Pennsylvania's Adopt-a-Wetland Program Wetland Education and Monitoring Module

Student Manual

Visit our Web Site: www.wetlands.psu.edu

Prepared by:
Ayesha Gray, Robert P. Brooks, Denice Heller Wardrop,
and Jennifer K. Perot
Penn State Cooperative Wetlands Center

Chapter 1 - Introduction to Wetlands

Objectives

The objectives of this section are to:

- introduce the students to the concept of a wetland
- introduce the three characteristics used to define a wetland
- describe different types of wetlands and wetland classification
- introduce and compare the concepts of wetland functions and values
- describe the concept of a watershed and its delineation

Definition of a Wetland

Wetlands are so variable that their appearance and boundaries fluctuate over time (Figure 1). These dynamic changes are what makes wetlands difficult to recognize. Yet, these same characteristics are what make wetlands so productive and diverse. Wetlands are unique. They are one of the few habitats that are protected and regulated by state and federal agencies. The following definition of wetlands is used for regulatory and permitting purposes:

Figure 1.Example of a wetland Photo by R.P. Brooks

"Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."

This definition states the three important features of wetlands. Look at the three underlined words - these define a wetland.

Water: Hydrology is the driving force in a wetland. The water in a wetland may either be contributed from above or below ground. The hydrologic evidence will necessarily be present at some time during the year, but it may not be obvious. The presence of water at or near the surface, or other indicators, such as flood debris and water stained leaves, clearly indicates that wetlands are present.

Note: Students will observe water levels during every visit.

Soils: Wet or hydric soils develop recognizable characteristics after being saturated for several weeks. A mixture of brown and gray mottles near the surface usually means the water table fluctuates during the year and may support wetland vegetation. Dark gray soils are usually very wet or hydric. Lists of hydric soils have also been developed by county offices of the National Resources Conservation Service.

Vegetation: Wetland plants, called hydrophytes, are the most obvious indicator that one is standing in a wetland area. Numerous field manuals are available to help identify wetland plants. The U.S. Fish and Wildlife Service developed a list of plants that occur in wetlands for various regions of the country. In this list, wetland plants are assigned to several categories depending on how often they are found in wet areas. For example, some species are called *obligates* because they are almost always found in standing water or saturated soils. Other species might be classified as *facultative* because they can adapt to either wet or dry conditions. (See the National Wetlands Inventory description of plant indicator status in Appendix 1).

Wetland Functions and Values

What do wetlands do? A function is a process. It is something the wetland does. Some functions can be measured or quantified, others are more difficult to measure.

Wetlands are an essential component of the environment. They are purifiers. They perform functions such as improving water quality by transforming chemicals or trapping sediment or preventing erosion. Wetlands perform a useful, free service in cleaning our waters, but these biological systems can be degraded and destroyed to the point where they are no longer able to perform these functions.

Wetlands have social and economic values associated with them. These values are something the wetland provides to humans. Some functions can also be thought of as values, such as flood control. When wetlands are destroyed, flooding is more prevalent and the costs of these floods can reach up to billions of dollars.

Shoreline Stabilization and Erosion Control

Figure 2. Soil erosion caused by livestock.
Photo by R.P. Brooks

Wetlands protect shorelines from the erosive action of waves. The dense root masses of emergent and woody hydrophytes stabilize river banks and shorelines. On banks and beaches where native vegetation has been removed or damaged by livestock grazing, the soil is quickly washed away (Figure 2). Eroded sediments carried downstream can cloud the water and smother the larvae of trout, bass, frogs, or reduce the penetration of light needed for aquatic plants.

Flood Control

Wetlands are important for flood control, acting as buffers during spring thaws and heavy rains. Wetlands adjacent to rivers and streams absorb the excess waters of floods and delay its release. By slowly releasing water, wetland basins and their associated vegetation can reduce the incidence of flooding downstream.

Sediment Trapping and Nutrient Removal

Wetlands trap pollutants and sediment that might otherwise contaminate streams and reservoirs. They can prevent toxins that have been dumped on the ground from seeping into groundwater. Plants are one of the important components of this function. Plants slow down the flow of water allowing silt to settle. Plants are also able to absorb nutrients and toxins. These nutrients are broken down and cycled through the food web as animals consume the plants. Plants use *photosynthesis* to provide food for themselves. The process supplies oxygen to the ecosystem, and the plants become food for other life forms. This is called "*primary productivity*".

Wildlife and Fisheries

Wetlands are important as breeding and spawning grounds for waterfowl, fish and amphibians (Figure 3). They provide protective cover and food for migrating birds, muskrat, moose and other wildlife species. Many species of juvenile finfish and shellfish are raised in wetlands before entering lakes and oceans. Aquatic invertebrates, such as snails, clams, crayfish and aquatic insects, are abundant in wetlands. These invertebrates are essential links in the food web that support waterfowl, furbearer and fish populations. Thus, recreational hunters, trappers, and anglers rely on wetlands, both directly and indirectly, to provide adequate numbers of harvestable species.

Figure 3. Heron. Photo by R.P. Brooks

Wetlands provide critical habitat for many threatened and endangered species. In Pennsylvania, the American bittern, king rail, Blanding's turtle, and eastern tiger salamander are but a few of the species of special concern that are dependent on wetlands.

Figure 4. Wetland plant. Photo by R.P. Brooks

Wetland Vegetation

Wetland plant communities provide the shelter and food upon which wetland fauna depend (Figure 4). Wetlands also provide homes for many species of rare plants including the spreading globe flower, whorled pogonia, carnivorous sundews and pitcher plants. In some instances, plant products are removed from wetlands. These include renewable supplies of blueberries and cranberries. Wetlands are also used as sources of timber and peat. The commercial production of berries, timber, or peat will invariably alter the hydrology of the system.

Recreation and Education

Wetlands provide a host of recreational and educational activities. They are living classrooms ready to teach lessons in plant and animal diversity. They are places of scientific research and artistic inspiration. Birders, photographers, musicians, students, hunters and anglers are all people that have benefited from the natural beauty of wetlands.

Types of Wetlands

(adapted from Wetlands and Wildlife, Brooks et al. 1993)

The term *wetlands* is actually an all-encompassing name for a very diverse and variable group of habitats (Figure 5). This variety is due to regional and local differences in climate, soils, topography, hydrology and water chemistry. These factors control to a large extent the amount and kind of vegetation in the area. *Can you name a type of wetland?*

Figure 5. Emergent wetland. Photo by R.P. Brooks

U. S. Fish and Wildlife Classification

In the 1970's the U.S. Fish and Wildlife Service (USFWS) designed a classification scheme to assist in a new effort called the National Wetlands Inventory. This new product, commonly called Cowardin classification (Cowardin et al. 1979), has become the most widely recognized and commonly used detailed classification for wetland ecosystems in the United States (Figure 6). The five major wetland systems recognized are: marine, estuarine, lacustrine, riverine and palustrine.

The marine system includes open ocean and coastlines, and is generally limited to beaches, rocky shores, and deep, saltwater habitats. Estuarine wetlands are coastal brackish areas such as tidal salt marshes, intertidal mudflats and coastal rivers. Lacustrine wetlands include deep freshwater areas such as lakes and reservoirs and the fringing wetlands. The Riverine system includes freshwater rivers, stream channels, and immediately adjacent wetlands. The Palustrine (meaning "marshy") system contains the majority of vegetated freshwater wetlands including marshes, swamps, bogs and wet meadows.

Emergent, Shrub, and Forested Wetlands

Wetlands are further characterized by either the amount of water in the area (nonvegetated wetlands) or the type of dominant plants in the area (vegetated wetlands). Types of nonvegetated wetland include the open water portions of lakes, ponds, rivers and streams. Vegetated wetlands can be broken into three main types: emergent wetlands, shrub wetlands and forested wetlands (Figure 6).

Emergent wetlands, commonly called marshes and meadows, are dominated by herbaceous (nonwoody) plants such as grasses, sedges, and forbs (broad-leaved plants) that "emerge" from the water. Shrub wetlands, commonly called shrub swamps or thickets, are dominated by low, woody plants such as willow, alder, buttonbush and meadowsweet. Forested wetlands,

known as wooded swamps or bottomland forests, are dominated by large trees over 6 meters (20 feet) tall. These trees include species such as red and silver maple, willow, pin oak, black ash, slippery elm, eastern hemlock, spruce and tamarack.

Many inland wetlands are a mosaic of several wetland types. Indeed, it is rather common to find nonvegetated and vegetated wetlands adjacent to each other. Emergent wetland communities are often present as fringing wetlands along lakes and other water bodies, or may include clumps of woody plants.

Bogs

Bogs are a unique mosaic of wetland types found in the northeastern and northwestern corners of Pennsylvania. Most of these originated during the last ice age when small, round "kettle ponds" were formed. Large blocks of ice were left behind as the glaciers retreated northward. Bogs do not have flowing water, but may have open water depending on how far succession has progressed. Plants associated with bogs include sphagnum moss, cranberry, blueberry, pitcher plant, leather-leaf, sheep laurel, black spruce and tamarack (Figure 7)

Figure 7. Bog. Photo by R.P. Brooks

Hydrogeomorphic Classification Do not need to know.

Hydrogeomorphic (HGM) classification is a promising new classification method developed by Dr. Mark Brinson from East Carolina University in Greenville, NC. This system classifies wetlands based on three characteristics: geomorphic setting (location of the wetland within the surrounding landscape), water source and transport (precipitation, surface and near-surface water flow and groundwater discharge), and hydrodynamics (direction and strength of water flow within the wetland). These characters are responsible for maintaining many of the functions performed by wetland ecosystems (Brinson 1993). This systems focuses on the abiotic factors that influence such functions as chemistry of water, habitat maintenance, and water storage and transport (Brinson 1993). The Cowardin classification system relies primarily on the structure and composition of the vegetative cover. The HGM approach does not mean to disregard the importance organisms play in the ecosystem, but rather intends to develop a better understanding of the relationship between organisms and the environment (Brinson 1993). Wetland functions are closely tied to HGM class.

Wetlands classified into different HGM classes perform different functions and have different structures; wetlands in the same HGM class should have similar functions. Each wetland is different, but if they are grouped based on functions they perform we can focus on the processes fundamental to the sustained existence of these ecosystems. Developing a method to classify wetlands based on what they do will also lend a greater understanding to the relationship between ecosystem structure and function. Using both the Cowardin and HGM classification systems is very useful in distinguishing among wetland types.