Wetland Natural Communities

What Are Wetlands?

Wetlands are vegetated ecosystems characterized by abundant water. In many ways, they are intermediate between upland and aquatic ecosystems. Upland natural communities have relatively dry soils that generally lack saturation or inundation except after heavy precipitation. Aquatic communities include the open water portions of streams and rivers as well as the deepwater portions of lakes and ponds greater than six feet deep. In contrast, wetland communities include the vegetated, shallow-water margins of lakes and ponds, the seasonally flooded borders of rivers and streams, and an amazing diversity of topographic settings across the landscape, including basins, seepage slopes, and wet flats.

Over the past 20 years, many definitions have been developed for the term and concept of "wetland." Although these definitions differ somewhat, most have identified three basic characteristics of wetlands. First, all are inundated by or saturated with water for varying periods during the growing season. Second, they contain wetland or hydric soils, which develop in saturated conditions. Finally, they are dominated by plant species that are adapted to life in saturated soils. Methodologies for identifying the precise location of wetland boundaries for regulatory purposes have been based on developing specific definitions for each of these three wetland characteristics, known technically as hydrology, hydric soils, and hydrophytic vegetation.

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Wetlands are known by many common names, and in recent years, these names have been applied more consistently to specific wetland types. ***Swamps*** are wetlands dominated by woody plants, either trees or shrubs. ***Marshes*** are wetlands dominated by herbaceous plants. ***Fens*** are peat-accumulating open wetlands that receive mineral-rich groundwater. ***Bogs*** are also peat-accumulating wetlands but are isolated from mineral-rich water sources by deep peat accumulation and therefore receive most of their water and nutrients from precipitation.

Wetlands along Jewett Brook in Barnet.

The Physical Environment of Wetlands

Many environmental factors have contributed to the development and evolution of Vermont's natural communities since the retreat of the glaciers 13,500 years ago. Of particular importance in wetlands are hydrology, nutrient availability, water and ice movement, and climate. These four factors affect the development of individual wetlands and are, in turn, greatly affected by landscape scale features, such as bedrock type, surficial deposits resulting from glacial action, topography, latitude, and elevation. The wetland community types described in the sections that follow can largely be explained by the environmental gradients created by these four factors. Although these four factors have all been discussed in the introduction to Part Three, hydrology and nutrient availability are reviewed here with special emphasis on their importance in wetlands.

These wetlands along a brook in the Southern Green Mountains can be distinguished by color as softwood swamp (green), shrub swamp (brown), and marsh (tan).

Hydrology

The frequency and duration of soil saturation or inundation are the primary factors determining the type of wetland that will develop in a particular setting. The permanent standing water of deep-water marshes excludes practically all woody plants and is suitable habitat for only those herbaceous plants that are adapted to the very low dissolved oxygen concentrations found in the inundated substrate. A fluctuating water table that rises with seasonal flooding and later falls below the soil surface excludes plants that are intolerant of inundation but is suitable habitat for many other herbaceous and woody plants. Under these conditions, there can be high biological activity in the soil during the periods of drying, resulting in hydric mineral soils or relatively shallow, well-decomposed organic soils (muck) such as those found in some swamps and shallow marshes.

Permanent soil saturation severely limits biological activity and results in the formation of poorly decomposed organic soils (peat) that can reach substantial depths, as are found in many peatlands. The lack of seasonal flooding in most peatlands also has a significant effect on the plants that are present.

Nutrient Availability

The availability of nutrients in a particular wetland setting has a significant effect on the plants that will grow and flourish there. ***Minerotrophic*** wetlands receive nutrients through contact with either surface water or groundwater sources. The chemical composition of these water sources varies considerably with the type of bedrock and surficial deposits through which the water has passed. Calcium is one of the most important minerals affecting plant distribution in wetlands. Fens are found in areas of the state with calcium-rich bedrock and are located in settings where mineral-rich groundwater percolates to the surface. Many marshes receive abundant surface water runoff, which provides a source of dissolved nutrients and minerals. In contrast, ***oligotrophic*** wetlands are poor in nutrients. Oligotrophic wetlands may be associated with bedrock types such as granite that provide little dissolved minerals or may occur in physical settings where groundwater and surface water runoff are not significant sources of enrichment. Bogs are especially low in nutrients. The deep accumulations of peat result in a raised water table that is above the influence of groundwater sources. Rainwater is the primary source of nutrients in these acid wetlands, and bogs are therefore referred to as being ***ombrotrophic.***

Ecological Functions of Wetlands

Our improved understanding of the functions that wetlands provide along with the worldwide loss of wetlands associated with land development have been the primary factors leading to increased efforts to protect these ecosystems. Functions generally refer to the physical, chemical, biological, and ecological attributes of wetlands without consideration of their importance to society. In contrast, wetland values refer to the processes or attributes of wetlands that are beneficial to society. The following discussion provides a review of wetland functions only. Although the wetland functions described below may provide substantial benefits to society, they are explained here in terms of their contribution to ecological processes. Values that are typically associated with wetlands include open space and aesthetics, education and research in natural science, and recreation and economic benefits.

Attenuation of Flood Flows

Many wetlands, especially those that occur in basins with restricted stream outlets or in the floodplains of rivers, have the capacity to store large volumes of water generated by heavy rainfall, rapid snowmelt, or floods. These wetlands release stored water slowly back into rivers or streams or in some cases allow the water to percolate into the ground. The collective effect of many such wetlands is a slowing of floodwaters, reduction in downstream flood peaks, and likewise a reduction in the severity of downstream bank erosion. The effectiveness of a particular wetland in attenuating flood flows depends on many factors, including the size of the wetland and its location in the watershed, the type of wetland soils present, and the dominant vegetation in the wetland.

Surface Water Quality Protection

Wetlands can be very effective in trapping sediments and removing nutrients and pollutants from surface water runoff before that water reaches streams or lakes. Clearly, the location of a particular wetland relative to sources of runoff and the receiving stream or lake is important in determining how effectively a wetland will protect the quality of surface waters.

Groundwater Discharge and Recharge

Groundwater discharge occurs when an underground water source meets the surface of the land. Groundwater recharge occurs when surface water soaks into the ground and contributes to an underground reservoir. It is generally accepted that more wetlands are associated with groundwater discharge than with groundwater recharge. Groundwater discharge may be evident as seeps or springs where water comes to the surface. These wetlands have characteristic features such as stable water levels and soil saturation, defined outlet channels, and water chemistry and vegetation that reflect mineral-enriched conditions. Many wetlands with groundwater discharge provide a constant supply of water that maintains base stream flows for fish and other aquatic life. Groundwater recharge wetlands are not permanently flooded or saturated and are often small isolated basins that receive runoff from a relatively small watershed.

Fisheries Habitat

Certain freshwater fish species require wetlands as spawning grounds and as nursery areas for their young. Spring spawning by northern pike in the emergent wetlands adjacent to Lake Champlain is a particularly good example. Others, like black bullhead, yellow perch, pumpkinseed, and bluegill, leave open water to spawn in shallow-water wetlands. Wetlands are also important for maintaining the quality of fish habitat by providing shade or discharging water from cold springs, both of which moderate surface water temperatures.

Great blue heron is one of many species of wildlife that depend on wetlands.

Wildlife Habitat

Wetlands provide essential habitat for numerous wildlife species. The dense vegetation found in most wetlands provides a variety of foods and also nesting sites that are relatively safe from predators. Many species, such as the Canada goose, wood duck, great blue heron, muskrat, beaver, snapping turtle, and bullfrog are wetland dependent, meaning that they rely on wetlands for some or all of their life cycles. For others, such as black bear, moose, deer, wood frogs, and marsh hawks, wetlands are not primary habitat but are important for a part of their life cycle or during certain times of the year. Wetlands also provide critical habitat for many animal groups that we know much less about, including dragonflies, butterflies, moths, beetles, and other insects.

Habitat for Rare, Threatened, and Endangered Species

Wetlands occupy only five to ten percent of the land area in Vermont, but they provide necessary habitats for the survival of a disproportionately high percentage of the threatened and endangered species in the state. Of the 153 threatened and endangered plant species in the state (May 1996), 54 species (35 percent) are closely associated with or are found exclusively in wetlands. Of the 42 species of animals (mammals, birds, reptiles, amphibians, fish, mollusks, insects, and amphipods) on the threatened and endangered list (May 1999), 9 species (21 percent) are closely associated with or found exclusively in wetlands. Examples of such wetland dependent species are Calypso orchid, Virginia chain fern, marsh valerian, common loon, spruce grouse, sedge wren, spotted turtle, and western chorus frog.

Shoreline Stabilization

Vegetated wetlands along the shores of lakes or the banks of rivers can protect against erosion caused by waves and strong currents. These wetlands dissipate wave and current energy, trap sediments, and bind and stabilize the wetland substrate. Wide wetlands with dense woody vegetation are most effective, but as can be observed in many locations along the shores of Lake Champlain, small emergent wetlands such as Deep Bulrush Marshes also contribute significantly to stabilizing the shoreline.

Beavers and Wetland Communities

A complex of beaver ponds and marsh in the Southern Green Mountains.

Beavers deserve special mention in any discussion of wetlands in Vermont. This largest member of the rodent family was abundant in Vermont prior to European settlement. According to Zadock Thompson in his *Natural History of Vermont* (1853), beavers were eliminated from the state by 1850. Habitat alteration and over-trapping were the primary causes of their demise. Beavers were reintroduced to Vermont in 1921, and they are now abundant in the state, occurring in every county and major watershed.

Beavers can affect almost all wetland community types, but they are most commonly associated with those communities occurring along streams and ponds. Beaver alteration of wetlands is a form of natural disturbance and generally occurs in cycles that may span decades. Dam construction and creation of an impoundment typically kills all woody plants in the affected area and can drastically alter species composition. Over a period of years, however, beavers typically deplete their local food supply – woody species that grow near their pond – and move to other suitable habitat. Although the impoundment may persist for years, eventually the dam fails for lack of regular maintenance and the beaver pond drains. The resulting wet mud flats are quickly colonized by annuals, then perennials, and finally woody plants after several years. Beavers may return when there is enough woody vegetation to supply them with

food again, and the cycle may be repeated. Without further disturbance over subsequent decades, succession will progress toward a more mature natural community.

Vermont is essentially a forested landscape and natural openings are uncommon. The dynamic cycle and the open wetlands created by beaver are an important part of our landscape diversity. All the successional wetland types created as part of this cycle are important habitats for numerous species of plants and animals. Wetland communities that are commonly associated with beaver impoundments include Shallow Emergent Marsh, Cattail Marsh, and Alder Swamp.

A familiar sign of beaver presence.

Wetland Soils

Developing an understanding of wetland or hydric soils is an essential element in understanding the ecology of individual wetlands. Hydric soils develop in response to the presence of water for significant periods during the growing season. The type of hydric soil present reflects the duration and frequency of soil saturation or inundation.

Hydric soils are separated into ***organic soils,*** which have at least 16 inches of organic material in the upper part of their profile, and ***mineral soils,*** which have less than 16 inches of organic matter. Organic soils develop under prolonged anaerobic conditions resulting from soil saturation or inundation. In these conditions, organic material accumulates at the surface of the soil profile. Two types of organic soils are recognized, with a continuum of variation between the two types. **Muck** is dark, well-decomposed organic soil in which few of the plant remains can be identified and most of the soil mass can be squeezed through the fingers when making a fist. **Peat** is partially decomposed organic soil in which plant remains can be clearly identified and clear water is squeezed out when pressed in a fist.

Two distinct features are recognizable in hydric mineral soils. **Gleyed mineral soils** are gray to occasionally bluish and result from the chemical reduction and loss of iron from the soil profile under conditions of permanent saturation. **Mottled mineral soils** have distinct spots of color (typically rust-colored) that are different from the dominant color of the soil matrix. This condition results from alternation in chemical oxidation and reduction associated with a seasonally fluctuating water table.

How to Identify

Forested Wetland *and* Open and Shrub Wetland Natural Communities

Using the guide below to distinguish between **Forested Wetlands** and **Open and Shrub Wetlands**, then go to the page indicated.

Forested Wetlands: Trees are common to abundant, covering more than 25 percent of the area when viewed from above. Read "Forested Wetlands" beginning on page 244, then go to the "How to Identify" key on page 245.

Open and Shrub Wetlands: Trees are sparse, covering less than 25 percent of the area in most cases. Shrubs or herbaceous plants are dominant. Black Spruce Woodland Bogs and Pitch Pine Woodland Bogs, which are in this category, can sometimes have tree cover of more than 25 percent but in other ways are more similar to open wetlands than to forested wetlands. Read "Open and Shrub Wetlands" beginning on page 309, then go to the "How to Identify" key on page 310.