woodland situation, which usually occur in less dry environments and have more soil development. Maritime Pitch Pine Woodlands on Dunes have little scrub oak and generally much sparser pines. Ridgetop Pitch Pine - Scrub Oak Communities are on bedrock outcrops, often ridges. In order to name and map Scrub Oak Shrublands, Sandplain Heathlands, and/or Sandplain Grasslands included in a Pitch Pine - Scrub Oak Community, those would need to occupy significant area or topographic differences where they are distinct (large frost pockets for example).

Associated Fauna: Many species of lepidopterans are restricted to the Pitch Pine - Scrub Oak Community and its openings. The bird fauna is generally that of oak woodlands; Rufous-sided Towhee (*Pipilo erythrophthalmus*), Pine Warbler (*Dendroica pinus*), and Ruffed Grouse (*Bonasa umbellus*) are common. At one Pitch Pine - Scrub Oak Community site, Prairie Warblers (*Setophaga discolor*) were very abundant, with their densest populations in the state. Whip-poor-will (*Caprimulgus vociferus*) and Common Nighthawk (*Chordeiles minor*) are now increasingly restricted to sandy openings of Pitch Pine - Scrub Oak Communities. American Woodcock (*Philohela minor*) also use the openings. Heath hens (*Tympanuchus cupido cupido*), a now extinct subspecies of prairie chicken, were adapted to scrub oak communities: they ate scrub oak acorns and berries in the openings, and used scrub oak for cover. Exclusion of fire followed by very large, hot fires in their habitat likely contributed to their extinction. The dense shrubs of Pitch Pine - Scrub Oak Communities in southeastern Massachusetts provide habitat for New England cottontail (*Sylvilagus transitionalis*). A variety of mice and voles use the scrub oak for cover and feed where they find acorns or berries. Larger mammals seem to prefer woodlands where they can move more easily.

Public Access: Myles Standish State Forest, Plymouth; Mashpee Pine Barrens WMA, Mashpee; Manuel F. Correllus State Forest, West Tisbury; Montague Plains WMA, Montague.

Threats: Development and fragmentation; succession from fire exclusion.

Management Needs: Reintroduction of fire according to fire management plans. Many areas that have not burned for more than 20 years may need to have fuels mechanically reduced (logging or brushcutting) before prescribed fires are attempted.

USNVC/NatureServe: Includes: *Pinus rigida* Woodlands Alliance -- *Pinus rigida*/*Quercus ilicifolia*/*Lespedeza capitata* Woodlands [CEGL006025] and *Pinus rigida* Woodlands Alliance -- *Pinus rigida*/*Quercus ilicifolia*/*Morella pensylvanica* Woodlands [CEGL006315].

Red Oak – Sugar Maple Transition Forest

Community Code: CT1B300000

State Rank: S4

Concept: Forests with species of northern hardwoods (maples) and a smaller proportion of central hardwoods (oaks) together. Has few of the extreme northern or southern indicators.

Environmental Setting: Red Oak - Sugar Maple Transition Forests are tall forests with closed, predominantly deciduous canopies, with conifers usually providing <20% of the cover. Lower layers have variable density, often with scattered individual trees and shrubs; the herbaceous layer is typically sparse. Red Oak - Sugar Maple Transition Forests are often on north- to northeast-facing, well-drained to moist slopes. The soils are often rocky, somewhat acidic, and of intermediate fertility. Most occurrences are at low to mid-elevations, usually under 475m (~1560 ft.).

Vegetation Description: Red Oak - Sugar Maple Transition Forests have a closed (>75% cover) canopy dominated by (>~25% cover) of northern red oak (*Quercus rubra*) with sugar maple (*Acer saccharum*), and variable proportions of beech (*Fagus grandifolia*), black birch (*Betula lenta*), and <20% conifers (white pine (*Pinus strobus*) and hemlock (*Tsuga canadensis*)). White and black oaks (*Quercus alba* and *Q. velutina*), red maple (*Acer rubrum*), white ash (*Fraxinus americana*), and yellow birch (*B. alleghaniensis*) are regular minor associates. Shrubs are usually sparse; typical species include striped maple (*Acer pensylvanicum*), maple-leaved viburnum (*Viburnum acerifolium*), beaked hazelnut (*Corylus cornuta*), mountain laurel (*Kalmia latifolia*), and witch hazel (*Hamamelis virginiana*). The herbaceous layer is often patchy and dominated by ferns such as intermediate wood fern (*Dryopteris intermedia*), Christmas fern (*Polystichum acrostichoides*), hay-scented fern (*Dennstaedtia punctilobula*), and

clubmosses (*Lycopodium clavatum* and *Dendrolycopodium obscurum*). Typical forest species may be present, including wild sarsaparilla (*Aralia nudicaulis*), Indian cucumber (*Medeola virginiana*), Canada mayflower (*Maianthemum canadense*), and whorled wood-aster (*Oclemena acuminata*), with broad-leaved woodland-sedge (*Carex platyphylla*) in the less acidic sites.

Differentiating Occurrences: Red Oak - Sugar Maple Transition Forest is differentiated from Northern Hardwood - Hemlock - White Pine Forest by its greater amount of oak, and from Oak - Hemlock - White Pine and other oak forests by its greater prominence of northern hardwoods and lack of widespread blueberry family shrubs. Like Rich, Mesic Forest, Red Oak - Sugar Maple Transition Forest is usually in Northern Hardwood - Hemlock - White Pine Forest or the transition between Northern Hardwood - Hemlock - White Pine Forest and the oak-dominated forests to the south. Rich, Mesic Forest lacks oaks and beech, and the occasional conifers that are important in Red Oak - Sugar Maple Transition Forests. The understory of Rich, Mesic Forest has dense spring ephemerals and lacks the abundant evergreen wood fern, Christmas fern, and wild sarsaparilla found in Red Oak - Sugar Maple Transition Forests, which may have scattered spring ephemerals. Sugar Maple - Oak - Hickory Forest includes multiple species of hickories and oaks in more abundance than occur in Red Oak - Sugar Maple Transition Forests. They tend to occur to the south and east in the state, but overlap with the distribution of Red Oak - Sugar Maple Transition Forests. Red Oak - Sugar Maple Transition Forests are more dominated by red oak and appear to be more acidic, less nutrient-rich, and less diverse than Sugar Maple - Oak - Hickory Forest, with undecomposed oak leaves covering the forest floor.

Associated Fauna: This widespread forest type provides habitat to many, particularly opportunistic, animal species. All upland forest types provide valuable structural attributes such as tree cavity den sites (used by a variety of bird and mammal species) and large woody material (used by various amphibian, reptile, and invertebrate species). Large mammals include Red Oak - Sugar Maple Transition Forest as parts of their habitat, but are usually more dependent on size of undisturbed forest than on the precise type. White-tailed deer (*Odocoileus virginianus*) are classic users of this forest type, although certainly not limited to it. Fisher (*Martes pennanti*) use larger, older examples. Most of the widespread small mammals would be expected in larger occurrences of the community. Frogs and salamanders breed in vernal pools and other wetlands and use the surrounding uplands in the rest of the year.

Public Access: South Mountain, Berkshire Natural Resources Council, Pittsfield; Monroe State Forest, Monroe.

Threats: Invasive species occur in less acidic sites with more nutrient availability.

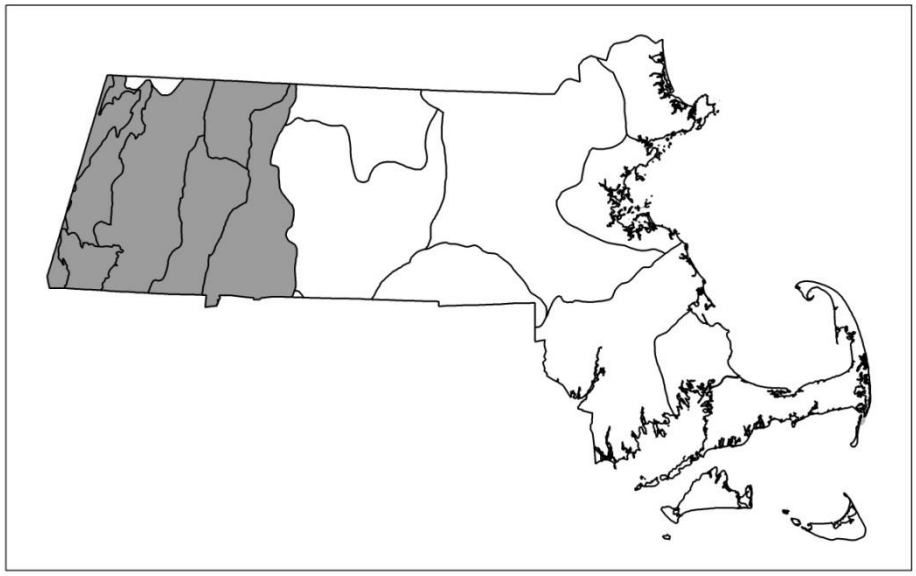
Management Needs: Some occurrences, especially with abundant white pine, are old-field successional, and others have been managed as woodlots and were selectively cut in the past, or may continue to be logged to the present. The understory reflects the history of the sites.

USNVC/NatureServe: A3241 *Quercus rubra - Acer saccharum* Forest Alliance - *Betula alleghaniensis - Quercus rubra/Polypodium virginianum* Woodland [CEGL006584]; *Quercus rubra - Acer saccharum - Fagus grandifolia/Viburnum acerifolium* Forest [CEGL006633]; A3297 *Acer saccharum - Tilia americana* Limestone Woodland Alliance - *Acer saccharum - Tilia americana - Fraxinus americana/Ostrya virginiana/Geranium robertianum* Woodland [CEGL005058](more northern than SMOHF, less rich than RMF); A3303 *Quercus rubra - Acer saccharum - Betula lenta* Forest Alliance - *Quercus rubra - Betula alleghaniensis/Osmunda cinnamomea* Forest -- *Quercus rubra - Betula alleghaniensis/Osmunda cinnamomea* Forest [CEGL006000]; *Quercus rubra - Acer saccharum* - (*Q. alba*) Forest Alliance -- *Acer saccharum - Quercus rubra/Hepatica nobilis* var. *obtusa* Forest [CEGL006046]; *Quercus rubra - Acer saccharum/Viburnum acerifolium - Lindera benzoin* Forest [CEGL006635].

Rich, Mesic Forest

Community Code: CT1C2A0000

State Rank: S3



Concept: A variant of the northern hardwood forest where sugar maple is usually dominant and there is a diverse herbaceous layer with abundant spring ephemerals, in a moist, nutrient-rich environment.

Environmental Setting: Occurring in western Massachusetts, Rich, Mesic Forests are restricted to elevations below 2,400 ft. (about 650 m), usually on east- or southeast-facing, concave, mid- to lower slopes with downslope movement of nutrients and organic matter. Rich refers to rich in nutrients; they are also rich in species. Mesic is the moderate moisture regime. Soils are usually deep, with leaves and other plant litter quickly incorporated into the soil, so that there is rarely more than one year's accumulation of leaves on the forest floor. The dominant trees of Rich, Mesic Forests are very shade-tolerant and able to establish and grow under low-light conditions of a full canopy. Species of lower layers are also shade-tolerant and can make use of transient light patches from small canopy gaps. Rich, Mesic Forests are noted for having abundant herbaceous species: spring ephemerals (plants that flower before tree leaf out and have foliage that disappears in late spring) are characteristic, along with slightly later bloomers that keep their leaves into summer and others that flower later.

Vegetation Description: Rich, Mesic Forests are dominated by sugar maple (*Acer saccharum*), with white ash (*Fraxinus americana*), bitternut hickory (*Carya cordiformis*), elm species (*Ulmus* spp.), and basswood (*Tilia americana*) being other characteristic trees. Butternut (*Juglans cinerea*) usually grows in Rich, Mesic Forests but is infrequent. Hop hornbeam (*Ostrya virginiana*) is common as a subcanopy tree. Although the shrub

layer is usually sparse, pagoda dogwood (*Swida alternifolia*), leatherwood (*Dirca palustris*), or red-berried elderberry (*Sambucus racemosa*) may be present. Typically, spring ephemerals are very abundant. The dense herbaceous layer typically has combinations of species that include some of bloodroot (*Sanguinaria canadensis*), maidenhair fern (*Adiantum pedatum*), late blue cohosh (*Caulophyllum thalictroides*), sweet cicely (*Osmorhiza claytonii*), Dutchman's breeches (*Dicentra cucullaria*), squirrel corn (*Dicentra canadensis*), toothwort (*Cardamine diphylla*), wild leek (*Allium tricoccum*), Goldie's fern (*Dryopteris goldiana*), and zigzag goldenrod (*Solidago flexicaulis*). A semi-evergreen fairly distinct sedge, plantain-leaf sedge (*Carex plantaginea*), is a good indicator of the community that is visible throughout the year.

Differentiating Occurrences: Rich, Mesic Forest is usually within the Northern Hardwood - Hemlock - White Pine Forest or in the transition between it and the oak-dominated forests to the south: Rich, Mesic Forest lacks conifers, beech (*Fagus grandifolia*), and oaks (*Quercus* spp.). The understory has dense spring ephemerals and lacks abundant evergreen wood fern (*Dryopteris intermedia*) and wild sarsaparilla (*Aralia nudicaulis*), both usually found in Northern Hardwood - Hemlock - White Pine Forest. Dense populations of late blue cohosh (*Caulophyllum thalictroides*), Virginia waterleaf (*Hydrophyllum virginianum*), or wild leek (*Allium tricoccum*) usually indicate Rich, Mesic Forests. The Northern Hardwood - Hemlock - White Pine Forest canopy includes eastern hemlock (*Tsuga canadensis*), white pine (*Pinus strobus*), American beech, and red oak (*Quercus rubra*). Rich Northern Hardwood - Hemlock - White Pine Forest may have scattered spring ephemerals, but also early yellow violet (*Viola rotundifolia*) and broad-leaved spring beauty (*Claytonia caroliniana*) that usually indicate lower nutrient availability. Red Oak - Sugar Maple Transition Forest has red oak as a dominant, with sugar maple, American beech, and black birch (*Betula lenta*). Spring ephemerals are not abundant. Geography is basic to differentiating Sugar Maple - Oak - Hickory Forest from Rich, Mesic Forest: most occurrences of Rich, Mesic Forests in Massachusetts are west of the Connecticut River Valley. The presence of multiple species of hickories (*Carya* spp.) and oaks (*Quercus* spp.) in Sugar Maple - Oak - Hickory Forest is a main difference between these two types. Broad-leaved woodland-sedge (*Carex platyphylla*) is close to being an indicator of Sugar Maple - Oak - Hickory Forest. Rich, Mesic Forest has plantain-leaf sedge (*Carex plantaginea*) instead. Rich, Mesic Forest is characterized by very dense herbaceous growth of spring ephemerals; Sugar Maple - Oak - Hickory Forest shares some of the species but with fewer individuals of fewer species. Sugar Maple - Oak - Hickory Forest has evergreen wood ferns that Rich, Mesic Forest lacks.

Associated Fauna: All of the upland forest types provide valuable structural attributes such as tree cavity den sites (used by a variety of bird and mammal species) and large woody material (used by various amphibian, reptile, and invertebrate species). Very few animal species are strongly associated with Rich, Mesic Forests to the exclusion of other community types. Birds of forests that breed in Rich, Mesic Forests include Wood Thrush (*Hylocichla mustelina*), Veery (*Catharus fuscescens*), Black-and-white

Warbler (*Mniotilta varia*), Ovenbird (*Seiurus aurocapillus*), Louisiana Waterthrush (*Parkesia motacilla*), Scarlet Tanager (*Piranga rubra*), and Barred Owls (*Strix varia*). Species that breed in vernal pools, such as mole salamanders (*Ambystoma* spp.), are often found in Rich, Mesic Forest. They use the surrounding Rich, Mesic Forest for foraging and hibernation. Most of the small mammals of forests occur in Rich, Mesic Forests, although some are limited to their geographical distribution. Southern flying squirrels (*Glaucomys volans*), grey squirrels (*Sciurus carolinensis*), woodland jumping mouse (*Napaeozapus insignis*), masked shrew (*Sorex cinereus*), and red-backed vole (*Clethrionomys gapperi*) are among the widespread species whose habitat includes Rich, Mesic Forests. Large mammals include Rich, Mesic Forests as parts of their habitat, but are usually more dependent on size of undisturbed forest than on the precise forest type.

Public Access: Day Mountain WMA, Dalton; Maple Hill WMA, West Stockbridge; The Hopper, Mt. Greylock State Reservation, Williamstown; Knightville Dam and Reservation (US Army Corps of Engineers), Huntington; Hiram H. Fox WMAs, Huntington; Appalachian Trail, Tyringham.

Threats: Invasive exotics do very well in the nutrient-rich, mesic conditions associated with these forests. Fragmentation and isolation can be problems for the species of the community.

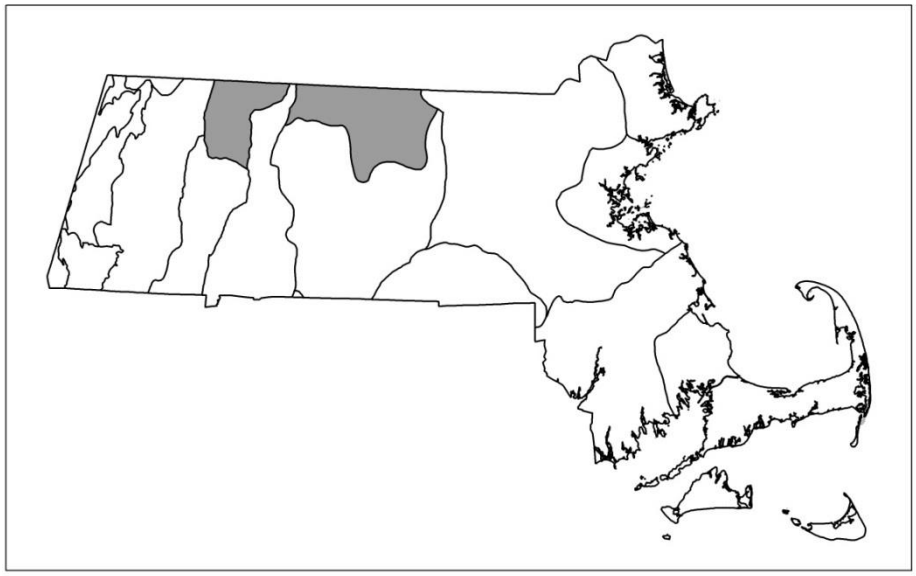
Management Needs: Control of exotics in exemplary sites.

USNVC/NatureServe: A3301 *Acer saccharum - Fagus grandifolia - Tilia americana* Forest Alliance - *Acer saccharum - Tilia americana/Acer pensylvanicum/Caulophyllum thalictroides* Forest [CEGL006637]; A3240 *Acer saccharum – Tilia americana - Fraxinus americana* Forest Alliance *Acer saccharum - Fraxinus americana/Acer spicatum/Caulophyllum thalictroides* Forest [CEGL006636]; A4126 *Acer saccharum - Tilia americana - Quercus rubra* Rocky Forest Alliance - *Acer saccharum- Fraxinus americana- Juglans cinerea/Staphylea trifolia* Forest [CEGL006577].

Ridgetop Heathland

Community Code: CT2B2B2000

State Rank: S2



Concept: A natural or semi-natural low shrub community on bedrock that often needs management to remain open in the absence of fire. The tree canopy is absent or poorly developed. Includes but is not restricted to abandoned lowbush blueberry farms.

Environmental Setting: Ridgetop Heathlands are shrublands of hills, ridgetops, and rock outcrops, sometimes instead of Acidic or Circumneutral Rocky Summits / Rock Outcrops or just below them. The exposed ridgetop environment is harsh, with intense sunlight, extreme daily and seasonal temperature variations, and bedrock at or close to the surface, resulting in nutrient-poor, droughty soils. They have a nearly continuous layer of low-growing shrubs. Some occurrences are derived from abandoned blueberry farms or grazed sites. If less than about 5000 sq. ft., an occurrence would be considered to be part of the surrounding rocky summit/rock outcrop, Ridgetop Pitch Pine - Scrub Oak Community, or Open Oak Forest/Woodland community. Without regular disturbance or management (fire or regular removal of trees), the community usually succeeds to woodland or forest, leaving mosaics of patchy occurrences along rocky ridges.

Vegetation Description: Overall, diversity is low, with heath shrubs forming an extensive, dense, low shrub layer dominated by low sweet blueberry (*Vaccinium angustifolium*) with early sweet blueberry (*Vaccinium pallidum*), black huckleberry (*Gaylussacia baccata*), bearberry (*Arctostaphylos uva-ursi*), and/or sheep-laurel (*Kalmia angustifolia*). Patches of taller shrubs may include black chokeberry (*Aronia melanocarpa*), mountain-laurel (*Kalmia latifolia*) and tree saplings from the surrounding forest, particularly white

pine (*Pinus strobus*), gray or white birch (*Betula populifolia* or *B. papyrifera*), or red maple (*Acer rubrum*). Little bluestem (*Schizachyrium scoparium*), poverty grass (*Danthonia spicata*) and hairgrass (*Deschampsia flexuosa*) typically occur in the sparse herbaceous layer. Three-toothed cinquefoil (*Sibbaldiopsis tridentata*) may be a characteristic species of northern occurrences.

Differentiating Occurrences: Ridgetop Heathlands occur on bedrock, often as semi-natural expansions of edges of rocky summit/rock outcrop communities. Identifying community types on rock outcrops is complicated by interdigitation of types and overlap of constituent species. If a community occupies a cumulative area of >5000 sq. ft. on a ridge, it may function as a separate community and be designated as such. Otherwise, small patches would be considered to be part of the variation in the prevailing community. Ridgetop Heathlands have large areas dominated by a fairly continuous cover (>50%) of low shrubs (often lowbush blueberry) and little exposed bedrock. Mosses, lichens, and grasses are present but not dominant. Rocky summit/rock outcrop communities are dominated by bare or lichen-covered rock. Ridgetop Pitch Pine - Scrub Oak Communities have scattered stunted pitch pine and dense scrub oak, and usually little bare rock. Shrub oaks and pitch pines need to be abundant, with tree oaks lacking, for the community to be pitch pine - scrub oak. Sandplain Heathlands - Inland Variant occur on sand or gravel soils, not on bedrock.

Associated Fauna: Ridgetops tend to be only a part of the habitat of most vertebrate animals. Lepidopteran fauna include heathland species such as the slender clearwing sphinx moth (*Hemaris gracilis*), pink sallow moth (*Psectraglaea carnosa*), and blueberry sallow moth (*Sympistis dentata*). Ravens (*Corvus corax*) are all around high elevations, especially near cliffs where they often nest.

Public Access: Leyden WMA, Leyden.

Threats: Succession, trampling along peaks and ridges near trails.

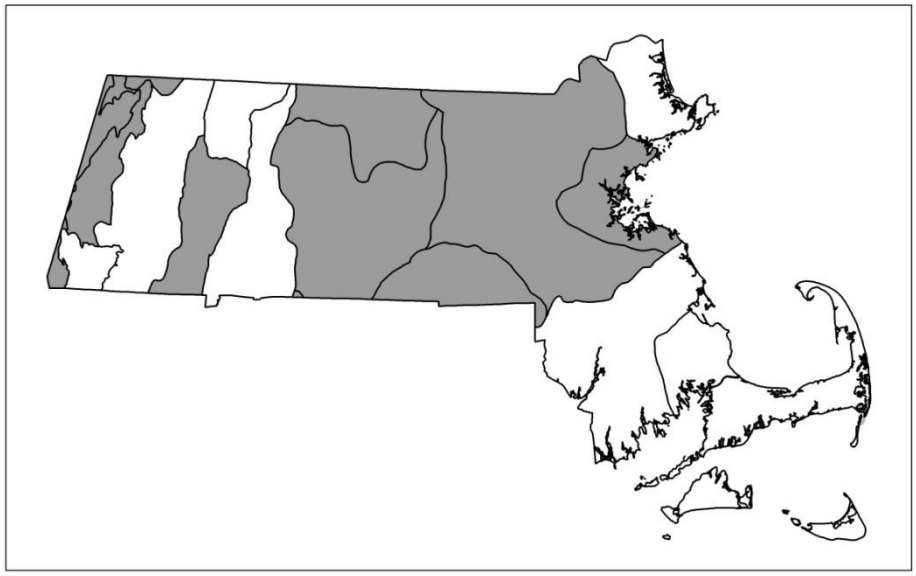
Management Needs: This community succeeds to forest if not burned or the trees removed on a 5- to 15-year cycle.

USNVC/NatureServe: Central Appalachian Pine-Oak Rocky Woodland System (Ridgetop Blueberry Heathland}. (System 201.571) and Northern Appalachian-Acadian Rocky Heath Outcrop (CES201.571): *Vaccinium angustifolium-Sorbus americana/Sibbaldiopsis tridentata* Dwarf-Shrubland (CEGL005094) and *Vaccinium* (*angustifolium*, *myrtilloides*, *pallidum*) Central Appalachian Dwarf-shrubland (CEGL003958) (Central Appalachian System only).

Ridgetop Pitch Pine – Scrub Oak Community

Community Code: CT2A1A1000

State Rank: S2



Concept: Ridgetop Pitch Pine - Scrub Oak community occurs on acidic bedrock, often in a mosaic with rocky summit/rock outcrop communities including Ridgetop Heathlands.

Environmental Setting: Ridgetop Pitch Pine - Scrub Oak Communities occur on exposed acidic bedrock, often in a mosaic with rocky summit/rock outcrop communities on ridgetops and steep upper mountain slopes with an open to closed canopy of pitch pine (*Pinus rigida*). The community is maintained by severe growing conditions; the characteristic species are tolerant of extremely xeric conditions. The most typical examples have a south to southwest aspect and receive high solar insolation. They are found on level crests as well as steep slopes. Soil accumulation is slow and soil depths are generally shallow, often with considerable exposed bedrock. Although some occurrences appear to be fire-dependent, other sites have little indication of past fire. In some places where fire has been infrequent, succession to White Pine - Oak Forest may be evident.

Vegetation Description: The canopy characteristically contains somewhat dwarfed pitch pines (*Pinus rigida*, avg. 5 m tall), with occasional red or other oaks (*Quercus rubra*, *Q. velutina*, *Q. montana*, or *Q. coccinea*), gray birch (*Betula populifolia*), black cherry (*Prunus serotina*), and red maple (*Acer rubrum*). White pine (*Pinus strobus*) may dominate the canopy in areas that have not experienced regular fire or other disturbance. In the shrub layer, scrub oak (*Quercus ilicifolia*) is the most characteristic species of the community, typically with patches of lower growing black huckleberry (*Gaylussacia baccata*) and lowbush blueberries (*Vaccinium angustifolium* and/or *V.*

pallidum). Other shrubs in lower abundance may include dwarf chinquapin-oak (*Quercus prinoides*), mountain laurel (*Kalmia latifolia*), wild raisin (*Viburnum cassinoides*), red chokeberry (*Aronia arbutifolia*), and serviceberries (*Amelanchier spp.*). The herbaceous layer is extremely sparse and tends to occur in rock crevices and at tree bases. Herbaceous layer plants include Canada mayflower (*Maianthemum canadense*), starflower (*Lysimachia borealis*), hairgrass (*Deschampsia flexuosa*), goldenrods (*Solidago* spp.), wintergreen (*Gaultheria procumbens*) and sedges (*Carex* spp.). Invasive exotic species are usually absent. The understory may be interspersed with areas of lichen-covered or exposed bedrock.

Differentiating Occurrences: Ridgetop Pitch Pine - Scrub Oak Communities have scattered stunted pitch pine and dense scrub oak. Usually, they have little bare rock. They are on bedrock ridgetops. Pitch Pine - Scrub Oak Communities are on sand or gravel, tend to be larger, and have most of the same species. Scrub Oak Shrublands lack pitch pine. Ridgetop Heathlands lack abundant scrub oak and pitch pine, have large areas dominated by continuous cover (>50%) of low shrubs, usually lowbush blueberry, and have little exposed bedrock. Rocky summit/rock outcrop communities are dominated by bare or lichen-covered rock. Identifying community types on rock outcrops is complicated by interdigitation of types and overlap of constituent species.

Associated Fauna: Ridgetops tend to be only a part of the habitat of most vertebrate animals, which are usually those of the surrounding forests and rocky outcrops. Larger mammals seem to prefer woodlands where they can move more easily, but birds find shelter in the dense shrubs during nesting and migration. Pitch Pine - Scrub Oak Communities have a rich lepidopteran fauna. Some of the rare moths of the larger Pitch Pine - Scrub Oak Communities on sands have been found in the ridgetop community.

Public Access: Appalachian Trail, Clarksburg; Appalachian and Taconic Trails, Mt. Washington; Monument Mtn. (The Trustees of Reservations)), Great Barrington; Tekoa Mtn. WMA, Russell; Middlesex Fells Reservation, Medford area; Blue Hills State Reservation, Milton area.

Threats: Forest succession, fire suppression, trampling, litter. The occurrences are threatened by exclusion of fire. Although many occurrences are on conservation lands, few are managed to maintain the specific natural community type. It would best be maintained by careful reintroduction of fire through prescribed burning or other fire management plans. Trails tend to run on ridge tops and, when the open areas supporting these communities are encountered, they invite human use, which can easily degrade the vegetation, destroy the lichen and moss cover on the rocks, and lead to soil loss. Balancing protection with use is possible with careful planning, such as adroit trail placement, education of users, and probably some triage of sites.

Management Needs: Prescribed fire to keep fuel loads down, limit succession, and allow regeneration of pitch pine and heaths. As open summits provide great views, trails and education are needed to minimize human impacts such as trampling and littering.

USNVC/NatureServe: *Pinus rigida* Woodland Alliance -- *Pinus rigida*/*Quercus ilicifolia*/*Aronia melanocarpa* Woodland [CEGL006323] --and, in part, *Pinus rigida*/*Aronia melanocarpa* Woodland [CEGL006116].

Riverside Rock Outcrop Community

Community Code: CT2A3A0000

State Rank: S3

Concept: Sparse, mostly herbaceous, vegetation limited to crevices where soil accumulates. Only outcrops influenced by river processes are considered to be riverside outcrops.

Environmental Setting: Only rock outcrops influenced by river processes are considered to be Riverside Rock Outcrop Communities, which nonetheless support terrestrial communities with non-wetland vegetation. The community occurs on flood- and ice-scoured bedrock stream banks and adjacent exposed ledges that are at or below the high water mark. The habitat is subject to flooding during much of the year. The outcrops may be low or steep on the river's edge or extending into the river channel. Mineral soil accumulates in crevices in the rocks. River spray and proximity to water may alleviate some of the harsh conditions usually encountered by plants growing in shallow soil in open areas.

Vegetation Description: Riverside Rock Outcrop Communities include low and scattered herbaceous plants; with few woody plants due to annual ice scouring. Generally there is a mix of only a few species per site: included might be harebell (*Campanula rotundifolia*), big bluestem grass (*Andropogon gerardii*), hemp dogbane (*Apocynum cannabinum*), goldenrods (*Solidago* spp.), and various asters (*Symphyotrichum* spp.) including New York aster (*Symphyotrichum novi-belgii*). Very occasional woody shrubs might be smooth rose (*Rosa blanda*) or running serviceberry (*Amelanchier stolonifera*). Non-native species that commonly occur are Canada bluegrass (*Poa compressa*) and purple loosestrife (*Lythrum salicaria*).

Differentiating Occurrences: Riverside Rock Outcrop Communities are open terrestrial communities often associated with Riverside Seep Communities, High-energy Riverside Meadows, and/or High-energy Riverbank Communities, all of which are wetter and support wetland vegetation. Riverside Rock Outcrop Communities are on bedrock and have the sparsest vegetation. High-energy Riverbank Communities occur on cobble and sand substrates and usually also have sparse, open, low vegetation, but with some bare cobble and sand. High-energy Rivershore Meadows and Riverside Seep Communities are wet and have fairly dense vegetation with some organic as well as mineral soil development. All occur along the shores of fast-flowing, high-energy rivers, and differences may not always be distinct.

Associated Fauna: These small, exposed communities have few, if any, animals that are restricted to them, but rather are parts of the habitat of wide-ranging riverine and upland animals, including shoreline foragers such as river otter (*Lontra canadensis*), mink (*Mustela vison*), and raccoons (*Procyon lotor*). Turtles are not attracted to rocks, preferring to bask on logs. Occasional bull frogs (*Rana catesbeiana*) or northern water snakes (*Nerodia sipedon*) would be expected. Common species of dragonflies and tiger beetles hunt over the rock areas.

Public Access: Visitation to Riverside Rock Outcrops is discouraged because of damage caused by trampling of plants.

Threats: Trampling by river users and competition from exotic species.

Management Needs: Removal of exotics from best sites.

USNVC/NatureServe: Related to: Great Lakes Alkaline Rocky Shore Sparse Vegetation [CEGL002506] and *Andropogon gerardii - Campanula rotundifolia - Solidago simplex* Herbaceous Vegetation [CEGL006284].

Sandplain Grassland

Community Code: CT2B2A0000

State Rank: S1

Concept: An open, near-coastal community visually dominated by native grasses, although forbs and shrubs are important components of the community.

Environmental Setting: Sandplain Grasslands are essentially treeless coastal communities, dominated by native grasses and herbaceous species with sparse shrubs, on sand or other dry, low-nutrient soils. Occurrences receive onshore winds and salt spray from storms, which delay succession to shrubland, woodland, and forest. Prior to European settlement, they likely occurred as openings close to the coast where salt spray suppressed the growth of woody plants, and in openings created by windstorms, fires, and localized agricultural activities. The community also occurs in openings within Pitch Pine - Scrub Oak Communities, often in depressions (frost pockets) where frost can occur throughout the growing season inhibiting woody growth. Most current occurrences are on land that was previously farmed or disturbed.

Vegetation Description: Sandplain Grasslands are dominated by graminoids, usually little bluestem grass (*Schizachyrium scoparium*), Pennsylvania sedge (*Carex pensylvanica*), and poverty grass (*Danthonia spicata*), with bearberry (*Arctostaphylos uva-ursi*), scrub oak (*Quercus ilicifolia*), stiff aster (*Ionactis linariifolia*), bayberry (*Morella pensylvanica*), lowbush blueberry (*Vaccinium angustifolium*), black huckleberry (*Gaylussacia baccata*), and a variety of goldenrods (*Solidago* and *Euthamia* spp.). The shrubs often form clonal patches. Goat's-rue (*Tephrosia virginiana*), yellow wild indigo (*Baptisia tinctoria*), butterflyweed (*Asclepias tuberosa*), colic-root (*Aletris farinosa*), and bird's-foot violet (*Viola pedata*) are good indicators of the community, although they occur in other dry habitats as well. Uncommon plants include sandplain

gerardia (*Agalinis acuta*), purple needlegrass (*Aristida purpurascens*), commons' and harsh panic-grass (*Dicanthelium ovale* ssp. *pseudopubescens* and *D. scabriusculum*), sandplain and stiff yellow (or rigid) flax (*Linum intercursum* and *L. medium* var. *texanum*), and Bayard's adder's mouth (*Malaxis bayardii*).

Differentiating Occurrences: Sandplain Grasslands are part of a structural and successional continuum with other coastal communities. When communities are not distinct, the best fit should be named. Sandplain Heathlands and Sandplain Grasslands share about 70% of their dominant species; the proportions of the species and the community structure separate the types. Sandplain Heathlands look shrubbier with a taller shrub layer comprised of scrub oak, black huckleberry, and/or lowbush blueberry. Overall, they have fewer plant species. Both Sandplain Grasslands and Maritime Dune Communities have grasses, forbs, and low shrubs, with patches of bare soil. Dune communities are on dunes and are often dominated by beach grass and beach heather that occur less abundantly in grasslands, where if they occur they are with other plants. Sandplain Grasslands - Inland Variant often have a greater abundance of non-native and weedy species. Sandplain Grasslands - Inland Variant are located inland, away from maritime influences. They have fewer coastal species such as sandplain flax (*Linum intercursum*), golden heather (*Hudsonia ericoides*), and sandplain blue-eyed grass (*Sisyrinchium fuscatum*). Cultural Grasslands are by dominated by non-native grasses maintained for pasture or hayfields.

Associated Fauna: Animals of Sandplain Grasslands are adapted to open areas. Seven species of birds of conservation interest in Massachusetts are highly dependent on grassland habitat for nesting, overwintering, or resting during migration, including Grasshopper Sparrow (*Ammodramus savannarum*) which is particularly adapted to areas with open ground between grass tussocks. Five other birds that are uncommon and declining in the state are also associated with grassland habitats, including the Eastern Meadowlark (*Sturnella magna*) which uses habitat with continuous short grass. Grasslands provide hunting territory for hawks, such as Northern Harrier (*Circus cyaneus*)) and Short-eared Owls (*Asio flammeus*). In Massachusetts, the American burying beetle (*Nicrophorus americanus*) is restricted to Nantucket, where a reintroduced population currently exists at apparently healthy population levels. The purple tiger beetle (*Cicindela purpurea*) is also faring best on the offshore islands, with a few remaining mainland populations. Both of these species are strongly associated with grassland and savanna habitats. There are multiple species of moths and butterflies with habitat primarily restricted to sandplain grasslands, nine of which are of conservation concern.

Public Access: Katama Plains Nature Preserve, Edgartown; Chilmark Cemetery, Chilmark; Head of the Plains and Middle Moors (Nantucket Conservation Foundation), Nantucket; Francis Crane WMA, Falmouth.

Threats: Exotics, such as Scotch Broom (*Cytisus scoparius*), Japanese knotweed (*Fallopia japonica*), cypress spurge (*Euphorbia cyparissias*), and especially cool-season grasses that form mats. Common non-native species include sheep fescue (*Festuca*

ovina), sweet vernalgrass (*Anthoxanthum odoratum*), velvet-grass (*Holcus lanatus*), bluegrass (*Poa pratensis*), timothy (*Phleum pratense*), spotted cat's ear (*Hypochaeris radicata*), narrow-leaved plantain (*Plantago lanceolata*), sheep-sorrel (*Rumex acetosella*), and others.

Management Needs: Fire management plans should be produced and implemented to introduce prescribed fire to the best examples. Reduce exotics where possible.

USNVC/NatureServe: NatureServe, NVC System: Northern Atlantic Coastal Plain Heathland and Grassland (CES203.895) *Morella pensylvanica/Schizachyrium littorale- Danthonia spicata* Shrub Herbaceous Vegetation (CEGL006067, G2). Association also as small patches in System: Northern Atlantic Coastal Plain Pitch Pine Barrens (CES203.269). Also: A3934 *Poa compressa - Solidago nemoralis - Centaurea biebersteinii* Ruderal Dry Meadow and Shrubland Alliance - CEGL006616 *Panicum virgatum* - (*Andropogon virginicus*) Ruderal Herbaceous Vegetation.

Sandplain Grassland – Inland Variant

Community Code: CT2B2A2000

State Rank: S2

Map: No Sandplain Grasslands – Inland Variant are documented in the NHESP database.

Concept: An often semi-natural open community, visually dominated by native grasses on sandplains or gravel in interior parts of the state, that usually needs management to remain treeless in the absence of fire. The community occurs in the surroundings of inland airports, and on military lands and wildlife management areas on sandplains.

Environmental Setting: Sandplain Grasslands - Inland Variants are open (essentially treeless), often semi-natural communities, visually dominated by native grasses and herbaceous species with sparse shrubs and patches of bare soil and lichens. They occur inland outside the influence of coastal storms and salt spray, primarily on sandplains or gravel (droughty, low-nutrient soils) and usually need management to remain open in the absence of fire or other disturbance. Otherwise, these grasslands generally succeed to forest. Surroundings often include Pitch Pine - Scrub Oak Communities. Many sites have been severely disturbed in the past which has slowed succession to woody species, but which has also allowed establishment of non-native species. The community occurs at small inland airports, along powerline rights of way, and on military lands and wildlife management areas on sandplains, all areas that are managed to exclude tall woody plants. Many current inland grasslands are the result of extensive clearing for agriculture that occurred with European settlement, some as expansions of original smaller occurrences and others created on poor sandy soils cleared of trees for grazing and crops.

Vegetation Description: Sandplain Grasslands - Inland Variant are dominated by graminoids, usually little bluestem (*Schizachyrium scoparium*), Pennsylvania sedge (*Carex pensylvanica*), and poverty grass (*Danthonia spicata*), often with many non-native species, especially many non-native grasses. These communities generally include a mix of herbaceous species such as goldenrods (*Solidago* and *Euthamia* spp.), milkweeds (*Asclepias spp.*) including butterflyweed (*A. tuberosa*), and occasionally New England blazing star (*Liatris scariosa* var. *novae-angliae*). There may be fewer shrubs than occur in coastal grasslands, although sweet fern (*Comptonia peregrina*) can form large patches, particularly in inland areas, and dewberries (*Rubus flagellaris* and *R. hispidus*) may be abundant in either. White pine is often the first tree to invade inland grasslands, with clonal species such as aspen (*Populus tremuloides*) and sumac (*Rhus* spp.) expanding from the edges.

Differentiating Occurrences: Sandplain Grasslands - Inland Variant are located inland away from maritime influences, out of even the storm salt spray zone, and, although on sandy soils, require regular management to stay open. The Inland Variant has fewer coastal species than the main, coastal Sandplain Grassland community: the Inland Variant lacks sandplain flax (*Linum intercursum*), golden heather (*Hudsonia ericoides*), and

sandplain blue-eyed grass (*Sisyrinchium fuscatum*). The Inland Variant often has an abundance of non-native and weedy species. Sandplain Heathlands - Inland Variant grade into Sandplain Grasslands - Inland Variant. Sandplain Heathlands - Inland Variant are and look shrubbier than grasslands, which look grassy. The visual appearance of being dominated by lowbush blueberry, scrub oak, or black huckleberry is a key difference from grasslands. Small patches of Sandplain Grasslands - Inland Variant in a mosaic with other communities are difficult to map and may be considered to be part of the variation of the prevailing community. Cultural Grasslands as a classification unit are intended to be grasslands that are cultivated or the results of cultivation with non-native, agricultural grasses (pastures and hayfields were the models).When communities are not distinct, the best fit should be named.

Associated Fauna: Location in the state and size of the grassland strongly affect the species that use grasslands. Many species of birds that use grasslands are more common in the midwestern prairies and agricultural fields. Airports currently support Massachusetts' largest populations of Upland Sandpipers (*Bartramia longicauda*), Grasshopper Sparrows (*Ammodramus savannarum*), and Savannah Sparrows (*Passerculus sandwichensis*). Other grassland birds include Killdeer (*Charadrius vociferus*), Eastern Meadowlarks (*Sturnella magna*), and Horned Larks (*Eremophila alpestris*). Meadow voles (*Microtus pennsylvanicus*), meadow jumping mice (*Zapus hudsonius*), and northern short-tailed shrews (*Blarina brevicauda*) would be expected in most grasslands. They would be hunted by garter snakes (*Thamnophis sirtalis*), long-tailed weasels (*Mustela frenata*), and American Kestrels (*Falco sparverius*), as well as wintering Northern Harriers (*Circus cyaneus*), Snowy Owls (*Nyctea scandiaca*), and Short-eared Owls (*Asio flammeus*). Lepidopteran fauna includes some species of sandplain grasslands, such as sandplain euchlaena, a geometrid moth (*Euchlaena madusaria*, Special Concern).

Public Access: Southwick WMA, Southwick; Montague Plains WMA, Montague.

Threats: Succession; development; ATV disturbance.

Management Needs: Mowing and grazing, in addition to fire, are required to maintain these communities. Fire management plans should be produced and followed to introduce prescribed fire to the best examples. Reduce exotics where possible.

USNVC/NatureServe: A3934 *Poa compressa* - *Solidago nemoralis* - *Centaurea biebersteinii* Ruderal Dry Meadow and Shrubland Alliance - CEGL006333 *Schizachyrium scoparium* - (*Andropogon virginicus*) - *Solidago* spp. Ruderal Herbaceous Vegetation.

Sandplain Heathland

Community Code: CT2B2B0000

State Rank: S1

Concept: An open, shrub-dominated, coastal community often in the zone receiving salt spray from storms, sharing many species with Sandplain Grasslands. Some heathlands have sparse clumps of plants with bare soil or lichen cover between the vascular plants.

Environmental Setting: Sandplain Heathlands are disturbance-dependent communities occurring on sandy/gravelly outwash plains and moraines near the coast. Plant cover in these nearly treeless shrublands ranges from nearly continuous to sparse with bare soil or lichen between clumps of plants. The rugged environment has extreme daily and seasonal temperature variations, nutrient-poor droughty soil, intense sunlight, and salt-laden winds. Although coastal heathlands are natural communities, until the late 19th century human activities increased their size and distribution with land clearing, grazing, and fires. Pre-European settlement occurrences were likely small patches in successional mosaics on drought-prone soils near the coast, where they were maintained by burning near Native American villages or by salt spray from coastal winds. Other occurrences may be maintained in frost pockets on outwash sandplains where unpredictable late season frosts inhibit growth of many species, including most trees.

Vegetation Description: Many of the dominant species in Sandplain Heathlands are low-growing woody shrubs, which if dominant are considered to be indicators of the community: black huckleberry (*Gaylussacia baccata*), bearberry (*Arctostaphylos uva-ursi*), and broom crowberry (*Corema conradii*). Other typical shrubs include lowbush blueberries (*Vaccinium angustifolium* and *V. pallidum*), bayberry (*Morella pensylvanica*), and

scrub oak (*Quercus ilicifolia*). Less dominant but usual species include golden heather (*Hudsonia ericoides*), chokeberry (*Aronia arbutifolia*), dwarf chinquapin oak (*Q. prinoides*), sweetfern (*Comptonia peregrina*), dewberry (*Rubus flagellaris*), little bluestem (*Schizachyrium scoparium* var. *scoparium*), and Pennsylvania sedge (*Carex pensylvanica*). The tall shrubland association particularly includes non-ericaceous shrubs such as beaked hazelnut (*Corylus cornuta*) and beach plum (*Prunus maritima* var. *maritima*). Many plants that are uncommon in Massachusetts occur in the Sandplain Heathlands, including sandplain flax (*Linum intercursum*), sandplain blue-eyed grass (*Sisyrinchium fuscatum*), eastern silvery aster (*Symphyotrichum concolor*), purple cudweed (*Gamochaeta purpurea*), butterfly weed (*Asclepias tuberosa*), and broom crowberry (*Corema conradii*).

Differentiating Occurrences: When bearberry and black huckleberry are dominant, they are considered to be indicators of Sandplain Heathlands. Sandplain Heathlands are in a continuum with openings in Pitch Pine - Scrub Oak Communities, Scrub Oak Shrublands, and maritime shrublands, woodlands, and forests. Their structure and species composition overlap with Maritime Dune Communities and Sandplain Grasslands. In mapping, as in defining, the edges are not always clear. Sandplain Heathlands and Sandplain Grasslands share about 70% of their dominant species: it is the proportion of the species and the resultant structure that separates the types. Sandplain Heathlands look shrubby and appear taller and have fewer vascular plant species than do grasslands. The communities are not distinct at some sites; in that case, the dominant one is named. Sandplain Heathlands are structurally similar to Maritime Dune Communities in that each has low shrub, herbaceous, and grassy growth, with patches of bare soil. Dune communities are on dunes and are often dominated by beach grass and beach heather, which occur less abundantly with more other species in Sandplain Heathlands. These communities may overlap along dune edges necessitating arbitrary assignment based on land form or the prevailing community type. Sandplain Heathlands and Maritime Shrubland Communities are shrublands; the Maritime Shrubland community is much denser, taller and more diverse. Maritime Juniper Woodland/Shrubland and Maritime Pitch Pine Woodland on Dunes are dominated by trees, although they may be scattered. Very small patches of any type within another community should be considered to be part of the variation of the main community. Sandplain Heathlands - Inland Variant are located inland at distances away from maritime influences. Ridgetop Heathlands are on bedrock.

Associated Fauna: Only a few bird species nest in Sandplain Heathlands, including Horned Lark (*Eremophila alpestris*), Savannah Sparrow (*Passerculus sandwichensis*), and Vesper Sparrow (*Pooecetes gramineus*). Short-eared Owls (*Asio flammeus*) are rare breeders in Massachusetts; one of their main food sources is the voles that live in heathlands. Birds of prey (or raptors) that may be seen hunting over the heathlands include Red-tailed Hawk (*Buteo jamaicensis*), American Kestrel (*Falco sparverius*), Merlin (*F. columbarius*), Peregrine Falcon (*F. peregrinus*), and Northern Harrier (*Circus cyaneus*). Other animals that can be found in heathlands include red-bellied snakes (*Storeria occipitomaculata*), meadow voles (*Microtus pennsylvanicus*),

short-tailed shrews (*Blarina brevicauda*), and such common insects as monarchs (*Danaus plexippus*) and pearl crescents (*Phyciodes tharos*). Several state-protected species of insects are also found in Sandplain Heathlands, including the chain-dotted geometer (*Cingilia catenaria*), the coastal heathland cutworm (*Abagrotis nefascia*), the barrens buckmoth (*Hemileuca maia*) and the purple tiger beetle (*Cicindela purpurea*). Before its extirpation from Massachusetts, the regal fritillary butterfly (*Speyeria idalia*) inhabited Sandplain Heathlands.

Public Access: Wasque Reservation (The Trustees of Reservations), Martha's Vineyard; Middle Moors (Nantucket Conservation Foundation), Nantucket; frost pockets in Myles Standish State Forest and Sly Ponds WMA, Plymouth.

Threats: The heathland community is considered to be vulnerable throughout its range. It has been estimated that about ninety per cent of coastal heathland in the northeastern United States has been lost since the middle of the nineteenth century, but other heathlands have been created by grazing and clearing. Reasons for this loss include suppression of fires, cessation of grazing by livestock in the affected areas, development of land, coastal erosion, and succession by trees and non-heathland shrubs. Excessive foot traffic and the use of off-road vehicles also threaten heathlands. Damage can be done by just one vehicle passing over the habitat; fifty passes of a vehicle will devegetate the surface. Prescribed burning and controlled grazing are being used to maintain remaining heathlands. Some exotic species such as black pine (*Pinus thunbergiana*) and Scotch broom (*Cytisus scoparius*) are issues. Fragmentation and development. Domestic pets and feral predators are problems for ground-nesting bird species, such as Short-eared Owl (*Asio flammeus*).

Management Needs: Selective tree removal, fire, and grazing are often required. Fire management plans should be produced and implemented to reintroduce fire. Remove exotics where a problem. Control foot and vehicular traffic.

USNVC/NatureServe: NVC System: Northern Atlantic Coastal Plain Heathland and Grassland (CES203.895) especially *Gaylussacia baccata - Vaccinium angustifolium - Arctostaphylos uva-ursi*/*Schizachyrium littorale* Dwarf-shrubland (CEGL006066, G3).

Sandplain Heathland – Inland Variant

Community Code: CT2B2B3000

State Rank: S2

Concept: Often semi-natural, usually successional, low shrub community on sandplains or gravel in interior parts of the state, which needs management to remain open in the absence of fire. Includes erosional gravel/sandy cliff face next to rivers or river floodplains. The tree canopy is absent or poorly developed.

Environmental Setting: Sandplain Heathlands - Inland Variant occur away from the coast, often on kames, glacial lake beaches, and other sand or gravel sediment deposits, including dry riverside bluffs (20- to 50-foot-high erosional gravel cliffs next to rivers). The rugged environment has intense sunlight, extreme daily and seasonal temperature variations, and nutrient-poor droughty soils. Like coastal Sandplain Heathlands, the Inland Variants are open, nearly treeless shrublands often dominated by low-growing members of the heath or blueberry family (Ericaceae). Plant cover ranges from nearly continuous to sparse with bare soil or lichen between clumps of plants. Some occurrences are variably sized openings in Pitch Pine – Scrub Oak Communities, often in depressions (frost pockets) on sandplains where unpredictable late season frosts inhibit growth of many species, including most trees. Other pre-European settlement occurrences were likely small patches in successional mosaics on drought-prone soils maintained by disturbances, including fires that enhanced blueberry production and kept the forest open around Native American villages. Current occurrences were likely enlarged or created by past land use (land clearing and farming) on low-nutrient soils. Fire has been important in at least some situations, especially on drier south- and southwest-facing slopes. Without disturbance or management, succession to open woodland, often pine or pine-oak, occurs.

Vegetation Description: Sandplain Heathland - Inland Variant community is composed of low-growing plants, including several species that can reproduce clonally. Overall diversity is fairly low, with heath (blueberry family) shrubs forming an extensive, dense low shrub layer dominated by low sweet blueberry (*Vaccinium angustifolium*), early sweet blueberry (*Vaccinium pallidum*), and/or black huckleberry (*Gaylussacia baccata*), with sweet fern (*Comptonia peregrina*), bearberry (*Arctostaphylos uva-ursi*), scrub oak (*Quercus ilicifolia*), American hazelnut (*Corylus americana*), New Jersey tea (*Ceanothus americanus*) and/or sheep-laurel (*Kalmia angustifolia*). Scattered individuals or patches of taller shrubs may include tree saplings from the surrounding forest, particularly pitch or white pine (*Pinus rigida* or *P. strobus*), gray or white birch (*Betula populifolia* or *B. papyrifera*), trembling aspen (*Populus tremuloides*), or red maple (*Acer rubrum*). Trailing arbutus (*Epigaea repens*) and teaberry (*Gaultheria procumbens*) are usually present, the latter abundant only on untilled soils. Little bluestem grass (*Schizachyrium scoparium*), poverty grass (*Danthonia spicata*), and hairgrass (*Deschampsia flexuosa*) typically occur in the sparse herbaceous layer that may also include goat's rue (*Tephrosia virginiana*), stiff aster (*Ionactis linariifolia*), woodland sunflower (*Helianthus divaricatus*), and wild lupine (*Lupinus perennis*) between shrub patches. Neither pitch pine nor scrub oak is dominant, although often present.

Differentiating Occurrences: Sandplain Heathlands - Inland Variant grade into Sandplain Grasslands - Inland Variant. They are often small patch communities within the prevailing forest matrix. The visual appearance of being dominated by blueberries or other low shrubs is a key difference from grasslands. Sandplain Heathlands - Inland Variant are located inland at distances away from maritime influences. Sandplain Heathlands are near the coast within the salt spray zone of storms. Ridgetop Heathlands occur on bedrock, often as semi-natural expansions of edges of rocky summits or old blueberry farms. Pitch Pine - Scrub Oak Communities are dominated by scrub oak with abundant pitch pine, neither of which is dominant in Sandplain Heathlands. Very small patches of Sandplain Heathland - Inland Variant inside a Pitch Pine - Scrub Oak Community may be considered to be variations in the Pitch Pine - Scrub Oak Community occurrence. Sandplain Heathlands - Inland Variant are and look shrubbier than Sandplain Grasslands - Inland Variant, which are dominated by grasses.

Associated Fauna: Savannah Sparrows (*Passerculus sandwichensis*) use sandplain heathlands, including inland variant occurrences. Meadow voles (*Microtus pennsylvanicus*), short-tailed shrews (*Blarina brevicauda*), and white-footed mice (*Peromyscus leucopus*) are often abundant near or under shrubs. White-footed mice are known to be one host of the deer tick (*Ixodes scapularis*) that carries Lyme and other diseases. Invertebrates of inland variant heathlands include butterflies such as hairstreaks and skippers. Uncommon species include slender clearwing sphinx moth (*Hemaris gracilis*), pink sallow moth (*Psectraglaea carnosa*), and blueberry sallow moth (*Sympistis dentata*).

Public Access: Montague Plains WMA, Montague; Barre Heathland, DCR Ware River Watershed

Area, Barre; Clinton Bluff WMA, Clinton.

Threats: Succession, including from fire suppression. Fragmentation and development. Domestic pets and feral predators are problems for ground-nesting bird species.

Management Needs: Selective tree removal, fire, and grazing are often required. Fire management plans should be produced and implemented to reintroduce fire. Remove exotics where a problem. Control foot and vehicular traffic.

USNVC/NatureServe:

Scrub Oak Shrubland

Community Code: CT2B1F1000

State Rank: S2

Concept: A shrubland dominated by scrub oak, with essentially no pitch pine (stems are very scattered if present), although within Pitch Pine - Scrub Oak Communities.

Environmental Setting: Scrub Oak Shrublands are dense shrublands, dominated by shrub oaks forming almost impenetrable thickets ranging from 2-3 feet (about 1m) to greater than 6 feet (2m) in height. They occur on sandplains, usually in depressions where localized frosts keep out competing trees, and on ridge tops. Disturbances in both environments maintain mosaics in space and time of grassland and heathland openings, shrublands, Pitch Pine - Scrub Oak Communities, and oak/pine forest. Scrub Oak Shrublands are dry with few nutrients available, since neither sand nor shallow soils on bedrock hold water or nutrients. Besides frosts that damage competing tree species, fires that eliminate or significantly reduce trees establish and maintain Scrub Oak Shrublands. Because the component shrub species both foster and are adapted to fire, Scrub Oak Shrublands are considered to be fire-dependent communities; scrub oak and heath species resprout readily after fires. It is likely that in the past this community burned under a variety of conditions, including during droughts and possibly during the growing season as well as the dormant season, so that structural and compositional variation may have been greater than what we see today. In addition, scrub oak communities seldom occur on land that has been plowed; even a hundred years after agricultural abandonment, many vegetatively reproducing plants are missing from the vegetation on previously plowed lands.

Vegetation Description: Scrub Oak Shrublands are dominated by shrub oaks, scrub oak (also called bear oak) (*Quercus ilicifolia*) and dwarf chinquapin oak (*Quercus prinoides*), that together have at least 40% cover. Sparse (<10% cover) tree species may include pitch pine (*Pinus rigida*), red or black oak (*Quercus rubra* or *velutina*), gray birch (*Betula populifolia*), and quaking aspen (*Populus tremuloides*). Other characteristic plants include black huckleberry (*Gaylussacia baccata*), lowbush blueberry (*Vaccinium angustifolium*), early sweet blueberry (*Vaccinium pallidum*), black chokeberry (*Aronia melanocarpa*), sheep laurel (*Kalmia angustifolia*), and sweet fern (*Comptonia peregrina*), along with Pennsylvania sedge (*Carex pensylvanica*), little bluestem (*Schizachyrium scoparium*), poverty grass (*Danthonia spicata*), cow wheat (*Melampyrum lineare*), bracken fern (*Pteridium aquilinum*), bearberry (*Arctostaphylos uva-ursi*), and areas of lichens (*Cladina* and *Cladonia* spp.).

Differentiating Occurrences: Scrub Oak Shrublands occur within Pitch Pine - Scrub Oak Communities, particularly in frost bottoms and frost pockets, and on ridge tops near Ridgetop Pitch Pine - Scrub Oak Communities. May be in a matrix with Sandplain Heathlands. Scrub Oak Shrublands are dominated by dense shrub oaks and lack pitch pine, on sand and on bedrock. Pitch Pine - Scrub Oak Communities have up to about 25% cover by pitch pine trees, are on sand or gravel, tend to be large, and have most of the same species. Ridgetop Pitch Pine - Scrub Oak Communities have scattered stunted pitch pine and dense scrub oak, and usually have little bare rock. They are on bedrock ridgetops. Ridgetop Heathlands lack abundant scrub oak and pitch pine, have large areas dominated by fairly continuous cover (>50%) of low shrubs, usually lowbush blueberry, and have little exposed bedrock. Rocky summit/rock outcrop communities are dominated by bare or lichen-covered rock. Identifying community types on rock outcrops is complicated by mixing of types in mosaics and overlap of constituent species. Very small occurrences of any community types should be considered to be parts of the prevailing community.

Associated Fauna: Scrub Oak Shrublands provide similar shrub habitat to the Pitch Pine - Scrub Oak Community often surrounding a shrubland. Species in Scrub Oak Shrublands include rare, as well as more common, moths and butterflies that are dependent on oaks and members of the blueberry family. Scrub Oak Shrublands in southeastern Massachusetts are being increasingly managed for New England cottontail (*Sylvilagus transitionalis*), which benefits other species that use the protection dense shrubs offer for nesting and resting, including Prairie Warbler (*Dendroica discolor*), which is declining throughout its range due to habitat loss. Common Yellowthroat (*Geothlypis trichas*), which nest in dense tangled vegetation, are very common in some scrub oak areas. Large mammals tend to avoid the dense shrub thickets.

Public Access: Middlesex Fells, Medford; Myles Standish State Forest, Plymouth; Lovell's Lane Conservation Area, Mashpee; Manuel F. Correllus State Forest, West Tisbury.

Threats: Development and fragmentation of the entire systems.

Management Needs: Experiments are needed to ascertain the fire dependence/sensitivity of the community and its dependent species.

USNVC/NatureServe: Nature Serve Systems: CES202.600 Central Appalachian Pine-Oak Rocky Woodland and CES203.269 Northern Atlantic Coastal Plain Pitch Pine Barrens. *Quercus ilicifolia* Shrubland Alliance -- *Quercus ilicifolia-Quercus prinoides* Shrubland [CEGL006111] and *Quercus ilicifolia - Prunus pumila* Shrubland [CEGL006121].

Spruce – Fir – Northern Hardwood Forest

Community Code: CT1D100000

State Rank: S4

Concept: A mixed forest with red spruce and northern hardwoods in cooler, usually northern, parts of the state

Environmental Setting: The Spruce - Fir - Northern Hardwoods Forest has a canopy of mixed spruce and northern hardwoods. It occurs in cool areas above ~450m (~1400 ft.), generally on rocky, nutrient-poor, dry to mesic, acidic soils. Often little light gets through the dense canopy and lower layers are sparse and patchy. Slow decomposition produces dense needle accumulation that further limits herbaceous growth. Tree reproduction is in gaps left by single tree fall.

Vegetation Description: The canopies of Spruce - Fir - Northern Hardwoods Forests have variable dominance of 25 to 75% conifers, and the inverse tree composition of northern hardwoods: red spruce (*Picea rubens*) and/or balsam fir (*Abies balsamea*) with eastern hemlock (*Tsuga canadensis*) may be dominant or co-dominant with sugar maple (*Acer saccharum*) and American beech (*Fagus grandifolia*). Eastern hemlock can be abundant or scattered. Heart-leaf paper birch (*Betula cordifolia*) and paper birch (*Betula papyrifera*) usually occur as scattered individuals. Characteristic shrubs include mountain maple (*Acer spicatum*), red-berried elder (*Sambucus racemosa*), northern mountain ash (*Sorbus americana*), hobblebush (*Viburnum lantanoides*), beaked hazel (*Corylus cornuta*), and American yew (*Taxus canadensis*). A low shrub layer has bunchberry (*Chamaepericlymenum canadense*), creeping snowberry (*Gaultheria hispidula*), and, occasionally, twinflower (*Linnaea borealis*). Herbs tend to be sparse, especially when conifers are abundant; plants include intermediate fern (*Dryopteris intermedia*), mountain wood fern (*Dryopteris campyloptera*),

bluebead lily (*Clintonia borealis*), painted trillium (*Trillium undulatum*), and wood sorrel (*Oxalis acetosella*).

Differentiating Occurrences: In Spruce - Fir - Northern Hardwoods Forests, red spruce is a dominant or at least present with other conifers, including balsam fir and eastern hemlock, while white pine is uncommon. Heart-leaf paper birch is present as scattered individuals. In Massachusetts, High Elevation Spruce - Fir Forest/Woodland occurs only in the Greylock range at the very highest elevations in the state and is more exposed, resulting in shorter, sparser trees in more open woodland conditions than in Spruce - Fir - Northern Hardwoods Forests. There is also a lower proportion of northern hardwoods. Northern Hardwoods - Hemlock - White Pine Forests lack abundant spruce, fir, and heart-leaf paper birch. Blueberry is occasionally present in the understory of Spruce - Fir - Northern Hardwoods Forest, but absent or nearly so in Northern Hardwoods - Hemlock - White Pine Forests. Successional Northern Hardwood Forest is best distinguished by the abundance of white birch and/or aspens in the canopy and northern hardwood species generally occurring in the subcanopy or shrub layer, not the canopy. If spruce or fir is present, it is as scattered individuals, <25% cover. Spruce - Fir - Northern Hardwoods Forest can have abundant eastern hemlock, but differ from other upland hemlock forests by the presence of red spruce, balsam fir, heart-leaf paper birch, and other species of cool areas, including mountain and striped maples (*Acer spicatum*, *A. pensylvanicum*), mountain ash (*Sorbus americana* and *S. decora*), and skunk currant (*Ribes glandulosum*). They lack species of warmer areas such as oaks (*Quercus* spp.), black birch (*Betula lenta*), and mountain laurel (*Kalmia latifolia*).

Associated Fauna: Animals of this community tend to be northern species that are more typical of forests of Vermont and New Hampshire. Birds include Golden-crowned Kinglet (*Regulus satrapa*), Blue-headed Vireo (*Vireo solitarius*), Blackburnian Warbler (*Dendroica fusca*), Yellow-rumped Warbler (*D. dominica*), and Magnolia Warbler (*D. magnolia*). Mammals include fisher (*Martes pennanti*), red squirrel (*Tamiasciurus hudsonicus*), snowshoe hare (*Lepus americanus*), northern flying squirrels (*Glaucomys sabrinus*), and pygmy shrews (*Sorex hoyi*). Amphibians would include the ubiquitous redbacked salamanders (*Plethodon cinereus*), wood frogs (*Rana sylvatica*), and red efts (juvenile stage of red-spotted newts, *Notophthalmus v. viridescens*).

Public Access: Monroe State Forest, Monroe; Mt. Greylock, Adams; Watatic Mountain Sanctuary and Ashburnham State Forest; Ashburnham.

Threats: Climate change and white pine replacing spruce in old field situations; clearing for ski slopes.

Management Needs:

USNVC/NatureServe: CEGL006053

Successional Northern Hardwood Forest

Community Code: CT1C1B0000

State Rank: S5

Map: No Successional Northern Hardwood Forests are documented in the NHESP database.

Concept: A broadly defined time sequence of forest communities, from thick young sprouts with little diversity, to mature, diversifying forests with undergrowth of more shade-tolerant trees. The canopy is seldom completely closed and undergrowth may be dense or open.

Environmental Setting: In cooler areas of Massachusetts, generally in northern, western, and higher elevation areas, Successional Northern Hardwood Forests precede Northern Hardwood - Hemlock - White Pine Forests when land has been left to natural processes after large-scale land opening events. They include a broad time sequence of predominantly deciduous forests growing where major disturbances such as fires, tornados, severe hurricanes, logging, or clearing for farm fields occurred a few to many decades in the past. The canopy, dominated by shade-intolerant tree species, is seldom completely closed and the subcanopy is generally composed of more shade-tolerant tree species. The shrub layer may be dense with low-diversity tree saplings or sprouts, or with more diverse deciduous broad-leaved species in older stands. There is usually an herbaceous layer of perennial forbs. Sites are generally dry-mesic to mesic.

Vegetation Description: The vegetation of successional communities is highly variable: it changes over time and depends on surrounding seed sources and the type of disturbance that removed the original forest. Typically, the canopy of Successional Northern Hardwood Forests includes aspen (*Populus tremuloides* and *P. grandidentata*), white birch (*Betula papyrifera*), red maple (*Acer rubrum*), and/or black cherry (*Prunus serotina*), with gray birch (*B. populifolia*) on very well-drained soils. There may be low percentages of white pine (*Pinus strobus*) or red spruce (*Picea rubens*). Pin cherry (*Prunus pensylvanica*) is a very early colonizer after heavy logging or fire. As the forest matures, the understory is made up of young northern hardwoods such as sugar maple (*Acer saccharum*), red maple (*A. rubrum*), white ash (*Fraxinus americana*), yellow birch (*B. alleghaniensis*), American beech (*Fagus grandifolia*), and red oak (*Quercus rubra*). Shrubs and herbaceous species are variable, sometimes including shade-tolerant pre-disturbance species or residual early post-disturbance pioneer species.

Differentiating Occurrences: Successional Northern Hardwood Forests are highly variable forests, usually in a successional sequence leading to Northern Hardwood - Hemlock- White Pine Forests or one of its named variants. The successional forest is best distinguished by the abundance of white birch and / or aspens in the canopy. All types of northern hardwood forests, including Northern Hardwood - Hemlock- White Pine Forest, are

dominated by sugar maple with other northern hardwoods such as white ash, yellow birch, American beech, and red oak, with low cover of white pine and hemlock; in the Successional Northern Hardwood Forest, the northern hardwoods generally occur predominantly in the subcanopy or shrub layer, not the canopy.

Associated Fauna: The structure of a community is important to animals. Successional communities change in structure quite quickly, and the animals inhabiting them change as the vegetation grows. For 0 to 10 years, trees are dense but small, often with blackberry (*Rubus* spp.) below. Fugitive bird species such as Chestnut-sided Warblers (*Dendroica pensylvanica*) and Mourning Warbler (*Oporornis philadelphia*) are common in the first 5 years after a major disturbance, especially if there are dead snags left for singing perches. Ruffed Grouse (*Bonasa umbellus*) and American Woodcock (*Scolopax minor*) inhabit younger forest, as does the New England cottontail (*Sylvilagus transitionalis*) if there is a dense shrub layer. After 30 years, Successional Northern Hardwood Forests are used by many generalist animals as part of their habitats.

Public Access: Sandisfield State Forest, Sandisfield; Leadmine WMA, Sturbridge; Minute Man National Historical Park, Concord.

Threats: Invasive species in disturbed areas.

Management Needs:

USNVC/NatureServe: A3225 *Betula papyrifera - Populus tremuloides - Acer rubrum* Forest Alliance - *Betula papyrifera - Acer saccharum*/Mixed Hardwoods Forest [CEGL002464]; A3229 *Acer rubrum - Prunus serotina - Pinus strobus* Ruderal Forest Alliance - *Populus* (*tremuloides*, *grandidentata*) - *Betula* (*populifolia*, *papyrifera*) Ruderal Woodland [CEGL006303], *Quercus rubra - Acer rubrum - Betula* spp. - *Pinus strobus* Ruderal Forest [CEGL006506], and *Acer saccharum - Betula* spp. - *Fagus grandifolia* Successional Forest [CEGL006628].

Successional White Pine Forest

Community Code: CT1A1A0000

State Rank: S5

Map: No Successional White Pine Forests are documented in the NHESP database.

Concept: Oldfield white pine, several decades since establishment. Other species co-occur with the white pine, but seldom share dominance. The forest floor is often carpeted with needles, with only a sparse herbaceous layer.

Environmental Setting: Oldfield white pines form the canopy of Successional White Pine Forests, which occur on abandoned agricultural land, usually former pastures. The near monoculture of white pines in the canopy is a combined artifact of human land-use history, seed ecology, and shade tolerance, resulting in a minor component of the pre-colonial forest becoming the most abundant tree in Massachusetts in the post-agricultural conditions that became widespread during the late 1800s. This semi-natural forest with dominant white pines may be maintained by selective logging, without which pines tend to be replaced by hardwoods such as oaks and red maples. The forest floor is often carpeted with needles, with only a sparse herbaceous layer.

Vegetation Description: Successional White Pine Forests have a near monoculture of white pine (*Pinus strobus*) (>75% cover) in the canopy, with scattered associates that vary with geography and prior land use, including white oak (*Quercus alba*), red oak (*Quercus rubra*), red maple (*Acer rubrum*), and early successional trees such as birches (*Betula* spp.) and aspens (*Populus* spp.). The shrub layer is variable, from sparse to thick, and may include black elderberry (*Sambucus nigra* ssp. *canadensis*), black cherry (*Prunus serotina*), maple-leaved viburnum (*Viburnum acerifolium*), and non-native species such as glossy buckthorn (*Frangula alnus*), bush honeysuckles (*Lonicera morrowii* complex), and/or multiflora rose (*Rosa multiflora*). Blackberry (*Rubus* spp.) vines may form thickets, and poison ivy (*Toxicodendron radicans*) often covers the ground near openings or in formerly open disturbed areas. Lowbush blueberries (*Vaccinium angustifolium* and *V. pallidum*) form patches mixed with black huckleberry (*Gaylussacia baccata*) on sites with less disturbed soils. Bracken fern (*Pteridium aquilinum*) may be in the shrub layer. The herbaceous layer is variable; large patches of Canada mayflower (*Maianthemum canadense*) and starflower (*Lysimachia borealis*), with clubmosses (such as ground-pine (*Dendrolycopodium obscurum*), southern ground-cedar (*Diphasiastrum digitatum*), and staghorn clubmoss (*Lycopodium clavatum*)), are particularly common on formerly plowed soil. Partridgeberry (*Mitchella repens*), fringed polygala (*Polygala paucifolia*), and pink lady's-slipper (*Cypripedium acaule*) grow in many longer established sites.

Differentiating Occurrences: Successional White Pine Forests are best distinguished by the >75% canopy cover of white pine. They are often in a successional sequence leading to White Pine - Oak

Forests, which have 25-75% cover of white pine and the inverse, 75-25% cover, of oaks, making the oaks clearly sharing dominance with the pine. Successional White Pine Forests grade into Northern Hardwood - Hemlock - White Pine Forests in northern areas and into Oak - Hemlock - White Pine Forests to the south. In southern areas, white pine forests occur near Pitch Pine - Oak Forests and grade into them. Determining types along the gradients may require careful, or even arbitrary, application of the definitions, or a decision to map at a more general scale while noting the existence of variation within map units. Pine plantations usually have rows of trees that produce a dense canopy over a generally low diversity understory that often includes native species. Plantations, being culturally created and managed, are not included as natural community types.

Associated Fauna: There are no species known to be restricted to the Successional White Pine Forests. The canopy monoculture and overall acidity from conifer needles restrict diversity. Blackburnian Warblers (*Dendroica fusca*) are probably the bird species most closely associated with dense white pine forests. Other birds of the community include Ovenbird (*Seiurus aurocapillus*), Yellow Warbler (*D. dominica*), Cooper's Hawk (*Accipiter cooperii*), and Northern Goshawk (*Accipiter gentilis*), as well as generalists such as the Black-capped Chickadee (*Poecile atricapillus*), and Red-breasted Nuthatch (*Sitta canadensis*).

Public Access: Townsend State Forest, Townsend; Douglas State Forest, Douglas; Oxbow National Wildlife Refuge, Harvard.

Threats: Non-native species such as glossy buckthorn (*Frangula alnus*), Morrow's honeysuckle (*Lonicera morrowii*), and privet (*Ligustrum obtusifolium*).

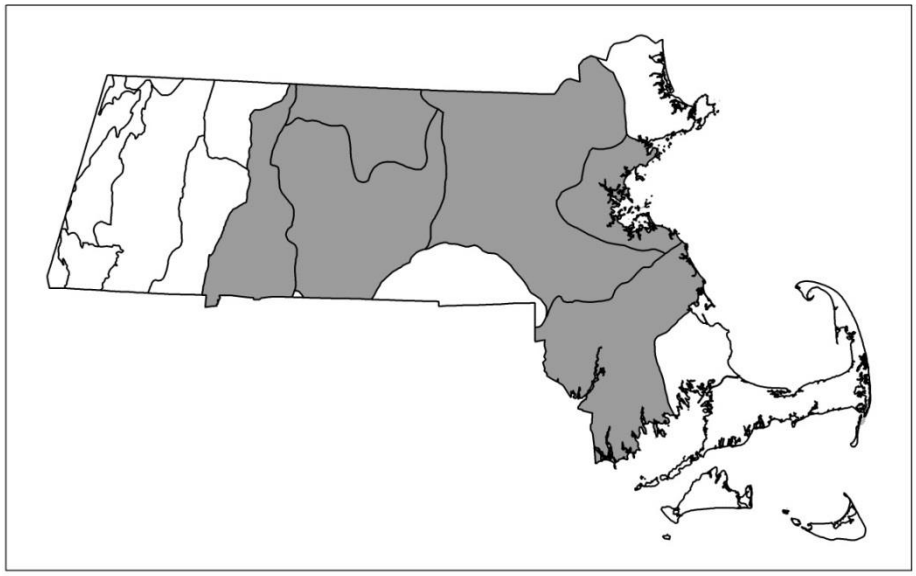
Management Needs: These are successional semi-natural forests: they are expected to change over time. No management is needed.

USNVC/NatureServe: A3227 *Juniperus virginiana - Pinus virginiana - Pinus echinata* Ruderal Forest Alliance - *Pinus strobus* Ruderal Forest (CEGL007944).

Sugar Maple – Oak – Hickory Forest

Community Code: CT1C2A1000

State Rank: S3



Concept: A species-rich forest that combines aspects of Rich, Mesic Forest of the northern hardwood forests with rich Oak - Hickory Forests of the central hardwood forests.

Environmental Setting: Community occurrences are in or east of the Connecticut River Valley in Massachusetts. They are associated with outcrops of circumneutral rock and the slopes below them, which have more nutrients than are available in the surrounding forest. Occurrences are usually small patches within matrix forests, with which many species are shared. Many but not all are on slopes with southeast to southwest aspect.

Vegetation Description: Like Rich, Mesic Forests, Sugar Maple - Oak - Hickory Forests are dominated by sugar maple (*Acer saccharum*) and red oak (*Quercus rubra*) with white ash (*Fraxinus americana*) and bitternut hickory (*Carya cordiformis*). Basswood (*Tilia americana*) occurs consistently as very scattered individuals. However, black, white, and/or chestnut oaks (*Q. velutina*. *Q. alba*, and *Q. montana*) and shagbark, pignut and/or mockernut hickories (*C. ovata*, *C. glabra*, and *C. tomentosa*) occur regularly in the canopy. Black birch (*Betula lenta*) is commonly present. The sparse subcanopy includes hop hornbeam (*Ostrya virginiana*), red maple (*A. rubrum*), and canopy species. Pagoda dogwood (*Swida alternifolia*) contributes to a usually sparse tall shrub layer. The shorter shrubs are dominated by maple-leaf viburnum (*Viburnum acerifolium*). The herbaceous layer varies from sparse to intermittent, with some spring ephemerals including bloodroot (*Sanguinaria canadensis*) and trout-lily (*Erythronium americanum*). There are fewer individuals and species of spring ephemerals than in true Rich, Mesic Forest, particularly in the easternmost

occurrences. Later-flowering species may include wild geranium (*Geranium maculatum*), herb Robert (*G. robertianum*), false Solomon's seal (*Maianthemum racemosum*), wild licorice (*Galium circaezans*), maidenhair fern (*Adiantum pedatum*), bottlebrush grass (*Elymus hystrix*), and large amounts of white wood aster (*Eurybia divaricata*). Broad-leaved, semi-evergreen sedges in the Laxiflorae are common, with broad-leaved woodland-sedge (*Carex platyphylla*) being close to an indicator of the community type. Witch hazel (*Hamamelis virginiana*), hepaticas (*Anemone acutiloba* and *A. americana*), and wild oats (*Uvularia sessilifolia*) usually occur in areas of transition to surrounding forest types.

Differentiating Occurrences: Geography is basic to differentiating Sugar Maple - Oak - Hickory Forest from Rich, Mesic Forest: most occurrences of Rich, Mesic Forest in Massachusetts are west of the Connecticut River Valley. The presence of multiple species of hickories and oaks in Sugar Maple - Oak - Hickory Forest is a main difference between these two types. Broad-leaved woodland-sedge (*Carex platyphylla*) is close to being an indicator of Sugar Maple - Oak - Hickory Forest. Rich, Mesic Forest is characterized by very dense herbaceous growth of spring ephemerals. Sugar Maple - Oak - Hickory Forest shares some of the ephemeral species but with fewer individuals of fewer species. Sugar Maple - Oak - Hickory Forest has evergreen ferns, Christmas fern (*Polystichum acrostichoides*) and evergreen wood ferns (such as *Dryopteris marginalis*), that Rich, Mesic Forests lack. Oak - Hickory Forests and Dry, Rich Oak Forests lack abundant sugar maple, basswood, and white ash, and lack spring ephemerals and herbaceous species indicative of rich conditions, such as herb Robert and others listed as characteristic Sugar Maple - Oak - Hickory Forest species.

Associated Fauna: Very few animal species are strongly associated with Sugar Maple - Oak - Hickory forests to the exclusion of other community types. Birds that breed in forests include Wood Thrush (*Hylocichla mustelina*), Veery (*Catharus fuscescens*), Black-and-white Warbler (*Mniotilta varia*), Ovenbird (*Seiurus aurocapillus*), Louisiana Waterthrush (*S. motacilla*), Scarlet Tanager (*Piranga rubra*), and Barred Owl (*Strix varia*). Species that breed in vernal pools are often found in surrounding forests, for example, species of mole salamanders (*Ambystoma* spp.) and spotted turtles (*Clemmys guttata*). Most of the small mammals of forests occur in rich forests, although some are limited by their geographical distribution. Southern flying squirrels (*Glaucomys volans*), grey squirrels (*Sciurus carolinensis*), woodland jumping mice (*Napaeozapus insignis*), masked shrews (*Sorex cinereus*), and red-backed voles (*Clethrionomys gapperi*) are among the widespread species whose habitat includes rich forests. Large mammals include rich forests as parts of their habitat, but are usually more dependent on size of undisturbed forest than on the precise type.

Public Access: Middlesex Fells Reservation, Stoneham; Manchester Reservoir Conservation Land, Attleboro; Wachusett Mountain State Reservation, Princeton; Palmer WMA, Palmer; Wells State Park, Sturbridge.

Threats: Occurrences are susceptible to invasive exotic species. Original easternmost version of community description: the easternmost occurrences are in very developed areas, although two are on conservation land. The other may be developed; there is an old subdivision plan and roads.

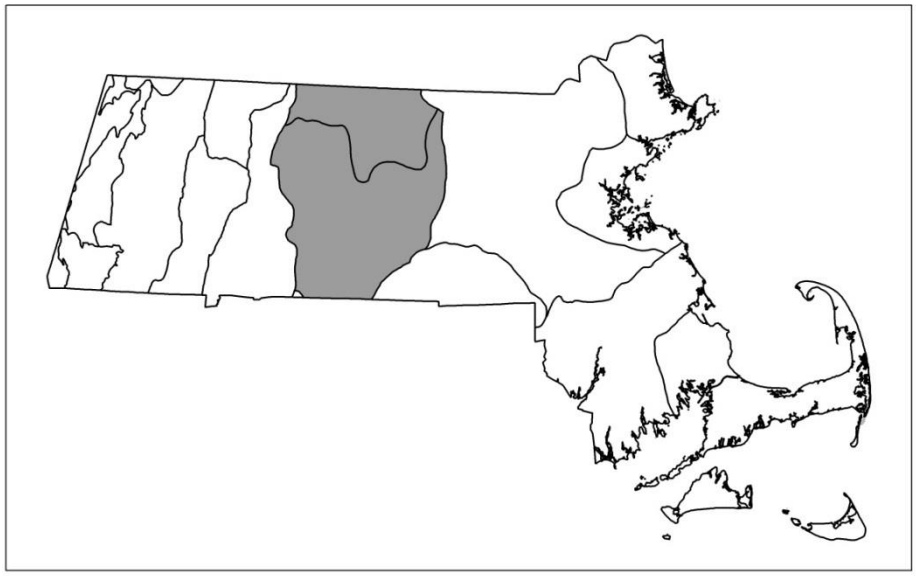
Management Needs: Removing invasive exotics as necessary and maintaining forested buffer around the occurrences would benefit the occurrences. Aside from removing invasive exotics, active management is not necessary.

USNVC/NatureServe: Related to: *Carya* (*glabra*, *ovata*) - *Fraxinus americana* - *Quercus* (*alba*, *rubra*) Forest Alliance - *Carya* (*glabra*, *ovata*) - *Fraxinus americana* - *Quercus* spp. Forest (CEGL006236). A3303 *Quercus rubra - Acer saccharum - Betula lenta* Forest Alliance - *Acer saccharum - Quercus rubra/Hepatica nobilis* var. *obtusa* Forest [CEGL006046]; A4126 *Acer saccharum - Tilia americana - Quercus rubra* Rocky Forest Alliance - *Acer saccharum - Fraxinus americana - Juglans cinerea/Staphylea trifolia/Adlumia fungosa* Forest [CEGL006577].

White Pine – Oak Forest

Community Code: CT1A100000

State Rank: S5



Concept: A forest of mixed dominance with oaks and white pine in the canopy.

Environmental Setting: White Pine - Oak Forest is a widespread successional community that occurs below 915m (3000 ft.) on slopes or flat to gently rolling moraines, till, or outwash plains. Sites are dry (but not very dry) to moist (mesic). The forest canopy is closed with mixed dominance of pines and deciduous trees in the canopy, often with a super-canopy of white pine. Indicators of past land use such as stone walls, old wood roads, and stumps may appear throughout.

Vegetation Description: White pine (25-75% cover, *Pinus strobus*) and oak species (25-75% cover*, Quercus rubra*, *Q. velutina*, *Q. alba*, *Q. coccinea*, and *Q. montana*) dominate the canopy layer in a variety of proportions. Pitch pine (*Pinus rigida*), red maple (*Acer rubrum*), white birch (*Betula papyrifera*), black birch (*B. lenta*), hickories (*Carya* spp.), American beech (*Fagus grandifolia*), and sassafras (*Sassafras albidum*) occur regularly but generally in low numbers. Chestnut (*Castanea dentata*) is frequently present as a shrubby tree. The shrub layer is variable in abundance and species. A prominent heath shrub layer, with lowbush blueberries (*Vaccinium angustifolium* and *V. pallidum*), black huckleberry (*Gaylussacia baccata*), mountain laurel (*Kalmia latifolia*), and/or sheep laurel (*K. angustifolia*), may be present. Other shrubs include maple-leaved viburnum (*Viburnum acerifolium*) and witch-hazel (*Hamamelis virginiana*). Typical species of the sparse herb layer include bracken fern (*Pteridium aquilinum*), wild sarsaparilla (*Aralia nudicaulis*), Canada mayflower (*Maianthemum canadense*), partridgeberry (*Mitchella repens*), pink lady's-slipper (*Cypripedium acaule*), cow-wheat (*Melampyrum lineare*), and whorled loosestrife (*Lysimachia*

quadrifolia). Evergreen patches of club mosses such as ground-pine (*Dendrolycopodium obscurum*), southern ground-cedar (*Diphasiastrum digitatum*), and staghorn clubmoss (*Lycopodium clavatum*) are particularly apparent in the winter.

Differentiating Occurrences: White Pine - Oak Forests have >25% cover of white pine overall (not just local patches). They are often in a successional sequence from Successional White Pine Forests: the key difference is the >25% of oaks in the White Pine - Oak Forest canopy. In southern or very dry areas, White Pine - Oak Forest may grade into Pitch Pine - Oak Forests which have >25% cover of pitch pine and <25% canopy of white pine. Related forest types in the oak continuum have <25% white pine. Coastal Forests/Woodlands are within a few miles of the coast at <~60 ft. elevation and receive storm winds and spray. The diverse canopies include oaks and often American holly, sassafras, and black gum; white pine may be present. In the northern areas, White Pine - Oak Forest may grade into Northern Hardwood - Hemlock- White Pine Forests that are dominated by sugar maple and white ash with <25% canopy cover of white pine. In these northern hardwoods forests, the only oak is red oak.

Associated Fauna: There are no species known to be restricted to the White Pine - Oak Forests; most animals in the forest are widespread generalists. Small mammals include white-footed mice (*Peromyscus leucopus*), gray squirrels (*Sciurus carolinensis*), short-tailed shrews (*Blarina brevicauda*), and chipmunks (*Tamias striatus*). Birds that nest in White Pine - Oak Forests include Eastern Wood-Pewee (*Contopus virens*), Red-eyed Vireo (*Vireo olivaceus*), Brown Creeper (*Certhia americana*), Hermit Thrush (*Catharus guttatus*), and Red-tailed Hawks (*Buteo lineatus*). If a community occurrence contains vernal pools, red-spotted newts (*Notophthalmus v. viridescens*) and spotted salamanders (*Ambystoma maculatum*) will live in the humus of the forest floor for most of their adult lives. All of the upland forest types provide valuable structural attributes, such as tree cavity den sites (which are utilized by a variety of bird and mammal species) and large woody material (which is utilized by various amphibian, reptile, and invertebrate species). Oak acorn production, an important source of wildlife food, is substantially greater in oak forest types than in northern forest types. Oaks and acorns play a fundamental role in the organization and dynamics of wildlife communities.

Public Access: Myles Standish State Forest, Plymouth; Freetown-Fall River State Forest, Freetown; Quabbin Reservation, Belchertown; Wachusett Meadow Wildlife Sanctuary (Massachusetts Audubon Sanctuary), Princeton.

Threats: Invasives can occur.

Management Needs: As a widespread successional forest occurring on previously disturbed land, generally sites do not need to be maintained. Some sites do have invasive species, such as barberry, that should be controlled if threatening more natural habitats or uncommon species.

USNVC/NatureServe: A2080 *Pinus strobus* - *Quercus prinus* Appalachian Forest Alliance - *Quercus* (*rubra*, *velutina*, *alba*) - *Betula lenta* - (*Pinus strobus*) Forest [CEGL006454]; A4209 *Quercus velutina* - *Quercus falcata* - *Pinus rigida* Coastal Plain Forest Alliance in part *Pinus strobus* - *Quercus alba*/*Ilex glabra* Forest [CEGL006382]; A4128 *Pinus strobus* - *Quercus alba* Allegheny Forest and Woodland Alliance - *Pinus strobus* - *Quercus* (*rubra*, *velutina*) - *Fagus grandifolia* Forest [CEGL006293].

Yellow Oak Dry Calcareous Forest

Community Code: CT1B2A0000

State Rank: S1

Concept: A dry, often open, oak - sugar maple forest with rich understory on shallow soil, often with areas of exposed marble or limestone bedrock.

Environmental Setting: The Yellow Oak Dry Calcareous Forest occurs on moderate to steep slopes and summits of low knolls or ridges underlain by calcium-rich limestone or dolostone. Exposed bedrock outcrops or boulders are common. The shallow soils tend to be well-drained and nutrient-rich, with a pH >6.5. The forest canopy is often somewhat open (>50% cover) and all layers have a large diversity of species. The community generally occurs as small (a few acres) patches on southwest- to southeast-facing slopes within other forest types.

Vegetation Description: Yellow oak (sometimes called chinquapin oak) (*Quercus muehlenbergii*) is the key characteristic and indicator species of Yellow Oak Dry Calcareous Forests, though rarely dominant in the canopy or subcanopy. The diverse, often somewhat open canopy is usually dominated by sugar maple (*Acer saccharum*), white oak (*Q. alba*), and black oak (*Q. velutina*), associated with red oak (*Q. rubra*), white ash (*Fraxinus americana*), shagbark hickory (*Carya ovata*), pignut hickory (*Carya glabra*), white pine (*Pinus strobus*), and hemlock (*Tsuga canadensis*). Yellow oak is often in the subcanopy, along with one or more of these canopy dominants and hop hornbeam (*Ostrya virginiana*). Tall shrubs include ironwood (*Carpinus caroliniana*), pagoda dogwood (*Swida alternifolia*), and bladdernut (*Staphylea trifolia*) with occasional prickly ash (*Zanthoxylum americanum*). The herbaceous layer tends to be rich in species. Dominant graminoids include Pennsylvania sedge (*Carex pensylvanica*), broadleaf sedge (*C. platyphylla*), thread-leaved sedge (*C. eburnea*), mountain

ricegrass (*Piptatherum racemosum*), and bottlebrush-grass (*Elymus hystrix*). Characteristic broad-leaved species include hog peanut (*Amphicarpaea bracteata*), early meadow-rue (*Thalictrum dioicum*), blunt-lobed hepatica (*Anemone americana*), lance-leaf bedstraw (*Galium lanceolatum*), broad-leaved ragwort (*Packera obovata*), and wild geranium (*Geranium maculatum*). In open, disturbed areas, red cedar (*Juniperus virginiana*) and aspen (*Populus tremuloides*) may be common, often with non-native species such as Norway maple (*Acer platanoides*), autumn olive (*Elaeagnus umbellata*), common buckthorn (*Rhamnus cathartica*), and Japanese barberry (*Berberis thunbergii*).

Differentiating Occurrences: In Massachusetts, Yellow Oak Dry Calcareous Forests occur only in southern Berkshire County on calcium-rich bedrock, usually on upper slopes and ridgetops. Yellow oak is the indicator and characteristic canopy and subcanopy species of Yellow Oak Dry Calcareous Forest and is seldom found growing in other communities. Other oak forests and woodlands are generally less diverse and lack species typical of calcium-rich environments, such as prickly ash, bladdernut, and pagoda dogwood, as well as yellow oak. In appearance, Yellow Oak Dry Calcareous Forest is similar to a Hickory - Hop Hornbeam Forest in having a somewhat open canopy that includes hickories and a subcanopy with hop hornbeam, and an often sedge-dominated herbaceous layer. However, the yellow oak forest has, of course, yellow oak and a richer flora due to its calcareous substrate.

Associated Fauna: Mature upland forest types provide valuable structural attributes such as tree cavity den sites. The fauna tends to be that of generally dry forests, but with no species restricted to the Yellow Oak Dry Calcareous Forest. The patches would be parts of the habitats of wide-ranging animals.

Public Access: Appalachian Trail, Sheffield; Dohoney Property (Sheffield Land Trust), Sheffield.

Threats: High deer densities likely reduce seedling numbers below what will provide for adequate regeneration. Exotic species do well in disturbed forests: Norway maple (*Acer platanoides*), Oriental bittersweet (*Celastrus orbiculatus*), Japanese barberry (*Berberis thunbergii*), glossy buckthorn (*Frangula alnus*), shrub honeysuckles (*Lonicera morrowii*), and other invasive species can displace native species and change the structure of forests. Yellow Oak may be logged for firewood or taken as associated species are logged for timber.

Management Needs: Exotic control on best examples. Since yellow oak forests generally occur in small patches, a surrounding buffer of a larger matrix forest is likely necessary to limit the likelihood of invasive species. Oak forests generally depend on some form of disturbance, with periodic low-intensity, dormant-season fires as the normal maintenance regime. Shallow soils and steep slopes may contribute to periodic loss of canopy species, thereby opening the forest floor to greater light.

USNVC/NatureServe: A2047 *Quercus muehlenbergii - Acer saccharum - Tilia americana* Forest Alliance -- *Acer saccharum - Quercus muehlenbergii/Carex platyphylla* Forest [CEGL006162]; very likely, but not mapped to MA: *Tsuga canadensis - Acer*

saccharum - *Quercus muehlenbergii* Lower New England/Northern Piedmont Forest [CEGL006924]. N system: Central Appalachian Dry Oak-Pine Forest CES202.591.

Palustrine Communities Descriptions

These are wetland natural communities in which the species composition is affected by flooding or saturated soil conditions, and the water table is at or near the surface most of the year.

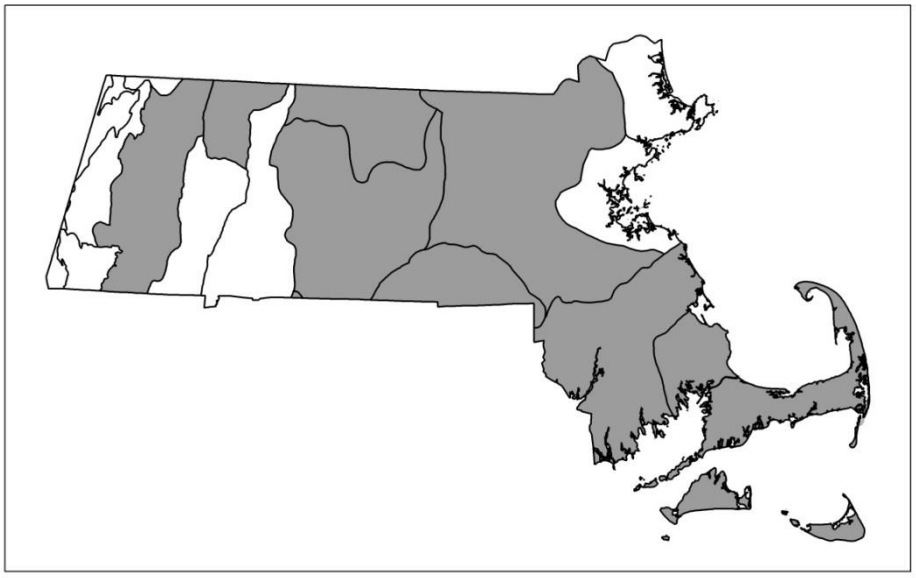
Note: The term “wetland” is not used in the sense of a “jurisdictional wetland,” which has a legal definition.

Pitcher Plant, photo by Patricia Swain, NHESP

Acidic Graminoid Fen

Community Code: CP2B0B1000

State Rank: S3



Concept: Mixed graminoid/herbaceous acidic peatlands with some groundwater and/or surface water flow but no calcareous seepage. Shrubs occur in clumps but are not dominant throughout.

Environmental Setting: Peatlands, commonly called bogs or fens, are wetland communities on peat, which is an accumulation of incompletely decomposed organic material. Bogs and acidic fens are northern communities; Massachusetts is at the southern limit of the geographic range of acidic peatlands, meaning that climatic conditions are marginal and occurrences are patchy. Acidic Graminoid Fens are sedge- and sphagnum-dominated peatlands that are weakly minerotrophic (mineral-rich). Acidic Graminoid Fens typically have some surface water inflow and some groundwater connectivity. Inlets and outlets are usually present, and standing water is present throughout much of the growing season. Peat mats are quaking and often unstable.

Vegetation Description: Species of sphagnum moss (*Sphagnum* spp.) are the most common plants in all acidic peatlands. As with vascular plants, the particular sphagnum species present vary depending on acidity and nutrient availability. Acidic Graminoid Fens have the most diversity of vascular plants of the acidic peatland communities. Graminoid (grass-like) and herbaceous species are dominant, although they share many shrub species with Acidic Shrub Fens. Typical graminoids include cotton-grasses (*Eriophorum* spp.) and other sedges such as beaked sedge (*Carex utriculata*), woolly-fruited sedge (*C. lasiocarpa* ssp. *americana*), white-beaked sedge (*Rhynchospora alba*), twig-sedge (*Cladium mariscoides*), and pondshore-rush (*Juncus pelocarpus*). Threeway sedge (*Dulichium arundinaceum*) and buckbean

(*Menyanthes trifoliata*), often found at fen edges, are good indicators of particularly minerotrophic (mineral-enriched) conditions. Characteristic herbaceous species include marsh St. John's-wort (*Triadenum virginicum*), arrow-arum (*Peltandra virginica*), and rose pogonia (*Pogonia ophioglossoides*). Large cranberry (*Vaccinium macrocarpon*) can be abundant. There is patchy shrub and tree (usually sapling) cover, including leatherleaf (*Chamaedaphne calyculata*), water-willow (*Decodon verticillatus*), swamp azalea (*Rhododendron viscosum*), sweet pepper-bush (*Clethra alnifolia*), poison sumac (*Toxicodendron vernix*), red maple (*Acer rubrum*), white or pitch pines (*Pinus strobus*, *P. rigida*), and Atlantic white cedar (*Chamaecyparis thyoides*).

Differentiating Occurrences: Natural communities on acidic peatlands all occur on sphagnum peat. The depth, density, and strength of the underlying peat control the structure and composition of each type of peatland community through the extent that plants growing on it are isolated from nutrients carried by groundwater. Acidic Graminoid Fens are differentiated by the dominance of graminoid and herbaceous species and by the lack of extensive shrubs. Threeway sedge (*Dulichium arundinaceum*) and buckbean (*Menyanthes trifoliata*) are characteristic of wet, nutrient-enriched edges of Acidic Graminoid Fens. Sea-level Fens occupy the interface between estuarine marshes and upland seepage slopes, and therefore have a distinct species assemblage including both estuarine and palustrine species. Regionally, three species are identified are considered to be diagnostic of Sea-level Fens: saltmarsh straw-sedge (*Carex hormathodes*), saltmarsh spike-sedge (*Eleocharis rostellata*), and saltmarsh threesquare (*Schoenoplectus americanus*). Twig-sedge (*Cladium mariscoides*) at the edges of salt marshes is also used as an indicator of Sea-level Fens. Interdunal Swales occur as part of a coastal dune system. They are graminoid- or shrub-dominated communities occurring in shallow basins (swales) between dunes. Some are fen-like with cranberries and sedges growing on shallow peat, but occurrence in dune systems is the defining characteristic. Acidic Shrub Fens are composed primarily of low-growing, interwoven shrubs. Dense water-willow and sweet gale are indicative and characteristic. Acidic Shrub Fens are wetter with a less well-developed sphagnum mat than other acidic peatlands. Level Bog communities receive little or no stream flow and are isolated from the water table, making them the most acidic (pH ~ 3 to 4) and nutrient-poor of peatland communities. The sphagnum peat tends to be deep and well-developed, graminoids may be present but not dominant, and shrubs are dominated by leatherleaf. Acidic Graminoid Fen - Spillway Fens are shallow acidic peatlands with mixed graminoid /herbaceous vegetation that develop on spillway bedrock channels associated with large dams.

Associated Fauna: Due to the extended periods of saturation, lack of nutrients, and high acidity and low oxygen content of the water, acidic peatlands are inhospitable to many animal species. Winged animals and large terrestrial animals can use peatlands as part of their habitat and then move on when conditions are unfavorable. Moose (*Alces alces*) and white-tailed deer (*Odocoileus virginianus*) use acidic peatlands for browsing and grazing, and their trails are often evident across the peat mat. Black bears (*Ursus americanus*) are attracted to the cranberries and blueberries in season.

Many bird species use peatlands for part of the year as nesting or foraging habitat. Massachusetts birds that can be found in acidic peatlands include Swamp Sparrows (*Melospiza georgiana*), Common Yellowthroat (*Geothlypis trichas*), Olive-sided and Alder Flycatchers (*Contopus cooperi* and *Empidonax alnorum*), Red-winged Blackbirds (*Agelaius phoeniceus*), and Gray Catbirds (*Dumetella carolinensis*). Many species of dragonflies and damselflies inhabit acidic peatlands, especially where there is adjacent open water; three state-protected rare dragonfly species, the Ringed Boghaunter (*Williamsonia lintneri*), Ebony Boghaunter (*W. fletcheri*), and Kennedy's Emerald (*Somatochlora kennedyi*) are limited to acidic peatlands in Massachusetts. Acidic peatlands are an important component of the habitat of several other uncommon animal species. Southern Bog Lemmings (*Synaptomys cooperi*) are limited to acidic peatlands in Massachusetts. Four-toed Salamanders (*Hemidactylium scutatum*) breed in nests in sphagnum moss. Spotted turtles (*Clemmys guttata*) occupy a variety of wetland habitats in Massachusetts, including acidic peatlands. Larvae of the Pitcher Plant Borer moth (*Papaipema appassionata*) feed on the stems and roots of pitcher plants, and larvae of the Chain Fern Borer (*P. stenocelis*) feed on the rhizomes of Virginia Chain Fern. These two moths are limited to sites where those plant species occur.

Public Access: Tully Lake Reservation (US Army Corps of Engineers), Royalston; Quaboag WMA, Brookfield; Noquochoke WMA, Dartmouth; Hockomock Swamp WMA, Bridgewater; Grassy Pond Conservation Area, Acton.

Threats: Nutrient enrichment from runoff from roads, lawns, septic systems, and agricultural fields. Other threats are alterations to the natural hydrology and trampling.

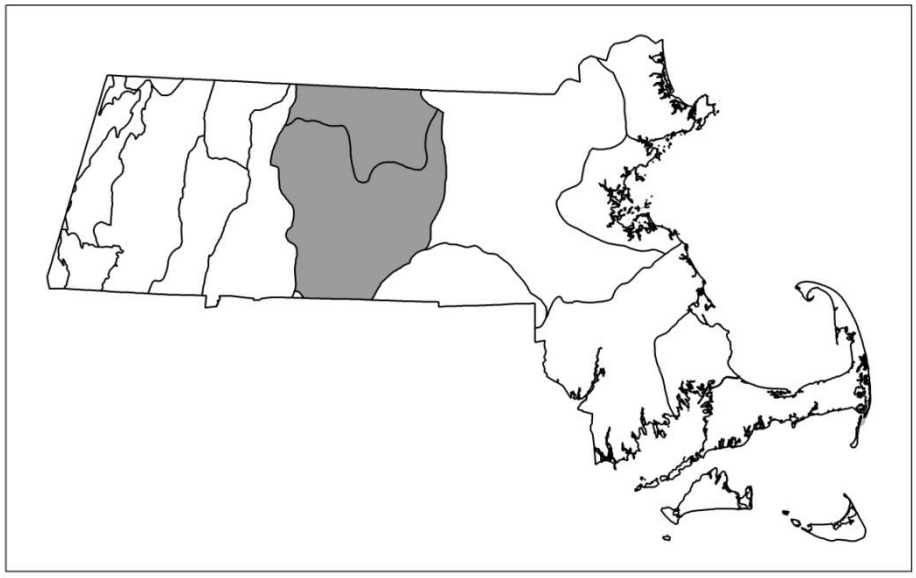
Management Needs: Cattails appear to proliferate in areas that experience road and/or lawn runoff. Efforts should be made to minimize runoff into these communities.

USNVC/NatureServe: In part *Chamaedaphne calyculata*/*Carex lasiocarpa-Utricularia* spp. Shrub Herbaceous Vegetation but leatherleaf not dominant.

Acidic Graminoid Fen – Spillway Fen

Community Code: CP2B0B100A

State Rank: SNR



Concept: Shallow acidic peatlands with mixed graminoid /herbaceous vegetation, that develop on spillway bedrock channels associated with large dams.

Environmental Setting: Shallow peat developed on spillway channel bottoms with groundwater seepage that keeps the coarse mineral soil substrate saturated most of the time. Annual herbicide or mowing treatment to control woody plants produces small patches of high mortality of a minute proportion of the fen each year and may play an important role in the observed patch dynamics and species diversity in the community.

Vegetation Description: The plants of the Acidic Graminoid Fen - Spillway Fen community include peatland species and species more typical of disturbed areas such as river or lake shores or wet gravel pits. Species shared with Acidic Graminoid Fens include sedges (*Carex* species), Tawny Cotton-grass (*Eriophorum virginicum*), Round-leaved Sundew (*Drosera rotundifolia*), and Rose Pogonia (*Pogonia ophioglossoides*). Horsetails (*Equisetum* spp.), including Variegated Scouring Rush (*Equisetum variegatum*), may cover substantial areas of the habitat. Canadian St. John's-wort (*Hypericum canadense*) and Spreading Bulrush (*Scirpus expansus*) occur at both reported sites. Both sites included multiple members of the sedge and grass families. One site included several regionally uncommon (but not State-Listed) species including Alpine Clubsedge (*Trichophorum alpinum*), Swamp-thistle (*Cirsium muticum*), and Northeastern Willow-herb (*Epilobium strictum*), along with large populations of orchid species.

Differentiating Occurrences: Spillway Fens are restricted to the spillways of large dams. Any sphagnum-dominated areas in spillways would be considered to be a Spillway Fen, a cultural variant of Acidic Graminoid Fen.

Associated Fauna: Due to the extended periods of saturation, lack of nutrients, and high acidity and low oxygen content of the water, acidic peatlands are inhospitable to many animal species. Spillway Fens, being on spillways of large dams, are not likely to be used as habitat by many of the wide-ranging large species that are found in other acidic peatlands.

Public Access: Tully Lake Reservation (US Army Corps of Engineers), Athol; Barre Falls Project Area (US Army Corps of Engineers), Barre.

Threats:

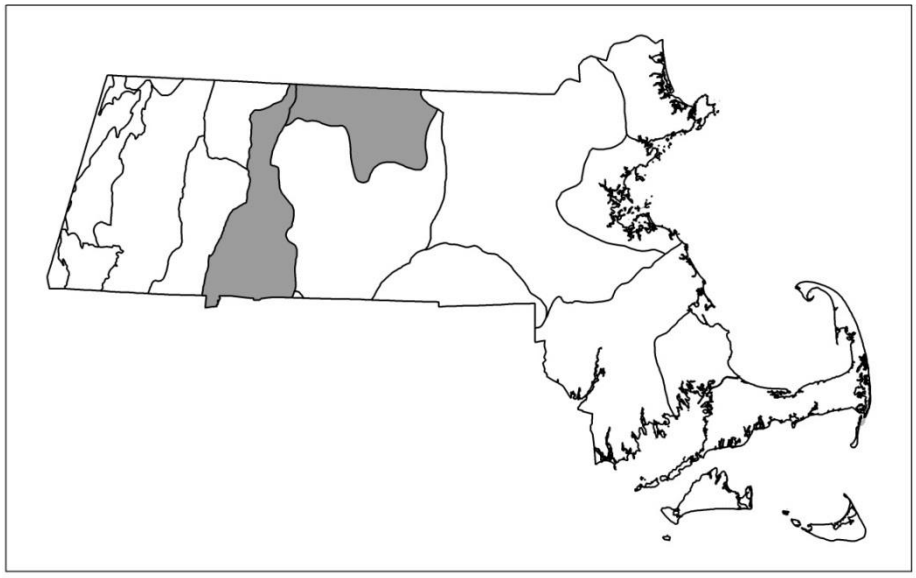
Management Needs: The community is maintained through active management of the spillways. The spillway is critical infrastructure for the flood control project and maintenance and repairs to maintain its function are inevitable. The annual herbicide treatment to control woody plants produces small patches of high mortality (but affecting a minute proportion of the fen each year) and may play an important role in the observed patch dynamics and species diversity in the community. Avoid altering the existing disturbance regime affected by the annual vegetation treatment. Debris, including substantial rubble of rock falls from the steep rock walls of the channel, may eventually need to be removed from the spillway channel. Consider developing a management plan to help conserve the fen habitat prior to conducting major work in the spillway.

USNVC/NatureServe:

Acidic Pondshore/Lakeshore Community

Community Code: CP2A0B1100

State Rank: S4



Concept: The broadly defined vegetation of acidic pondshores found statewide. The vegetation is often shrubby around lakes and ponds that have little natural fluctuation of water levels.

Environmental Setting: The Acidic Pondshore/Lakeshore Community is broadly defined to cover most of the pondshores in the state that are not explicitly excluded, such as calcareous pondshores and coastal plain pondshores. Many occurrences are narrow (often <1m wide) and are submerged or saturated for a significant part of the year or continuously in wet years. In ponds or lakes that have little natural fluctuation in water levels, the shores are often shrub-dominated. Shallow ponds with gradual slopes may have broader shores with emergents along the shore or, if there is regular disturbance such as water level changes or ice scour, the vegetation may be sparse.

Vegetation Description: The vegetation is highly variable among Acidic Pondshores/ Lakeshore Community occurrences, with hydrology and topography of the basin and geographic location in the state strongly influencing the plants that are present. Shore vegetation may include shrubs such as mountain laurel (*Kalmia latifolia*), maleberry (*Lyonia ligustrina*), mountain holly (*Ilex mucronata*), arrow-wood (*Viburnum dentatum*), and leatherleaf (*Chamaedaphne calyculata*), with rhodora (*Rhododendron canadense*), steeple-bush (*Spiraea tomentosa*), and American filbert (*Corylus americana*). Herbaceous vegetation on the shoreline is diverse and commonly includes spotted Joe-pye-weed (*Eutrochium maculatum*), tussock-sedge (*Carex stricta*), northern water-horehound (*Lycopus uniflorus*), and royal fern (*Osmunda regalis*). Emergent aquatic species grow adjacent to the shoreline and can merge into it. Gradual

shores may have more beach-like conditions with herbaceous species such as golden pert (*Gratiola aurea*).

Differentiating Occurrences: Coastal Plain Pondshores and Coastal Plain Pondshores - Inland Variant have been separated out, as those communities that develop in groundwater-flooded depressions in inland outwash sand plains and have shorelines that are seasonally exposed, but submerged or saturated for a significant part of the year or continuously in wet years. The seasonal development of herbaceous vegetation in zones as water levels go down are distinctive for the Coastal Plain Pondshore - Inland Variant. Shorelines of Acidic Pondshores/Lakeshores tend to be dominated by trees or shrubs to the water edge and have limited annual fluctuation. In sites with less linear communities, the community type tends to be designated as Shrub Swamp.

Associated Fauna: The shrubs, sedges, bulrushes, and grasses of Inland Acidic Pondshore/Lakeshores provide a food resource for waterfowl and other marsh birds.

Public Access: Long Pond, Tully Lake Reservation (US Army Corps of Engineers), Royalston.

Threats: More information is needed to assess the threats to Acidic Pondshore/Lakeshore Communities. Probable threats include trampling from ORVs, alteration of normal water-level fluctuations, and shoreline development. Invasives include purple loosestrife and phragmites.

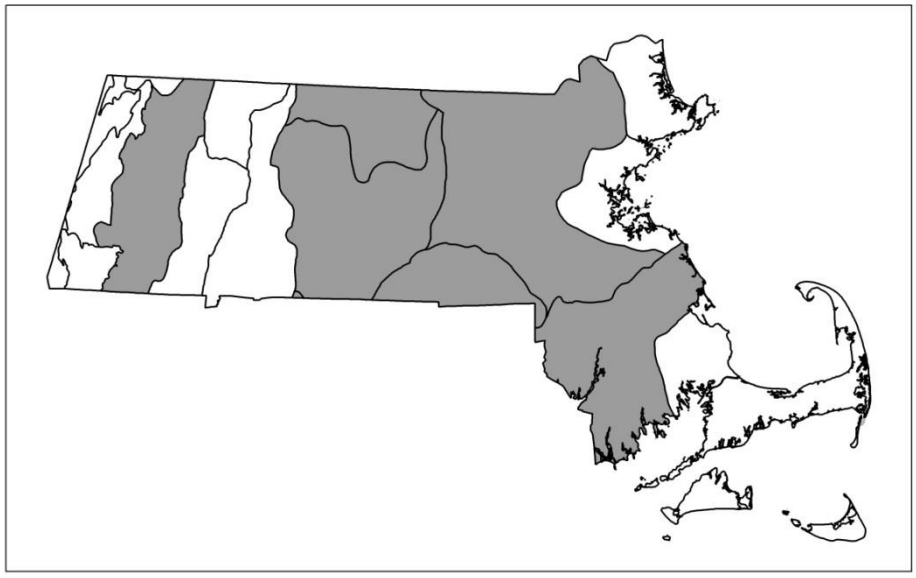
Management Needs: More information is needed to assess the management needs of Acidic Pondshore/Lakeshore Communities.

USNVC/NatureServe: In System: CES201.586 Laurentian-Acadian Lakeshore Beach and related to Eroding Clay Bank Sparse Vegetation [CEGL002584]; and Igneous - Metamorphic Cobble - Gravel Inland Lake Shore Sparse Vegetation [CEGL002303].

Acidic Shrub Fen

Community Code: CP2B0B2000

State Rank: S3



Concept: Shrub-dominated acidic peatlands characterized by a mixture of low-growing, primarily deciduous shrubs. Acidic Shrub Fens experience some groundwater and/or surface water flow, but not calcareous seepage.

Environmental Setting: Acidic Shrub Fens typically occur along pond margins, often at the edges of peat mats where the peat may be weak. Acidic Shrub Fens are primarily composed of low-growing, interwoven shrubs with patches of sphagnum moss growing at the shrub bases. Although acidic peatland communities, the plants of Acidic Shrub Fens are often in contact with pond water or have other surface or groundwater connectivity. The communities are weakly minerotrophic (some nutrients are present in the water and available to the plants). Standing water is present throughout much of the growing season. Peat mats are quaking and often unstable.

Vegetation Description: Dense, low growing (<1m tall) shrubs make up the dominant layer of Acidic Shrub Fens. Leatherleaf (*Chamaedaphne calyculata*), sweet gale (*Myrica gale*), water-willow (*Decodon verticillatus*), and meadow-sweet (*Spiraea alba* var. *latifolia*) are typical, sometimes with scattered taller highbush blueberry (*Vaccinium corymbosum*), red maples (*Acer rubrum*), alder (*Alnus* spp.), and/or sweet-pepperbush (*Clethra alnifolia*). Herbaceous plants may be abundant and diverse, or quite sparse. The layer often includes St. John's-worts (*Hypericum* spp.) and arrowheads (*Sagittaria* spp.). Typical graminoids include sedges (*Carex* spp.), cotton-grasses (*Eriophorum* spp.), and beak-rushes (*Rhynchospora* spp.).

Differentiating Occurrences: Acidic Shrub Fens are composed primarily of low-growing, interwoven shrubs with patches of sphagnum moss growing at the shrub bases. Dense water-willow and

sweet gale are indicative and characteristic. Acidic Shrub Fens are wetter with a less well-developed sphagnum mat than other acidic peatlands. Acidic Graminoid Fens are differentiated by the abundance of graminoid and herbaceous species and lack of extensive shrubs. Level Bog communities receive little or no stream flow and they are isolated from the water table, making them the most acidic (pH is in the range of 3 to 4) and nutrient-poor of peatland communities. The sphagnum peat tends to be deep and well developed, graminoids may be present but not dominant, and shrubs are dominated by leatherleaf. Kettlehole Level Bogs are a subset of Level Bogs that occur in iceblock depressions (commonly called kettleholes) in sandy glacial outwash. They are typically small (<3 acres) and round, and they lack inlets and outlets. Highbush Blueberry Thickets are dominated by tall (2m or more) dense shrubs of the blueberry family with other deciduous species. Shrub Swamps lack peat, are often more diverse than Acidic Shrub Fens, and are not dominated by blueberries or other ericaceous plants. They are often dense and tall.

Associated Fauna: Due to the extended periods of saturation, lack of nutrients, and high acidity and low oxygen content of the water, acidic peatlands are inhospitable to many animal species, including most amphibians and reptiles. Acidic Shrub Fens, when on the edge of open water, are less acidic and have more oxygen in the water than other types of peatlands. Winged animals and large terrestrial animals can use peatlands as part of their habitat and then move on when conditions are unfavorable. Many bird species use peatlands for part of the year as nesting or foraging habitat. Many species of dragonflies and damselflies inhabit acidic peatlands, especially where there is adjacent open water.

Public Access: Lowell-Dracut-Tyngsborough State Forest, Dracut; Quaboag WMA, Brookfield; Upton State Forest, Upton; Tully Lake Reservation (US Army Corps of Engineers), Royalston; Mud Pond-Horseshoe Pond Bog, Farmington River WMA, Otis.

Threats: Hydrologic alteration and nutrient enrichment from road and lawn runoff. Trampling from humans affects peat mat integrity, although the peat along shores is often very unstable and discourages access.

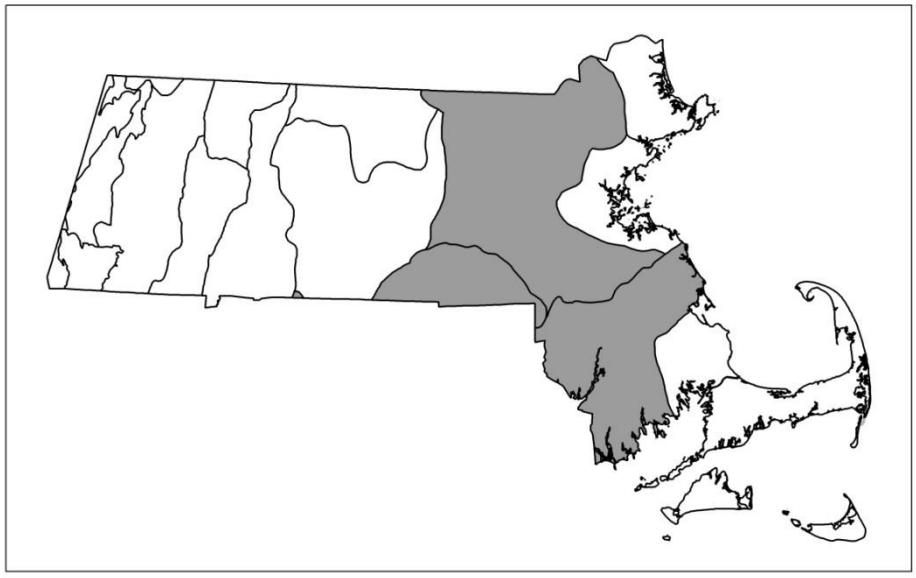
Management Needs: Pondside occurrences are threatened by wetland alterations (including dock building, small-scale peat mining operations, and conversion to commercial cranberry bogs), encroaching development, changes in hydrology, and nutrient enrichment from leach fields, road salt run-off, and siltation.

USNVC/NatureServe: *Myrica gale* - *Chamaedaphne calyculata*/*Carex* (*lasiocarpa*, *utriculata*) - *Utricularia* spp. Shrub Herbaceous Vegetation [CEGL006302] and *Myrica gale* - *Spiraea alba* - *Chamaedaphne calyculata* Shrubland [CEGL006512]. In part *Chamaedaphne calyculata* - (*Gaylussacia bigeloviana*) - *Decodon verticillatus*/*Woodwardia virginica* Dwarf-shrubland [CEGL006008]; also in part *Decodon verticillatus* Semipermanently Flooded Shrubland [CEGL005089].

Alluvial Atlantic White Cedar Swamp

Community Code: CP1B1A4000

State Rank: S2



Concept: Forested swamps occurring along low-gradient rivers where Atlantic white cedar is co-dominant with red maple in the overstory.

Environmental Setting: Alluvial Atlantic White Cedar Swamps occur within the floodplain of low-gradient rivers and streams, or at the fringes of open marshy areas along ponds. They receive annual or semi-annual overbank flooding, making them more mineral-rich than other Atlantic white cedar wetlands. But like other Atlantic white cedar swamps and other floodplain communities, they are often poorly drained, retaining sediment-saturated flood water well into the growing season. Groundwater from uplands and surrounding wetlands may maintain soil moisture over the growing season. Soils are typically silt loams with a mucky surface organic layer. Alluvial Atlantic White Cedar Swamps often occur in wetland mosaics with other alluvial and floodplain forests and swamps, as well as with more open wetland communities.

Vegetation Description: Alluvial Atlantic White Cedar Swamps are highly variable in their composition. Atlantic white cedar (*Chamaecyparis thyoides*) and red maple (*Acer rubrum*) dominate the tree layer, and highbush blueberry (*Vaccinium corymbosum*) and sweet pepper-bush (*Clethra alnifolia*) occur in the shrub layer, along with silky dogwood (*Swida amomum*). The herb layer is comprised of species common to very wet, open, or enriched sites, including sensitive fern (*Onoclea sensibilis*), royal fern (*Osmunda regalis*), bugleweed (*Lycopus* spp.), marsh fern (*Thelypteris palustris*), and marsh St. John's-wort (*Triadenum virginicum*).

Differentiating Occurrences: Alluvial Atlantic White Cedar Swamps differ from other Atlantic white cedar wetlands in that they occur within the floodplain of low-gradient rivers and streams or at the fringes of open marshy areas along ponds, generally in the eastern part of the state. They receive annual or semi-annual overbank flooding, making them more mineral-rich than other Atlantic white cedar wetlands. Silky dogwood, sensitive and royal ferns, bugleweed, and marsh St. John's-wort are more common than in other Atlantic white cedar swamps, and sphagnum carpets are less dense in regularly flooded areas. As with all natural communities, transitions and mixes occur. Coastal Atlantic White Cedar Swamps are not along river floodplains, although geographic distribution and resultant coastal species may overlap with Alluvial Atlantic White Cedar Swamps. Inland Atlantic White Cedar Swamps may also overlap geographically, but are also not in floodplains. Yellow birch is more common in Inland Atlantic White Cedar Swamps than in Alluvial Atlantic White Cedar Swamps. Inland Atlantic White Cedar Swamps have lower abundance of coastal indicators such as greenbrier, inkberry, dangleberry, swamp sweetbells, Virginia chain-fern, and netted chain-fern than Alluvial or Coastal Atlantic White Cedar Swamps. In Alluvial Red Maple Swamps, silver maple is often codominant with red maple; there is very little Atlantic white cedar (<25% cover), if it is present at all.

Associated Fauna: Alluvial Atlantic White Cedar Swamps can function as vernal pool habitat if water remains standing for 2-3 months and they lack fish; these areas provide important amphibian breeding habitat.

Public Access: Maple Park Conservation Area, Mansfield; West Hill Dam and Park (US Army Corps of Engineers), Uxbridge; Moose Hill Wildlife Sanctuary (Massachusetts Audubon Society), Sharon; Bungay River Conservation Area, Attleboro; Noquochoke WMA, Dartmouth.

Threats: The two greatest threats to Atlantic white cedar swamps are land clearing for agricultural, commercial and residential development, and interference with normal hydrological functioning as a result of development. Atlantic white cedar has been cut extensively for posts and shingles for over three centuries. In an extensive statewide vegetation inventory funded by NHESP in 1990, no uncut stands were found, but several sites contained cedars that were 100-200 years old. Selective cutting is detrimental to the persistence of Atlantic white cedar swamps, because hardwoods, such as red maple, out-compete and replace Atlantic white cedar. Any alteration to the natural hydroperiod of Atlantic white cedar swamps threatens their persistence.

Management Needs: Due to the limited distribution of Atlantic white cedar swamps, it is recommended that no clearing or filling of these wetlands be allowed. Atlantic white cedar will regenerate best following catastrophic disturbance events such as hurricanes and fires. Data suggest that in the absence of disturbance, red maple and shrubs increase in abundance at the expense of Atlantic white cedar. Fire suppression negatively threatens the long-term persistence of Atlantic white cedar swamps, and controlled burning practices may be an appropriate restoration tool in many areas.

Controlled burning should be accompanied by small-patch clearcuts to be most effective. By clear-cutting small patches, generally 20 m x 20 m, and removing the slash and competing vegetation, pure, even-aged stands of Atlantic white cedar are able to regenerate. Atlantic white cedar swamps require a natural cycle of wet and dry periods for their survival and reproduction. Standing water for much of the year is unfavorable for both seed germination and seedling survival, and young seedlings are killed by both drowning and drought. It is recommended that any alterations in water levels be avoided, including development and road construction in uplands surrounding Atlantic white cedar swamps which can alter water levels. Where cedar wetlands are associated with river systems, it is important to maintain the normal hydrologic regime of the river.

USNVC/NatureServe: *Chamaecyparis thyoides* Northern Peatland Alliance [A3400] -- *Chamaecyparis thyoides* - *Acer rubrum*/*Lycopus* spp. Forest (CEGL006364).

Alluvial Hardwood Flat Community

Community Code: CP1A2A4000

State Rank: S3

Concept: Fairly open hardwood forests on alluvial flats along small rivers and large streams.

Environmental Setting: Alluvial Hardwood Flat Forests occur along moderate-gradient reaches of small rivers and large streams where flooding is of short, intense duration, as the small watersheds respond rapidly to local weather events. The soils tend to be coarse sand and gravel, with mesic to locally hydric moisture regimes.

Vegetation Description: White pines (*Pinus strobus*), substantially taller than the hardwood canopy, are sparsely emergent above the canopy. The sparse to closed tree canopy has black cherry (*Prunus serotina*) co-dominant with red maple (*Acer rubrum*) and scattered American elm (*Ulmus americana*), white ash (*Fraxinus americana*), sugar maple (*Acer saccharum*), and white pine. The mid-story layer consists of saplings of the tree species, plus ironwood (*Carpinus caroliniana*), smooth shadbush (*Amelanchier laevis*), alternate-leaved dogwood (*Swida alternifolia*), witch hazel (*Hamamelis virginiana*), and blackberry (*Rubus alleghaniensis*). A wide variety of shrubs and saplings are consistently present, but never at high density. Tree species that are absent from the canopy, such as red oak (*Quercus rubra*), paper birch (*Betula papyrifera*), and eastern hemlock (*Tsuga canadensis*), are common in the shrub layer. The herbaceous layer is dense and species-rich, with mesic forbs, ferns, grasses and sedges well-represented. The structure of the herbaceous layer varies from stand to stand and is often patchy within a stand. Woodgrass (*Brachyelytrum aristosum*) and New York fern (*Parathelypteris noveboracensis*) are two characteristic species normally present, often with substantial cover in dominant patches. Other fairly common plants in the layer include jack-in-the-pulpit (*Arisaema triphyllum*), lady fern (*Athyrium filix-femina* var. *angustum*), sensitive

fern (*Onoclea sensibilis*), interrupted fern (*Osmunda claytoniana*), bristly dewberry (*Rubus hispidus*), and tall meadow-rue (*Thalictrum pubescens*). The non-native invasive shrub glossy buckthorn (*Frangula alnus*) is often encountered, but seldom at high densities. Meander scars support pockets of diverse wetland vegetation and, sometimes, aquatic species.

Differentiating Occurrences: Alluvial Hardwood Flats are along small streams that have multiple short flooding events throughout the year after storms. Black cherry and white pine are usually abundant in the canopy with red maple, but not silver maple. Alluvial Red Maple Swamps, along low-gradient rivers, flood annually and are slow to drain. Silver maple is often a codominant with red maple. High-terrace Floodplain Forests do not flood annually. They have a mix of floodplain trees, including silver maple, and mesic, deciduous hardwoods. The diverse herbaceous layer includes floodplain species and others more typical of rich forests. Red Maple Swamps are in basins or hillside seeps along small drainage ways. They are dominated by red maple.

Associated Fauna: Alluvial Hardwood Flats provide shade for the associated stream and filter water coming from surrounding uplands, improving water quality for the fish and other animals of the stream. Being small communities, they are part of the habitat of the wide-ranging riverine and upland animals. Old meander scars and depressions without fish provide vernal pool habitat.

Public Access: Tully Lake Reservation (US Army Corps of Engineers), Royalston; Royalston Falls Reservation (The Trustees of Reservations) and Royalston State Forest, Royalston; Warwick State Forest, Warwick.

Threats: Invasives. Succession.

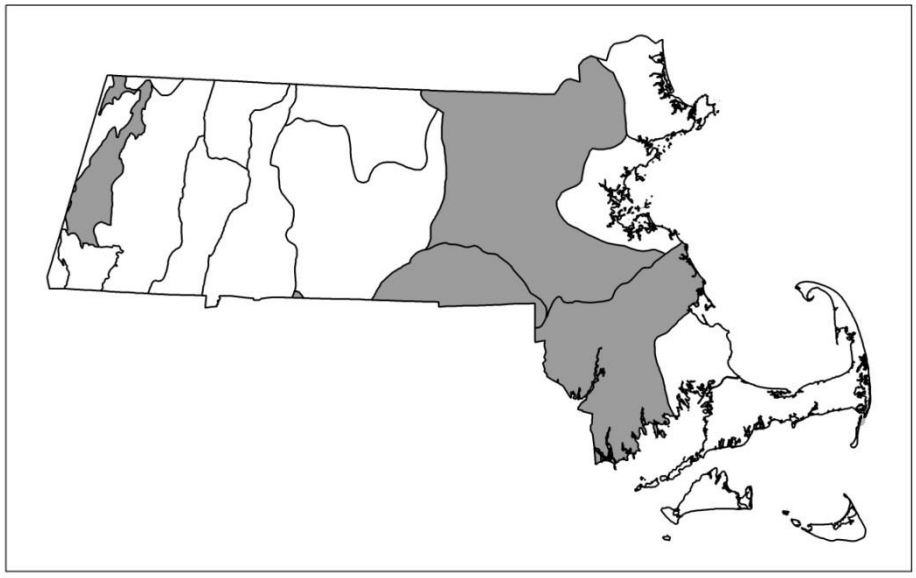
Management Needs:

USNVC/NatureServe: *Acer rubrum - Prunus serotina*/*Cornus amomum* Forest, CEGL006503 *Quercus bicolor - Acer rubrum*/*Carpinus caroliniana* Forest.

Alluvial Red Maple Swamp

Community Code: CP1A2A1A00

State Rank: S3



Concept: A rich variant of Red Maple Swamp, that occurs in low areas along rivers and streams that experience overbank flooding.

Environmental Setting: Alluvial Red Maple Swamps occur along mainstem sections of low-gradient rivers and streams that flood periodically, primarily in the eastern part of the state. They experience overbank flooding, but they appear to be more poorly drained than true floodplain forests. Soils are typically silt loams with pronounced soil mottling and a surface organic layer. Alluvial Red Maple Swamps may occur as parts of wetland mosaics with other types of floodplain forests, shrub swamps, and other wetland communities. Groundwater from uplands and surrounding wetlands may maintain soil moisture over the growing season.

Vegetation Description: The overstory of Alluvial Red Maple Swamps is a mixture of red maple (*Acer rubrum*) and, usually, silver maple (*A. saccharinum*) along riverbanks, with lesser amounts of American elm (*Ulmus americana*), sugar maple (*A. saccharum*), green ash (*Fraxinus pennsylvanica*), shagbark hickory (*Carya ovata*), and/or swamp white oak (*Quercus bicolor*). Red oak (*Q. rubra*), white pine (*Pinus strobus*), and black cherry (*Prunus serotina*) occur in elevated sections. A subcanopy includes the canopy dominants along with hornbeam (*Carpinus caroliniana*). Unlike true floodplain forests, Alluvial Red Maple Swamps have well-developed shrub layers with northern arrow-wood (*Viburnum dentatum* var. *lucidum*), American hazelnut (*Corylus americana*), silky dogwood (*Swida amomum*), buttonbush (*Cephalanthus occidentalis*), meadowsweet (*Spiraea alba* var. *latifolia*), and the non-native glossy buckthorn (*Frangula alnus*). Vines include poison ivy (*Toxicodendron radicans*). In the coastal plain, shrubs may include mountain laurel (*Kalmia latifolia*), winterberry

(*Ilex verticillata*), and sweet pepper-bush (*Clethra alnifolia*). The herbaceous layer is often dominated by sensitive fern (*Onoclea sensibilis*) and false nettle (*Boehmeria cylindrica*), mixed with a rich assemblage of herbaceous species that commonly includes cinnamon fern (*Osmundastrum cinnamomeum*), royal fern (*Osmunda regalis*), goldenrods (*Solidago* spp.), jewelweeds (*Impatiens* spp.), beggar-ticks (*Bidens* spp.), bugleweeds (*Lycopus* spp.), awned sedge (*Carex crinita*), and grasses, including rice cutgrass (*Leersia oryzoides*), bluejoint grass (*Calamagrostis canadensis*), and woodreed (*Cinna arundinacea*).

Differentiating Occurrences: Alluvial Red Maple Swamps occur along low-gradient rivers and receive river flood waters. Unlike true floodplain forests, alluvial swamp forests have well-developed shrub layers composed of northern arrow-wood (*Viburnum dentatum* var. *lucidum*), silky dogwood (*Swida amomum*), and the non-native glossy buckthorn (*Frangula alnus*).Silver maple is often a codominant with red maple. The periodic river flooding is a key process in the Alluvial Red Maple Swamps that affects species composition and differentiates it from closely related community types. Alluvial Hardwood Flats are along small streams that have multiple short flooding events throughout the year after storms. Black cherry and white pine are usually abundant in the canopy with red maple, but not silver maple. High-terrace Floodplain Forests do not flood annually. They have a mix of floodplain trees and mesic, deciduous hardwoods. The diverse herbaceous layer includes floodplain species and others more typical of rich forests. Red Maple Swamps are in basins or hillside seeps along small drainage ways. They are less diverse than Alluvial Red Maple Swamps in all layers.

Associated Fauna: Alluvial red maple swamps, especially at the upland fringe or in old meander scars and oxbows, can function as vernal pool habitat if water remains standing for 2-3 months and they lack fish; these areas provide important amphibian breeding habitat. Riverine odonates use adjacent alluvial red maple swamps for shelter.

Public Access: Taunton River WMA and Black Brook WMA, Middleborough; West Hill Dam and Park (US Army Corps of Engineers), Northbridge; George L. Darey Housatonic Valley WMA, Lenox.

Threats: Invasion of non-native plant species, including moneywort (*Lysimachia nummularia*) and glossy buckthorn (*Frangula alnus*).

Management Needs: Removal of non-native plant species.

USNVC/NatureServe: *Acer rubrum - Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance --*Acer rubrum - Fraxinus* (*pennsylvanica*, *americana*)/*Lindera benzoin*/*Symplocarpus foetidus* Forest (CEGL006406) [CEGL006975; *Acer* (*rubrum*, *saccharinum*) - *Ulmus americana* forest (but this alliance is freely drained, not poorly drained, and not as shrubby as the Mass description)]. *Quercus bicolor - Acer rubrum*/*Carpinus caroliniana* Forest (CEGL006386)

Atlantic White Cedar Bog

Community Code: CP1B1B2000

State Rank: S2

Concept: Acidic forested peatlands, with a nearly continuous heath shrub layer and an open canopy in which Atlantic white cedar is the characteristic tree species.

Environmental Setting: Atlantic White Cedar Bogs are semi-forested, acidic, dwarf-shrub peatlands: wetlands with incompletely decomposed plant material (peat) that accumulates when saturated year-round with water that is cool, acidic, poorly oxygenated, and low in nutrients. Short (2-10m or 6-30 ft.) Atlantic white cedar trees dominate the open canopy. An open to nearly continuous, low (~1m or 3ft) shrub layer often incl udes small Atlantic white cedars. In Massachusetts, many Atlantic White Cedar Bogs occur as small (<3 acre) openings within larger Atlantic white cedar swamps, in parts of the state where oak and oak - pine forests dominate the landscape. The settings are variable: pond border, patches in large swamps, and on Cape Cod, in kettleholes where they are surrounded by upland Pitch Pine - Oak Forest/Woodlands and Pitch Pine - Scrub Oak Communities.

Vegetation Description: Total canopy coverage is low (<25% cover) with Atlantic white cedar (*Chamaecyparis thyoides*) dominant with scattered red maple (*Acer rubrum*). Occasional associates include white and pitch pine (*Pinus strobus* and *P. rigida*), grey birch (*Betula populifolia*), and black spruce (*Picea mariana*). Scattered clumps of tall shrubs include highbush blueberry (*Vaccinium corymbosum*) and swamp azalea (*Rhododendron viscosum*). An often continuous low shrub layer is dominated by leatherleaf (*Chamaedaphne calyculata*) and sheep laurel (*Kalmia angustifolia*), with black and dwarf huckleberry (*Gaylussacia baccata* and *G. bigeloviana*), rhodora (*Rhododendron canadense*), and bog rosemary (*Andromeda polifolia* var. *glaucophylla*). There is typically a well-formed sphagnum moss layer below the

shrubs, and large and small cranberry (*Vaccinium macrocarpon* and *V. oxycoccos*), sundews (*Drosera* spp.), and pitcher plants (*Sarracenia purpurea*) occur throughout. Virginia chain-fern (*Woodwardia virginica*) tends to be more common in peatlands, including Atlantic White Cedar Bogs, in southeastern Massachusetts than in other parts of the state.

Differentiating Occurrences: Atlantic White Cedar Bogs have sparse canopy (averaging <25%, but there may be local clumps of trees) cover of Atlantic white cedar over sphagnum on peat. Atlantic White Cedar Bogs share many species and characteristics with other acidic peatlands, including Level Bogs, which they might be considered a variation of, as well as Kettlehole Level Bogs and Acidic Graminoid Fens. The most obvious difference is the presence of Atlantic white cedar in the sparse tree layer and as scattered shrubs on the sphagnum mat. Atlantic White Cedar Bogs often occur as openings in Coastal, Inland, and Northern Atlantic White Cedar Swamps, which are forested wetland communities with closed canopies (>25% tree cover overall, generally more), with >25% cover of Atlantic white cedar. Atlantic White Cedar Bogs have, overall, <25% cover of canopy species (there may be clumps of trees with very locally greater cover; the coverage is for the extent of the community, which will have areas of no canopy cover at all), with Atlantic white cedar dominating the canopy that does occur. Whether Atlantic White Cedar Bogs are considered to be separate entities or openings in the prevailing Atlantic white cedar swamps depends on the patch size and abundance of local patches: 2 acres (that may be cumulative across local patches) are required in the community ranking specifications.

Associated Fauna: Winged animals and large terrestrial animals can use peatlands as part of a larger habitat. White-tailed deer browse on shrubs in acidic peatlands, leaving trails across the peat mat. Some birds use peatlands for nesting or foraging. The acidity and low oxygen content make peatlands poor habitat for most amphibians and reptiles, although four-toed salamanders nest in sphagnum hummocks over water and individuals may incorporate Atlantic White Cedar Bogs as part of their habitat. Many species of dragonflies and damselflies inhabit acidic peatlands, especially where there is adjacent open water. Atlantic White Cedar bogs with dense patches of Virginia chain fern or water willow are likely to support species of moths that specialize in those plants.

Public Access: Mashpee WMA, Mashpee; Hockomock Swamp WMA (Nunkets Pond, Lake Nippenicket), Bridgewater; Blue Hills Reservation (Ponkapoag Pond), Canton; Peters Pond Area (town-owned), Dracut.

Threats: The two greatest threats to Atlantic white cedar swamps are land clearing for agricultural, commercial and residential development, and interference of normal hydrological functioning as a result of development. Atlantic white cedar has been cut extensively for posts and shingles for over three centuries. In an extensive statewide vegetation inventory funded by NHESP in 1990, no uncut stands were found, but several sites contained cedars that were 100-200 years old. Selective cutting is detrimental to the persistence of Atlantic white cedar swamps, because

hardwoods, such as red maple, outcompete and replace Atlantic white cedar. Any alteration to the natural hydroperiod of Atlantic white cedar swamps threatens their persistence. The peat in Atlantic White Cedar Bogs is threatened by hydrology changes and introduction of nutrients.

Management Needs: Due to the limited distribution of Atlantic white cedar swamps, it is recommended that no clearing or filling of these wetlands be allowed. Atlantic white cedar will regenerate best following catastrophic disturbance events such as hurricanes and fires. Data suggest that in the absence of disturbance, red maple and shrubs increase in abundance at the expense of Atlantic white cedar. Fire suppression negatively threatens the long-term persistence of Atlantic white cedar swamps, and controlled burning practices may be an appropriate restoration tool in many areas. Controlled burning should be accompanied by small-patch clearcuts to be most effective. By clear-cutting small patches (generally 20 m x 20 m) and removing the slash and competing vegetation, pure, even-aged stands of Atlantic white cedar are able to regenerate. Atlantic white cedar swamps require a natural cycle of wet and dry periods for their survival and reproduction. Standing water for much of the year is unfavorable for both seed germination and seedling survival, and young seedlings are killed by both drowning and drought. It is recommended that any alterations in water levels be avoided. This includes development and road construction in uplands surrounding Atlantic white cedar swamps which can alter water levels. Where cedar wetlands are associated with river systems, it is important to maintain normal hydrologic regime of the river.

USNVC/NatureServe: *Chamaecyparis thyoides* Northern Peatland Alliance -- *Chamaecyparis thyoides*/ *Chamaedaphne calyculata* Woodland [CEGL006321].

Black Gum – Pin Oak – Swamp White Oak Perched Swamp

Community Code: CP1A2A3000

State Rank: S1

Concept: A red maple-dominated basin swamp, in which black gum, pin oak, and swamp white oak are important components of the overstory. This vegetation association is limited to lakebed sediments of glacial Lake Hitchcock in the Connecticut Valley.

Environmental Setting: Black Gum - Pin Oak - Swamp White Oak Perched Swamps (perched swamps) are closed-canopy deciduous forests that occur on the flat lakebed of glacial Lake Hitchcock in the Connecticut River valley. The glacial lake substrate includes layers of clay overlain by varying depths of silt and sand. The relatively impermeable nature of the clay layer produces a locally perched water table that is not directly connected with the regional water tables, and supports this wetland community that is not found in the active floodplains of the river. There may be some connection to the groundwater along the margins of these wetlands or, to a more limited degree, through slow vertical movement. The surface topography is hummock and hollow with the hummocks about 0.5 m (about 1.5 ft.) high. With the exception of some sedges most of the vegetation is confined to the hummocks. The sites are wet at least seasonally, flooding in the spring and drying out over the summer. Periodic flooding occurs as indicated by the lack of organic matter accumulation.

Vegetation Description: The forest canopy is generally closed, but ranges from 50 to 100% closure. The stands are a mosaic of microsites with different degrees of wetness supporting slightly different species mixes. In general, red maple (*Acer rubrum*) dominates the overstory, but the species giving their names to the community that are at or near the northern limits of their ranges in the Connecticut River Valley of Massachusetts are generally present, often in abundance: these are black gum (*Nyssa sylvatica*),

pin oak (*Quercus palustris*), and swamp white oak (*Q. bicolor*). Other hardwoods, including ashes (*Fraxinus* spp.), regularly occur as scattered individuals. Drier sites include eastern hemlock (*Tsuga canadensis*) as a common associate with yellow birch (*Betula alleghaniensis*) consistently present at low densities. All sites have a fairly dense shrub layer similar to other red maple swamps. Common species include highbush blueberry (*Vaccinium corymbosum*), northern arrow-wood (*Viburnum dentatum* var. *lucidum*), common winterberry (*Ilex verticillata*), witch hazel (*Hamamelis virginiana*), and serviceberry (*Amelanchier spp.*). The wettest sites also have spicebush (*Lindera benzoin*) or often buttonbush (*Cephalanthus occidentalis*). Mountain laurel (*Kalmia latifolia*) is found in the drier sites, often in dense thickets. The herbaceous layer is variable, but cinnamon fern (*Osmundastrum cinnamomeum*) occurs at all known sites. Other common herbaceous species are Canada mayflower (*Maianthemum canadense*), goldthread (*Coptis trifolia*), Indian cucumber-root (*Medeola virginiana*), and various fern and sedge species (*Carex* spp.), particularly in the wetter sites. One of the most striking characteristics of this swamp forest is the high coverage of ferns. Netted chain-fern (*Woodwardia areolata*), a southern coastal plain species, occurs at some of the sites.

Differentiating Occurrences: Black Gum - Pin Oak - Swamp White Oak Perched Swamps are known only from the Connecticut River Valley in areas underlain by clays in lakebed sediments of glacial Lake Hitchcock. The presence of fairly high proportions of black gum, pin oak, and swamp white oak in the canopy, in addition to the topographic setting, distinguish the type. Red Maple - Black Gum Swamps are generally in small, topographically constrained basins surrounded by upland forests. Black gum needs to be dominant or codominant in large areas of the swamp for the occurrence to be a black gum swamp, but they don't have high proportions of pin oak or swamp white oak. Red Maple Swamps may have black gum, or occasional pin oak or swamp white oak in low proportions in the canopy, but not as dominants or codominants.

Associated Fauna: Perched swamps can function as vernal pool habitat if water remains standing for 2-3 months and they lack fish; these areas provide important amphibian breeding habitat.

Public Access: Lawrence Swamp Conservation Area, Amherst; Great Swamp WMA, Whately.

Threats: It is likely that this community type once covered a larger area of the Connecticut Valley, but much of the lake bottom has been cleared and converted to agriculture. Only patches of these perched swamps remain. Current threats include alteration of water chemistry from road and farm runoff (in particular, the accumulation of road salts), ditching by land owners to drain water, and logging.

Management Needs: Disturbed areas appear to have large amounts of glossy buckthorn (*Frangula alnus*). Efforts to prevent further disturbance may prevent the spread of this invasive plant species.

USNVC/NatureServe: Not described; related to *Quercus palustris - Quercus bicolor - Acer rubrum* Flatwoods Forest (CEGL005037). Also related to *Quercus palustris - Quercus*

bicolor - *Nyssa sylvatica* - *Acer rubrum* Sand Flatwoods Forest (CEGL002100);
System: North-Central Interior Wet Flatwoods (CES202.700)

Calcareous Basin Fen

Community Code: CP2B0A3000

State Rank: S1

Concept: Sedge-shrub peatlands occurring in well-defined basins that have calcareous groundwater (and sometimes surface water) inputs. Calcareous Basin Fens are the least rich of the three calcareous fen communities described in Massachusetts.

Environmental Setting: Calcareous Basin Fens occur in well-defined basins with permanently saturated deep (>2m (6.5 ft.)) peat and consolidated or floating sedge-dominated peat mats around any open water in the basin. Waters are circumneutral to alkaline (pH 6.0-8.1), with high concentrations of calcium and magnesium cations and bicarbonate anions dissolved from limestone and dolostone bedrock or glacial materials rich in those elements. They are the least rich (with respect to water chemistry) of all the calcareous fen communities, at least partially because the nutrients get tied up in the thick peat and are not available for plant growth. Water moves slowly in peat and oxygen that groundwater carries is quickly used up: the resulting anaerobic conditions inhibit growth of microorganisms that would otherwise break down remains of dead plants, which contributes to the development of more peat. Because peat tends to absorb ions that are plant nutrients and release acid-forming hydrogen ions, the resulting water in thick peat is fairly acidic, despite the presence of calcium. This community type has existed at sites for a few thousand years and appears to be relatively stable over time.

Vegetation Description: Calcareous Basin Fens are sedge-dominated peatlands with scattered shrubs. Typical sedges include slender woolly-fruited sedge (*Carex lasiocarpa* ssp. *americana*) and water-sedge (*C. aquatilis* ssp. *altior*), with multiple other sedges, narrow-leaved cattail (*Typha angustifolia*), and white beaksedge (*Rhynchospora alba*). There are often patches of hard-stemmed bulrush (*Schoenoplectus acutus*

var. *acutus*). Grass of Parnassus (*Parnassia glauca*) may also be present. Scattered shrubs include shrubby cinquefoil (*Dasiphora floribunda*) and sweet-gale (*Myrica gale*), associated with typical bog/acidic fen species such as pitcher plant (*Sarracenia purpurea*), round-leaved sundew (*Drosera rotundifolia*), bog rosemary (*Andromeda polifolia* var. *glaucophylla*), twig rush (*Cladium mariscoides*), buckbean (*Menyanthes trifoliata*), and large cranberry (*Vaccinium macrocarpon*). Mosses are extensive and may include star campylium moss (*Campylium stellatum*), *Calliergonella* spp., and *Sphagnum* spp. In the increasingly wet area near the upland edge, a dense shrubby zone may include dense bog birch (*Betula pumila*).

Differentiating Occurrences: All calcareous wetlands include shrubby cinquefoil (*Dasiphora floribunda*). Most also have other calciphiles (calcium-loving plants) such as grass of Parnassus (*Parnassia glauca*), Kalm's lobelia (*Lobelia kalmii*), alder-leaf buckthorn (*Rhamnus alnifolia*), hemlock parsley (*Conioselinum chinense*), autumn and hoary willows (*Salix serissima* and *S. candida*), and slender cotton-grass (*Eriophorum gracile*). Within a given site, calcareous fen communities grade from one to another as conditions change. Calcareous Basin Fens have deep (> 2.0 meters (6.5 ft.)) peat in basins. They are dominated by sedges with a sparse shrub layer; they generally contain a more developed bryophyte layer than the other calcareous fens. They share many species with acidic fens, but include species restricted to calcareous conditions, such as bog birch and the calciphiles listed above. Calcareous Sloping Fens are on shallow to moderate slopes and have more mineral soil than other calcareous fens; peat is mostly restricted to sedge hummocks. A diverse herbaceous layer dominates the vegetation. Tall shrubs and short trees may occur in scattered patches. Calcareous Seepage Marshes have a mixture of herbaceous, graminoid and shrub species similar to an emergent marsh, with mucky peat generally 0.5 to 2m deep. They are generally flat to slightly sloping. Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps are dominated by trees and tall shrubs in a somewhat sparse forest where small openings share many of the species and conditions of Calcareous Sloping Fens. They may abut Calcareous Sloping Fens in a wetland mosaic.

Associated Fauna: Calcareous basin fens can function as vernal pool habitat if water remains standing for 2-3 months; these areas provide important amphibian breeding habitat.

Public Access: Due to the sensitivity of calcareous wetlands to damage from visitation, most land owners prefer not to publicize the locations.

Threats: Changes in groundwater quality and quantity; and any human activities that disturb the vegetation, substrate, or water supply. In disturbed areas, cattails may displace calcium-loving species. Beaver activity threatens calcareous fen communities by altering surface water chemistry. There is evidence to suggest that ponding of water by beaver dams may increase the water's relative acidity, possibly due to the accumulation of organic acids or to dilution from acid rain (Motzkin, 1993).

Management Needs: Fires, grazing, and/or mowing may be necessary to maintain open fen habitats. More information is needed.

USNVC/NatureServe: *Myrica gale-Dasiphora fruticosa* ssp. *floribunda*/*Carex lasiocarpa - Cladium mariscoides* Shrub Herbaceous Vegetation [CEGL006068] G2G3; *Cornus racemosa*/*Carex* (*sterilis*, *aquatilis*, *lacustris*) Shrub Herbaceous Vegetation (CEGL006123) G2G3.

Calcareous Pondshore/Lakeshore Community

Community Code: CP2A0B1300

State Rank: S2

Concept: Vegetated gravelly, sandy, or muddy shores of calcareous or circumneutral inland lakes and ponds.

Environmental Setting: Calcareous Pondshore/Lakeshores are submerged or saturated for a significant part of the year or continuously in wet years. The substrate is mineral soil and may range in texture from fine silts to sand and gravel. Organic material may accumulate, creating quite mucky sediments. Some shores are steep mineral banks; others are gradual with emergent vegetation that grades into Deep or Shallow Emergent Marshes, calcareous fens, shrub swamps, or forested swamps that can form extensive wetland complexes within the basins. Calcareous ponds are restricted to limestone areas of Berkshire County where they are surrounded by upland Northern Hardwoods - Hemlock - White Pine Forests.

Vegetation Description: Calcareous Pondshores/Lakeshores have abundant shrubs in many areas with red maple (*Acer rubrum*), speckled alder (*Alnus incana* spp. *rugosa*), and swamp rose (*Rosa palustris*). The herbaceous layer is dominated by sedges, especially awned sedge (*Carex crinita*), porcupine sedge (*C. hystericina*), lakeside sedge (*C. lacustris*), tussock sedge (*C. stricta*), threeway sedge (*Dulichium arundinaceum*), and soft-stemmed spikerush (*Eleocharis obtusa*). Northern blue flag (*Iris versicolor*) is also common on the shore. Emergent species in the shallow water adjacent to the often ill-defined shoreline include bur reeds (*Sparganium androcladum* and *S. eurycarpum*). The shores and surrounding marshes often have patches of the invasives purple loosestrife (*Lythrum salicaria*), common reed (*Phragmites australis*), and reed canary-grass (*Phalaris arundinacea*). Sites with steep silty banks may have additional exotics such as true forget-me-not (*Myosotis scorpioides*) and

moneywort (*Lysimachia nummularia*). The ponds themselves contain mats of the green alga stonewort (*Chara* sp.) and support aquatic plants including several species of pondweeds (*Potamogeton* spp.) that are restricted to calcareous waters.

Differentiating Occurrences: All the pondshore/lakeshore communities occur around water bodies that can be differentiated by setting and location. Calcareous Ponds and Lakes occur in the Marble Valleys of Berkshire County and have calcium in the water derived from nearby limestone or dolostone bedrock. The ponds usually have inflow and outflow, and often have mats of stoneworts (*Chara* sp.) in the lake bottoms. The shore line is often not distinct, merging into marsh or other wetlands. Acidic ponds and lakes have lower pH than calcareous ponds, and do not have stoneworts. Many have inflow or outflows. Acidic pondshore vegetation is broadly defined and variable, and includes shorelines not explicitly included in calcareous or coastal plain pondshores. Coastal Plain Ponds are generally on sand in the coastal plain in closed basins that intersect groundwater that affects pond levels. The seasonally and annually fluctuating water table typically leaves an exposed shoreline by late summer that supports common and rare, generally coastal or southern, mostly herbaceous species. Coastal Plain Pondshores - Inland Variant also occur in closed basins in sandy outwash, but in the Connecticut River Valley. Coastal plain species grow in them, but include fewer specialists. Freshwater Mud Flat Communities are within ponds rather than on shorelines. They have low, sparse, annual herbaceous vegetation on recently exposed muddy sediments.

Associated Fauna: There are a few species that specialize in alkaline (therefore calcareous, in Massachusetts) ponds or lakes, but these invertebrates are not particularly associated with shorelines, but the waterbodies themselves. Some shorelines immediately become shrub swamp and emergent marshes where inconspicuous ("secretive") water birds nest. Such marsh nesters are not concerned with the water chemistry, but rather in the extent of habitat and lack of human disturbance. Their use of extensive marshes and associated open water are not shore-based, per se.

Public Access: Three Mile Pond WMA, Sheffield; Agawam Lake WMA, Stockbridge.

Threats: The primary threat is exotic, invasive species including purple loosestrife (*Lythrum salicaria*), common reed (*Phragmites australis*), and reed canary-grass (*Phalaris arundinacea*). Other threats include alteration of normal water-level fluctuations, shoreline development, and disturbance from off road vehicles.

Management Needs: More information is needed to assess the management needs of calcareous pondshore/lakeshore communities.

USNVC/NatureServe: Pond: A4066: *Potamogeton* spp. - *Ceratophyllum* spp. - *Elodea* spp. Herbaceous Alliance: *Elodea canadensis* - *Potamogeton* spp. Eastern Herbaceous Vegetation [CEGL006431].

Calcareous Seepage Marsh

Community Code: CP2B0A2000

State Rank: S2

Concept: Mixed herbaceous/graminoid/shrub wetlands that experience some calcareous groundwater seepage. Calcareous Seepage Marshes are intermediate in richness of the three calcareous fen communities described in Massachusetts.

Environmental Setting: Calcareous Seepage Marshes are open (non-forested) wetlands, with scattered shrubs in a mix of herbaceous and graminoid plants. There may be areas of open water and some of the herbaceous vegetation may occur on floating mats during the growing season. Although there are hummocks and hollows, the overall surface is flat to slightly sloping. The community is maintained by calcareous groundwater in a variety of physical settings: in basins, in canopy gaps in rich forested swamps, in current or former beaver drainages, or in level to slightly sloping sites associated with sloping fens. Typically, there are 50-200+ cm (1-6.5 ft.) of mucky peat (moderate to well-decomposed organic sediments). Waters are circumneutral to alkaline (pH 6.0-8.1) with high concentrations of calcium and magnesium cations and bicarbonate anions dissolved from bedrock or glacial materials rich in those elements. In marshes, the plant materials in the mucky substrate are decomposed more than in fens with peat, likely due to greater availability of more types of nutrients, more oxygen, and/or warmer ground water. Peat accumulates as plants die back each year; in cool, acidic, wet, anaerobic environments with low nutrient availability, they decompose very slowly and organic material builds up.

Vegetation Description: Calcareous Seepage Marshes have a mix of scattered shrubs, herbaceous, and graminoid species similar to an emergent marsh. A diverse but generally not dense shrub layer may include winterberry (*Ilex verticillata*), buttonbush (*Cephalanthus occidentalis*), highbush blueberry (*Vaccinium corymbosum*), swamp rose (*Rosa*

palustris), meadowsweet (*Spiraea alba* var. *latifolia*), alders (*Alnus* spp.), and/or poison-sumac (*Toxicodendron vernix*), as well as shrubby calciphiles such as hoary willow (*Salix discolor*), autumn willow (*S. serissima*), swamp birch (*Betula pumila*), and shrubby cinquefoil (*Dasiphora floribunda*). The dense herbaceous/graminoid layer is a mixture of typical marsh species such as cattails (*Typha angustifolia*, *T. latifolia*), sweet flag (*Acorus calamus*), lakeside sedge (*Carex lacustris*), tussock sedge (*C. stricta*), cinnamon fern (*Osmundastrum cinnamomeum*), royal fern (*Osmunda regalis*), swamp milkweed (*Asclepias incarnata*), and swamp loosestrife (*Lysimachia thyrsiflora*), and calciphiles such as Labrador bedstraw (*Galium labradoricum*), grass-of-Parnassus (*Parnassia glauca*), Kalm's lobelia (*Lobelia kalmii*), hemlock parsley (*Conioselinum chinense*), and slender cotton-grass (*Eriophorum gracile*).

Differentiating Occurrences: All calcareous wetlands include shrubby cinquefoil (*Dasiphora floribunda*). Most also have other calciphiles (calcium-loving plants) such as grass-of-Parnassus (*Parnassia glauca*), Kalm's lobelia (*Lobelia kalmii*), alder-leaf buckthorn (*Rhamnus alnifolia*), hemlock parsley (*Conioselinum chinense*), autumn and hoary willows (*Salix serissima* and *S. candida*), and slender cotton-grass (*Eriophorum gracile*). Within a given site, calcareous fen communities grade from one to another as conditions change. Calcareous Seepage Marshes share species with both Shallow and Deep Emergent Marshes, but contain more calciphiles. Calcareous Basin Fens have deep (> 2.0 meters (6.5 ft.)) peat in basins. They are dominated by sedges with a sparse shrub layer; they generally contain a more developed bryophyte layer than the other calcareous fens. They share many species with acidic fens, but include species restricted to calcareous conditions, such as bog birch and the calciphiles listed above. Calcareous Sloping Fens are on shallow to moderate slopes and have more mineral soil than other calcareous fens; peat is mostly restricted to sedge hummocks. A diverse herbaceous layer dominates the vegetation. Tall shrubs and short trees may occur in scattered patches. Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps are dominated by sparse trees and tall shrubs. Small openings share many of the species and conditions of Calcareous Sloping Fens.

Associated Fauna: Calcareous Seepage Marshes contribute variation within the habitats of large, mobile animals. They function as vernal pool habitat if water remains standing for 2-3 months; these areas provide important amphibian breeding habitat.

Public Access: Due to the sensitivity of calcareous wetlands to damage from visitation, most land owners prefer not to publicize the locations.

Threats: Changes in groundwater quality and quantity; and any human activities that disturb the vegetation, substrate, or water supply. In disturbed areas, cattails may displace calcium-loving species. Beaver activity threatens calcareous fen communities by altering surface water chemistry. There is evidence to suggest that ponding of water by beaver dams may increase the water's relative acidity, possibly due to the accumulation of organic acids or to dilution from acid rain (Motzkin, 1993).

Management Needs: Fires, grazing, and/or mowing may be necessary to maintain open fen habitats. More information is needed.

USNVC/NatureServe: Includes G805 *Cornus amomum-Salix discolor*/*Pentaphylloides floribunda*/*Carex stricta* shrubland [CEGL006359].

Calcareous Sloping Fen

Community Code: CP2B0A1000

State Rank: S2

Concept: Open, sedge-dominated wetlands occurring on slight to moderate slopes where there is calcareous groundwater seepage. Calcareous Sloping Fens are the most calcium- and species-rich of the three calcareous fen communities described in Massachusetts. They are rare species "hot spots" with many associated rare plant and animal species.

Environmental Setting: Calcareous Sloping Fens are generally small, open, graminoid- and herbaceous-dominated wetlands, which may occur as multiple patches in a wetland or in wetland complexes with other wetland community types. They are on (or at the base of) shallow to moderate slopes and maintained by circumneutral to alkaline (pH 6.0-8.1) groundwater seepage, with high concentrations of calcium and magnesium cations and bicarbonate anions dissolved from nearby bedrock or glacial materials. Seepage may be visible as distinct rivulets. Where there is heavy groundwater discharge, the mineral soil is exposed with organic matter accumulations in small hummocks. Calcareous Sloping Fens have a shallower depth of organic matter than other types of calcareous fens due to more rapid and aerated groundwater flow. Some form of disturbance is important to preventing dominance by woody species.

Vegetation Description: Calcareous Sloping Fens are dominated by sedges, such as prickly sedge (*Carex interior*), delicate sedge (*C. leptalea*), yellow sedge (*C. flava*), tussock sedge (*C. stricta*), marsh sedge (*C. lacustris*) and porcupine sedge (*C. hystericina*), and grasses, including marsh muhly (*Muhlenbergia glomerata*) and fowl mannagrass (*Glyceria striata*). Herbaceous species include Kalm's lobelia (*Lobelia kalmii*), water-horehound (*Lycopus uniflorus*), grass-of-Parnassus (*Parnassia glauca*),

rough-leaved goldenrod (*Solidago patula*), fen-goldenrod (*S. purshii*), and marsh fern (*Thelypteris palustris* var. *pubescens*). Shrubby cinquefoil (*Dasiphora floribunda*) is almost always present in a low shrub layer, sometimes with the native alder-leaf buckthorn (*Rhamnus alnifolia*). A sparse, and generally low, canopy layer may include white pine (*Pinus strobus*), larch (*Larix laricina*), red maple (*Acer rubrum*), and alders (*Alnus incana* spp. *rugosa*, *A. serrulata*), with shrubby autumn, hoary, and silky willow (*Salix serissima*, *S. candida*, and *S. sericea*) along the margins. There is often a bryophyte layer, dominated by sphagnum moss species, though moss cover is generally less in sloping fens than other fens. Calcareous Sloping Fens may occur as openings at the bases of slopes, in upland forests or swamps, or may grade into more open wetlands downslope.

Differentiating Occurrences: All calcareous wetlands include shrubby cinquefoil (*Dasiphora floribunda*). Most also have other calciphiles (calcium-loving plants) such as grass-of-parnassus (*Parnassia glauca*), Kalm's lobelia (*Lobelia kalmii*), alder-leaf buckthorn (*Rhamnus alnifolia*), hemlock parsley (*Conioselinum chinense*), autumn and hoary willows (*Salix serissima* and *S. candida*), and slender cotton-grass (*Eriophorum gracile*). Within a given site, calcareous fen communities grade from one to another as conditions change. Calcareous Sloping Fens are on shallow to moderate slopes and have more mineral soil than other calcareous fens; peat is mostly restricted to sedge hummocks. A diverse herbaceous layer dominates the vegetation. Tall shrubs and short trees may occur in scattered patches. Nutrients arrive as seepage from uplands through mineral soil. Calcareous Seepage Marshes have a mixture of herbaceous, graminoid and shrub species similar to an emergent marsh, with peat generally 0.5 to 2m deep. They are generally flat but may be slightly sloping. Calcareous Basin Fens are peatlands with deep organic soil > 2.0 meters (6.5 ft.). They are dominated by sedges with a sparse shrub layer and generally contain a more developed bryophyte layer than the other calcareous fens. They form in basins (best observed away from the edges). They share many species with acidic fens, but include some species restricted in Massachusetts to calcareous conditions, such as bog birch and some of the calciphiles listed above. Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps are dominated by trees and tall shrubs in a somewhat sparse forest where small openings share many of the species and conditions of Calcareous Sloping Fens. They may abut Calcareous Sloping Fens in a wetland mosaic.

Associated Fauna: Calcareous sloping fens can function as vernal pool habitat if water remains standing for 2-3 months; these areas provide important amphibian breeding habitat. Rare animals include turtles and dragonflies. Regionally rare ant species are also known to occur in this community type.

Public Access: Due to the sensitivity of calcareous wetlands to damage from visitation, most land owners prefer not to publicize the locations.

Threats: Changes in groundwater quality and quantity, and any human activities that disturb the vegetation, substrate, or water supply. In disturbed areas, cattails may displace calcium-loving species. Beaver activity threatens calcareous fen communities by

altering surface water chemistry. There is evidence to suggest that ponding of water by beaver dams may increase the water's relative acidity, possibly due to the accumulation of organic acids or to dilution from acid rain (Motzkin, 1993). Invasive species tolerant of wet conditions noted in calcareous fens include reed-canary grass (*Phalaris arundinacea*), purple loosestrife (*Lythrum salicaria*), common reed (*Phragmites australis*), buckthorns (*Rhamnus cathartica* and *Frangula alnus*), Japanese barberry (*Berberis thunbergii*), and bush honeysuckle (*Lonicera morrowii*).

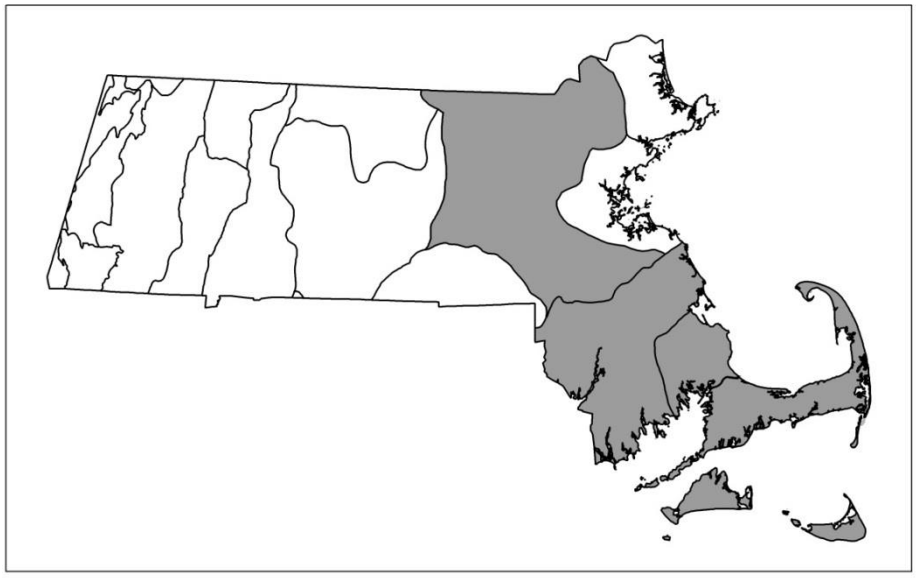
Management Needs: Calcareous Sloping Fens are dependent on groundwater. Since they are small, slight changes in the amount or quality of groundwater could profoundly affect species composition and abundance. Activities occurring uphill, such as groundwater withdrawal, could reduce flows to the fen. Surface discharges may also increase flows as well as erosion. Disturbance such as ditching or other alterations to drainage patterns can also have significant effects. Impounding of wetlands from road crossings or from beaver activity can increase water levels, flooding the fens and eliminating habitat. At the same time, without natural disturbance events, vegetation succession leading to increasing shrub dominance could reduce the size of these peatland communities and their rare species habitat. Periodic grazing, mowing, fire, or short-term flooding may be necessary to maintain open fen habitats.

USNVC/NatureServe: *Dasiphora fruticosa* ssp. *floribunda*/*Carex* (*sterilis*, *hystericina*, *flava*) Shrub Herbaceous Vegetation [CEGL006326] G2.

Coastal Atlantic White Cedar Swamp

Community Code: CP1B1A1000

State Rank: S2



Concept: Basin swamps dominated by Atlantic white cedar in the overstory and by a mixture of coastal species in the understory.

Environmental Setting: Coastal Atlantic White Cedar Swamps typically occur at low elevations (< 60 ft. above sea level) in southeastern Massachusetts (Cape Cod and Islands, Plymouth and Bristol Counties), with saturated peat of variable depth over the mineral sediments. As in all Atlantic white cedar swamps, standing water generally occurs for at least half of the growing season. The water and soil are nutrient-poor, and particularly low in nitrogen and phosphorus. There is a high iron content in the soil; the iron (called "bog iron") was mined in the early days of manufacturing. Soil pH is acidic (3.1-5.5) and leaf litter decomposition is slow. Because of the dominance of conifers in the canopy, occurrences may be dark and have limited understory growth. Fallen and tipped trees are common.

Vegetation Description: Atlantic white cedar swamps are defined as having >25% cover of Atlantic white cedar in the canopy; it is usually mixed with red maple (*Acer rubrum*). Occasional associates in Coastal Atlantic White Cedar Swamps include white pine (*Pinus strobus*), hemlock (*Tsuga canadensis*), and occasionally pitch pine (*Pinus rigida*). These swamps can have a very dense shrub layer, including highbush blueberry (*Vaccinium corymbosum*), swamp azalea (*Rhododendron viscosum*), sweet pepper-bush (*Clethra alnifolia*) and fetterbush (*Eubotrys racemosa*). In Cape Cod sites, inkberry (*Ilex glabra*) frequently occurs. The herb layer is sparse and patchy with cinnamon fern (*Osmundastrum cinnamomeum*), Virginia chain fern (*Woodwardia virginica*), starflower (*Lysimachia borealis*), and wild sarsaparilla (*Aralia nudicaulis*). The ground layer is dominated by *Sphagnum* spp. mosses.

Differentiating Occurrences: Although each of the Atlantic white cedar swamp community types has a characteristic vegetation structure and composition, as with all natural communities, transitions and mixes do occur. Coastal Atlantic White Cedar Swamps generally occur below 60 ft. elevation and in southeastern Massachusetts (the Cape and Islands, Plymouth and Bristol Counties). In Coastal Atlantic White Cedar Swamp, pitch pine (*Pinus rigida*) is an occasional canopy associate seldom found in other Atlantic white cedar swamp types. Other species that are found in greater abundance in coastal than elsewhere include greenbrier (*Smilax rotundifolia*), the shrubs inkberry (*Ilex glabra*), dangleberrry (*Gaylussacia frondosa*), sheep laurel (*Kalmia angustifolia*), and fetterbush (*Eubotrys racemosa*), and the ferns Virginia chain-fern and netted chain-fern (*Woodwardia virginica* and *W. areolata*). Inland Atlantic White Cedar Swamps typically occur at elevations > 60 ft. above sea level and not in southeastern Massachusetts. Yellow Birch (*Betula alleghaniensis*) is more common than in Coastal Atlantic White Cedar Swamps. Inland Atlantic White Cedar Swamps have lower abundance of coastal indicators than Coastal Atlantic White Cedar Swamps. High-elevation Inland Atlantic White Cedar Swamps also have northern species, such as creeping snowberry (*Gaultheria hispidula*) and bunchberry (*Chamaepericlymenum canadense*). Atlantic white cedar also occurs in Atlantic White Cedar Bogs, relatively open peatland communities with canopy cover <25%. Alluvial Atlantic White Cedar Swamps are along streams. The vegetation is highly variable. Atlantic white cedar and red maple dominate the tree layer, and highbush blueberry and sweet pepperbush occur in the shrub layer along with silky dogwood (*Swida amomum*). The herb layer includes sensitive fern (*Onoclea sensibilis*), royal fern (*Osmunda regalis*), bugleweed (*Lycopus* spp.) and marsh St. John's-wort (*Hypericum virginicum*). Red Maple Swamps in basins in southeastern Massachusetts are often former Atlantic white cedar swamps that were cut in the past. Many have small patches of Atlantic white cedar; however, Atlantic white cedar needs to be dominant in the overstory for the community to be classified as an Atlantic white cedar swamp. Mapping of relatively large dense patches of Atlantic white cedar as Atlantic white cedar swamp communities may be useful within a Red Maple Swamp to indicate a mosaic of wetland communities.

Associated Fauna: Young Atlantic white cedar thickets provide excellent cover for deer, rabbits and birds. Atlantic white cedar foliage and twigs are preferred winter browse for white-tailed deer, while rabbits and mice can feed on cedar seedlings. Although no bird species appear to be restricted to Atlantic white cedar communities, they provide nesting habitat for many species including Northern Waterthrush (*Parkesia noveboracensis*), Veery (*Catharus fuscescens*), Red-breasted Nuthatch (*Sitta canadensis*), Brown Creeper (*Certhia americana*), Black-and-white Warbler (*Mniotilta varia*), and Black-capped Chickadee (*Poecile atricapillus*). Coastal Atlantic White Cedar Swamps can function as vernal pool habitat if water remains standing for 2-3 months and they lack fish; these areas provide important amphibian breeding habitat.

Public Access: Marconi Atlantic White Cedar Swamp, Cape Cod National Seashore, Wellfleet; Mashpee Pine Barrens WMA, Mashpee; Freetown-Fall River State Forest and

Copicut WMA, Freetown; Great Cedar Swamp (Massachusetts Audubon Society), Lakeville; Hockomock Swamp WMA, Taunton/Bridgewater.

Threats: The two greatest threats to Atlantic white cedar swamps are land clearing for agricultural, commercial and residential development, and interference of normal hydrological functioning as a result of development. Atlantic white cedar has been cut extensively for posts and shingles for over three centuries. In an extensive statewide vegetation inventory funded by MNHESP in 1990, no uncut stands were found, but several sites contained cedars that were 100-200 years old. Selective cutting is detrimental to the persistence of Atlantic white cedar swamps, because hardwoods, such as red maple, outcompete and replace Atlantic white cedar. Any alteration to the natural hydroperiod of Atlantic white cedar swamps threatens their persistence.

Management Needs: Due to the limited distribution of Atlantic white cedar swamps, it is recommended that no clearing or filling of these wetlands be allowed. Atlantic white cedar will regenerate best following catastrophic disturbance events such as hurricanes and fires. Data suggest that in the absence of disturbance, red maple and shrubs increase in abundance at the expense of Atlantic white cedar. Fire suppression negatively threatens the long-term persistence of Atlantic white cedar swamps, and controlled burning practices may be an appropriate restoration tool in many areas. Controlled burning should be accompanied by small-patch clearcuts to be most effective. By clear-cutting small patches (generally 20 m x 20 m) and removing the slash and competing vegetation, pure, even-aged stands of Atlantic white cedar are able to regenerate. Atlantic white cedar swamps require a natural cycle of wet and dry periods for their survival and reproduction. Standing water for much of the year is unfavorable for both seed germination and seedling survival, and young seedlings are killed by both drowning and drought. It is recommended that any alterations in water levels be avoided. This includes development and road construction in uplands surrounding Atlantic white cedar swamps which can alter water levels. Where cedar wetlands are associated with river systems, it is important to maintain normal hydrologic regime of the river.

USNVC/NatureServe: *Chamaecyparis thyoides* Northern Peatland Alliance [A3400] -- *Chamaecyparis thyoides*/*Ilex glabra* - *Rhododendron viscosum* Forest (CEGL006188) -distinguished by coastal plain indicators.

Coastal Plain Pondshore Community

Community Code: CP2A0B1200

State Rank: S3

Concept: Herbaceous communities of exposed pondshores in southeastern Massachusetts that are characterized by a distinct coastal plain flora.

Environmental Setting: Coastal Plain Pondshore Communities are herbaceous communities characterized by a distinct coastal plain flora on exposed pondshores in southeastern Massachusetts. Coastal plain ponds are shallow, highly acidic, low-nutrient, groundwater ponds in sandy glacial outwash, with no inlet or outlet. Water rises and falls with changes in the water table, typically leaving an exposed shoreline in late summer. Annual and inter-annual fluctuations in water levels are key to maintaining the community: low-water years eliminate obligate aquatic plants and allow adapted plants to grow, and high-water years limit invasion by woody species. The community develops best in small ponds or bays of larger ponds with little space for wind sweep that causes wave and ice damage along shorelines on large ponds. The substrates are usually sand, sometimes with cobbles; a surface layer of organic muck occurs on some ponds and pondshores. Many of the plant species of the community are able to start growth from seed, perennial basal leaves, or roots while under water in the spring and grow in the increasingly dry soils as the season progresses; others may germinate only when exposed to air. In wet years, the water level does not recede as far as in dry years, and the constituent species may grow vegetatively while submerged, with little flowering, or may not grow or germinate at all.

Vegetation Description: Coastal Plain Pondshore Communities are composed of a mixture of herbaceous and graminoid plants that include state-rare species that can be locally abundant, growing mixed with more common plants typical of dry grasslands (such as little

bluestem (*Schizachyrium scoparium*)) or marshes (including rushes (*Juncus* spp.), sedges (Cyperaceae species), bonesets (*Eupatorium perfoliatum*), and purple gerardia (*Agalinis purpurea*)). Vegetation zonation is correlated with flooding regime. A characteristic zonation pattern from dry to waterline is as follows: 1. upland oak/pine forest; 2. shrub border dominated by highbush blueberry (*Vaccinium corymbosum*) associated with sweet pepper-bush (*Clethra alnifolia*) and green briar (*Smilax rotundifolia*); 3. an intermediate area of beach providing habitat for most of the species of the Coastal Plain Pondshore Community: an emergent exposed pondshore dominated by slender-leaved flat-topped goldenrod (*Euthamia caroliniana*), pondshore rush (*Juncus pelocarpus*), rose coreopsis (*Coreopsis rosea*), golden pert (*Gratiola aurea*), beaksedges (*Rhynchospora* spp.), lance-leaf violet (*Viola lanceolata*), and dwarf St. John's-wort (*Hypericum mutilum*); 4. semi-permanently flooded zone characterized by one or more of the following: bayonet rush (*Juncus militaris*), spike-rushes (*Eleocharis* spp.), or pipewort (*Eriocaulon aquaticum*); and 5. hydromorphic rooted vegetation in deeper water including yellow water-lily (*Nuphar variegata*), white water-lily (*Nymphaea odorata*), and Robbins' spike-rush (*Eleocharis robbinsii*). Not every pond has every zone, shores within ponds vary, and zones change width and species composition from year to year.

Differentiating Occurrences: Coastal Plain Pondshore Communities are in the coastal plain, generally on sand around ponds in closed basins that intersect groundwater affecting pond levels. The seasonally and annually fluctuating water table typically leaves an exposed shoreline by late summer that supports common and rare, often coastal or southern, herbaceous species. Coastal Plain Pondshore Communities - Inland Variant also occur in closed basins in sandy outwash, but are in the Connecticut River Valley. Some, but fewer, coastal plain species grow in them. Acidic Pondshore/Lakeshore Community is broadly defined, variable, and includes shorelines not explicitly included in coastal plain pondshores, the inland variant, or calcareous ponds. The shoreline is often not distinct, merging into marsh or other wetlands. Many ponds have inflow or outflows. Calcareous Pondshores /Lakeshores occur in the Marble Valleys of Berkshire County, around ponds that have calcium in the water. Freshwater Mud Flat Communities are within ponds rather than along shores. Mud flats in Coastal Plain Ponds are treated as part of the pondshore community.

Associated Fauna: Coastal plain pondshores and ponds provide habitat for a number of state-rare animal and plant species, many of which occur only on coastal plain ponds. Coastal plain pondshores are important habitat for dragonflies and damselflies (over 45 species are known to occur on coastal plain ponds and several of those species are rare). They are also important turtle habitat, for painted, musk, spotted, and snapping turtles, and the federally endangered Northern red-bellied cooters. Larger ponds and pondshores are used by migrating and wintering waterfowl, including common and hooded mergansers, goldeneye, and bufflehead. Coastal plain ponds support warm-water fish and freshwater mussels. They can function as vernal pool habitat when fish populations are absent.

Public Access: Myles Standish State Forest, Carver; Hyannis Ponds WMA, Barnstable; Nickerson State Park, Brewster.

Threats: Multiple threats affect coastal plain pondshore communities. The greatest threat is from overdevelopment of coastal Massachusetts which impacts pondshores directly through housing and recreation and indirectly through water withdrawal. Shrub and tree encroachment threaten pondshore vegetation in areas with heavy water withdrawal and lessened inundation of the upper shore.

Management Needs: Natural hydrology needs to be maintained. Periodic high water prevents tree and shrub encroachment, and seasonal low water is necessary to expose the pondshore. Vehicle use should be prohibited along pondshores.

USNVC/NatureServe: The following USNVC/NatureServe associations are known to occur in Massachusetts, and are included within the broad category of coastal plain pondshore community. They are listed according to the zones in which they occur (as described above). Shrub border (zone 2) includes *Vaccinium corymbosum*/*Sphagnum* spp. shrubland [CEGL006190] and a typically narrow band of *Calamagrostis canadensis-Dichanthelium meridionale* herbaceous vegetation [CEGL006243]. The emergent exposed pondshore (zone 3) is characterized by one or more of the following: *Rhexia virginica-Panicum verrucosum* herbaceous vegetation [CEGL006264]; *Rhexia virginica-Crotalaria sagittalis* herbaceous vegetation [CEGL006300]; and *Rhynchospora capitellata-Sabatia kennedyana* herbaceous vegetation [CEGL006210]. The semipermanently flooded zone (zone 4) has *Lysimachia terrestris-Dulichium arundinaceum* herbaceous vegetation [CEGL006035]; *Juncus militaris* herbaceous vegetation [CEGL006345]; *Eleocharis* (*obtusa*, *flavescens*)*-Eriocaulon aquaticum* herbaceous vegetation [CEGL006261]; and *Eleocharis flavescens-Xyris difformis* herbaceous vegetation [CEGL006400]. Open water (zone 5) is common to other ponds in MA and includes *Nuphar lutea* ssp. *advena* herbaceous vegetation [CEGL004324] and *Nymphaea odorata-Eleocharis robbinsii* herbaceous vegetation [CEGL006086].

Coastal Plain Pondshore – Inland Variant

Community Code: CP2A0B120A

State Rank: S1

Concept: The community has apparent vegetation zones of graminoids or herbaceous species on sloping, seasonally exposed, gravelly, sandy or muddy shores of acidic, inland lakes and ponds with substantial natural fluctuation of water levels.

Environmental Setting: Coastal Plain Pondshore Community - Inland variant is very similar to the Coastal Plain Pondshore Community: both are subsets of Acidic Pondshores/Lakeshores. Coastal Plain Pondshore Community - Inland Variant develops in groundwater-flooded depressions in outwash sand plains outside of southeastern Massachusetts. The shorelines of Coastal Plain Pondshore Communities - Inland Variant are seasonally exposed, but submerged or saturated for a significant part of the year or continuously in wet years. Natural fluctuation of water levels throughout any particular year and between years is necessary for the community to develop: plants of the community emerge during low-water periods and high-water years limit invasion by woody species. Shorelines range from broad expanses of mucky shores on very shallow, muddy ponds with shrub islands, to narrow sandy shores on ponds in steep depressions, and large sand-bottomed ponds where shoreline substrate ranges from sand to deep muck. Essentially all of the Coastal Plain Pondshore Communities - Inland Variant have been impacted by recreation and development.

Vegetation Description: The vegetation of Coastal Plain Pondshore Communities - Inland Variant may be sparse or dense, with variable species composition. Exposed pondshores may be narrow bands or cover much or all of a basin. The community is usually a mix of graminoid and herbaceous vegetation in zones created when habitat is made accessible as water levels go down throughout the growing season. A characteristic

zonation pattern from dry to waterline is: 1. shrub border dominated by highbush blueberry (*Vaccinium corymbosum*) associated with red maple (*Acer rubrum*), often grading into water-willow (*Decodon verticillatus*); 2. zone of exposed sandy pondshore with mostly annual species such as flatsedges (*Cyperus* spp.), rushes (*Juncus* spp.), smartweeds (*Polygonum* and *Persicaria* spp.), false pimpernel (*Lindernia dubia*), and St. John's-worts (Hypericum and *Triadenum* spp.); 3. semipermanently flooded zone with low herbaceous and emergent species on organic sediments characterized by spike-rushes (*Eleocharis* spp.), pipewort (*Eriocaulon aquaticum*), beak-rushes/ horned-sedges (*Rhynchospora* spp.), golden pert (*Gratiola aurea*), seedboxes or water purslane (*Ludwigia* spp.), or false pimpernel (*Lindernia dubia*), or stranded aquatic plants; 4. open, deeper water zone with rooted aquatic vegetation including yellow (*Nuphar variegata*) and white water-lilies (*Nymphaea odorata*). Not every pond has every zone, and zones vary in width and species composition from year to year.

Differentiating Occurrences: Coastal Plain Pondshore Communities are in the coastal plain, generally on sand around ponds in closed basins that intersect groundwater that affects pond levels. The seasonally and annually fluctuating water table typically leaves an exposed shoreline by late summer that supports herbaceous species. Coastal Plain Pondshores - Inland Variant also occur in closed basins in sandy outwash, but are in the Connecticut River Valley. Some, but fewer, coastal plain species grow in them. Acidic Pondshore/Lakeshore Community is broadly defined, variable, and includes shorelines not explicitly included in coastal plain pondshores, the inland variant, or calcareous ponds. The shoreline may merge into marsh or other wetlands. Many ponds have inflow or outflows. Kettlehole Wet Meadows are also seasonally inundated, but develop into dense graminoid marshes on mucky peat. Freshwater Mud Flat Communities are within ponds rather than along shores. Mud flats in Coastal Plain Pondshore Communities - Inland Variant are treated as part of the pondshore community.

Associated Fauna: Coastal Plain Pondshore Communities - Inland Variant and ponds are parts of the habitat of wide-ranging animals, including dragonflies and damselflies. Shorelines, particularly larger muddy areas, are used for foraging by shorebirds. Larger ponds and pondshores are used by migrating and wintering waterfowl.

Public Access: Five Mile Pond, Loon Pond, and Lake Lorraine, Springfield; Spectacle Pond, Wilbraham.

Threats: Trampling from walking and ORVs, alteration of normal water-level fluctuations, and shoreline development. Exotic plants including purple loosestrife.

Management Needs: Protection of areas near beaches from clearing, filling, and trampling. Control of invasives.

USNVC/NatureServe: CES203.518 Northern Atlantic Coastal Plain Pond - system.

Cobble Bar Forest

Community Code: CP1A2B5000

State Rank: S2

Concept: A variant of high-energy riverbanks, characterized by open forests dominated by sycamores and cottonwoods growing on sandy cobble bars.

Environmental Setting: Cobble Bar Forests occur on coarse alluvial substrate (cobble, gravel, and sand deposited by rivers) on flood- and ice-scoured river shores and islands, in relatively low-gradient sections of high-energy rivers where the bank is low. These forests are often young or successional, with fairly open canopies. Older, possibly more stabilized, community occurrences accumulate silt and other relatively fine sediments that bury the coarse materials and the bases of trees. These deeper sediments raise the shoreline, which changes the flood and scour regimes. The result is that protected areas of Cobble Bar Forest succeed to other types of floodplain forest, at least until flooding scours the shoreline in the natural course of river meandering.

Vegetation Description: All floodplain forest communities in Massachusetts have silver maple in the canopy, but associated plant species vary depending on the intensity and duration of flooding and on geographic location. In Cobble Bar Forests, sycamore (*Platanus occidentalis*) and cottonwood (*Populus deltoides*) may be more abundant than silver maple (*Acer saccharinum*) in the canopy. Slightly inland from the disturbed river edge, green ash (*Fraxinus pennsylvanica*) and American elm (*Ulmus americana*) often occur. The shrub layer, usually with scattered plants, may be dominated by dense cover of invasive species such as common privet (*Ligustrum vulgare*), Japanese knotweed (*Fallopia japonica*), Japanese barberry (*Berberis thunbergii*), multiflora rose (*Rosa multiflora*), and bush honeysuckle (*Lonicera* spp.). The herbaceous layer is diverse, with plants growing between cobbles and patches of

sand. The typically sparse herbaceous layer includes native and exotic disturbance-adapted species and annuals as well as perennials: sedges (*Carex* spp.), deer-tongue grass (*Dichanthelium clandestinum*), sensitive fern (*Onoclea sensibilis*), horsetail (*Equisetum* spp.), and false Solomon's seal (*Maianthemum racemosum*). Vines can be dense particularly at open edges where grapes (*Vitis* spp.), Oriental bittersweet (*Celastrus orbiculatus*), Virginia creeper (*Parthenocissus quinquefolia*), and poison ivy (*Toxicodendron radicans*) can cover tree and shrub foliage and tie them into impenetrable masses.

Differentiating Occurrences: Cobble Bar Forests are limited to cobble and other coarse substrates along high-energy rivers where little deposition of finer materials occurs and flooding and ice flows scour the surface. These narrow bands of forest are close to the river edge where flood waters recede quickly after the flood events, not behind berms that retain flood waters. Other floodplain communities, including High-Terrace, Major-river, Transitional, and Small-river Floodplain Forests, generally occur on silt and mixed mineral and organic soil substrates. Major-river, Transitional, and Small-river Floodplain Forests are behind low berms that slow flood waters and detain them causing alluvial silt deposition. Cobble Bar Forests are the only floodplain forests with abundant sycamore (*Platanus occidentalis*), although other floodplain forest species, particularly cottonwood (*Populus deltoides*) and silver maple (*Acer saccharinum*), are present as associates. High-Energy Riverbank Communities also occur within the zone of active erosion on cobble and sand substrates along steep-gradient, fast-flowing rivers, but have sparse, open low vegetation with no trees.

Associated Fauna: Provide habitat for riverine odonates.

Public Access: Robinson State Park, Agawam; Westfield River Access, Westfield.

Threats: This is a high-disturbance habitat and non-native taxa are abundant.

Management Needs: Maintenance of normal flooding intensity is needed to maintain community.

USNVC/NatureServe: Close to: *Platanus occidentalis* - (*Fraxinus pennsylvanica*, *Celtis laevigata*, *Acer saccharinum*) Temporarily Flooded Forest Alliance: *Platanus occidentalis* - *Fraxinus pennsylvanica* Forest (CEGL006036).

Deep Emergent Marsh

Community Code: CP2A0A1200

State Rank: S4

Concept: Tall graminoid/emergent herbaceous wetlands occurring on saturated, mucky mineral soils that are seasonally inundated and permanently saturated.

Environmental Setting: Deep Emergent Marshes occur along rivers and streams, lakes, artificial impoundments, and other waterbodies. Deep Emergent Marshes are generally flooded with half a foot to 3 feet of water year round, though water depth may vary not only during the growing season, but from year to year. Vegetation is primarily herbaceous and graminoid; species type and abundance vary with water depth. There may be areas of open water with little or no vegetation, except for aquatic plants. Deep Emergent Marshes often occur as patches in intergrading complexes of forested and shrub swamps and open water. The soils are a mixture of organic and mineral components, typically with a layer of well-decomposed organic muck at the surface overlying mineral soil. The movement of ice following thaws can disturb vegetation within marshes, particularly adjacent to open water. Depending on the amount of open water, wave action due to wind or boating may affect vegetation and sediment deposits.

Vegetation Description: Tall graminoids, like broad-leaved cattail (*Typha latifolia*) and phragmites (*Phragmites australis*), often form extensive dense stands. Narrow-leaved cattail (*Typha angustifolia*) occurs in more alkaline sites or in saline areas along roads. Other characteristic graminoids include wool-grass (*Scirpus cyperinus*), common threesquare (*Schoenoplectus pungens*), Canada bluejoint (*Calamagrostis canadensis* var. *canadensis*), reed canary-grass (*Phalaris arundinacea*), rice cut-grass (*Leersia oryzoides*), and tussock-sedge (*Carex stricta*). Herbaceous associates include arrow-leaf tearthumb (*Persicaria sagittata*), bulblet water-hemlock (*Cicuta*

bulbifera), swamp-candles (*Lysimachia terrestris*), beggar-ticks (*Bidens* spp.), bedstraw (*Galium* spp.), common arrowhead (*Sagittaria latifolia* var. *latifolia*), slender-leaved goldenrod (*Euthamia caroliniana*), and marsh-fern (*Thelypteris palustris* var. *pubescens*). Nutrient-rich sites in Berkshire County typically have cattails mixed with soft-stemmed bulrush (*Schoenoplectus tabernaemontani*), hard-stemmed bulrush (*S. acutus*), river-horsetail (*Equisetum fluviatile*), marsh-cinquefoil (*Comarum palustre*), sweet-flag (*Acorus calamus*), bristly sedge (*Carex comosa*), lakeside sedge (*C. lacustris*), and giant bur-reed (*Sparganium eurycarpum*), among others. Short shrubs including sweet-gale (*Myrica gale*), meadowsweet (*Spiraea alba* var. *latifolia*), and hardhack (*S. tomentosa*) may be scattered among tall graminoids. Tall shrubs such as speckled and smooth alders (*Alnus incana* and *A. serrulata*), and highbush blueberry (*Vaccinium corymbosum*) are generally sparse, totaling <25% cover. Invasive species include purple loosestrife (*Lythrum salicaria*) and common reed (*Phragmites australis*).

Differentiating Occurrences: The physical and biological characteristics of emergent marsh, wet meadow, shrub swamp, and shoreline communities overlap and intergrade. The vegetation for all these types is broadly defined and understudied: focused surveys might establish which dominant species and hydrological situations define identifiable community types, or might determine that there is a continuum of types that require arbitrary separation. Deep Emergent Marshes are tall graminoid wetlands often dominated by cattails, phragmites, and wool-grass growing in water from a half foot to 3 ft. deep. Shallow Emergent Marshes are short graminoid/herbaceous wetlands and usually have shallow (averaging <6" deep) surface water all year. Shallow Emergent Marsh vegetation composition is similar to Deep Emergent Marsh, except that shorter grasses, sedges and rushes dominate. Shrub Swamps have >25% cover of shrubs. Wet Meadows are graminoid wetland subtypes of emergent marshes, typically with a single sedge or grass species dominating. Standing water is not present throughout the growing season as in emergent marshes. Kettlehole Wet Meadows occur in small basins on mucky peat. Coastal Plain Pondshore Communities and Coastal Plain Pondshore Communities - Inland Variant are generally on sand in closed basins that intersect groundwater. The exposed shoreline supports herbaceous species not generally dominated by dense graminoids. Acidic Pondshores/Lakeshores are broadly defined, variable shorelines around open water, not explicitly included in calcareous or coastal plain pondshores. The shoreline is often not distinct, merging into emergent marsh or other wetlands. Bogs and fens are peatlands, with peat instead of mucky mineral soil; however, gradations do exist.

Associated Fauna: Deep Emergent Marsh is the primary nesting habitat for a suite of secretive marshbirds (rails, bitterns, grebes, and moorhens). This habitat also provides important nesting habitat for other birds of high conservation interest, such as Marsh Wren, Northern Harrier, and a variety of ducks. Deep Emergent Marsh habitat supports many species of frogs and salamanders, especially leopard, pickerel, green, and bull frogs, and some vernal-pool obligate species, such as wood

frogs and spotted salamanders, may use areas of Deep Emergent Marsh for egg-laying if the areas are fish free.

Public Access: Hop Brook WMA, Tyringham; Quaboag River WMA, East Brookfield/Brookfield/ West Brookfield; Pantry Brook WMA, Sudbury.

Threats: Deep Emergent Marshes are threatened by filling and dredging, impoundments that alter natural water-level fluctuations, and by nutrient inputs from adjacent roads, fields, or septic systems. Invasive species are a significant threat. Reed canary-grass (*Phalaris arundinacea*) can collect sediments that alter water depths and reduce habitat variability. Common reed (*Phragmites australis*) can also form monocultural stands that out-compete native species. Purple loosestrife (*Lythrum salicaria*) has a similar range of water depth requirements as cattails, and will gradually invade and become abundant in such systems.

Management Needs: Control of exotics. Maintain normal water level and fluctuation.

USNVC/NatureServe: G125. Eastern North American Freshwater Marsh: A1436 *Typha angustifolia - Typha latifolia - Schoenoplectus* spp. Deep Marsh Herbaceous Alliance - *Typha* (*angustifolia*, *latifolia*) - (*Schoenoplectus* spp.) Eastern Herbaceous Vegetation [CEEGL006153]; A3664 *Schoenoplectus acutus - Schoenoplectus fluviatilis - Schoenoplectus tabernaemontani* Deep Marsh Herbaceous Alliance - *Schoenoplectus* (*tabernaemontani*, *acutus*) Eastern Herbaceous Vegetation [CEGL006275]; *Schoenoplectus fluviatilis* Herbaceous Vegetation [CEGL006366]; Calcareous *Schoenoplectus acutus - Carex lasiocarpa* Herbaceous Vegetation [CEGL006358]; A3669 *Peltandra virginica - Pontederia cordata - Sagittaria* spp. Herbaceous Alliance - CEGL006191 *Pontederia cordata - Peltandra virginica - Sagittaria latifolia* Herbaceous Vegetation. G556. Northern and Central Ruderal Wet Meadow and Marsh - A1431 *Phragmites australis* ssp. *australis* Ruderal Herbaceous Alliance - *Phragmites australis* Eastern North America Temperate Ruderal Herbaceous Vegetation [CEGL004141]; A1381 *Phalaris arundinacea* Herbaceous Alliance ALSO Shallow Emergent Marsh - *Phalaris arundinacea* Eastern Herbaceous Vegetation [CEGL006044].

Freshwater Mud Flat Community

Community Code: CP2A0B2100

State Rank: S4

Concept: Sparsely vegetated herbaceous community dominated by low, usually annual, herbs, developing on recently exposed muddy pond or river-bottom sediments.

Environmental Setting: Freshwater Mud Flat Communities develop over the summer as water levels go down and sediments are exposed in low-gradient stream channels, backwaters, abandoned channels, beaver ponds, oxbow ponds, and other ponds that are usually flooded during winters or other times of high water. The mucky, silty mineral soils are poorly drained and may remain saturated even when the surface is exposed. Succession to other communities occurs at all sites, notably in abandoned beaver ponds, when flooding is removed.

Vegetation Description: Often sparsely vegetated, mudflat vegetation is typically dominated by annuals or herbaceous perennials such as water-purslane (*Ludwigia palustris*), smartweeds (*Persicaria* spp.), rice cut-grass (*Leersia oryzoides*), swamp-candles (*Lysimachia terrestris*), ditch-stonecrop (*Penthorum sedoides*), or little spike-rush (*Eleocharis acicularis*). Mudflat spike-rush (*Eleocharis intermedia*) is restricted to calcareous or circumneutral mudflats. In oxbows, trees such as silver maple (*Acer saccharinum*) or American elm (*Ulmus americana*) may overhang these communities providing partial cover. In ponded situations, mud flat communities may include floating and emergent aquatic plants, such as yellow water-lily (*Nuphar variegata*), duckweeds (*Lemna* spp.), and bladderworts (*Utricularia* spp.), stranded when the water receded.

Differentiating Occurrences: Freshwater Mud Flat Communities have low, sparse, annual herbaceous vegetation on recently exposed muddy (fine mixed organic and mineral materials) sediments in

rivers and ponds, where they may include stranded aquatic vegetation. They are closely related to Low-energy Riverbank Communities, which are on slopes of river banks composed of a mix of relatively fine mineral materials (clay, silt, or sand). The stream bottoms of Low-energy Riverbanks can merge into Freshwater Mud Flats; separation depends on patch size and connectedness. High-energy Riverbank Communities occur along the shores of fast-flowing, high energy rivers with sparse plants growing in sediment caught between rock cobbles. Riverine Pointbar and Beach Communities are along higher energy rivers on sand or gravel. Deep and Shallow Emergent Marshes have dense graminoid emergent plants on mucky sediments, often with standing water at the base of the plants. In tidal areas, mud flats are considered to be parts of adjacent Fresh/Brackish Tidal Marshes. Mud flats in coastal plain ponds are treated as parts of the Coastal Plain Pondshore Community. Mud flats that emerge from human-mediated water lowering in lakes or rivers, including for dam repair or removal, or for nuisance plant control, are usually temporary and would develop River and Lake Drawdown Communities that might be extensions of naturally occurring mud flat communities.

Associated Fauna: Shorebirds, such as Spotted Sandpiper (*Actitis macularius*) and Solitary Sandpiper (*Tringa solitaria*), forage on mud flats throughout their breeding season and those and additional shorebirds such as Greater Yellowlegs (*Tringa melanoleuca*) stop at mud flats during migration.

Public Access: Hop Brook WMA, Lee.

Threats: True forget-me-not (*Myosotis scorpioides*) and moneywort (*Lysimachia nummularia*) are mat-forming, non-native plant species that can appear to be crowding out native plants. Purple loosestrife (*Lythrum salicaria*) can also occur in these habitats.

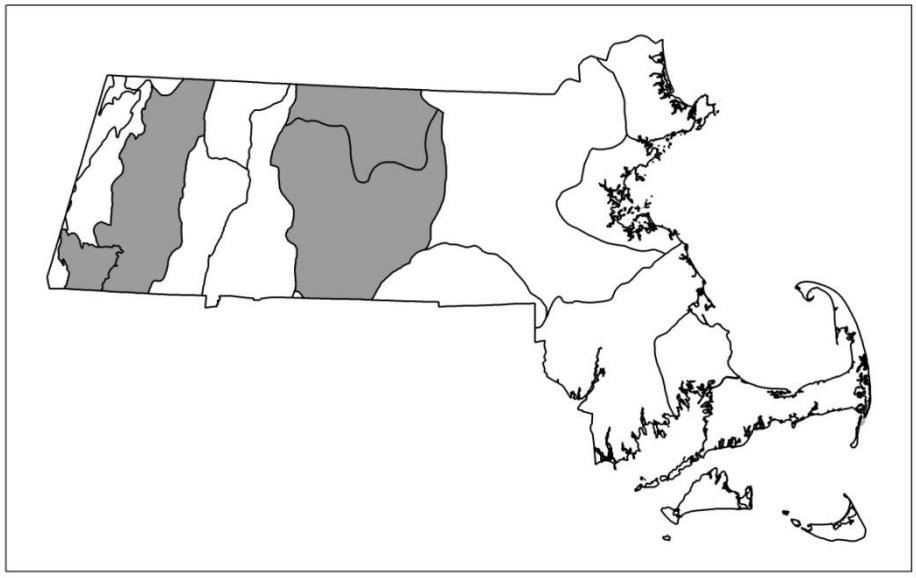
Management Needs: Exotic control where practical.

USNVC/NatureServe: River Mudflats Sparse Vegetation [CEGL002314]; Lake Mudflats Sparse Vegetation [CEGL002313].

Hemlock Swamp

Community Code: CP1A12A000

State Rank: S4



Concept: Acidic forested swamps where eastern hemlock is dominant or co-dominant in the canopy.

Environmental Setting: Hemlock Swamps are characterized by a dense tree canopy dominated by mature eastern hemlock, allowing little light to reach the forest floor. Due to the nearly closed and mostly coniferous canopy, the understory is usually low in overall plant diversity, with patches of ferns and extensive areas of sphagnum mosses. Hemlock Swamps tend to occur in large or long depressions and often contain standing water and small intermittent streams; there is a hummock-hollow topography with trees growing on the hummocks. The hollows have wetter, organic peaty soils and are saturated throughout the year.

Vegetation Description: Eastern hemlock (*Tsuga canadensis*) is the dominant tree species in Hemlock Swamps. Hemlock forms stands with dense canopies alone or mixed with lower amounts of white pine (*Pinus strobus*), red maple (*Acer rubrum*), or yellow birch (*Betula alleghaniensis*). The hemlock-dominated canopy allows little light through to support plants in lower strata, resulting in a patchy subcanopy that is usually comprised of the overstory species growing in occasional canopy gaps created by windthrows. The poorly developed shrub layer has sparse and patchy cover with hemlock most characteristic: the saplings may persist in the understory for many decades, to be released to grow into maturity when canopy gaps occur. Typical shrubs include winterberry (*Ilex verticillata*), mountain laurel (*Kalmia latifolia*), highbush blueberry (*Vaccinium corymbosum*), currents (*Ribes* spp.), mountain holly (*Nemopanthus mucronatus*), alders (*Alnus* spp.), witch hazel (*Hamamelis virginiana*), and maleberry (*Lyonia ligustrina*). Ferns are common, especially

cinnamon fern (*Osmundastrum cinnamomeum*), along with goldthread (*Coptis trifolia*), partridgeberry (*Mitchella repens*), and wild sarsaparilla (*Aralia nudicaulis*). The hummocky ground layer is covered with sphagnum moss and the liverwort *Bazzania trilobata*; the moss *Thuidium delicatulum* is often present.

Differentiating Occurrences: Many swamps have eastern hemlock (*Tsuga canadensis*) as a component of the canopy, but Hemlock Swamps are differentiated by having eastern hemlock as the dominant canopy species throughout the community. Red Maple Swamps and named variants such as Red Maple-Black Gum Swamps often have pockets of hemlock or scattered hemlocks, but overall those community types are dominated by deciduous trees, particularly red maple, and hemlocks are present in low overall percentages as part of the normal variation within the community. Red Maple Swamps have more species diversity in all the layers, as well as denser shrubs and herbaceous layers, than do Hemlock Swamps. In northern and western portions of the state at higher elevations, Hemlock Swamps grade into Red Spruce Swamps, differentiated by the dominance of red spruce and the addition of species typical of colder or northern areas. In the western portion of the state in areas with calcium-enriched seepage waters, Hemlock Swamps grade into Rich Conifer Swamps which are characterized by less abundance of hemlock and a much more diverse floral assemblage, including elm (*Ulmus* sp.), spicebush (*Lindera benzoin*), poison ivy and poison sumac (*Toxicodendron radicans* and *vernix*), marsh marigold (*Caltha palustris*), spotted touch-me-not (*Impatiens capensis*), jack-in-the-pulpit (*Arisaema triphyllum*), Pennsylvania bittercress (*Cardamine pensylvanica*), water avens (*Geum rivale*), wood-sorrel (*Oxalis montana*), green wood orchid (*Platanthera clavellata*), blue marsh violet (*Viola cucullata*), and hemlock parsley (*Conioselinum chinense*).In the southeast part of the state, hemlock mixes with Atlantic white cedar (*Chamaecyparis calyculata*) and other species typical of the coastal plain or more southern areas, grading into Atlantic white cedar swamps, with type determined by the overall dominant tree species.

Associated Fauna: Hemlock Swamps are part of habitat of large mobile animals. Ground-level browsers, including white-tailed deer (*Odocoileus virginianus*), snowshoe hare (*Lepus americanus*), and New England cottontail (*Sylvilagus transitionalis*), use shrubby areas in the community. Conifer swamps tend to have dense shade and are relatively cool in the summer, making them preferred areas for moose (*Alces alces*), animals that get too hot and have trouble controlling their body temperature. Birds that nest or forage in canopies or mid-sections of conifers don't differentiate on whether the site is wet or not: many birds of upland conifer forest also use Hemlock Swamps. Areas of Hemlock Swamps where water remains standing for 2-3 months and that lack fish can function as vernal pool habitat for amphibian breeding.

Public Access: Three Mile Pond WMA, Sheffield; Appalachian Trail Corridor, Tyringham; Otis State Forest, Otis; Ware River Watershed, Rutland; Wolf Swamp WMA, Brookfield.

Threats: Invasive exotic insect pests (e.g., hemlock woolly adelgid (*Adelges tsugae*) and elongate hemlock scale (*Fiorinia externa*)); altered hydrology.

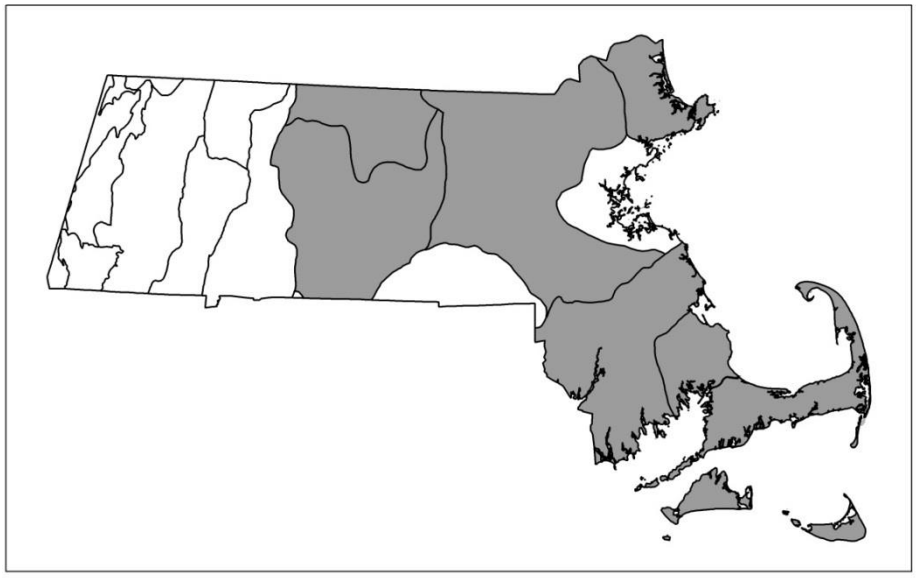
Management Needs: More information is needed to assess the management needs for Hemlock Swamps. The use of undisturbed natural buffers around the best occurrences of the community reduces the potential for impacts from changes in the surrounding environment.

USNVC/NatureServe: *Tsuga canadensis* Saturated Forest Alliance - *Tsuga canadensis Betula alleghaniensis*/*Ilex verticillata*/*Sphagnum* spp. Forest [CEGL006226].

Highbush Blueberry Thicket

Community Code: CP2B0C2000

State Rank: S4



Concept: Acidic peatlands dominated by dense highbush blueberry bushes on hummocky sphagnum moss.

Environmental Setting: Highbush Blueberry Thickets occur as a border thicket around more open peatlands or coastal plain ponds, and within small basins or seasonally flooded zones in larger wetlands. This community is influenced by a strongly fluctuating water table with flooded conditions in spring and early summer, followed by a drop in the water table below soil surface usually by late summer. The sphagnum mat is variable: it can be thick and stable on peat, or as a shallow organic layer often over sand, or there may be moss on hummocks at the base of shrub stems, with unstable muck in the surrounding hollows.

Vegetation Description: Highbush Blueberry Thickets are tall-shrub peatlands dominated by dense highbush blueberries (*Vaccinium corymbosum*) with swamp azalea (*Rhododendron viscosum*), winterberry (*Ilex verticillata*), sweet pepper-bush (*Clethra alnifolia*), and scattered red maple (*Acer rubrum*) as common associates. Typical short shrubs include leatherleaf (*Chamaedaphne calyculata*), sheep laurel (*Kalmia angustifolia*), and dwarf huckleberry (*Gaylussacia bigeloviana*). The variable herbaceous layer tends to be sparse, but can be locally abundant. Ferns can be the most common herbs present, including cinnamon fern (*Osmundastrum cinnamomeum*), royal fern (*Osmunda regalis*), marsh fern (*Thelypteris palustris*), sensitive fern (*Onoclea sensibilis*), and Virginia chain-fern (*Woodwardia virginica*), along with pitcher plants (*Sarracenia purpurea*) or other herbs of fens including marsh St. John's-wort (*Triadenum virginicum*), three-leaved Solomon's seal (*Maianthemum trifolium*), wild calla (*Calla palustris*), northern water-horehound (*Lycopus uniflorus*), and threeway

sedge (*Dulichium arundinaceum*). A layer of peatmoss is common and varies in cover.

Differentiating Occurrences: The physical and biological characteristics of Highbush Blueberry Thickets, Acidic Shrub Fen, Shrub Swamp, and Fresh/ Brackish Tidal Shrubland overlap and intergrade. They all lack tree cover (<25% canopy cover); they are all dominated by dense shrubs on wet substrates. Highbush Blueberry Thickets are tall-shrub fens, dominated by highbush blueberries or other members of the blueberry family, on peat or at least have sphagnum at the base of the shrubs. Acidic Shrub Fens are dominated by low-growing shrubs, along with sphagnum moss and herbaceous species of varying abundance on wet, often weak, peat. Shrub Swamps lack peat, are often quite diverse, and are not dominated by blueberries or other ericaceous plants. Fresh/Brackish Tidal Shrubland are dense to open shrublands along tidal sections of coastal rivers.

Associated Fauna: Moats of wet, ponded areas associated with highbush blueberry thickets provide important amphibian breeding habitat and function as vernal pools if they have two to three months of ponding and lack fish.

Public Access: Punkhorn Parklands (town-owned), Brewster; Briar Swamp - Dogtown Commons (town-owned), Rockport; Quaboag WMA, East Brookfield.

Threats: Hydrologic alterations and nutrient enrichment from road and lawn runoff may impact this community. More information is needed.

Management Needs:

USNVC/NatureServe: A1018 *Vaccinium corymbosum* Peat Thicket Alliance - *Vaccinium corymbosum*/*Sphagnum* spp. Shrubland [CEGL006190]; *Vaccinium corymbosum* - *Rhododendron viscosum* - *Clethra alnifolia* Shrubland [CEGL006371].

High-energy Riverbank Community

Community Code: CP2A0B2400

State Rank: S3

Concept: Sparse, open, herbaceous/graminoid communities occurring on cobble and sand substrates of steep-gradient, fast-flowing rivers that experience severe flooding and ice scour.

Environmental Setting: High-energy Riverbank Communities occur within the zone of active erosion and sedimentation of steep-gradient, fast-flowing rivers, and are shaped by continued annual flood events and winter ice scour. They are characterized by cobble and sand substrates and sparse, open vegetation. High-energy Riverbank Communities occur as both narrow rocky zones along riverbanks and as large areas on the exposed, upstream ends of riverine islands. They are broadly defined communities with variation in structure and dominant species, occurring both among rivers and among sites within rivers. Differences in severity of scouring and flooding create a gradient of substrate types from the river's edge to the upland transition that can correlate to changes in vegetation.

Vegetation Description: Vegetation zonation within High-energy Riverbank communities corresponds to substrate type and severity of flooding. On open cobbles, a usually sparse mix of native and non-native species dominates: false dragonhead (*Physostegia virginiana*), cocklebur (*Xanthium strumarium*), beggar's-ticks (*Bidens* spp.), and lady's thumb (*Persicaria maculosa*) are dominant, growing with colt's-foot (*Tussilago farfara*), wild heal-all (*Prunella vulgaris*), and scattered riverside-sedge (*Carex torta*). Along the Connecticut River, there is typically a distinct band of switchgrass (*Panicum virgatum*) with mixed grasslands of switchgrass, big and little bluestem (*Andropogon gerardii* and *Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), and goldenrods (*Solidago* sp.) in the sandier areas with

dense patches of sandbar willow (*Salix exigua* ssp. *interior*) and sandbar cherry (*Prunus pumila* var. *depressa*). Intense flooding and ice scour prevent establishment and growth of trees or tall shrubs. Short shrubs such as shadbush (*Amelanchier spp.*), silky dogwood (*Swida amomum*), willows (*Salix sericea* and *S. lucida* ssp. *lucida*), and sapling sycamores (*Platanus occidentalis*) form a vegetation zone on the sandiest sections, typically bordering floodplain forests that occupy siltier soils.

Differentiating Occurrences: On river islands, the presence of zones of switch grass (*Panicum virgatum*), big bluestem (*Andropogon gerardii*), and Indian grass (*Sorghastrum nutans*), along with sandbar willow (*Salix exigua* ssp. *interior*) and/or sandbar cherry (*Prunus pumila* var. *depressa*) are indicative of High-energy Riverbank Communities. Along rivers, High-energy Riverbank Communities have, on average, sparser vegetation and more and drier, barer ground than do High-energy Rivershore Meadows or Riverside Seeps. As the percentages of sand, silt, and moisture increase, hemp dogbane (*Apocynum cannabinum*), riverside-sedge (*Carex torta*), Canadian burnet (*Sanguisorba canadensis*), and water horsetail (*Equisetum fluviatile*), as a group characteristic of High-energy Rivershore Meadows, become denser and dominant. Riverside Seep Communities occur at the base of steep riverbanks where mineral-enriched groundwater seeps out of the bottom of the upland slope; they are wetter than associated High-energy Rivershore Meadows and High-energy Riverbank Communities. Muskflower (*Mimulus moschatus*), Canadian burnet (*Sanguisorba canadensis*), and golden alexanders (*Zizia aurea*) as a group are good indicator species of Riverside Seeps. Low-energy Riverbank Communities are open herbaceous/graminoid communities occurring on sandy or silty mineral soils of river and stream banks, which do not experience severe flooding or ice scour. The vegetation is often dominated by reed canary-grass (*Phalaris arundinacea*), Canada bluejoint grass (*Calamagrostis canadensis*), or other dense grasses, with some of the same species typical of disturbed areas as High-energy Riverbanks. Cobble bars that have a tree canopy (cover >30%) are classified separately as Cobble Bar Forests.

Associated Fauna: High-energy Riverbank Communities are very open. They provide habitat for migrating shorebirds, including Solitary and Spotted Sandpipers, and for other birds of open habitats such as Killdeer. Dragonfly and tiger beetle larvae live in burrows in sand between cobbles and boulders; adult tiger beetles forage on sand above the high-water mark.

Public Access: Gilbert A. Bliss State Forest/Chesterfield Gorge Reservation (The Trustees of Reservations), Chesterfield; Tolland State Forest, Otis/Sandisfield/Tolland; Sunderland Islands WMA, Deerfield/Sunderland; Green River WMA, Colrain/Leyden; Mohawk Trail State Forest, Charlemont/Florida/Hawley/Savoy.

Threats: The two major threats to high-energy river communities are alteration of natural flooding regimes due to river control projects, and the invasion of non-native plant species. High-energy riverbank environments are created by severe flooding and ice scour, and these natural disturbance regimes are necessary to maintain the community. Because of the community's exposure to flooding, it is susceptible to

colonization by exotic plants, such as Japanese knotweed (*Fallopia japonica*), purple loosestrife (*Lythrum salicaria*), colt's-foot (*Tussilago farfara*), and lady's thumb (*Persicaria maculosa*) that have their seeds washed in from upstream sources. Trampling from campers and boaters creates further disturbance and favors fast-growing exotic plants.

Management Needs: Where possible, highly invasive exotic plants should be mechanically removed. Management to reduce non-native plant species throughout a drainage basin will help preserve the native plant communities of high-energy riverbanks. Natural hydrologic regimes should be maintained.

USNVC/NatureServe: CEGL006536 *Carex torta - Apocynum cannabinum - Cyperus* spp. herbaceous vegetation (Northeastern Temperate Cobble Scour Rivershore).

High-energy Rivershore Meadow

Community Code: CP2A0B2410

State Rank: S2

Concept: Variably sized and occurring in about 10m-wide bands along medium to high-energy river channels, High-energy Rivershore Meadows occur in areas that are kept open by flooding and ice scouring.

Environmental Setting: High-energy Rivershore Meadows are level to gently sloping communities in frequently flooded areas just above the summer low water levels of high-energy rivers. The narrow communities extend to shrubby or tree covered uplands. Frequent flooding and occasional extreme events contribute to the occurrence and persistence of extensive High-energy Rivershore Meadow communities, although the impacts of storm events on individual rivershore meadows and plant populations are highly variable. Vegetation structure and composition vary considerably within rivershore meadows, with some zonation apparently related to differences in elevation, substrate, frequency of flooding, and degree of ice scour. Unlike more northern rivers where deep ice may accumulate annually, ice depth and persistence into early spring along the rivershore meadows in Massachusetts is apparently highly variable. Because they are along high-energy rivers, the community substrate tends to be large sediments along the river, such as cobbles, with sand and smaller materials accumulating only where water slows, often in gradients towards the upland bank. The fairly dense plants and their roots contribute to slowing flood waters, and the finer sediments collect in vegetated areas.

Vegetation Description: Rivershore meadows are dominated by perennial graminoid and forb species. Narrow, low-lying areas near the river's edge and scoured or eroded depressions with moist, mineral substrates are characterized by sparse to moderate cover of

low sedges and rushes, especially brown beak-rush (*Rhynchospora capitellata*), spike-rushes (*Eleocharis* spp.), and rush species (*Juncus* spp.). Above this zone, riverside-sedge (*Carex torta*) dominates along with hemp dogbane (*Apocynum cannabinum*); associates include groundnut (*Apios americana*), deer-tongue (*Dichanthelium clandestinum*), swamp candles (*Lysimachia terrestris*), fringed loosestrife (*L. ciliata*), field-mint (*Mentha* sp.), blue monkey-flower (*Mimulus ringens*), obedient plant (*Physostegia virginiana*), small purple-fringed orchis (*Platanthera psycodes*), Canadian burnet (*Sanguisorba canadensis*), grass-leaf flat-topped goldenrod (*Euthamia graminifolia*), and New York aster (*Symphyotrichum novi-belgii*). Higher areas are characterized by tall forbs and grasses, including big bluestem (*Andropogon gerardii*), Canada bluejoint (*Calamagrostis canadensis*), tall flat-topped white aster (*Doellingeria umbellata*), riverbank wild rye (*Elymus riparius*), spotted joe-pye-weed (*Eutrochium maculatum*), sunflower (*Helianthus* sp.), reed canary-grass (*Phalaris arundinacea*), and goldenrods (*Solidago* spp.). The highest portions of the rivershore meadows, just below the adjacent woodlands, are often dominated by ferns and shrubs, especially interrupted fern (*Osmunda claytoniana*), speckled alder (*Alnus incana*), glossy buckthorn (*Frangula alnus*), and Japanese knotweed (*Fallopia japonica*).

Differentiating Occurrences: On cobble shores along high-energy rivers, High-energy Rivershore Meadows intergrade with High-energy Riverbank and Riverside Seep communities. High-energy Rivershore Meadows are densely vegetated with a characteristic group of dominant plants (hemp dogbane, riverside-sedge and Canadian burnet) in a mix with other forbs and graminoids. Riverside Seeps occur at the base of steep riverbanks where groundwater seeps out of the bottom of the upland slope; they are wetter than associated High-energy Rivershore Meadows and High-energy Riverbank Communities. Muskflower, Canadian burnet, and golden alexanders as a group are good indicator species of Riverside Seeps. High-energy Riverbank Communities have, on average, sparser vegetation and more bare ground than do High-energy Rivershore Meadows or Riverside Seeps.

Associated Fauna: High-energy Rivershore Meadows filter water coming from surrounding uplands, improving water quality for the fish and other animals of the stream. As they are small communities, they are part of the habitat of wide-ranging riverine and upland animals.

Public Access: Gilbert A. Bliss State Forest, Chesterfield.

Threats: Invasive species, particularly large patches of *Fallopia japonica* on the upland edge, and *Lythrum salicaria*, *Phalaris arundinacea*, and *Frangula alnus* scattered throughout. Japanese Knotweed poses by far the greatest threat to rivershore meadows where it often occurs as dense monocultures, dominating continuous linear patches that extend for tens or hundreds of meters. In some instances, recent or ongoing expansion of Japanese Knotweed clones actively threatens rivershore meadows.

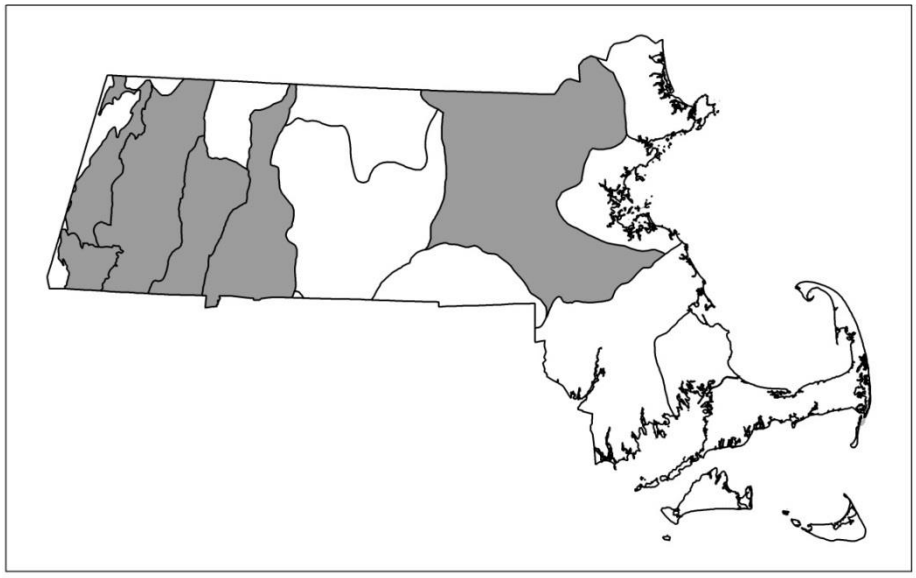
Management Needs: Control of invasive species, particularly *Fallopia*.

USNVC/NatureServe: CEGL006536: Northeastern Temperate Cobble Scour Rivershore (*Carex torta* - *Apocynum cannabinum* - *Cyperus* spp. Herbaceous Vegetation).

High-terrace Floodplain Forest

Community Code: CP1A2B4000

State Rank: S2



Concept: Mesic, deciduous hardwood forests of high alluvial terraces above the zone of annual flooding. This community type also occurs along riverbanks of high-gradient, northern rivers.

Environmental Setting: High-terrace Floodplain Forests occur on raised banks adjacent to rivers and streams, on steep banks bordering high-gradient rivers in the western parts of the state, on high alluvial terraces, and on raised areas within Major-river and Small-river Floodplain Forests. In general, these communities are within the 100-year flood zone of rivers, and thus are river-influenced, but they typically are not flooded annually, as indicated by the presence of a distinct surface soil organic layer. Soils are typically silt loams. As with other types of floodplain forests and Rich, Mesic Forests, the rich soils and moist conditions make disturbed areas in them prone to invasions by exotic plant species.

Vegetation Description: These floodplain forests typically have more structural and species diversity than other floodplain forests. They have a mix of species that includes many that also occur in lower floodplain forests and others from mesic, deciduous hardwood forests, particularly Rich, Mesic Forests. The canopy may include red, silver, and sugar maples (*Acer rubrum*, *A. saccharinum*, and *A. saccharum*) growing with birches (*Betula* spp.), hickories (*Carya cordiformis*, *C. glabra*, and *C. ovata*), ashes (*Fraxinus* spp.), butternut (*Juglans cinerea*), sycamore (*Platanus occidentalis*), cottonwood (*Populus deltoides*), black cherry (*Prunus serotina*), basswood (*Tilia americana*), and elms (*Ulmus* spp.). Large hackberry (*Celtis occidentalis*) trees grow in High-terrace Floodplain Forests along the southern Housatonic River. Ironwood (*Carpinus caroliniana*) is characteristically in an open subcanopy that may also

include species from the canopy. The shrub layer varies from sparse to well-developed, with northern arrowwood (*Viburnum dentatum* var. *lucidum*), nannyberry (*V. lentago*), and winterberry (*Ilex verticillata*) commonly mixed with variable amounts of non-native shrubs, including Japanese Knotweed (*Fallopia japonica*), Japanese barberry (*Berberis thunbergii*), and buckthorns (*Frangula alnus* and *Rhamnus cathartica*). The herbaceous layer is a mixture of the characteristic floodplain forest plants - sensitive fern (*Onoclea sensibilis*), ostrich fern (*Matteuccia struthiopteris*), and wood-nettle (*Laportea canadensis*) - and rich upland herbs, such as lady fern (*Athyrium filix-femina*), zigzag goldenrod (*Solidago flexicaulis*), white snakeroot (*Ageratina altissima*), jack-in-the-pulpit (*Arisaema triphyllum*), and bellwort (*Uvularia sessilifolia*). Other characteristic herbaceous taxa include honewort (*Cryptotaenia canadensis*), floodplain avens (*Geum laciniatum*), jumpseed (*Persicaria virginianum*), trilliums (*Trillium* spp.), trout-lily (*Erythronium americanum*), enchanter's nightshade (*Circaea canadensis* ssp. *canadensis*), and the grasses bottlebrush grass (*Elymus hystrix*) and Wiegand's wild rye (*E. wiegandii*). Vines, very dense in places, include grape (*Vitis riparia*), prickly cucumber (*Echinocystis lobata*), moonseed (*Menispermum canadense*), Virginia creeper (*Parthenocissus quinquefolia*), poison ivy (*Toxicodendron radicans*), and the invasive Oriental bittersweet (*Celastrus orbiculatus*).

Differentiating Occurrences: Occurrences of High-terrace Floodplain Forests tend to be relatively small, narrow forests on high alluvial terraces that flood only occasionally (not annually) and for a shorter duration than other types of floodplain forests. Less flooding typically results in more structural and species diversity than found in other floodplain forests. High-terrace Floodplain Forests are most closely related to Transitional Floodplain Forests, Small-river Floodplain Forests, and Rich Mesic Forests. They are sometimes seen as a hybrid between floodplain and upland forests, as the vegetation composition of all layers of this forest type is a mixture of floodplain taxa, such as red and silver maple (*Acer rubrum* and *A. saccharinum*), and mesic, deciduous hardwoods including sugar maple (*A. saccharum*), shagbark hickory (*Carya ovata*), black cherry (*Prunus serotina*), American elm (*Ulmus americana*), and basswood (*Tilia americana*). Ironwood (*Carpinus caroliniana*) typically forms an open subcanopy. They have more litter accumulated than other floodplain forests. Alluvial Red Maple Swamps along low-gradient rivers flood annually and are slow to drain. Silver maple is often a codominant with red maple, without the mix of upland species. Alluvial Hardwood Flats are along small streams that have multiple short flooding events throughout the year after storms. Black cherry and white pine are usually abundant in the canopy with red maple, but not silver maple. Major-river, Transitional, and Small-river Floodplain Forests flood annually, are dominated by silver maple, and lack the upland forest species. Rich, Mesic Forests lack silver maple and other species of floodplain forests. They are not associated with river flooding.

Associated Fauna: High-terrace Floodplain Forests can contain low wet depressions that function as vernal pools and provide important amphibian breeding habitat. Being small communities, they are part of the habitat of wide-ranging riverine and upland

animals. Changes in water quality and quantity will alter herbaceous, and eventually tree, species, changing habitat for birds and browsers, such as deer and rabbits.

Public Access: George L. Darey Housatonic Valley WMA, Lenox; Knightville WMA, Huntington/Chesterfield; Arcadia Wildlife Sanctuary (Massachusetts Audubon Society), Northampton; Bolton Flats WMA, Bolton/Lancaster.

Threats: Most high terraces have been converted to agriculture. Remaining examples are typically small and disturbed by selective logging and trail clearing. The lack of natural vegetated buffers makes these communities highly susceptible to non-native plant invasions. Most known examples have non-native plant species comprising a substantial percentage of overall plant cover. Because these communities fall outside of wetland boundaries, they are not subject to wetland regulations making them targets for selective logging and clearing for agriculture.

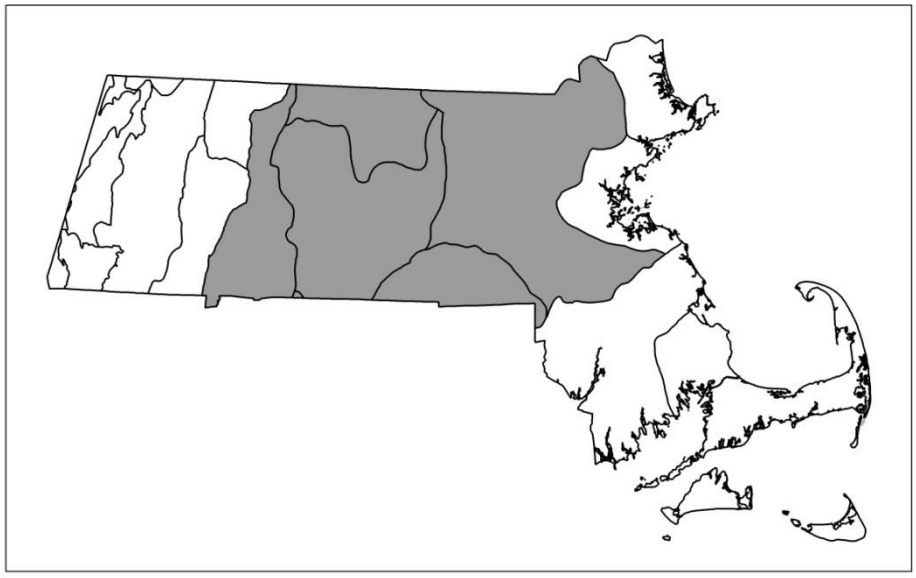
Management Needs: Removal of non-native species.

USNVC/NatureServe: *Acer saccharum* - *Carya cordiformis* Temporarily Flooded Forest Alliance -- *Acer saccharum* - *Fraxinus* spp. - *Tilia americana*/*Matteuccia struthiopteris* - *Ageratina altissima* Forest [CEGL006114].

Inland Atlantic White Cedar Swamp

Community Code: CP1B1A2000

State Rank: S2



Concept: Inland basin or seepage swamps dominated by Atlantic white cedar in the overstory. Hemlock, spruce, red maple, and yellow birch co-occur, and coastal indicator species are lacking.

Environmental Setting: Inland Atlantic White Cedar Swamps generally occur in the central part of the state in basins or seepage wetlands at a wide range of elevations. As in all Atlantic white cedar swamps, water-saturated peat overlies the mineral sediments (sand and gravel, glacial lake sediments, or till deposits), and standing water generally occurs for half of the growing season or longer. There is typically some surface water movement, and some sites receive groundwater seepage from nearby steep till deposits. The water and soil are nutrient-poor, and particularly low in nitrogen and phosphorus. Soil pH is acidic (3.1-5.5) and leaf litter decomposition is slow. When conifers dominate the canopy, occurrences may be dark and have limited understory growth. Fallen and tipped trees are common and the resultant openings become tangles with dense shrub and sapling growth around downed trunks.

Vegetation Description: Atlantic white cedar swamps are defined as having >25% cover of Atlantic white cedar in the canopy. Associated canopy trees in Inland Atlantic White Cedar Swamps differ depending on elevation. In sites lower than 700 ft. elevation, Atlantic white cedar (*Chamaecyparis thyoides*) is mixed with hemlock (*Tsuga canadensis*), red maple (*Acer rubrum*), and yellow birch (*Betula alleghaniensis*). At elevations above 700 ft., Atlantic white cedar is mixed with hemlock and spruce (*Picea* spp.). The low-elevation sites typically have sweet pepper-bush (*Clethra alnifolia*) and winterberry (*Ilex verticillata*) in the shrub layer, and high-elevation sites have abundant mountain holly (*Ilex mucronata*). The herb layer of both low- and

high-elevation sites is similar, with cinnamon fern (*Osmundastrum cinnamomeum*), starflower (*Lysimachia borealis*), and Canada mayflower (*Maianthemum canadense*) common. High-elevation sites also have northern species such as creeping snowberry (*Gaultheria hispidula*) and bunchberry (*Chamaepericlymenum canadense*).

Differentiating Occurrences: Although each of the Atlantic white cedar swamp community types has a characteristic vegetation structure and composition, as with all natural communities, transitions and mixes do occur. Coastal Atlantic White Cedar Swamps generally occur below 60 ft. elevation and in southeastern Massachusetts (the Cape and Islands, Plymouth and Bristol Counties). In Coastal Atlantic White Cedar Swamps, pitch pine (*Pinus rigida*) is an occasional canopy associate seldom found in other Atlantic white cedar swamp types. Other species that are found in greater abundance in coastal sites than elsewhere include greenbrier (*Smilax rotundifolia*), the shrubs inkberry (*Ilex glabra*), dangleberrry (*Gaylussacia frondosa*), sheep laurel (*Kalmia angustifolia*), and fetterbush (*Eubotrys racemosa*), and the ferns Virginia chain-fern and netted chain-fern (*Woodwardia virginica* and *W. areolata*). Inland Atlantic White Cedar Swamps typically occur at elevations > 60 ft. above sea level and not in southeast Massachusetts. Yellow birch (*Betula alleghaniensis*) is more common than in Coastal Atlantic White Cedar Swamps. Inland Atlantic White Cedar Swamps have lower abundance of coastal indicators than Coastal Atlantic White Cedar Swamps. High-elevation Inland Atlantic White Cedar Swamps also have northern species such as creeping snowberry (*Gaultheria hispidula*) and bunchberry (*Chamaepericlymenum canadense*). Northern Atlantic White Cedar Swamps are codominated by northern conifers such as black and red spruce (*Picea mariana* and *P. rubens*) and balsam fir (*Abies balsamea*). Shrubs and herbs are similar to those found in high-elevation Inland Atlantic White Cedar Swamps, along with Labrador tea (*Rhododendron groenlandicum*) and rhodora (*Rhododendron canadense*). Northern Atlantic White Cedar Swamps are restricted to basins at high elevations, with the single documented example at >1100 ft. Atlantic white cedar also occurs in Atlantic White Cedar Bogs, relatively open peatland communities with canopy cover <25%. Alluvial Atlantic White Cedar Swamps are along streams. The vegetation is highly variable. Atlantic white cedar and red maple dominate the tree layer, and highbush blueberry and sweet pepperbush occur in the shrub layer along with silky dogwood (*Swida amomum*). The herb layer includes sensitive fern (*Onoclea sensibilis*), royal fern (*Osmunda regalis*), bugleweed (*Lycopus* spp.), and marsh St. John's-wort (*Hypericum virginicum*). In Alluvial Red Maple Swamps, silver maple is often a codominant with red maple. If Atlantic white cedar is present, it is well under 25% cover. Red Maple Swamps in basins in southeastern Massachusetts are often former Atlantic white cedar swamps that were cut in the past. Many have small patches of Atlantic white cedar; however, Atlantic white cedar needs to be dominant in the overstory for the community to be classified as an Atlantic white cedar swamp. Mapping of relatively large dense patches of Atlantic white cedar as Atlantic white cedar swamp communities may be useful within a Red Maple Swamp to indicate a mosaic of wetland communities.

Associated Fauna: Inland Atlantic White Cedar Swamps can function as vernal pool habitat if water remains standing for 2-3 months and they lack fish; these areas provide important amphibian breeding habitat.

Public Access: Boxford State Forest, Boxford; Westborough Cedar Swamp (DCR and Sudbury Valley Trustees), Westborough; Douglas State Forest, Douglas; Hodges Village Dam Flood Risk Management Project (US Army Corps of Engineers), Oxford; Cedar Swamp Conservation Area, Monson.

Threats: The two greatest threats to Atlantic white cedar swamps are land clearing for agricultural, commercial and residential development, and interference of normal hydrological functioning as a result of development. Atlantic white cedar has been cut extensively for posts and shingles for over three centuries. In an extensive statewide vegetation inventory funded by NHESP in 1990, no uncut stands were found, but several sites contained cedars that were 100-200 years old. Selective cutting is detrimental to the persistence of Atlantic white cedar swamps, because hardwoods, such as red maple, outcompete and replace Atlantic white cedar. Any alteration to the natural hydroperiod of Atlantic white cedar swamps threatens their persistence.

Management Needs: Due to the limited distribution of Atlantic white cedar swamps, it is recommended that no clearing or filling of these wetlands be allowed. Atlantic white cedar will regenerate best following catastrophic disturbance events such as hurricanes and fires. Data suggest that in the absence of disturbance, red maple and shrubs increase in abundance at the expense of Atlantic white cedar. Fire suppression negatively threatens the long-term persistence of Atlantic white cedar swamps, and controlled burning practices may be an appropriate restoration tool in many areas. Controlled burning should be accompanied by small-patch clearcuts to be most effective. By clear-cutting small patches (generally 20 m x 20 m) and removing the slash and competing vegetation, pure, even-aged stands of Atlantic white cedar are able to regenerate. Atlantic white cedar swamps require a natural cycle of wet and dry periods for their survival and reproduction. Standing water for much of the year is unfavorable for both seed germination and seedling survival, and young seedlings are killed by both drowning and drought. It is recommended that any alterations in water levels be avoided. This includes development and road construction in uplands surrounding Atlantic white cedar swamps which can alter water levels. Where cedar wetlands are associated with river systems, it is important to maintain normal hydrologic regime of the river.

USNVC/NatureServe: *Chamaecyparis thyoides* Saturated Forest Alliance - *Chamaecyparis thyoides* - (*Tsuga canadensis*, *Betula alleghaniensis*)/*Clethra alnifolia* Forest (CEGL006189); includes much of *Chamaecyparis thyoides*/*Rhododendron maximum* Forest (CEGL006355) except for lacking dominant *Rhododendron maximum*.

Interdunal Marsh/Swale

Community Code: CP2A0A1100

State Rank: S2

Concept: Graminoid- or shrub-dominated coastal community occurring in shallow basins (swales) between sand dunes.

Environmental Setting: Interdunal Marshes/Swales form in barrier beach systems in low, shallow depressions between sand dunes. The best examples are complexes of multiple swales with varied conditions. Soils generally have a thin (1 cm) organic layer over coarse sand. The substrate may be seasonally flooded or permanently inundated, with water coming from groundwater and precipitation, with occasional brackish overwash from storms. The water regime controls the vegetation. The community is usually graminoid- or shrub-dominated. One variant has a pitch pine canopy.

Vegetation Description: Interdunal swale vegetation ranges from graminoid-dominated to low shrub-dominated, with or without scattered patches of tall shrubs or, occasionally, a canopy of pitch pine. The most common type is dominated by large cranberry (*Vaccinium macrocarpon*; often with > 90% cover) on sphagnum moss. Typical associates include various rushes (*Juncus pelocarpus*, *J. canadensis*, etc.), spatulate-leaved and thread-leaved sundews (*Drosera intermedia* and *D. filiformis*), beaksedges (*Rhynchospora capitellata* and *R. alba*), yellow-eyed grasses (*Xyris* spp.), St. John's-worts (*Triadenum* spp.), southern bog clubmoss (*Lycopodiella appressa*), and several orchid species such as rose pogonia (*Pogonia ophioglossoides*), grass-pink (*Spiranthes cernua*), and nodding ladies-tresses (*Spiranthes cernua*) and occasional arethusa (*Arethusa bulbosa*) and ragged fringed orchis (*Platanthera lacera*). Graminoid-dominated swales are characterized by a mixture of rushes (*Juncus* spp.), beaksedges (*Rhynchospora* spp.) and other graminoids. Some interdunal swales have large numbers of Plymouth gentian (*Sabatia kennedyana*).

Scattered pitch pine (*Pinus rigida*), eastern red cedar (*Juniperus virginiana*), bayberry (*Morella pensylvanica*), sheep laurel (*Kalmia angustifolia*) or other wetland shrubs can also occur.

Differentiating Occurrences: Occurrence in shallow, wet basins in dune systems is the defining characteristic of Interdunal Marsh/Swales. They are graminoid-, shrub-, or pitch pine-dominated communities growing on shallow peat over sand. Acidic Graminoid Fens and Sea-level Fens are differentiated by location; they are not in barrier beach systems. They both generally have deeper peat than Interdunal Marshes/Swales, but all share many species.

Associated Fauna: Interdunal swales can function as vernal pool habitat if water remains standing for 2-3 months and they lack fish; these swales provide important amphibian breeding habitat, particularly for toads such as American toad, Fowler's toad, and eastern spadefoot. Interdunal swales are part of the habitat of mobile animals for food, cover, and nesting sites. They can be an important source of freshwater in the generally very dry and exposed dune systems.

Public Access: Several dune systems on public lands have trails and/or boardwalks that intersect interdunal swales. If visited, care should be taken not to create trails across the peat surface or in the easily damaged surrounding dunes. Cape Cod National Seashore, multiple areas; Parker River National Wildlife Refuge, Newburyport, multiple areas; Sandy Neck Beach Conservation Area (town-owned), Barnstable; Demarest Lloyd State Park, Dartmouth.

Threats: Invasion of non-native species (especially phragmites (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*)).

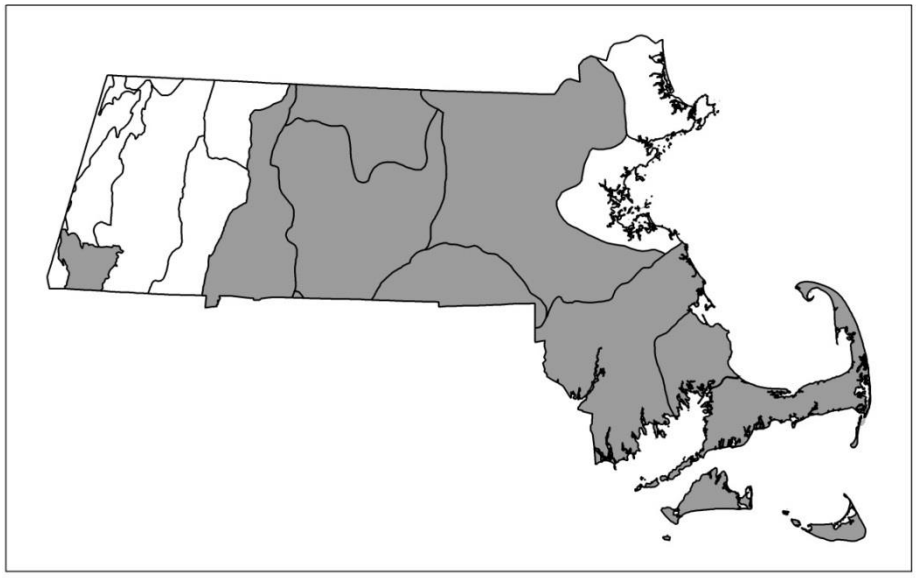
Management Needs: Control the spread of phragmites and purple loosestrife.

USNVC/NatureServe: *Vaccinium macrocarpon-Myrica pensylvanica* Dwarf-shrubland [CEGL006141]; *Spartina patens* Seasonally Flooded Herbaceous Vegetation [CEGL006342]. *Cladium mariscoides*/*Vaccinium macrocarpon - Morella pensylvanica* Dwarf-shrubland (CEGL006141, G2G3) (?); ?A0580 *Pinus rigida* Saturated Woodland Alliance - *Pinus rigida*/*Vaccinium macrocarpon* Woodland [CEGL006127].

Kettlehole Level Bog

Community Code: CP2B0C1100

State Rank: S2



Concept: A variant of level bogs occurring in kettle depressions in sandy glacial outwash. Vegetation is typically zoned in rings.

Environmental Setting: Kettlehole Level Bogs are a subset of Level Bogs that occur in iceblock depressions (commonly called kettleholes) in sandy glacial outwash. They are typically small (< 3 acres) and round, and they lack inlets and outlets. Kettlehole Level Bogs are peatlands: wetlands with incompletely decomposed plant material (peat) that accumulates when saturated year-round by water that is cool, acidic, poorly oxygenated, and low in nutrients. The peat isolates the vegetation from the water table, making the communities the most acidic (pH range 3 to 4), and nutrient-poor of peatland communities. The word "level" differentiates Massachusetts bogs from the raised bogs of more northern latitudes, where peat becomes so thick that precipitation is the only source of nutrients. Massachusetts' climate is not cold enough to develop raised bogs; the state is at the southern limit of the geographic range of peatlands.

Vegetation Description: Sphagnum moss (*Sphagnum* spp.) is the most common plant in all acidic peatlands, forming a mat that the vascular plants grow on and producing most of the peat that underlies the community. Kettlehole level bogs have similar vegetation to level bogs, except that the vegetation is typically in a ringed zonation pattern. Often the outer wet moat is dominated by a mixture of highbush blueberry (*Vaccinium corymbosum*) and swamp azalea (*Rhododendron viscosum*), bordered to the interior by a ring of rhodora (*Rhododendron canadense*). The mat has a mixture of tall and short shrubs that are predominantly ericaceous (members of the Heath family). Leatherleaf (*Chamaedaphne calyculata*) is dominant. Other typical ericaceous

shrubs include rhodora, sheep laurel (*Kalmia angustifolia*), bog laurel (*Kalmia polifolia*), bog-rosemary (*Andromeda polifolia* var. *glaucophylla*), Labrador tea (*Rhododendron groenlandicum*), and low-growing large and small cranberry (*Vaccinium macrocarpon* and *V. oxycoccos*). Scattered, stunted coniferous trees (primarily tamarack (*Larix laricina*) and black spruce (*Picea mariana*)) occur throughout. A mixture of specialized bog plants grow on the hummocky sphagnum surface, including carnivorous pitcher plants (*Sarracenia purpurea*) and sundews (*Drosera rotundifolia* and *D. intermedia*). Many of the kettlehole bogs observed in the state have drier and more stable sphagnum mats than Level Bogs that are not in kettleholes, and they have abundant bog laurel and three-leaved Solomon's seal (*Maianthemum trifolium*).

Differentiating Occurrences: Natural communities on acidic peatlands all occur on sphagnum peat. The depth, density, and strength of the underlying peat control the structure and composition of each type of peatland community because plants growing on it are isolated from nutrients carried by groundwater. In Level Bogs, the sphagnum peat tends to be deep and well-developed, graminoids may be present but not dominant, and shrubs are dominated by leatherleaf. Kettlehole Level Bogs are a subset of Level Bogs that occur in kettleholes in sandy glacial outwash. They are typically small (<3 acres) and round, and they lack inlets and outlets. Kettlehole Level Bogs have similar vegetation to Level Bogs, except that the vegetation is typically in a ringed zonation pattern. Atlantic White Cedar Bogs have a sparse canopy cover of Atlantic white cedar trees over sphagnum on peat. Acidic Graminoid Fens are dominated by graminoid and herbaceous species and lack extensive shrubs. Spruce-Tamarack Bogs are acidic forested peatlands with an overstory of black spruce and tamarack.

Associated Fauna: Due to the extended periods of saturation, the lack of nutrients, and the high acidity and low oxygen content of the water, acidic peatlands are inhospitable to many animal species. Winged animals and large terrestrial animals can use peatlands as part of their habitat and then move on when conditions are unfavorable. Moose and white-tailed deer use acidic peatlands for browsing and grazing, and their trails are often evident across the peat mat. Bears are attracted to the cranberries and blueberries in season. Many bird species use peatlands for part of the year as nesting or foraging habitat. Massachusetts birds that can be found in acidic peatlands include Swamp and White-tailed Sparrows, Common Yellowthroat, Olive-sided and Alder Flycatchers, Red-winged Blackbirds, and Gray Catbirds. The acidity and low oxygen content of the water in Kettlehole Level Bogs make them poor habitat for most amphibians and reptiles, although some species can breed in the shallow pools that form among the sphagnum hummocks. Many species of dragonflies and damselflies inhabit acidic peatlands, especially where there is adjacent open water.

Public Access: Bog surfaces are damaged by trampling; sites with boardwalks are best suited to visitation.

Threats: Hydrologic alteration and nutrient enrichment from road and lawn runoff. Trampling from humans affects peat mat integrity.

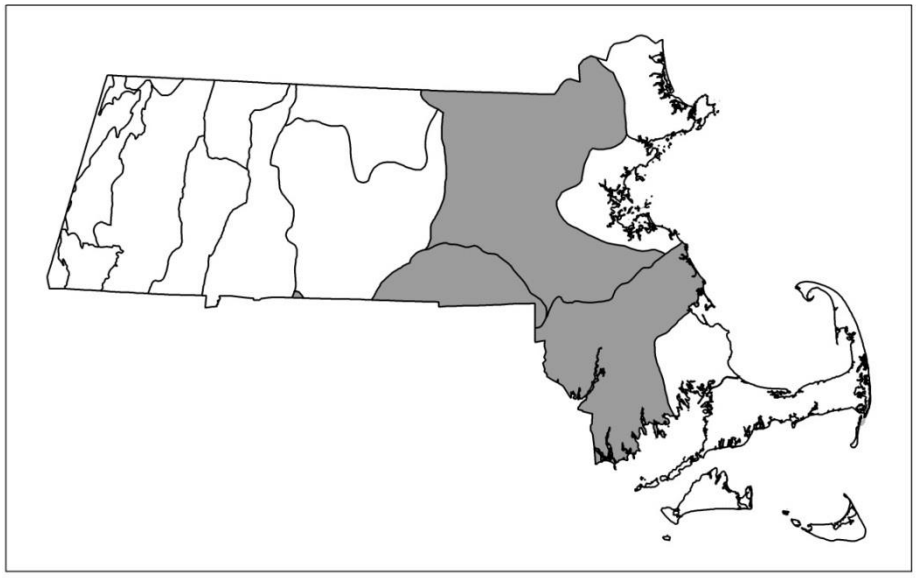
Management Needs: The public should be encouraged to visit only those sites with established boardwalks. Signs need to be posted along boardwalks encouraging visitors to stay off the peat mat. Monitor the impact of salt and other nutrient runoff into bogs, and work to minimize runoff. Remove phragmites where it has become established.

USNVC/NatureServe: Includes *Vaccinium corymbosum*/*Sphagnum* spp. Shrubland; *Picea mariana*/*Kalmia angustifolia*/*Sphagnum* spp. Forest; *Picea mariana*/*Sphagnum* spp. (Lower New England/Northern Piedmont, North Atlantic Coast) Woodland; *Kalmia angustifolia-Chamaedaphne calyculata* (*Picea mariana*)/*Cladina* Dwarf-shrubland.

Kettlehole Wet Meadow

Community Code: CP2A0A2100

State Rank: S3



Concept: Graminoid/emergent herbaceous or mixed shrub/herbaceous communities that are restricted to small (<5 acres), seasonally inundated kettle depressions in sandy glacial outwash.

Environmental Setting: The Kettlehole Wet Meadow community is a variation of both Wet Meadow and Shallow Emergent Marsh communities. It occurs in depression basins (kettleholes in glacial sediments) that are seasonally inundated by local runoff and groundwater fluctuations and often have no stream inlet or outlet. In the winters of most years, they may be shallow ponds that then dry down to mucky peaty sediments through the summer; emergent, usually graminoid, vegetation, becomes dense as the growing season progresses. Deep peat does not develop due to the seasonal drawdown of water. A series of plant associations occur along a gradient from the higher, drier margins to the lower, wetter centers.

Vegetation Description: Kettlehole Wet Meadows are typically fringed with shrubs, such as leatherleaf (*Chamaedaphne calyculata*), highbush blueberry (*Vaccinium corymbosum*), buttonbush (*Cephalanthus occidentalis*), and water willow (*Decodon verticillatus*), and trees including tupelo (*Nyssa sylvatica*), swamp white oak (*Quercus bicolor*), and red maple (*Acer rubrum*), often with sphagnum moss (*Sphagnum* spp.) under them. By the end of the summer, with lowered water, the basin is covered by a dense growth of emergents graminoids, often in zones or patches of single species. The dominants may be bulrushes, sedges, or rushes, or, occasionally, grass. Wool-grass (*Scirpus cyperinus*) can be close to a monoculture when present. Other species present may include different *Scirpus* species (such as dusky wool-grass (*S. atrocinctus*), meadow bulrush (*S. hattorianus*), red-stemmed bulrush (*S.*

microcarpus), and Torrey's bulrush (*Schoenoplectus torreyi*)), sedges including tussock-sedge (*Carex stricta*), rushes (such as marsh rush (*Juncus canadensis*), bayonet rush (*J. militaris*), and pondshore rush (*J. pelocarpus*)), and grasses (including panic-grasses (*Dichanthelium* and *Panicum* spp.), creeping bentgrass (*Agrostis stolonifera*), and mannagrass (*Glyceria pallida* and *G. acutiflora*)) ferns including marsh fern (*Thelypteris palustris*), and forbs such as beggar's ticks (*Bidens* spp.).

Differentiating Occurrences: Kettlehole Wet Meadows are a specialized type of Shallow Emergent Marsh in small basins that have dense graminoid marshes on mucky peat. They are temporarily inundated after storms as well from high groundwater. Wet Meadows, related graminoid communities, are in lake basins, backwaters, and sloughs along rivers. Shallow Emergent Marshes are graminoid wetlands in broad, flat areas bordering rivers or along pond margins and are seasonally flooded. Coastal Plain Pondshore Communities and Coastal Plain Pondshores - Inland Variant are generally on sand around ponds in closed basins that intersect groundwater affecting the pond levels. The seasonally fluctuating water table typically leaves an exposed shoreline by late summer that supports herbaceous species. Sediments are sandy or mucky, but not peaty, and late summer vegetation is not dominated by tall dense graminoids.

Associated Fauna: Because they are small, Kettlehole Wet Meadows are parts of the habitat of wide-ranging species, including wetland nesting birds. Kettlehole Wet Meadows often function as vernal pools: with standing water in the winter and spring, and drawdown to the sediments in most summers, the areas provide important breeding habitat for amphibians that live in surrounding forests during the rest of the year.

Public Access: Douglas State Forest, Douglas; Minute Man National Historical Park, Concord; Demarest Lloyd State Park, Dartmouth.

Threats: Alterations to natural water-level fluctuations. The sites for which there are vegetation data have surprisingly few non-native plant species, and exotics may not currently threaten these communities.

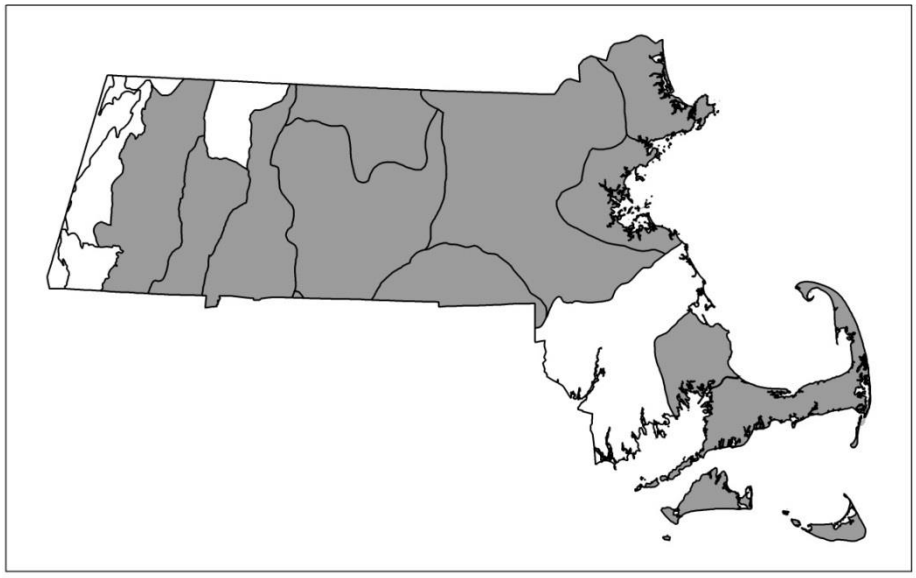
Management Needs: More information is needed on the physical and hydrological processes associated with Kettlehole Wet Meadows in order to make educated management recommendations. It is known that seasonal water level fluctuations play an important role in the occurrence of the community. Spring high-water levels prevent encroachment of woody shrubs and trees, and late-summer low-water levels allow characteristic narrow-leaved emergents to appear. Any alteration in natural water level fluctuations, such as groundwater withdrawal, would negatively affect the community. Kettlehole Wet Meadows may be prone to burning during low-water periods, but the role of fire in community dynamics is not known.

USNVC/NatureServe: A.1386 - *Scirpus cyperinus* Seasonally Flooded Herbaceous Alliance, *Scirpus cyperinus* Seasonally Flooded Herbaceous Vegetation [CEGL006349]; (part of) A4107 *Carex* spp. - *Calamagrostis canadensis* Eastern Wet Meadow Herbaceous Alliance, *Carex stricta* - *Carex vesicaria* Herbaceous Vegetation [CEGL006412].

Level Bog

Community Code: CP2B0C1000

State Rank: S3



Concept: Acidic, dwarf ericaceous shrub peatlands, generally with pronounced hummock-hollow topography. Level Bogs are the most acidic and nutrient-poor of Massachusetts peatland communities.

Environmental Setting: Level Bogs are peatlands: wetlands with incompletely decomposed plant material (peat) that accumulates when saturated year-round by water that is cool, acidic, poorly oxygenated, and low in nutrients. They receive little or no stream flow and they are isolated from the water table, making them the most acidic (pH range 3 to 4), and nutrient-poor of peatland communities. Level Bogs develop along pond margins, at the headwaters of streams, and in pockets within large basins. Level Bogs that develop in isolated valley bottoms without inlet or outlet streams are classified as Kettlehole Level Bogs, a subset of Level Bog. The word "level" is used to differentiate Massachusetts bogs from the raised or domed bogs of more northern latitudes, where peat becomes so thick that the surface of the bog is actually domed, and the only way nutrients enter the system is through precipitation. Massachusetts' climate is not cold enough for raised bogs to develop; the state is at the southern limit of the geographic range of peatlands.

Vegetation Description: Sphagnum moss (*Sphagnum* spp.) is the most common plant in all acidic peatlands, forming a mat that the vascular plants grow on and producing most of the peat that underlies the community. Level Bogs are characterized by a mixture of tall and short shrubs that are predominantly in the heath family. Leatherleaf (*Chamaedaphne calyculata*) is dominant with other shrubs, typically including rhodora (*Rhododendron canadense*), sheep laurel (*Kalmia angustifolia*), bog laurel (*K. polifolia*), bog rosemary (*Andromeda polifolia* var. *glaucophylla*), Labrador tea

(*Rhododendron groenlandicum*), highbush blueberry (*Vaccinium corymbosum*), and low-growing large and small cranberry (*Vaccinium macrocarpon* and *V. oxycoccos*). Scattered, stunted trees (primarily tamarack (*Larix laricina*) and black spruce (*Picea mariana*), with red maple (*Acer rubrum*) saplings) occur throughout. A mixture of specialized bog plants grow on the hummocky sphagnum surface, including carnivorous pitcher plants (*Sarracenia purpurea*) and sundews (*Drosera rotundifolia* and *D. intermedia*).

Differentiating Occurrences: Natural communities on acidic peatlands all occur on sphagnum peat. The depth, density, and strength of the underlying peat control the structure and composition of each type of peatland community because plants growing on it are isolated from nutrients carried by groundwater. Level Bog communities receive little or no stream flow and they are isolated from the water table, making them the most acidic (pH ~ 3 to 4) and nutrient-poor of peatland communities. The sphagnum peat tends to be deep and well-developed, graminoids may be present but not dominant, and shrubs are dominated by leatherleaf. Kettlehole Level Bogs are a subset of Level Bogs that occur in iceblock depressions (commonly called kettleholes) in sandy glacial outwash. They are typically small (<3 acres) and round, and they lack inlets and outlets. Atlantic White Cedar Bogs have a sparse canopy (averaging <25%, but there may be local clumps of trees) cover of Atlantic white cedar over sphagnum on peat. Atlantic White Cedar Bogs share many species and characteristics with other acidic peatlands, including Level Bogs. Acidic Graminoid Fens are differentiated by the dominance of graminoid and herbaceous species and lack of extensive shrubs. Threeway sedge (*Dulichium arundinaceum*) and buckbean (*Menyanthes trifoliata*) are characteristic of the wet, nutrient-enriched edges of Acidic Graminoid Fens. Sea-level Fens occupy the interface between estuarine marshes and upland seepage slopes, and therefore have a distinct species assemblage including both estuarine and palustrine species. Regionally, three species have been identified as diagnostic: saltmarsh straw-sedge (*Carex hormathodes*), saltmarsh spike-sedge (*Eleocharis rostellata*), and saltmarsh threesquare (*Schoenoplectus americanus*). Twig-sedge (*Cladium mariscoides*) at the edges of salt marshes is also used as an indicator of Sea-level Fens. Interdunal Marshes/Swales occur as part of a coastal dune system. They are graminoid- or shrub-dominated communities occurring in shallow basins (swales) between dunes. Some are fen-like with cranberries and sedges growing on shallow peat, but occurrence in dune systems is the defining characteristic. Acidic Shrub Fens are composed primarily of low-growing, interwoven shrubs. Dense water-willow and sweet gale are indicative and characteristic. Acidic Shrub Fens are wetter with a less well-developed sphagnum mat than other acidic peatlands. Spruce - Tamarack Bogs are acidic forested peatlands, with an overstory of black spruce and tamarack and an understory of heath shrubs on sphagnum moss.

Associated Fauna: Due to the extended periods of saturation, the lack of nutrients, and the high acidity and low oxygen content of the water, acidic peatlands are inhospitable to many animal species. Winged animals and large terrestrial animals can use peatlands as part of their habitat and then move on when conditions are

unfavorable. Moose and white-tailed deer use acidic peatlands for browsing and grazing, and their trails are often evident across the peat mat. Bears are attracted to the cranberries and blueberries in season. Many bird species use peatlands for part of the year as nesting or foraging habitat. Massachusetts birds that can be found in acidic peatlands include Swamp and White-tailed Sparrows, Common Yellowthroat, Olive-sided and Alder Flycatchers, Red-winged Blackbirds, and Gray Catbirds. The acidity and low oxygen content of Level Bogs make them poor habitat for most amphibians and reptiles, although some species can breed in the shallow pools that form among the sphagnum hummocks. Many species of dragonflies and damselflies inhabit acidic peatlands, especially where there is adjacent open water.

Public Access: Bog surfaces are damaged by trampling; sites with boardwalks are best suited to visitation, such as Ponkapoag Bog (DCR), Canton; Poutwater Pond (DCR), Sterling; Black Pond Nature Preserve (TNC), Norwell; Hawley Bog, Hawley.

Threats: Hydrologic alteration and nutrient enrichment from road and lawn runoff. Trampling from humans affects peat mat integrity.

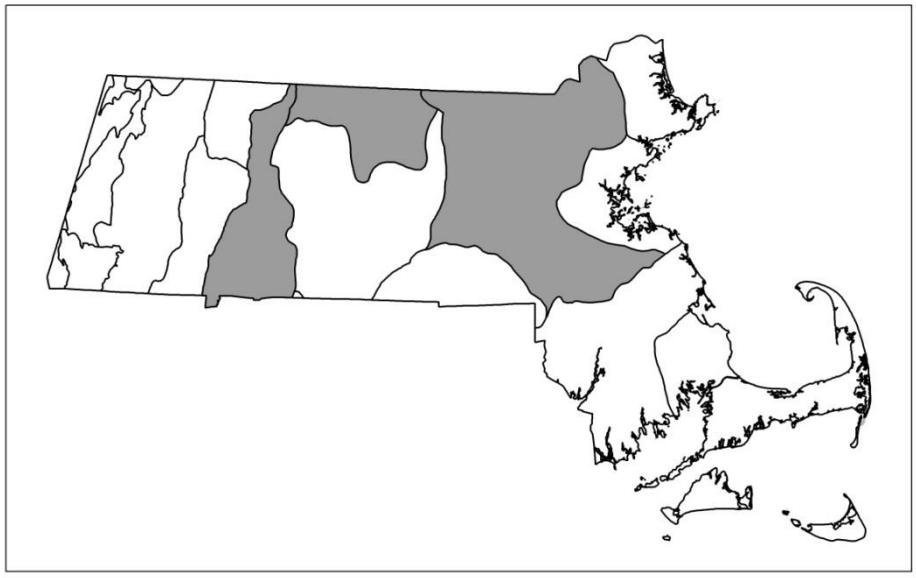
Management Needs: The public should be encouraged to visit only those sites with established boardwalks. Signs need to be posted along boardwalks encouraging visitors to stay off the peat mat. Monitor the impact of salt and other nutrient runoff into bogs, and work to minimize runoff. Remove phragmites where it has become established.

USNVC/NatureServe: A3451 *Sphagnum rubellum - Rhynchospora alba* Sub-boreal Peat Lawn Alliance - *Sphagnum rubellum - Vaccinium oxycoccos* Nonvascular Vegetation [CEGL006135]; and in part A3450 *Chamaedaphne calyculata* Sub-boreal Dwarf-shrub Acidic Peatland Alliance - *Chamaedaphne calyculata* - (*Gaylussacia bigeloviana*) - *Decodon verticillatus*/*Woodwardia virginica* Dwarf-shrubland [CEGL006008]. Probably A3481 *Chamaedaphne calyculata - Kalmia polifolia*/*Carex oligosperma* Acidic Shrub Bog and Fen Alliance - *Chamaedaphne calyculata*/*Eriophorum virginicum*/*Sphagnum rubellum* Dwarf-shrubland [CEGL006513] and *Rhododendron canadense - Chamaedaphne calyculata* Dwarf-shrubland [CEGL006514].

Low-energy Riverbank Community

Community Code: CP2A0B2300

State Rank: S4



Concept: Open herbaceous/graminoid communities occurring on sandy or silty mineral soils of river and streambanks that do not experience severe flooding or ice scour.

Environmental Setting: Low-energy Riverbank Communities are on low-gradient sections of rivers of various sizes that flood but do not experience severe scouring; they often occur between higher gradient sections of the river where there are rapids and rocky shorelines. The linear, often narrow, community develops on gravelly bars and shorelines just above summer low-water levels but below spring high-water levels. The riverbanks are fine-grained material (sand, silt, and possibly clay) with the vegetation growing on mineral soil, rather than the peaty or mucky soil that characterizes marshes and wet meadows.

Vegetation Description: The structure of Low-energy Riverbank Communities is generally an open mixture of herbaceous and graminoid species with occasional scattered shrubs that may dominate locally and trees at the inland margin. The species composition is variable and diverse. Common graminoids are reed canary-grass (*Phalaris arundinacea*), cockspur-grass (*Echinochloa muricata*), fall panic-grass (*Panicum dichotomiflorum*), rice cut-grass (*Leersia oryzoides*), and Canada bluejoint (*Calamagrostis canadensis* var. *canadensis*). Broad-leaf herbs commonly include devil's pitchforks (*Bidens frondosa*), smartweeds (*Persicaria* and *Polygonum* spp.), orange jewelweed (*Impatiens capensis*), cardinal flower (*Lobelia cardinalis*), various goldenrods (*Solidago* spp.), and sensitive and royal ferns (*Onoclea sensibilis* and *Osmunda regalis*). Species typical of disturbed areas (such as cocklebur (*Xanthium strumarium* var. *canadense*)) including non-native purple loosestrife (*Lythrum salicaria*) and/or Japanese knotweed (*Fallopia japonica*) are common and may be abundant. Shrubs

occur in local patches with the most common species including speckled alder (*Alnus incana* ssp. *rugosa*), dogwoods (*Swida* spp.), black elderberry (*Sambucus nigra* ssp. *canadensis*), and highbush blueberry (*Vaccinium corymbosum*).

Differentiating Occurrences: Low-energy Riverbank Communities are on the slopes of riverbanks which are composed of a mix of relatively fine mineral materials (clay, silt, or sand) and lack both the cobble substrate of high-energy areas and the organic materials of marshes. Freshwater Mud Flat Communities have low, sparse, annual herbaceous vegetation on recently exposed muddy (mucky, silty mineral) sediments in ponds and streams. Mud flats at the base of banks may be included in a bank community if they are very small and an extension of the riverbank, and do not extend much into the stream channel. High-energy Riverbank Communities occur along the shores of fast-flowing, high-energy rivers with sparse plants growing in sediment caught between rock cobbles. Low-energy Riverbank communities have sparser vegetation than marshes and wet meadows. Shallow and Deep Emergent Marshes are dominated by perennial graminoids and are permanently saturated. Unlike Low-energy Riverbanks with a mineral substrate, marshes typically have a layer of well-decomposed organic muck at the surface overlying mineral soil. Wet Meadows have dense mixed herbaceous/graminoid vegetation growing on permanently saturated mucky sediments.

Associated Fauna: Few animals are restricted to these narrow, linear, riverside communities, but many wide-ranging riverine and upland animals include low-energy riverbanks as part of their habitats. Muskrats (*Ondatra zibethicus*), beavers (*Castor canadensis*), and river otters (*Lontra canadensis*) build burrows in banks. Turtles nest in flatter parts at the top of banks. Riverine dragonflies hunt over and rest in Low-energy Riverbank Communities.

Public Access: Millers River WMA, Athol/Phillipston; Bolton Flats WMA, Harvard/Lancaster/Bolton.

Threats: Invasion by non-native plant species is the greatest threat to the community.

Management Needs: Non-native plant species removal.

USNVC/NatureServe: Includes *Calamagrostis canadensis Phalaris arundinacea* Herbaceous Alliance [CEGL005174] and *Phalaris arundinacea* Eastern Herbaceous Vegetation [CEGL006335]. Clay Bank Sparse Vegetation NVC CEGL002584.

Major-river Floodplain Forest

Community Code: CP1A2B1000

State Rank: S2

Concept: Silver maple-dominated forest community of alluvial floodplains of the Connecticut, Deerfield and Housatonic Rivers.

Environmental Setting: Floodplain forests are deciduous forested wetland communities, which develop next to rivers and streams and receive annual (or semi-annual) overbank flooding and alluvial silt deposition. Three floodplain forest communities can be viewed as points on a continuum from most severely scoured and well-drained (major-river type) to least severely scoured and poorly drained (small-river type). Major-river Floodplain Forests occur along mainstem sections of large rivers (the Connecticut, Housatonic, and Deerfield Rivers in Massachusetts). Soils are predominantly sandy loams without soil mottles and without a surface organic layer. Flooding at these sites occurs annually and is usually severe. An island variant of Major-river Floodplain Forests (Type I in Kearsley, 1998) occurs on elevated sections of riverine islands and riverbanks of major rivers, where there are high levels of both natural and human disturbance.

Vegetation Description: All floodplain forest communities in Massachusetts have silver maple (*Acer saccharinum*) as the defining tree, but associated plant species vary depending on the intensity and duration of flooding and on geographic location. Major-river Floodplain Forests have silver maple (*Acer saccharinum*) strongly dominant in the overstory (>60% cover) mixed with lesser amounts of cottonwood (*Populus deltoides*). American elm (*Ulmus americana*) and/or slippery elm (*U. rubra*) occur in the subcanopy. Shrubs are generally lacking. The herbaceous layer is usually dominated by a 3-6 ft. (1-2 m) tall, dense cover of wood-nettles (*Laportea canadensis*). Ostrich fern (*Matteuccia struthiopteris*) is sometimes abundant. White

cut-grass (*Leersia virginica*) is consistently represented, but in low amounts (typically <5% cover). Other regular associates are common woodreed (*Cinna arundinacea*) and jack-in-the-pulpit (*Arisaema triphyllum*). An island variant of Major-river Floodplain Forests (Type I in Kearsley, 1998) has similar species, but silver maple is not dominant in the overstory and the herbaceous layer is typically strongly dominated by ostrich fern. The overstory is an even mix of silver maple, cottonwood, sycamore (*Platanus occidentalis*), and American ash (*Fraxinus americana*), with box elder (*Acer negundo*) and hackberry (*Celtis occidentalis*) common in the subcanopy on the Housatonic River. Species typical of disturbed areas, such as staghorn sumac (*Rhus typhina*) and the non-native bittersweet (*Celastrus orbiculatus*), are also common in this variant, as are the vines riverbank grape (*Vitis riparia*) and Virginia creeper (*Parthenocissus quinquefolia*).

Differentiating Occurrences: Floodplain forest communities occur within the zone of active flooding of rivers and streams on mineral soils that receive annual silt deposition. They differ in the size of river on which they occur and in the severity of flooding. Small-river, Transitional, and Major-river Floodplain Forests can be viewed as points on a continuum from least severely scoured and poorly drained (small-river type) to most severely scoured and well-drained (major-river type). Mixes of floodplain forest communities can occur as a riparian community complex at a single site. For example, a Major-river Floodplain Forest might occur on a level floodplain with small-river vegetation along tributaries entering the major-river floodplain, High-terrace Floodplain Forests on abandoned river terraces above the active floodplain, and Alluvial Red Maple Swamps in poorly drained, seasonally flooded depressions within the level floodplain, with associated High-energy Riverbanks on well-scoured, riverine gravel bars. Major-river Floodplain Forests occur along mainstem sections of large rivers (the Connecticut, Housatonic, and Deerfield Rivers in Massachusetts). Soils are predominantly sandy loams without soil mottles and without a surface organic layer. Flooding at these sites is usually severe. Transitional Floodplain Forests occur on third-order or smaller tributaries of the Connecticut River, on portions of the Housatonic River, and in depressions within Major-river Floodplain Forests of the Connecticut and Deerfield Rivers. Soils are intermediate in severity of flooding, soil texture, and drainage between Major-river and Small-river Floodplain Forests. Soils are either silt loams or very fine sandy loams, and soil mottling is generally present within 60 cm (2 ft.) of soil surface. A surface organic layer is typically absent. Small-river Floodplain Forests occur on third-order or smaller tributaries of the Connecticut and Nashua Rivers, on small rivers of eastern Massachusetts where banks are low and overbank flooding occurs (Ipswich, Assabet, Concord, Shawsheen, and Three Mile rivers), and on edges of riverine islands of the Merrimack River. Annual flooding occurs, but the water volume and degree of scour are much less than in Major-river Floodplain Forests. Soils are hydric silt loams and fine sandy loams with soil mottling within the top 60 cm (2 ft.) and sometimes with a surface organic layer. Major-river Floodplain Forests are the least likely type of floodplain forest to have shrubs, or even saplings of the canopy trees. The herbaceous layer of the major-river types is often essentially a monoculture of wood nettles, sometimes with dense ostrich fern. Other species are

scattered. Occurrences of High-terrace Floodplain Forests tend to be relatively small narrow forests on high alluvial terraces that flood only occasionally (not annually) and for a shorter duration than other types of floodplain forests. They are sometimes seen as a hybrid between floodplain and upland forests, and include upland species lacking in other types of floodplain forest. They have more litter accumulated than other floodplain forests. Alluvial Red Maple Swamps along low-gradient rivers flood annually and are slow to drain. Silver maple is often a codominant with red maple. They have dense shrub and diverse herbaceous layers. Alluvial Hardwood Flats are along small streams that have multiple short flooding events throughout the year after storms. Black cherry and white pine are usually abundant in the canopy with red maple, but not silver maple.

Associated Fauna: Floodplain forests are often part of the habitat of wide-ranging riverine and upland animals, providing sheltered riverside corridors for deer and migratory songbirds. Floodplain forests are insect-rich habitats that attract warblers, thrushes, and other songbirds. Raptors such as Bald Eagles use riverbank trees as nest and perch sites. In spring floods, Wood Ducks and Hooded Mergansers like the shady edges of floodplain forests and the interior meander scar pools. Eastern comma butterflies feed on elm, nettles, and hops, and the shady riverbanks are patrolled by several dragonfly species such as ocellated and fawn darners. Where vernal pools occur in floodplain forests, such as in meander scars or backwater sloughs, leopard, pickerel and green frogs, American toads, and mole salamanders can be found. Changes in water quality and quantity alter herbaceous, and eventually tree, species, changing habitat for birds and browsers such as deer and rabbits.

Public Access: Fannie Stebbins Memorial Wildlife Refuge, Longmeadow; Rainbow Beach WMA, Northampton; Robinson State Park, Agawam; George L. Darey Housatonic Valley WMA, Pittsfield; Canoe Meadows Wildlife Sanctuary (Massachusetts Audubon Society), Pittsfield.

Threats: Current threats include alteration of natural hydrology through damming, loss of vegetated buffer, disturbance by trail cutting and the subsequent invasion of non-native plant species. In a 1997 statewide floodplain forest community inventory, non-native plant species were observed at all floodplain forest sites surveyed, but they appeared to be localized to areas where the canopy was opened, the herbaceous layer was cleared, and the soil was disturbed. Non-native plant species were most abundant in the island variants of Major-river Floodplain Forests that are heavily used by campers and boaters for recreation. Japanese knotweed (*Fallopia japonica*) currently poses the greatest threat to Major-river Floodplain Forests because of its ability to spread rapidly and shade out all other herbaceous plants.

Management Needs: The natural hydrologic regime that created these special communities and their natural closed-canopy forest structure must be maintained. It is extremely difficult and time-consuming to eradicate Japanese knotweed once it has established. The best way to avoid its spread is to prevent its establishment by avoiding all clearing and disturbance within floodplain forest areas, particularly on the sandier banks.

USNVC/NatureServe: *Acer saccharinum* Temporarily Flooded Forest Alliance -- *Acer saccharinum-Populus deltoides*/*Matteuccia struthiopteris* Forest [CEGL006147].

Northern Atlantic White Cedar Swamp

Community Code: CP1B1A3000

State Rank: S1

Concept: A variant of spruce swamps in which Atlantic white cedar is an associate in the tree canopy.

Environmental Setting: Northern Atlantic White Cedar Swamps are restricted to basins at high elevations, over 1100 feet, the highest known elevation for Atlantic white cedar in the state. As with all Atlantic white cedar swamps, water-saturated peat overlies the mineral sediments, and standing water generally occurs for half of the growing season or longer. The water and soil are nutrient-poor, and particularly low in nitrogen and phosphorus. There is a high iron content in the soil; the iron (called "bog iron") was mined in the early days of manufacturing. Soil pH is acidic (3.1-5.5) and leaf litter decomposition is slow.

Vegetation Description: Atlantic white cedar swamps are defined as having >25% cover of Atlantic white cedar in the canopy; Atlantic white cedar is usually mixed with red maple (*Acer rubrum*). Most Atlantic white cedar swamp occurrences include highbush blueberry (*Vaccinium corymbosum*) and swamp azalea (*Rhododendron viscosum*). The ground layer is dominated by *Sphagnum* spp. mosses. Northern Atlantic White Cedar Swamps are dominated by northern conifers such as black and red spruce (*Picea mariana* and *P. rubens*) and balsam fir (*Abies balsamea*); Atlantic white cedar occurs as an associate. Shrubs and herbs also include species of cool northern areas, such as mountain holly (*Ilex mucronata*), creeping snowberry (*Gaultheria procumbens*), and bunchberry (*Chamaepericlymenum canadense*) (also found in the high-elevation variant of Inland Atlantic White Cedar Swamp). Labrador tea (*Rhododendron groenlandicum*) and rhodora (*Rhododendron canadense*) are

common in the single documented Northern Atlantic White Cedar Swamp occurrence.

Differentiating Occurrences: Although each of the Atlantic white cedar swamp community types has a characteristic vegetation structure and composition, as with all natural communities, transitions and mixes do occur. Northern Atlantic White Cedar Swamps are restricted to basins at high elevations with the single documented example at >1100 ft. Northern Atlantic White Cedar Swamps are codominated by northern conifers such as black and red spruce (*Picea mariana* and *P. rubens*) and balsam fir (*Abies balsamea*). Shrubs and herbs include typically northern species such as Labrador tea (*Rhododendron groenlandicum*) and rhodora (*Rhododendron canadense*), as well as creeping snowberry (*Gaultheria hispidula*) and bunchberry (*Chamaepericlymenum canadense*), that also are found in high-elevation variant Inland Atlantic White Cedar Swamps. Inland Atlantic White Cedar Swamps typically occur at elevations <1000 ft. and lack the full set of northern species. Red Spruce Swamps may occur near Northern Atlantic White Cedar Swamps, but red spruce (*Picea rubens*) is dominant in the overstory and Atlantic white cedar is seldom present, and then <25% canopy cover. Atlantic White Cedar Bogs are relatively open peatland communities with tree canopy cover <25%. They may have scattered black spruce, but lack red spruce.

Associated Fauna: Atlantic white cedar swamps contribute variation to the habitats of wide-ranging wildlife species. Young Atlantic white cedar thickets provide excellent cover for deer, rabbits and birds. Atlantic white cedar foliage and twigs are preferred winter browse for white-tailed deer, while rabbits and mice can feed on cedar seedlings. Although no bird species appear to be restricted to Atlantic white cedar communities, dense conifer forests are important bird habitat. Swamps function as vernal pool habitat if water remains standing for 2-3 months and they lack fish; these areas provide important amphibian breeding habitat.

Public Access: Westminster State Forest, Westminster.

Threats: The two greatest threats to Atlantic white cedar swamps are land clearing for agricultural, commercial and residential development, and interference of normal hydrological functioning as a result of development. Atlantic white cedar has been cut extensively for posts and shingles for over three centuries. In an extensive statewide vegetation inventory funded by NHESP in 1990, no uncut stands were found, but several sites contained cedars that were 100-200 years old. Selective cutting is detrimental to the persistence of Atlantic white cedar swamps, because hardwoods, such as red maple, out-compete and replace Atlantic white cedar. Any alteration to the natural hydroperiod of Atlantic white cedar swamps threatens their persistence.

Management Needs: Due to the limited distribution of Atlantic white cedar swamps, it is recommended that no clearing or filling of these wetlands be allowed. Atlantic white cedar will regenerate best following catastrophic disturbance events such as hurricanes and fires. Data suggest that in the absence of disturbance, red maple and shrubs

increase in abundance at the expense of Atlantic white cedar. Fire suppression negatively threatens the long-term persistence of Atlantic white cedar swamps, and controlled burning practices may be an appropriate restoration tool in many areas. Controlled burning should be accompanied by small-patch clearcuts to be most effective. By clear-cutting small patches, generally 20 m x 20 m, and removing the slash and competing vegetation, pure, even-aged stands of Atlantic white cedar are able to regenerate. Atlantic white cedar swamps require a natural cycle of wet and dry periods for their survival and reproduction. Standing water for much of the year is unfavorable for both seed germination and seedling survival, and young seedlings are killed by both drowning and drought. It is recommended that any alterations in water levels be avoided; this includes development and road construction in uplands surrounding Atlantic white cedar swamps which can alter water levels. Where cedar wetlands are associated with river systems, it is important to maintain the normal hydrologic regime of the river.

USNVC/NatureServe: *Chamaecyparis thyoides* Northern Peatland Alliance [A3400] -- *Chamaecyparis thyoides-Picea rubens*/*Gaylussacia baccata*/*Gaultheria hispidula* forest [CEGL006363].

Red Maple – Black Ash – Bur Oak Swamp

Community Code: CP1B2B1000

State Rank: S2

Concept: Deciduous swamp forest occurring in areas with somewhat enriched circumneutral groundwater. The tree canopy is close to continuous.

Environmental Setting: Red Maple - Black Ash - Bur Oak Swamps are forested wetland communities on flat but hummocky terrain, characterized by a generally closed (but varying from continuous to scattered) canopy at 60 ft. or higher. The hummock - hollow topography supports a variety of species from herbaceous emergents in the hollows to shrubs and trees on the hummocks. The community occurs in western Massachusetts within the eastern edge of the range of bur oak, where somewhat nutrient-enriched circumneutral, but not calcareous, groundwater occurs. Soils are a mucky mix of mineral and organic, silt and sandy loams, with pH ranges generally 5.1 to 7.3. The sediments are saturated throughout the year; in the spring hollows are filled with water but by late summer many have dried to bare surfaces or leaf litter, supporting plants tolerant of the changing moisture regime.

Vegetation Description: The canopy is a variable mixture of deciduous and occasionally coniferous trees. Red maple (*Acer rubrum*), black ash (*Fraxinus nigra*), and bur oak (*Quercus macrocarpa*) are the most common. Swamp white oak and white oaks (*Q. bicolor* and *Q. alba*) are present and hybridize with bur oak. Associated tree species include green ash (*F. pennsylvanica*), slippery and American elms (*Ulmus rubra* and *U. americana*), sugar maple (*A. saccharum*), and yellow birch (*Betula alleghaniensis*). When present, eastern hemlock (*Tsuga canadensis*), tamarack (*Larix laricina*), and white pine (*Pinus strobus*) are generally scattered, but sometimes locally abundant. The subcanopy has a similar composition, often dominated by black ash. The shrub layer is generally patchy, with highbush blueberry (*Vaccinium corymbosum*),

winterberry (*Ilex verticillata*), hornbeam (*Carpinus caroliniana*), and black ash, with witch-hazel (*Hamamelis virginiana*) and spicebush (*Lindera benzoin*) near the edges. The herbaceous layer is variable and moderately diverse although dominated by tussock sedge (*Carex stricta*) and skunk cabbage (*Symplocarpus foetidus*). Other typical herbaceous layer species are common horsetail (*Equisetum arvense*), awned sedge (*Carex crinita*), sensitive fern (*Onoclea sensibilis*), cinnamon fern (*Osmunda cinnamomea*), royal fern (*Osmunda regalis*), foamflower (*Tiarella cordifolia*), goldthread (*Coptis trifolia*), marsh marigold (*Tiarella cordifolia*), and northern blue flag (*Iris versicolor*). Poison sumac (*Toxicodendron vernix*) is uncommon. Even in open areas, true calciphiles (calcium-loving) species are absent. Invasive species established in areas of past disturbances include the aggressive exotics Japanese barberry (*Berberis thunbergii*), glossy buckthorn (*Frangula alnus*), and phragmites (*Phragmites australis*).

Differentiating Occurrences: Red Maple - Black Ash - Bur Oak Swamps are similar in structure and species composition to Red Maple - Black Ash Swamps), but bur oak swamps occur in Berkshire County near marble/limestone bedrock and black ash swamps occur east of Berkshire County. Both are forested wetlands with fairly closed canopies, but only the bur oak swamps have bur oak or bur oak/swamp white oak hybrids. A detailed study would be needed to determine other differences or similarities between the two community types. Bur oak swamps are often geographically close to Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps (calcareous seepage swamps); however, bur oak swamps are more forest-like with taller trees and more closed canopies, with stands of bur oak or bur oak/swamp white oak hybrids more likely than in calcareous seepage swamps. The clearest differentiation may be that even in openings, bur oak swamps do not have the strong calciphiles found in calcareous seepage swamps. (Calciphiles include shrubby cinquefoil (*Dasiphora floribunda*), grass-of-Parnassus (*Parnassia glauca*), Kalm's lobelia (*Lobelia kalmii*), alder-leaf buckthorn (*Rhamnus alnifolia*), hemlock parsley (*Conioselinum chinense*), autumn and hoary willows (*Salix serissima* and *S. candida*), and slender cotton-grass (*Eriophorum gracile*).

Associated Fauna: Swamps can function as vernal pool habitat if water remains standing for 2-3 months and they lack fish; these areas provide important amphibian breeding habitat.

Public Access: George L. Darey Housatonic Valley WMA, Lenox.

Threats: Logging, alteration of water levels, and invasive species are the primary threats. Beavers and windthrow are locally dominant processes that could lead to a shift to a shrubland if canopy dominants are not able to regenerate. Invasive species are established in areas of disturbances such as canopy opening and water level changes, including the aggressive exotics Japanese barberry (*Berberis thunbergii*), glossy buckthorn (*Frangula alnus*) and phragmites (*Phragmites australis*).

Management Needs: Removal/control of non-native plant species.

USNVC/NatureServe: *Fraxinus nigra - Acer rubrum* Saturated Forest Alliance: CEGL006502 *Acer rubrum - Fraxinus nigra* - (*Tsuga canadensis*)/*Tiarella cordifolia* Forest. Related to *Acer rubrum - Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance CEGL006630: *Acer (rubrum, saccharinum*) - *Fraxinus pennsylvanica*/*Ilex verticillata*/*Osmunda regalis*/Forest and Midwestern CEGL002098- *Quercus macrocarpa - Quercus bicolor - Carya laciniosa*/*Leersia* spp.- *Cinna* spp. Forest.

Red Maple – Black Ash – Tamarack Calcareous Seepage Swamp

Community Code: CP1B2B0000

State Rank: S2

Concept: Mixed deciduous-coniferous forested swamps with a sparse canopy occurring in areas where there is calcareous groundwater seepage. The species-rich herbaceous layer is characterized by calcium-loving species. Calcareous seepage swamps can also be called forested fens.

Environmental Setting: Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps are wetland forests characterized by fairly short and sparse deciduous and coniferous trees and a diverse mix of shrub and herbaceous species. There are relatively high pH levels and high availability of calcium from surrounding limestone bedrock and soils. Distinctive characteristics include the presence of trees and high numbers of calcium-loving species. Otherwise, they grade into other types of wetlands and calcareous communities. These swamps generally occur in basins, but may have streams flowing through or adjacent to them. Soils usually have up to 12 inches of mucky organic material over mineral layers. Generally, the surface has a hummocky topography from tree tip-up mounds and mosses growing over shrub stems. The canopy may be open or somewhat closed with openings, so that light availability to the surface is variable across an occurrence.

Vegetation Description: A variable mixture of deciduous and coniferous trees forms the sparse canopy, but black ash (*Fraxinus nigra*), tamarack (*Larix laricina*), and red maple (*Acer rubrum*) are most common. Associated tree species may include yellow birch (*Betula alleghaniensis*), American elm (*Ulmus americana*), white pine (*Pinus strobus*), and eastern hemlock (*Tsuga canadensis*), depending on the site. At elevations above ~1000 ft., red spruce (*Picea rubens*), balsam fir (*Abies balsamea*), and Canada yew (*Taxus canadensis*) can also occur. Ironwood (*Carpinus caroliniana*) is characteristic

of the subcanopy. The shrub layer can be dense and diverse. Characteristic species are poison sumac (*Toxicodendron vernix*) and alder-leaf buckthorn (*Rhamnus alnifolia*), mixed with speckled alder (*Alnus rugosa*), gray dogwood (*Swida racemosa*), winterberry (*Ilex verticillata*), spicebush (*Lindera benzoin*), meadowsweet (*Spiraea alba* var. *latifolia*), and highbush blueberry (*Vaccinium corymbosum*). Shrubby cinquefoil (*Dasiphora floribunda*) often occurs in open areas. The herbaceous layer is diverse with many calciphilic (calcium-loving) species mixed in with other common wetland plants. Characteristic calciphiles are delicate sedge (*Carex leptalea*), brome-like sedge (*Carex bromoides*), long-stalked sedge (*Carex pedunculata*), rough-leaved goldenrod (*Solidago patula*), and golden ragwort (*Packera aurea*). Widespread species that usually occur in the herbaceous layer are skunk cabbage (*Symplocarpus foetidus*), sensitive fern (*Onoclea sensibilis*), royal fern (*Osmunda regalis*), jewelweed (*Impatiens capensis*), naked mitrewort (*Mitella nuda*), and additional sedges such as lakeside sedge (*Carex lacustris*). At one site, more than 80 species were counted in the herbaceous layer. This community type also has a concentration of state-protected rare plant species.

Differentiating Occurrences: This calcareous seepage swamp is more of a sparse wet woodland than related swamps, but it is shrubbier with more scattered low trees than most calcareous fens. All calcareous wetlands include shrubby cinquefoil (*Dasiphora floribunda*). Most also have other calciphiles (calcium-loving plants) such as grass-of-Parnassus (*Parnassia glauca*), Kalm's lobelia (*Lobelia kalmii*), hemlock parsley (*Conioselinum chinense*), alder-leaf buckthorn (*Rhamnus alnifolia*), autumn and hoary willows (*Salix serissima* and *S. candida*), and slender cotton-grass (*Eriophorum gracile*). Within a given site, calcareous fen communities grade from one to another as conditions change. Red Maple - Black Ash -Tamarack Calcareous Seepage Swamps are dominated by sparse trees and tall shrubs. Small openings share many of the species and conditions of Calcareous Sloping Fens or Calcareous Seepage Marshes, either or both of which may occur in mosaics in the same wetland. Calcareous Seepage Marshes lack the tree cover of the calcareous seepage swamps. They share species with both Shallow and Deep Emergent Marshes, but contain more calciphiles. Calcareous Sloping Fens may have tall shrubs and short trees in scattered patches. A diverse herbaceous layer dominates the vegetation. They are on shallow to moderate slopes and peat is mostly restricted to sedge hummocks. Calcareous Basin Fens have deep (> 2.0 meters (6.5 ft.)) peat in basins. They are dominated by sedges with a sparse shrub layer; they generally contain a more developed bryophyte layer than the other calcareous fens. Red Maple - Black Ash - Bur Oak Swamps and Red Maple - Black Ash Swamps have more closed canopies and do not have the strong calciphiles found in the Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps. Stands of bur oak or bur oak/swamp white oak hybrids are more likely in Red Maple - Black Ash - Bur Oak Swamps than calcareous seepage swamps. Rich Conifer Swamps are high-elevation (>1000 ft.) forested wetlands that often include some calciphiles and other species found in calcareous seepage swamps but contain significant amounts of red spruce (*Picea rubens*) and/or balsam fir (*Abies balsamea*).

Associated Fauna: Calcareous seepage swamps can function as vernal pool habitat if water remains standing for 2-3 months and they lack fish; these areas provide important amphibian breeding habitat.

Public Access: Due to the sensitivity of calcareous wetlands to damage from visitation, most land owners prefer not to publicize the locations.

Threats: Logging, nutrient inputs such as road salts, damming by beavers, and alterations of water levels threaten this community. Water level disturbance can lead to the invasion by non-native plants, including the aggressive exotics purple loosestrife (*Lythrum salicaria*), Tatarian honeysuckle (*Lonicera tatarica*), and Morrow's honeysuckle (*Lonicera morrowii*). Phragmites (*Phragmites australis*) is also an aggressive exotic in disturbed forested fens.

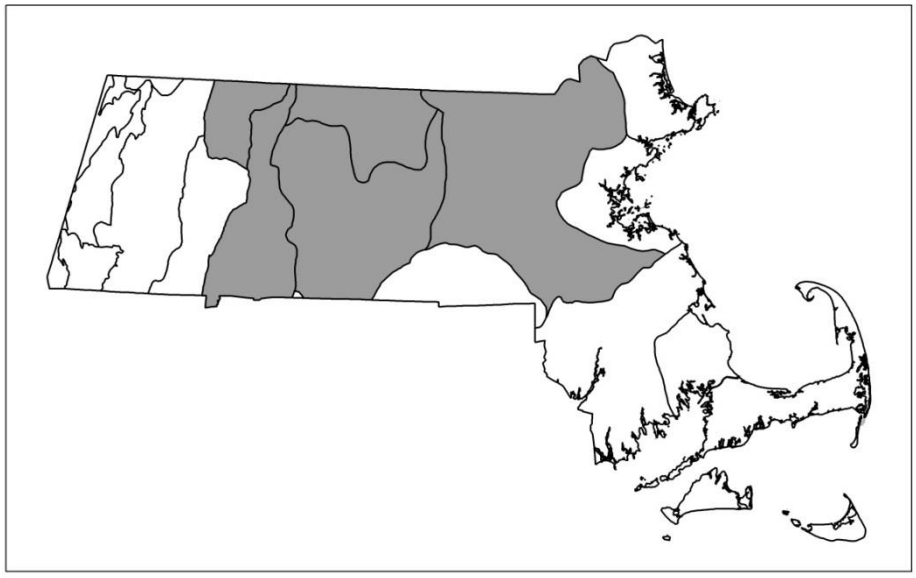
Management Needs: Removal/control of non-native plant species, especially phragmites.

USNVC/NatureServe: *Fraxinus nigra - Acer rubrum* Saturated Forest Alliance -- *Fraxinus nigra-Acer rubrum*-(*Larix laricina*)/*Rhamnus alnifolia* Forest [CEGL006009].

Red Maple – Black Ash Swamp

Community Code: CP1A2A2000

State Rank: S2



Concept: A rich variant of Red Maple Swamps in which black ash (*Fraxinus nigra*) is abundant in the canopy. Red Maple - Black Ash Swamps are associated with circumneutral groundwater seepage.

Environmental Setting: Red Maple - Black Ash Swamps are deciduous wetland forests characterized by a high diversity of tree species and dominated by red maple and black ash, with a relatively diverse herbaceous layer and many tall shrubs in the understory. They typically occur in areas with circumneutral groundwater seepage (the pH of black ash swamps in Essex County ranges between 7.0 and 7.4) and are relatively wet with seasonal inundation in depressions at or near the headwaters of streams, especially in the northern part of the state. Occasionally, they occur on sloping edges of river floodplains, adjacent to upland slopes where seepage input occurs or as small seepy pockets within larger Red Maple Swamp matrices. The surface topography is hummock and hollow, with fluctuating surface water levels in between the hummocks.

Vegetation Description: Red maple (*Acer rubrum*) and black ash (*Fraxinus nigra*) are prominent in the canopy and sub-canopy. Black ash trees do not usually grow very large in these wet environments and can be most abundant in the subcanopy. Common associates in the canopy include yellow birch (*Betula alleghaniensis*), white pine (*Pinus strobus*), and hemlock (*Tsuga canadensis*), all of which vary in abundance from site to site. The subcanopy is characterized by black ash and often American elm (*Ulmus americana*), with saplings of canopy tree species. The shrub layer is variable in cover, although relatively high in species diversity. The most characteristic shrub encountered in these swamps is winterberry (*Ilex verticillata*). Other common

associates include highbush blueberry (*Vaccinium corymbosum*), poison sumac (*Toxicodendron vernix*), speckled alder (*Alnus incana* ssp. *rugosa*), and spicebush (*Lindera benzoin*). Occasional shrubs include witch-hazel (*Hamamelis virginiana*), silky dogwood (*Swida amomum*), northern arrow-wood (*Viburnum dentatum* var. *lucidum*), and mountain holly (*Ilex mucronata*). In addition, saplings of most of the tree canopy species are also present in the shrub layer. The herbaceous layer is lush and diverse. Cinnamon fern (*Osmundastrum cinnamomeum*) and skunk cabbage (*Symplocarpus foetidus*) are usually the most abundant herbaceous species, with a high coverage of other ferns, including royal fern (*Osmunda regalis* var. *spectabilis*), marsh-fern (*Thelypteris palustris*), and sensitive fern (*Onoclea sensibilis*). Herbaceous associates include seep indicators like swamp saxifrage (*Micranthes pensylvanica*), golden ragwort (*Packera aurea*), foamflower (*Tiarella cordifolia*), and golden saxifrage (*Chrysosplenium americanum*), as well as widespread forest wetland species such as jewelweed (*Impatiens capensis*), jack-in-the-pulpit (*Arisaema triphyllum*), water avens (*Geum rivale*), goldthread (*Coptis trifolia*), tussock sedge (*Carex stricta*), and fowl meadow-grass (*Glyceria striata*). Mosses (predominantly *Sphagnum* spp.), can be dense on the hummocks, although there is little buildup of peat.

Differentiating Occurrences: Red Maple - Black Ash Swamps (black ash swamps) are an enriched variant of Red Maple Swamps that are very similar in structure and general species composition. However, to be a black ash swamp, black ash must be of sufficient abundance to be close to codominant in the canopy/subcanopy in at least parts of the swamp; otherwise, the site would be considered to be within the variation of the broadly defined Red Maple Swamp which may include scattered black ash trees. Black ash swamps generally include more abundant indicators of enriched seepage than do Red Maple Swamps. Red Maple - Black Ash - Bur Oak Swamps (bur oak swamps) are similar in structure and species composition to Red Maple - Black Ash Swamps (black ash swamps), but bur oak swamps occur in Berkshire County near marble/limestone bedrock and black ash swamps occur east of Berkshire County. Both are forested wetlands with fairly closed canopies;, but only the bur oak swamps have bur oak (*Quercus macrocarpa*) or bur oak/swamp white oak (*Q. bicolor*) hybrids. They also have more ironwood (*Carpinus caroliniana*) in the tall shrub layer. Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps (calcareous seepage swamps) have sparser canopies than black ash swamps. The clearest difference may be that even in openings, black ash swamps do not have the strong calciphiles found in calcareous seepage swamps. Calciphiles include shrubby cinquefoil (*Dasiphora floribunda*), grass-of-Parnassus (*Parnassia glauca*), Kalm's lobelia (*Lobelia kalmii*), alder-leaf buckthorn (*Rhamnus alnifolia*), hemlock parsley (*Conioselinum chinense*), autumn and hoary willows (*Salix serissima* and *S. candida*), and slender cotton-grass (*Eriophorum gracile*).Rich Conifer Swamps also have closed canopies but with high proportions of eastern hemlock (*Tsuga canadensis*), red spruce (*Picea rubens*), or balsam fir (*Abies balsamea*) as important canopy species, along with variable amounts of hardwoods and white pine. Black ash is an occasional species rather than a co-dominant.

Associated Fauna: Red Maple - Black Ash Swamps can function as vernal pool habitat if water remains standing for 2-3 months and they lack fish; these areas provide important amphibian breeding habitat.

Public Access: Oxbow National Wildlife Refuge, Harvard; Tully Lake Reservation (US Army Corps of Engineers), Royalston; Satan's Kingdom WMA, Northfield; Mt. Holyoke Range State Park, South Hadley.

Threats: Known threats include alteration of natural seepage and logging. More information is needed to determine the greatest threats to black ash swamps.

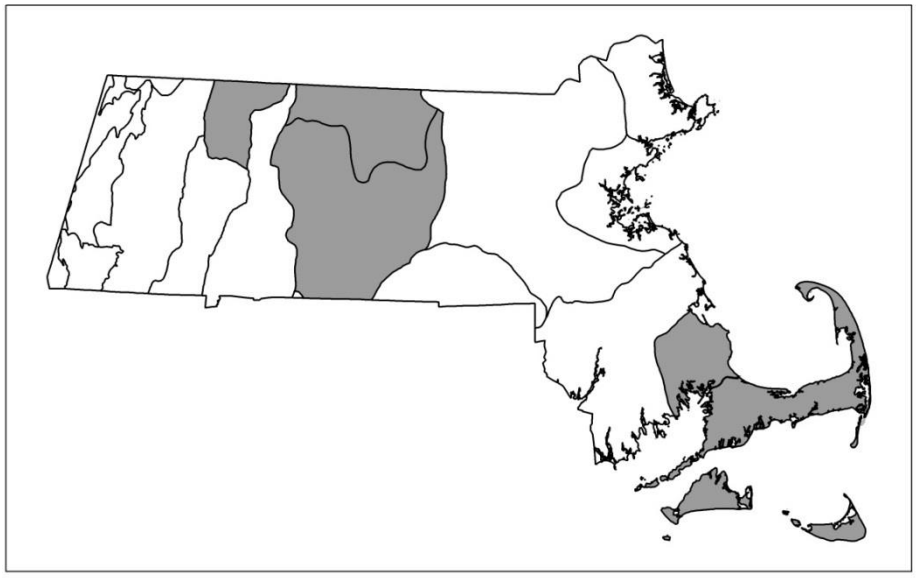
Management Needs: More information is needed to assess the management needs of black ash swamps.

USNVC/NatureServe: *Fraxinus nigra - Acer rubrum* Saturated Forest Alliance: *Acer rubrum - Fraxinus nigra* - (*Tsuga canadensis*)/*Tiarella cordifolia* Forest (CEGL006502); Related to: *Acer rubrum -Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance: *Fraxinus nigra-Acer rubrum*/*Nemopanthus mucronatus-Vaccinium corymbosum* Forest (CEGL006220).

Red Maple – Black Gum Swamp

Community Code: CP1B2A0000

State Rank: S2



Concept: Forested acidic basin swamps with accumulations of peat. Black gum is dominant or codominant with red maple in the canopy.

Environmental Setting: Red Maple - Black Gum Swamps (black gum swamps) are small-patch deciduous swamp forests characterized by abundant black gum (*Nyssa sylvatica*) in the canopy. Some black gum swamps contain large, very old (300 to > 500 years) black gum trees, left behind during tree harvests due to lack of interest in the wood by settlers and subsequent loggers. Black gum swamps in Massachusetts have relatively small watersheds and limited drainage with a small intermittent outlet channel, but usually have no defined inlet and are usually isolated from perennial streams. Most reported occurrences are in depressions at about 1000 ft. elevation, perched on hillside benches or concavities in glacial till soils. The acidic, nutrient-poor peat or muck hummocks and hollows are generally saturated and/or seasonally flooded.

Vegetation Description: Red Maple - Black Gum Swamps have pronounced hummock-hollow topography, with woody vegetation confined to the hummocks. The canopy is open, often in the 25-50% cover range. Black gum (*Nyssa sylvatica*) is abundant in the canopy, often codominant with red maple (*Acer rubrum*). Eastern hemlock (*Tsuga canadensis*) is often abundant. Associates with lower abundance include yellow birch (*Betula alleghaniensis*), white pine (*Pinus strobus*), red spruce (*Picea rubens*), and black ash (*Fraxinus nigra*). The shrub layer is often well-developed but is variable in cover; typical species include highbush blueberry (*Vaccinium corymbosum*), common and smooth winterberry (*Ilex verticillata* and *I. laevigata*), common mountain-holly (*I. mucronata*), mountain laurel (*Kalmia latifolia*), and wild raisin (*Viburnum nudum*

var. *cassinoides*). Cinnamon fern (*Osmundastrum cinnamomeum*) is usually the most abundant herbaceous species present, growing primarily on the mossy hummocks. Although the herbaceous component is generally not diverse, other species include royal fern (*Osmunda regalis* var. *spectabilis*), marsh-fern (*Thelypteris palustris*), Massachusetts fern (*Thelypteris simulata*), beggar-ticks (*Bidens frondosa*), goldthread (*Coptis trifolia*), northern water-horehound (*Lycopus uniflorus*), swamp-dewberry (*Rubus hispidus*), and marsh St. John's-wort (*Triadenum virginicum*). Wet hollows are typically lined with sedges including silvery bog-sedge (*Carex canescens*), bladder-sedge (*C. intumescens*), tussock-sedge (*C. stricta*), and three-seeded bog sedge (*C. trisperma*).

Differentiating Occurrences: Red Maple-Black Gum Swamps are generally in small, topographically constrained basins, surrounded by upland forests, as opposed to being part of a larger wetland. Besides being dominant or codominant in defined Red Maple - Black Gum Swamp communities, black gum occurs in a variety of other settings, including seepage swamps and along fringes of ponds or shorelines. Black gum needs to be dominant or codominant in large areas of the swamp for the occurrence to be considered a Red Maple - Black Gum Swamp. Red Maple Swamps: Black gum needs to be dominant or codominant in the canopy in large areas of the swamp for the community to be considered separate from a Red Maple Swamp. Most Red Maple Swamps have a more diverse herbaceous layer and many are in larger basins. However, the species overlap is great and it is the presence of many black gums in the canopy that provides the distinctive difference to black gum swamps. Another forested swamp in Massachusetts that contains black gum is the Black Gum-Pin Oak-Swamp White Oak Perched Swamp known only from the Connecticut River Valley in areas underlain by clays in sediments of glacial Lake Hitchcock. The presence of pin oak and swamp white oak in the canopy, in addition to the topographic setting distinguish the type. This Perched swamp is found at low elevations and often nested within larger wetland systems. Other related communities include Red Maple- Black Ash Swamps and Rich Conifer Swamps. These wetland forests have many of the same species present in the herb, shrub, or canopy layers, but black gum is only a minor component.

Associated Fauna: Red Maple - Black Gum Swamps can function as vernal pool habitat if water remains standing for 2-3 months and they lack fish; these areas provide important amphibian breeding habitat.

Public Access: Oakham WMA, Oakham; Satan's Kingdom WMA, Northfield; Beebe Woods Conservation Area, Falmouth.

Threats: Hydrologic alterations threaten black gum swamps. Selective logging of trees other than black gum may have allowed the relative abundance of black gum to increase. More information is needed.

Management Needs: More information is needed to assess the management needs for black gum swamps.

USNVC/NatureServe: *Acer rubrum* - *Nyssa sylvatica* Saturated Forest Alliance -- *Acer rubrum-Nyssa sylvatica-Betula alleghaniensis/Sphagnum* spp. Forest [CEGL006014] and *Acer rubrum* - *Nyssa sylvatica/Rhododendron viscosum* - *Clethra alnifolia* Forest [CEGL006156].

Red Maple Swamp

Community Code: CP1A2A1000

State Rank: S5

Concept: Acidic forested swamps with red maple dominant in the overstory. Red Maple Swamps are the most common forested wetlands in Massachusetts.

Environmental Setting: Red Maple Swamps occur in many different physical settings. Golet et al. (1993) describe three basic types: hillside seeps and upland drainage ways fed primarily by groundwater seepage and overland flow; seasonally flooded basin swamps in undrained basins in till or stratified drift (or low-lying areas in outwash as on Cape Cod); and alluvial swamps on low-lying floodplains, oxbows, or river terraces. The last category is classified separately in Massachusetts; see the description for Alluvial Red Maple Swamp. Depending on the physical setting, Red Maple Swamps receive water through surface runoff, groundwater inputs, or stream and lake overflow. The hydrogeologic setting is the primary determinant of water regime and the plant community structure and composition. pH ranges from less than 4 to 7. Soils have shallow to thick organic layers overlying mineral sands/silts.

Vegetation Description: Red maple (*Acer rubrum*) is usually strongly dominant in the overstory, and often provides more than 90% of the canopy cover. A variable mixture of tree species co-occurs with red maple, including yellow birch (*Betula alleghaniensis*), black gum (*Nyssa sylvatica*), white ash (*Fraxinus americana*), white pine (*Pinus strobus*), American elm (*Ulmus americana*), hemlock (*Tsuga canadensis*), pin oak (*Quercus palustris*), and swamp white oak (*Quercus bicolor*). Atlantic white cedar (*Chamaecyparis thyoides*) is a common associate in coastal areas and locally at sites in central Massachusetts and the lower Connecticut Valley. When Atlantic white cedar is dominant in the overstory, the community is classified as an Atlantic white cedar swamp. The shrub layer of Red Maple Swamps is often dense and

well-developed, generally with >50% cover, but it can be variable. In eastern Massachusetts, sweet pepper-bush (*Clethra alnifolia*) and swamp azalea (*Rhododendron viscosum*) are the dominant shrubs, often dense and bound together by greenbriers (mainly *Smilax rotundifolia*). Other common shrubs are highbush blueberry (*Vaccinium corymbosum*) and common winterberry (*Ilex verticillata*), which are often dominant, along with spicebush (*Lindera benzoin*). In richer areas, northern arrow-wood (*Viburnum dentatum* var. *lucidum*), speckled alder (*Alnus incana* ssp. *rugosa*), nannyberry (*Viburnum lentago*), and poison sumac (*Toxicodendron vernix*) also occur. The herbaceous layer is highly variable, but ferns are usually abundant. Cinnamon fern (*Osmundastrum cinnamomeum*) is common; other ferns include sensitive fern (*Onoclea sensibilis*), royal fern (*Osmunda regalis*), marsh fern (*Thelypteris palustris*), and spinulose wood fern (*Dryopteris carthusiana*). Skunk cabbage (*Symplocarpus foetidus*) is one of the most common herbaceous species. Graminoids are common, mixed with a variety of herbaceous species. Variants of Red Maple Swamps associated with groundwater seepage usually have a richer flora than depressional occurrences, with multiple species mixed in the canopy and an even more diverse herbaceous layer.

Differentiating Occurrences: Red Maple Swamp is a broadly defined red maple-dominated community type. Several fairly distinctive types have been defined separately. Alluvial Red Maple Swamps occur along low-gradient rivers and receive river flood waters. Silver maple is often a codominant with red maple. Alluvial Hardwood Flats are along small, flashy streams, usually have black cherry and white pine abundantly in the canopy, and have ironwood and alternate-leaved dogwood mixed with other shrub species. Red Maple - Black Ash Swamps are an enriched variant of Red Maple Swamps, with black ash close to codominant in the canopy/subcanopy in at least parts of the swamp. Red Maple - Black Ash - Bur Oak Swamps occur in Berkshire County and have bur oak or bur oak/swamp white oak hybrid trees. Red Maple - Black Gum Swamps are generally in small, topographically constrained basins surrounded by upland forests. Black gum needs to be abundant in large areas of the swamp. Black Gum - Pin Oak - Swamp White Oak Perched Swamps occur in the Connecticut River Valley on glacial Lake Hitchcock lakebed sediments. The presence of fairly high proportions of black gum, pin oak, and swamp white oak in the canopy, in addition to the topographic setting, distinguish the type. When Atlantic white cedar is dominant in the overstory, the community is classified as an Atlantic white cedar swamp.

Associated Fauna: Red Maple Swamps contribute variation to the habitats of many wide-ranging wildlife species. Songbirds of swamp forest are similar to the birds of structurally similar upland forests, but the dense shrub layers provide excellent nesting locations for birds of thickets. The amount of escape cover and water availability makes swamps important habitat for many species of small mammals. Ground-dwelling species, such as reptiles and amphibians, are affected by the presence of wet or moist soils in swamps, and tend to use them for breeding and feeding. Parts of Red Maple Swamps that have two or three months of ponding and

lack fish can function as vernal pools; these sections provide important amphibian breeding habitat.

Public Access: Red Maple Swamps literally occur state-wide. Because they are so widespread and abundant, NHESP does not usually keep track of occurrences. Examples on public lands from the NHESP database are in the Quaboag WMA, West Brookfield, and Haskell Swamp WMA, Rochester.

Threats: Conversion to agriculture; filling for development and highway construction; upland development adjacent to swamps impacting normal hydrology and geochemistry.

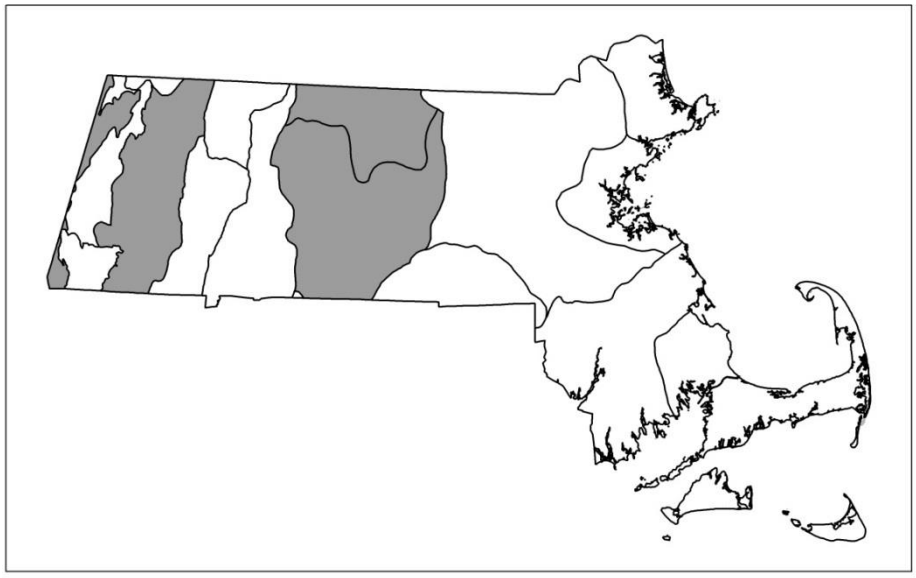
Management Needs: Control of glossy buckthorn (*Frangula alnus*).

USNVC/NatureServe: *Acer rubrum*/*Nemopanthus mucronatus* - *Vaccinium corymbosum* Forest (CEGL006220); *Acer rubrum*/*Carex stricta* - *Onoclea sensibilis* Woodland (CEGL006119; *Acer rubrum*/*Carex lacustris* Woodland (CEGL006105).

Red Spruce Swamp

Community Code: CP1A11A000

State Rank: S3



Concept: Forested wetlands, primarily of high elevations in western and north-central Massachusetts, dominated by red spruce.

Environmental Setting: Red Spruce Swamps are tall (>20 m) forested coniferous wetlands, typically found at higher elevations in the central and western parts of the state. They tend to occur in poorly drained basins with no obvious inlets and small intermittent outlets that may form stream headwaters. Deep (often >2m) organic sediments (peat or muck) in these swamps create acidic and nutrient-poor conditions.

Vegetation Description: The tree canopy in Red Spruce Swamps is typically closed and dominated by red spruce (*Picea rubens*); associates with variable but much lower abundance include white pine (*Pinus strobus*), eastern hemlock (*Tsuga canadensis*), balsam fir (*Abies balsamea*), red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*), and yellow birch (*Betula alleghaniensis*). Black spruce (*Picea mariana*) may be present in low numbers. The subcanopy is usually low in percent cover and may be comprised of one or more of the canopy species. The shrub component is often fairly sparse and grows primarily on the tops and sides of the hummocks. A diagnostic shrub of these swamps is mountain holly (*Ilex mucronata*). Associated shrubs may include highbush blueberry (*Vaccinium corymbosum*), wild raisin (*Viburnum nudum* var. *cassinoides*), winterberry (*Ilex verticillata*), and occasionally swamp azalea (*Rhododendron viscosum*) or maleberry (*Lyonia ligustrina*). The herb layer may be prominent and dominated by cinnamon fern (*Osmundastrum cinnamomeum*) with bluebead-lily (*Clintonia borealis*), creeping snowberry (*Gaultheria hispidula*), Massachusetts fern (*Thelypteris simulata*), goldthread (*Coptis trifolia*), bunchberry (*Chamaepericlymenum canadense*), and small amounts of three-seeded bog sedge

(*Carex trisperma*). On the drier hummocks, starflower (*Lysimachia borealis*) and wild sarsaparilla (*Aralia nudicaulis*) may occur in small amounts. The ground is often a carpet dominated by sphagnum moss and the liverwort *Bazzania trilobata*.

Differentiating Occurrences: Red Spruce Swamps have tall, large-diameter trees, dominated by red spruce, generally with an open understory. Creeping snowberry (*Gaultheria hispidula*) and twinflower (*Linnaea borealis* ssp. *americana*) are good indicators of Red Spruce Swamps but do not occur in all examples. Rich Conifer Swamps are characterized by a canopy of mixed red spruce and hemlock, with balsam fir and deciduous trees including black ash (*Fraxinus nigra*), and species such as spicebush (*Lindera benzoin*) that indicate less acidic conditions, and pockets of moss rather than sphagnum lawns. Hemlock Swamps are dominated by eastern hemlock. Spruce - Tamarack Bogs have a dense tree canopy dominated by generally short (<40' tall) black spruce (*P. mariana*) and tamarack (*Larix laricina*), with bog-indicator species such as Labrador tea (*Rhododendron groenlandicum*) and bog laurel (*Kalmia polifolia*) in the often dense shrub layer.

Associated Fauna: Red Spruce Swamps are part of the habitat of large mobile animals. Conifer swamps tend to have dense shade and are relatively cool in the summer, making them preferred areas for animals that get hot, such as moose (*Alces alces*). Red Spruce Swamps can function as vernal pool habitat for amphibian breeding if water remains standing for 2-3 months and they lack fish. Also expected would be northern bird species that use conifer forests such as the declining Rusty Blackbird (*Euphagus carolinus*).

Public Access: Greylock State Reservation, Williamstown; Chalet WMA, Dalton; October Mountain State Forest, Washington; Cookson State Forest, New Marlborough; Warwick State Forest, Warwick; Tully Lake Reservation (US Army Corps of Engineers) and Birch Hill WMA, Royalston; Phillipston WMA, Phillipston; Ashburnham State Forest, Ashburnham.

Threats: Climate change; altered hydrology.

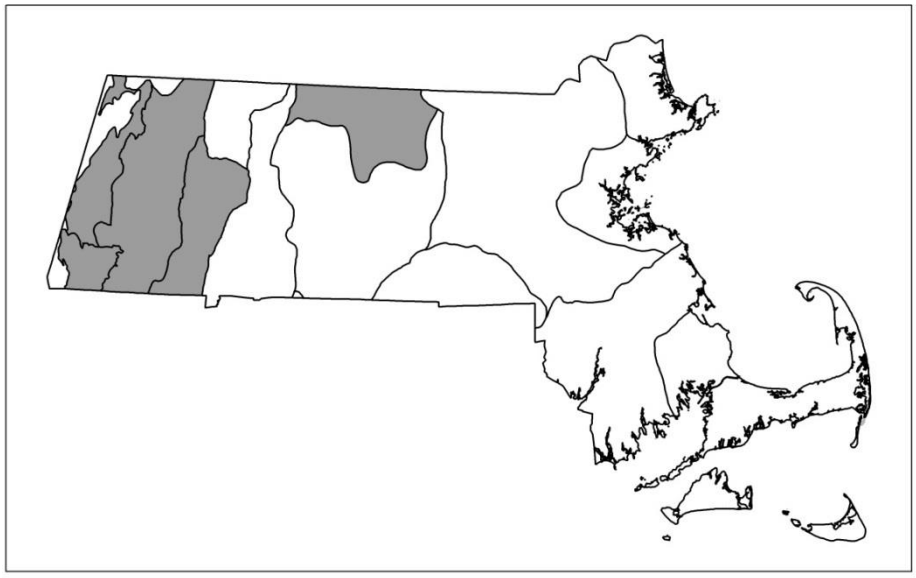
Management Needs: Timber harvesting should be prohibited at some sites to allow old-growth characteristics to develop.

USNVC/NatureServe: *Picea rubens - Abies balsamea* Saturated Forest Alliance -- *Picea rubens-Abies balsamea/Gaultheria hispidula/Sphagnum* spp. [CEGL006312]; *Picea rubens - Acer rubrum/Nemopanthus mucronatus* Forest [CEGL006198].

Rich Conifer Swamp

Community Code: CP1A130000

State Rank: S3



Concept: Species-rich conifer swamps with eastern hemlock, balsam fir, or red spruce as important canopy species, along with variable amounts of hardwoods and white pine.

Environmental Setting: The canopies of Rich Conifer Swamps are dominated by mixed conifers with a high proportion of deciduous trees. Mineral-enriched water flows or seeps into the community and supports a high diversity of species in all strata. The surface is hummocky with areas of moss on the hummocks and bare soil or water in the hollows. Most plants grow on hummocks above deep pockets of muck. The substrate is saturated for much of the year.

Vegetation Description: The vegetation of Rich Conifer Swamps is variable. The canopy is dominated by conifers (eastern hemlock (*Tsuga canadensis*), balsam fir (*Abies balsamea*), or red spruce (*Picea rubens*), alone or together) mixed with red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), American elm (*Ulmus americana*), and black ash (*Fraxinus nigra*). Species indicative of mineral-enriched conditions are typical in the understory. Dense patches in the shrub layer may include spicebush (*Lindera benzoin*), witch hazel (*Hamamelis virginiana*), or hornbeam (*Carpinus caroliniana*). The variable and diverse herbaceous layer may include jack-in-the-pulpit (*Arisaema triphyllum*), foamflower (*Tiarella cordifolia* var. *cordifolia*), lesser mitrewort (*Mitella nuda*), wild oats (*Uvularia sessilifolia*), oak-fern (*Gymnocarpium dryopteris*), slender mannagrass (*Glyceria melicaria*), delicate sedge (*Carex leptalea* ssp. *leptalea*), swamp-saxifrage (*Micranthes pensylvanica*), northern horse-balm (*Collinsonia canadensis*), golden ragwort (*Packera aurea*), golden saxifrage (*Chrysosplenium*

americanum), rough-leaved goldenrod (*Solidago patula* var. *patula*), swamp-goldenrod (*S. uliginosa*), and purple avens (*Geum rivale*).

Differentiating Occurrences: Rich Conifer Swamps are characterized by a canopy of mixed red spruce and hemlock, with balsam fir and deciduous trees including black ash. Shrubs may be dense and include species such as spicebush that indicate less acidic conditions with greater nutrient availability. The surface has pockets of moss rather than sphagnum lawns. The canopy in Red Spruce Swamps is dominated by red spruce; lower strata are sparse. Sphagnum often forms a continuous ground cover. Although all types of forested wetlands can include scattered patches of eastern hemlock, only in Hemlock Swamps is it the dominant canopy species throughout the community. Lower strata are sparse in Hemlock Swamps where sphagnum may form a continuous ground cover. Red Maple Swamps and named variants such as Red Maple - Black Gum Swamps are dominated by deciduous trees, particularly red maple. Atlantic white cedar swamps are dominated by Atlantic white cedar trees.

Associated Fauna: Rich Conifer Swamps are part of the habitat of large mobile animals. Ground-level browsers, including white-tailed deer (*Odocoileus virginianus*), snowshoe hare (*Lepus americanus*), and New England cottontail (*Sylvilagus transitionalis*), use shrubby areas in the community. Conifer swamps tend to have dense shade and are relatively cool in the summer, making them preferred areas for moose (*Alces alces*), animals that get too hot and have trouble controlling their body's temperature. Birds that nest or forage in canopies or mid-sections of conifers do not differentiate on whether the site is wet or not; many birds of upland conifer forest also use Rich Conifer Swamps. Areas of Rich Conifer Swamps where water remains standing for 2-3 months and that lack fish can function as vernal pool habitat for amphibian breeding.

Public Access: Appalachian Trail Corridor, Sheffield; Agawam Lake WMA, Great Barrington; Hinsdale Flats WMA, Hinsdale; Savoy WMA and Notchview Reservation (The Trustees of Reservations), Windsor; Hiram H. Fox WMA, Chester; Otis State Forest, Sandisfield; Orange WCE, Orange.

Threats: Invasive exotic insect pests (e.g., hemlock woolly adelgid (*Adelges tsugae*) and elongate hemlock scale (*Fiorinia externa*)); altered hydrology.

Management Needs: Removal of invasive exotic plants where they are established. The use of undisturbed natural buffers around the best occurrences of the community reduces the potential for impacts from changes in the surrounding environment.

USNVC/NatureServe: *Tsuga canadensis* - *Acer rubrum* Saturated Forest Alliance (Eastern Hemlock - Red Maple Saturated Forest Alliance) - *Betula alleghaniensis* - *Acer rubrum* - (*Tsuga canadensis*, *Abies balsamea*)/*Osmunda cinnamomea* Forest [CEGL006380]; (Hardwood - Conifer Seepage Forest; *Picea mariana*/*Alnus incana*/*Sphagnum* spp. Forest (CEGL002452).

River and Lake Drawdown Community

Community Code: CP2A0B250A

State Rank: SNR

Concept: Sparsely to moderately vegetated exposed drawdown areas of reservoirs and behind dams.

Environmental Setting: River and Lake Drawdown Communities develop on sediments exposed when water levels are low in impounded waterbodies. They may be expansions of riverside beaches and pointbars, or mudflats exposed by drawdown for any reason including for dam repair or removal. There is wide variability in substrate type, with rocky or sandy sediments abutting beaches and pointbars where water regularly flows, or mudflats where impoundment water is slow or still. Large areas of bottom sediments may be exposed as a result of drawdown. Sites are submerged when impoundments are full.

Vegetation Description: The vegetation of the River and Lake Drawdown Community varies in space and time due to differences in substrate, flooding regime, length of time since flooding, geography, and other physical constraints. Vegetation is usually low-growing with cover varying from very sparse to dense (<10% to >80% cover). Weedy (opportunistic, non-competitive, short-lived, quick to reproduce) species quickly dominate recently exposed sediments. Early community development can be from species expanding ranges from beaches, pointbars, or backwater mudflats, or from growth of long-surviving seeds left in the seed bank after previous drawdowns. These pioneers are quickly supplemented by readily transported seeds and plant parts from surrounding areas. Typical species include smartweeds (*Polygonum* and *Persicaria* spp.), water purslane (*Ludwigia palustris*), false pimpernel (*Lindernia dubia*), and various graminoids such as sandbar-lovegrass (*Eragrostis hypnoides*), sand sedge (*Bulbostylis capillaris*), awned flatsedge (*Cyperus squarrosus*),

spike-rushes (*Eleocharis* spp.), and beak rushes or horned sedges (*Rhynchospora* spp.). Some stranded floating-leaved or emergent aquatic plants may temporarily survive in exposed sediments, including water lilies (*Nymphaea* or *Nuphar* spp.), bulrushes (*Bolboschoenus* spp.), and rushes (*Juncus* spp.). A wide range of other native and non-native species may occur.

Differentiating Occurrences: River and Lake Drawdown Communities occur on often large areas of exposed sediments of reservoirs and behind dams when water levels are lowered. Riverine Pointbar and Beach Communities are in high-energy stream channels on sand or gravel. Freshwater Mud Flat Communities have low, sparse, annual herbaceous vegetation on recently exposed muddy (fine mixed organic and mineral materials) sediments in river backwaters and ponds, where they may include stranded aquatic vegetation. The drawdown community shares many of the same opportunistic species of mud flats and pointbars, but may cover more extensive areas.

Associated Fauna: Wide-ranging animals include River and Lake Drawdown Communities opportunistically as part of their habitats. Shorebirds forage for invertebrates on the exposed sediments of these communities throughout their breeding season and during migration. Adult fish can normally swim to deeper water unless caught in isolated depressions; however, a year's reproductive class can be lost if fish have spawned on sediments that become exposed. If sediments become dewatered or desiccated, the mortality of the benthic-dwelling organisms, such as freshwater mussels or dragonfly larvae, would increase.

Public Access: The communities are ephemeral and depend on recent management. They are potentially statewide, in any ponded river or reservoir.

Threats:

Management Needs:

USNVC/NatureServe: Related to: River Mudflats Sparse Vegetation [CEGL002314]; Lake Mudflats Sparse Vegetation [CEGL002313]; Inland Freshwater Strand Beach Sparse Vegetation [CEGL002310]. Included in the broadly described: *Lysimachia ciliata - Apocynum cannabinum* Sparse Vegetation [CEGL006554]; Related concept to: Riverine Sand Flats - Bars Sparse Vegetation [CEGL002049].

Riverine Pointbar and Beach Community

Community Code: CP2A0B2500

State Rank: S4

Concept: Sparsely vegetated exposed sand/gravel beaches and pointbars of rivers and large streams.

Environmental Setting: Riverine Pointbar and Beach Communities occur on sands and gravels deposited in the channel below the streambank on the insides of meander curves. River currents move faster on the outside of a turn and more slowly on the inside. Coarser sediments settle on the outside, where velocity is higher, with finer sediments on the inside, nearer to the shoreline. These areas are scoured by ice in the spring and by periodic flooding during high-water periods following snow melt or after major storm events. Flooding and ice scour limit the extent to which woody vegetation can become established. Constant flooding, scouring, and deposition limit soil development. Pointbars and beaches can move around in the channel depending on water dynamics.

Vegetation Description: The vegetation tends to be sparse, with bare sand or gravel dominating, at least on the most recently exposed areas; it is patchy, flood-battered, and highly variable with seasonal and spatial zonation. Herbaceous and graminoid vegetation dominates in more frequently flooded areas, with woody vegetation where less frequently flooded. Plants start growing as water levels go down, so the areas closer to the uplands tend to start growing sooner in the spring, and lower areas may have young plants into the summer. Tall beggar's-ticks (*Bidens vulgata*) is typical but will be scattered. Other species include smartweeds (*Persicaria* and *Polygonum* spp.), cocklebur (*Xanthium strumarium*), soft-stemmed spike-sedge (*Eleocharis obtusa*), Smith's club-sedge (*Schoenoplectus smithii*), awned flatsedge (*Cyperus squarrosus*), pondshore-flatsedge (*Cyperus dentatus*), and lovegrasses (*Eragrostis* spp.). On

smaller rivers, cardinal flower (*Lobelia cardinalis*) often grows on pointbars. Non-native weedy species may include barnyard grass (*Echinochloa crus-galli*), crab-grass (*Digitaria sanguinalis*), chickweeds (*Myosoton aquaticum* and others), and members of the mustard family, along with purple loosestrife (*Lythrum salicaria*) and Japanese knotweed (*Fallopia japonica*).

Differentiating Occurrences: Riverine Pointbar and Beach Communities are in high-energy stream channels on sand or gravel. River and Lake Drawdown Communities develop on sediments exposed in reservoirs and behind dams when water levels are lowered. High-energy Riverbank Communities occur on the banks of fast-flowing, high-energy rivers with sparse plants growing in sediment caught between rock cobbles. Low-energy Riverbank Communities are on slopes of river banks composed of a mix of relatively fine mineral materials (clay, silt, or sand). The communities may include scattered shrubs or trees along with herbaceous species. Freshwater Mud Flat Communities have low, sparse, annual herbaceous vegetation on recently exposed muddy (fine mixed organic and mineral materials) sediments in river backwaters and ponds, where they may include stranded aquatic vegetation.

Associated Fauna: Few animals are restricted to these patchy, ephemeral communities, but wide-ranging animals include Riverine Pointbar and Beach Communities as part of their habitats. Shorebirds forage on pointbars and beaches throughout their breeding season and during migration. Turtles nest in drier parts of point bars and beaches. The larvae of several species of tiger beetle live in burrows in sandy point bars and beaches, and the adults hunt the same areas. Many river dragonflies include pointbars and beaches in their hunting territories.

Public Access: Robinson State Park, Agawam; Farmington River Watershed, Sandisfield; Tully Lake Reservation (US Army Corps of Engineers), Royalston.

Threats: Trampling from campers and boaters negatively impacts both the plant and animal communities of Riverine Pointbar and Beach Communities. Alterations to normal flooding regimes can impact alluvial deposition, resulting in expansion or reduction of beach size. The exotic invasive Japanese knotweed (*Fallopia japonica*) is a very aggressive colonizer of riverside communities and can displace native species where it becomes established.

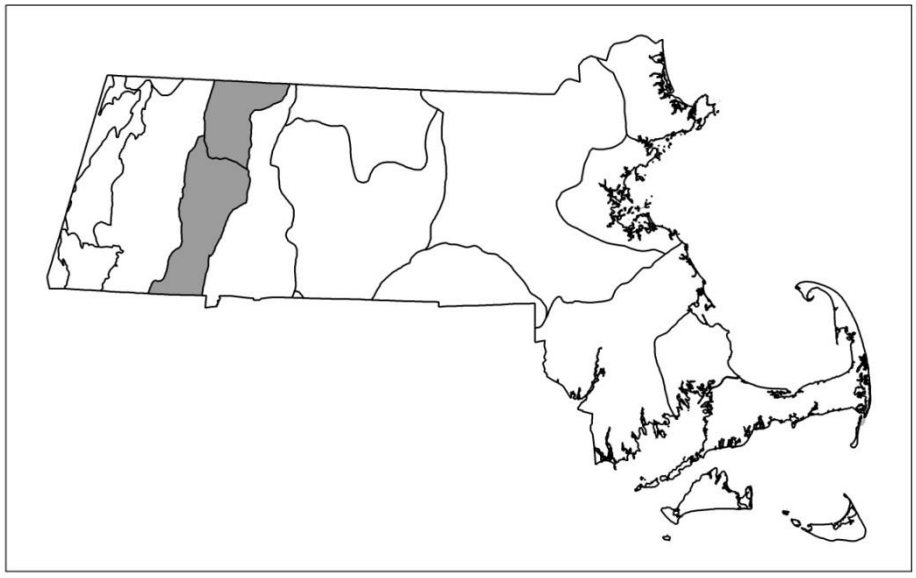
Management Needs: Cocklebur (*Xanthium strumarium*) and Japanese knotweed (*Fallopia japonica*) removal may be necessary from areas used as larval habitat by Puritan tiger beetles. The two species grow quickly and shade large areas, thus eliminating habitat for the tiger beetles. More information is needed to assess the management needs for pointbars and beaches.

USNVC/NatureServe: Inland Freshwater Strand Beach Sparse Vegetation (CEGL002310). Included in the broadly described: *Lysimachia ciliata - Apocynum cannabinum* sparse vegetation (CEGL006554); Related concept to: Riverine Sand Flats - Bars Sparse Vegetation (CEGL002049).

Riverside Seep Community

Community Code: CP2A0B2200

State Rank: S2



Concept: Mixed herbaceous community along river shores where groundwater discharge provides mineral enrichment, often kept open by flood and ice scour.

Environmental Setting: Riverside Seep Communities occur at the base of steep riverbanks where groundwater discharges from adjacent upland slopes. Groundwater discharge in seeps may be diffuse or concentrated in seepage rivulets, and groundwater flow appears to vary substantially among seeps; some seeps may dry out during the summer, others flow year-round. They are often associated with Riverside Rock Outcrop Communities or near rapids. Others may be at the base of talus slopes and associated with High-energy Riverbank Communities or gravel bars. Organic soils are seldom present except in sheltered areas. Mineral-rich seepage leads to a high species diversity of mostly herbaceous plants. Periodic flooding and, likely, ice scour from the river helps to prevent woody shrub encroachment.

Vegetation Description: The vegetation of Riverside Seep Communities is variable, apparently related to the flow and mineral content of groundwater. Seeps that dry during the summer months often have relatively sparse vegetation. The wettest parts of Riverside Seep Communities also have bare ground, including wet rocks and sometimes open water, but are typically mossy with a mixture of herbs and sedges. The general vegetation of Riverside Seep Communities that flow year-round is fairly dense and includes many graminoids (not all at each site) such as brown beak-rush (*Rhynchospora capitellata*), creeping spike-rush (*Eleocharis palustris*), scabrous sedge (*Carex scabrata*), sallow sedge (*C. lurida*), northern awned-sedge (*Carex gynandra*), wool-grass (*Scirpus cyperinus*), grass-leaf rush (*Juncus marginatus*), jointed rush (*J. articulatus*), marsh rush (*J. canadensis*), soft rush (*J. effusus*), Canada

bluejoint (*Calamagrostis canadensis*), fascicled panic-grass (*Dichanthelium acuminatum* ssp. *fasciculatum*), riverbank wild rye (*Elymus riparius*), upland bentgrass (*Agrostis perennans*), and green-fruited bur-reed (*Sparganium erectum*). Forbs include northern dwarf St. John's-wort (*Hypericum boreale*), swamp saxifrage (*Micranthes pensylvanica*), sensitive fern (*Onoclea sensibilis*), and marsh bellflower (*Campanula aparinoides*). Other characteristic herbs include spotted joe-pye-weed (*Eutrochium maculatum*), boneset (*Eupatorium perfoliatum*), orange jewelweed (*Impatiens capensis*), and fringed loosestrife (*Lysimachia ciliata*). Woody species such as speckled alder (*Alnus incana* ssp. *rugosa*) and willows (*Salix* spp.) are often present but not dominant. Muskflower (*Mimulus moschatus*), Canadian burnet (*Sanguisorba canadensis*), and golden alexanders (*Zizia aurea*) are indicative of minerotrophic conditions, and as a group are good indicator species of the community type. The non-native plants colt's foot (*Tussilago farfara*) and purple loosestrife (*Lythrum salicaria*) can also be abundant in the community. The vegetation described here is from sites in the western part of the state; eastern sites may be different.

Differentiating Occurrences: Riverside Seep Communities are small-patch communities that often occur with and grade into High-energy Rivershore Marshes and High-energy Riverbank Communities along high-energy rivers. Riverside Seep Communities occur at the base of steep riverbanks where groundwater discharges from the bottom of the upland slope; they are wetter than associated High-energy Rivershore Meadows and High-energy Riverbank Communities. Muskflower, Canadian burnet, and golden Alexanders as a group are good indicators of Riverside Seep Communities. High-energy Rivershore Meadows are densely vegetated with a characteristic group of dominant plants - hemp dogbane, riverside-sedge and Canadian burnet - in a mix with other forbs and graminoids. High-energy Riverbank Communities have, on average, sparser vegetation and more bare ground than do High-energy Rivershore Meadows or Riverside Seep Communities.

Associated Fauna: Because they are small communities, Riverside Seeps are part of the habitat of the wide-ranging riverine and upland animals.

Public Access: Gilbert A. Bliss State Forest, Chesterfield; Knightville Dam (US Army Corps of Engineers), Huntington; Catamount State Forest, Charlemont. These communities are disturbed by trampling from recreation which can lead to the invasion of non-native plant species already present at many sites.

Threats: It is not known to what extent dam construction and the resulting altered hydrology have affected the occurrence of riverside seep communities. These communities are disturbed by trampling from recreation, which leads to the invasion of non-native plant species. Purple loosestrife can be dominant where disturbance is high.

Management Needs: Removal of non-native plant species and maintenance of natural flooding regimes.

USNVC/NatureServe: G792. Laurentian and Acadian Riverscour Vegetation. G755. Central Riverine Wetland Vegetation - Often occurs with A3647 *Carex torta* Riverscour Alliance - *Carex torta* - *Apocynum cannabinum* - *Cyperus* spp. Herbaceous Vegetation [CEGL006536].

Sea-level Fen

Community Code: CP2B0B3000

State Rank: S1

Concept: Herbaceous/graminoid peatlands that occur at the upland edges of tidal marshes. The combination of upland freshwater seepage and infrequent salt or brackish overwash produces a mixed plant community of freshwater and estuarine species.

Environmental Setting: Sea-level Fens are herbaceous/graminoid peatlands just above normal high tide at the upland edge of estuarine tidal marshes. Periodic brackish overwash mixed with freshwater seepage from sandy uplands produces a plant community of mixed freshwater and estuarine species on sedgy peat over sand or gravel. Sea-level Fens are near their northern limits in Massachusetts and are better developed to the south, where they include more specialized species.

Vegetation Description: Sphagnum moss (*Sphagnum* spp.) is common in all acidic peatlands, forming a mat that the vascular plants grow on, and producing much of the peat that underlies the community. In Sea-level Fens, sphagnum peat is mixed with peat derived from sedges. Three species diagnostic of Sea-level Fens are identified in regional descriptions: saltmarsh straw-sedge (*Carex hormathodes*), saltmarsh spike-sedge (*Eleocharis rostellata*), and saltmarsh threesquare (*Schoenoplectus americanus*). Twig-sedge (*Cladium mariscoides*) at the edges of salt marshes is also used as an indicator of Sea-level Fens. Other common species include New York aster (*Symphyotrichum novi-belgii*), spatulate-leaved sundew (*Drosera intermedia*), Canada rush (*Juncus canadensis*), pondshore-rush (*Juncus pelocarpus*), swamp-candles (*Lysimachia terrestris*), native and invasive exotic subspecies of common reed (*Phragmites australis*), white beak-sedge (*Rhynchospora alba*), swamp-rose (*Rosa palustris*), common threesquare (*Schoenoplectus pungens*), poison ivy (*Toxicodendron radicans*), marsh St. John's-wort (*Triadenum virginicum*),

and large cranberry (*Vaccinium macrocarpon*). Occasional shrubs include poison sumac (*Toxicodendron vernix*), swamp azalea (*Rhododendron viscosum*), bayberry (*Morella pensylvanica*), groundsel-tree (*Baccharis halimifolia*), and eastern red cedar (*Juniperus virginiana*).

Differentiating Occurrences: Natural communities on acidic peatlands all occur on sphagnum peat. The depth, density, and strength of the underlying peat control the structure and composition of each type of peatland community because plants growing on it are isolated from nutrients carried by groundwater. Sea-level Fens are most identifiable by location: they occupy the interface between estuarine marshes and upland seepage slopes, and therefore have a distinct species assemblage including both estuarine and palustrine species. Three species diagnostic of Sea-level Fens are identified in regional descriptions: saltmarsh straw-sedge (*Carex hormathodes*), saltmarsh spike-sedge (*Eleocharis rostellata*), and saltmarsh threesquare (*Schoenoplectus americanus*). Twig-sedge (*Cladium mariscoides*) at the edges of salt marshes is also used as an indicator of Sea-level Fens. Acidic Graminoid Fens are differentiated by the dominance of graminoid and herbaceous species and the lack of extensive shrubs. Threeway sedge (*Dulichium arundinaceum*) and buckbean (*Menyanthes trifoliata*) are characteristic of wet, nutrient-enriched edges of Acidic Graminoid Fens. Interdunal Marshes/Swales occur as part of a coastal dune system. They are graminoid- or shrub-dominated communities occurring in shallow basins (swales) between dunes. Some are fen-like with cranberries and sedges growing on shallow peat, but occurrence in dune systems is the defining characteristic. Acidic Shrub Fens are composed primarily of low-growing, interwoven shrubs. Dense water-willow and sweet gale are indicative and characteristic. Acidic Shrub Fens are wetter with a less well-developed sphagnum mat than other acidic peatlands.

Associated Fauna: Few animals are likely to differentiate between Sea-level Fens and other wetlands. Species sensitive to salt would avoid Sea-level Fens during and after saltwater incursions; at other times, the fens would be part of the habitat of mobile wetland and upland animals. Songbirds use shrubby parts of the community for nesting and foraging, particularly when the surrounding areas also have dense shrubs.

Public Access: None of the known sites are entirely in conservation ownership. If visited, care should be taken not to create trails across the easily damaged peat surface.

Threats: Rozsa (2014) mentions that this community degrades every ~20 years (metonic cycle). During the first half of the metonic cycle, the tidal range increases about 6 cm. This causes the anaerobic peat-building phase. Then the tide range decreases and in the aerobic phase *Juncus* returns and becomes dominant. Finally, groundwater discharge washes away the decomposing peat. In some places, the eroded edge resembles a pedestrian path. Alteration to the natural hydrologic regime. Development in the uplands may have negative effects on upland seepage. Invasive phragmites, particularly in areas with native populations.

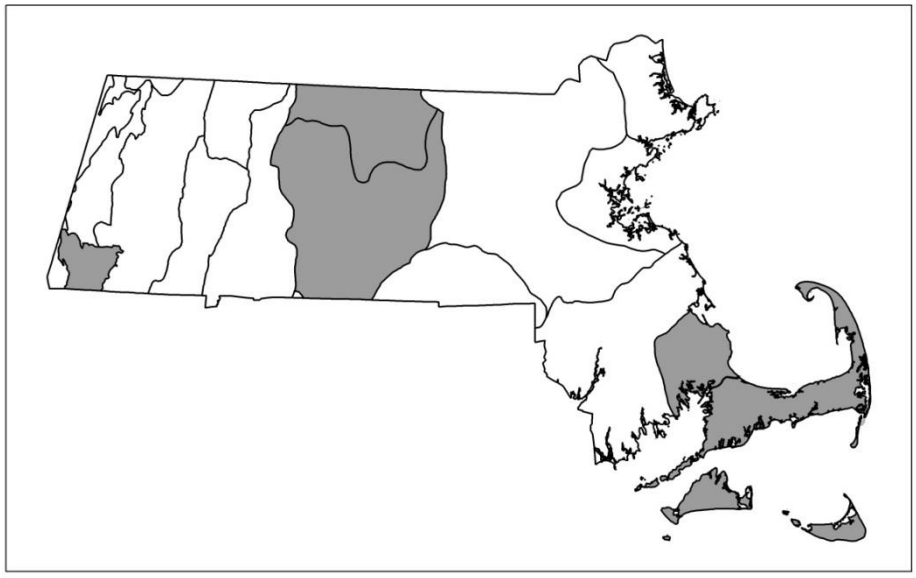
Management Needs: Maintain natural hydrology and upland buffer.

USNVC/NatureServe: *Cladium mariscoides-Drosera intermedia-Eleocharis rostellata* herbaceous vegetation [CEGL006310]. G1 (2014).

Shallow Emergent Marsh

Community Code: CP2A0A1300

State Rank: S4



Concept: Grass-, sedge-, and/or rush-dominated wetlands on mucky mineral soils that are seasonally inundated and permanently saturated.

Environmental Setting: Shallow Emergent Marshes occur in broad, flat areas bordering low-energy rivers and streams (often in backwater sloughs), or along pond and lake margins. There is standing or running water during the growing season and throughout much of the year, with water depth averaging less than about 15 cm (~6 in.). Shallow marshes commonly occur in abandoned beaver flowages, and in some states they are named abandoned beaver meadows or beaver flowage communities. The substrate is typically a layer of well-decomposed organic muck overlying mineral material.

Vegetation Description: Short grasses, sedges, and rushes mixed with scattered forbs (broad-leaved herbaceous plants) dominate Shallow Emergent Marshes. Tussock-forming species such as tussock sedge (*Carex stricta*) and Canada bluejoint (*Calamagrostis canadensis* var. *canadensis*) may form a hummock-hollow topography over broad areas. Forbs often include sensitive fern (*Onoclea sensibilis*), marsh fern (*Thelypteris palustris*), swamp-candles (*Lysimachia terrestris*), marsh St. John's-wort (*Triadenum virginicum*), Joe-Pye-weeds (*Eutrochium* spp.), bonesets (*Eupatorium* spp.), and water-horehound (*Lycopus* spp.). Low shrubs such as spiraea (*Spiraea* spp.), red osier dogwood (*Swida sericea*), leatherleaf (*Chamaedaphne calyculata*), and sweet gale (*Myrica gale*) may be present with <25% coverage. Areas with shallow water between or instead of tussocks typically have a mixture of bur-reeds (*Sparganium* spp.), sedges (*Carex* spp.), and rice cut-grass (*Leersia oryzoides*). Areas with more permanent open water often support floating-leaved plants like water-lilies (*Nymphaea odorata* and *Nuphar* spp.) and submerged plants like pondweeds

(*Potamogeton* spp.). Duckweed (*Lemna* spp.) is abundant in still water. It is common to see tussock sedge-dominated marshes in old beaver flowages mixed with scattered alder (*Eupatorium* spp.) and spiraea (*Spiraea* spp.). Sites with a history of severe disturbance may be dominated by or include an abundance of exotic species including purple loosestrife (*Lythrum salicaria*), reed canary-grass (*Phalaris arundinacea*), phragmites (*Phragmites australis*), or Japanese knotweed (*Fallopia japonica*). Cattails (*Typha* spp.), phragmites (*Phragmites australis*), and wool-grass (*Scirpus cyperinus*) (the dominants of Deep Emergent Marshes) often occur, but do not dominate. Tall shrubs and tree saplings are uncommon and when present are often clustered together.

Differentiating Occurrences: The physical and biological characteristics of emergent marsh, wet meadow, and shoreline communities overlap and intergrade. The vegetation for all these types is broadly defined and understudied: focused surveys might establish which dominant species and hydrological situations define identifiable community types, or might determine that there is a continuum of types that require arbitrary separation. Shallow Emergent Marshes are graminoid/herbaceous wetlands and usually have shallow (averaging <6 in deep) surface water all year. Shallow Emergent Marsh vegetation composition is similar to Deep Emergent Marsh except that shorter grasses, sedges and rushes dominate. Cattails, phragmites, and wool-grass (the dominants of Deep Emergent Marshes) can occur but never dominate Shallow Emergent Marshes. Deep Emergent Marshes are tall graminoid wetlands that are usually flooded with deeper water (averaging 6 in to 3 ft.). Shrub Swamps have >25% cover of shrubs. Wet Meadows are graminoid wetland subtypes of Shallow Emergent Marshes, typically with a single sedge or grass species dominating. Standing water is not present throughout the growing season as in emergent marshes. Kettlehole Wet Meadows occur in small basins on mucky peat. Coastal Plain Pondshore Communities and Coastal Plain Pondshores - Inland Variant are generally on sand in closed basins that intersect groundwater. The exposed shoreline supports herbaceous species not generally dominated by dense graminoids. Acidic Pondshores/ Lakeshores are broadly defined, variable shorelines around open water not explicitly included in calcareous or coastal plain pondshores. The shoreline is often not distinct, merging into marsh or other wetlands. Bogs and Fens are peatlands and have peat instead of mucky mineral soil; however, gradations do exist.

Associated Fauna: Shallow Emergent Marshes are excellent habitat for muskrats. Shallow Emergent Marsh habitat supports many species of frogs and salamanders, especially leopard, pickerel, green, and bull frogs, and some vernal pool obligate species, such as wood frogs and spotted salamanders, may use areas of Shallow Emergent Marsh for egg-laying if they are fish free.

Public Access: Wolf Swamp WMA, Brookfield/Sturbridge; Warwick State Forest, Warwick; Great Meadows National Wildlife Refuge, Concord area; Charles River Watershed (US Army Corps of Engineers), Dedham area; Neponset River Reservation, Canton area.

Threats: Shallow Emergent Marshes are threatened by filling and dredging, impoundments that alter natural water-level fluctuations, and nutrient inputs from adjacent roads, fields, or septic systems. The invasion and spread of purple loosestrife (*Lythrum salicaria*) alters natural community structure and composition.

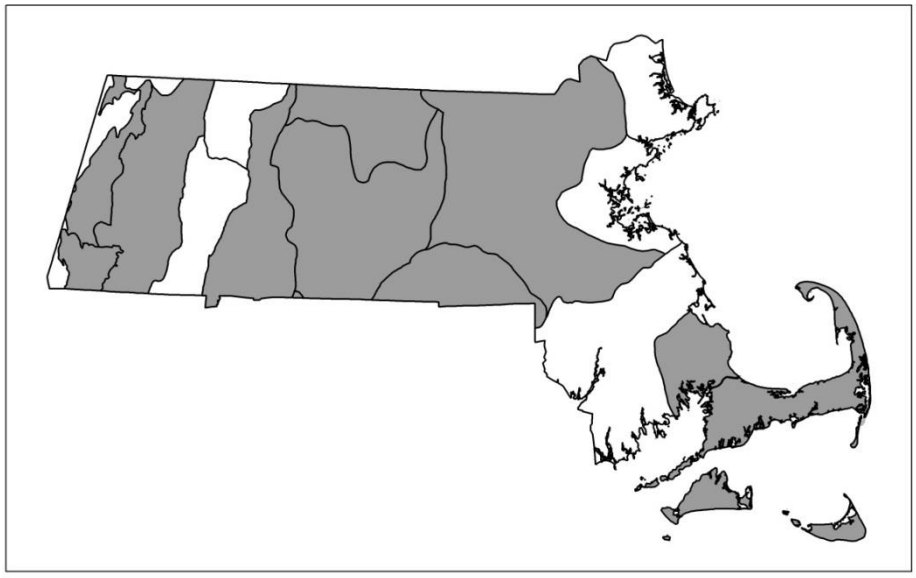
Management Needs: Efforts are needed to control the spread of purple loosestrife.

USNVC/NatureServe: G125. Eastern North American Freshwater Marsh: and G556. Northern and Central Ruderal Wet Meadow and Marsh.

Shrub Swamp

Community Code: CP2A0C0000

State Rank: S5



Concept: Shrub-dominated wetlands occurring on mineral or mucky mineral soils that are seasonally or temporarily flooded.

Environmental Setting: Wetland shrubs dominate Shrub Swamps. Shrub height may be from <1m to 5 meters, of uniform height or mixed. Shrub density can be variable, from dense (>75% cover) to fairly open (25-75% cover), with graminoid, herbaceous, or open water areas between shrubs. These common, widespread communities can be found where the water table is at or above the soil surface for most of the year, in lowlands, along the margins of rivers, streams and other waterbodies, and along or within forested or herbaceous-dominated wetlands. Soils may be mineral or well-decomposed organic material.

Vegetation Description: The species composition of Shrub Swamps is highly variable within and among sites. Possible dominant and codominant shrub species include speckled alder (*Alnus incana* ssp. *rugosa*), smooth alder (*A. serrulata*), meadowsweet (*Spiraea alba* var. *latifolia*), steeplebush (*S. tomentosa*), buttonbush (*Cephalanthus occidentalis*), maleberry (*Lyonia ligustrina*), swamp azalea (*Rhododendron viscosum*), silky dogwood (*Swida amomum*), winterberry (*Ilex verticillata*), sweet gale (*Myrica gale*), willows including pussy willow (Salix discolor) and black willow (*S. nigra*), arrowwood (*Viburnum dentatum*), and poison sumac (*Toxicodendron vernix*). Shrub swamps in areas with circumneutral water often have abundant spicebush (*Lindera benzoin*). Low-growing, weak-stemmed shrubs include dewberry (*Rubus hispidus*), water-willow (*Decodon verticillatus*), and Canadian burnet (*Sanguisorba canadensis*). Trees tend to be scattered and stunted and may include red maple (*Acer rubrum*), gray birch (*Betula populifolia*), white pine (*Pinus strobus*), or other

species found in either forested swamps or adjacent uplands. In general, a shrub community will have <25% cover of tree canopy. Since shrubs often form dense thickets, the herbaceous layer of shrub swamps is often sparse and species-poor. A mixture of the following species is typical: common arrowhead (*Sagittaria latifolia*), skunk cabbage (*Symplocarpus foetidus*), ferns (especially cinnamon fern (*Osmundastrum cinnamomeum*), sensitive fern (*Onoclea sensibilis*), royal fern (*Osmunda regalis*), and marsh fern (*Thelypteris palustris*)), sedges (*Carex* spp.), bluejoint grass (*Calamagrostis canadensis*), bur reed (*Sparganium* spp.), virgin's-bower (*Clematis virginiana*), swamp candles (*Lysimachia terrestris*), clearweed (*Pilea pumila*), and turtlehead (*Chelone glabra*). While nonvascular flora is not a major component, sphagnum has been recorded in substantial abundance in some occurrences. Invasive species include reed canary-grass (*Phalaris arundinacea*), glossy buckthorn (*Frangula alnus*), common buckthorn (*Rhamnus alnifolia*), and purple loosestrife (*Lythrum salicaria*).

Differentiating Occurrences: The physical and biological characteristics of Shrub Swamp, Acidic Shrub Fen, Highbush Blueberry Thickets, Fresh/ Brackish Tidal Shrubland, emergent marshes, and shoreline communities overlap and intergrade. They all lack tree cover (<25% canopy cover) and they are all on wet substrates. Shrub Swamps have >25% cover of tall shrubs with well-decomposed organic soils. If highbush blueberries (*Vaccinium corymbosum*) are dominant, the community is likely to be a Highbush Blueberry Thicket, a tall-shrub community occurring on peat. Acidic Shrub Fens are peatlands, dominated by low-growing shrubs with sphagnum moss and herbaceous species of varying abundance. Deep Emergent Marshes and Shallow Emergent Marshes are graminoid-dominated wetlands with <25% cover of tall shrubs. Acidic Pondshores/Lakeshores are broadly defined, variable shorelines around open water. Shorelines often merge into swamps or marshes. Fresh/Brackish Tidal Shrublands are dense to open shrublands along tidal sections of coastal rivers. Forested swamp communities such as Red Maple Swamp and its variants often contain a significant shrub component, and may include patches of shrub swamp where the tree canopy cover is <25%.

Associated Fauna: Many Shrub Swamps provide high-quality vernal-pool habitats. Relatively long hydroperiods ensure that amphibian larvae have plenty of time to develop, and the diverse vegetation structure provides both cover for larvae and egg-attachment substrates for breeding adults. Many species of migratory birds use the dense shrub thickets as protected nesting habitat. In the winter when the surface is frozen, browsers, including New England cottontail, have easy access to the shrubs and protection in the dense thickets. The larvae of many rare and common moth species feed on a variety of shrubs and associated herbaceous plants in Shrub Swamps throughout Massachusetts.

Public Access: Greenler Reservation (Essex County Greenbelt Association), Boxford; Tophet Swamp (Town of Westminster and North County Land Trust), Westminster; Jacobs Hill Reservation (The Trustees of Reservations), Royalston; Wekepeke WCE, Sterling; Nineteenth Hill WCE, Winchendon.

Threats: Invasive species can include reed canary-grass (*Phalaris arundinacea*), common buckthorn (*Rhamnus alnifolia*), glossy buckthorn (*Frangula alnus*), and purple loosestrife (*Lythrum salicaria*).

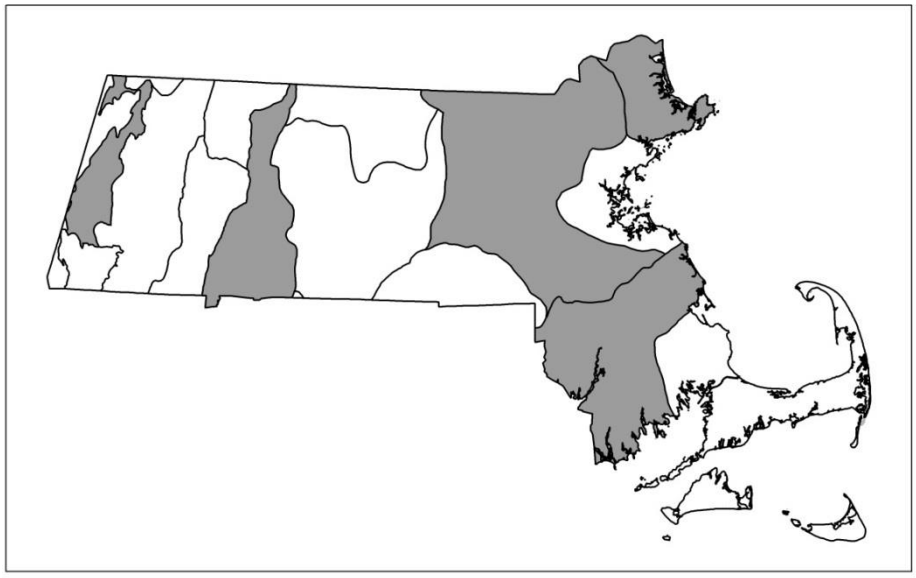
Management Needs: Maintain water quality and quantity, as well as natural hydroperiods. Control invasives where practical. Most types of shrub swamps are successional and need regular disturbance to be maintained in place, or they are maintained as parts of a larger area by disturbances moving over the landscape in time and space.

USNVC/NatureServe: G167: Northern and Central Shrub Swamp - *Alnus incana* Swamp Shrubland [CEGL002381]; *Alnus serrulata* Eastern Shrubland [CEGL005082]; *Cephalanthus occidentalis* Semipermanently Flooded Shrubland [CEGL003908]; *Decodon verticillatus* Semipermanently Flooded Shrubland [CEGL005089]; *Cornus* (*amomum*, *sericea*) - *Viburnum dentatum* - *Rosa multiflora* Ruderal Shrubland [CEGL006576]; *Cephalanthus occidentalis* - *Decodon verticillatus* Shrubland Northeastern Buttonbush Shrub Swamp [CEGL006069]; *Alnus incana* - *Cornus* (*amomum*, *sericea*)/*Clematis virginiana* Shrubland [CEGL006062]; *Alnus incana* - *Viburnum recognitum*/*Calamagrostis canadensis* Shrubland [CEGL006546].

Small-river Floodplain Forest

Community Code: CP1A2B3000

State Rank: S2



Concept: Silver maple/green ash-dominated forests occurring on alluvial soils of small rivers and streams.

Environmental Setting: Small-river Floodplain Forests occur on third-order or smaller tributaries of the Connecticut, Housatonic, and Nashua Rivers, on small rivers of eastern Massachusetts where banks are low and overbank flooding occurs such as the Ipswich, Assabet, Concord, Shawsheen, and Three Mile Rivers, and on edges of riverine islands of the Merrimack River. Annual flooding occurs, but the water volume and degree of scour are much less than in Major-river Floodplain Forests. Soils are hydric silt loams and fine sandy loams with soil mottling within the top 60 cm (2 ft.) and sometimes with a surface organic layer. Patches of the Small-river Floodplain Forest community type also occur in poorly-drained depressions within the level floodplain of other types of floodplain forests.

Vegetation Description: Small-river Floodplain Forests have been called a silver maple-green ash-false nettle-sensitive fern vegetation association. Silver maple (*Acer saccharinum*) is almost always dominant in the overstory, often with green ash (*Fraxinus pennsylvanica*) in the canopy or subcanopy. American or slippery elm (*Ulmus americana* and *U. rubra*), swamp white oak (*Quercus bicolor*) (in wetter areas), and red maple (*Acer rubrum*) often occur in low numbers. Pin oak (*Quercus palustris*) is a common canopy associate in the Connecticut River basin, and river birch (*Betula nigra*) typical in the Merrimack River basin. The shrub layer consists mainly of silky dogwood (*Swida amomum*) and buttonbush (*Cephalanthus occidentalis*). There is greater herbaceous plant diversity in Small-river Floodplain Forests than in Major-river and Transitional types. Sensitive fern (*Onoclea sensibilis*) and false

nettle (*Boehmeria cylindrica*) are most common, and associates include the moisture-loving plants water hemlock (*Cicuta maculata*), swamp candles (*Lysimachia terrestris*), and water parsnip (*Sium suave*). The non-native plant species moneywort (*Lysimachia nummularia*), forget-me-not (*Myosotis scorpioides*), and glossy buckthorn (*Frangula alnus*) are often prevalent in small disturbed areas. Other invasive species regularly include bush honeysuckles (*Lonicera morrowii*), Japanese barberry (*Berberis thunbergii*), and privet (*Ligustrum vulgare*).

Differentiating Occurrences: Floodplain forest communities occur within the zone of active flooding of rivers and streams on mineral soils that receive annual silt deposition. They differ in the size of river on which they are found and in the severity of flooding. Small-river, Transitional, and Major-river Floodplain Forests can be viewed as points on a continuum from least severely scoured and poorly drained (small-river type) to most severely scoured and well-drained (major-river type). Major-river Floodplain Forests occur along mainstem sections of large rivers (the Connecticut, Housatonic, and Deerfield Rivers in Massachusetts). Soils are predominantly sandy loams without soil mottles and without a surface organic layer. Flooding at these sites is usually severe. Transitional Floodplain Forests occur on third-order or smaller tributaries of the Connecticut River, on portions of the Housatonic River, and in depressions within Major-river Floodplain Forests of the Connecticut and Deerfield Rivers. Soils are intermediate in severity of flooding, soil texture, and drainage between Major-river and Small-river Floodplain Forests. Soils are either silt loams or very fine sandy loams, and soil mottling is generally present within 60 cm (2 ft.) of soil surface. A surface organic layer is typically absent. Small-river Floodplain Forests occur on third-order or smaller tributaries of the Connecticut and Nashua Rivers, on small rivers of eastern Massachusetts where banks are low and overbank flooding occurs (Ipswich, Assabet, Concord, Shawsheen, and Three Mile), and on edges of riverine islands of the Merrimack River. Annual flooding occurs, but the water volume and degree of scour are much less than in Major-river Floodplain Forests. Soils are hydric silt loams and fine sandy loams with soil mottling within the top 60 cm (2 ft.) and sometimes with a surface organic layer. Small-river Floodplain Forests, like all annually flooded forests, are dominated by silver maple, but with more other species mixed in than the other types. However, cottonwood (*Populus deltoides*) is typically absent in the canopy of the Small-river type. Small-river Floodplain Forests have a more substantial shrub layer than either Major-river and Transitional types, but less than Red Maple Alluvial Swamps. There is greater herbaceous plant diversity in Small-river Floodplain Forests than in Major-river and Transitional types, but again, the Alluvial Red Maple Swamps have a greater diversity. Occurrences of High-terrace Floodplain Forests tend to be relatively small narrow forests on high alluvial terraces that flood only occasionally (not annually) and for a shorter duration than other types of floodplain forests. They are sometimes seen as a hybrid between floodplain and upland forests, and include upland species lacking in other types of floodplain forest. They have more litter accumulated than other floodplain forests. Alluvial Red Maple Swamps along low-gradient rivers flood annually and are slow to drain. Silver maple is often a codominant with red maple. They have dense shrub and diverse herbaceous layers.

Alluvial Hardwood Flats are along small streams that have multiple short flooding events throughout the year after storms. Black cherry and white pine are usually abundant in the canopy with red maple, but not silver maple.

Associated Fauna: Small-river Floodplain Forests often contain meander scars or backwater sloughs that function as vernal pools and provide important amphibian breeding habitat. Becau7se they are small communities, they are part of the habitat of wide-ranging riverine and upland animals, providing sheltered, riverside corridors for deer and migratory songbirds. Floodplain forests are insect-rich habitats that attract warblers, thrushes and other songbirds. Yellow-throated and Warbling Vireos nest in the canopies of riverside trees. In spring floods, Wood Ducks and Hooded Mergansers like the shady edges of floodplain forests and the interior meander scar pools. Eastern comma butterflies feed on elm, nettles and hops, and the shady riverbanks are patrolled by dragonflies. Changes in water quality and quantity alter herbaceous, and eventually tree, species, changing habitat for birds and browsers, such as deer and rabbits.

Public Access: Bailey Conservation Area (Essex County Greenbelt Association), North Andover; Great Meadows National Wildlife Refuge, Concord; Oxbow National Wildlife Refuge, Ayer; Arcadia Wildlife Sanctuary (Massachusetts Audubon Society), Northampton; Hop Brook WMA, Lee.

Threats: The non-native plant species, moneywort (*Lysimachia nummularia*), forget-me-not (*Myosotis scorpioides*), and glossy buckthorn (*Frangula alnus*), are most prevalent in Small-river and Transitional Floodplain Forest types, especially in disturbed areas. Other invasive species regularly include bush honeysuckles (*Lonicera morrowii*), Japanese barberry (*Berberis thunbergii*), and privet (*Ligustrum vulgare*).

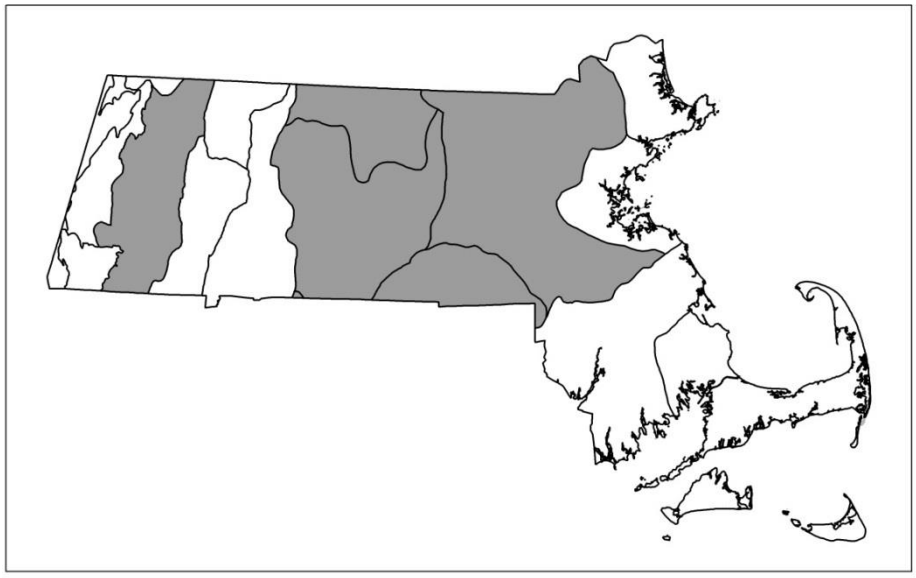
Management Needs: Removal of non-native plants is needed, especially in areas where they are competing with state-protected rare species.

USNVC/NatureServe: Similar to *Quercus palustris* - *Acer rubrum* Temporarily Flooded Forest Alliance -- *Quercus palustris-Acer rubrum/Carex grayi-Geum canadense* Forest [CEGL006185] and to *Acer saccharinum* Temporarily Flooded Forest Alliance -- *Acer saccharinum/Onoclea sensibilis* - *Boehmeria cylindrica* Forest (CEGL006176) (in areas with calcareous or sedimentary bedrock) and maybe CEGL006548 *Acer* (*rubrum*, *saccharinum*) - *Fraxinus pennsylvanica* - *Ulmus americana*/*Boehmeria cylindrica* Forest.

Spruce – Tamarack Bog

Community Code: CP1B1B1000

State Rank: S2



Concept: Acidic forested peatlands with a short overstory (usually) of black spruce and tamarack and an understory of heath shrubs on sphagnum moss.

Environmental Setting: Spruce - Tamarack Bogs are forested communities that occur on thick peat deposits, often as part of larger wetland complexes, usually in the older, more stable areas, that include other forested, shrub, and open community types. The forested bogs are late-successional peatlands that typically occur around more open bog mats. The layer of peat (dead and living moss and barely or partially decomposed roots and other plant material) isolates the plants from nutrients in groundwater. The forest canopy is >25% cover, often with dense small (<12m (40 ft.) and dbh <15cm (6in)) black spruce and tamarack trees, although northern/higher elevation occurrences may be more forest-like.

Vegetation Description: Spruce - Tamarack Bogs are forested peatlands dominated by spruce (usually black spruce, *Picea mariana*, sometimes red spruce, *P. rubens*) and tamarack (*Larix laricina*) and with substantial cover of sphagnum moss on the surface. Shrubs, often of the heath family (such as highbush blueberry (*Vaccinium corymbosum*)), swamp azalea (*Rhododendron viscosum*) and leatherleaf (*Chamaedaphne calyculata*) may form dense shrub layers. Spruce and tamarack are key indicators of this community, along with an extensive surface cover of sphagnum moss that may be hidden under shrubs. Lichens cover or drape branches, with the most obvious being old man's beard (*Usnea* spp.). Other tree species often present include red maple (*Acer rubrum*), white pine (*Pinus strobus*), and pitch pine (*Pinus rigida*). The species of the shrub layer, often dense and about 2m (6.5 ft.) tall, vary with geographic area. Labrador tea (*Rhododendron groenlandicum*), creeping snowberry (*Gaultheria*

hispidula), and, to some extent, bog laurel (*Kalmia polifolia*) are most likely in northern and western parts of the state; sweet pepperbush (*Clethra alnifolia*) tends to be more eastern and southern. Mountain holly (*Nemopanthus mucronatus*), wild raisin (*Viburnum nudum* var. *cassinoides*), leatherleaf (*Chamaedaphne calyculata*), winterberry (*Ilex verticillata*), highbush blueberry (*Vaccinium corymbosum*), mountain laurel (*Kalmia latifolia*), sheep laurel (*K. angustifolia*), fetterbush (*Eubotrys racemosa*), and maleberry (*Lyonia ligustrina*) may be present anywhere. The herbaceous layer can include three-seeded bog sedge (*Carex trisperma*), tussock sedge (*Carex stricta*), three-leaved Solomon's seal (*Maianthemum trifolium* WL), bluebead-lily (*Clintonia borealis*), goldthread (*Coptis trifolia*), pitcher plant (*Sarracenia purpurea*), sensitive fern (*Onoclea sensibilis*), marsh fern (*Thelypteris palustris*), cinnamon fern (*Osmundastrum cinnamomeum*), and water arum (*Calla palustris*). Dwarf mistletoe (*Arceuthobium pusillum*) has been found in some occurrences.

Differentiating Occurrences: Spruce - Tamarack Bogs have a tree canopy of >25%, dominated by black spruce and tamarack. Open (non-forested) acidic peatlands such as Level Bogs, Kettlehole Level Bogs, and Acidic Graminoid Fens may have clumps of trees, but with <25% canopy overall. Atlantic White Cedar Bogs have >25% tree canopy and the existing trees are dominated by Atlantic white cedar (*Chamaecyparis thyoides*). Atlantic White Cedar Bogs share many species with Spruce - Tamarack Bogs, but are generally found within Pitch Pine - Scrub Oak or Oak - Pine communities. Red Spruce Swamps have taller, larger diameter trees and are dominated by red rather than black spruce, generally with a more open understory (fewer shrubs). They share species with Spruce - Tamarack Bogs, but also contain balsam fir (*Abies balsamea*). Red Spruce Swamp occurrences are often larger than Spruce - Tamarack Bogs. Hemlock Swamps are dominated by eastern hemlock (*Tsuga canadensis*). Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps also contain tamarack, and may contain red spruce. However, these generally have much greater species diversity and occur in calcareous or circumneutral groundwater.

Associated Fauna: Small patch communities such as Spruce - Tamarack Bogs contribute variation to the habitats of large, mobile animals. Breeding birds include a suite of northern species typical of conifer forests.

Public Access: Cookson State Forest, New Marlborough; Otis State Forest, Otis; Muddy Brook WMA, Hardwick; Ware River Watershed (Dept. of Conservation and Recreation), Rutland and Oakham.

Threats: Nutrient input from surroundings would damage the peat. Changes in hydrology that might either flood or drain peatlands such as road construction or nearby water withdrawal.

Management Needs:

USNVC/NatureServe: A3418 *Picea rubens* Northern Appalachian Swamp Forest Alliance *Picea mariana*/(*Vaccinium corymbosum*, *Gaylussacia baccata*)/*Sphagnum* spp. Woodland

(CEGL006098); northern MA *Picea mariana* - (*Larix laricina*)/*Ledum groenlandicum*/*Sphagnum* spp. Forest. (CEGL005271) [NatureServe maps as further north].

Transitional Floodplain Forest

Community Code: CP1A2B2000

State Rank: S2

Concept: Silver maple-green ash-American elm forests occurring on alluvial soils. Transitional Floodplain Forests are intermediate in vegetation composition and soils between Major- and Small-river Floodplain Forest types.

Environmental Setting: Transitional Floodplain Forests are known to occur on third-order or smaller tributaries of the Connecticut River, on portions of the Housatonic River, and in depressions within Major-river Floodplain Forests of the Connecticut and Deerfield Rivers. Sites generally experience annual flooding. The severity of flooding, soil texture, and soil drainage of Transitional Floodplain Forests is intermediate between Major-river and Small-river Floodplain Forests. Soils are either silt loams or very fine sandy loams, and soil mottling is generally present within 60 cm (2 ft.) of soil surface. A surface organic layer is typically absent.

Vegetation Description: All floodplain forest communities in Massachusetts have silver maple (*Acer saccharinum*) as the dominant tree taxon, but associated plant species vary depending on the intensity and duration of flooding and on geographic location. Transitional Floodplain Forests have a vegetation association intermediate between Major-river and Small-river Floodplain Forests. Silver maple is dominant in the canopy, but unlike in major-river forests, cottonwood (*Populus deltoides*) is typically absent. Similar to Small-river Floodplain Forests, green ash (*Fraxinus pennsylvanica*) and American elm (*Ulmus americana*) are in the canopy and subcanopy. A shrub layer is generally lacking; however, saplings of overstory trees are common. Vines are abundant with hog peanut (*Amphicarpaea bracteata*) most common and poison ivy (*Toxicodendron radicans*) regularly present. The herbaceous layer is typically an even mixture of wood-nettle (*Laportea canadensis*), ostrich fern (*Matteuccia*

struthiopteris), sensitive fern (*Onoclea sensibilis*), and false nettle (*Boehmeria cylindrica*). Occasional associates include Gray's sedge (*Carex grayi*), cattail sedge (*Carex typhina*), and green dragon (*Arisaema dracontium*).

Differentiating Occurrences: Small-river, Transitional, and Major-river Floodplain Forests all occur along rivers with active annual flooding and silt deposition. They differ in the size of river on which they occur and in the flooding severity. They are points in a continuum of scouring and drainage. Transitional Floodplain Forest soils are intermediate in severity of flooding, soil texture, and drainage, usually without a surface organic layer. Cottonwood is usually absent, but ash and elm trees are present. Tree saplings are common but shrubs are generally absent. The herbaceous layer is a mix of species. Small-river Floodplain Forests occur on small rivers where banks are low and overbank flooding occurs annually, but with limited water volume and scour. Soils are hydric silt or fine sandy loams, sometimes with a surface organic layer. They also lack cottonwood and have ash and elm trees, but have a distinct shrub layer and a diverse herbaceous layer. Major-river Floodplain Forests occur along large rivers with severe flooding and scouring. Soils are predominantly not hydric and lack a surface organic layer. Cottonwood can be common in the canopy with silver maple, but few other trees are present. A shrub layer is usually absent and the herbaceous layer is often dominated by a near monoculture of wood nettle. High-terrace Floodplain Forests are on high alluvial terraces that do not flood annually and then only for a short duration. They have upland trees such as sugar maple as well as floodplain species. They have more litter accumulated than other floodplain forests. Alluvial Red Maple Swamps along low-gradient rivers flood annually and are slow to drain. Silver maple is often a codominant with red maple. Alluvial Hardwood Flats are along small streams that have multiple short flooding events throughout the year. Black cherry and white pine are abundant in the canopy with red maple, but not silver maple.

Associated Fauna: Floodplain forests are often part of the habitat of wide-ranging riverine and upland animals, providing sheltered, riverside corridors for deer and migratory songbirds. Floodplain forests are insect-rich habitats that attract warblers, thrushes and other songbirds. Yellow-throated and Warbling Vireos nest in the canopies of riverside trees. Raptors such as Bald Eagles use riverbank trees as nest and perch sites. In spring floods, Wood Ducks and Hooded Mergansers like the shady edges of floodplain forests and the interior meander scar pools. Eastern comma butterflies feed on elm, nettles and hops, and the shady riverbanks are patrolled by several dragonfly species such as ocellated and fawn darners. Where vernal pools occur in floodplain forests, such as meander scars or backwater sloughs, leopard, pickerel and green frogs, American toads, and mole salamanders can be found. Changes in water quality and quantity alter herbaceous, and eventually tree, species, changing habitat for birds and browsers, such as deer and rabbits.

Public Access: George L. Darey Housatonic Valley WMA, Lenox; Canoe Meadows Wildlife Sanctuary (Massachusetts Audubon Society), Pittsfield; Connecticut River Access–Montague (along the Sawmill River), Montague.

Threats: Threats are similar to those for Major-river Floodplain Forests. Non-native plant species can be abundant in disturbed, open areas. The most common non-native plant species are moneywort (*Lysimachia nummularia*), forget-me-not (*Myosotis scorpioides*), and glossy buckthorn (*Frangula alnus*).

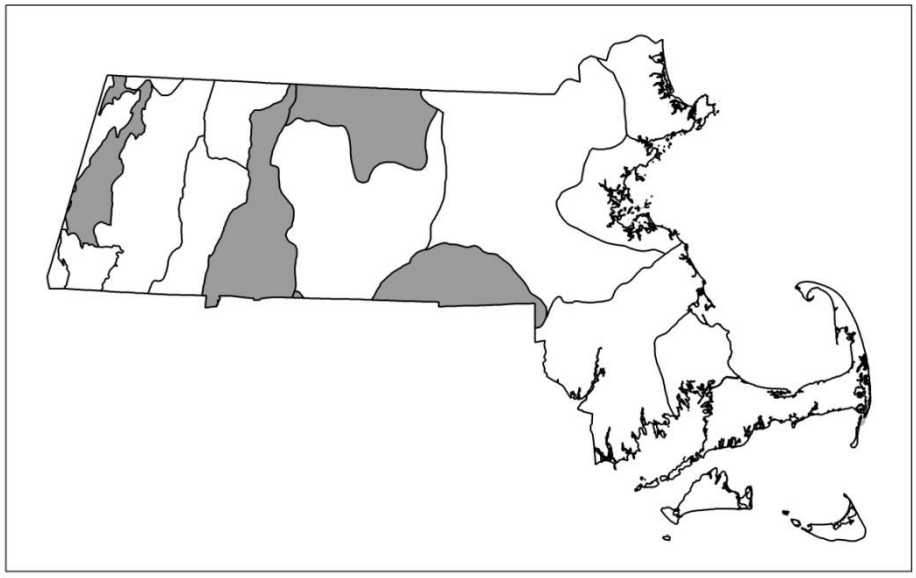
Management Needs: All efforts should be made to mechanically remove non-native plant species and to prevent further clearing.

USNVC/NatureServe: Similar to *Acer* (*rubrum*, *saccharinum*) - *Ulmus americana* Temporarily Flooded Forest Alliance -- *Acer saccharinum-Ulmus americana*/*Onoclea sensibilis* Forest [CEGL006001], and *Acer rubrum* - *Fraxinus pennsylvanica* Seasonally Flooded Forest Alliance *Acer* (*rubrum*, *saccharinum*) - *Fraxinus pennsylvanica* - *Ulmus americana*/*Boehmeria cylindrica* Forest [CEGL006548].

Wet Meadow

Community Code: CP2A0A2000

State Rank: S4



Concept: Graminoid/emergent herbaceous communities that are similar to Deep and Shallow Emergent Marshes, except that they are temporarily rather than seasonally flooded. The soil is saturated during the growing season but not generally inundated. Repeated disturbance, usually from grazing or mowing, keeps these communities open.

Environmental Setting: Wet Meadows occur in lake basins, wet depressions, along slow-moving streams, and in sloughs and other areas with impeded drainage along rivers. The mucky mineral soils are permanently saturated and flood occasionally, but standing water is not present throughout the growing season as in Deep and Shallow Emergent Marshes. As Wet Meadows flood only temporarily, woody plants could become established: many sites are managed using other forms of repeated disturbance, including grazing or mowing, to prevent succession to shrubs or woodland.

Vegetation Description: Wet Meadows are often uniform-appearing communities dominated by a single species from the sedge family or sometimes a rush or a grass. Tussock-forming sedges, such as tussock-sedge (*Carex stricta*) or lakeside sedge (*Carex lacustris*), often have over 50% cover, with variable proportions of other graminoids and herbaceous species. Canada bluejoint (*Calamagrostis canadensis* var. *canadensis*), wool-grass (*Scirpus cyperinus*), woolly-fruited sedge (*Carex lasiocarpa* ssp. *americana*), slender spike-sedge (*Eleocharis tenuis* var. *tenuis*), stalked wool-grass (*Scirpus pedicellatus*), rice cut-grass (*Leersia oryzoides*), and brown beak-sedge (*Rhynchospora capitellata*) are typical of wet meadows and may occasionally be dominant. Characteristic herbaceous associates include water smartweed (*Persicaria amphibia*), river-horsetail (*Equisetum fluviatile*), nodding bur-marigold

(*Bidens cernua*), spotted joe-pye-weed (*Eutrochium maculatum*), and northern blue flag (*Iris versicolor*). Calcareous wet meadows have additional lime-loving species, including red-footed spike-sedge (*Eleocharis erythropoda*), delicate sedge (*Carex leptalea* ssp. *leptalea*), and fen-sedge (*Carex tetanica*). Wet Meadows are called "sedge meadows" in many other states, but "wet meadow" is used in Massachusetts because of known occurrences of meadows dominated by rice cut-grass, Canada bluejoint, and other non-sedge species.

Differentiating Occurrences: The physical and biological characteristics of Wet Meadow, emergent marsh, and shoreline communities overlap and intergrade. The vegetation for all these types is broadly defined: focused surveys might establish which dominant species and hydrological situations define identifiable community types, or might determine that there is a continuum of types that require arbitrary separation. Wet Meadows are graminoid wetland communities similar to, and could be considered to be subtypes of, Shallow Emergent Marshes, but typically a single sedge or grass species dominates. Standing water is not present throughout the growing season as in emergent marshes. Kettlehole Wet Meadows, a specialized type of Shallow Emergent Marsh, are in small basins that have dense graminoid marshes on mucky peat. They are temporarily inundated after storms as well from high groundwater. Shallow Emergent Marshes are graminoid wetlands in broad, flat areas bordering rivers or along lake margins, are seasonally flooded, and usually have surface water all year. Coastal Plain Pondshore Communities and Coastal Plain Pondshores - Inland Variant are generally on sand around ponds in closed basins that intersect groundwater which affects pond levels. By late summer, an exposed shoreline supports herbaceous species that is not generally dominated by tall dense graminoids. Sediments are sandy or mucky, but not peaty. Acidic Pondshores/Lakeshores are broadly defined, variable shorelines around open water not explicitly included in calcareous or coastal plain pondshores. The shore line is often not distinct, merging into marsh or other wetlands.

Associated Fauna: Many animals, vertebrates, and invertebrates, common and rare, use Wet Meadows and marshes for feeding, nesting, roosting, cover, and movement corridors. The sedges, bulrushes and grasses of Wet Meadows provide a food resource for a variety of marsh birds. Large patches of Wet Meadow are the key habitat for such species as Wilson’s Snipe and Sedge Wren. Inconspicuous ("secretive") water birds, such as rails and bitterns, nest in Wet Meadows and marshes that lack human disturbance.

Public Access: Hop Brook WMA, Lee; Ashburnham State Forest, Ashburnham.

Threats: Wet Meadows are threatened by filling and dredging, and by nutrient inputs from adjacent roads, fields, or septic systems. The invasion and spread of purple loosestrife (*Lythrum salicaria*) alters community structure and composition.

Management Needs: Efforts are needed to control the spread of purple loosestrife. Continue activities that have kept the community open, e.g., fall mowing.

USNVC/NatureServe: G771, Includes: (part of) A4107 *Carex* spp. - *Calamagrostis canadensis* Eastern Wet Meadow Herbaceous Alliance, *Carex stricta* - *Carex vesicaria* Herbaceous Vegetation [CEGL006412]. A1399 *Leersia oryzoides* - *Glyceria striata* Herbaceous Alliance, *Leersia oryzoides* - *Sagittaria latifolia* Herbaceous Vegetation [CEGL006461].

Estuarine Communities Descriptions

These are tidal wetlands with fresh to salt water, in which the vegetation and substrate is flooded twice daily by fresh, brackish, or saltwater tides. These wetland communities have some direct hydrological connection to the open ocean.

Salt Marsh, photo by Bill Byrne, MassWildlife

Brackish Tidal Marsh

Community Code: CE2B300000

State Rank: S2

Concept: Mixed herbaceous marsh that is flooded by daily tides and occurs in brackish reach of coastal rivers. May also occur in smaller patches in upper zones of coastal salt marshes and salt ponds, usually near seepages or freshwater transition areas.

Environmental Setting: Brackish tidal marshes occur along free-flowing coastal rivers. Smaller patches often occur along the edges of salt marsh habitat, near stream inputs, seepages or other freshwater transition areas. Tidal amplitude ranges from 0 to 150 cm (comparable to freshwater tidal marshes), while average annual salinity is (0.5) - 5-18 ppt. The community is often structurally diverse, including high marsh and low marsh, with occasional occurrences along rocky shores, seepages, and ditches. The Brackish Tidal Marsh mud flat zone is rich in organic sediments and grades into adjacent less organic brackish mud flats, which are classified as Seagrass Communities.

Vegetation Description: Narrow-leaved cattail (*Typha angustifolia*) is typically dominant in the backmarsh, with frequent stands of common reed (*Phragmites australis*) and less frequent stands of North American reed (*P. australis* ssp. *americanus*). Freshwater cordgrass (*Spartina pectinata*) and saltmarsh bulrush (*Bolboschoenus robust us*) occur along the banks, associated with switchgrass (*Panicum virgatum*), seaside-goldenrod (*Solidago sempervirens*), rose-mallow (*Hibiscus moscheutos*), saltmarsh sedge (*Carex paleacea*), and bentgrass (*Agrostis stolonifera*), which frequently sprawls over the edge. Low marsh supports stands of saltmarsh cordgrass (*Spartina alterniflora*) and common three-square (*Schoenoplectus pungens*). Mudflats and shores support sparse low herbs such as saltmarsh-fleabane (*Pluchea odorata*), water pimpernel (*Samolus floribundus*), mud lily (*Lilaeopsis chinensis*), and creeping

spearwort (*Ranunculus reptans*). Plants of freshwater tidal marshes occasionally occur in the higher zones of brackish marshes.

Differentiating Occurrences: Brackish Tidal Marshes occur along free-flowing coastal rivers. Smaller patches often occur along the edges of salt marsh habitat, near stream inputs, seepages or other freshwater transition areas. Brackish Tidal Marshes are geographically limited to short stretches of tidal rivers where salinity is between fresh- and salt water levels and along the upper edges of Salt Marshes where freshwater enters from uplands. Saltmarsh bulrush and salt reedgrass occur in brackish conditions. In Salt Marshes, saltmarsh hay and saltmarsh cordgrass are dense and dominate in saline conditions. Salt Marshes have less diverse vascular plants than do Brackish Tidal Marshes. Freshwater Tidal Marshes are in coastal streams; the presence of sweet flag and wild rice indicate fresh water, not brackish or salt. Freshwater Tidal Marshes lack salt-tolerant plants. Long's bittercress, estuary arrowhead, and estuary beggar-ticks, although shared with Brackish Tidal Marshes, most commonly occur in freshwater situations. Lilaeopsis, Atlantic mudwort, water-pimpernel, Parker's pipewort, and Eaton's beggar-ticks grow in both Brackish and Freshwater Tidal Marshes, but are more likely in brackish marshes.

Associated Fauna: This community provides outstanding general wildlife habitat, with abundant food sources for migratory and wintering waterfowl, and is generally associated with river reaches with spawning habitat for anadromous fisheries. Amphibian and reptile diversity is lower than in freshwater tidal communities.

Public Access: West Newbury Conservation Area, West Newbury; Willow Brook Farm Preserve (Wildlands Trust), Pembroke; Stetson Meadows, Norwell; Mounces Meadow, Marshfield.

Threats: Invasive species appear to be the primary threat to this natural community. Brackish tidal marshes in several rivers are dominated by common reed (*Phragmites australis*). Rising sea levels.

Management Needs:

USNVC/NatureServe: Includes *Schoenoplectus pungens* Tidal Herbaceous Vegetation [CEGL004188]; *Spartina alterniflora - Lilaeopsis chinensis* Herbaceous Vegetation [CEGL004193]; *Spartina cynosuroides* Herbaceous Vegetation [CEGL004195]; *Typha angustifolia - Hibiscus moscheutos* Herbaceous Vegetation [CEGL004201]; *Schoenoplectus robustus- Spartina alterniflora* Herbaceous Vegetation [CEGL006416]; *Spartina patens - Agrostis stolonifera* Herbaceous Vegetation [CEGL006365]; *Spartina patens - Festuca rubra* - (*Spartina pectinata*) Herbaceous Vegetation [CEGL006368]; *Panicum virgatum - Spartina patens - Carex silicea* Herbaceous Vegetation [CEGL006150]; *Eleocharis rostellata - Spartina patens* Herbaceous Vegetation Spikerush Lawn Tidal Marsh [CEGL006611]; *Schoenoplectus americanus - Spartina patens* Herbaceous Vegetation [CEGL006612]; *Phragmites australis* Tidal Ruderal Herbaceous Vegetation [CEGL004187].

Coastal Salt Pond Community

Community Code: CE3B000000

State Rank: S2

Concept: The vegetation in and surrounding coastal saline to brackish ponds with shallow water. The inland ends tend to be fresher, with denser, taller vegetation developing.

Environmental Setting: Salt ponds are found on the south and east sides of Cape Cod, Martha's Vineyard, Nantucket, and along Buzzards Bay. The critical process causing great variability in salt ponds is the irregular or periodic creation of sandspits that separate the pond waters from direct tidal ocean influence, often for prolonged periods. Formed by drifting sand, the sandspits allow formation of brackish ponds with little tidal action. Water levels fluctuate when the ponds are closed to the ocean, with evaporation reducing water level and freshwater inflow from streams, groundwater, and rain raising water levels. Sandspits may be breached in storms or by human action, allowing water exchange with the ocean and renewed exposure to tidal and wave action. Shoreline marshes may be fresh to brackish to salt. Sea-level Fens may occur in very restricted areas along the shores.

Vegetation Description: Coastal salt pond vegetation is quite variable both spatially and temporally. Eelgrass (*Zostera marina*) beds are often dominant communities of subtidal mud flats. Other areas may have various macroalgae such as sea lettuce or not be vegetated. Towards the ocean, salt marsh usually occurs just above the shore. Mud or sand shores appear during dry spells that support mudflat species such as Atlantic mudwort (*Limosella australis*), saltpond spikerush (*Eleocharis parvula*), saltpond flatsedge (*Cyperus filicinus*), seaside crowfoot (*Ranunculus cymbalaria*), false pimpernel (*Lindernia dubia*), lesser waterwort (*Elatine minima*), water pygmyweed

(*Crassula aquatica*), and saltpond pennywort (*Hydrocotyle verticillata*). The vegetation of inland ends is similar to the landward, brackish portions of salt marshes, with beds of narrow-leaved cattail (*Typha angustifolia*), common reed (*Phragmites australis*), freshwater cordgrass (*Spartina pectinata*), switchgrass (*Panicum virgatum*), bulrushes (*Schoenoplectus* spp., particularly *S. pungens*), and mock bishop's-weed (*Ptilimnium capillaceum*). During fresh periods, extensive beds of pondweeds (*Potamogeton* spp.) may form.

Differentiating Occurrences: The Coastal Salt Pond Community is the only estuarine community represented by a body of water with a narrow opening to the sea, generally formed between the mainland and a barrier beach. Sites contain variable vegetation including seagrasses and the vegetation of many saline and brackish mud flats. Seagrass Communities on marine and estuarine subtidal and intertidal flats have some similar species but are in open, shallow, saline or brackish water.

Associated Fauna: Within the salt pond, fishes are those typically found in estuaries. Eel (*Anguilla rostrata*), alewife (*Alosa pseudoharengus*), and white perch (*Bairdiella chrysura*) are typical fish species. Bird species would be typical of estuaries and near shore areas. A large number of small to large invertebrates live in or on the sediments. Their distribution is influenced by sediment composition and oxygen levels. Some, such as clams, oysters, and other bivalves, filter water for nutrients. Other species such as segmented worms, amphipods, shrimp, clams, and snails extract organic matter from sediments and churn the sediments as they feed, making material available to other organisms. Eastern oysters (*Crassostrea virginica*) extract material from the water column. In some cases, oysters or mussels (including blue mussels (*Mytilus edulis*)), having attached to the substrate, may attach to one another, forming oyster or mussel beds. Many nematodes, sponges, mollusks and barnacles hold on to submerged plants, such as eelgrass or macroalgae.

Public Access: Sesachacha Pond, Nantucket; Allen's Pond, Dartmouth; Tisbury Great Pond and coves off of it, West Tisbury; Salt Pond, Falmouth.

Threats: Artificially maintaining ponds open or closed. The increasingly invasive Mute Swan (*Cygnus olor*) is becoming more abundant and displacing native species. Eutrophication and other forms of coastal pollution, dock and pier construction. Nutrient input and changes in water flow from development along shore lines. Phragmites is a major problem.

Management Needs: Changes in the flow of freshwater can alter the salinity of these systems: below impoundments and areas of water withdrawal, salt tides extend further upstream, affecting species composition and abundance, particularly during drought periods when river flows are low.

USNVC/NatureServe: Includes parts of: *Zostera marina* Permanently Flooded - Tidal Herbaceous Alliance --*Zostera marina* Atlantic Herbaceous Vegetation [CEGL004336]; Includes part of *Spartina patens* High Tidal Marsh Alliance -*Schoenoplectus pungens - Eleocharis parvula* Herbaceous Vegetation [CEGL006398].

Fresh/Brackish Tidal Shrubland

Community Code: CE2C000000

State Rank: S1

Concept: Dense to open shrubland flooded by daily tides, occurring along the freshwater to brackish reach of coastal rivers and along the upland edges of salt marshes.

Environmental Setting: Normally located as a transition between Freshwater Tidal Marsh and Fresh/Brackish Tidal Swamp, there may also be patches of tidal shrublands throughout the Freshwater Tidal Marshes. Additional brackish occurrences are along the upland fringes of Salt Marshes. There is a great deal of micro-relief (tussocks and furrows) leading to high species diversity. Floodwaters are typically slightly acid (pH less than 5) and soils are usually mineral without significant peat deposits. Average annual salinity values of less than 0.5 ppt would be expected in Fresh/Brackish Tidal Shrublands, and (0.5) -5 -18 ppt in Fresh/Brackish Tidal Swamps.

Vegetation Description: Tidal freshwater or slightly brackish shrublands dominated by sweet gale (*Myrica gale*) and smooth alder (*Alnus serrulata*) with some speckled alder (*Alnus incana* ssp. *rugosa*). Some examples may have a mixed canopy with other shrubs such as silky dogwood (*Swida amomum*), swamp-rose (*Rosa palustris*), winterberry (*Ilex verticillata*), common elderberry (*Sambucus nigra* ssp. *canadensis*), willow (*Salix* spp.), buttonbush (*Cephalanthus occidentalis*), and poison ivy (*Toxicodendron radicans*). More northern examples may contain northern arrow-wood (*Viburnum dentatum* var. *lucidum*) and meadowsweet (*Spiraea alba* var. *latifolia*). Tussock-sedge (*Carex stricta*) may also be present. Some herbaceous associates are royal fern (*Osmunda regalis* var. *spectabilis*), marsh-fern (*Thelypteris palustris* var. *pubescens*), bedstraws (*Galium* spp.), common cattail (*Typha latifolia*), arrow-arum

(*Peltandra virginica*), New York aster (*Symphyotrichum novi-belgii*), false nettle (*Boehmeria cylindrica*), touch-me-not (*Impatiens capensis*), and swamp milkweed (*Asclepias incarnata*).

Differentiating Occurrences: Tidal swamps are forested, dominated by trees. Tidal shrublands have less than 25% tree canopy. The key difference from other types of Shrub Swamp is that Fresh/Brackish Tidal Shrublands are restricted to the area of freshwater/ brackish water tidal action on coastal rivers, or where there is freshwater seepage along the edges of salt marshes just above the zone of regular saltwater incursion. An additional difference is the presence of salt marsh plants mixed with the more usual freshwater species. Maritime Shrublands are upland communities. Shrubby areas within and at the upland edges of Salt Marshes would be mappable as Fresh/Brackish Tidal Shrubland if large enough; otherwise, they are considered to be part of the expected variation of Salt Marshes.

Associated Fauna: Because the size and structure of the shrubland present are more important to most animals that would use such a habitat than are the slight fluctuations in water levels on a daily basis, the species present are often those of maritime and coastal shrublands. Coastal shrublands are particularly important to migrating flocks of songbirds.

Public Access: There are no examples on public land in the NHESP database.

Threats: Disruption of tidal influence on the rivers, clearing for boat landings. Invasion by expanding populations of the non-native *Phragmites australis*.

Management Needs:

USNVC/NatureServe: *Alnus* (*incana*, *serrulata*) Tidal Shrubland Alliance -- *Alnus* (*incana* ssp. *rugosa*, *serrulata*) - *Cornus amomum* Shrubland [CEGL006337]; *Baccharis halimifolia - Iva frutescens* Tidal Shrubland Alliance: *Baccharis halimifolia - Iva frutescens*/*Panicum virgatum* [CEGL003921]; *Iva frutescens*/*Spartina patens* Shrubland [CEGL006848].

Fresh/Brackish Tidal Swamp

Community Code: CE1A000000

State Rank: S1

Concept: Low-stature forested wetland located along coastal rivers, at the upper limit of tidal influence, and flooded by daily tides. Dense shrub understory and unusually rich herbaceous layer.

Environmental Setting: Tidal swamps occur along free-flowing coastal rivers, occurring upstream of Freshwater Tidal Marshes, within the upper limits of tidal influence. The community represents an ecotone from tidal marsh to more typical non-tidal forested wetlands. Another variation of this community occurs along smaller streams at the upper limit of tidal influence. Tidal amplitude may range from 0 to 40 cm or more (estimated), and average annual salinity is less than 0.5 ppt in freshwater areas, with gradients to 5 ppt. Brackish occurrences (average annual salinity (0.5) 5 - 18 ppt) may also occur.

Vegetation Description: Red maple (*Acer rubrum*), swamp white oak (*Quercus bicolor*), Atlantic white cedar (*Chamaecyparis thyoides*), and occasionally green ash (*Fraxinus pennsylvanica*) and/or American elm (*Ulmus americana*) occur on elevated hummocks and form an open forest canopy. The shrub layer is often very dense, and typically includes northern arrow-wood (*Viburnum dentatum* var. *lucidum*), winterberry holly (*Ilex verticillata*), hornbeam (*Carpinus caroliniana*), and silky dogwood (*Swida amomum*). Common greenbrier (*Smilax rotundifolia*), poison ivy (*Toxicodendron radicans*), and grapes (*Vitis* sp.) weave through the shrub layer. Large mucky hollows flooded by daily tides support a diverse assemblage of herbs and graminoids. Most of these are typical of the nearby freshwater tidal marsh habitat, and include jewelweed

(*Impatiens capensis*), sensitive fern (*Onoclea sensibilis*) and wild rice (*Zizania aquatica*).

Differentiating Occurrences: The key difference from other types of forested wetlands, particularly Red Maple Swamp, Alluvial Red Maple Swamp, and Alluvial Atlantic White Cedar Swamp, is that Fresh/Brackish Tidal Swamps are restricted to the area of freshwater tidal action on coastal rivers, above the zone of regular saltwater incursion. Being associated with freshwater and brackish tidal marshes, the presence of species from those communities in the openings between trees would be indicative of freshwater tidal conditions; however, the best indicators, estuary beggar-ticks and Eaton's beggar-ticks, are very uncommon. Tidal swamps are forested, dominated by trees, which differentiates them from tidal shrublands, which are dominated by shrubs (<5m, generally multi-stemmed), with <25% trees in the canopy.

Associated Fauna: The size of the swamp and structure produced by the forest and shrubs present are more important to most animals that would use a tidal swamp than are the slight daily fluctuations in water levels from the tides. Fresh/Brackish Tidal Swamps and Shrublands provide habitat for nesting Gray Catbird (*Dumetella carolinensis*), Common Yellowthroat (*Geothlypis trichas*), Swamp Sparrow (*Melospiza georgiana*), Wood Duck (*Aix sponsa*), Marsh Wren (*Cistothorus palustris*), and Veery (*Catharus fuscescens*). The habitat is also used as roosting areas by resident Great Blue Heron (*Ardea herodias*), Green Heron (*Butorides striatus*), Red-tailed Hawk *(Buteo jamaicensis*), and other raptors.

Public Access: Willow Brook Farm Preserve (Wildlands Trust), Pembroke.

Threats: Alteration of river hydrology from excessive water withdrawal may have significant effect on plant communities. Exotic shrubs including honeysuckles can become dense.

Management Needs: Determine hydrologic requirements, and develop system for monitoring hydrologic stress. Investigate occurrences along small streams and in brackish wetlands.

USNVC/NatureServe: *Acer rubrum - Fraxinus pennsylvanica* Tidal Woodland Alliance -- *Acer rubrum - Fraxinus pennsylvanica*/*Polygonum* spp. Woodland [CEGL006165].

Freshwater Tidal Marsh

Community Code: CE2B400000

State Rank: S1

Concept: An estuarine, intertidal, mixed herbaceous marsh flooded by daily tides, occurring in the freshwater reach of coastal rivers.

Environmental Setting: Freshwater Tidal Marshes occur along free-flowing coastal rivers. Tidal amplitude may range from 0 to 150 cm, and average annual salinity is less than 0.5 ppt (from 0.5 ppt to 5 ppt salinity; there is a gradient of species to the more clearly brackish, which has an average annual salinity of 5-18 ppt). This community occurs upstream of Brackish Tidal Marshes, in the upper limits of tidal influence. The community may often be structurally diverse, including high marsh, low marsh, mud flats, rocky shore, ditches, and seepages. High marsh, also called backmarsh, begins with an abrupt bank of peat 1-3 feet above mean low water. Backmarsh is generally more developed along lower gradient rivers, and is often the most diverse vegetated zone of the Freshwater Tidal Marsh. Low marsh develops in small pockets located below the bank of high marsh on muddy or rocky sloping shores of tidal freshwater areas. Large rivers such as the Merrimack have more low marsh habitat in their Freshwater Tidal Marshes than do smaller rivers. Mud flats within the river channel have regular disturbance from sediment deposition and prolonged inundation. They are sparsely vegetated with a different suite of low-growing, usually annual, plants. Rocky shore habitat, like the mud flats, is sparsely vegetated with low growing annuals and is usually limited to small patches on shallow soils. Higher gradient or larger rivers have more of this habitat type than do smaller rivers with less scouring.

Vegetation Description: Freshwater Tidal Marshes are characterized by salt-intolerant plant species. Dominant species include: bluejoint (*Calamagrostis canadensis*), sedges (*Carex*

stricta), narrow-leaved cattail (*Typha angustifolia*), wild rice (*Zizania aquatica*), smartweeds and tearthumbs (*Persicaria punctata*, *P. arifolia*), false pimpernel (*Lindernia dubia*), jewelweed (*Impatiens capensis*), climbing hempweed (*Mikania scandens*), and sweet flag (*Acorus calamus*). Shrubs such as buttonbush (*Cephalanthus occidentalis*) and silky dogwood (*Swida amomum*) may occasionally be present on the upper edges of the backmarsh. Low marsh typically supports stand-forming emergent plants, often with tough mat-forming rhizomes that resist erosion, although some annuals may also dominate large sections of marsh. Large stands of wild rice (*Zizania aquatica*) usually dominate the muddy areas; however, stands of sweet flag (*Acorus calamus*), soft-stem bulrush (*Schoenoplectus tabernaemontani*), grass-leaf arrowhead (*Sagittaria graminea*), pickerel-weed (*Pontederia cordata*), and water dock (*Rumex orbiculatus*) frequently occur in freshwater tidal low marshes. Freshwater cord-grass (*Spartina pectinata*), three-square (*Scirpus pungens*), and water hemp (*Amaranthus cannabinus*) are typical of rockier substrates. Typical species of the more sparsely vegetated mud flats include spike sedges (*Eleocharis* spp.), water purslane (*Ludwigia palustris*), water starwort (*Callitriche palustris*), and bittercresses (*Cardamine* spp.). Rocky shore habitat supports creeping spearwort (*Ranunculus flammula* var. *reptans*) and estuary beggar-ticks (*Bidens hyperborea*), which although shared with brackish tidal marshes, most commonly occur in the freshwater situation.

Differentiating Occurrences: Freshwater Tidal Marshes represent the upstream end of a gradient, ranging from coastal Salt Marsh to Brackish Tidal Marsh to Freshwater Tidal Marsh. Wet Meadows are in wetlands unaffected by tides. Freshwater Tidal Marshes are characterized by salt-intolerant plant species, although some species of Brackish Tidal Marshes also occur in freshwater tidal conditions. Salt Marsh plants such as saltmarsh hay (*Spartina patens*), saltmarsh cordgrass (*S. alterniflora*), and saltmarsh bulrush (*Bolboschoenus robustus*) are not present. Long's bittercress (*C. longii*), along with estuary arrowhead (*Sagittaria montevidensis* ssp. *spongiosa*) and estuary beggar-ticks (*Bidens hyperborea*), although shared with Brackish Tidal Marshes, most commonly occur in the freshwater situation. Some other species that co-occur in Freshwater and Brackish Tidal Marshes are more likely to be found in the brackish to salt condition: lilaeopsis or eastern grasswort (*Lilaeopsis chinensis*), Atlantic mudwort (*Limosella australis*), water-pimpernel (*Samolus valerandi*), Parker's pipewort (*Eriocaulon parkeri*), and Eaton's beggar-ticks (*Bidens eatonii*).

Associated Fauna: This community provides outstanding general wildlife habitat, with abundant food sources for migratory and wintering waterfowl, and is generally associated with river reaches with spawning habitat for anadromous fisheries such as shad or herring (*Alosa* spp.). It tends to have more vertebrate species than do the Brackish Tidal Marshes, including freshwater snakes and muskrats. Freshwater Tidal Marshes provide habitat for nesting marsh birds. Wild rice is a very important food source for migrating Sora (*Porzana carolina*) and other rails. Freshwater mussels are locally abundant along the tidal channel. Associated rare animals include the New England siltsnail (*Floridobia winkleyi*) and the coastal marsh snail (*Littoridinops tenuipes*),

which are both known to occur in drainage ditches and seepages in Freshwater and Brackish Tidal Marshes.

Public Access: West Newbury Conservation Area, West Newbury; Willow Brook Farm Preserve (Wildlands Trust), Pembroke; Stetson Meadows, Norwell; Mounces Meadow, Marshfield.

Threats: Rising sea level may change the occurrences to brackish or salt marsh. Water withdrawal upstream may reduce freshwater flow and allow saltwater further upstream. Development associated with recreational activity (docks, landings) may threaten tidal shore habitat. Invasive species may displace native species or change habitat structure. Invasive plants, including common reed (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), and yellow flag (*Iris pseudacorus*), are established in some systems, although long-term threat is unknown.

Management Needs: Monitor invasive plant populations. Prevent alteration of tidal shores. Maintain stream flow and allow tidal flow. Freshwater Tidal Marshes are geographically limited to short, upstream stretches of tidal rivers in coastal areas; in the past, dams were often placed in rivers below the upper reaches of the tidal influence and so reduced the areas with tidal influence. Historic filling and channelization also reduced the shoreline occurrences of tidal marshes. The recent trend of dam removals allows for natural and assisted restoration of freshwater tidal habitat. Alteration of river hydrology from excessive water withdrawal may have significant effects on plant communities; the extent of tidal influence and the upstream range of the salt front depend in part on the amount of water flowing downstream. Other management often needed in Freshwater Tidal Marshes is control of invasive species.

USNVC/NatureServe: A1485 *Zizania aquatica - Zizaniopsis miliacea* Tidal Freshwater Marsh Alliance -- *Zizania aquatica* Tidal Herbaceous Vegetation [CEGL004202]. A1708 *Nuphar advena - Nuphar sagittifolia* Tidal Freshwater Marsh Alliance -- *Nuphar lutea* ssp. *advena* Tidal Herbaceous Vegetation [CEGL004472]; A3579 *Isoetes riparia - Eriocaulon parkeri* Intertidal Freshwater Marsh Alliance -- *Isoetes riparia* Tidal Herbaceous Vegetation [CEGL006058]; and *Eriocaulon parkeri - Polygonum punctatum* Herbaceous Vegetation [CEGL006352]; A3581 *Stuckenia pectinata - Zannichellia palustris - Ceratophyllum demersum* Freshwater Subtidal Herbaceous Alliance -- *Stuckenia pectinata - Potamogeton perfoliatus-* (*Zannichellia palustris*) Tidal Herbaceous Vegetation [CEGL006027]; A3664 *Schoenoplectus acutus - Schoenoplectus fluviatilis- Schoenoplectus tabernaemontani* Deep Marsh Herbaceous Alliance - *Schoenoplectus fluviatilis* Herbaceous Vegetation [CEGL006366]; A4017 *Peltandra virginica - Pontederia cordata - Sagittaria* spp. Oligohaline Tidal Marsh Alliance -- *Sagittaria subulata - Limosella australis* Tidal Herbaceous Vegetation [CEGL004473;] *Peltandra virginica - Pontederia cordata* Tidal Herbaceous Vegetation [CEGL004706]; *Impatiens capensis - Peltandra virginica - Polygonum arifolium - Schoenoplectus fluviatilis- Typha angustifolia* Tidal Herbaceous Vegetation; *Amaranthus cannabinus* Tidal Herbaceous Vegetation [CEGL006080]; *Impatiens capensis - Peltandra virginica - Polygonum*

arifolium - *Schoenoplectus fluviatilis- Typha angustifolia* Tidal Herbaceous Vegetation [CEGL006325]; *Acorus calamus* Tidal Herbaceous Vegetation [CEGL006833].

Marine Intertidal Gravel/Sand Beach Community

Community Code: CM2B000000

State Rank: S4

Map: No Marine Intertidal Gravel/Sand Beach Communities are documented in the NHESP database.

Concept: Invertebrates and nonvascular plants dominate this highly stressed community in the intertidal (wave action) zone of beaches.

Environmental Setting: Marine beaches are exposed between high tides: they occur below the wrack line and above permanent water, and are often interspersed with low areas that contain intertidal pools. These are high-energy habitats. Marine beaches are between Maritime Beach Strand Communities above the high tide line and marine subtidal communities below the low tide line.

Vegetation Description: Sparse non-vascular plants. Invertebrates are the most abundant resident group, with shorebirds among the most visible animals in the habitat.

Differentiating Occurrences: Marine Intertidal Gravel/Sand Beach Communities are below the wrack line and submerged twice daily by tides. Any vegetation in the Marine Intertidal Gravel/Sand Beach Community is non-vascular. Maritime Beach Strand Communities are above the daily high tides, between the wrack line and the dunes, and support scattered vascular plants. Seagrass Communities tend to be subtidal communities, occurring below the low tide line.

Associated Fauna: Many shorebirds such as Sanderlings (*Calidris alba*), Least Sandpipers (*C. minutilla*), Semipalmated Sandpipers (*C. pusilla*), Semipalmated Plover (*Charadrius semipalmatus*) and Red Knot (*Calidris canutus*) forage along shorelines during migrations. When exposed, the sites are part of important resting areas for shorebirds. Piping Plovers (*Charadrius melodus*) nest on the beach strand and forage in the wrack line. Gulls (*Larus* spp.) are ubiquitous in all shore and shallow water environments. Tiger beetles also forage on exposed portions of the intertidal beach. Few mammals use this portion of the beach for more than passing through. Horseshoe crabs spawn in intertidal beaches.

Public Access: Cape Cod National Seashore; Monomoy National Wildlife Refuge, Orleans and Chatham; Horseneck Beach State Reservation, Westport; Parker River National Wildlife Refuge, Newbury; Boston Harbor Islands, Boston area.

Threats: Disturbance of foraging and resting birds by domestic animals and people, off-road vehicles, and recreational boaters.

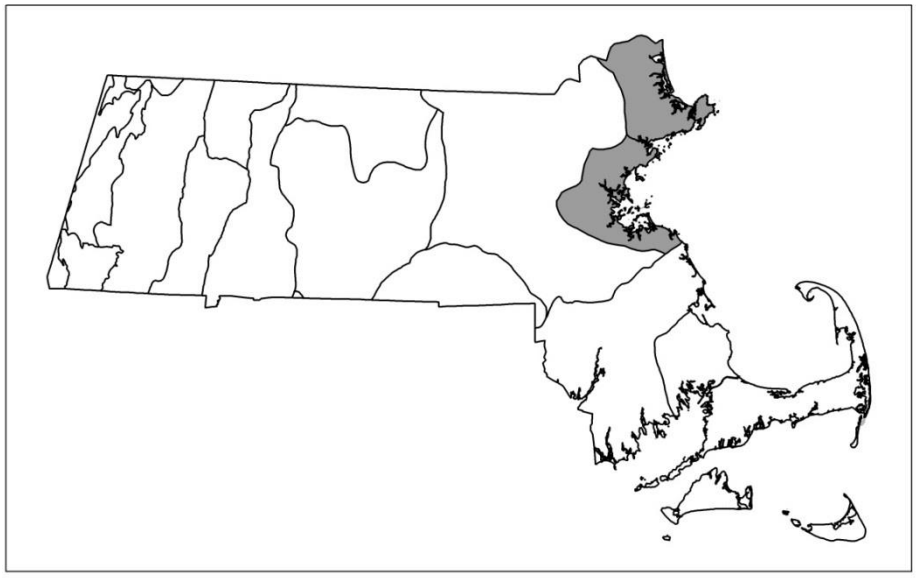
Management Needs:

USNVC/NatureServe: Sand, non-vegetated.

Marine Intertidal Rocky Shore Community

Community Code: CM2A000000

State Rank: S4



Concept: A community dominated by invertebrates and non-vascular plants, in a high-stress environment alternately covered by tides and exposed to desiccation and thermal stress.

Environmental Setting: Marine Intertidal Rocky Shore Communities occur along rocky shores, from the supratidal splash zone to the limits of light penetration in the subtidal zone. This community grades into the rocky subtidal community on the ocean side and the Maritime Rock Cliff Community toward the upland above the tidal zone. Marine Intertidal Rocky Shore Communities are dominated by invertebrates and non-vascular plants, in a high-stress environment alternately covered by tides and exposed to desiccation and thermal stress. The largest natural disturbances to the community are from winter storms that directly remove organisms. In the absence of physical removal during such events, competition for space on rocks determines the types of species that dominate. Microhabitat features include tide pools of varying depth and sizes, rocks (granite) ranging in size from huge boulders and bedrock to cobbles, rock faces varying in degree of exposure to wave energy, and crevasses and surge channels within and between rocks.

Vegetation Description: The communities of rocky shores are dominated by crustaceans, molluscs, and macroscopic algae. The algae (seaweed) provide cover and food for the animals. The rocky shore community shows a distinct zonation from the splash zone to the zone of complete inundation. The community is dominated by marine algae, especially bladder wrack (*Fucus vesiculos*) and rockweed (*Ascophyllum nodosum*) on mid-tidal rock faces. In low intertidal tide pools, marine red algae such as Irish moss

(*Chondrus crispus*), *Polysiphonia* spp., and encrusting red algae (*Chytolithion*) are common. Common green algae include sea-lettuce (*Ulva lactuca*), which is common throughout.

Differentiating Occurrences: This is the only marine rock community covered in saltwater twice daily and fully exposed to the waves. Marine Intertidal Gravel/Sand Beach Communities have smaller substrates, but may share some of the species, are also inundated by twice daily tides, and receive the full force of waves.

Associated Fauna: This was probably the habitat of the extinct sea mink (*Mustela vison macrodon*). Wintering sea birds such as Harlequin Duck (*Histrionicus histrionicus*) and Great Cormorants (*Phalacrocorax carbo*) feed among submerged rocks close to shore. Wintering Purple Sandpipers (*Calidris maritima*) forage among exposed rocks in low tide. This is a foraging area for marine fish such as striped bass (*Morone saxatilis*) during high tide. Rocky shores provide habitat, including tidal pools, for many marine invertebrates that are important to community structure, including blue mussels (*Mytilus edulis* - a competitive dominant for space); several species of herbivorous gastropods, especially periwinkle snails (*Littorina littorea*, an exotic marine species); a predatory snail, dog whelk, (*Nucella lapillus*); and sea stars (*Asterias forbesi* and *A. vulgaris*).

Public Access: Halibut Point State Park, Rockport; East Point/Lodge Park, Nahant. The Marine Intertidal Rocky Shore Community occurs where bedrock is at the surface, particularly from Cape Ann south to Marshfield. There are scattered occurrences along Buzzards Bay and the Elizabeth Islands.

Threats: Invasive species.

Management Needs:

USNVC/NatureServe: Tidal temperate or subpolar alga vegetation: A4133 North Atlantic Tidal Rocky Shoreline Alliance; *Ascophyllum nodosum* - *Fucus vesiculosus* Tidal Algal Nonvascular Vegetation (CEGL006341); *Laminaria agardhii* Tidal Algal Nonvascular Vegetation (CEGL006344).

Salt Marsh

Community Code: CE2B100000

State Rank: S3

Concept: A graminoid-dominated, tidally flooded coastal community with several zones.

Environmental Setting: Salt marshes form in areas subject to oceanic tides that are mostly sheltered from wave energy. They usually develop in estuaries and behind barrier beaches and spits. A peat develops in the higher marshes, with marsh plants extending into flats in stabilized areas as plants trap sediments and organic material, raising the surface area. Upper edges may be brackish where freshwater surface runoff enters from the upland.

Vegetation Description: Saltwater cord-grass (*Spartina alterniflora*) dominates the low marsh area, between the low and mean high tide. Between the mean high tide and the spring high tide, in the high marsh area, salt-hay (*Spartina patens*) dominates, usually mixed with spike grass (*Distichlis spicata*). Towards the upland edge, black grass (*Juncus gerardii*) becomes more common. Mixed throughout, especially towards the upper edges, are sea-lavender (*Limonium carolinianum*), seaside goldenrod (*Solidago sempervirens*), and other salt-tolerant species. At the freshest edges, salt marsh switchgrass (*Panicum virgatum*) may be common. At those upper edges and on ditch spoils, groundsel-tree (*Baccharis halimifolia*) and saltmarsh elder (*Iva frutescens*) can form shrubby zones. Scattered in low, poorly drained, salty areas, salt pannes form with populations of glasswort (*Salicornia* spp.).

Differentiating Occurrences: Salt Marsh is flooded by saltwater (annual average salinity >18ppt). Dominated by saltwater cordgrass and salt hay, it looks grassy. Brackish Tidal Marsh has salinity levels between fresh- and salt water (0.5-18 ppt,). The vegetation is mixed with

saltmarsh bulrush, salt reedgrass, and narrow-leaved cattail. Freshwater Tidal Marsh lacks saltwater cordgrass and salt hay, and has sweet flag, wild rice, climbing hempweed, and other broad-leaved herbaceous plants. It is flooded by freshwater (salinity <0.5 ppt).

Associated Fauna: Many species of birds forage in salt marshes. A few, such as Seaside Sparrow (*Ammodramus maritimus*) and the Saltmarsh Sharptailed Sparrow (*A. caudacutus*), nest there as well. In fall and winter, Short-eared Owls (*Asio flammeus*), Snowy Owls (*Nyctea scandiaca*), and Northern Harrier (*Circus cyaneus*) hunt in salt marshes. In summer, Snowy Egrets (*Egretta thula*), American Black Ducks (*Anas rubripes*), and a number of shorebirds forage in pools at low tide. Few mammals are resident in salt marshes, but meadow voles (*Microtus pensylvanicus*) use them, retreating to dryer areas during high tides. Fiddler crabs (*Uca* spp.) are identified with saltmarsh creeks on Cape Cod and to the south. Native sesarma crabs (*Sesarma reticulatum*), which graze on cordgrass, appear to be increasing, and possibly expanding northward into saltmarshes in the Gulf of Maine.

Public Access: Parker River National Wildlife Refuge, Newbury; Salisbury Marsh, Salisbury; Great Marshes, Barnstable; Nauset Marsh, Eastham; Great Sippewissett Marsh, Falmouth.

Threats: Invasive species, coastal erosion, sea-level rise, coastal development, tidal restrictions, stormwater flows and land source impacts, filling, dredging, and ditching.

Management Needs:

USNVC/NatureServe: Salt Marsh System, includes: *Spartina alterniflora* Tidal Herbaceous Alliance -- *Spartina alterniflora*/(*Ascophyllum nodosum*) Acadian, Virginian Zone Herbaceous Vegetation [CEGL004192]; *Spartina patens* - (*Distichlis spicata*) Tidal Herbaceous Alliance -- *Spartina patens* - *Distichlis spicata* - *Plantago maritima* Herbaceous Vegetation [CEGL006006] and *Spartina patens* - *Agrostis stolonifera* Herbaceous Vegetation [CEGL006365]; *Panicum virgatum* Tidal Herbaceous Alliance -- *Panicum virgatum* Tidal Herbaceous Vegetation [Provisional] [CEGL006150]; *Baccharis halimifolia* - *Iva frutescens* Tidal shrubland Alliance - *Baccharis halimifolia* - *Iva frutescens*/*Panicum virgatum* Shrubland [CEGL006063]; *Sarcocornia perennis*- (*Distichlis spicata*, *Salicornia* spp.) Tidal Herbaceous Alliance - *Sarcocornia perennis* - *Salicornia* spp. - *Spartina alterniflora* Herbaceous Vegetation [CEGL004308].

Seagrass Community

Community Code: CE2D00000A

State Rank: S3

Concept: Estuarine or marine sparsely to densely vegetated communities, completely submerged at high tide and dominated by eelgrass, with a strong invertebrate component.

Environmental Setting: Permanently submerged, saline to brackish, subtidal to intertidal sand/mud flats that support vascular plant beds, in open ocean or near shore in, usually, less than 2m of water. Includes beds of tidal creeks draining salt marshes and river mouths. The salinity of the water changes with the tides and flow of rivers or streams. Actual species present at any place depend on salinity, water temperature, depth, and substrate type. Inter- and subtidal flats are regularly disturbed by currents and tides, storms, and winter ice moving and redepositing sediments, and changing areas inhabited by flora and fauna.

Vegetation Description: Sparsely to densely vegetated communities dominated by eelgrass (*Zostera marina*) and widgeon grass (*Ruppia maritima*), which may be in dense beds. Waterweed (*Elodea nuttallii*), coontail (*Ceratophyllum demersum*), sago pondweed (*Stuckenia pectinata*), and horned pondweed (*Zannichellia palustris*) may be mixed in or form locally dense beds, particularly in areas with fresh water. Algae, in the form of diatoms, may form mats on the surface. Macroalgae [seaweeds], including sea lettuce (*Ulva* spp.) and red algae (*Polysiphonia* spp.), can be locally dense; their occurrences are related to nutrient levels. Flowering plants in shallow waters include those typical of freshwater wetlands, such as wild rice (*Zizania aquatica*) as well as several species more restricted to brackish waters. River arrowhead (*Sagittaria subulata*), Parker's pipewort (*Eriocaulon parkeri*), and Long's bitter-cress

(*Cardamine longii*) grow in fresh/brackish tidal flats. Where waters are more saline, species such as quillwort (*Isoetes riparia*) and saltpond spike-rush (*Eleocharis parvula*) become more common. Invertebrates vary with substrate and depth, and may control the vegetation.

Differentiating Occurrences: All seagrass beds are included in this community type. Estuarine and marine sand/mud flats often support eelgrass beds. Submerged rocky habitats are often dominated by kelp and other algae. Occurrences in Coastal Salt Ponds are included with that community type. Inter- and sub-tidal flats occur all along the Atlantic coast and have many variants. A national classification of marine and estuarine communities is in the early stages of development.

Associated Fauna: Submerged vegetation provides winter feeding sites for waterfowl, including Brant (*Branta bernicla*), American Black Duck (*Anas rubripes*), and sea birds. Vascular plant beds are key nursery habitat for larval and juvenile fishes; the plants also provide surfaces for attachment of invertebrates including shellfish. Fish such as alewife (*Alosa pseudoharengus*), American shad (*Alosa sapidissima*), and striped bass (*Morone saxitilis*) are characteristic of estuarine subtidal habitats which also provide habitat for horseshoe crabs (*Limulus polyphemus*). Marine subtidal flats are spawning areas for winter flounder (*Pseudopleuronectes americanus*) and other fish.

Public Access: Billingsgate Shoals Wildlife Sanctuary, Wellfleet; Joppa Flats, Newbury.

Threats: Coastal pollution. Overfishing, benthic alteration by fishing gear, coastal pollution, dock and pier construction, and dredging all change and degrade the character of seagrass beds.

Management Needs:

USNVC/NatureServe: NatureServe system: CES203.246 Northern Atlantic Coastal Plain Seagrass Bed Membership: *Ruppia maritima* Acadian/Virginian Zone Temperate Herbaceous Vegetation (CEGL006167, GNR); *Zostera marina* Herbaceous Vegetation (CEGL004336, G4G5). Or NVC Group 383 Widgeongrass; *Ruppia maritima* Permanently Flooded - Tidal Temperate Herbaceous Alliance.

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Glossary

These definitions are intended to provide clarity to common words used in a technical sense as well as technical words used somewhat generally. They are all used in the Classification. The definitions are derived from natural community classifications from New York, Maine, and Vermont, the U.S. National Vegetation Classification, and plant ecology and geology texts.

Abundance: the number of individuals of a species in a community.

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

Acidic, Acidity: soil or water with pH <5.5 (5.6 to 7.4 are circumneutral).

Aerated: mixed with air.

Aerobic: areas or conditions with oxygen.

Alkaline: soil or water with a pH > 7.4; basic.

Alluvial; Alluvium: characterized by sediment deposited by running water. Floodplains, pointbars, and most beaches are made of, or covered by, alluvium.

Anadromous: fish that breed in freshwater but spend the rest of their lives at sea.

Anaerobic: areas or conditions without oxygen, usually water-logged.

Anions: negatively charged atomic particles or parts of molecules. In the environment, anions can combine with hydrogen ions to form acids.

Annual; Annual vegetation: plants or groups of plants with a life cycle completed in one growing season. Often characteristic of disturbed habitats.

Aquatic: freshwater habitat where plants grow primarily below the water surface; not included in the *Classification of Natural Communities of Massachusetts*.

Aspect: the direction of exposure of a hill slope.

Assemblage: general term for a group of organisms that live together, no scale is implied.

Associate: a species that occurs in the same community as another species.

Association: in lower case, a general term for a group of organisms that live together. Capitalized, the most finely named groups of species used by the USNVC and NatureServe, usually more finely divided than the Natural Communities in the *Classification of Natural Communities of Massachusetts*.

Backmarsh: marshes that form in poorly drained areas of floodplains.

Backwater: part of a river outside of the main current where water is stagnant.

Bald: an open, bare rock summit or outcrop along a bedrock ridge.

Bank: riverside; broader than the legal definition in the Massachusetts Wetlands Protection Act.

Basalt; Basaltic: a type of very hard bedrock that is usually associated with circumneutral soil or runoff. Less acidic than granite.

Basic: soil or water with a pH above 7.4; alkaline.

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

Biodiversity: all species in an area, including their genetic variability. The complex of life; biological diversity.

Bog: peatland dominated at ground level by a dominance of Sphagnum moss. Bogs have fewer nutrients and are more acidic than other wetlands. Massachusetts is south of the region that has true bogs that receive their water and minerals only from precipitation.

Brackish: tidal water of estuaries where salinity is between fresh and salt water; brackish water has approximately 0.5 to 18 ppt dissolved salts.

Broad-leaved: plants that have wide leaves with well-defined leaf blades, in contrast to needle-like or linear.

Browsers: animals that feed on shoots and leaves of woody plants.

Bryophyte: group of non-vascular plants including mosses, liverworts, and hornworts.

Calcareous: rocks (or soils derived from them) with a high calcium content. Soils and water in areas with calcareous rocks tend to be alkaline or basic (pH >7.4).

Calciphile; Calciphilic: plants that tend to grow in areas of relatively high calcium in the soil or water: calcium-loving plants.

Canopy: in forests or woodlands, the uppermost layer formed by the tops of trees.

Cations: positively charged ions (parts of molecules); often important for plant growth including calcium (Ca++) and potassium (K+).

Central Hardwood Forest: a broadly defined type of matrix forest dominated by oaks (except for red oak), often with hickories, south of the Northern Hardwood Forest and the area of overlap called the Transition Forest.

Characteristic species: species that are generally found in a type of natural community; such species may be widespread and also occur in other community types.

Circumneutral: not strongly acidic or basic, with a pH around neutral (pH 5.5 to 7.4).

Clay: soil made of very fine particles (<0.002mm), smaller than silt. Clay soils can inhibit movement of water in the ground.

Cliff: any exposed, steep rock outcrop, defined in this classification as having slopes >60 degrees.

Closed: referring to forests; closed canopies have >75% cover of vegetation.

Coarse: material that is relatively large in comparison to other material of the same type. Coarse soils have sands and gravel. Coarse woody debris has not yet been reduced in size by biological or physical processes.

Coarse filter: a coarse filter for biodiversity protection is to identify and conserve examples of all types of natural communities and large landscape blocks in the expectation of conserving a high percentage of native species. Protection of individual species is considered to be a fine filter approach.

Coastal: areas near the coast at <60 ft. (about 18m) elevation receiving daily or storm winds with salt spray.

Cobbles: rounded rocks larger than gravel and smaller than boulders (64 to 256 mm diameter, about 2 1/2 in to 10 1/2 in). In Berkshire County, limestone hills are often called Cobbles (such as Bartholomew's Cobble).

Co-dominant: two or more species that share dominance (are very abundant) in a particular vegetation layer, usually the canopy. Codominant species have relatively similar cover or abundance and together influence other species and the environment.

Community: a group of species that recur together, usually in particular environmental conditions. Community attributes include structure, diversity, and dominance, and have indicator and characteristic species.

Conglomerate: a type of sedimentary rock with rounded pebbles or larger stones in a matrix that cements them together.

Conifer forest: a forest dominated by trees of cone-bearing species (conifers), such as eastern hemlock and pines. Needle-leaved, usually evergreen, trees.

Consolidated: sedimentary material that is geologically cemented into solid rock, as opposed to unconsolidated material such as sand or gravel.

Cover (percent): percentage of ground or sky estimated to be occupied by plants (species or layer) in a given area (often reported in cover classes, such as <1%, 6-25%, or 75-100%). A layer may have a total cover >100% if based on cover of individual species.

Cover type: forest categories based on dominant tree species, used by foresters. They may be broader or narrower than community types.

Cultural: used in this classification to indicate vegetation established and maintained, by humans. Examples include lawns, agriculture including pastures and orchards, and many plantations.

DBH: for trees, diameter at breast height (4.5 ft. (1.4m) above the ground); stems with dbh of >4 in (10cm) are generally considered to be trees.

Deciduous vegetation: plants that lose their leaves in the winter. Used informally, "deciduous forest" is shorthand for a forest dominated by broad-leaf trees.

Dewater: removal of water from sediments or soils.

Diagnostic: if present, diagnostic species as a group indicate that a particular community type is present. Their absence means that the community is not present.

Diversity: the number of species present in a community.

Dolostone: a sedimentary carbonate rock, more than half dolomite (calcium magnesium carbonate). It is related to limestone.

Dominant: the most abundant species present or one that produces the most cover in a community; it is usually in the uppermost layer.

Drawdown: lowering of the water level in a reservoir or behind a dam.

Ecology: the study of interrelationships between organisms and their surroundings.

Ecoregions: large areas (relative to communities) geographically and environmentally defined with fairly similar environmental conditions; ecological regions.

Ecotone: transition areas between occurrences of different community types.

Emergent: plants that grow above, or come out of, the surroundings. Forest emergents are the tops of the trees grown above the general canopy. Aquatic emergent plants extend above the water, not floating or submerged, although water inundates their bases.

Enriched: having more nutrients than the surrounding area.

Ephemeral: part of the phrase "spring ephemerals," herbaceous plants species that appear, grow, reproduce, and die back in the spring, starting before leaves develop on the trees.

Ericaceous; Ericad: shrubs of the blueberry or heath family (Ericaceae). Includes blueberries, huckleberries, cranberries, laurels, azaleas, and many bog shrubs.

Estuarine; Estuary: estuaries include tidal habitats and adjacent tidal wetlands in which ocean water is at least occasionally diluted by freshwater from the land. Estuarine communities are subject to varying salinity, tidal actions, and wind, all of which affect what plants are able to grow.

Exemplary: the best. In the NHESP database, used for the best occurrences of the more common natural community types.

Exotic species: species not native to Massachusetts.

Fen: a sphagnum peatland that receives more nutrients than bogs; sedges and other graminoids dominate above the moss surface, often with scattered shrubs or stunted trees. Fens are usually less acidic than bogs.

Fine filter: conservation of biodiversity by protection of individual species, fine filters focus on those species least likely to be caught in the coarse filter natural community approach.

Floodplain: along rivers, flattish areas where moving water floods seasonally deposits sediment that form mineral soils.

Flora; Floristically: the entire group of plants in an area; about the plant species of an area.

Forb: a broad-leaved herbaceous plant; a non-woody plant that is not a graminoid. Most plants called wildflowers are forbs.

Forest: vegetation dominated by trees with canopy cover >25%. If forests and woodlands are separated, forests are taller (>~30ft (10m)) and have denser canopies (>60% cover from overlapping crowns; woodland canopies generally have 25-60% cover).

Fragmentation: community occurrences that in the past would have been a continuous whole, but are now separated from each other by development or other land uses that inhibit natural processes and that restrict species movement.

Frequency: used to consider how regularly a species occurs in a community type and to compare types. In quantitative sampling, frequency is the percentage of plots with a particular species out of all plots sampled.

Freshwater: water with a salinity of < 0.5 parts per thousand. Most of the water of inland areas except for tidal rivers.

Fugitive species: species typical of disturbed areas that are excellent at dispersal, reproduce quickly and abundantly, and usually have short lives. Opportunistic species.

Generalist species: occur in a wide range of environmental conditions. Contrast to specialists that have particular requirements found in a narrow range of environments.

Geochemistry: the distribution of chemical elements of rocks and minerals, and their movement in soil and water.

Graminoid: collective term for plants with a grass-like growth form: including grasses (Family Poaceae), sedges (Cyperaceae), rushes (Juncaceae), cat-tails (Typhaceae), and irises (Iridaceae), as well as some smaller families.

Granite: a type of very hard bedrock that usually produces or is associated with acidic soil or runoff.

Grassland: vegetation dominated by grasses and other graminoids, mixed with forbs and short shrubs, usually on sandy, rapidly draining soils, naturally maintained by salt spray or fire, otherwise successional. Occurrences may depend on management such as prescribed fire or mowing.

Groundwater: water below the soil surface in soil pore spaces and fractures of rocks.

Habitat: the area an organism normally lives in, defined by attributes of the physical environment as well as other organisms.

Hardwood: broad-leaved trees and the wood from them, as contrasted to softwood - conifers and their wood.

Headland: a coastal landform characterized by rocky shores, steep cliffs, and high waves that extend from the coast into the ocean or other water body.

Headwaters: the source of a river or stream; places where rivers begin.

Heath: shrubs of the blueberry family (Ericaceae) including blueberries, huckleberries, cranberries, laurels, azaleas, and many bog shrubs.

Heathland: a shrubland dominated by low growing members of the heath family (huckleberry, blueberry, bearberry) or related plants (broom crowberry, beach heather, golden heather) often with scrub oak and a mixture of sedges and grasses.

Herb: a non-woody vascular plant that usually dies back at the end of the growing season and regenerates from underground organs or seeds.

Herbaceous vegetation: generalized non-woody vascular plants, including all forbs, graminoids, ferns, and fern allies (including horsetails and clubmosses).

Hollow: low area in a marsh or swamp, generally with standing water in the spring. Usually associated with hummocks.

Hummock: high area in a marsh or swamp, often with shrubs or trees on it. Usually associated with low hollows.

Humus: the organic part of soil, formed from the breakdown of plant and animal remains. Humus is below the detritus layer which is less decomposed.

Hydric: used generally in the Classification to mean a very wet environment. Not here restricted to the legal definition in the Massachusetts Wetlands Protection Act and its regulations.

Hydrogeologic: a combination of the water regime and the topography and chemistry (geology) of the site.

Hydrology: the occurrence, distribution, movement, and properties of the waters of the earth and their relationship with the environment.

Hydroperiod: seasonal pattern of water levels in a wetland.

Iceblock depressions: these occur where large chunks of ice left by a glacier were buried in sand. When the ice melted, a depression was left in the land surface that persists today. Also called kettleholes.

Indicator species: these species occur only in a particular community type, which is indicated by its presence. Indicator species are uncommon, and may not be in every occurrence of the community type.

Insolation: the sun exposure (solar irradiance) that reaches the earth's surface at the area of interest.

Intertidal: the area between the tides, exposed to the air and elements twice a day between periods of inundation.

Invasive species: species of plants, animals, or pathogens that are not native to a specific area whose introduction causes environmental or economic harm.

Kames: sand and gravel deposits from glacial meltwater streams that became sand mounds or small hills on the land surface that support species and communities adapted to dry conditions.

Kettlehole: iceblock depressions that occur where large chunks of ice left by a glacier were buried in sand. When the ice melted, a depression in the land surface was left that persists today.

Landscape: a loosely defined area around a community occurrence. Evaluation of the landscape includes whether that area is in natural vegetation, developed, or a combination, and the degree to which natural processes such as fire, flooding, and animal migrations can occur.

Large patch community: see matrix community: Large patch communities occur within the matrix in more specialized conditions (generally 100-500 acres).

Layer: a somewhat arbitrary vertical category of the distribution of the height of the tops of plants in a community: ground layer, herbaceous layer, shrub layer, subcanopy, or canopy. A layer includes all plants that are that height: the herbaceous layer includes tree seedlings and small shrubs.

Lepidoptera; Lepidopteran: the order of insects that includes moths and butterflies; a member of the group.

Lichen: a non-vascular organism consisting of a fungus and an alga or cyanobacterium in a symbiotic association.

Limestone: a calcium-rich bedrock that produces calcium-rich, alkaline soil and water in its vicinity. In Massachusetts, most often in the western part of the state.

Liverwort: a group of small non-vascular plants related to mosses.

Loamy: fertile soils that contain a mix of sizes of soil particles (sand and silt, with a smaller amount of clay), mixed with organic matter (humus).

Marine: of the ocean or oceanic water.

Maritime: coastal lands immediately adjacent to the ocean that receive daily salt spray.

Marsh: wetlands dominated by herbaceous growth (graminoids or forbs) with little or no accumulation of peat. The substrate is usually wet muck, mineral soil with well decomposed organic material.

Massif: a mountain or a compact group of mountains forming an independent part of a range.

Matrix community: natural communities occur naturally at different spatial scales: matrix communities are the prevailing widespread vegetation (about 5000 acres or more). Large patch communities occur within the matrix in more specialized conditions (generally 100-500 acres). Small patch communities are inherently and appropriately very small, limited by localized environmental conditions (about 1 to 100 acres).

Meadow: dense herbaceous vegetation, commonly of limited extent surrounded by other kinds of natural communities. Often maintained by mowing or light grazing, without which trees invade.

Mesic: moist, neither dry nor wet.

Microsite; microhabitat: within a community, small areas with different conditions from the prevailing that may support different organisms and contribute to the community's diversity.

Mineral soil: soils primarily made up of sand, silts, and/or clays and lacking significant amounts of organic material.

Minerotrophic: wetlands that receive minerals and nutrients from surface or ground water.

Moat: a band of open water on the upland edge around a peat mat.

Moraines: hills or ridges of mixed sized glacial debris formed on the ends and sides of a glacier.

Moss: small, non-vascular plants, a group in the bryophytes.

Mottle: in wetland soils, grey streaking or spots (mottles) occur when soils are waterlogged for prolonged periods of time.

Muck: very decomposed organic wetland soils in which plant remains are not identifiable to the unaided eye. If a handful is squeezed, muck, unlike peat, will escape between the fingers leaving little behind.

Native: a species that naturally occurs in the area of focus whose ancestors occurred in the area without human intervention.

Natural community: an assemblage of organisms that recur together and interact with each other and their physical environment. A natural community refers to an actual occurrence on the ground.

Natural community type: a named categorization for classification and discussion purposes with generalized, consolidated descriptions from known occurrences of that assemblage of organisms.

Natural; Semi-natural: communities with predominantly native vegetation in appropriate environmental conditions. Lands that have been or are managed to restore native vegetation or natural habitats may be included as semi-natural as may be sites dominated by native vegetation in an early successional stage that are managed for other purposes (such as air fields and cemeteries).

Non-native: species from other areas (not just from other continents) whose ancestors were introduced by humans. Particularly species introduced since European settlement that are invasive and interfere with the habitats of native species.

Non-vascular: a plant or plant-like organism without specialized conductive tissue for liquids. Includes bryophytes, lichens, and algae.

Northern Hardwood Forest: a broadly defined matrix forest dominated by sugar maple, white ash, American beech, yellow, black and white birch, red oak, black cherry, and basswood (northern hardwoods).

Obligate: species that are restricted to particular habitats. As used here, wetland obligates (species that usually occur in wetlands) are not restricted to the lists in the Massachusetts Wetlands Protection Act and its regulations.

Open: vegetation not dominated by trees or tall shrubs: Cover of woody vegetation (trees plus tall shrubs) is <25%.

Opening: places in forests where sun reaches lower layers through a gap in the canopy. Openings may be where trees have fallen or the ground does not support trees.

Opportunistic species: plants that respond quickly to new habitat availability through excellent dispersal of rapidly grown abundant seeds. Also called fugitive species.

Organic soil: soil with >20% organic matter. Organic soils usually develop under anaerobic conditions in wetlands, includes peat and muck.

Outcrop: bedrock that is exposed and appears at the surface.

Outwash: sand and gravel deposited, often in flat plains, by meltwater from glaciers.

Overstory: the canopy, the highest layer of vegetation in a forest.

Oxbow: in a floodplain, an abandoned meander cut off from the main river.

Palustrine: of or pertaining to non-tidal freshwater wetlands.

Pannes: semi-permanently to permanently flooded shallow depressions in a salt marsh.

Patch community: natural communities occur naturally at different spatial scales; large patch communities occur in specialized conditions (generally 100-500 acres). Small patch communities are inherently and appropriately very small, limited by localized environmental conditions to under about 100 acres.

Peat: unconsolidated, undecomposed plant material that has accumulated in wetlands.

Peatland: wetland with saturated, built up, undegraded organic material, peat. Bogs and fens are peatlands.

Percent cover: the proportion of sky or ground covered by the leaf area of a given layer or a species. Within a layer, if percent cover is estimated by species, total cover may be >100%.

Perennial: plant species that with a life cycle of more than two growing seasons.

pH: the scale used to specify the acidity or alkalinity of a substance. For ecological purposes, pH of <5.5 is called acidic, 5.5-7.4 is considered circumneutral, and a pH of >7.5 is alkaline (or basic).

Pioneer species: species that colonize newly open, disturbed sites, usually early successional opportunistic or fugitive species tolerant of strong sun and exposure.

Plantations: forest stands of planted trees generally of the same age and species, usually intended to be for harvested for wood products.

Pointbar: gravel accumulation along the inside curve of a meandering stream.

Ppt: parts per thousand; for example, the salinity of freshwater is <0.5 ppt.

Reintroduce: to bring back a species or process known to have previously occurred in an area but is currently not present. Reintroduction may be part of a restoration project.

Restoration: renewing and restoring degraded or damaged ecosystems and habitats.

Rich: natural communities with abundant nutrients available for plant and animal growth; and with a high diversity of appropriate native species.

Riparian: along river banks and river margins.

Riverbank: slopes bordering a river that may be vertical to shallow slope; location of riparian habitats; use in this Classification is not restricted to the legal definition in the Massachusetts Wetlands Protection Act.

Saline; Salinity: salty, salts in water / the amount of salt in water, usually expressed in parts per thousand (ppt) by weight.

Saltwater: ocean water has a salinity of 35 ppt, but in relation to brackish and freshwater, saltwater in estuarine areas has an annual average of >18 ppt.

Sand: coarse finely ground rock and mineral particles, (0.06 to 2mm) smaller than gravel and larger than silt. Sandy soils are dry, acidic, and low in nutrients.

Saturated: poorly drained soils that are continuously filled with water, but usually without surface water. Soils that are always wet.

Savanna: parklike vegetation where scattered trees produce a <50% canopy cover, over a grassy, herbaceous, or low shrub understory.

Scrub: vegetation dominated by shrubs.

Sedge: an herbaceous plant with narrow grass-like leaves in the Cyperaceae family, particularly a species of the genus *Carex*.

Seepage; Seeps: groundwater exiting the soil surface, usually on a slope or into a depression, forming a moist or wet place.

Shrub: a perennial woody plant, usually <15 ft. (~5m) at maturity, with multiple erect, spreading or prostrate stems or branches starting at about ground level.

Shrubland: vegetation dominated by shrubs, with shrub cover >25% and tree cover <25% (some pitch pine/scrub oak communities may have denser trees).

Silt: soil mineral particles smaller than sand and larger than clay; 0.004 - 0.06mm.

Slough: along rivers, a backwater channel or inlet only sporadically filled with water, often with deep mud.

Small patch community: inherently and appropriately very small communities, limited by localized environmental conditions (about 1 to 100 ac). See matrix community.

Softwood: conifers and the wood from them; contrasted to hardwoods - broad-leaved trees and the wood from them.

Sparse vegetation: non-biological substrate features dominate and vegetation is nearly absent (cover <25%) and may be concentrated in particular spots. When sparse is used to describe species or a layer, it is used non-numerically for occurring only sporadically although present.

Sphagnum mosses: peat mosses; mosses in the genus Sphagnum that cover the surface and form the substrate in most bogs and fens.

Stand: a forestry term for a group of trees distinguishable from adjacent stands, generally managed as a unit.

Strata: vertical layers of plants in a community: in this classification, the canopy, subcanopy, shrub, herbaceous, and ground layers.

Streambank: same as riverbank: slopes bordering a river; not used in the legal sense of the Massachusetts Wetlands Protection Act.

Structure: the vertical and horizontal spatial arrangement of vegetation and other biotic and abiotic features in a community.

Subcanopy: in forests, a distinct layer formed by the tops of relatively short trees that is beneath the tree canopy and above the shrub layer.

Succession: natural changes over time in composition and structure of a community after a disturbance.

Suite: a group of species with somewhat similar habitat requirements.

Swale: a moist or wet depression, often marshy.

Swamp: wetland vegetation dominated by trees or shrubs, with little or no accumulation of peat. A swamp may have marshy openings without trees.

Systems: informal groupings of communities that occur together within a controlling environmental factor that affects them all: such as barrier beach systems.

Talus: coarse rock fragments of any size or shape on a slope, often below a cliff; the accumulated mass of such loose rock.

Terrace: a flattish remnant of a former floodplain above and along the current floodplain. High terraces are above the annual flood zone.

Terrestrial: of or pertaining to communities not significantly influenced by standing or moving water; upland communities on predominantly dry to mesic soils.

Till: a layer of unsorted sediments (clay, silt, sand, gravel, or boulder sized fragments in any combination) deposited directly by glaciers. Till is the parent material from which many of Massachusetts' soils developed.

Transition Hardwoods: a diverse group of forest types with mixes of northern hardwood species (e.g., beech, birch, and maple), central hardwood species (e.g., oak and hickory), and softwood species (especially white pine). Transitional forests occur where human land-use has blurred the line between formerly more distinct Northern Hardwoods and Central Hardwoods forests.

Traprock: basalt ridges, rugged topographic features resistant to erosion, elevated above the surroundings in the Connecticut Valley.

Tree: a woody plant generally with a single main stem that normally reaches a height of more than about 16 ft. (about 5m) at maturity.

Treeless: vegetation where trees are very scattered, forming a canopy of <25% cover.

Unconsolidated: material such as sand or gravel that is loose and remains as individual particles, as opposed to consolidated material that is geologically cemented into solid rock.

Undergrowth: vegetation layers in a forest below the canopy and subcanopy.

Untilled: soils that were never plowed; lands that were never cleared and cultivated for crops.

Upland: areas with moist to well-drained soils where the water table is below the surface; not wetlands.

Vascular plant: plant with tissue that conducts fluids; individual of seed plants (Angiosperms and Gymnosperms), ferns, or fern allies.

Vegetation: all the plants of an area considered collectively.

Water table: the upper surface of the area of permanent saturation of the soil, the ground water.

Weed; Weedy species: species that disperse their seeds widely, grow rapidly, and are able to quickly take advantage of disturbances. Opportunistic species, often but not always non-native.

Wetlands: lands that are usually saturated with water; water table at or near the surface most of the year. The term is not used here in the sense of a “jurisdictional wetland”, which has a more limited legal meaning.

Woodlands: communities with shorter trees (<about 30 ft. (~10m) than forests (>~30 ft.), and a more open canopy (25-60% cover, with forests having >60% cover if types are divided), may have a fairly continuous low shrub layer between the trees. Not always a distinct community group; may be successional.

Woody plant: trees and shrubs and some vines: plants with woody tissue.

Wrack: wreckage, including seaweeds placed on the shore by the waves; any member of coarse brown seaweeds that grow on the shoreline.

Xeric: of, characterized by, or adapted to extremely dry conditions.

Acknowledgements

This revised and updated Version 2.0 of *The Classification of the Natural Communities of Massachusetts* and fact sheets for each community type described continues to be a product of the Natural Heritage & Endangered Species Program (NHESP) and the cadre of dedicated field ecologists and naturalists in Massachusetts. All the thanks given in the 2001 Version 1.3 are still valid; the information in that document from those biologists was the basis of the natural community classification. Many years of many people's fieldwork and observations, with data compiled in natural community and species surveys, property reports, management plans, and more, continue to contribute to the core information in the classification. Over the years since the 2001 version of the classification, several new community types were recommended and described by Chris Buelow, Matthew Hickler, Glenn Motzkin, Robert Bertin, Ted Elliman, and Roberta Lombardi. Brian Reid, Karen Searcy and Sally Shaw contributed natural community descriptions to the 2001 version. Most of the original and subsequent descriptions, written by staff or outside contributors, have been modified for this 2016 update.

Jennifer Kearsley's major contribution to the 2001 natural community classification needs to be acknowledged: she wrote the original descriptions for the Palustrine system and established the format that this Version 2.0 continues to use. Her model for the ecoregion descriptions is the basis for this update. Her careful studies of the floodplain forests and the acidic peatlands continue to be the baseline for the classification of those groups of communities.

NHESP ecologists and supporting staff wrote most of the original natural community descriptions and fact sheets while supported by general NHESP funding. Some of the original wetland community descriptions and fact sheets were partially funded by grants from the U.S. Environmental Protection Agency. Funding from the Natural Resource Damage Assessment and Restoration Programs of the Massachusetts Executive Office of Energy & Environmental Affairs and the U.S. Fish and Wildlife Service allowed the writing and updating of fact sheets for natural communities along the Housatonic River. Although the original fact sheets have been rewritten for this update, some of the original language has been incorporated into the classification descriptions and the new fact sheets.

In addition to the material used to develop and support the 2001 natural community classification, new community reports and information came from many very useful sources:

The *Flora of Worcester County* (Bertin and Rawinski) includes very helpful species habitat and distribution notes.

The Association to Preserve Cape Cod sponsored natural community interns (Lindsay Cook and Alexander Etkind) whose work on the Cape increased the number of community occurrences in the NHESP database. Questions from the interns about ambiguous community descriptions improved the community descriptions. JoAnne Morimoto oversaw their work.

Maps of aerially interpreted natural communities with verification plots provided to NHESP for the Massachusetts Military Reservation (Camp Edwards), Nantucket (from The Nature Conservancy), and the property of an anonymous private trust increased our knowledge of the distribution of various community types.

Detailed property survey reports of National Park lands including the Appalachian Trail Corridor, the Boston Harbor Islands, Minute Man National Historic Park, Saugus Iron Works, and the Cape Cod National Seashore provided many natural community occurrences. Natural communities from several of these reports have not yet been completely incorporated into the NHESP database. The National Park Service and NatureServe provided copies of the reports and maps.

MassWildlife's Habitat Program focused a survey for Rich, Mesic Forests on Wildlife Management Areas; Habitat Program leader and forester John Scanlon and his staff lead by Nancy Putnam provided data that greatly increased the number and distribution of sites for Rich, Mesic Forests. Other plots and descriptions from the forest surveys enhanced information on the variations of more common types of forested natural communities.

For several years, the Department of Conservation and Recreation's Bureau of Forestry worked with NHESP to conduct preharvest surveys for rare plants and uncommon natural communities on areas selected for timber harvests. The reports on natural community occurrences by the surveyors not only added information on distribution of various community types, but also added occurrences of several uncommon types (not harvested once identified) to the NHESP database.

The US Army Corps of Engineers continued to survey their properties for rare species and uncommon natural communities; NHESP received copies of reports for properties for which NHESP had not been involved with the surveys as well as receiving funding to coordinate surveys on other properties, including Tully Lake and parts of the Charles River flood management area.

For this update as well as for the 2001 draft of the *Classification of Natural Communities of Massachusetts*, Bruce Sorrie's extensive field notes, detailed reports from Glenn Motzkin and Tom Rawinski, and Pam Weatherbee's *Flora of Berkshire County* as well as her field forms were particularly helpful in establishing the details of community composition in Massachusetts. Reports submitted to NHESP's Small Research Contracts Program and Ecological Restoration Program also contributed significant information to the classification.

Descriptions of communities from classifications from surrounding states and from NatureServe (originally the science division of The Nature Conservancy) and the US National Vegetation Classification have also contributed greatly to the information in the classification.

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Pat Huckery, Matt Burne, Tim Simmons, and Brad Blodget contributed rare animal information, and Matt Burne and Pat Huckery identified communities that can function as vernal pool habitat. Brad Blodget, Tom French, and Tim Simmons supplied information on more common animal species, especially those using terrestrial communities – but the interpretations and restatements of their information should not be held against them.

Several people commented on earlier versions of the classification, but like the zoologists, they should not be held accountable for the use made, or not made, of their input. Comments from Jesse Bellemare, Robert Buchsbaum, Russ Hopping, Anne-Marie Kittredge, Glenn Motzkin, Tom Rawinski, Tim Simmons, Pam Weatherbee, and Robert Zaremba were very valuable and much appreciated. Henry Woolsey, Marea Gabriel, and Darren Singer provided encouragement and editorial comments on the 2001 version.

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The data organization and availability reflect the effective management by several data managers and hordes of interns, work-study students, and volunteers over more than 35 years. Preliminary conceptual design and organization for the 2001 version was accomplished through meetings of the authors, Julie Lundgren, Henry Woolsey, and Vicki Frey. Vicki Frey and Jean Collins developed the Access database. David Szczebak and Laura Chaskelson produced the sub-ecoregion distribution maps for the original classification. David Szczebak produced most of the shape files for the maps for this updated Version 2.0 and the 2016 community fact sheets.

Earlier versions of *The Classification of Natural Communities of Massachusetts* did not include a key. Kasey Rolih, from the University of Massachusetts Amherst, shared a key to the NHESP natural communities she developed for a Housatonic Watershed Biodiversity Assessment Project in 2000. In 2006, Paul Cavanagh, then at Manomet Center for Conservation Sciences, developed (with the support of Manomet and the Massachusetts Environmental Trust) *A Guide to the Massachusetts Natural Communities,* which he made available to the NHESP. These keys and keys in the natural community classifications for surrounding states and in various NatureServe property reports were reviewed before the key that goes with Version 2.0 of the Massachusetts was developed. However, no one else should be blamed for what was ultimately produced. Jon Regosin suggested multiple improvements in the format to the key to Version 2.0. Jessica Pederson of the New England Wild Flower Society (now the Native Plant Trust) passed along a request to students who had taken the Society's Plant Communities of New England class for help working through the draft key. The Nashua River Watershed Association hosted a talk on the natural communities of the area and the revised classification - and a request for help with the key. The NRWA's supportive communications manager, Wynne Trevor-Kvenvold, organized publicity for the talk and follow-up workshop and natural community walk. Workshops with impressively knowledgeable people from these groups identified some problems with the key that resulted in improvements. Thanks to Paula Terrasi, Conservation Administrator for the Pepperell Conservation Commission for help with the workshops. And thanks to workshop participants Therese Thompson, Louise Barteau, Nancy Lebedzinski, Bruce McGarry, and Pam Durrant, who carefully went through the key and provided helpful observations on its structure and content.

In the years leading up to the production of Version 2.0 of *The Classification of Natural Communities of Massachusetts,* Jonathan Regosin and Thomas French provided time to focus on revising and updating the classification and fact sheets. This focus was also enabled by many staff who took up various programmatic

projects that the author would otherwise have been involved with - particularly Karro Frost and Lynn Harper. NHESP staff contributed to and supported Version 2.0, not least by data management, data retrieval, and copy editing, coordinated and mostly done by Sarah Maier. Jennifer Longsdorf did the painstaking work of finding and manually italicizing all the scientific names in the Classification and providing a list of them for pairing with the common names used in the fact sheets. She just as carefully prepared all the fact sheets and classification pages for posting on the web, and did that, too. Kim Justham entered most of the natural community polygons in the past decade. Amanda Veinotte coordinates the NHESP web pages.

Appendices

Appendix 1: NHESP Priority Types of Natural Communities

Communities ranked S1 through S3S4 are Priority Natural Communities.

Terrestrial	Rank
High Elevation Spruce - Fir Forest/Woodland	S1
Maritime Juniper Woodland/Shrubland	S1
Maritime Pitch Pine Woodland on Dunes	S1
Oak - Tulip Tree Forest	S1
Sandplain Grassland	S1
Sandplain Heathland	S1
Yellow Oak Dry Calcareous Forest	S1
Calcareous Rocky Summit/Rock Outcrop Community	S2
Hickory - Hop Hornbeam Forest/Woodland	S2
Maritime Erosional Cliff Community	S2
Maritime Forest/Woodland	S2
Maritime Rock Cliff Community	S2
Open Talus/Coarse Boulder Community	S2
Pitch Pine - Scrub Oak Community	S2
Ridgetop Heathland	S2
Ridgetop Pitch Pine - Scrub Oak Community	S2
Sandplain Gressland – Inland Variant	S2
Sandplain Heathland - Inland Variant	S2
Scrub Oak Shrubland	S2
Circumneutral Rocky Summit/Rock Outcrop Community	S2S3
Calcareous Rock Cliff Community	S3
Circumneutral Rock Cliff Community	S3
Maritime Beach Strand Community	S3
Maritime Dune Community	S3
Maritime Shrubland	S3
Open Oak Forest/Woodland	S3
Rich, Mesic Forest	S3
Riverside Rock Outcrop Community	S3
Sugar Maple - Oak - Hickory Forest	S3
Black Oak - Scarlet Oak Woodland	S3S4

Estuarine	Rank
Fresh/Brackish Tidal Shrubland	S1
Fresh/Brackish Tidal Swamp	S1
Freshwater Tidal Marsh	S1
Brackish Tidal Marsh	S2
Coastal Salt Pond Community	S2
Salt Marsh	S3
Seagrass Community	S3

Palustrine	Rank
Black Gum - Pin Oak - Swamp White Oak Perched Swamp	S1
Calcareous Basin Fen	S1
Coastal Plain Pondshore Community - Inland Variant	S1
Northern Atlantic White Cedar Swamp	S1
Sea-level Fen	S1
Alluvial Atlantic White Cedar Swamp	S2
Atlantic White Cedar Bog	S2
Calcareous Pondshore/Lakeshore Community	S2
Calcareous Seepage Marsh	S2
Calcareous Sloping Fen	S2
Coastal Atlantic White Cedar Swamp	S2
Cobble Bar Forest	S2
High-energy Rivershore Meadow	S2
High-terrace Floodplain Forest	S2
Inland Atlantic White Cedar Swamp	S2
Interdunal Marsh/Swale	S2
Kettlehole Level Bog	S2
Major-river Floodplain Forest	S2
Red Maple - Black Ash - Bur Oak Swamp	S2
Red Maple - Black Ash - Tamarack Calcareous Seepage Swamp	S2
Red Maple - Black Ash Swamp	S2
Red Maple - Black Gum Swamp	S2
Riverside Seep Community	S2
Small-river Floodplain Forest	S2
Spruce - Tamarack Bog	S2
Transitional Floodplain Forest	S2
Acidic Graminoid Fen	S3
Acidic Shrub Fen	S3
Alluvial Hardwood Flat Community	S3
Alluvial Red Maple Swamp	S3
Coastal Plain Pondshore Community	S3
High-energy Riverbank Community	S3
Kettlehole Wet Meadow	S3
Level Bog	S3
Red Spruce Swamp	S3
Rich Conifer Swamp	S3

Appendix 2: Acronyms and Abbreviations

These are used in this *Classification of the Natural Communities of Massachusetts* and associated fact sheets.

Acronym or abbreviation	What it stands for	Where it is likely encountered in the natural community classification
~	about; approximately	Vegetation description
<	less than	Vegetation description
>	greater than	Vegetation description
ACOE	US Army Corps of Engineers	Examples with Public Access; Introduction
AGF	Acidic Graminoid Fen	Vegetation description
ASF	Acidic Shrub Fen	Vegetation description
ATV	All-terrain Vehicle	Threats
AWC	Atlantic White Cedar	Descriptions; Similar Communities
AWCS	Atlantic White Cedar Swamp	Examples with Public Access; Descriptions
BOSOW	Black Oak - Scarlet Oak Woodlands	Descriptions; Similar Communities
CAWCS	Coastal Atlantic White Cedar Swamp	Vegetation and Similar Communities
CCNS	Cape Cod National Seashore	Examples with Public Access
cm	centimeters	Descriptions
CPPS	Coastal Plain Pond Shore	Descriptions; Similar Communities
DCR	Massachusetts Department of Conservation and Recreation	Examples with Public Access; Introduction
DEM	Deep Emergent Marshes	Descriptions; Similar Communities
DEP	Massachusetts Department of Environmental Protection	Introduction
DFG	Massachusetts Department of Fish & Game	Examples with Public Access
DFW	Massachusetts Division of Fisheries & Wildlife	Examples with Public Access
E	Endangered, under MESA	Habitat Values
ECGA	Essex County Greenbelt Association	Examples with Public Access
ELCODE	Element Code	Guide to Understanding Fact Sheets
EPA	US Environmental Protection Agency	Introduction
ft	feet	Descriptions
FW	Freshwater	Descriptions; Similar Communities
HHH	Hickory - Hop Hornbeam Forests/Woodlands	Descriptions; Similar Communities
in	inches	Descriptions
m	meters	Descriptions
MA	Massachusetts	Similar Communities
MAS	Massachusetts Audubon Society	Examples with Public Access
MESA	Massachusetts Endangered Species Act	Habitat Values for Associated Species
MGCT, MGLT	Mount Grace Land Conservation Trust	Examples with Public Access
Mt.	Mount (as part of site names)	Examples with Public Access
Mtn.	Mountain (as part of site names)	Examples with Public Access
NCF	Nantucket Conservation Foundation	Examples with Public Access
NHESP	Natural Heritage & Endangered Species Program	Examples with Public Access; Introduction
NHHWPF	Northern Hardwoods - Hemlock - White Pine Forest	Descriptions; Similar Communities
NS	National Seashore	Examples with Public Access
NWR	National Wildlife Refuge, US Fish and Wildlife Service	Examples with Public Access
OHWP, OHWPF	Oak - Hemlock - White Pine Forest	Descriptions; Similar Communities
ORV	Off-road Vehicle	Threats
pH	level of acidity (<7) or alkalinity (>7);	Descriptions
PPOF	Pitch Pine - Oak Forests/Woodlands	Descriptions; Similar Communities
PPSO	Pitch Pine/Scrub Oak	Descriptions; Similar Communities
ppt	parts per thousand	Description discussions of salinity of water
RMF	Rich, Mesic Forests	Descriptions; Similar Communities

Acronym or abbreviation	What it stands for	Where it is likely encountered in the natural community classification
ROSMTF	Red Oak - Sugar Maple Transition Forests	Descriptions; Similar Communities
RPPSO	Ridgetop Pitch Pine/Scrub Oak	Descriptions; Similar Communities
SC	Species of Special Concern, under MESA	Habitat Values
S1	Critically imperiled in MA	Guide to Fact Sheets; Fact Sheets
S2	Imperiled in MA	Guide to Fact Sheets; Fact Sheets
S3	Vulnerable in MA	Guide to Fact Sheets; Fact Sheets
S4	Apparently secure in MA	Guide to Fact Sheets; Fact Sheets
S5	Demonstrably secure in MA	Guide to Fact Sheets; Fact Sheets
SE	Southeast	Vegetation Description
SMB	Southeastern Massachusetts Bioreserve	Examples with Public Access
SEM	Shallow Emergent Marshes	Descriptions; Similar Communities
SF	State Forest; DCR land	Examples with Public Access
SFNHF	Spruce - Fir - Northern Hardwoods Forest	Descriptions; Similar Communities
SMOH, SMOHF	Sugar Maple - Oak - Hickory Forest	Vegetation and Environmental Descriptions; Similar Communities
SP	State Park; DCR land	Examples with Public Access
SR	State Reservation; DCR land	Examples with Public Access
SRANK	State Rank	Guide to Understanding Fact Sheets
SU	Status Unknown in MA	Guide to Fact Sheets; Fact Sheets
SW	Southwest	Descriptions
T	Threatened, under MESA	Habitat Values
TNC	The Nature Conservancy	Examples with Public Access
TTOR	The Trustees of Reservations	Examples with Public Access
USACE	US Army Corps of Engineers	Examples with Public Access; Introduction
WCE	Wildlife Conservation Easement	Examples with Public Access
WL	Watch List (A non-regulatory NHESP category of Plants)	Descriptions
WMA	Wildlife Management Area	Examples with Public Access
WPOF	White Pine - Oak Forest	Descriptions; Similar Communities
WS	Wildlife Sanctuary	Examples with Public Access

Appendix 3: Key to the Identification of Natural Communities

Keys to the descriptions of the natural communities of Massachusetts are intended to assist users in identifying the natural communities that they encounter in the state. As with the classification, the keys are intended to be used by anyone with an interest in conservation and a familiarity with the plants of Massachusetts. The keys lead to named natural community types, and on the NHESP website are linked to illustrated fact sheets describing the natural community in more detail than available in the key.

The keys to the natural communities follow a typical pattern of taxonomic keys; that is, they are dichotomous, consisting of pairs of diverging options (couplets) requiring choices between the options given. Both choices should be considered with the best fit for the observed community being followed to the next couplet in the key (identified by a code on the far right of the page), or to a named community type that will be linked to the fact sheet for that community.

Because defined natural communities are parts of gradients in time and space and the definitions are based on both generalization of occurrences and idealization of the types, there are seldom exact fits between concrete examples (occurrences) and the definitions. Also, transitional areas - physical and biological - abound on the landscape and add great confusion to attempts to classify the natural communities formed by the vegetation. The named classified community types are defined from descriptions made at the 'best' or core areas: identification of communities located on the ground should then also use the core areas of those communities, not edges or areas of transition to adjoining community occurrences. Information on locations provided in the descriptions and as part of the key is for guidance. Reforestation after land clearance led to widespread vegetation homogenization and expansion of the broad transitional areas. In addition, patches of many community types naturally occur outside of the main areas of distribution when conditions (particularly moisture, temperatures, and soils) are appropriate and the plants that make up the communities are dispersed to them.

Very general numbers are used to divide community types in the keys. They are round numbers, for guidance not meant to be absolutely precise. For example, "about 25% cover by woody plants >5m tall" was used as the separators between forested and not forested. These are meant to be guides; they are approximate both in the field and the classification.

Cover by a vegetation layer refers to the estimated percentage of ground (looking down) or sky (looking up) visually blocked by the particular layer of focus. In the case of a community being described, the coverage of a layer is intended to be estimated over the entire occurrence. That is, if it is the cover of the tree canopy that is being estimated, the observer should move or look around to see if the canopy cover is consistently above or below the 25% threshold for determining whether the occurrence is a forest or not. The same is true for the other vegetation layers that are used to define the structure of a community.

Keys and descriptions for other states and the US National Vegetation Classification, and in forestry manuals may use different numbers as criteria for separating structural types. The purposes of the classifications may be different (for example, differentiating forests from woodlands or from parklike savannas), or it may be that what seems forested in different places is different. No one is wrong; these are the results of trying to impose order on a not all that cooperative nature.

Some community types are reached through multiple approaches in the key (that is, some woodlands and shrublands can be reached through either the forest or shrubland keys and some shrublands and open herbaceous communities are in both shrubland and open keys).

If the community reached at the end of keying does not seem to be the correct fit, it is worth keeping track of that result while going back through the key to see if a different choice or choices might have been reasonable and following that path to a different community that can be compared. Or, an unknown community that does not fit the described communities may be intermediate between two community types and may be described as such. There are several broadly defined communities (such as Northern Hardwood – Hemlock – White Pine Forest or Oak – Hemlock –White Pine Forest) that have recurrent variations that are named as natural community types. If a community occurrence does not match a named variant of a broadly defined type, it can be placed in the broadly defined types that capture their main characteristics. The broadly defined types are often the common types and most often encountered. This classification was designed to identify uncommon types of natural communities for conservation attention: the more common types are often of conservation interest if in excellent condition, large, not fragmented (especially for forests), and in very good landscape context (not impinged on by human disturbance factors).

Organization of the Classification

As in the previous versions of the *Classification of Natural Communities of Massachusetts*, natural community **types** are divided into three major categories or systems: **Terrestrial**, **Palustrine**, and **Estuarine**. Within these categories the structural dominance – growth form or physiognomy such as forest, shrubland, and open herbaceous or sparsely vegetated – is used to identify structural groups within each system. The forested categories in the terrestrial and palustrine sections are each further subdivided by whether there is dominance by conifers (evergreens), deciduous trees, or a mix of both. Vascular plants compose the vegetation of the natural communities that are described in this classification (however, communities comprised of submerged vascular plants are not included, except for Seagrass Communities).

Different parts of the keys may follow different patterns of what is best suited for differentiation; location in the state or substrate type divide some groups of communities from others. More detailed information on species dominance and composition are generally used in later divisions and as the final determinant of type.

A significant presence of non-tidal freshwater is used to define the Palustrine system; the Estuarine system is defined by the presence of water with some salinity or tidal influence. All tidally influenced

communities are in the Estuarine system whether the tidal water is saline or fresh. Salt spray communities not influenced by tides are treated as terrestrial.

This classification includes neither Aquatic (deep water systems with primarily submerged or floating plants) nor Marine (open ocean) communities. National classifications of both have been undertaken by other organizations.

Terrestrial Key

- Occur in upland on predominantly well-drained (dry to mesic) soils
- Not significantly influenced by standing or moving water.
- Vegetation is not adapted to growing in water or on very wet substrates even if the soil surface is occasionally flooded or saturated.

Note: Does not include High-terrace Floodplain Forest (see Palustrine).

Palustrine Key

- All freshwater, non-tidal wetlands dominated by trees, shrubs, or persistent emergents, including mosses and lichens.
- Submersed and floating-leaved aquatics are considered to be aquatic and are not included in this classification.
- All tidal wetlands are included in the estuarine system.
- Riverside communities that receive annual or semi-annual overbank flooding, e.g. floodplain forests.

Notes: High-terrace floodplain forests (although technically terrestrial communities) are included in the palustrine section in order to group them with other floodplain forest communities. The term “wetland” is not used in the sense of a “jurisdictional wetland”, which has a legal definition.

Estuarine Key

- Estuarine wetlands are affected by salt or brackish water, or tidal flooding by salt, brackish, or freshwater.
- Estuarine areas extend landward and up streams to where oceanic salts (defined as > 0.5 ppt salinity in an annual average low flow period) or tides (including freshwater tidal areas) have an influence on the vegetation.
- Hyper-salinity (compared to the ocean) may occur temporarily in some areas (such as in salt ponds).

How to use this Key:

It is important to refer to the community descriptions in the main body of this classification as the final step in confirming a natural community determination. Those have more complete descriptions and more information about typically dominant, characteristic, and indicator species than do the keys.

The Key is formatted as follows:

Couplet Code. Description to note key distinguishing features: **Natural Community Name or next step**
Longer description of Natural Community

Similar Communities: Related Natural Community #1 brief description and how it is different. Related Natural Community #2 brief description and how it is different. Related Natural Community #3 brief description and how it is different.

In the couplet code, T stands for terrestrial communities; P for Palustrine communities; and E for Estuarine communities. Within each community system, forests come first, subdivided into dominant leaf-type groups for convenience. Several named community types are variable in the dominance of conifers and listed in several leaf-type sections for convenience in keying. Shrub-dominated communities follow, with open communities that have few (<25% cover) trees and tall shrubs, are herbaceous or low-shrub-dominated, or are sparsely vegetated, at the end of each system. Each of these codes lead to a specific couplet with two choices that meet previous requirements of steps up to that point.

Terrestrial System

T: Upland natural communities; on predominantly well-drained soils that are dry to mesic; vegetation is never hydrophytic even if soil surface is seasonally flooded or saturated.

T1a. Forests, Woodlands, Tall Shrublands. Trees or tall shrubs as uppermost layer (>~6ft (~2 m)); total woody cover of that layer >25%: **T2**
T1b. Open Uplands, Grasslands, Low Shrublands. Tree and tall shrub cover in the uppermost stratum <25%; uppermost vegetation stratum is strongly shrubby <2m tall, or herbaceous or sparse; open uplands, may have small islands of trees: **T50**

T2a. Forests and Woodlands. Tree canopy cover >25% (single trunks, >~15 ft. (~5m) tall): **T3**
T2b. Shrublands**.** Shrub cover >25% (<~15 ft. (~5m) tall), trees <25%: **T36**

T3a. Deciduous Forest and Woodland (trees >25% cover); broad-leaved (generally deciduous) trees >75% of the cover (several types also in the mixed forest key): **T4**
T3b. Conifer or Mixed Forest/Woodland. Trees >25% cover; conifer trees>25% of the cover: **T22**

T4a. Upland forest with upland trees, such as oaks, beech, or sugar maple, over a small area of wetland soil and wetland herbaceous layer: **Forest Seep Community**

Forest Seep Communities are small wetland areas that retain the canopy of the surrounding upland forest; although they are wet, they may not show up as wetlands on wetlands maps.

Similar Communities: Swamps have wetland tree species rooted in the wetland or seep; wetland trees contribute >25% of the canopy cover. Swamps are in the Palustrine system key. Riverside Seep Communities occur at the base of steep riverbanks where groundwater emerges from the upland slope; they are generally not forested. Many calcareous wetland communities receive seepage waters, but are defined as separate communities with distinct floras, in the Palustrine System. Rich, Mesic Forests on slopes can have seasonally seepy patches that are part of the forest variation and are not separated as distinct communities.

T4b. Deciduous upland forests without wetland soils and wetland herbaceous layer: **T5**

T5a. Deciduous forest directly along the coast in the regular salt spray zone or on dunes or barrier beaches: **Maritime Forest/Woodland**

Maritime Forests/Woodlands usually occur in a mosaic with other barrier beach, maritime, and/or coastal communities. Communities grade into other types in the mosaic, maturing and being reset to earlier successional stages by disturbance from storms, movement of sand, flooding, and drought. Determining actual boundaries among the communities in a maritime mosaic is difficult and may require arbitrary assignments. Patches that are <5000 ft^2 should be noted in descriptions, but considered to be part of the variation of the surrounding community. Maritime Forests/Woodlands are very near the ocean, receive regular salt spray, and have stunted canopies (often <~30 ft. (~10m) tall, or the height of surrounding dunes) of mixed tree species.

Similar Communities: Maritime Pitch Pine Woodlands on Dunes are dominated by pitch pine, have sparser canopies, and are usually quite exposed and close to the ocean. Maritime Juniper Forest/Woodlands are dominated by red cedar and are usually close to the ocean. Maritime Shrublands are dominated by shrubs and have <25% tree canopy. Coastal Forest/Woodlands are further from the coast and are not affected by salt spray on a daily basis. They have taller trees and a shrub layer consisting primarily of low bush blueberry and black huckleberry.

T5b. Deciduous forest not receiving regular salt spray from the ocean, and not on dunes or barrier beaches: **T6**

T6a. Deciduous forest at low (<60 ft.) elevation near the coast, receiving salt and wind from storms, but not daily: **Coastal Forest/Woodland**

Coastal Forest/Woodlands grade into Maritime Forests/Woodlands along the coast, in the areas of daily salt spray, and they grade into forests of the oak and oak-pine continuum on the inland side. Edges of communities on the ground may be difficult to differentiate requiring arbitrary determinations of boundaries. Small patches (<5000 ft^2) of different types should be noted in descriptions, but considered as part of the variation of the prevailing community. Coastal Forest/Woodlands are within a few miles of the coast at <~60 ft. elevation and are not affected by salt spray on a daily basis, but receive storm winds with salt spray. They are predominantly deciduous forests with canopies usually at about 30-60 ft. (~10-20m) and an often dense shrub layer consisting primarily of low bush blueberry and black huckleberry.

Similar Communities: Maritime Forests/Woodlands are very near the ocean, receive regular salt spray, and often have stunted (often <~30 ft. (10m) canopies of mixed tree species. Oak - Hemlock - White Pine Forests and its named variants (including but not limited to) Pitch Pine - Oak Forests, White Pine - Oak Forests, and Mixed Oak Forests abut and grade into Coastal Forests. They receive much less storm spray and mature examples are taller than ~60 ft. (~20m).

T6b. Deciduous forest at >60 ft. elevation, occurring inland from the ocean and not regularly affected by storm winds off the ocean: **T7**

T7a. Forests with multiple species of oaks, mixed with sugar maple in the canopy: **T8**
T7b. Forests dominated by either central hardwoods (oaks, not including red oak, with hickories) or northern hardwoods (including sugar maple and white ash; red oak may be present as an associate), not mixed deciduous and coniferous species. (Red maple and beech are not useful indicators.)**: T10**

T8a. Deciduous forest dominated by sugar maple and white ash with scattered basswoods, a mix of black, white, and other oaks, and shagbark, pignut and/or mockernut hickories: **Sugar Maple - Oak - Hickory Forest**

Similar Communities: Sugar Maple - Oak - Hickory Forests are diverse forests in central and eastern Massachusetts where conditions, including nutrient richness, support northern hardwood species mixed with species of Oak - Hickory Forests. Broad-leaved woodland-sedge is close to being an indicator of Sugar Maple - Oak - Hickory Forest. Rich, Mesic Forests in Massachusetts are mostly west of the Connecticut River Valley, while Sugar Maple - Oak - Hickory Forest is to the east. The presence of multiple species of hickories and oaks in Sugar Maple - Oak - Hickory Forests is a main difference between these two types. Oak - Hickory Forests and Dry, Rich Oak Forests lack abundant sugar maple, white ash, and scattered basswood, and lack spring ephemerals and herbaceous species indicative of rich conditions, such as herb Robert and bloodroot.

T8b. Red oak is the dominant oak growing mixed with sugar maple, scattered white ash, and occasional white and black oaks: **T9**

T9a. Tall deciduous forest dominated by a mix of red oak and sugar maple with other oaks, beech, and birches: **Red Oak - Sugar Maple Transition Forest**

Red Oak - Sugar Maple Transition Forest has a closed (>75% cover) canopy dominated by (>~25% cover) of northern red oak, with sugar maple, and variable proportions of beech, black birch, red maple, and other associates.

Similar Communities: Oak – Tulip Tree Forests are similar but have tulip trees emergent above the canopy, and often present in all the vegetation layers. They often have a mix of northern and more southern or coastal species (called central hardwoods) in all layers. Northern Hardwood - Hemlock - White Pine Forest has fewer oaks and fewer species of oak. Hemlock and white pine are generally present. Oak - Hemlock - White Pine and other oak forests have much less red oak, sugar maple, and other northern hardwoods, and usually have abundant blueberry family shrubs. Sugar Maple - Oak - Hickory Forest includes multiple species of hickories and oaks in more abundance than occur in Red Oak - Sugar Maple Transition Forest. They tend to occur to the south and east in the state, but overlap with the distribution of Red Oak - Sugar Maple Transition Forest. Red Oak - Sugar Maple Transition Forests are more dominated by red oak and appear to be more acidic, less nutrient-rich, and less diverse than Sugar Maple - Oak - Hickory Forests, with undecomposed oak leaves covering the forest floor.

T9b. Tall red oak forest with tulip trees emerging above the canopy; canopy has a mix of oaks and northern hardwoods: **Oak - Tulip Tree Forest**

Oak - Tulip Tree Forests are distinguished by multiple mature tulip trees (not just occasional individuals) with a strong dominance of red oak (>25%), in association with both northern and central hardwoods.

Similar Communities: Red Oak - Sugar Maple Transition Forest is very similar but lacks tulip trees, and tends to have a less strong mix of species of northern areas (such as mountain and striped maples, and bluebead lily) combined with more southern or coastal species (such as tulip tree and sassafras). Other types of oak forest lack large populations of tulip trees and sugar maples, and tend to have more ericaceous shrub species.

T10a. Deciduous forest dominated by oak trees (but red oak is not a dominant) or with an abundance of oaks of multiple species, including red oak, in the canopy. Typically in eastern, central, or southern Massachusetts, or on south-facing slopes in the west, north, or at elevation: **T11**

T10b. Deciduous forest dominated by northern hardwoods such as sugar maple and white ash, typically in the western or northern parts of the state or at elevation or on north facing slopes: **T19**

T11a. Yellow oak is in the forest canopy, on marble or limestone hills in the Western New England Marble Valley of the Hudson Highlands Ecoregion (southern Berkshire County): **Yellow Oak Dry Calcareous Forest**

In Massachusetts, Yellow Oak Dry Calcareous Forests occur only in southern Berkshire County on calcium-rich bedrock, usually on upper slopes and ridgetops. Yellow oak is the indicator and characteristic canopy and subcanopy species of Yellow Oak Dry Calcareous Forest and is seldom found growing in other communities. Other oak forests and woodlands are generally less diverse and lack species typical of calcium-rich environments, such as prickly ash, bladdernut, and pagoda dogwood, as well as yellow oak.

Similar Communities: In appearance, Yellow Oak Dry Calcareous Forest is similar to a Hickory - Hop Hornbeam Forest/Woodland in having a somewhat open canopy that includes hickories, a subcanopy with hop hornbeam, and an often sedge-dominated herbaceous layer. However, the yellow oak forest has a richer flora due to its calcareous substrate and, of course, yellow oak.

T11b. Deciduous oak forest without yellow oak or tulip trees in the canopy: **T12**

T12a. Oak forest/woodland of dry ridgetops and upper slopes, dominated by chestnut oak**: Chestnut Oak Forest/Woodland**

Although distinctive because of the dominance of chestnut oak and its usual upper slope and ridgetop position, Chestnut Oak Forest/Woodland is part of a continuum of dry, acidic communities that contain a variety of tree oak and pine species.

Similar Communities: Mixed Oak Forests/Woodlands have more oak species (black, scarlet, white, red, and chestnut oak) and birches than most other types of oak forests and lack abundant pines or hemlock. Chestnut Oak is not dominant. Oak - Hemlock - White Pine Forests are dominated by a mix of tree oaks with scattered white pine and hemlock, either of which may be locally dense. Black Oak - Scarlet Oak Woodlands are distinguished by abundant scarlet oak with black oak, usually in woodlands (woodlands have shorter trees more widely spaced than in a forest). Open Oak Woodlands occur on upper hill slopes with short red (and black or hybrid) and white oak trees scattered over a low shrub or graminoid (grass and sedge) understory around small rock outcrops. Coastal Forests/Woodlands are within a few miles of the coast at <~60 ft. elevation and receive storm winds and spray. The diverse canopy includes oaks and often has American holly, sassafras, and black gum. White Pine - Oak Forests and Pitch Pine- Oak Forests have >25% cover of pines overall (not just local patches) and a mix of oak species where black oak is particularly important.

T12b. Oak forest/woodland not dominated by chestnut oak (or yellow oak or tulip tree)**: T13**

T13a. Oak woodland with a black and scarlet oak canopy over a blueberry shrub layer maintained by regular light fires**: Black Oak - Scarlet Oak Forest/Woodland**

Many types of oak communities grade into one another in time and space and are difficult to differentiate both in a classification and on the ground. They all have tree oaks and most have a low shrub layer dominated

by plants of the blueberry family. Black Oak - Scarlet Oak Woodland often occurs on dry slopes. Most canopy trees are relatively short (<~60 ft. (<20m)) and the cover is generally interrupted rather than continuous (~60 % cover). The subcanopy is sparse, and the low shrub layer dense.

Similar Communities: Open Oak Woodlands occur on upper hill slopes with short red (and black or hybrid) and white oak trees scattered over a low shrub or graminoid (grass and sedge) understory around small rock outcrops. Mixed Oak Forests/Woodlands have more oak species than Black Oak - Scarlet Oak Woodlands (black, scarlet, and white plus red oak and chestnut oak), and black birch. The type is broadly defined and Black Oak - Scarlet Oak Woodland could be considered as a defined subtype. Coastal Forests/Woodlands are within a few miles of the coast at <~60 ft. elevation and receive storm winds and spray. The diverse canopy includes oaks and often has American holly, sassafras, and black gum. Oak - Hemlock - White - Pine Forests are the most broadly defined in the continuum of oak-dominated forests; specific types are split out from this matrix type. Oak - Hemlock - White - Pine Forests is dominated by a mix of tree oaks with scattered white pine and hemlock, either of which may be in local dense patches. White Pine - Oak Forests have >25% cover of white pine overall (not just local patches). Pitch Pine - Oak Forests have>25% cover of pitch pine overall (not just local patches).

T13b. Deciduous oak forest or woodland not dominated by yellow oak, chestnut oak, red oak, or a mix of black and scarlet oak: **T14**

T14a. Oak woodland on gradual upper hill slopes below the summit, with short red, black, red-black hybrid, and white oak trees scattered over a huckleberry or other ericaceous low shrub layer or graminoid understory around small rock outcrops: **Open Oak Forest/Woodland**

Open Oak Forests/Woodlands are part of a continuum of dry, acidic communities that contain a variety of tree oak and pine species. Many types of oak communities grade into one another in time and space and are difficult to differentiate both in a classification and on the ground. They all have tree oaks and a low shrub layer dominated by blueberry family plants. They often occur between a rocky summit and the surrounding taller forest.

Similar Communities: Black Oak - Scarlet Oak Woodlands are also predominantly woodlands, but not usually associated with rocky outcrops. Abundant scarlet oak with black oak is the key indicator of the type. Mixed Oak Forests/Woodlands have more oak species than Open Oak Woodlands (black, scarlet, and white plus red oak and chestnut oak), and black birch. They are not generally near the summits of hills with rock outcrops. Coastal Forests/Woodlands are within a few miles of the coast at <~60 ft. elevation and receive storm winds and spray. The diverse canopy includes oaks and often has American holly, sassafras, and black gum. Oak – Hemlock – White - Pine Forests are the most broadly defined in the continuum of oak-dominated forests; specific types are split out from this matrix type. Oak – Hemlock – White - Pine Forest is dominated by a mix of tree oaks with scattered white pine and hemlock, either of which may be in local dense patches. White Pine - Oak Forests have >25% cover of white pine overall (not just local patches). Pitch Pine - Oak Forests have>25% cover of pitch pine overall (not just local patches).

T14b. Deciduous oak forest or woodland not as described in the couplets above; not dominated by yellow oak, chestnut oak, red oak, a mix of black and scarlet oak, or a mix of short red and white oaks around rocky summits: **T15**

T15a. Deciduous oak forest/woodland with a closed to interrupted canopy formed by a variable mix of black, white, red, scarlet, and chestnut oak trees with black and white birches and red maple: **Mixed Oak Forest/Woodland**

Mixed Oak Forests/Woodland is a broadly defined tree oak-dominated community that grades into other more narrowly defined communities. They often occur in areas that burn regularly, with dry soils and exposed slopes. It is part of a continuum of dry, acidic communities that contain a variety of tree oak and pine species. Mixed Oak Forests/Woodlands have more oak species than most other oak forests (black, scarlet, white, red, and chestnut oak), as well as birches. They lack abundant pines or hemlock, and lack hop-hornbeam and indicators of rich sites.

Similar Communities: Oak - Hemlock - White Pine Forest is the most broadly defined in the continuum of oak-dominated forests; specific types are split out from this matrix type. Oak - Hemlock - White Pine

Forest is dominated by a mix of tree oaks with scattered white pine and hemlock, either of which may be in local dense patches. Black Oak - Scarlet Oak Woodland is characterized by abundant scarlet oak with black oak dominating the open canopy. Open Oak Woodland occurs on upper hill slopes with short red, black, red-black hybrid, and white oak trees scattered over a low shrub or graminoid understory around small rock outcrops. Occurrences are often between a rocky summit and the surrounding taller forest. Coastal Forests/Woodlands are within a few miles of the coast at <~60 ft. elevation and receive storm winds and spray. The diverse canopy includes oaks and often has American holly, sassafras, and black gum. White Pine - Oak Forests have >25% cover of white pine overall (not just local patches). Pitch Pine - Oak Forests have>25% cover of pitch pine overall (not just local patches).

T15b. Deciduous oak forest or woodland not as described in couplets above; not dominated by yellow oak, chestnut oak, red oak, a mix of black and scarlet oak, a mix of short red and white oaks around rocky summits, or a mix of black, scarlet, white, red, and chestnut oaks and birches: **T16**

T16a. Highly variable mixed oak, red maple, and conifer forest with a generally closed canopy: **Oak - Hemlock - White Pine Forest**

Oak - Hemlock - White Pine Forest is the most broadly defined in the continuum of oak-dominated forests; specific types are split out from this matrix type. Oak - Hemlock - White Pine Forest is dominated by a mix of tree oaks with white pine and hemlock, either of which may be in local dense patches or locally absent. Oaks (white, scarlet, chestnut, black, and red), black birch, American beech, black cherry, and red maple form the canopy in association with scattered eastern hemlock and white pine. Relative proportions of the species vary greatly among sites.

Similar Communities: White Pine - Oak Forest has >25% cover of white pine overall (not just local patches). The rest of the related forest types in the oak continuum lack significant conifer presence. Oak - Hickory Forest is on the less acidic and moister end of the continuum of oak communities; it has hickories in at least low percentages in the canopy. Flowering dogwood and hop hornbeam are often present in the subcanopy. It generally has diverse shrub and herbaceous layers. Dry, Rich Oak Forest/Woodland is also on the less acidic end of the continuum of oak-dominated communities; it includes low percentages of sugar maple and white ash, and has a diverse herbaceous layer that includes false foxgloves and multiple legumes. Mixed Oak Forest/Woodlands tend to be on dry acidic soils and exposed slopes with an open canopy (<75% cover) and an understory dominated by heath species. Coastal Forest/Woodland is within a few miles of the coast at <~60 ft. elevation and receives storm winds and salt spray. The diverse canopy includes oaks, but also often has American holly, sassafras, and black gum. In the northern part of its range, the Oak - Hemlock - White Pine Forest tends to be on south-facing slopes and is surrounded by Northern Hardwood - Hemlock- White Pine Forest that is dominated by sugar maple and white ash. In Northern Hardwood - Hemlock- White Pine Forests, the only oak is red oak and the only hickory is bitternut hickory, which is not common in Oak - Hemlock - White Pine Forests.

T16b. Deciduous forest generally dominated by oaks or surrounded by oak forests, with a sparse shrub layer with few members of the blueberry family: **T17**

T17a. A somewhat open oak-dominated canopy with occasional sugar and red maples, American beech, hickories, and scattered eastern hemlock on southwest-facing mid-slopes with well-drained often rocky soils that appear to be slightly acidic and of intermediate fertility: **Dry, Rich Oak Forest/Woodland**

Dry, Rich Oak Forest is a deciduous, predominantly oak, forest with a rich understory of herbaceous plants, including legumes and graminoids. Dry, Rich Oak Forests are on the richer, less acidic end of a continuum of oak-dominated forests. The addition of occasional maples in the canopy, flowering dogwoods and hop-hornbeams in the subcanopy, and a shrub layer lacking abundant heaths distinguishes this from more acidic oak forests and woodlands.

Similar Communities: Sugar Maple - Oak - Hickory Forests are moister and have a greater abundance of northern hardwoods (primarily sugar maple, basswood, and white ash). The herbaceous layer of Sugar Maple - Oak - Hickory Forest has fewer legumes and more spring ephemerals and herbaceous species indicative of rich conditions (such as herb Robert, wild geranium, and baneberry) than Dry, Rich Oak Forests. Red Oak – Sugar Maple Transition Forests have a greater dominance of red oak and sugar maple

than Dry, Rich Oak Forests. They have a less dense and less rich herbaceous layer, particularly lacking the legumes and false fox-gloves. Dry, Rich Oak Forests may be an open, early successional variant of Oak - Hickory Forests that is maintained by regular or severe disturbance, particularly fire. They both lack abundant sugar maple, basswood, and white ash, and lack spring ephemerals and herbaceous species indicative of rich conditions. Both include a mix of tree oak species and prominent but not dominant hickories. Oak - Hickory Forests tend to have more closed canopies and less of an herbaceous layer. Flowering dogwood is more common in the subcanopy of Oak - Hickory Forests than in Dry, Rich Oak Forests where it also occurs.

T17b. Deciduous forest with prominent hickories in the area of oak forests, with abundant oaks in or surrounding the community: **T18**

T18a. Forests on slopes with shallow soils, with hickory species prominent in the mixed hardwood canopy, with a very sparse shrub layer that lacks blueberry family shrubs and a nearly continuous cover of graminoids: **Hickory - Hop Hornbeam Forest/Woodland**

Hickory - Hop Hornbeam Forests/Woodlands have a park-like appearance with sparse shrub layer and a distinctive sedge understory. Hickories dominate the canopy with hop hornbeam forming a subcanopy. Oaks (particularly red oak) may or may not be part of the canopy but occur in surrounding forests.

Similar Communities: Oak - Hickory Forest canopies are generally closed or almost closed, with white and black oaks, rather than primarily red oak. Hickories are consistently present but not dominant. Flowering dogwood is characteristic. Shrubs are sparse but more abundant and more diverse than in HHH. Dry, Rich Oak Forests are dominated by oaks rather than hickories, the subcanopy is not dominated by hop hornbeam, and they lack the extensive sedge lawn of Hickory - Hop Hornbeam Forests/Woodlands. Mixed Oak Forests/Woodlands and other oak-dominated woodlands have a continuous low shrub layer formed by members of the blueberry family which are not characteristic of the Hickory – Hop Hornbeam Forest/Woodland.

T18b. Oak forests dominated by one or several species of tree oaks, with hickories prominent. The subcanopy includes hop hornbeam, flowering dogwood, and shadbush: **Oak - Hickory Forest**

Oak - Hickory Forests are in the middle to moist end of a continuum of forests that are dominated by tree oaks. They are more diverse in all the vegetation layers than many oak forests/woodlands in the continuum. The canopies of Oak - Hickory Forests are generally closed or almost closed (typically > 67% cover). White and black oaks usually dominate the canopy, with red or chestnut oaks producing additional canopy cover. Hickories and scarlet oaks are consistently present but not dominant.

Similar Communities: Hickory - Hop Hornbeam Forests/Woodlands have a park-like appearance with sparse shrub layer and a distinctive sedge understory. Hickories dominate the canopy with hop hornbeam forming a subcanopy. Dry, Rich Oak Forests might be an open, early successional variant of Oak - Hickory Forests that is maintained by regular or severe disturbance, particularly fire. Sugar Maple - Oak - Hickory Forests have abundant sugar maple, basswood, and white ash and fewer legumes and more spring ephemerals and herbaceous species indicative of rich conditions (such as herb Robert, wild geranium, and baneberry) than Oak - Hickory Forests. Red Oak - Sugar Maple Transition Forests have a greater dominance of red oak and sugar maple than Oak - Hickory Forests, and they have few hickories. Mixed Oak Forests/Woodlands lack abundant hickories and flowering dogwood and have a continuous low shrub layer formed by members of the blueberry family not found in Oak - Hickory Forests. Oak - Hemlock - White Pine Forests are the most broadly defined in the continuum of oak-dominated forests; Oak - Hickory Forests with abundant hickories are split out from this broad type. White Pine - Oak Forests have >25% cover of white pine overall (not just local patches). Pitch Pine - Oak Forests have >25% cover of pitch pine overall (not just local patches).

T19a. Deciduous forests dominated by northern hardwoods such as sugar maple and white ash in the canopy or subcanopy: **T20**

T19b. Deciduous forests with abundant (>~25%) red oak mixed with northern hardwoods, such as sugar maple and white ash**: T8 (above)**

T20a. The forest canopy is dominated by white birch, aspens, and red maple, with northern hardwood tree species (including sugar maple, white ash, and yellow birch) predominantly in the subcanopy: **Successional Northern Hardwood Forest**

Successional Northern Hardwood Forests include young to more mature forests in the northern and western parts of Massachusetts, and on northern slopes and at elevation, that have had past major disturbances that continue to affect the diversity and structure of the forest. They are highly variable forests, usually in a successional sequence leading to Northern Hardwood – Hemlock - White Pine Forests. In the Successional Northern Hardwood Forest, the northern hardwoods generally occur predominantly in the subcanopy or shrub layer, not the canopy.

Similar Communities: Northern Hardwood - Hemlock- White Pine Forests are dominated by sugar maple, white, ash, and other northern hardwoods in the canopy. The successional forest is best distinguished by the abundance of white birch and / or aspens in the canopy.

T20b. Deciduous forest with a canopy dominated by northern hardwood tree species, including sugar maple, white ash, and yellow birch: **T21**

T21a. Northern hardwoods forest with a canopy dominated by sugar maple over a sparse shrub layer and a dense, diverse herbaceous layer with many spring ephemeral wild flowers, on moist, nutrient-rich slopes: **Rich, Mesic Forest Community**

Rich, Mesic Forest is usually within the Northern Hardwood - Hemlock - White Pine Forest or in the transition between it and the oak-dominated forests to the south. Rich, Mesic Forest lacks conifers, beech, and oaks. The understory has dense spring ephemerals and lacks the abundant evergreen wood fern and wild sarsaparilla found in Northern Hardwood - Hemlock - White Pine Forest. Dense populations of late blue cohosh, Virginia waterleaf, or wild leek usually indicate Rich, Mesic Forest.

Similar Communities: The Northern Hardwood - Hemlock - White Pine Forest canopy is dominated by sugar maple and white ash, with American beech, red oak, eastern hemlock, and white pine, any of which may be locally abundant or locally absent. Rich examples of Northern Hardwood - Hemlock - White Pine Forest may have scattered spring ephemerals, but also early yellow violet and broad-leaved spring beauty that usually indicate lower nutrient availability. Red Oak - Sugar Maple Transition Forest has red oak as a dominant, with sugar maple, American beech, and black birch. Spring ephemerals are not abundant. Geography is basic to differentiating Sugar Maple - Oak - Hickory Forest from Rich, Mesic Forest: most occurrences of Sugar Maple - Oak - Hickory Forest are east of the Connecticut River Valley, and Rich, Mesic Forest is generally to the west. The presence of multiple species of hickories and oaks in Sugar Maple - Oak - Hickory Forest is a main difference between these two types. Broad-leaved woodland-sedge is close to being an indicator of Sugar Maple - Oak - Hickory Forest. Rich, Mesic Forest has plantain-leaf sedge instead. Rich, Mesic Forest is characterized by very dense herbaceous growth of spring ephemerals. Sugar Maple - Oak - Hickory Forest shares some of the species but with fewer individuals of fewer species. Sugar Maple - Oak - Hickory Forest has evergreen wood ferns that are lacking in Rich, Mesic Forest.

T21b. Tall forests with generally closed canopies of northern hardwoods mixed with hemlock and white pine: **Northern Hardwoods - Hemlock - White Pine Forest**

Northern Hardwoods - Hemlock - White Pine Forest is a widespread forest type in northern areas or on north-facing slopes. The forest generally has sparse shrub and herbaceous layers. Although conifers are part of the forest, they may be scattered and local, in sufficiently low percentages for the forest to appear to be a deciduous forest type.

Similar Communities: Within the matrix of Northern Hardwoods - Hemlock - White Pine Forest, subtypes with distinct species assemblages that occur in specialized conditions are named separately. All types of northern hardwood forests, including Northern Hardwoods - Hemlock - White Pine Forest, are dominated by sugar maple with white ash, yellow birch, American beech, and red oak, with low cover of white pine and hemlock. Northern Hardwoods - Hemlock - White Pine Forest lacks abundant spruce or fir. To the north and upslope, Northern Hardwoods - Hemlock - White Pine Forests grade into Spruce - Fir - Northern Hardwoods Forests. Red spruce or balsam fir are abundant in Spruce - Fir - Northern Hardwoods Forests, and white pine is uncommon. Successional Northern Hardwood Forest is best distinguished by the abundance of white birch or aspens in the canopy, while northern hardwood species generally occur in

the subcanopy or shrub layer, not in the canopy. Rich, Mesic Forest is a nutrient- and species-rich large-patch community usually within the Northern Hardwoods - Hemlock - White Pine Forest area. Rich, Mesic Forest lacks conifers, beech, and red oak. The understory has dense spring ephemerals and very little evergreen wood fern, Christmas fern, or wild sarsaparilla. Red Oak - Sugar Maple Transition Forest has red oak as a dominant, with sugar maple, American beech, and black birch. Other northern hardwoods are occasional associates. Spring ephemerals are not abundant. Oak - Hemlock - White Pine Forests occur to the south and in warmer areas; sugar maple is lacking and they are dominated by a mix of oak species that except for red oak do not occur in Northern Hardwoods - Hemlock - White Pine Forest. Blueberry and huckleberry usually are significant in the understory of Oak - Hemlock - White Pine Forests, but absent or nearly so in Northern Hardwoods - Hemlock - White Pine Forest.

T22a. Conifer forest/woodland. Forest (trees >25% cover); conifer trees >75% of the cover and broad-leaved trees <25% of the cover: **T23**
T22b. Mixed conifer/deciduous forest/woodland. Canopy trees >25% cover, with mixed tree species: conifer trees 25-75% of the cover and deciduous trees 75-25% of the cover: **T29**

T23a. Canopy dominated by upland conifer trees over a small area of wetland soil and wetland herbaceous layer**:** **T4a, Forest Seep Community (above)**
T23b. Canopy dominated by upland conifer trees without wetland soils and wetland herbaceous layer: **T24**

T24a. Conifer forest/woodland/ near the coast, in the daily or storm salt spray zone or on dunes or barrier beaches: **T25**
T24b. Conifer forest/woodland inland from the coast, and not in the daily or regular storm spray zone: **T26**

T25a. Woodland conifer or tall shrubland dominated by red cedar very near the coast, in the daily salt spray zone, or on dunes or barrier beaches: **Maritime Juniper Woodland/Shrubland**

Maritime Juniper Woodlands/Shrublands are predominantly evergreen woodlands/shrublands within the coastal salt spray zone, often on dunes or bluffs over the ocean. The trees tend to be short (< 5 m (~15 feet) and scattered. The tops of trees and shrubs are sculpted by winds and salt spray. The community grades from sparse shrubland to woodland, in areas of constant changes of levels of salt spray and substrate stability; even in stable situations, community edges may not be clear. Maritime Juniper Woodland/Shrubland intergrades and interdigitates with Maritime Pitch Pine Woodland on Dunes and Maritime Forest/Woodland. Very small patches (<5000 ft^2) of any type within another community should be considered to be part of the variation of the other community.

Similar Communities: Maritime Pitch Pine Woodlands on Dunes are dominated by pitch pine, but share species with the juniper community. Maritime Shrubland Communities are dominated by a dense mixture of primarily deciduous shrubs, but may include red cedar. Outside of the maritime salt spray zone, some rocky outcrops with non-acidic bedrock support a shrub community that may include red cedar; in the Massachusetts classification of natural communities, these are included in Circumneutral Rocky Summit/Rock Outcrop and Calcareous Rocky Summit/Rock Outcrop communities. Maritime Forests/Woodlands are very near the ocean, receive regular salt spray, and have stunted canopies of mixed tree species; they are not dominated by Red cedar.

T25b. Conifer woodlands dominated by pitch pine, directly along the coast in the daily salt spray zone on dunes**:** **Maritime Pitch Pine Woodlands on Dunes**

Maritime Pitch Pine Woodlands on Dunes have scattered pitch pines, many with partially buried trunks. Between the pines, there is bare sand with sparse, low-growing, drought-tolerant plants, fungi, and lichens.

Similar Communities: Pitch Pine - Oak Forests/Woodlands have nearly closed canopies that include abundant tree oaks, and have little bare ground, more soil development, and more species diversity than the dune community. The pines having skirts is typical of the dune community; in more established woodlands, even if the pine trunks are partially buried, shaded lower branches are unlikely to remain alive.

T26a. Forests/woodlands with canopies dominated by white pine. Found state-wide, although most typically in eastern, central, or southern Massachusetts, or on south-facing slopes in the west, north, or at elevation: **Successional White Pine Forest**

Successional White Pine Forests are best distinguished by the >75% canopy cover of white pine. Successional White Pine Forests grade into Northern Hardwood - Hemlock - White Pine Forest to the north and the general matrix of Oak -Hemlock - White Pine Forest to the south.

Similar Communities: White Pine - Oak Forests have 25-75% cover of white pine and the inverse, 75-25%, of oaks, making the oaks clearly sharing dominance with the pine. Successional White Pine Forests often become White Pine - Oak Forests over time. Pitch Pine - Oak Forests are often near white pine forests in southern areas and grade into them. Determining types along the gradients may require careful, or even arbitrary, application of the definitions, or a decision to map at a more general scale while noting the existence of variation within map units. Pine plantations usually have rows of trees that produce a dense canopy over a generally low-diversity understory that often includes native species. Plantations, being culturally created and managed, are not defined as natural community types.

T26b. Forests with other conifer canopies, including hemlock and spruce: **T27**

T27a. Forests dominated by eastern hemlock: **Hemlock Forest**

In Hemlock Forests, eastern hemlock is the dominant canopy species (>50% canopy cover) throughout the community. They typically occur on north-facing slopes or along north-facing ravines.

Similar Communities: Both Oak - Hemlock - White Pine Forest and Northern Hardwoods - Hemlock - White Pine Forest have relatively small, scattered patches of hemlock that are part of the variation in the overall forest. These mixed forest types tend to have much greater diversity in all layers than do Hemlock Forests. Hemlock Swamps are also dominated by eastern hemlock, but are wetlands; Hemlock Forests are upland communities.

T27b. Forests/woodlands dominated by red spruce, often with balsam fir: **T28**

T28a. Forest canopy is dominated by red spruce and fir with >25% northern hardwood trees: **Spruce - Fir - Northern Hardwoods Forest**

In Spruce - Fir - Northern Hardwoods Forests, red spruce is dominant, or at least present with other conifers, including balsam fir and eastern hemlock. White pine is uncommon. Deciduous species contribute >25% of the canopy cover, overall. Occurrences are highly variable and may be locally dominated by conifers or may have mixed canopies. Spruce - Fir - Northern Hardwoods Forest can have abundant eastern hemlock, but differ from other upland hemlock forests by the presence of red spruce, balsam fir, or heart-leaf paper birch, and other species of cool areas, including mountain and striped maples, mountain ash, and skunk currant, and by the absence of species of warmer areas such as oaks, black birch, and mountain laurel.

Similar Communities: In Massachusetts, High Elevation Spruce - Fir Forest/Woodland occurs only in the Greylock range at the very highest elevations in the state where trees are very exposed, resulting in shorter, sparser trees in more open woodland conditions than Spruce - Fir - Northern Hardwoods Forest. Deciduous northern hardwoods constitute <25% of the cover of High Elevation Spruce - Fir Forest/Woodland. Northern Hardwoods - Hemlock - White Pine Forests lack abundant spruce, fir, and heart-leaf paper birch.

T28b. Forest canopy is dominated by often stunted spruce and fir with <25% deciduous trees overall: **High Elevation Spruce - Fir Forest/Woodland**

In Massachusetts, High Elevation Spruce - Fir Forest/Woodland occurs only on the Greylock massif at the very highest elevations in the state, and has short, sculpted trees with >75% spruce and fir combined, with the rest of the canopy dominated by birches with other northern hardwoods.

Similar Communities: Spruce - Fir - Northern Hardwoods Forests occur at slightly lower elevations in the Berkshires and also in the higher elevation areas of the northern Worcester Plateau. Spruce - Fir - Northern Hardwoods Forest has taller, less windswept trees; red spruce is dominant, or at least present with other conifers, including balsam fir and eastern hemlock. Northern Hardwoods generally comprise >25% of the canopy. If spruce or fir are present in Northern Hardwoods - Hemlock - White Pine Forests or Successional Northern Hardwood Forests, it is as scattered individuals with <25% cover.

T29a. Canopy a mix of coniferous and deciduous upland trees over a small area of wetland soil and wetland herbaceous layer: **T4a, Forest Seep Community (above)**
T29b. Canopy a mix of coniferous and deciduous upland trees without wetland soils or a wetland herbaceous layer: **T30**

T30a. Mixed forest/woodland near the coast, below 60 ft. elevation, in the daily or storm salt spray zone or on dunes or barrier beaches: **T31**
T30b. Mixed forest/woodland inland from the coast, above 60 ft. elevation and not in the daily or regular storm spray zone)**: T32**

T31a. Mixed forest directly along the coast in the daily salt spray zone or on dunes or barrier beaches: **T5a, Maritime Forest/Woodland (above)**
T31b. Deciduous forest at low (<60 ft.) elevation near the coast, receiving salt and wind from storms, but not on a daily basis: **T6a, Coastal Forest/Woodland (above)**

T32a. Forests with canopies of mixed central hardwoods (oaks often with hickories) and conifers. Red maple and American beech are not useful indicators. Typically in eastern, central, or southern Massachusetts, or on south-facing slopes in the west, north, or at elevation: **T33**
T32b. Forests with canopies of mixed northern hardwoods (including sugar maple, white ash, and birches, with red oak present as an associate) and conifers in the canopy. (Red maple and American beech are not useful indicators.) Typically north or west, or at elevation, or on north-facing slopes: **T35**

T33a. Mixed forest with >25% oak and >25% pine in the canopy, generally away from the coast at >60 ft. elevation: **T34**
T33b. Highly variable mixed oak, red maple, and conifer forest, with a generally closed canopy: **T16a, Oak - Hemlock - White Pine Forest (above)**

T34a. Pitch pine and tree oaks dominate the canopy generally on dry, low-nutrient, acidic soils. Occurs statewide, but forms a matrix forest in southeastern Massachusetts: **Pitch Pine - Oak Forest Woodland**

Pitch Pine - Oak Forest/Woodland is part of a continuum of dry, acidic communities dominated by a variety of tree oak and pine species. Similar communities often mix on the ground, with successional stages present that are strongly influenced by historic and recent disturbances. Topography, soils, and local climate control the broader vegetation types. In Pitch Pine - Oak Forest/Woodlands, pitch pine and tree oaks are each at least 25% of the canopy.

Similar Communities: Pitch Pine - Scrub Oak Communities have <25% cover of trees and lack tree oaks. Neither White Pine - Oak Forest nor Successional White Pine Forest have >25% cover of pitch pine; in both, white pine is a dominant. Maritime Pitch Pine Woodlands on Dunes are on dunes. They are dominated by pitch pine and usually lack abundant tree oaks. Maritime Forests/Woodlands are very near the ocean, receive regular salt spray, and have stunted canopies of mixed tree species. Coastal Forest/Woodlands generally have a more diverse tree layer than Pitch Pine - Oak Forests, although they may include some pitch pine and many oaks with other trees. Oak - Hemlock - White Pine Forests have <25% pitch pine, and >25% hemlock, plus white pine.

T34b. White pine and tree oaks dominate the canopy or white pines may form a super-canopy. A widespread successional community type: **White Pine - Oak Forest**

White Pine - Oak Forests have >25% cover of white pine overall (not just local patches) and >25% oaks.

Similar Communities: Successional White Pine Forests have <25% oaks in the canopy. Pitch Pine - Oak Forests have >25% cover of pitch pine and <25% canopy of white pine. Oak forests dominated by various species of oak have <25% white pine. Coastal Forests/Woodlands are within a few miles of the coast at <~60 ft. elevation and receive storm winds and spray. The diverse canopies include oaks and often American holly, sassafras, and black gum; white pine may be present. Oak - Hemlock - White Pine Forests have >25% hemlock plus white pine. In general, OHWP are more diverse than White Pine - Oak Forests**.**

Northern Hardwood - Hemlock- White Pine Forests are dominated by sugar maple and white ash with <25% canopy cover of white pine and the only oak is red oak.

T35a. Canopy consists of mixed northern hardwood trees including sugar maple, white ash, and yellow birch with >25% combined cover of eastern hemlock and white pine: **T21b, Northern Hardwoods - Hemlock - White Pine Forest (above)**
T35b. Forest canopy consists of a mix of red spruce and northern hardwood trees: **T28a, Spruce - Fir - Northern Hardwoods Forest (above)**

T36a. Shrublands regularly exposed to salt spray in coastal and maritime areas; maritime and coastal shrublands in the regular salt spray zone**: T37**
T36b. Shrublands inland from regular salt spray: **T45**

T37a. Maritime and coastal shrublands dominated by conifers/evergreen species**: T38**
T37b. Maritime and coastal shrublands dominated by deciduous species**: T41**

T38a. Shrubland or woodland dominated by red cedar on barrier beach systems, dunes, or ocean bluffs: **T25a, Maritime Juniper Woodland/Shrubland (above)**
T38b. Shrubland or woodland with a low canopy of pitch pine, near the coast at <60 ft. elevation, receiving daily or storm winds with salt spray: **T39**

T39a. Shrubland or woodland on dunes, dominated by pitch pine, in the zone of regular salt spray**: T25b, Maritime Pitch Pine Woodlands on Dunes (above)**
T39b. Shrubland or woodland (<25% coverage of trees) with pitch pine over dense scrub oak: **T40**

T40a. Shrubland or woodland on sand, with pitch pine (<25% coverage) over dense scrub oak: **Pitch Pine - Scrub Oak Community**

Pitch Pine - Scrub Oak Communities are shrub-dominated, with scattered to dense trees and scattered openings. Shrubs are usually dense.

Similar Communities: Pitch Pine - Oak Forest/Woodlands have >40% canopy and tree oaks that do not occur in the Pitch Pine - Scrub Oak communities. Scrub oak is much less abundant and less dense in the forest/woodland type, which usually occurs in less dry environments and has more soil development. Maritime Pitch Pine on Dunes has little scrub oak and generally has much sparser pines. Ridgetop Pitch Pine - Scrub Oak Communities are on bedrock outcrops, often ridges. Scrub Oak Shrublands are dominated by dense shrub oaks and lack pitch pine. Sandplain Grasslands and Sandplain Heathlands may occur as open patches within Pitch Pine - Scrub Oak occurrences. In order to name and map included Scrub Oak Shrublands, Sandplain Heathlands, and/or Sandplain Grasslands, the small patches would need to occupy significant area or topographic differences where they are distinct (large frost pockets, for example).

T40b. Shrubland or woodland on rock, with pitch pine (<25% coverage) over scrub oak: **Ridgetop Pitch Pine - Scrub Oak Community**

Ridgetop Pitch Pine - Scrub Oak Communities on bedrock ridges have scattered stunted pitch pine and dense scrub oak, with little bare rock, usually. Identifying community types on rock outcrops is complicated by interdigitating of types and overlap of constituent species.

Similar Communities: Pitch Pine - Scrub Oak Communities are on sand or gravel, tend to be larger, and have most of the same species. Scrub Oak Shrublands lack pitch pine. Ridgetop Heathlands, also on bedrock ridges, lack abundant scrub oak and pitch pine, have large areas dominated by continuous cover (>50%) of low shrubs, usually lowbush blueberry, and have little exposed bedrock. Rocky Summit/Rock Outcrop communities are dominated by bare or lichen-covered rock.

T41a. Coastal shrublands on erosional cliff faces next to the ocean, dominated by deciduous species: **Maritime Erosional Cliff Community**

The Maritime Erosional Cliff Community usually has extremely sparse vegetation on cliffs being actively eroded by the sea. Occasionally shrubs (including wild rose, bayberry, and beach plum) or woody vines (such as green briar or poison ivy) dominate the vegetation. Maritime Erosional Cliffs are made of mixed unconsolidated material.

Similar Communities: The Maritime Rock Cliff Community is on bedrock.

T41b. Coastal deciduous shrubland not on cliff faces: **T42**

T42a. Deciduous shrubland dominated by members of the blueberry family, usually <~6 ft. (~2m) tall, often not dense: **Sandplain Heathland**

Sandplain Heathlands are open, shrub-dominated coastal communities. They have many plants from the Heath or blueberry family and share many species with Sandplain Grasslands. Sparse patches of shrubs may have bare soil or lichens between them. When bearberry and black huckleberry are dominant, they are considered to be indicators of Sandplain Heathlands. Small patches may occur as openings in Pitch Pine - Scrub Oak Communities, Scrub Oak Shrublands, Maritime Shrublands, Coastal Forests, and Maritime Forests/Woodlands. In mapping, as in defining, the edges are not always clear.

Similar Communities: The structure and species composition of Sandplain Heathlands overlap with Sandplain Grasslands and Maritime Dune Communities. Sandplain Heathlands and Sandplain Grasslands share about 70% of their dominant species: it is the proportion of the species and the resultant structure that separates the types. Sandplain Heathlands look shrubby, appear taller, and have fewer vascular plant species and more bare ground than do grasslands. The communities are not distinct at some sites; in that case, the dominant community is the one designated. Maritime Dune Communities are structurally similar to Sandplain Heathlands in that each has low shrub, herbaceous, and grassy growth with patches of bare soil. Dune communities are on dunes and are often dominated by beach grass and beach heather. These species occur less abundantly with more other species in Sandplain Heathlands. These communities may overlap along dune edges, necessitating arbitrary assignment of community types based on land form or the prevailing community type. Maritime Shrublands are generally much denser, taller, and more diverse than Sandplain Heathlands and are less dominated by members of the blueberry family. Maritime Juniper Woodland/Shrubland and Maritime Pitch Pine Woodland on Dunes are on dunes, and are dominated by trees, although the trees may be scattered. Very small patches of any type within another community should be considered to be part of the variation of the main community. Sandplain Heathlands - Inland Variant are located inland at distances away from maritime influences. Ridgetop Heathlands are on bedrock.

T42b. Shrubland dominated by mixed shrubs or scrub oak: **T43**

T43a. Coastal deciduous shrubland dominated by mixed shrubs, often dense and of mixed heights: **Maritime Shrubland**

Maritime Shrublands are intended to be large, relatively continuous areas of shrublands in the salt spray zone. Large patches of Scrub Oak are separated out as their own community type. When shrub cover is <~40%, the community is considered to be something else, often Sandplain Heathland. Tree cover of Maritime Shrublands is <~ 25% overall. The differences among the communities and associations are often gradual, making differentiation on the ground difficult at times.

Similar Communities: Scrub Oak Shrublands are dominated by dense shrub oaks and lack pitch pine. They are less diverse than Maritime Shrublands and generally further from the ocean, usually out of the daily or regular storm salt spray zone. Maritime Dunes include patches of shrubs in areas protected from winds and salt spray. When large and continuous, such patches might be considered to be Maritime Shrublands.

T43b. Shrubland dominated by scrub oak, with or without a sparse pitch pine overstory: **T44**

T44a. Scrub oak-dominated shrubland, with pitch pine forming a sparse canopy of up to ~25% cover**: T40a, Pitch Pine - Scrub Oak Community (above)**

T44b. Scrub oak-dominated shrubland without pitch pine canopy: **Scrub Oak Shrubland**

Scrub Oak Shrublands are on sand and bedrock, are dominated by dense shrub oaks, and lack pitch pine. They generally occur within Pitch Pine - Scrub Oak Communities, particularly in frost bottoms and frost pockets, and

on ridge tops near Ridgetop Pitch Pine - Scrub Oak Communities. They may occur in a matrix with Sandplain Heathlands.

Similar Communities: Pitch Pine - Scrub Oak Communities have <25% cover by pitch pine trees, are on sand or gravel, tend to be large, and have most of the same species. Sandplain Heathlands and Sandplain Heathlands – Inland Variant may include some scrub oak with other shrubs, generally of the blueberry family. Scrub oak is not dominant in either community. Both types of Sandplain Heathlands tend to be sparser and more diverse than scrub oak shrublands. Ridgetop Pitch Pine - Scrub Oak Communities occur on bedrock ridgetops, have scattered stunted pitch pine and dense scrub oak, and usually have little bare rock showing. Ridgetop Heathlands lack abundant scrub oak and pitch pine, have large areas dominated by fairly continuous cover (>50%) of low shrubs, usually lowbush blueberry, and have little exposed bedrock. Acidic Rocky Summit/Rock Outcrop communities are dominated by bare or lichen-covered rock. Identifying community types on rock outcrops is complicated by the mixing of community types in mosaics and overlap of constituent species. Very small occurrences of any community types should be considered to be parts of the prevailing community.

T45a. Inland deciduous shrubland away from the coast, dominated by scrub oak, with or without a sparse pitch pine overstory**: T44 (above)**
T45b. Inland deciduous shrubland, dominated by mixed shrub species or blueberry family shrubs, not dominated by scrub oak: **T46**

T46a. Inland deciduous shrubland, dominated by members of the blueberry family, usually <~6 ft. (~2m) tall: **T47**
T46b. Mixed species shrublands on rocky outcrops or summits, often sparsely vegetated around bare rock**: T48**

Rocky Summit/Rock Outcrop Communities are dominated by bare rock with vegetation that often includes shrubs. Three rocky summit/rock outcrop community types are named depending on whether the exposed bedrock is acidic (pH < 6.0), circumneutral (pH 6.0 - 7.5), or calcareous (pH > 7.5). The pH is identified from geological or soils maps, or often inferred from the vegetation or location. These communities would not be expected to co-occur since the type of bedrock determines the type of natural community. However, depending on size, one site could have multiple other types of ridgetop/outcrop communities. If one community type is predominant and the others are in small areas within it, the dominant community type would be named with notes on the variation.

T47a. Shrubland on rocky ridges, dominated by generally dense, low-growing blueberries, along with other members of the blueberry family: **Ridgetop Heathland**

Ridgetop Heathlands occur on bedrock, at the edges of Acidic (or sometimes Circumneutral) Rocky Summit/Rock Outcrop communities. Identifying community types on rock outcrops is complicated by interdigitating of types and overlap of constituent species. If a community occupies a cumulative area of >5000 ft^2 on a ridge, it may function as a separate community and be designated as such. Otherwise, small patches would be considered to be part of the variation in the prevailing community.

Similar Communities: Acidic Rocky Summit/Rock Outcrop communities are dominated by low shrubs and significant scattered clumps of grass. Vegetation is discontinuous with large areas of bare or moss- or lichen-covered rock. Ridgetop Heathlands have large areas dominated by a fairly continuous cover (>50%) of low shrubs (often lowbush blueberry), and have only scattered grasses and little exposed bedrock. Ridgetop Pitch Pine - Scrub Oak Communities have scattered stunted pitch pine and dense scrub oak, and usually have little bare rock. Shrub oaks and pitch pines need to be abundant, with tree oaks lacking for the community to be a Pitch Pine - Scrub Oak Community. Sandplain Heathlands - Inland Variant occur on sand or gravel soils, not on bedrock.

T47b. Shrubland on sand or gravel away from the coast, with abundant blueberry family plants: **Sandplain Heathland – Inland Variant**

Sandplain Heathland - Inland Variant is a low shrub community, usually successional, on sandplains or gravel in interior parts of the state. It needs management to remain open (with <25% tree cover) in the absence of fire. Occurrences include those on erosional gravel/sandy cliff faces next to rivers or river floodplains. Sandplain Heathlands - Inland Variant grade into Sandplain Grasslands - Inland Variant. Both are often small patch

communities within the prevailing forest matrix. Domination by blueberries or other low shrubs is a key difference from grasslands.

Similar Communities: Sandplain Heathlands are near the coast within the storm salt spray zone. Sandplain Heathlands - Inland Variant are located inland at distances away from maritime influences. Ridgetop Heathlands occur on bedrock, often at the edges of rocky summits or on old blueberry farms. Pitch Pine - Scrub Oak Communities are dominated by scrub oak with pitch pine, neither of which is dominant in Sandplain Heathlands. Very small patches of Sandplain Heathland - Inland Variant inside a Pitch Pine - Scrub Oak Community may be considered to be variation in the Pitch Pine - Scrub Oak Community occurrence. Sandplain Grasslands - Inland Variant are dominated by grasses; Sandplain Heathlands - Inland Variant are and look shrubbier.

T48a. Acidic bedrock outcrops or summits, often sparsely vegetated with discontinuous low shrubs and scattered clumps of grasses. The shrubs usually include scattered (not dominant) blueberries, huckleberry, chokeberry, scrub oak, and/or bearberry: **Acidic Rocky Summit/Rock Outcrop Community**

The vegetation of Acidic Rocky Summit/Rock Outcrop Communities is often predominantly low shrubs, with grasses, sedges, and a few herbaceous species forming a secondary component. Acidic Rock Outcrops tend to lack columbine, climbing fumitory, red cedar, and/or pink corydalis, all of which are more likely on circumneutral or calcareous outcrops. In the eastern part of the state, the Acidic Rocky Summit/Rock Outcrop Community is often associated with dry oak and pine forests.

Similar Communities: The vegetation of Circumneutral Rocky Summit/Rock Outcrop Communities is predominantly grasses, sedges, and a variety of herbaceous species. The circumneutral rocky summit community is often associated with hickory-hop hornbeam, oak-hickory, or forests with sugar maple. The vegetation of Calcareous Rocky Summit/Rock Outcrop Communities is predominantly shrubs mixed with herbaceous plants, with steeper, moister ledges supporting a rich community of ferns. Calcareous outcrops may be near or above patches of Rich, Mesic Forests or enriched northern hardwood forests. Acidic Rocky Summits/Rock Outcrop Communities can be difficult to separate from other ridgetop communities that may be present at the same site in a mosaic of communities. Rock cliffs are vertical to near vertical (more than about 60% slope); rock outcrops are not that steep. The difference is arbitrary. If Acidic, Circumneutral, or Calcareous Rock Cliffs are small (less than about 5000 ft^2), patches would be considered to be variations of the surrounding type and would be included in that type. Scrub Oak Shrublands have dominant, dense shrub oaks, no pines, few other trees, and little bare rock. Ridgetop Pitch Pine - Scrub Oak Communities have multiple but scattered stunted pitch pine trees and dense scrub oak, and usually have little bare rock. There need to be abundant shrub oaks and pitch pines for the community to be Pitchy Pine – Scrub Oak Communities or Scrub Oak Shrublands. Ridgetop Heathland has large areas dominated by lowbush blueberry, and little exposed bedrock. They may occur at the edges of Acidic Rocky Summits.

T48b. Circumneutral or calcareous bedrock outcrops or summits, often sparsely vegetated with discontinuous shrubs and herbaceous plants. Plants include columbine, climbing fumitory, red cedar, and/or pink corydalis: **T49**

T49a. Outcrops of circumneutral bedrock, often sparsely vegetated, with grasses, sedges and forbs dominating. Except for the Carolina rose and bearberry, shrubs are usually restricted to the edge of the openings. Red cedar may be present: **Circumneutral Rocky Summit/Rock Outcrop Community**

Sparsely vegetated, Circumneutral Rocky Summit/Rock Outcrop Communities occur on exposed circumneutral bedrock. The circumneutral rocky summit community is often associated with hickory-hop hornbeam, oak-hickory, or forests with sugar maple.

Similar Communities: Acidic Rocky Summit/Rock Outcrop communities generally lack columbine, climbing fumitory, red cedar, pink corydalis, broad-leaved woodland-sedge, ebony spleenwort, bulblet fern, or fragile fern, which typically occur in Circumneutral Rocky Summit/Rock Outcrops. Acidic Rocky Summit/Rock Outcrop communities are often associated with dry oak and pine forests. Calcareous Rocky Summit/Rock Outcrop Communities may include plantain-leaf sedge, maidenhair spleenwort, or walking fern, indicating calcareous conditions. The vegetation is predominantly shrubs mixed with herbaceous plants, with steeper, moister ledges supporting a rich community of ferns. Calcareous outcrops may be

near or above patches of Rich, Mesic Forest or enriched northern hardwood forests. Rock cliffs are vertical to near vertical (more than about 60% slope); rock outcrops are not that steep. The difference is arbitrary. If Acidic, Circumneutral, or Calcareous Rock Cliffs are small (less than about 5000 ft^2), patches would be considered to be variations of the surrounding type and would be included in that type. Ridgetop Pitch Pine - Scrub Oak Community occur on rocky acidic ridges, have pitch pine and abundant, often dense scrub oak, and usually have less bare rock (this may not be true where abundant visitation has caused loss of plant and soil cover). In Scrub Oak Shrublands, scrub oak is dominant and dense, with few trees, and little bare rock, usually on acidic bedrock. Ridgetop Heathland Community is dominated by heaths, usually low bush blueberry, usually on acidic bedrock.

T49b. Marble or limestone (calcareous rock) outcrops or summit, with sparse vegetation: **Calcareous Rocky Summit/Rock Outcrop Community**

Calcareous Rocky Summit/Rock Outcrop Communities are sparsely vegetated (but the least sparse of the named communities of rocky summits/rock outcrops), dry, open communities, usually on steep, mid-slope, calcareous ledges in the marble regions of Berkshire County or the Connecticut River Valley. Calcareous Rocky Summit/Rock Outcrop Communities may include plantain-leaf sedge, maidenhair spleenwort, walking fern, or other herbaceous species typical of Rich, Mesic Forests.

Similar Communities: Rock cliffs are vertical to near vertical (more than about 60% slope); rock outcrops are not that steep. The difference is arbitrary. If Acidic, Circumneutral, or Calcareous Rock Cliffs are small (less than about 5000 ft^2), patches would be considered to be variations of the surrounding type and would be included in that type. Cliffs are generally very sparsely vegetated and seldom include shrubs. Ridgetop Pitch Pine - Scrub Oak Communities occur on rocky acidic ridges, have pitch pine and abundant, often dense scrub oak, and usually have less bare rock (this may not be true where abundant visitation has caused loss of plant and soil cover). In Scrub Oak Shrublands, scrub oak is dominant and dense, with few trees, and little bare rock, usually on acidic bedrock. Ridgetop Heathland Community is dominated by heaths, usually low bush blueberry, usually on acidic bedrock.

T50a. Open vegetation regularly exposed to salt spray from the ocean in coastal and maritime areas, on sand or rock substrate**: T51**

T50b. Open vegetation inland from regular salt spray; vegetation of rocky summits, ridges, rock outcrops, rocky slopes, or inland sandplains**: T58**

T51a. Open vegetation on any substrate, abutting ocean, within daily salt spray zone: **T52**

T51b. Maritime and coastal vegetation near the ocean, not directly next to open water, not affected daily by salt spray from tides**: T55**

T52a. Sparse vegetation on rock cliffs next to the ocean, above normal high tide: **Maritime Rock Cliff Community**

Sparsely vegetated Maritime Rock Cliff Communities are in cracks and ledges of seawards cliffs on rocky headlands above the tidal and salt spray zones. The low, scattered plants are salt and wind hardy, and are often somewhat weedy species of the surroundings. Rock cliffs are arbitrarily defined as near vertical (>60% slope). A variety of different bedrocks form Maritime Rock Cliffs.

Similar Communities: Maritime Erosional Cliff Communities are also in the salt spray zone above the intertidal shores. The substrate of mixed unconsolidated material of erosional cliffs is highly unstable. The Maritime Beach Strand Community is not on bedrock and is not close to vertical. Maritime Shrublands occur outside of the daily salt spray zone and are generally on flatter surfaces; they share species with Maritime Rock Cliff Communities, but are much more densely vegetated. The Marine Intertidal Rocky Shore Community is on rocky shores below the normal high tide, sometimes below a rock cliff. Any vegetation is non-vascular. This community is discussed in the Estuarine system.

T52b. Sparse vegetation next to the ocean, not on rock cliffs: **T53**

T53a. Sparse vegetation on cliffs being actively eroded by the sea: **T41a, Maritime Erosional Cliff Community (above)**

T53b. Sparse vegetation next to the ocean, not on cliffs: **T54**

T54a. Sparsely vegetated, long, narrow community between wrack line of high tide and foredunes: **Maritime Beach Strand Community**

Maritime Beach Strand Communities have scattered vascular plants. They may be part of a barrier beach system. They occur above the daily high tides, between the wrack line and for dune, or on top of a berm, cliff, or other structure. Maritime Beach Strand Communities may be inundated or structurally altered by storm tides.

Similar Communities: Marine Intertidal Gravel/Sand Beach communities are below the wrack line and submerged twice daily by tides. Any vegetation in the Marine Intertidal Gravel/Sand Beach is non-vascular. This community is discussed in the Estuarine system.

T54b. Community on dynamic sand dunes: **Maritime Dune Community**

Maritime Dune Communities are on dynamic sand dunes, with patches of herbaceous plants and shrubs interspersed with areas of bare sand. They are often part of a barrier beach system. Barrier beach and dune communities occur in mosaics that shift location over time as the dunes move; even in stable situations, the community edges may not be clear. Maritime Dune Communities are the most sparsely vegetated communities on the dune systems, dominated by beach grass and beach heather, with scattered patches of low shrubs, including red cedar, pitch pines, bayberry, herbaceous species, and grasses, with bare sand.

Similar Communities: Sandplain Heathlands have more diverse vegetation and much less beach grass and beach heather than Maritime Dune Communities and are not on dunes. Along the edges of dunes, Sandplain Heathlands and Maritime Dune Communities may overlap. Maritime Juniper Woodland/Shrubland, Maritime Pitch Pine Woodland on Dunes, and Maritime Shrubland Communities all have woody plants dominating and can be on dunes. When large enough (>~5000 ft^2), they are mapped as separate communities from the dune community. Very small patches of any type within another community should be considered to be part of the variation of the larger community.

T55a. Community on dynamic sand dunes**: T54b, Maritime Dune Community (above)**

T55b. Community not on sand dunes or barrier beaches, dominated by low shrubs or grasses: **T56**

T56a. Deciduous, usually sparse shrubland, dominated by members of the blueberry family, usually <~6 ft. (~2m) tall: **T42a, Sandplain Heathland (above)**

T56b. Grass-dominated community, often mixed with forbs and occasional shrubs, within the coastal zone influenced by salt-laden storm winds: **T57**

T57a. An open, near-coastal community dominated by native grasses, with significant presence of forbs and shrubs: **Sandplain Grassland**

Sandplain Grasslands are essentially treeless coastal communities dominated by native grasses and herbaceous species with sparse shrubs on sand or other dry, low-nutrient soils. Sandplain Grasslands are part of a structural and successional continuum with other coastal communities. When communities are not distinct the best fitting community type should be chosen to designate the site.

Similar Communities: Sandplain Heathlands have a shrubby appearance with a taller shrub layer than Sandplain Grasslands. The structure and greater proportions of shrubs in Sandplain Heathlands separates them from Sandplain Grasslands. Maritime Dune Communities are on dunes and are often dominated by beach grass and beach heather that occur less abundantly in grasslands. Sandplain Grasslands - Inland Variant are located inland away from maritime influences and lack coastal species, such as sandplain flax, golden heather, and sandplain blue-eyed grass. Although dominated by little bluestem grass, Sandplain Grasslands - Inland Variant often have an abundance of non-native and weedy species. Cultural Grasslands are dominated by non-native grasses maintained for pasture or hayfields. Salt Marshes are coastal and dominated by grasses, but are inundated by salt water in twice-daily tides. They are in the Estuarine system.

T57b. Grassland dominated by non-native grasses requiring sowing and maintenance, occurring state-wide, including coastally: **Cultural Grassland**

Cultural Grasslands are grasslands that are cultivated or are the results of cultivation. They are dominated by non-native agricultural grasses. Examples are pastures and hayfields.

Similar Communities: Sandplain Grasslands and Sandplain Grasslands - Inland Variant are dominated by native grasses, often by the distinctive little bluestem. Sandplain Heathlands and Sandplain Heathlands - Inland Variant are dominated by native shrubs and look shrubbier than grasslands, with a shrub layer comprised of scrub oak, black huckleberry, and/or lowbush blueberry.

T58a. Open to shrubby vegetation of rocky summits, ridges, rocky slopes, and other rock outcrops: **T59**
T58b. Open to grassy or shrubby vegetation not on bedrock; dry, open vegetation of inland sandplains and non-forested sites**: T66**

T59a. Terrestrial (non-wetland) vegetation on rock outcrops, influenced by river processes: **Riverside Rock Outcrop Community**

Sparsely vegetated, Riverside Rock Outcrop Communities occur in crevices where soil accumulates on flood-scoured bedrock outcrops along rivers. These open terrestrial communities may be associated with wetland communities around the bedrock outcrops.

Similar Communities: High-energy Riverbank Communities are wetland communities that occur on cobble and sand substrates. They also usually have sparse, open low vegetation, but with some bare cobble and sand. High-energy Rivershore Meadow and Riverside Seep Communities are wetland communities that have fairly dense vegetation, with some organic as well as mineral soil development. They occur along the shores of fast-flowing, high-energy rivers.

T59b. Open vegetation of rocky summits, ridges, and rocky slopes: **T60**

T60a. Sparse vegetation among large boulders or talus: **Open Talus/Coarse Boulder Community**

Open Talus/Coarse Boulder Communities are sparsely vegetated communities of vines and scattered herbaceous plants on moss- or lichen-covered boulders or broken rocks on slopes with deciduous litter in crevices and little to no tree canopy. Small (<5000 ft^2) occurrences of Open Talus at the base of cliffs would be included with the cliff or surrounding forest as appropriate to the size and site. If the Open Talus is larger than the cliff or outcrop, it might be named as the community type with the other small part as a variation within it. Talus, boulder fields, rocky summits, rock outcrops, and rock cliffs all support natural communities adjacent to and grading into each other, all within and reflecting the surrounding matrix forest. Forested areas lower in the talus slope/ boulder field are considered to be a different community, usually part of the prevailing forest.

Similar Communities: Acidic, Circumneutral, and Calcareous Rock Cliff Communities are on vertical to near vertical slopes (>60%) with sparse vegetation. Open Talus/Coarse Boulder communities are on broken rocks on a slope rather than on near-vertical cliffs with continuous rock. Rocky Summit/Rock Outcrop Communities have patches of bare rock that are part of the continuous underlying bedrock. Open Talus/Coarse Boulder Communities are on broken or sometimes loose rocks, often with deep crevices where vegetation is rooted.

T60b. Vegetation on bedrock summits or outcrops: **T61**

T61a. Sparse (to patchily dense) vegetation of rocky summits or rock outcrops on hills: **T62**
T61b. Sparse vegetation on cliff faces (>60% slope)**: T64**

Rock Cliff Communities are dominated by bare rock with open and very scattered vegetation that may include grasses, forbs, and shrubs. Cliffs are defined as vertical to near vertical (>~60% slope). Cliff communities are often between rocky outcrops and talus slopes. Three rock cliff community types are named depending on whether the exposed bedrock is acidic (pH < 6.0), circumneutral (pH 6.0 - 7.5), or basic (alkaline, named calcareous for calcium availability) (pH > 7.5). The pH is identified from geological or soils maps, or often inferred from the vegetation or location. These communities would not be expected to co-occur since the type of bedrock determines the type of natural community. However, depending on size, one site could have multiple other types of summit, ridgetop, or rock outcrop communities. If one community type is predominant and the others are in small areas within it, the dominant community type would be named with notes on the variation.

T62a. Acidic bedrock outcrops or summits, often sparsely vegetated with discontinuous low shrubs and scattered clumps of grasses. The shrubs usually include scattered, not dominant, blueberries, huckleberry, chokeberry, scrub oak, and/or bearberry: **T48a, Acidic Rocky Summit/Rock Outcrop Community (above)**
T62b. Circumneutral or calcareous bedrock outcrops or summits, often sparsely vegetated with discontinuous shrubs and herbaceous plants around. Plants include columbine, climbing fumitory, red cedar, and/or pink corydalis: **T63**

T63a. Outcrops of circumneutral bedrock, often sparsely vegetated, with grasses, sedges and forbs dominating. Except for the Carolina rose and bearberry, shrubs are usually restricted to the edge of the openings. Red cedar may be present: **T49a, Circumneutral Rocky Summit/Rock Outcrop Community (above)**
T63b. Marble or limestone (calcareous rock) outcrops or summits, with sparsely vegetation: **T49b, Calcareous Rocky Summit/Rock Outcrop Community (above)**

T64a. Extremely sparsely vegetated cliff (>~60% slope) on acidic bedrock; vegetation includes species of dry, low-nutrient openings in surrounding forests: **Acidic Rock Cliff Community**

Vascular plants in the extremely sparsely vegetated Acidic Rock Cliff Communities grow on small ledges and in crevices of acidic cliff faces. There may be dense patches of lichen. Acidic rock cliffs form on resistant bedrock, such as granite. Little soil and few nutrients are available to support plants on the acidic cliff faces or the large talus at the base of the cliff. Presence of columbine, pink corydalis, marginal wood-fern, ebony spleenwort, maidenhair spleenwort, purple cliff brake, or red cedar usually indicates less acidic conditions. These species are unlikely to be on Acidic Rock Cliffs.

Similar Communities: Calcareous Rock Cliff Communities include species requiring high nutrient levels (nutrient richness) or high pH such as smooth rock-cress, lyre-leaved rock-cress, fragile rock-brake, purple cliff brake, and bulblet-fern. These are not usually found in Circumneutral Rock Cliff Communities. Rocky summits and rock outcrops also have bare rock, but are not near vertical (>~60% slope). Open Talus/Coarse Boulder Communities have broken rock rather than continuous, near-vertical rock faces.

T64b. Extremely sparsely vegetated cliff (>~60% slope) on non-acidic bedrock: **T65**

T65a. Sparse vegetation on cliffs on sandstone, traprock, conglomerate, or other non-acidic, non-calcareous rock: **Circumneutral Rock Cliff Community**

Plants in the extremely sparsely vegetated Circumneutral Rock Cliff Communities grow on small ledges and in crevices on a circumneutral cliff face. In distribution, Circumneutral Rock Cliffs overlap with and are more widespread than Calcareous Rock Cliff Communities, which are restricted to the Marble Valley and Connecticut Valley ecoregions. Circumneutral Rock Cliff Communities would be expected to have some of the following characteristic species: columbine, pink corydalis, marginal wood-fern, ebony spleenwort, herb Robert, green rock-cress, or red cedar.

Similar Communities: Acidic Rock Cliff Communities have a lower diversity of species, and lack columbine, pink corydalis, marginal wood-fern, ebony spleenwort, maidenhair spleenwort, purple cliff brake, or red cedar. Calcareous Rock Cliff Communities include species requiring high nutrient levels (nutrient richness) or high pH, such as smooth rock-cress, lyre-leaved rock-cress, fragile rock-brake, purple cliff brake, and bulblet-fern. Rocky summits and rock outcrops also have bare rock, but are not near vertical (>~60% slope). Open Talus/Coarse Boulder Communities have broken rock rather than continuous, near-vertical rock faces.

T65b. Sparse vegetation on cliffs of limestone, dolomite, or other calcareous bedrock: **Calcareous Rock Cliff Community**

In Massachusetts, Calcareous Rock Cliff Communities are restricted to the Marble Valleys and Connecticut Valley ecoregions. They include species requiring high nutrient levels (nutrient richness) or high pH, such as smooth rock-cress, lyre-leaved rock-cress, fragile rock-brake, purple cliff brake, and bulblet-fern, that are not usually found in Circumneutral Rock Cliff Communities or Acidic Rock Cliff Communities.

Similar Communities: Circumneutral Rock Cliff communities would be expected to have some of the following characteristic species: columbine, pink corydalis, marginal wood-fern, ebony spleenwort, herb

Robert, green rock-cress, or red cedar. Acidic Rock Cliff Communities have a lower diversity of species, and lack columbine, pink corydalis, marginal wood-fern, ebony spleenwort, maidenhair spleenwort, purple cliff brake, or red cedar. Rocky summits and rock outcrops also have bare rock, but are not near vertical (>~60% slope). Open Talus/Coarse Boulder Communities have broken rock rather than continuous, near-vertical rock faces.

T66a. Shrubland, often with sparse vegetation, but with abundant blueberry family plants, on sand or gravel away from the coast: **T47b, Sandplain Heathland – Inland Variant (above)**
T66b. Open (essentially treeless) vegetation dominated by grasses, in areas inland from maritime influences, on sand, gravel, or tilled soils: **T67**

T67a. Grassland dominated by native grasses, usually on sand or gravel substrates: **Sandplain Grassland - Inland Variant**

Sandplain Grassland - Inland Variant is an open community dominated by native grasses on sandplains or gravel in interior parts of the state. They usually need management to remain treeless in the absence of fire. The largest examples of the community in Massachusetts occur at inland airports, military lands, and wildlife management areas on sandplains. The Inland Variant often has an abundance of non-native and weedy species. Small patches of Sandplain Grasslands - Inland Variant in a mosaic with other communities may be considered to be part of the variation of the prevailing community. When communities are not distinct, the best-fitting community should be the type designated for the site.

Similar Communities: Sandplain Grasslands have more coastal species than the Inland Variant, which lacks sandplain flax, golden heather, and sandplain blue-eyed grass. Sandplain Heathlands - Inland Variant grade into Sandplain Grasslands - Inland Variant. Sandplain Heathlands - Inland Variant are shrubbier than grasslands. The dominance of lowbush blueberry, scrub oak, or black huckleberry is a key difference from grasslands. Cultural Grasslands as a classification unit are intended to be grasslands that are cultivated or the results of cultivation with non-native, agricultural grasses, such as pastures and hayfields.

T67b. Grassland dominated by non-native grasses requiring sowing and maintenance, occurring statewide, including in coastal areas: **T57b, Cultural Grassland (above)**

Palustrine System

P: Wetland communities where the species composition is affected by flooding or saturated soil conditions. The soil is usually saturated with the water table at or near the surface most of the year. Note: The term "wetland" is not used in the sense of a "jurisdictional wetland," which has a legal definition.

P1a. Trees or tall shrubs (>~6ft (~2 m)) are the uppermost layer, with total woody cover >25%. The canopy is closed to partially open, and includes woodlands: **P2**
P1b. Tree and tall shrub cover in the uppermost stratum <25%. The uppermost vegetation stratum is strongly sparse, herbaceous, or shrubs <~6 ft. (~2m) tall. There may be small islands of trees or tall shrubs. Low (<~6 ft. (~2m)) shrubs may be dense: **P33**

P2a. Trees (single trunks, >~15 ft. (~5m) tall); total woody cover >25%; trees >25%: **P3**
P2b. Shrubs (<~15 ft. (~5m) tall); total woody cover >25%; trees <25%: **P23**

P3a. Forest (trees >25% cover); broad-leaved (generally deciduous) trees >75% of the cover (several types have mixed coniferous/deciduous canopies): **P4**
P3b. Forest (trees >25% cover); conifer trees >25% of the cover (several types have mixed coniferous/deciduous canopies)**: P16**

P4a. Deciduous swamps along rivers in floodplains: **P5**
P4b. Deciduous swamps not in floodplains along rivers; may be in basins, seepage slopes, small valleys, lake shores, or other wet areas**: P11**

P5a. Deciduous to mixed canopy forests along moderate-gradient reaches of small rivers and large streams in small watersheds where multiple short-duration flooding events occur throughout the year: **Alluvial Hardwood Flat Community**

Alluvial Hardwood Flat Communities are fairly open hardwood forests along small rivers and streams on river-deposited material. They flood briefly after storms. Black cherry and white pine are usually abundant in the canopy with red maple, but not silver maple.

Similar Communities: Alluvial Red Maple Swamps, along low-gradient rivers, flood annually and are slow to drain. Silver maple may be codominant with red maple. High-terrace Floodplain Forests do not flood annually. They have a mix of floodplain trees, including silver maple, and mesic, deciduous hardwoods. The diverse herbaceous layer includes floodplain species and others more typical of rich forests. Red Maple Swamps are in basins or hillside seeps along small drainage ways. They are dominated by red maple.

P5b. Deciduous forests along rivers with active annual flooding, with cobble or silt deposition: **P6**

P6a. Narrow bands of forests on coarse substrates along the shorelines of high-energy rivers: **Cobble Bar Forest**

Cobble Bar Forests are limited to cobble and other coarse substrates along high-energy rivers where little deposition of finer materials occurs and flooding and ice flows scour the surface. These narrow bands of forest are close to the river edge where flood waters recede quickly after the flood events, not behind berms that retain flood waters. In Cobble Bar Forests, sycamore and cottonwood may be more abundant than silver maple in the canopy.

Similar Communities: High-terrace, Major-river, Transitional, and Small-river Floodplain Forests generally occur on silt and mixed mineral and organic soil substrates. Major-river, Transitional and Small-river Floodplain Forests are behind low berms that slow and detain flood waters, causing alluvial silt deposition. High-energy Riverbank Communities also occur within the zone of active erosion on cobble and sand substrates along steep-gradient, fast-flowing rivers, but have sparse, open low vegetation and no trees.

P6b. Deciduous forests of river floodplains in the silt deposition zones with an active, generally annual, flood regime: **P7**

P7a. Swamps dominated by red and silver maples, in low areas along low-gradient rivers with overbank flooding: **Alluvial Red Maple Swamp**

Flood waters in Alluvial Red Maple Swamps drain more slowly than from other floodplain communities. Unlike true floodplain forests, alluvial swamp forests have well-developed shrub layers composed of northern arrow-wood, silky dogwood, and the non-native glossy buckthorn. Soils are typically silt loams with pronounced soil mottling and a surface organic layer.

Similar Communities: Alluvial Hardwood Flats are along small streams that have multiple short flooding events throughout the year after storms. Black cherry and white pine are usually abundant in the canopy with red maple, but not silver maple. High-terrace Floodplain Forests do not flood annually. They have a mix of floodplain trees and mesic, deciduous hardwoods. The diverse herbaceous layer includes floodplain species and others more typical of rich forests. Red Maple Swamps are in basins or hillside seeps along small drainage ways. They are less diverse than Alluvial Red Maple Swamps in all layers. Major-river, Transitional, and Small-river Floodplain Forests are dominated by silver maple, while red maple is uncommon, and they lack the well-developed shrub layer found in Alluvial Red Maple Swamps. None of them has a surface organic layer, due to annual scouring by active flood waters. Alluvial Atlantic White Cedar Swamps occur along low-gradient rivers with Atlantic white cedar and red maple co-dominant in the canopy.

P7b. Floodplain forests with abundant silver maple in the canopy: **P8**

P8a. Mesic, deciduous hardwood forests of high alluvial terraces above the zone of annual flooding: **High-terrace Floodplain Forest**

High-terrace Floodplain Forests flood less regularly and for shorter periods than other floodplain forests. They have more structural and species diversity and more litter accumulation than other floodplain forests. Vegetation in all layers is a mix of floodplain and upland taxa, with silver maple growing with sugar maple and shagbark hickory. Ironwood typically forms an open subcanopy.

Similar Communities: Alluvial Red Maple Swamps along low-gradient rivers flood annually and are slow to drain. Silver maple is often a codominant with red maple, without the mix of upland species. Alluvial Hardwood Flats are along small streams that have multiple short flooding events after storms throughout the year. Black cherry and white pine are usually abundant in the canopy with red maple, but not silver maple. Major-river, Transitional, and Small River Floodplain Forests flood annually, are dominated by silver maple, and lack the upland forest species. Rich, Mesic Forests are upland forests that lack silver maple and other species of floodplain forests. They are not associated with river flooding.

P8b. Floodplain forests dominated by silver maple that are flooded annually: **P9**

True floodplain forest communities occur within the zone of active flooding of rivers and streams on mineral soils that receive annual silt deposition. They differ in the size of river on which they occur and in the severity of flooding. Major-river, Transitional, and Small-river Floodplain Forests can be viewed as points on a continuum from most severely scoured and well-drained (major-river type) to least severely scoured and poorly drained (small-river type). Mixes of floodplain forest communities can occur as a riparian community complex at a single site. Distinctive large patches should be designated; small patches would be noted as part of the site variation with the main community type.

P9a. Floodplain forests along mainstems of large rivers with a dense herbaceous layer of wood nettle or ostrich fern: **Major-river Floodplain Forest**

Major-river Floodplain Forests have severe flooding with rapidly flowing flood waters that scour the surface. They seldom have a shrub layer. Soils are predominantly sandy loams without soil mottles and without a surface organic layer.

Similar Communities: Transitional Floodplain Forests occur on smaller tributaries of the Connecticut River, on portions of the Housatonic River, and in depressions within Major-river Floodplain Forests of the Connecticut and Deerfield Rivers. Small-river Floodplain Forests occur on smaller tributaries of major

rivers, on small rivers where banks are low and overbank flooding occurs, and on edges of riverine islands. Annual flooding occurs, but the water volume and degree of scour are much less than in Major-river Floodplain Forests. High-terrace Floodplain Forests tend to be relatively small, narrow forests on high alluvial terraces that flood only occasionally (not annually) and for a shorter duration than other types of floodplain forests. They include a mix of upland and floodplain species and have more litter accumulated than other floodplain forests. Alluvial Red Maple Swamps along low-gradient rivers flood annually and are slow to drain. Silver maple is often a codominant with red maple. They have dense shrub and diverse herbaceous layers. Alluvial Hardwood Flats are along small streams that have multiple short flooding events after storms throughout the year. Black cherry and white pine are usually abundant in the canopy with red maple, but not silver maple.

P9b. Floodplain forests on alluvial soils, usually dominated by silver maple, with green ash and American elm in the canopy: **P10**

P10a. Floodplain forest of middle-sized rivers, without a shrub layer. Soils are generally not hydric and lack a surface organic layer: **Transitional Floodplain Forest**

Transitional Floodplain Forest soils are intermediate in severity of flooding, soil texture, and drainage, and do not usually have a surface organic layer. Cottonwood is usually absent, but ash and elm trees are present. Tree saplings are common but shrubs are generally absent. The herbaceous layer is a mix of species.

Similar Communities: Major-river Floodplain Forests occur along large rivers with severe flooding. Soils are predominantly not hydric and lack a surface organic layer. Cottonwood and silver maple can be common in the canopy, but few other trees are present. A shrub layer is usually absent and the herbaceous layer is often dominated by a near monoculture of wood nettle. Small-river Floodplain Forests occur on small rivers where banks are low and overbank flooding occurs annually, but with limited water volume and scour. Soils are hydric silt or fine sandy loams, sometimes with a surface organic layer. They also lack cottonwood and have ash and elm trees, but have a distinct shrub layer and a diverse herbaceous layer. High-terrace Floodplain Forests tend to be relatively small, narrow forests on high alluvial terraces that flood only occasionally (not annually) and for a shorter duration than other types of floodplain forests. They include a mix of upland and floodplain species and have more litter accumulated than other floodplain forests. Alluvial Red Maple Swamps, along low-gradient rivers, flood annually and are slow to drain. Silver maple is often a codominant with red maple. They have dense shrub and diverse herbaceous layers. Alluvial Hardwood Flats are along small streams that have multiple short flooding events after storms throughout the year. Black cherry and white pine are usually abundant in the canopy with red maple, but not silver maple.

P10b. Floodplain forest with a shrub layer, occurring along small, low-gradient rivers. Soils are hydric, often with an organic layer: **Small-river Floodplain Forest**

Small-river Floodplain Forests occur on smaller tributaries of major rivers and on small rivers of eastern Massachusetts where banks are low and annual overbank flooding occurs. Silver maple is mixed with more other species than in other types of floodplain forest. However, cottonwood is typically absent in the canopy of the small-river type. Small-river Floodplain Forests have a more substantial shrub layer than either Major-river and Transitional types, but less than in Red Maple Alluvial Swamps. There is greater herbaceous plant diversity in Small-river Floodplain Forests than in Major-river and Transitional types, but again, the Alluvial Red Maple Swamps have a greater diversity.

Similar Communities: Major-river Floodplain Forests have severe flooding with rapidly flowing flood waters that scour the surface. They seldom have a shrub layer. Soils are predominantly sandy loams without soil mottles and without a surface organic layer. Transitional Floodplain Forests occur on smaller tributaries of the Connecticut River, on portions of the Housatonic River, and in depressions within Major-river Floodplain Forests of the Connecticut and Deerfield Rivers. High-terrace Floodplain Forests tend to be relatively small narrow forests on high alluvial terraces that flood only occasionally (not annually) and for a shorter duration than other types of floodplain forests. They include a mix of upland and floodplain species and have more litter accumulated than other floodplain forests. Alluvial Red Maple Swamps along low-gradient rivers flood annually and are slow to drain. Silver maple is often a codominant with red maple. They have dense shrub and diverse herbaceous layers. Alluvial Hardwood Flats are along small

streams that have multiple short flooding events throughout the year after storms. Black cherry and white pine are usually abundant in the canopy with red maple, but not silver maple.

P11a. Basin swamp with black gum dominant or codominant with red maple in the canopy: **P12**
P11b. Swamps with species other than black gum codominant with red maple: **P13**

P12a. Red maple-dominated basin swamp, in which black gum, pin oak, and swamp white oak are important components of the overstory. Deciduous swamp on glacial lakebed sediments in the Connecticut River Valley: **Black Gum - Pin Oak - Swamp White Oak Perched Swamp**

Black Gum - Pin Oak - Swamp White Oak Perched Swamps are known only from the Connecticut River Valley in areas underlain by clays in the lakebed sediments of glacial Lake Hitchcock. The presence of fairly high proportions of black gum, pin oak, and swamp white oak in the canopy, in addition to the topographic setting, distinguish the type.

Similar Communities: Red Maple - Black Gum Swamps are generally in small topographically constrained basins surrounded by upland forests. Black gum needs to be dominant or codominant in large areas of the swamp for the occurrence to be a black gum swamp, but they don't have high proportions of pin oak or swamp white oak. Red Maple Swamps may have black gum or occasional pin oak or swamp white oak in low proportions in the canopy, but not as dominants or codominants.

P12b. Swamps typically in small basins characterized by abundant (>~25% cover) black gum in the canopy, along with red maple: **Red Maple - Black Gum Swamp**

Red Maple - Black Gum Swamps are generally in small topographically constrained basins, surrounded by upland forests, as opposed to being parts of larger wetlands. Black gum needs to be dominant or codominant in large areas of the swamp for the occurrence to be considered a Red Maple - Black Gum Swamp.

Similar Communities: Red Maple Swamps do not have black gum as a dominant or codominant in large areas of the swamp, although it may be present as scattered individuals. Most Red Maple Swamps have a more diverse herbaceous layer; however, the species overlap is great between these types. Many Red Maple Swamps are in large basins. The key difference is the abundance of black gum in Red Maple – Black Gum Swamps. Black Gum - Pin Oak - Swamp White Oak Perched Swamps are known only from the Connecticut River Valley in areas underlain by clays in the sediments of glacial Lake Hitchcock. The presence of pin oak and swamp white oak in the canopy, in addition to the topographic setting, distinguish the type. This perched swamp is found at low elevations and often nested within larger wetland systems. Red Maple - Black Ash Swamps and Rich Conifer Swamps share many species with Red Maple – Black Gum Swamps, but black gum is only a minor component of these communities.

P13a. Basin swamps with black ash as a regular subcanopy associate of red maple**: P14**
P13b. Red maple strongly dominant in the canopy with a variable mix of other species: **Red Maple Swamp**

Red Maple Swamp is a common, broadly defined, red maple-dominated community type. It is highly variable in its species composition, with canopy associates including yellow birch, black gum, white ash, white pine, American elm, hemlock, pin oak, and swamp white oak. Soils have shallow to thick organic layers overlying mineral sands/silts. Distinctive types are defined separately.

Similar Communities: Alluvial Red Maple Swamps occur along low-gradient rivers and receive river flood waters. Silver maple is often a codominant with red maple. Alluvial Hardwood Flats are along small, flashy streams, with black cherry and white pine abundant in the canopy, and ironwood and alternate-leaved dogwood mixed with other shrub species in the subcanopy layer. Red Maple - Black Ash Swamps are an enriched variant of Red Maple Swamps with black ash close to codominant in the canopy/subcanopy in at least parts of the swamp. Red Maple - Black Ash - Bur Oak Swamps occur in Berkshire County and have bur oak or hybrid bur oak/swamp white oak trees. Red Maple - Black Gum Swamps are generally in small, topographically constrained basins surrounded by upland forests. Black gum is abundant in large areas of the swamp. Black Gum - Pin Oak - Swamp White Oak Perched Swamps occur in the Connecticut River Valley on glacial Lake Hitchcock lakebed sediments. The presence of fairly high proportions of black gum, pin oak and swamp white oak in the canopy, in addition to the topographic setting, distinguish the type.

All types of Atlantic White Cedar Swamp are dominated by Atlantic white cedar in the overstory, often with red maple.

P14a. Areas near marble/limestone bedrock, primarily in the Marble Valleys in Berkshire County; also parts of the Connecticut River Valley: **P15**

P14b. Red maple-dominated swamps, with black ash abundant in the subcanopy, east of Marble Valleys in Berkshire County: **Red Maple - Black Ash Swamp**

Red Maple - Black Ash Swamps are an enriched variant of Red Maple Swamps, with black ash abundant (>~25%) in the canopy/subcanopy in at least parts of the swamp. Red Maple - Black Ash Swamps generally include spicebush and indicators of enriched seepage such as swamp saxifrage, golden ragwort, foamflower, and golden saxifrage.

Similar Communities: Red Maple - Black Ash - Bur Oak Swamps (bur oak swamps) are similar in structure and species composition to Red Maple - Black Ash Swamps (black ash swamps), but bur oak swamps occur in Berkshire County near marble/limestone bedrock and black ash swamps occur east of Berkshire County. Both are forested wetlands with fairly closed canopies; but only the bur oak swamps have bur oak or bur oak/swamp white oak hybrids and also have more ironwood in the tall shrub layer. Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps (calcareous seepage swamps) have sparser canopies than black ash swamps. The clearest difference may be that even in openings, black ash swamps do not have the strong calciphiles found in calcareous seepage swamps. Rich Conifer Swamps include black ash as an occasional species rather than a co-dominant. Rich Conifer Swamps have high proportions of eastern hemlock, red spruce, or balsam fir as important canopy species, along with variable amounts of hardwoods and white pine. Red Maple Swamps may include scattered black ash trees but they are not co-dominant. They seldom include seepage indicators.

P15a. Swamp with closed to continuous canopy cover in areas with somewhat enriched circumneutral groundwater: **Red Maple - Black Ash - Bur Oak Swamp**

Red Maple - Black Ash - Bur Oak Swamps are mostly deciduous forests of circumneutral, somewhat nutrient-enriched, often large wetlands. Red maple, black ash, and bur oak, and other species of trees growing on hummocks form an almost continuous tall canopy over variable shrub and diverse dense herbaceous layers. Bur oak swamps occur in Berkshire County near marble/limestone bedrock. They do not have calciphiles in openings.

Similar Communities: Red Maple - Black Ash Swamps (black ash swamps) occur east of Berkshire County and do not include bur oak. Red Maple - Black Ash Swamps are enriched swamps with black ash close to codominant with red maple in the canopy/subcanopy in at least parts of the swamp. Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps (calcareous seepage swamps) have sparse, low canopies. Openings generally include strong calciphiles such as shrubby cinquefoil and grass-of-Parnassus.

P15b. Mixed deciduous-coniferous forested swamps with a sparse canopy occurring in areas where there is calcareous groundwater seepage. The species-rich herbaceous layer is characterized by calcium-loving species: **Red Maple - Black Ash - Tamarack Calcareous Seepage Swamp**

Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps are dominated by sparse trees and tall shrubs. Small openings share many of the species and conditions of Calcareous Sloping Fens or Calcareous Seepage Marshes, either or both of which may occur in mosaics in the same wetland. All calcareous wetlands include shrubby cinquefoil and most have other calciphiles such as grass-of-Parnassus and Kalm's lobelia.

Similar Communities: Calcareous Seepage Marshes lack the tree cover of the calcareous seepage swamps. They share species with both Shallow and Deep Emergent Marshes, but contain more calciphiles. Calcareous Sloping Fens may have tall shrubs and short trees in scattered patches. A diverse herbaceous layer dominates the vegetation. They are on shallow to moderate slopes and peat is mostly restricted to sedge hummocks. Calcareous Basin Fens have deep (> 2.0 meters (6.5 ft.)) peat in basins. They are dominated by sedges with a sparse shrub layer; they generally contain a more developed bryophyte layer than the other calcareous fens. Red Maple - Black Ash - Bur Oak Swamps and Red Maple - Black Ash Swamps have taller, more closed canopies and do not have the strong calciphiles found in the Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps. Stands of bur oak or hybrid bur oak/swamp white oak

are more likely in Red Maple - Black Ash - Bur Oak Swamps than in calcareous seepage swamps. Rich Conifer Swamps are high elevation (>1000 ft.) forested wetlands that often include some calciphiles and other species found in calcareous seepage swamps, but contain significant amounts of red spruce and/or balsam fir.

P16a. Conifer swamp dominated by Atlantic white cedar (often mixed with red maple): **P17**

Red Maple Swamps in basins in southeastern Massachusetts are often former Atlantic white cedar swamps that were cut in the past. Many have small patches of Atlantic white cedar; however, Atlantic white cedar needs to be dominant in the overstory for the community to be classified as an Atlantic white cedar swamp. Mapping of relatively large dense patches of Atlantic white cedar as Atlantic white cedar swamps communities may be useful within a Red Maple Swamp to indicate a mosaic of wetland communities.

P16b. Conifer swamp dominated by trees other than Atlantic white cedar**: P20**

P17a. Atlantic white cedar swamp along low-gradient rivers; canopy codominated by red maple: **Alluvial Atlantic White Cedar Swamp**

Alluvial Atlantic White Cedar Swamps occur along smaller rivers and ponds where Atlantic white cedar is co-dominant with red maple. Annual floods make them more mineral-rich than other Atlantic White Cedar wetlands. Silky dogwood, sensitive and royal ferns, bugleweed, and marsh St. John's-wort are more common than in other Atlantic white cedar swamps, and sphagnum carpets are less dense in regularly flooded areas. As with all natural communities, transitions and mixes occur.

Similar Communities: Coastal Atlantic White Cedar Swamps are not along river floodplains, although geographic distribution and resultant coastal species may overlap with Alluvial Atlantic White Cedar Swamps. Inland Atlantic White Cedar Swamps may also overlap geographically, but are also not in floodplains. Yellow birch is more common than in Alluvial Atlantic White Cedar Swamps. Inland Atlantic White Cedar Swamps have lower abundance of coastal indicators such as greenbrier, inkberry, dangleberry, swamp sweetbells, Virginia chain-fern, and netted chain-fern than Alluvial or Coastal Atlantic White Cedar Swamps. Northern Atlantic White Cedar Swamps have Atlantic white cedar in the tree canopy, along with northern conifers such as black and red spruce. This nutrient-poor community type is restricted to basins at high elevations with the single documented example at >1100 ft. In Alluvial Red Maple Swamps, silver maple is often codominant with red maple; there is very little Atlantic white cedar (<25% cover), if it is present at all.

P17b. Atlantic white cedar swamps not along rivers: **P18**

P18a. Atlantic white cedar swamps at low elevations (< 60 ft. above sea level) in southeastern Massachusetts: **Coastal Atlantic White Cedar Swamp**

Coastal Atlantic White Cedar Swamps occur on saturated peat of variable depth over the mineral sediments. In Coastal Atlantic White Cedar Swamps, pitch pine is an occasional canopy associate seldom found in other Atlantic white cedar swamp types. Other species that are found in greater abundance in Coastal Atlantic White Cedar Swamps than other Atlantic white cedar swamps include greenbrier, the shrubs inkberry and dangleberry, and the ferns Virginia chain-fern and netted chain-fern.

Similar Communities: Inland Atlantic White Cedar Swamps typically occur at elevations > 60 ft. above sea level and not in southeastern Massachusetts. Yellow birch is more common than in Coastal Atlantic White Cedar Swamps. Inland Atlantic White Cedar Swamps have lower abundance of coastal indicators than Coastal Atlantic White Cedar Swamps. Northern Atlantic White Cedar Swamps have Atlantic white cedar in the tree canopy, along with northern conifers such as black and red spruce. This nutrient-poor community type is restricted to basins at high elevations with the known example at >1100 ft. Alluvial Atlantic White Cedar Swamps are along rivers and streams. The vegetation is highly variable. Atlantic white cedar and red maple dominate the tree layer. Atlantic White Cedar Bogs have sparse canopy (averaging <25%, but there may be local clumps of trees) cover of Atlantic white cedar over sphagnum on peat.

P18b. Atlantic white cedar-dominated swamps inland at >60 ft. elevation, not in southeastern Massachusetts; coastal species lacking: **P19**

P19a. Atlantic white cedar-dominated swamps inland at between 60 and 1100 ft. elevation: **Inland Atlantic White Cedar Swamp**

Inland Atlantic White Cedar Swamps occur away from the coast in basins or seepage areas, with Atlantic white cedar dominant in the overstory with associated eastern hemlock, spruce, red maple, and yellow birch. Coastal indicator species such as greenbrier, inkberry, and the ferns Virginia chain-fern and netted chain-fern are lacking. Inland Atlantic White Cedar Swamps typically do not occur not in southeastern Massachusetts.

Similar Communities: Alluvial Atlantic White Cedar Swamps are along rivers and streams. The vegetation is highly variable. Atlantic white cedar and red maple dominate the tree layer. Coastal Atlantic White Cedar Swamps are not along river floodplains, Coastal Atlantic White Cedar Swamps generally occur at < 60 ft. elevation and in southeastern Massachusetts. Northern Atlantic White Cedar Swamps have Atlantic white cedar in the tree canopy, along with northern conifers such as black and red spruce. This nutrient-poor community type is restricted to basins at high elevations >1100 ft., with the single documented example at >1100 ft. Atlantic White Cedar Bogs have sparse canopy (averaging <25%, but there may be local clumps of trees) cover of Atlantic white cedar over sphagnum on peat.

P19b. Atlantic white cedar swamp restricted to basins at high elevation (>1100 ft.), codominated by spruce and fir: **Northern Atlantic White Cedar Swamp**

Northern Atlantic White Cedar Swamps are restricted to basins at high elevations with the single documented example at >1100 ft. Northern Atlantic White Cedar Swamps are codominated by northern conifers, such as black and red spruce and balsam fir. Shrubs and herbs include typically northern species such as Labrador tea and rhodora, as well as creeping snowberry and bunchberry that also are found in high-elevation variant Inland Atlantic White Cedar Swamps.

Similar Communities: Alluvial Atlantic White Cedar Swamps are along rivers and streams. The vegetation is highly variable. Atlantic white cedar and red maple dominate the tree layer. Coastal Atlantic White Cedar Swamps are not along river floodplains, Coastal Atlantic White Cedar Swamps generally occur at < 60 ft. elevation and in southeastern Massachusetts. Inland Atlantic White Cedar Swamps typically occur at elevations > 60 ft. above sea level and not in southeastern Massachusetts. Yellow birch is more common than in Coastal Atlantic White Cedar Swamps. Inland Atlantic White Cedar Swamps typically occur at elevations <1000 ft. and lack the full set of northern species. Atlantic White Cedar Bogs have sparse canopy (averaging <25%, but there may be local clumps of trees) cover of Atlantic white cedar over sphagnum on peat. They may have scattered black spruce, but lack red spruce. Red Spruce Swamps may occur near Northern Atlantic White Cedar Swamps, but red spruce is dominant in the overstory and Atlantic white cedar is seldom present, and then as <25% canopy cover.

P20a. Conifer Swamp dominated by eastern hemlock: **Hemlock Swamp**

Hemlock Swamps are acidic forested wetlands characterized by a dense tree canopy dominated by mature eastern hemlock, allowing little light to reach the forest floor. They occur in poorly drained basins throughout the state where the organic soils are saturated throughout the year. Many swamps have eastern hemlock as a component of the canopy but Hemlock Swamps are differentiated by having eastern hemlock as the dominant canopy species throughout the community.

Similar Communities: Red Maple Swamps and named variants such as Red Maple - Black Gum Swamps often have pockets of hemlock or scattered hemlocks, but overall those community types are dominated by deciduous trees, particularly red maple, and hemlocks are present in low overall percentages as part of the normal variation within the community. Red Maple Swamps have more species diversity in all the layers, as well as denser shrubs and herbaceous layers, than do Hemlock Swamps. Red Spruce Swamps are dominated by red spruce and have species typical of colder or northern areas not found in Hemlock Swamps. Rich Conifer Swamps in the western portion of the state occur in areas with calcium-enriched seepage waters and are characterized by red spruce, less abundance of hemlock, and a much more diverse species assemblage, including elm, spicebush, marsh marigold, and hemlock. In the southeast part of the state, hemlock mixes with Atlantic white cedar and other species typical of the coastal plain or more southern areas, grading into Atlantic white cedar swamps, with the type determined by the overall dominant tree species.

P20b. Conifer swamp dominated by or with a significant component of a spruce species: **P21**

P21a. Forested peatlands with a usually dense, short canopy of black spruce and tamarack over heath shrubs on sphagnum moss: **Spruce – Tamarack Bog**

Spruce - Tamarack Bogs are acidic forested peatlands that often occur in the older, more stable areas of larger wetland complexes that include other forested, shrub, and open community types. Spruce and tamarack are key indicators of this community, along with an extensive surface cover of sphagnum moss that may be hidden under shrubs. Lichens cover or drape branches. They occur in kettlehole depressions, at watershed divides, and along pond margins.

Similar Communities: Level Bogs, Kettlehole Level Bogs, and Acidic Graminoid Fens (open (non-forested) acidic peatlands) may have clumps of trees, but with <25% canopy overall. Atlantic White Cedar Bogs have sparse canopy (averaging <25%, but there may be local clumps of trees) cover of Atlantic white cedar over sphagnum on peat. They may have scattered black spruce, but lack red spruce. Atlantic White Cedar Bogs share many species with Spruce-Tamarack Bogs, but are generally found within Pitch Pine-Scrub Oak or Oak-Pine communities. Red Spruce Swamps have taller, larger diameter trees, dominated by red rather than black spruce, generally with a more open understory (fewer shrubs). They share species with Spruce - Tamarack Bogs, but also contain balsam fir. Red Spruce Swamp occurrences are often larger than Spruce - Tamarack Bogs. Hemlock Swamps are dominated by eastern hemlock, which are usually much taller and less dense than trees in Spruce - Tamarack Bogs. Red Maple - Black Ash - Tamarack Calcareous Seepage Swamps also include tamarack, and may have red spruce. However, these generally have much greater species diversity, including abundant deciduous trees, and occur in calcareous or circumneutral groundwater, with calciphiles in openings.

P21b. Red spruce-dominated swamps with balsam fir or deciduous species: **P22**

P22a. Forested wetlands, primarily of high elevations in western and north-central Massachusetts, dominated by red spruce: **Red Spruce Swamp**

Red Spruce Swamps have tall, large-diameter trees, dominated by red spruce, generally with an open understory. Creeping snowberry and twinflower are good indicators of Red Spruce Swamps but they do not occur in all examples.

Similar Communities: Rich Conifer Swamps are high elevation (>1000 ft.) forested wetlands that are characterized by a canopy of mixed red spruce, hemlock, balsam fir, and deciduous trees including black ash They may have species such as spicebush that indicate less acidic conditions, and pockets of moss rather than sphagnum lawns. Hemlock Swamps are dominated by eastern hemlock. Lower strata are sparse. Sphagnum may form a continuous ground cover. Spruce-Tamarack Bogs have a dense tree canopy dominated by generally short (<40' tall) black spruce and tamarack, and an often dense shrub layer.

P22b. Species-rich conifer swamps with eastern hemlock, balsam fir, or red spruce important in the canopy, with variable but high proportions of deciduous trees and white pine: **Rich Conifer Swamp**

Rich Conifer Swamps are characterized by a canopy of mixed red spruce, hemlock, balsam fir, and deciduous trees, including black ash and red maple. Shrubs may be dense and include species indicative of mineral-enriched conditions, including spicebush. The surface has pockets of moss rather than sphagnum lawns.

Similar Communities: Red Spruce Swamps are dominated by red spruce; lower strata are sparse. Sphagnum often forms a continuous ground cover. Hemlock Swamps are dominated by eastern hemlock throughout the community. Other types of forested wetlands often have scattered patches of eastern hemlock. Lower strata are sparse. Sphagnum may form a continuous ground cover. Red Maple Swamps and its named variants such are dominated by deciduous trees, particularly red maple. Atlantic white cedar swamps are dominated by Atlantic white cedar trees.

P23a. Shrublands, dominated by dense shrubs: **P24**
P23b. Open, sparsely vegetated, herbaceous, or low shrub wetland communities**: P26**

P24a. Tall (>~6 ft. (~2m)) shrub-dominated wetlands occurring on mineral or mucky mineral soils that are seasonally or temporarily flooded: **Shrub Swamp**

Shrub Swamps have >25% cover of tall shrubs on mixed mineral and well-decomposed organic soils. Shrub Swamp Communities are a common and variable type of wetlands occurring on seasonally or temporarily flooded soils. They are often found in the transition zone between emergent marshes and swamp forests.

Similar Communities: Highbush Blueberry Thickets are tall shrub communities occurring on peat, dominated by usually very dense highbush blueberries. Acidic Shrub Fens are peatlands, dominated by low growing shrubs, along with patchy sphagnum moss and herbaceous species of varying abundance. Deep Emergent Marshes and Shallow Emergent Marshes are graminoid-dominated wetlands with <25% cover of tall shrubs. Acidic Pondshore/ Lakeshore Communities are broadly defined, variable shorelines around open water. Shorelines often merge into swamps or marshes. Fresh/ Brackish Tidal Shrublands are dense to open shrublands along tidal sections of coastal rivers. They are part of the Estuarine system. Red Maple Swamp and its variants (forested swamp communities) often contain a significant shrub component, and may include patches of shrub swamp where the tree canopy cover is <25%.

P24b. Acidic peatlands dominated by shrubs: **P25**

P25a. Acidic peatlands dominated by dense highbush blueberry bushes on hummocky sphagnum moss: **Highbush Blueberry Thicket**

The physical and biological characteristics of Highbush Blueberry Thickets, Acidic Shrub Fen, Shrub Swamp, and Fresh/ Brackish Tidal Shrubland overlap and intergrade. They all lack tree cover (<25% canopy cover); they are all dominated by dense shrubs on wet substrates. Highbush Blueberry Thickets are tall shrub fens, dominated by highbush blueberries or other members of the blueberry family, on peat or at least have sphagnum at the base of the shrubs. Other peatlands include highbush blueberries as patches in more open communities or under canopies.

Similar Communities: Acidic Shrub Fens are dominated by low growing shrubs, with sphagnum moss and herbaceous species of varying abundance on wet, often weak peat. Shrub Swamps lack peat, are often quite diverse, and are not dominated by blueberries or other ericaceous plants. Fresh/ Brackish Tidal Shrubland are dense to open shrublands along tidal sections of coastal rivers, part of the Estuarine system.

P25b. Shrub-dominated acidic peatlands characterized by a mixture of low-growing, primarily deciduous shrubs. The peat is usually wetter and looser than in other peatlands: **Acidic Shrub Fen**

Acidic Shrub Fens are composed primarily of low-growing, interwoven shrubs with patches of sphagnum moss growing at the shrub bases. Dense water-willow and sweet gale are indicative and characteristic. Acidic Shrub Fens are wetter, with a less well-developed sphagnum mat than other acidic peatlands.

Similar Communities: Acidic Graminoid Fens are differentiated by the abundance of graminoid and herbaceous species and the lack of extensive shrubs. Level Bog communities receive little or no stream flow and are isolated from the water table, making them the most acidic (pH is in the range of 3 to 4) and nutrient-poor of peatland communities. The sphagnum peat tends to be deep and well developed, graminoids may be present but not dominant, and shrubs are dominated by leatherleaf. Kettlehole Level Bogs are a subset of Level Bogs that occur in iceblock depressions (commonly called kettleholes) in sandy glacial outwash. They are typically small (<3 acres) and round, and they lack inlets and outlets. Highbush Blueberry Thickets are dominated by tall (>~6 ft. (~2m)) dense shrubs of the blueberry family with other deciduous species. Shrub Swamps lack peat, are often more diverse than Acidic Shrub Fens and are not dominated by blueberries or other ericaceous plants. They are often dense and tall.

P26a. Acidic peatlands on sphagnum mats that are at least fairly well developed: **P27**

Natural communities on acidic peatlands all occur on sphagnum peat. The depth, density, and strength of the underlying peat control the structure and composition of each type of peatland community because plants growing on it are isolated from nutrients carried by groundwater.

P26b. Other open wetland communities, generally without well-developed sphagnum mats and deep peat: **P33**

Other open, sparsely vegetated, herbaceous, or low shrub wetland communities, generally without well-developed sphagnum mats and deep peat; may be in areas with calcium-rich groundwater and occur on peat.

P27a. Acidic peatlands that receive little or no stream flow and are (mostly) isolated from the water table by the peat: **P28**
P27b. Acidic peatlands where growing plants receive nutrients from stream flow or ground water; fens**: P30**

P28a. Acidic dwarf ericaceous shrub peatlands, generally with pronounced hummock-hollow topography: **Level Bog**

Level Bogs are dwarf-shrub peatlands, generally with pronounced hummocks and hollows in sphagnum moss. These wetland communities are very acidic and nutrient-poor because the peat isolates them from nutrients in groundwater and streams. The sphagnum peat tends to be deep and well-developed, graminoids may be present but not dominant, and shrubs are dominated by leatherleaf.

Similar Communities: Kettlehole Level Bogs are a subset of Level Bogs that occur in iceblock depressions (commonly called kettleholes) in sandy glacial outwash. They are typically small (<3 acres) and round, and they lack inlets and outlets. Atlantic White Cedar Bogs have sparse canopies (averaging <25%, but there may be locally denser cover) of Atlantic white cedar over sphagnum on peat. Atlantic White Cedar Bogs share many species and characteristics with other acidic peatlands, including Level Bogs. Acidic Graminoid Fens are dominated by graminoid and herbaceous species and by the lack of extensive shrubs. Three-way sedge and buckbean are characteristic of the wet, nutrient-enriched edges of Acidic Graminoid Fens. Sea-level Fens occupy the interface between estuarine marshes and upland seepage slopes, and therefore include both estuarine and palustrine species. Regionally, three species are considered to be diagnostic of Sea-level Fens: saltmarsh straw-sedge, saltmarsh spike-sedge, and saltmarsh threesquare. Twig-sedge at the edges of salt marshes is also used as an indicator of Sea-level Fens. Interdunal Swales occur as part of a coastal dune system. They are graminoid- or shrub-dominated communities occurring in shallow basins (swales) between dunes. Some are fen-like with cranberries and sedges growing on shallow peat, but occurrence in dune systems is the defining characteristic. Acidic Shrub Fens are composed primarily of low-growing, interwoven shrubs. Dense water-willow and sweet gale are indicative and characteristic. Acidic Shrub Fens are wetter with a less well-developed sphagnum mat than other acidic peatlands. Spruce - Tamarack Bogs are acidic forested peatlands with an overstory of black spruce and tamarack and an understory of heath shrubs on sphagnum moss.

P28b. Other acidic dwarf ericaceous shrub peatlands that are (mostly) isolated from the water table by the peat: **P29**

P29a. Level Bogs that develop in isolated valley bottoms without inlet or outlet streams, often in kettle depressions in sandy glacial outwash: **Kettlehole Level Bog**

Kettlehole Level Bogs are acidic dwarf-shrub peatlands with little water input or outflow, that form in circular depressions left by melting iceblocks in sandy glacial outwash. They are typically small (<3 acres) and round, and they lack inlets and outlets. The vegetation in Kettlehole Level Bogs usually grows in rings.

Similar Communities: In Level Bogs, the sphagnum peat tends to be deep and well developed, graminoids may be present but not dominant, and low shrubs are dominated by leatherleaf. Atlantic White Cedar Bogs have sparse canopy (averaging <25%, but there may be locally denser cover) of Atlantic white cedar over sphagnum on peat. Atlantic White Cedar Bogs share many species and characteristics with other acidic peatlands, including Level Bogs. Acidic Graminoid Fens are dominated by graminoid and herbaceous species and lack extensive shrubs. Spruce-Tamarack Bogs are acidic forested peatlands with an overstory of black spruce and tamarack.

P29b. Bogs with Atlantic white cedar (generally <25% cover): **Atlantic White Cedar Bog**

Atlantic White Cedar Bogs have sparse canopy (averaging <25%, but there may be local clumps of trees) cover of Atlantic white cedar with sphagnum on peat. The coverage vale is for the full extent of the community (which may have areas of no canopy cover at all), with Atlantic white cedar dominating the canopy that does occur. Atlantic White Cedar Bogs share many species and characteristics with other acidic peatlands, including Level Bogs, Kettlehole Level Bogs, and Acidic Graminoid Fens.

Similar Communities: Level Bogs, Kettlehole Level Bogs, and Acidic Graminoid Fens do not have Atlantic white cedar on the sphagnum mat. Coastal, Inland, and Northern Atlantic White Cedar Swamps are forested wetland communities with closed canopies (>25% tree cover overall, generally more), with >25%

cover of Atlantic white cedar. Atlantic White Cedar Bogs have, overall, <25% cover of canopy species (there may be small clumps of trees with greater cover), with Atlantic white cedar dominating the canopy that does occur. Whether Atlantic White Cedar Bogs are considered to be separate entities or openings in the prevailing Atlantic white cedar swamp depends on the patch size and abundance of local patches.

P30a. Acidic peatlands where growing plants receive nutrients from stream flow or groundwater, on natural substrates: **Acidic Graminoid Fen**

Acidic Graminoid Fens are sedge- and sphagnum-dominated acidic peatlands that experience some groundwater and/or surface water flow, but no calcareous seepage. Standing water is often present throughout much of the growing season. Abundant herbaceous species are mixed with the dominant sedges; they generally lack of extensive tall shrubs. Three-way sedge and buckbean are characteristic of wet, nutrient-enriched edges of Acidic Graminoid Fens.

Similar Communities: Sea-level Fens occupy the interface between estuarine marshes and upland seepage slopes, and have a mix of estuarine and palustrine species. Regionally, three species are considered diagnostic of Sea-level Fens: saltmarsh straw-sedge, saltmarsh spike-sedge, and saltmarsh threesquare. Twig-sedge at the edges of salt marshes is also a good indicator of Sea-level Fens. Interdunal Swales occur as part of a coastal dune system. They are graminoid- or shrub-dominated communities occurring in shallow basins (swales) between dunes. Some are fen-like with cranberries and sedges growing on shallow peat, but occurrence in dune systems is the defining characteristic. Acidic Shrub Fens are composed primarily of low-growing, interwoven shrubs. Dense water-willow and sweet gale are indicative and characteristic. They are wetter with a less well-developed sphagnum mat than other acidic peatlands. Level Bog communities receive little or no stream flow and are isolated from the water table, making them the most acidic (pH ~ 3 to 4) and nutrient-poor of peatland communities. The sphagnum peat tends to be deep and well developed, graminoids may be present but not dominant, and shrubs are dominated by leatherleaf. Acidic Graminoid Fen - Spillway Fens are shallow acidic peatlands with mixed graminoid/herbaceous vegetation that develops on spillway bedrock channels associated with large dams.

P30b. Other acidic fens: **P31**

P31a. Acidic peatlands where growing plants receive nutrients from stream flow or groundwater, on spillways of large dams: **Acidic Graminoid Fen - Spillway Fen**

Acidic Graminoid Fen - Spillway Fen is a cultural variant of Acidic Graminoid Fen. They are shallow acidic peatlands with mixed graminoid/herbaceous vegetation, that develops on and are restricted to spillway bedrock channels associated with large dams.

P31b. Acidic peatlands along coast or on barrier beaches: **P32**

P32a. Herbaceous/graminoid peatlands that occur at the upland edges of ocean tidal marshes. The combination of upland freshwater seepage and infrequent salt or brackish overwash produces a mixed plant community of freshwater and estuarine species on peat: **Sea-level Fen**

Sea-level Fens are most identifiable by location: they occupy the interface between estuarine marshes and upland seepage slopes, and therefore have a distinct species assemblage including both estuarine and palustrine species. Regionally, three species are considered diagnostic of Sea-level Fens: saltmarsh straw-sedge, saltmarsh spike-sedge, and saltmarsh threesquare. Twig-sedge at the edges of salt marshes is also used as an indicator of Sea-level Fens.

Similar Communities: Acidic Graminoid Fens are differentiated by the dominance of graminoid and herbaceous species and lack of extensive shrubs. They are also not very near the coast. Three-way sedge and buckbean are characteristic of wet, nutrient-enriched edges of Acidic Graminoid Fens. Interdunal Swales occur as part of a coastal dune system. They are graminoid- or shrub-dominated communities occurring in shallow basins (swales) between dunes. Some are fen-like with cranberries and sedges growing on shallow peat, but occurrence in dune systems is the defining characteristic. Acidic Shrub Fens are composed primarily of low-growing, interwoven shrubs. Dense water-willow and sweet gale are indicative and characteristic. Acidic Shrub Fens are wetter with a less well-developed sphagnum mat than other acidic peatlands.

P32b. Small patch wetland communities in shallow basins (swales) between dunes in coastal dune systems: **Interdunal Marsh/Swale**

Interdunal Marshes/Swales are not always peatlands, but many occurrences include sphagnum, cranberry, and other peatland plants. Interdunal Marshes/Swales occur as part of a coastal dune system. They are graminoid- or shrub-dominated communities occurring in shallow basins (swales) between dunes. Some are fen-like with cranberries and sedges growing on shallow peat, but occurrence in dune systems is the defining characteristic.

Similar Communities: Interdunal Marshes/Swales are the only open or shrub-dominated freshwater wetlands in dune systems.

P33a. Sparse, herbaceous, or low shrub calcareous wetland communities in areas with marble or limestone bedrock; may have peat: **P34**

All calcareous wetlands include shrubby cinquefoil. Most also have other calciphiles (calcium-loving plants) such as grass-of-Parnassus, Kalm's lobelia, alder-leaf buckthorn, hemlock parsley, autumn and hoary willows, and slender cotton-grass. Within a given site, calcareous fen communities may grade from one type to another.

P33b. Other sparse, herbaceous, or low shrub wetland communities**: P36**

Neither acidic sphagnum peatlands nor calcareous fens. The physical and biological characteristics of emergent marsh, wet meadow, and shoreline communities overlap and intergrade. The vegetation for all these types is broadly defined.

P34a. Sedge-shrub peatlands occurring in well-defined basins that have calcareous water inputs: **Calcareous Basin Fen**

Calcareous Basin Fens are sedge-shrub peatlands occurring on deep (>2.0 m (6.5 ft.)) peat in well-defined basins that have calcareous water inputs. These uncommon communities are the least nutrient- and species-rich of the three types of calcareous fen communities described in Massachusetts. They are dominated by sedges with a sparse shrub layer; they generally contain a more developed bryophyte layer than the other calcareous fens. They share many species with acidic fens, but include species restricted to calcareous conditions, such as bog birch and other calciphiles.

Similar Communities: Calcareous Sloping Fens are on shallow to moderate slopes and have more mineral soil than other calcareous fens; peat is mostly restricted to sedge hummocks. A diverse herbaceous layer dominates the vegetation. Tall shrubs and short trees may occur in scattered patches. Calcareous Seepage Marshes include some calciphiles as well as generalist species in a mixture of herbaceous, graminoid, and shrub species similar to an emergent marsh, with peat generally 0.5 to 2 meters deep. They are flat to slightly sloping. Black Ash-Red Maple-Tamarack Calcareous Seepage Swamps are dominated by tree species and tall shrubs. Small openings within them share many of the species and conditions of Calcareous Sloping Fens. Calcareous Pondshore/Lakeshore Communities consist of shrubby, herbaceous, or graminoid vegetation along shores of hard-water lakes. These communities are saturated for much of the year with some plants emerging only during low water.

P34b. Sedge-shrub peatlands occurring that have calcareous water inputs, not in well-defined basins: **P35**

P35a. Marshy wetlands enriched by calcareous groundwater seepage: **Calcareous Seepage Marsh**

Calcareous Seepage Marshes are marshy wetlands enriched by calcareous groundwater seepage. Of the three types of calcareous fen communities described in Massachusetts, they are intermediate in richness and botanical rarities. They share species with both Shallow and Deep Emergent Marshes, but contain more calciphiles.

Similar Communities: Calcareous Basin Fens have deep (>2.0 m (6.5 ft.)) peat in basins. They are dominated by sedges with a sparse shrub layer; they generally contain a more developed bryophyte layer than the other calcareous fens. They share many species with acidic fens, but include species restricted to calcareous conditions, such as bog birch, shrubby cinquefoil, grass-of-Parnassus, Kalm's lobelia, alder-leaf buckthorn, hemlock parsley, autumn and hoary willows, and slender cotton-grass. Calcareous Sloping Fens are on shallow to moderate slopes and have more mineral soil than other calcareous fens; peat is

mostly restricted to sedge hummocks. A diverse herbaceous layer that includes many calciphiles dominates the vegetation. Tall shrubs and short trees may occur in scattered patches. Black Ash - Red Maple - Tamarack Calcareous Seepage Swamps are dominated by sparse trees and tall shrubs. Small openings share many of the species and conditions of Calcareous Sloping Fens. Shallow Emergent Marshes are graminoid/herbaceous wetlands in broad, flat areas bordering rivers or along pond margins. The mucky mineral substrate has shallow standing water throughout the growing season. Deep Emergent Marshes are tall graminoid wetlands in deep water (up to 3 ft.) in broad, flat areas along slow rivers or ponds. Broad-leaved cat-tail and phragmites often form extensive dense stands. Calcareous Pondshore/Lakeshore Communities consist of shrubby, herbaceous, or graminoid vegetation along shores of hard-water lakes. These communities are saturated for much of the year with some plants emerging only during low water.

P35b. Marshy wetlands on shallow to moderate slopes enriched by calcareous groundwater seepage: **Calcareous Sloping Fen**

Calcareous Sloping Fens are on shallow to moderate slopes and have more mineral soil than other calcareous fens; peat is mostly restricted to sedge hummocks. A diverse herbaceous layer dominates the vegetation. Tall shrubs and short trees may occur in scattered patches.

Similar Communities: Calcareous Seepage Marshes include some calciphiles as well as generalist species in a mixture of herbaceous, graminoid and shrub species similar to an emergent marsh, with peat generally 0.5 to 2 meters deep. They are flat to slightly sloping. Calcareous Basin Fens have deep (>2.0 meters (6.5 ft.)) peat in basins. They are dominated by sedges with a sparse shrub layer; they generally contain a more developed bryophyte layer than the other calcareous fens. They share many species with acidic fens, but include species restricted to calcareous conditions, such as bog birch, shrubby cinquefoil, grass-of-Parnassus, Kalm's lobelia, alder-leaf buckthorn, hemlock parsley, autumn and hoary willows, and slender cotton-grass. Black Ash-Red Maple-Tamarack Calcareous Seepage Swamps are dominated by sparse trees and tall shrubs. Small openings share many of the species and conditions of Calcareous Sloping Fens.

P36a. Wetlands with permanently saturated soils that do not have standing water throughout the growing season: **P37**

P36b. Wetlands that have standing water through the growing season including along lake or river shores: **P38**

P37a. Graminoid wetland communities that occur in wet depressions, along streams, and in sloughs and backwaters in river basins. The mucky mineral soil is saturated during the growing season but not generally inundated: **Wet Meadow**

Wet Meadows are graminoid/emergent herbaceous communities that are similar to Deep and Shallow Emergent Marshes except that they are temporarily rather than seasonally flooded. They typically have a single sedge or grass species dominating. Repeated disturbance, usually from grazing or mowing, keeps these communities open. The mucky mineral soils are permanently saturated and flood occasionally, but standing water is not present throughout the growing season as in Deep and Shallow Emergent Marshes.

Similar Communities: Kettlehole Wet Meadows are dense graminoid marshes on mucky peat that occur in small basins. They are temporarily inundated after storms as well from high groundwater. Shallow Emergent Marshes are graminoid wetlands in broad, flat areas bordering rivers or along lake margins, are seasonally flooded, and usually have surface water all year. Wet Meadows do not have standing water throughout the growing season. Deep Emergent Marshes are tall graminoid seasonally flooded wetlands with deep water (up to 3 ft.). They generally form in broad, flat areas along slow rivers or ponds. Coastal Plain Pondshore Communities and Coastal Plain Pondshores – Inland Variant are generally on sand around ponds in closed basins that intersect groundwater. By late summer, an exposed shoreline supports a suite of herbaceous species that is not generally dominated by tall dense graminoids. Sediments are sandy or mucky, but not peaty. Acidic Pondshores/Lakeshores are broadly defined, variable shorelines around open water not explicitly included in calcareous or coastal plain pondshores. The shore line is often not distinct, merging into marsh or other wetlands.

P37b. Treeless graminoid communities in small (<5 acres) depressions in stratified glacial deposits. For most of the year they look like shallow ponds, but by late summer dense graminoid vegetation covers the mixed organic sediments. The small basins often have no stream inlet or outlet: **Kettlehole Wet Meadow**

Kettlehole Wet Meadows are dense graminoid marshes on mucky peat that occur in small basins. They are temporarily inundated after storms as well as from high groundwater.

Similar Communities: Wet Meadows, also graminoid communities, are in larger lake basins, backwaters, and sloughs along rivers. Shallow Emergent Marshes are predominantly graminoid wetlands in broad, flat areas bordering rivers or along pond margins and are seasonally flooded. Deep Emergent Marshes are tall, graminoid, seasonally flooded wetlands with deep water (up to 3 ft.). They generally form in broad, flat areas along slow rivers or ponds. Coastal Plain Pondshore Communities and Coastal Plain Pondshores – Inland Variant are generally on sand around ponds in closed basins that intersect groundwater. The seasonally fluctuating water table typically leaves an exposed shoreline by late summer that supports herbaceous species. Sediments are sandy or mucky, but not peaty, and late summer vegetation is not dominated by tall dense graminoids.

P38a. Dense vegetation on mucky mineral soils that are seasonally inundated and permanently saturated with standing water throughout the growing season: **P39**
P38b. Sparse, herbaceous, or low shrub communities associated with lakes or rivers, generally on mineral soils**: P40**

P39a. Wetlands dominated by relatively short grasses, sedges, and rushes on mucky mineral soils that have shallow (averaging <6 in. deep) surface water all year, including during the growing season. They often occur in broad, flat areas bordering slow rivers or along pond margins: **Shallow Emergent Marsh**

Shallow Emergent Marshes are graminoid/herbaceous wetlands that usually have shallow (averaging <6 in. deep (15 cm)) surface water all year. Cattails, phragmites, and wool-grass (the dominants of Deep Emergent Marshes) can occur but never dominate. The substrate is typically a layer of well-decomposed organic muck overlying mineral material.

Similar Communities: Deep Emergent Marshes are tall graminoid wetlands that are usually flooded with water averaging 6 in. to 3 ft. (15 cm to 1m)). They are dominated by cattails, phragmites, and wool-grass. Shrub Swamps have >25% cover of shrubs. Wet Meadows are graminoid wetlands, typically with a single sedge or grass species dominating. Standing water is not present throughout the growing season as in emergent marshes. Kettlehole Wet Meadows are dense graminoid marshes on mucky peat that occur in small basins. They are temporarily inundated after storms as well from high groundwater. Coastal Plain Pondshore Communities and Coastal Plain Pondshores - Inland Variant are generally on sand in closed basins that intersect groundwater. The exposed shoreline supports herbaceous species not generally dominated by dense graminoids. Acidic Pondshores/ Lakeshores are broadly defined, variable shorelines around open water not explicitly included in calcareous or coastal plain pondshores. The shoreline is often not distinct, merging into marsh or other wetlands. Calcareous Pondshore/Lakeshore Communities consist of shrubby, herbaceous, or graminoid vegetation along shores of hard-water lakes. These communities are saturated for much of the year with some plants emerging only during low water. The ponds themselves contain mats of the green alga stonewort. Bogs and fens are peatlands and have peat instead of mucky mineral soil; however, gradations do exist among types.

P39b. Wetlands dominated by tall graminoids on mucky mineral soils in deep water (<3 ft. (~1m) deep) surface water all year, including during the growing season. They occur along rivers and streams, lakes, artificial impoundments, and other water bodies: **Deep Emergent Marsh**

Deep Emergent Marshes are tall graminoid wetlands often dominated by cattails, phragmites, and wool-grass growing in water from a half foot to 3 ft. deep. Water depth may vary not only during the growing season, but from year to year.

Similar Communities: Shallow Emergent Marshes are short graminoid/herbaceous wetlands and usually have shallow (averaging <6" (~15 cm) deep) surface water all year. Vegetation composition is similar to Deep Emergent Marsh except that shorter grasses, sedges and rushes dominate. Shrub Swamps have >25% cover of shrubs. Wet Meadows are graminoid wetlands typically with a single sedge or grass species

dominating. Standing water is not present throughout the growing season as in emergent marshes. Kettlehole Wet Meadows are dense graminoid marshes on mucky peat that occur in small basins. They are temporarily inundated after storms as well from high groundwater. Calcareous Pondshore/Lakeshore Communities consist of shrubby, herbaceous, or graminoid vegetation along shores of hard-water lakes. These communities are saturated for much of the year with some plants emerging only during low water. The ponds themselves contain mats of the green alga stonewort. Coastal Plain Pondshore Communities and Coastal Plain Pondshores - Inland Variant are generally on sand in closed basins that intersect groundwater. The exposed shoreline supports herbaceous species not generally dominated by dense graminoids. Acidic Pondshores/ Lakeshores are broadly defined, variable shorelines around open water not explicitly included in calcareous or coastal plain pondshores. The shoreline is often not distinct, merging into emergent marsh or other wetlands. Bogs and Fens are peatlands, not dominated by cattails, phragmites, or wool-grass, without standing water.

P40a. Non-aquatic vegetation associated with lakes and ponds; mostly shores with mineral soils: **P41**
P40b. Wetland vegetation associated with river or stream shores**: P45**

P41a. Vegetation associated with calcareous lakeshores. Stoneworts may form mats on the lake bottoms: **Calcareous Pondshore/Lakeshore Community**

Calcareous Pondshore/Lakeshore Communities are submerged or saturated for a significant part of the year or continuously in wet years. They occur on gravelly, sandy or muddy shores of calcareous or circumneutral inland lakes and ponds. Documented only from the Marble Valleys of Berkshire County, they have calcium in the water derived from nearby limestone or dolostone bedrock. The ponds usually have inflow and outflow. The shore line is often not distinct, merging into marsh or other wetlands.

Similar Communities: Acidic Pondshore/Lakeshore Communities are on lakes with lower pH (<pH7) than calcareous ponds, and do not have stoneworts. Many have inflow or outflows. Acidic pondshore vegetation is broadly defined, variable, and includes shorelines not explicitly included in calcareous or coastal plain pondshores. Coastal Plain Pondshore Communities are generally on ponds in sand in the coastal plain, in closed basins that intersect groundwater. The seasonally and annually fluctuating water table typically leaves an exposed shoreline by late summer that supports common and rare, generally coastal or southern, mostly herbaceous species. Coastal Plain Pondshores - Inland Variant also occur in closed basins in sandy outwash, but in the Connecticut River Valley. Coastal plain species grow in them, but include fewer specialists. Freshwater Mud Flat Communities are within ponds rather than shorelines. They have low, sparse annual herbaceous vegetation on recently exposed muddy sediments.

P41b. Vegetation associated with shores of ponds and lakes that are not calcareous; not in areas of marble or limestone bedrock: **P42**

P42a. Vegetation associated with shores of ponds and lakes that are closed basins in sandy outwash: **P43**
P42b. Vegetation associated with shores or exposed lake bottoms of lakes, ponds, or low-energy rivers, not in closed basins in sandy outwash**: P44**

P43a. Herbaceous communities of exposed pondshores in southeastern Massachusetts that are characterized by a distinct coastal plain flora: **Coastal Plain Pondshore Community**

Coastal Plain Pondshore Communities occur on exposed shores of ponds in glacial outwash in the coastal plain where water levels are controlled by seasonal groundwater changes. The herbaceous flora has a distinct southern component.

Similar Communities: Coastal Plain Pondshores - Inland Variant also occur in closed basins in sandy outwash, but are in the Connecticut River Valley. Some, but fewer, coastal plain species grow in them. Acidic Pondshore/Lakeshore Community is broadly defined, variable, and includes shorelines not explicitly included in coastal plain pondshores, the inland variant, or calcareous ponds. The shore line is often not distinct, merging into marsh or other wetlands. Many ponds have inflow or outflows. Calcareous Pondshores /Lakeshores occur in the Marble Valleys of Berkshire County, around ponds that have calcium

in the water. Freshwater Mud Flat Communities are within ponds rather than along shores. Mud flats in Coastal Plain Ponds are treated as part of the pondshore community.

P43b. Herbaceous communities of exposed pondshores in closed basins in sandy outwash in the Connecticut River Valley: **Coastal Plain Pondshores - Inland Variant**

Coastal Plain Pondshores - Inland Variant have vegetation zones of graminoids or herbaceous species on sloping, seasonally exposed, gravelly, sandy or muddy shores of acidic, inland lakes and ponds that have substantial natural fluctuation of water levels.

Similar Communities: Acidic Pondshore/Lakeshore Communities are broadly defined, variable, and include shorelines not explicitly included in coastal plain pondshores, the inland variant, or calcareous ponds. The shore line is often not distinct, merging into marsh or other wetlands. Many ponds have inflow or outflows. Coastal Plain Pondshore Communities are generally on ponds in sand in the coastal plain in closed basins that intersect groundwater. The seasonally and annually fluctuating water table typically leaves an exposed shoreline by late summer that supports common and rare, generally coastal or southern, mostly herbaceous species. Calcareous Pondshores /Lakeshores occur in the Marble Valleys of Berkshire County, around ponds that have calcium in the water. Freshwater Mud Flat Communities are within ponds rather than along shores. Mud flats in Coastal Plain Ponds are treated as part of the pondshore community.

P44a. Vegetation associated with shores of acidic ponds and lakes that are not closed basins in sandy outwash: **Acidic Pondshore/Lakeshore Community**

The Acidic Pondshore/Lakeshore Community is broadly defined to cover most of the pondshores in the state that are not explicitly excluded such as calcareous pondshores and Coastal Plain Pondshore Communities. Many occurrences are narrow (often <1m wide) and are submerged or saturated for a significant part of the year or continuously in wet years. In ponds or lakes that have little natural fluctuation in water levels, the shores are often shrub dominated. Shallow ponds with gradual slopes may have broader shores with emergents along the shore or, if there is regular disturbance such as water level changes or ice scour, the vegetation may be sparse.

Similar Communities: Coastal Plain Pondshore Communities are generally on ponds in sand in the coastal plain in closed basins that intersect groundwater that affects pond levels. The seasonally and annually fluctuating water table typically leaves an exposed shoreline by late summer that supports common and rare, generally coastal or southern, herbaceous dominated species. Coastal Plain Pondshores - Inland Variant also occur in closed basins in sandy outwash, but in the Connecticut River Valley. Coastal plain species grow in them, but include fewer specialists. Freshwater Mud Flat Communities are within ponds rather than shorelines. They have low, sparse annual herbaceous vegetation on recently exposed muddy sediments. Calcareous Pondshore/Lakeshore Communities consist of shrubby, herbaceous, or graminoid vegetation along shores of hard-water lakes. These communities are saturated for much of the year with some plants emerging only during low water. The ponds themselves contain mats of the green alga stonewort.

P44b. Sparsely vegetated herbaceous community dominated by herbs (usually annuals) on recently exposed fine sediments: **Freshwater Mud Flat Communities**

Freshwater Mud Flat Communities have low, sparse annual herbaceous vegetation on recently exposed muddy sediments in rivers and ponds, where they may include stranded aquatic vegetation.

Similar Communities: Low-energy Riverbank Communities are on slopes of river banks composed of a mix of relatively fine mineral materials (clay, silt, or sand). The stream bottoms of Low-energy Riverbanks can merge into Freshwater Mud Flat Communities; separation depends on patch size and connectedness. High-energy Riverbank Communities occur along the shores of fast-flowing, high-energy rivers, with sparse plants growing in the sediment caught between rock cobbles. Riverine Pointbar and Beach Communities are along higher energy rivers on sand or gravel. Deep and Shallow Emergent Marshes have dense graminoid emergent plants on mucky sediments, often with standing water at the base of the plants. Freshwater Tidal Marshes and Brackish Tidal Marshes occur in tidally influenced stretches of coastal rivers; the communities are defined to include mud flats adjacent to marshier, more densely vegetated areas in the tidal reach. Mud flats in coastal plain ponds are treated as parts of the Coastal

Plain Pondshore Community. Mud flats that emerge from human-mediated water lowering in lakes or rivers (including for dam repair or removal, or for nuisance plant control) are usually temporary and would develop River and Lake Drawdown Communities that might be extensions of naturally occurring mud flat communities.

P45a. Open vegetation associated with low-energy or low-gradient rivers and streams: **P46**
P45b. Open vegetation associated with high-energy or high-gradient rivers and streams**: P47**

P46a. Sparsely to moderately vegetated exposed drawdown areas of reservoirs and behind dams: **River and Lake Drawdown Community**

River and Lake Drawdown Communities occur on exposed sediments of reservoirs and behind dams when water levels are lowered. These areas are often large. The vegetation of the River and Lake Drawdown Community is usually low-growing with cover varying from very sparse to dense. Weedy, opportunistic, non-competitive, short-lived, quick-to-reproduce species quickly dominate recently exposed sediments.

Similar Communities: Riverine Pointbar and Beach Communities are in high-energy stream channels on sand or gravel. Freshwater Mud Flat Communities have low, sparse, annual herbaceous vegetation on recently exposed muddy sediments in river backwaters and ponds where they may include stranded aquatic vegetation. The drawdown community shares many of the same opportunistic species of mud flats and pointbars but may cover more extensive areas.

P46b. Open herbaceous vegetation occurring on sandy or silty soils of river banks that do not have severe flooding or ice scour: **Low-energy Riverbank Community**

Low-energy Riverbank Communities are on slopes of river banks composed of a mix of relatively fine mineral materials (clay, silt, or sand) that lack both the cobble substrate of high-energy areas and the organic materials of marshes. The communities may include scattered shrubs or trees along with herbaceous species.

Similar Communities: Freshwater Mud Flat Communities have low, sparse, annual herbaceous vegetation on recently exposed muddy (mucky, silty mineral) sediments in ponds and streams. Mud flats at the base of banks may be included in a bank community if they are very small, are an extension of the riverbank, and do not extend much into the stream channel. High-energy Riverbank Communities occur along the shores of fast-flowing, high-energy rivers, with sparse plants growing in the sediment caught between rock cobbles. Shallow and Deep Emergent Marshes are dominated by perennial graminoids and are permanently saturated. Unlike Low-energy Riverbanks with a mineral substrate, marshes typically have a layer of well-decomposed organic muck at the surface, overlying mineral soil. They both have denser vegetation than most Low-energy Riverbank Communities. Wet Meadows have dense mixed herbaceous/graminoid vegetation growing on permanently saturated mucky sediments.

P47a. Sparsely vegetated exposed sand/gravel beaches and pointbars of high energy-rivers and large streams: **Riverine Pointbar and Beach Community**

Riverine Pointbar and Beach Communities are on exposed sand or gravel river beaches in high-energy stream channels. The vegetation tends to be sparse, with bare sand or gravel dominating, at least on the most recently exposed areas; it is patchy, flood-battered, and highly variable with seasonal and spatial zonation. Herbaceous and graminoid vegetation dominates in more frequently flooded areas, with woody vegetation where less frequently flooded.

Similar Communities: High-energy Riverbank Communities occur on the banks of fast-flowing, high-energy rivers with sparse plants growing in the sediment caught between rock cobbles. Low-energy Riverbank Communities are on slopes of river banks composed of a mix of relatively fine mineral materials (clay, silt, or sand). The communities may include scattered shrubs or trees along with herbaceous species. Freshwater Mud Flat Communities have low, sparse annual herbaceous vegetation on recently exposed muddy sediments in river backwaters and ponds, where they may include stranded aquatic vegetation. River and Lake Drawdown Communities are sparsely to moderately vegetated exposed drawdown areas of reservoirs and behind dams.

P47b. Communities of the shores of high-energy/high gradient rivers, between the water and the bank above sandbars and beaches: **P48**

P48a. Sparse, open herbaceous/graminoid communities occurring on cobble and sand substrates of steep-gradient, fast-flowing rivers that experience severe flooding and ice scour: **High-energy Riverbank Community**

High-energy Riverbank Communities include river shores and edges of islands. Along river islands, zones of switch grass, big bluestem, and Indian grass, along with sandbar willow and/or sandbar cherry, are indicative of High-energy Riverbanks. Along rivers, High-energy Riverbanks have, on average, sparser vegetation and more dry, bare ground than do High-energy Rivershore Meadows or Riverside Seeps.

Similar Communities: High-energy Rivershore Meadows occur on shores as the percentages of sand and silt, and moisture increase, supporting hemp dogbane, riverside-sedge, Canadian burnet, and water horsetail that as a group characterize the rivershore meadows. Riverside Seeps occur at the base of steep riverbanks where mineral-enriched groundwater seeps out of the bottom of the upland slope; they are wetter than associated High-energy Rivershore Meadows and High-energy Riverbank Communities. Low-energy Riverbank Communities are open herbaceous/graminoid communities occurring on sandy or silty mineral soils of river and stream banks that do not experience severe flooding or ice scour. The vegetation is often dominated by reed canary grass, Canada blue joint grass, or other dense grasses, with some of the same species typical of disturbed areas as High-energy Riverbanks. Cobble Bar Forests occur on cobble bars that have a tree canopy (cover >30%).

P48b. Communities between the open cobbles exposed in the summer and the steep bank to the surrounding uplands: **P49**

P49. Variably sized, occurring in about 30 ft. (~10m) wide bands along medium to high-energy river channels, kept open by flooding and ice scouring: **High-energy Rivershore Meadow**

High-energy Rivershore Meadows are densely vegetated with a characteristic group of dominant plants - hemp dogbane, riverside-sedge and Canadian burnet - in a mix with other forbs and graminoids. On cobble shores along high-energy rivers, High-energy Rivershore Meadows intergrade with High-energy Riverbank and Riverside Seep Communities.

Similar Communities: Riverside Seep Communities occur at the base of steep riverbanks where groundwater seeps out of the bottom of the upland slope; they are wetter than associated High-energy Rivershore Meadows and High-energy Riverbank Communities. Muskflower, Canadian burnet, and golden alexanders as a group are good indicator species of Riverside Seeps. High-energy Riverbank Communities have, on average, sparser vegetation and more bare ground than do High-energy Rivershore Meadows or Riverside Seeps.

P49. Mixed herbaceous community along river shores where groundwater discharge provides mineral enrichment, often kept open by flood and ice scour: **Riverside Seep Community**

Riverside Seep Communities are small patch communities that often occur with and grade into High-energy Rivershore Meadows and High-energy Riverbank communities along high-energy rivers. Riverside Seep Communities occur at the base of steep riverbanks where groundwater discharges from the bottom of the upland slope; they are wetter than associated High-energy Rivershore Meadows and High-energy Riverbank Communities. Muskflower, Canadian burnet, and golden alexanders as a group are good indicator species of Riverside Seeps.

Similar Communities: High-energy Rivershore Meadows are densely vegetated with a characteristic group of dominant plants - hemp dogbane, riverside-sedge and Canadian burnet - in a mix with other forbs and graminoids. High-energy Riverbank Communities have, on average, sparser vegetation and more bare ground than do High-energy Rivershore Meadows or Riverside Seeps.

Estuarine System

E: Tidal wetlands with fresh to salt water. Vegetation is flooded twice daily by fresh, brackish or saltwater tides. Wetland communities with some direct hydrological connection to the open ocean. Substrate has regular, daily, water level fluctuations caused by ocean tides.

E1a. Trees or tall shrubs (>~6ft (~2 m)) as uppermost layer, with total woody cover of that layer >25%; along free-flowing coastal rivers in areas influenced by daily tides**: E2**
E1b. Tree and tall shrub cover in the uppermost layer <25%; uppermost vegetation layer sparse, herbaceous, or low shrubs <~6 ft. (~2m) tall**: E3**

E2a. Trees dominant (single trunks, >~15 ft. (~5m) tall), total woody cover >25%, trees >25%: **Fresh/Brackish Tidal Swamp**

Fresh/Brackish Tidal Swamps are low-stature forested wetlands located along coastal rivers, flooded by daily tides at the upper limit of tidal influence. They have a dense shrub understory and an unusually rich herbaceous layer.

Similar Communities: Freshwater Tidal Marshes occur downslope and downstream from tidal swamps. They are not dominated by trees. Other types of forested wetlands, particularly Red Maple Swamps, Alluvial Red Maple Swamps, and Alluvial Atlantic White Cedar Swamps, do not occur in the sections of coastal rivers that are influenced by daily tides. Fresh/Brackish Tidal Shrublands are dominated by shrubs (<5m, generally multi-stemmed), with <25% trees in the canopy.

E2b. Shrub-dominated (multiple trunks, <~15 ft. (~5m) tall); total woody cover >25%, trees <25%: **Fresh/Brackish Tidal Shrubland**

Fresh/Brackish Tidal Shrublands are dense to open shrublands flooded by daily tides, occurring along the freshwater to brackish reach of coastal rivers and along the upland edges of salt marshes. Shrubby areas within and at the upland edges of salt marshes could be designated as Fresh/Brackish Tidal Shrubland if large enough; otherwise, they would be considered to be part of the expected variation of Salt Marshes. Some Salt Marsh plants occur in tidal shrublands mixed with the more usual freshwater species.

Similar Communities: Fresh/Brackish Tidal Swamps are forested and dominated by trees. Tidal shrublands have less than 25% tree canopy. Shrub Swamps do not occur in areas with brackish water, not where there is freshwater/brackish water tidal action on coastal rivers or where there is freshwater seepage along the edges of salt marshes just above the zone of regular salt water incursion. They do not include typically salt marsh species. Maritime Shrublands are upland communities.

E3a. Open vegetation along tidal rivers and streams in areas where fresh and salt water mix: **E4**
E3b. Vegetation inundated by salt water in daily tides or submerged in salt water: **E5**

E4a. An estuarine intertidal, mixed herbaceous marsh flooded by daily tides, and occurring in the freshwater reach of coastal rivers: **Freshwater Tidal Marsh**

Freshwater Tidal Marshes represent the upstream end of a gradient, ranging from coastal Salt Marsh through Brackish Tidal Marsh to Freshwater Tidal Marsh. Freshwater Tidal Marshes are characterized by salt-intolerant plant species such as sweet flag and wild rice, and do not include Salt Marsh plants such as saltmarsh hay and saltmarsh cordgrass.

Similar Communities: Salt Marshes are submerged twice daily by salt water. Saltmarsh hay and saltmarsh cordgrass are dense and dominate. Brackish Tidal Marshes are limited to short stretches of tidal rivers where salinity is between fresh and salt water levels and along the upper edges of Salt Marshes where freshwater enters from uplands. Saltmarsh bulrush and salt reedgrass occur in brackish conditions. Wet Meadows are not affected by tides.

E4b. Mixed herbaceous marsh that is flooded by daily tides, in brackish reaches of coastal rivers. May also occur in small patches in upper zones of coastal salt marshes and salt ponds, usually near seepages or freshwater transition areas: **Brackish Tidal Marsh**

Brackish Tidal Marshes are limited to short stretches of free-flowing tidal sections of coastal rivers where salinity is between fresh and salt water levels. Smaller patches often occur along the edges of salt marsh habitat, near stream inputs, seepages, or other freshwater transition areas, such as the upper edges of Salt Marshes where freshwater enters from uplands. Saltmarsh bulrush and salt reedgrass occur in brackish conditions.

Similar Communities: Salt Marshes are submerged twice daily by salt water. Saltmarsh hay and saltmarsh cordgrass are dense and dominate. Salt Marshes have less diverse vascular plants than do Brackish Tidal Marshes. Freshwater Tidal Marshes are a mixed herbaceous marsh flooded by daily tides, in the freshwater reaches of coastal rivers; the presence of sweet flag and wild rice indicates fresh water, not brackish or salt. Freshwater Tidal Marshes lack salt-tolerant plants.

E5a. Community submerged on flats in salt water, intertidal or subtidal, estuarine or marine, or in coastal salt ponds irregularly open to the ocean: **E6**
E5b. Intertidal communities along shores covered twice daily in salt water by tides, on ocean shores, bays, and in salt water sections of coastal rivers: **E7**

E6a. Community on flats in salt water, either intertidal or subtidal, dominated by eelgrass or widgeon grass, not in coastal salt ponds: **Seagrass Community**

Seagrass Communities occur on estuarine or marine flats with sand or mud substrates that are completely submerged by, usually, less than 2m of water at high tide. They are sparsely to densely vegetated communities, completely submerged at high tide and dominated by eelgrass with a strong invertebrate component. All seagrass beds not in Coastal Salt Ponds are included in this community type.

Similar Communities: Coastal Salt Ponds may include eelgrass or widgeon grass beds, but those are included in the Coastal Salt Pond community type. Marine Intertidal Gravel/Sand Beaches are below the wrack line and submerged twice daily by tides. Any vegetation is non-vascular. Marine Intertidal Rocky Shore Communities are dominated by invertebrates and non-vascular macro-algae (seaweeds). They are covered in salt water twice daily, and are fully exposed to waves. A national classification of marine and estuarine communities is in the early stages of development. Inter- and sub-tidal flats occur all along the Atlantic coast, and have many variants. Subtidal submerged rocky habitats are often dominated by kelp and other algae; they are not included in this classification.

E6b. The vegetation in and surrounding coastal saline to brackish ponds separated from the ocean by sandspits: **Coastal Salt Pond Community**

Coastal Salt Ponds are separated from the ocean by sandspits that open and close irregularly causing great variability in salinity, water levels, and vegetation within the salt pond. The inland ends tend to be fresher water, with denser, taller vegetation developing where freshwater enters from uplands.

Similar Communities: This is the only community represented by a body of water with a narrow opening to the sea, generally formed between the mainland and a barrier beach. Seagrass Communities have some similar species but occur on inter- and subtidal flats in open saline or brackish waters, with no freshwater component.

E7a. A densely vegetated, graminoid-dominated, tidally flooded coastal community, with multiple recurring zones: **Salt Marsh**

Salt Marshes are graminoid-dominated, tidally flooded coastal communities developed on non-sphagnum peaty material in areas protected from wave energy in estuaries and behind barrier beaches. Salt Marshes are flooded by salt water twice daily. Most of the vegetation is dominated by saltwater cordgrass and salt hay.

Similar Communities: Brackish Tidal Marshes have salinity levels between fresh- and salt water (0.5-18 ppt,). The vegetation is mixed with saltmarsh bulrush, salt reedgrass, and narrow-leaved cattail, not with saltwater cordgrass and salt hay. Freshwater Tidal Marsh lacks saltwater cordgrass and salt hay, and has sweet flag, wild rice, climbing hempweed, and other broad-leaved herbaceous plants. It is flooded by freshwater (salinity <0.5 ppt). The various freshwater marshes and Wet Meadows are not flooded by daily tides and are not dominated by saltwater cordgrass and salt hay.

E7b. Intertidal rocky or gravel/sand shore, vegetated sparsely to densely by nonvascular macro-algae (seaweeds): **E8**

E8a. Rocky ocean shore covered by salt water in twice daily tides: **Marine Intertidal Rocky Shore Community**

Marine Intertidal Rocky Shores are dominated by invertebrates and non-vascular plants, in a high-stress environment alternately covered by tides and exposed to desiccation and thermal stress.

Similar Communities: This is the only marine rock community covered in salt water twice daily. It is fully exposed to waves. Marine Intertidal Gravel/Sand Beaches have smaller substrate materials, but may share some of the species and are also inundated by twice daily tides and receive the full force of waves. Maritime Rock Cliff Communities are sparsely vegetated terrestrial communities where plants grow in cracks and ledges where soil collects, within the salt spray zone, but above normal high tides. They are often physically above Marine Intertidal Rocky Shore communities.

E8b. Gravel or sand beaches submerged twice daily by salt water tides: **Marine Intertidal Gravel/Sand Beach Community**

Marine Intertidal Gravel/Sand Beaches are below the wrack line and submerged twice daily by tides. Invertebrates and nonvascular plants dominate Marine Intertidal Gravel/Sand Beaches, a highly stressed community in the intertidal (zone of beaches, below the Maritime Beach Strand community.

Similar Communities: Maritime Beach Strand Communities are above the daily high tides, between the wrack line and the dunes, and they support scattered vascular plants. Seagrass Communities are dominated by vascular eelgrass or widgeon grass, on subtidal or intertidal mud flats that are not in the zones of intense wave action.

Appendix 4: Natural Community Field Forms

Natural Community

FIELD FORM INSTRUCTIONS

Modified for **Massachusetts**
by Patricia Swain, NHESP, and Nancy Putnam, MassWildlife Forest Project Ecologist
with Andy Finton, NHESP (Form 2) and John Scanlon, MassWildlife Forest Project Leader

from a 1991 draft by
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Field forms were designed to standardize data collection. We have divided the community data into categories, and designed separate forms with different purposes. Detailed instructions for each form follow this introductory summary.

FORM 1: TRANSECT, SITE SURVEY SUMMARY:

Use this form for reconnaissance, for a new site that is essentially unknown from a community description perspective. Use this form to try to "make sense" of the landform: where are the communities in relation to changes in topography? What are the communities? What are the boundaries? For sites that are degraded (obvious C and D ranked community occurrences), this may be the only community form completed. It will serve as a record of the visit and provide some community data, but probably will not be mapped or entered into the database of Priority and Exemplary Communities. Information on low quality community occurrences may be entered into a secondary community database to be tracked for a record of the sites. Form 1 is useful for recording general information along transects, with notes taken when communities change.

FORM 2: NATURAL COMMUNITY SUMMARY AND RANKING:

Use to record information on the community location, description, threats, and rank. The natural community will be a part of a property or site: a bog, hemlock ravine, and an isolated stretch of floodplain forest are all communities. Single Form2s may have several plots or transect forms with them. On the back of Form 2 is guidance for assigning a rank for a community occurrence (element occurrence rank), generally for A or B-ranked occurrences, or best known occurrences (C- or D- ranked common communities for which no pristine examples occur). The basis of ranking needs to be explained: range wide, state wide, or locally. These ranks are meant to apply state wide: if you are only familiar with the community in part of the state, give it a relative rank, but give your area of comparison. If you are giving it a global rank say so clearly. Form 2 contains fields for ownership information – if known - and other miscellaneous information that will assist in initiating protection activity. This form will also contain basic information regarding management needs of the community element: burning, exclosures, etc. This form can also be used as a record of subsequent visits, as an update form. A marked up topographic map must accompany Form 2, showing location and boundaries of the community type.

FORM 3, BASIC VEGETATION AND HABITAT INFORMATION:

This form is to report plots, usually done in the best occurrences of community types. There can be several Form 3s for any given community occurrence and its Form 2. This form contains all the basic information fields needed for minimum documentation of community occurrences. The sampling method is the relevé, which appears to be a reasonable compromise between the community "species list" and the more detailed plot techniques (e.g. macro-plots). Relevés are circular, square, or rectangular plots placed in the most representative portion of the community occurrence (but placement within this area should be random). Plots in most cases are not permanently marked (but semi-permanent markers may be used if a return visit is anticipated). Plots may be measured with a

tape, but if you are familiar with your pace length, you may simply pace the distance and flag the corners. Identify what size and shape plot was used, or if it was plotless.

A given community occurrence may have several plots. All the information on Form 3 pertains to the plot. If more than one plot is taken (large community occurrences may require more than one plot), use a new sheet for each plot. Each should be labeled carefully to associate it with other Form 3s and with its Form 2. Make sure each plot can be identified if the pieces of paper get separated. Each set of forms needs a map associated with it to locate the plots and the community.

Follow the instructions for filling out Form 3 as much as possible. There is a lot of information requested, and you may not be able to supply it all. Soil information is helpful, but requires equipment you may not have with you. Do what you can, balancing information acquisition with time available. General descriptions are very useful.

All forms submitted to NHESP will be photocopied. Interns may transcribe them. You need to be neat and clear. Pencil doesn't photocopy well. Your data is valuable – help us make it useful by being legible!

Form 1: Transect, Site Survey Summary

A. Identifiers:

1) **Site Name** - "Official" name. Leave blank if you don't know it.
2) **Survey Site Name** - provisional name assigned by field worker; should represent an identifiable feature on topographic map.
3) **Town** - appropriate name from topographic map.
4) **Directions** – provide these from an easily identified road or other location. Include parking information if useful. These should be precise directions in words; attach a map if appropriate.
5) **GPS used, yes or no, and the latitude and longitude, make and model of the GPS unit if used.** Provide the lat and long from a topo map if no GPS was used. If GPS points are taken at each observation location, provide the points below and leave the lat and long blank here.
6) **Source Code** -assigned by NHESP.
7) **Survey Date** - year, month, day. Date of survey.
8) **Main Surveyor**: name of person responsible for the identifications and information.
9) **Other Surveyors** - names and addresses, as appropriate, for field assistants.

B. Topography:

10) **Transect** - a sequence number for identifying location.
11) **A topographic map must accompany the form, with locations indicated. Reconnaissance Diagram**: a diagrammatic cross section or toposequence showing changes in elevation and corresponding changes in vegetation and soils. Mark each observation point and releve location on the diagram. (Corresponding brief descriptions for each point are given in part C). Use arrow to show compass direction and indicate approximate elevation changes and distance covered in meters. Indicate scale using ruler or stick figure.

C.Vegetation/Habitat Observations:

12) **Observation point number for the transect, GPS point name, and GPS latitude and longitude.** Give the GPS point a unique identifier for correlating with other information.
13) **Community name** - state or national vegetation name, if known; provisional name may be assigned if preferred – label as such if used.
14) **Additional data** - state whether Form 2 and/or Form 3 were completed for this observation point.
15) **General Description** - briefly describe the community or feature with the physiognomy and three dominant species and characteristic species of each stratum. If form 3 was filled out, this can be omitted, and write "see form 3," and make sure they are identified for easy cross reference.

Form 2: Natural Community Summary and Ranking

Always include a copy of the appropriate USGS topographic map with this form, with the community and any transects shown.

1) **Community Name** - name of the community type from the Massachusetts draft classification.
2) **NatureServe Association Name** – an optional field for those working with the National Classification.
3) **Survey Date** - Date the field work was done.
4) **Today's Date** - Date the form is filled out.
5) **Survey site name** - Provisional name of the site, usually named after a geographic feature.
6) **Surveyors name(s)** - give the main surveyor's name first, followed by any field assistants present. Add addresses if appropriate.
7) **Best Source** – if the form is based on previous work or someone else's survey, provide a citation.
8) **Transcriber** – leave blank, NHESP use only.
9) **Town** - official town the site is in, not local village
10) **Directions to site** - from an easily identified road or other location. Include parking information if useful. Give precise directions in words; attach map if appropriate. Use clear sentences that will be understandable to someone who is unfamiliar with the area and has only your directions to follow. Give distances as closely as possible and use compass directions. Give additional directions to the plot within the site.
11) **GPS point(s)** – yes or no, and supply if taken.
12) **Vegetation Description** - description of the community with a list of key species and community structure.
13) **Physical Description** - Give a word picture of the area, including a general description of the physical features and the landscape. Describe the setting for the site, including whether there is surrounding conservation land, highways, or development.
14) **Is the community on conservation land:** if known, name the property.
15) **Evidence of Disturbances/Threats/Management** – describe disturbances that may affect the quality or viability of the community. Threats and evidence of disturbances should be from observations made in the field or from information gained through knowledgeable sources. You may add any management recommendations as appropriate.
16) **Recreational Use** – evidence of ATV's, ORV's, snowmobiles, horses, or mountain bikes and the existence of established trails or roads that are within or on the edge of the community occurrence.
17) **Protection comments -** to be filled out only if the information is known.
18) **General Comments** – notes on sampling techniques, other forms filled out, and other information gathered or needed. Note if photographs were taken and are available and what type (digital, slides, prints).

19-21) Owner information - leave blank if not known

Community Element Occurrence Ranking

These fields are very helpful and important; fill out the parts you are comfortable with. Use the comment fields. In the comments field state what the comparisons are to: is this a property, region, state, or range-wide assessment? Comment on size, exotics, management possibilities, position in the landscape, ownership or other useful criteria.

Form 3: Basic Vegetation and Habitat Information

These instructions were generalized from modifications made by Nancy Putnam and John Scanlon for combined allowable harvest and biological inventory of MassWildlife lands.

This form is used to report plots that are traditionally located in the best occurrences and in the most representative portions of natural communities. Traditionally, Form 3 plots are subjectively located in order to capture the full biodiversity of plant communities.

Complete a Form 3 at the first place within a community where it looks appropriate. Complete additional Form 3s as needed if there are substantial changes in vegetation composition and/or structure in subsequent parts of the natural community occurrence. Examples of "substantial changes" include a shift in tree species composition from American beech and yellow birch to sugar maple and white ash within a stand of northern hardwoods, or a shift in species composition from black oak and American beech to red oak and sugar maple in a stand of mixed hardwoods. Likewise, a shift in tree size from 8-10" DBH dominant trees to 12-14" might warrant two sample plots. Also, a shift in canopy closure from relatively open (35% canopy) to relatively closed (60% canopy) might warrant two sample plots.

A. Identifiers:

1) **Community Type –** State name of observed community type using the Massachusetts Classification (Swain 2020) or NatureServe's US NVC**.** If you are unsure if one of these community types applies, mark the name as provisional.
2) **GPS Point:** Take a GPS point at the center of the plot, name the point using a unique identifier, and record the identifier used.
3) **Assigned Type** – Leave blank, this is for the official community type name, assigned by NHESP staff.
4) **Latitude** - in decimal degrees. **Longitude** - in decimal degrees. **Provide projection if not in Mass State Plane!**
5) **Site Name** - "Official" name. Leave blank if you don't know it.
6) **Quad name(s) -** USGS quadrangle map name and scale (optional)**.**
7) **Ecoregion** – Use MassWildlife ecoregions from USFS (can be assigned later).
8) **County** – county name from map (optional)
9) **Town** – town or city name from map, not local village.
10) **Directions** – from an easily identified road or other known location. Include parking information if useful. Give precise directions in words; attach map if appropriate. Use clear sentences that will be understandable to someone who is unfamiliar with the area and has only your directions to follow. Give distances as closely as possible and use compass directions to plot. Edit/enhance directions at the end of each field day.
11) **Survey Date** - year, month, and day. Pertains to date of field survey.
12) **Previous observations of this type at this site –** If you have observed this community type at this site before, list the dates of your previous observations.
13) **Surveyors** - names and addresses, as appropriate. List principal surveyor first.

B. Environmental Description:

14) **Plot #** - Your number, may be the same as the GPS point identifier if desired.
15) **Photos Taken** – Circle Y or N. Provide photo number or other identifier.
16) **Elevation** – (from topo map) elevation of the plot, in feet or meters, label units used.
17) **Topographic Position** - topographic position of the plot in the landscape, check off.
18) **Topographic Sketch** - draw a topographical sketch and indicate position of plot. Add N arrow to show compass direction and indicate approximate elevation changes (optional).
19) **Slope Aspect** - use a compass and be sure to correct for the magnetic declination.
20) **Slope Class** - measure slope using a clinometer or check appropriate slope class. Note if clinometer used.
21) **Slope Shape –** circle the appropriate type for vertical or horizontal topography observed
22) **Downed Wood** – record diameter, approximate length in 5 foot increments, and decay class for the single piece of downed wood ≥ 4" that has the largest diameter of all downed wood in the plot or near GPS point (e.g., if one piece of downed wood has a 20" diameter, and all other pieces of downed wood have a smaller diameter, record the approximate length and the decay class for the 20" piece). Then, estimate the average diameter of all downed wood ≥ 4" in diameter in the plot. Then record the % cover (cover classes from item 41) of downed wood. Use the following decay classes:

    Decay Class A = bark is usually present, at least partially, wood is still firm, but some areas may be soft when pressed with a foot, branches may be intact and log is often elevated, at least partially.

    Decay Class B = bark is usually absent, wood is very spongy when pressed with fingers, log is usually entirely on the ground, and branches are usually absent.

23) **Fuel load –** estimate levels of dead and highly flammable fuels that are less than ¼" in diameter.
24) **Snags:** Record the species, DBH, and approximate height class (estimate or use Kuchler height classes in #41) of standing dead trees ≥4" DBH.
25) **Unvegetated Surface** – Check only one option that represents the most dominant feature in the plot. For example, if there is a scattering of both small rocks and large rocks at the site, check large rocks on the pick list. Likewise, if there are ledge (bedrock) outcrops and large rocks in the vicinity of the plot, check bedrock. However, if there is only a slight outcrop of bedrock, but numerous large rocks near the plot, check large rocks on the pick list.
26) **Litter and duff depth:** Litter includes freshly-fallen leaves, needles, twigs, bark, fruits, and wood fragments. Duff is the fermentation layer and humus layer (organic horizon). Measure depth from top of litter down to the edge of mineral soil and round it to the nearest one-half inch.
27) **Parent Material/Bedrock** - note the geologic substrate influencing the plant community (bedrock or surficial materials), if known.

    Igneous and Metamorphic Rocks

    Granitic (Granite, Schyolite, Syenite, Trachyte)
    Gabbroic (Gabbro, Basalt, Pyroxenite, Peridotite)
    Dioritic (Diorite, Dacite, Andesite)
    Gneiss, Schist, Slate and Phyllite, Marble, and Serpentine

Sedimentary Rocks
- Conglomerates and Breccias
- Limestone and Dolomite
- Sandstone, Siltstone, Shale
- Marl, Gypsum

Glacial deposits:
- Undifferentiated glacial deposit, till, moraine, bedrock and till
- Glacio-fluvial deposits (outwash plains, ice-contacted GF deposits, eskers, kames, pro-glacial deltas, etc.)
- Deltaic deposits (alluvial cones, deltaic complexes)
- Lacustrine & fluvial deposits (glacio-fluvial, fluvio-lacustrine, freshwater sandy beaches, stony/gravelly shore)
- Marine deposits (bars, spits, sandy beaches, old shorelines, old beach ridges, old marine clays, etc.)
- Organic deposits: peat (with clear fibric structure) and muck
- Marsh, regularly flooded by lake or river (high mineral content)
- Slope and modified deposits: talus and scree slopes, colluvial, solifluction, landslide
- Aeolian deposits: dunes, aeolian sand flats, loess deposits, cover sands

28) Moisture Regime - moisture regime is based on the amount of water available to plants. It is evaluated on the basis of soil drainage, soil structure and texture, and climate. Choose one:

Very Dry: medium and coarse sands: steep eroding sands, rock piles, gravel, and shallow soils, not influenced by ground water.

Dry: deep silty sands and loamy sands, not influenced by ground water.

Moist: soil surface above the maximum water level; normal soil profile development hampered because of imperfect drainage. Upper 1-2 feet of soil well-aerated during vegetative season. Occurs also on heavy textured soils with perched water table and on dry deep peat.

Wet: water level at soil surface for most of vegetative season. Reduced gley layer up to mineral soil surface on mineral soils; mottling usually absent or insignificant. Organic soil, gleysol

Saturated: water level above soil surface for most part of vegetative season. Minimum water level approximately at soil surface. Organic soil.

Periodically Inundated: (hydric) known to be periodically inundated due to flood/drought cycles or other variable moisture regimes.

Permanently Inundated: (hydric) minimum water level above soil surface, soils permanently inundated.

29) Soil Type – estimate overall texture of upper 1 m of loose deposit.

Sand: soil does not remain in a ball when squeezed, soil particles are 0.05-2.0mm in diameter.

Clay: generally hard when dry and sticky and plastic when wet, soil particles are <0.002 mm in diameter.

Loam: consists of sand, silt, and clay separates ranging from sandy loams to silty clay loams.

Muck: dark colored, finely divided, well-decomposed organic soil material mixed with mineral soil material. The content of organic matter is more than 20%.

Peat: unconsolidated material, largely undecomposed organic matter that has accumulated under excess moisture.

30) Sphagnum Hummocks Overhanging Water: these areas may be important nesting habitat for Four-toed Salamanders. Document these habitats if they are visible from the plot and only if they are

greater than 25 m^2 in overall size. If these habitats are larger than 0.5 acre, a separate plot (Form 3) should be done within that community type. For sphagnum habitats less than 0.5 acre estimate the size of the sphagnum/open water habitat, if pools of water or channels of moving water are present, circle the appropriate category(s). Measure or estimate maximum water depths in three locations within the channels or pools of water present. Record the habitat location with a GPS point.

31) Evidence of Land Use History – Circle or record observations of agricultural, management, or past development activities that are evident within or near the plot. This will help determine the occurrence of primary vs. secondary forest (primary forest may have been cut, but was never converted to agriculture, and may retain soil invertebrates and vegetation root structures that are absent from secondary forest).

32) Evidence of Disturbance – Circle observed evidence of non-anthropogenic disturbance within or near the plot.

33) Environmental Comments - Additional observations, note whether vegetation is homogeneous or made up of distinct patches; evidence of erosion or sedimentation; invasive plant species, etc. For invasive plants, list the scientific name of the species and note whether the infestation observed at the plot appears to be New (colonizing), Established, or Expanding. Document all ATV activity that is causing erosion, rutting, or other environmental degradation. Take a digital photo and GPS waypoint at each occurrence.

C. VEGETATION: Protocol for Community form (Form 3, back).

34) System: check appropriate ecological system for the plot

35) Plot Number: for correlating with site forms (Form2) and other plots. Should be the same as #14.

36) Plot dimensions: Normally, width and length dimensions for square plots. Say if "plotless." Square plots are preferred. Because there is greater potential for edge effects or patchiness in long rectangular plots, use them only when needed to fit in a narrow zone. Circle or variable radius plots are possible. Specify what is used. Plot sizes vary with the type of community. Choose the appropriate plot size based on the table below:

Forest:	200 - 500 m^2	
Seedling and sapling (1-6" dbh dominate); development classes 1 & 2:		10 x 10 m plot
Large pole (trees 7-12" dbh dominate); development class 3:		15 x 15 m plot
Sawtimber (trees >12" dbh): development classes 4 & 5:		20 x 20 m plot
Shrubland:	50 - 200 m^2	8 x 8 m plot
Grassland & **Heath**:	25 - 100 m^2 may be multiple smaller plots	5 x 5 m plot

37) Leaf Phenology - Check the type of leaf structure for the dominant stratum (greater than 25% cover).

38) Physiognomic Type - Select the description that best describes the community structure.

39) Photo Cover Type: Cover type abbreviation used by the photo interpreter, if available.

39a) Field-Observed Cover Type: Record observed cover type for the area around and including the plot.

40) Strata / life forms - Visually divide the community into vegetation layers. Indicate a distinct range of height above ground for each stratum (e.g., 50-80 feet for the tree canopy, T2). Then record the total percent cover for each stratum within the relevé. All vegetation layers may not be present at all plots. Remember that the height ranges for individual vegetation layers cannot overlap. However, the % cover may total to >100% since tree canopy occurs above shrub canopy, and shrub canopy occurs above herbaceous vegetation. Also, if gaps occur between vegetation layers, represent those gaps in the height data (e.g., if there is a 10 foot gap between the bottom of the tree canopy and the top of the tree sub-canopy, you might record their heights as 50-80 feet and 20-40 feet, respectively).

41) Releve Data - list all species and their abundance/cover classes for each stratum, beginning with the tallest. Separate each stratum with a blank line. On the first line of each stratum, record the stratum code (OR Kuchler code), with its total percent cover. Species outside the plot should be listed in parentheses and not counted in the total number of species used in tabular comparison. For tree strata, include diameters (DBH) of several (or all, say which) of the (largest) trees in the plot. IF YOU USE A DIFFERENT APPROACH, MAKE IT VERY CLEAR WHAT YOU HAVE DONE.

Braun-Blanquet

Cover/abundance values:	
r:	one or few individuals
+	occasional, < 5% cover
1	common, < 5% cover
2-	5-12% cover
2+	13-25% cover
3	26-50% cover
4	51-75% cover
5	> 75% cover

Sociability scale:
1 growing solitarily, singly
2 small groups, small tussocks
3 small patches, large tussocks
4 large patches, mats
5 great crowds, mats covering whole plot

Kuchler Height Classes **an alternative to the protocol on the back of form 3**

Life form Categories

Woody Plants	
B	Broadleaf evergreen
D	Broadleaf deciduous
E	Needleleaf evergreen
N	Needleleaf deciduous
S	Semideciduous (B+D)
M	Mixed (D+E)

Herbaceous Plants	
G	Graminoids
H	Forbs
L	Lichens, mosses

Special Life Forms	
C	Climbers (lianas)
X	Epiphytes

Structural Categories

Height (stratification)	
8	>35m
7	20 - 35m
6	10 -20m
5	5 - 10m
4	2 - 5m
3	0..5 - 2m
2	0.1- 0.5m (knee high)
1	<0.1m (ankle high)

Coverage (of the layer)	
c	continuous (>75%)
i	interrupted (50 - 75%)
p	parklike, patches (25 - 50%)
r	rare (5 - 25%)
b	barely present, sporadic (1-5%)
a	almost absent, scarce, (<1%)

Using relevé procedures.

Plot sizes vary with the community--generally 20 x 20m or 10 x10m for forest. If necessary subplots can be nested for different layers (5x5m for shrubs, several 1x1m for herbaceous)--label clearly whatever is done.

NOTE: You may prefer using actual estimated coverages instead of cover classes. If doing that be consistent, and clearly explain what you have done.

Kuchler height class
Species name1 Braun-Blanquet's code notes (cover, sociability)
Species name2 Braun-Blanquet's code notes (cover, sociability)

Examples: (some people use abbreviations for species in notes, Acsa or Quru)

D6c

Acer saccharum	4.1	dbh to 10"
Quercus rubra	3.1	dbh to 8"
Acer rubrum	2.1	dbh to 6", one dead stem
Fraxinus americana	1.1	dbh to 8", edge of plot, most canopy out

M5r

Pinus strobus	2.1
Acer rubrum	2.2, multiple stems
Sassafras albidum	+.1
Betula papyrifera	1.2

D3p

Cornus ammomum	1.2
Viburnum acerifolium	+.1

H1-2p (There's a choice here--call entire layer H and list small Ds and Gs, or separate each growth form. Purists probably separate. I tend to name the layer by appearance, so if grassy looking its G, even if it has Hs or if it is broadleaved herbaceous looking its H, but includes woody and grassy. Tends to be a long section.)

Aster infirmus	+.1 (fl) (There are lots of +.1, s, probably most common.)
Aster paternus	+.2
Viola sp	1.2 (it is best to be as precise as possible on species for the computer)
Eupatorium rugosum	+.1
Geum canadense	+.1
Osmunda cinnamomea	2.2
Acer rubrum	+.1
Vaccinium angustifolium	2.4
(Carex stricta	3.4, area near woods, not in plot)

B1a

Mitchella repens	+.2
Gaultheria procumbens	+.2

Note: There's flexibility here. Lump overlapping size classes (i.e. D4-5r). This is one reason for using the self defined strata on the top of the back of form 3, as well as the Kuchler classes. If it's a measured plot, say so: if eye-balled, say where. And so on.

COMMUNITY FORM 1: TRANSECT, SITE SURVEY SUMMARY

MA Natural Heritage & Endangered Species Program

A. Identifiers

1. Site name: _____ 2. Survey site name: _____

3. Town (LOCALJURIS): _____ 4. Directions: _____

_____

_____

_____

_____

5. GPS (if not below) _____ Lat. _____ Long _____ Make and Model _____

6. Sourcecode (NHESP use): _____ 7. Survey date _____ 8. Main Surveyor: _____

9. Other Surveyors: _____

B. Topography 10. Transect

11. A topo map must also be attached with location indicated. Reconnaissance diagram: Scale:

C. Vegetation / Habitat

12. Observation point 1. GPS Pt_____ GPS Lat. Long	Observation point 2. GPS Pt_____ GPS Lat. Long	Observation point 3. GPS Pt._____ GPS Lat. Long
13. Community type: _____ 14. Additional data: Site form2 __ form 3___	Community type:_____ Additional data: Site form2____ form 3___	Community type:_____ Additional data: Site form2____ form 3_____
15. General description (physiognomy, characteristic & dominant spp. of all layers)	General description:	General description:

11. A topo map must also be attached with location indicated. Reconnaissance diagram: Scale:

Observation Point 4 GPS Pt_____	**Observation Point 5** GPS Pt_____	**Observation Point 6** GPS Pt_____	**Observation Point 7** GPS Pt_____
GPS Lat. Long	GPS Lat. Long	GPS Lat. Long	GPS Lat. Long
Community type:_____ Additional data: Site form2____form 3_____	Community type:_____ Additional data: Site form2_____form 3_____	Community type:_____ Additional data: Site form2____form 3_____	Community type:_____ Additional data: Site form2____ form 3_____
General Description:	General Description:	General Description:	General Description:

Natural Heritage & Endangered Species Program
Massachusetts Division of Fisheries & Wildlife
1 Rabbit Hill Rd.
Westborough, MA 01581
508-389-6360

FORM 2: NATURAL COMMUNITY SUMMARY AND RANKING

(A location map must accompany this form.)

A. Identifiers:

Community Name (Swain 2020): _____

NatureServe Association Name (Optional): _____

Survey Date: _____ Today's Date: _____

Survey Site Name: _____

Surveyor Name(s): _____

Best Source (Field survey or secondary source used to complete this form, **NHESP use**): _____

_____

Transcriber (**NHESP use only**. YY-MM-DD XXX): _____ Town Name: _____

Directions to site: _____

_____

_____

GPS Point(s)___Yes___No___ Latitude _____ Longitude _____

B. Community Description:

Vegetation Description (**Summarize** the vegetation: dominant and/or characteristic species, indicator species, community structure, variants/microhabitat features, unvegetated surface; spatial distribution (i.e., size, number, and separation distance of patches); intact natural processes, geology, hydrology, topography, and soil properties, especially if relevant to the community identification): _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____Estimated size (acres) _____ GIS Acres (if available) _____

Physical Description (Describe the landscape surrounding the community, including the natural area. Both within and surrounding the community, describe: physical structures and land use practices; natural disturbances; embedded, adjacent, and nearby natural communities including aquatic features; notable landforms; scenic qualities): _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Is community on conservation land (if known): _____ Managed Area Name: _____

Evidence of Disturbance/Threats to the Community/Management Recommendations (Describe the anthropogenic disturbances that have decreased the quality and viability of the community such as hydrologic alterations (ditching, damming, erosion etc.), logging, mining, livestock grazing, plantations, orchards, structures, trampling, and exotic flora or fauna within and surrounding the community. Discuss threats to the site and management implications.):

Recreational Use (evidence of ATV's, ORV's, mountain bikes, horses, walking trails, etc.):

Protection Comments (Comment on the legal protectability of the site):

General Comments (Note the type of sampling done; observation point (form 1), releve plot (form 3), plant list, etc.; note any additional field work needed. Comment on questionable identification.):

Owner's Name (if known): Telephone: (__)

Address:

Is Owner: aware of community? __yes _ no __unknown; Protecting community? __yes __no __unknown

Owner Comments (e.g., contact owner prior to visiting the site):

C: Community Element Occurrence Ranking: (Refer to community ranking specifications for assistance.)

Community Size Rank: (Compare relative size to other known occurrences, configuration, patchiness)

A – Excellent **B** – Good **C** – Marginal **D** - Poor

Comments:

Community Condition Rank: (Consider development/maturity (e.g., old growth), abiotic condition, species and physiognomic diversity, ecological processes, abundance of exotic species, internal connectivity, degree of anthropogenic disturbance including fragmentation).

A – Excellent **B** – Good **C** – Marginal **D** - Poor

Comments:

Community Landscape Context Rank: (Consider the size and connectivity of the natural landscape, the position of the community within the landscape, and the landscape condition)

A – Excellent **B** – Good **C** – Marginal **D** - Poor

Comments:

Community EO Rank: (What are the long-term prospects for continued existence of this occurrence at the indicated level of quality? A summary of all factors listed above. Explain the basis of your ranking: range wide, state wide, or locally.)

A – Excellent **B** – Good **C** – Marginal **D** - Poor

Comments (Summarize the above and justify the EO Rank assigned):

Other rare species and/or natural communities observed at this site (**NHESP use**) T/U = Transcribed/Updated?):

	SPECIES OR COMMUNITY	T/U?		SPECIES OR COMMUNITY	T/U?
1			4		
2			5		
3			6		

MAPS: required. Insert or attach maps with boundaries of the natural community shown. Show GPS points and tracks. At least one map must be at 1:12,000 scale and show road names, pond names, and/or other identifiable features. Preferred format would be a topo map and an aerial. Google Earth maps with road names are acceptable. ALSO provide the GPS points and boundary electronically.

PHOTOS: required. Insert or attach photos of the community occurrence. Label the photos with photographer's name, date taken, and where taken. Include information on why each photo is included. (For example, photo of Pitch Pine/Scrub Oak Community occurrence at Wings Hole, from the western edge towards the center, showing the variation in shrub layer. Or photo of Atlantic White Cedar Swamp from the center towards the upland, showing hummocks and hollows.)

Form 3: Quantitative Community Characterization

MA Natural Heritage & Endangered Species Program

A. Identifiers (general EOR information)

1. Community type (observed): _____ 2. GPS Point: _____
3. Assigned type (NHESP use): _____ 4. Lat: _____N Long _____W
5. Site name: _____ 6. Quad name(s): _____
7. Ecoregion (DFW): _____ 8. County name(s): _____
9. Town: _____ 10.Directions: _____

_____

11. Survey date_____ 12. Previous observations at this site: _____
13. Surveyors: _____

B. Environmental Description

14. **PLOT #**	15. **Photos taken Y N;** **Identifier _____**	16. **Elevation (from topo)**: ____ m or ft
17. **Topographic position**: ___Summit/Crest ___High slope ___Step in slope ___Mid slope ___Toe of slope ___Low slope ___Rolling Terrain ___Level ___Channel wall ___Basin floor ___Channel bed ___Other	18. **Topographic sketch**: 19. **Slope aspect**:_____	20. **Slope Class** (Percent): Flat (<2%) Steep (48-95%) Gentle (2-9%) Very Steep (>95%) Moderate (10-25%) Abrupt (cliff or ledge) Rather Steep (26-47%) 21. **Slope Shape**: Vertically: Concave Convex Linear Horizontally: Concave Convex Linear
22. **Downed Wood** (within or partially within plot) Max. diameter/length/decay class: _____ Average diameter for all downed wood ≥4 in. _____(estimate) Abundance of downed wood ≥4 in. diameter (using cover classes) _____ 23. **Fuel load (< ¼ inch in diameter)**: Low = 1 Moderate = 2 High = 3 24. **Snags ≥ 4" DBH**: Species DBH ht. _____ _____ ___ _____ _____ ___ _____ _____ ___ _____ _____ ___ _____ _____ ___	25. **Un-vegetated surface (check the single, most dominant feature)**: ____ Bedrock ____ Large rocks (boulders > 24 in.) ____ Small rocks (stones 10-24 in.) ____ Cobbles (2-9 in.) ____ Gravel (<2 in.) ____ Sand ____ Litter ____ Bare soil ____ Water ____ Other: _____ 26. **Combined litter & duff depth**: _____inches 27. **Parent material**: _____	28. M**oisture regime**: ____Very dry ____Dry ____Wet ____Moist ____Saturated ____Periodically inundated ____Permanently inundated 29. **Soil type** (if observed) ____ sand ____loam ____clay ____peat ____muck other_____
30. **Sphagnum hummocks overhanging water:** (only if >25 m^2 and visible from plot) GPS point (location): _____ Size of habitat: _____ 3 water depths _____ (max. inches) Circle: Moving channels or Pools of Water Comments: _____	31. **Evidence of Land Use History**: stone walls, barbed wire, wolf trees cut stumps, multi-trunk trees, foundations, wells Other _____ _____	32. **Evidence of Disturbance**: Fires: fire scars, charcoal, standing snags Blowdowns: aligned downed trees Ice damage: broken tree tops Disease: adelgid, gypsy moth, beech bark Other: _____

33. **Environmental Comments**: vegetation homogeneity, erosion / sedimentation, invasive species presence/distribution, etc:

C. VEGETATION 34. **System**: __ Terrestrial __ Palustrine __ Estuarine 35. **PLOT NUMBER**:_____36. **Plot Dimensions**:_____

37. **Leaf phenology**:
____Deciduous
____Semi-deciduous
____Semi-Evergreen
____Evergreen
____Perennial
____Annual

38. **Physiognomic type**:
____Forest
____Sparse woodland
____Shrubland
____Dwarf shrubland
____Sparse dwarf shrubland
____Herbaceous
____Woodland
____Scrub thicket
____Sparse shrubland
____Dwarf scrub thicket
____Non-vascular
____Sparsely vegetated

39. **Photo Cover Type**: _____ 39a. **Field-Observed Cover Type:** _____

40. **Strata/life forms** **height (m or ft)** **% cover** **Cover Classes**

T1 Emergent tree			+ <1%
T2 Tree canopy			**1** =1-5%
T3 Tree sub-canopy			**2** =6-25%
S1 Tall shrub			**3** =26-50%
S2 Short shrub			**4** =51-75%
H Herbaceous			**5** >75%
N Non-vascular			
V Vine / liana			

41. **Plant Species & abundance**: list each species and the corresponding cover class for each stratum.
