What is a Wetland?

A wetland is an area where water covers the soil, or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season. Water largely determines how the soil develops and the types of plant and animal communities living in and on the soil. Wetlands may support both aquatic and land species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants and promotes the development of characteristic wetland soils.

Wetlands vary widely because of regional and local differences in soils, topography, climate, water, vegetation and other factors, including human disturbance. Indeed, wetlands are found from the tundra to the tropics and on every continent except Antarctica. Two general categories of wetlands are recognized: coastal wetlands and inland wetlands.

Although wetlands are often wet, a wetland might not be wet year-round. In fact, some of the most important wetlands are only seasonally wet. Wetlands are the link between the land and the water. They are transition zones where the flow of water, the cycling of nutrients, and the energy of the sun meet to produce a unique ecosystem characterized by hydrology, soils, and vegetation—making these areas very important features of a watershed. Using a watershed-based approach to wetland protection ensures that the whole system, including land, air, and water resources, is protected.

Often called “nurseries of life,” wetlands provide habitat for thousands of species of aquatic and terrestrial plants and animals. Although wetlands are best known for being home to water lilies, turtles, frogs, snakes, alligators, and crocodiles, they also provide important habitat for waterfowl, fish, and mammals. Migrating birds use wetlands to rest and feed during their cross-continental journeys and as nesting sites when they are at home. As a result, wetland loss has a serious impact on these species. Habitat ruin since the 1970s has been a leading cause of species extinction.

Wetlands do more than provide habitat for plants and animals in the watershed. When streams and rivers overflow, wetlands help to absorb and slow floodwaters. This ability to control floods can alleviate property damage and loss and can even save lives. Wetlands also absorb excess nutrients, sediment, and other pollutants before they reach rivers, lakes, and other waterbodies. They are great spots for fishing, canoeing, hiking, and bird-watching, and they make wonderful outdoor classrooms for people of all ages.

Types of Wetlands

Do you think all wetlands are the same? Think again. Each wetland differs due to variations in soils, landscape, climate, water, vegetation, and human disturbance. Wetlands found in the United States include: marshes, swamps, bogs, fens, vernal pools, and prairie potholes, to name a few.

MARSHES are wetlands dominated by soft-stemmed vegetation. They are sometimes saturated, flooded, or ponded with water and characterized by grasses adapted to wet soil conditions. Marshes are further characterized as **tidal marshes** and **non-tidal marshes**.

Tidal (coastal) marshes occur along coastlines and are influenced by tides and often by freshwater from runoff, rivers, or ground water. Salt marshes are the most common types of tidal marshes and are characterized by salt tolerant plants. Salt marshes have one of the highest rates of productivity among wetland ecosystems because of the inflow of nutrients from surface and/or tidal water. Tidal freshwater marshes are located upstream of estuaries. Tides influence water levels but the water is fresh. The lack of salt stress allows a greater diversity of plants to thrive. Cattail,

wild rice, pickerelweed, and arrowhead are common and help support a large and diverse range of bird and fish species, among other wildlife.

Non-tidal (inland) marshes are also dominated by soft-stemmed low plants and frequently occur in poorly drained depressions, floodplains, and shallow water areas along the edges of lakes and rivers. These freshwater marshes are characterized by periodic or permanent shallow water. They typically derive most of their water from surface waters, including floodwater and runoff, but do receive ground water inputs. Major regions of the United States that support inland marshes include the Great Lakes coastal marshes, the prairie pothole region, and the Florida Everglades.

SWAMPS are wetlands dominated by trees and other woody plants. Swamps occur in either freshwater or saltwater floodplains. They are characterized by very wet soils during the growing season and standing water during certain times of the year. Well-known swamps include Georgia's Okefenokee Swamp and Virginia's Great Dismal Swamp. Swamps are classified as forested, shrub, or mangrove. Forested swamps are found in broad floodplains of the northeast, southeast, and south-central United States and receive floodwater from nearby rivers and streams. Common deciduous trees found in these areas include bald cypress, swamp white oak, and red maple. Shrub swamps are similar to forested swamps except that shrubby species like buttonbush and swamp rose dominate. Mangrove swamps are coastal wetlands characterized by salt-tolerant trees, shrubs, and other plants growing in brackish to saline tidal waters.

BOGS are freshwater wetlands characterized by spongy peat deposits, evergreen trees and shrubs, and a floor covered by a thick carpet of sphagnum moss. These systems, whose only water source is rainwater, are usually found in glaciated areas, often in old glacial lakes, of the northern United States.

FENS are freshwater peat-forming wetlands covered mostly by grasses, sedges, reeds, and wildflowers. Like bogs, most fens formed when glaciers retreated. Unlike bogs, fens receive water from streams and groundwater in addition to precipitation. With an increased rate of water exchange, fens are less acidic than bogs and thus more nutrient-rich. Fens are often near bogs and over time will likely become bogs.

VERNAL POOLS, also called **VERNAL PONDS**, are temporary woodland pools that provide habitat for distinctive plants and animals. Vernal ponds themselves are generally less than 40 yards in diameter and no more than 4 feet deep, although they receive water from a larger surrounding landscape. Named from *vernalis*, the Latin word for spring, vernal ponds are formed seasonally in shallow ground depressions from spring snowmelt, precipitation, and rising water tables. Vernal pools have either bedrock or a hard clay layer in the soil that helps hold water in the depression. Generally drying up in late summer, these ponds are only temporary woodland reservoirs. They are slightly harder to identify during the summer and fall months; however, there are several clues to look for. Blackened, compressed leaf litter; gray soil; watermarks on surrounding tree trunks; and the presence of moisture-tolerant vegetation all suggest an area that collects water part of the year. Red maple, highbush blueberry, and buttonbush are all common at these locations.

The seasonal nature of vernal ponds means that they are uninhabited by fish. This makes them the perfect habitat for a variety of amphibians and invertebrates to breed and develop with less chance of predation. Species like mole salamanders, wood frogs, and fairy shrimp depend exclusively on vernal ponds for part of their life cycles. Often a pond is the ancestral home of an amphibian community that resides nearby in the forest each winter, then migrates to the same pond each spring to lay its eggs. Spring peepers, American toads, spadefoot toads, gray tree frogs, green frogs, and red-spotted newt are among the many creatures that may come to breed. By the end of the breeding season, ponds are filled with egg clusters that appear as jellylike masses containing small, round eggs. As activity inside the pond increases each spring, it attracts other animals to the vernal community. Some turtle species visit the ponds to feed on egg masses, while snakes and raccoons may feed on tadpoles and frogs. Birds like the green heron and red-shouldered hawk also visit ponds to feed.

PRAIRIE POTHOLES are found in the grasslands of North Dakota and South Dakota. Prairie potholes develop when snowmelt, rain and groundwater fill the pockmarks left on the landscape by glaciers. Some prairie pothole marshes are temporary, while others may be essentially permanent. Here a pattern of rough concentric circles develops. Submerged and floating aquatic plants take over the deeper water in the middle of the pothole while bulrushes and cattails grow closer to shore. Wet, sedge-rich marshes lie next to the upland.

The Upper Midwest, because of its numerous shallow lakes and marshes, rich soils, and warm summers, is described as being one of the most important wetland regions in the world. The area is home to more than 50 percent of North American migratory waterfowl, with many species dependent on the prairie potholes for breeding and feeding. In addition to supporting waterfowl hunting and birding, prairie potholes also absorb surges of rain, snow melt, and floodwaters thereby reducing the risk and severity of downstream flooding. Many of these important and highly productive communities have been altered or destroyed due to increased agricultural and commercial development. As a result, only an estimated 40 to 50 percent of the region's original prairie pothole wetlands remain undrained today.

Why are Wetlands Important?

Wetlands are some of the most biologically productive natural ecosystems in the world, comparable to tropical rain forests and coral reefs in their productivity and the diversity of species they support. Aquatic plant life flourishes in the nutrient-rich environment, and energy converted by the plants is passed up the food chain to fish, waterfowl, and other wildlife and to us as well. In addition to the biological productivity of wetlands, an acre of wetland can store 1–1.5 million gallons of floodwater. Although wetlands keep only about 5% of the land surface in the conterminous United States, they are home to 31% of our plant species and support one-third of all endangered species. Wetlands are found on all continents except Antarctica and their diversity is as broad as their geographic occurrences. Read on for more specific functions and values of wetland ecosystems.

Functions of a Wetland

Long regarded as wastelands, wetlands are now recognized as important features in the landscape that provide numerous beneficial services for people and for fish and wildlife. For example, wetlands naturally protect and improve water quality, provide fish and wildlife habitats, store floodwaters, and maintain surface water flow during dry periods. These beneficial services, considered valuable to societies worldwide, are the result of the inherent and unique natural characteristics of wetlands.

Wetland functions include:

- Absorption and storage of flood waters and ground water recharge in dry periods
- Protection of coastlines from high energy open ocean waves
- Slowing of water velocity so sediments may settle out thereby improving water quality
- Filtering and removal of excess nutrients and toxins by wetland soils and plants
- Providing nurseries for juveniles of many aquatic species including most commercially harvested fish
- Providing habitat for many upland species such as raccoons and deer as well as habitat for sensitive wetland dependent species like salamanders
- Stop-over and resting sites for migratory birds as well as waterfowl habitat. In fact, up to one-half of North American bird species nest or feed in wetlands

Value of Wetlands to Humans

Alternately, the value of a wetland is an estimate of the importance or worth of one or more of its functions to society. For example, a value can be determined by the revenue generated from the sale of fish that depend on the wetland, by the tourist dollars associated with the wetland, or by public support for protecting fish and wildlife. Although large-scale benefits of functions can be valued, determining the value of individual wetlands is difficult because they differ widely and do not all perform the same functions or perform functions equally well.

Wetlands improve water quality in nearby rivers and streams, and thus have considerable value as filters for future drinking water. When water enters a wetland, it slows down and moves around wetland plants. Much of the suspended sediment drops out and settles to the wetland floor. Plant roots in the soil absorb excess nutrients in the water from fertilizers, manure, leaking septic tanks, and municipal sewage. While a certain level of nutrients is necessary in water ecosystems, excess nutrients can cause algae growth that’s harmful to fish and other aquatic life. A wetland’s natural filtration process can remove excess nutrients before water leaves a wetland, making it healthier for drinking, swimming and supporting plants and animals. Some types of wetlands are so good at this filtration function that environmental managers construct similar artificial wetlands to treat storm water and wastewater.

Wetlands can play a role in reducing the frequency and intensity of floods by acting as natural buffers, soaking up and storing a significant amount of floodwater. A wetland can typically store about three-acre feet of water, or one million gallons. An acre-foot is one acre of land, about three-quarters the size of a football field, covered

one foot deep in water. Three acre-feet describes the same area of land covered by three feet of water. Coastal wetlands serve as storm surge protectors when hurricanes or tropical storms come ashore. In the Gulf coast area, barrier islands, shoals, marshes, forested wetlands and other features of the coastal landscape can provide a significant and potentially sustainable buffer from wind wave action and storm surge generated by tropical storms and hurricanes.

After peak flood flows have passed, wetlands slowly release the stored waters, reducing property damage downstream or inland. One reason floods have become more costly is that over half of the wetlands in the United States have been drained or filled. The loss of more than 64 million acres of wetlands in the Upper Mississippi Basin since the 1780's contributed to high floodwaters during the Great Flood of 1993 that caused billions of dollars in damage.

Wetlands contribute to the national and local economies by producing resources including foods like cranberries and rice and commercially harvested fish, by enabling recreational activities such birdwatching which generates over $100 billion per year, and by providing other benefits, such as pollution control and flood protection. While it can be difficult to calculate the economic value provided by a single wetland, it is possible to evaluate the range of services provided by all wetlands and assign a dollar value. These amounts can be impressive. According to one assessment of natural ecosystems, the dollar value of wetlands worldwide was estimated to be $14.9 trillion.

What is Wetland Restoration?

Maintaining only 15% of the land area of a watershed in wetlands can reduce flooding peaks by as much as 60%. The damage sustained by the Gulf Coast during Hurricane Katrina could have been less severe if more wetlands along the coast and Mississippi delta had been in place. Because natural wetlands are so effective at removing pollutants from water that flows through them, engineers and scientists construct systems that replicate some of the functions of natural wetlands. These constructed treatment wetlands use natural processes involving wetland vegetation, soils and their associated microbial life to improve water quality. They are often less expensive to build than traditional wastewater and stormwater treatment options, have low operating and maintenance expenses and can handle fluctuating water levels. For example, in 1990 city managers in Phoenix, Arizona, needed to improve the performance of a wastewater treatment plant to meet new state water quality standards. After learning that upgrading the plant might cost as much as $635 million, the managers started to look for a more cost-effective way to provide final treatment to the plant's wastewater discharge into the Salt River. A preliminary study suggested that a constructed wetland system would sufficiently clean the discharge water while supporting high-quality wetland habitat for birds, including endangered species, and protecting downstream residents from flooding. All these benefits would be achieved at a lower cost than retrofitting the existing treatment plant. As a result, the 12-acre Tres Rios Demonstration Project began in 1993 with assistance from the Corps of Engineers, the Bureau of Reclamation and EPA's Environmental Technology Initiative and now receives about two million gallons of wastewater per day. This project is still flourishing, serving as a home for thousands of birds and other wildlife. There are hundreds of wastewater treatment wetlands operating in the United States today.

Although wetlands are capable of absorbing pollutants from the surface water, there is a limit to their capacity to do so. The primary pollutants causing wetland degradation are sediment, fertilizer, human sewage, animal waste, road salts, pesticides, heavy metals, and 22 states have lost at least 50 % of their original wetlands. Since the 1970s, the most extensive losses have been in Louisiana, Mississippi, Arkansas, Florida, South Carolina, and North Carolina. Pollutants can originate from many sources, including: runoff from urban, agricultural, deforestation, and mining areas,Air pollution from cars, factories, power plants, old landfills and dumps that leak toxic substances.

Wetlands are one of the most valuable and fragile components of a watershed, but for many years they were filled and drained for agriculture and development. Now we are learning that wetlands are crucial to the health

of our waters and wildlife. Wetland restoration, the renewal of natural and historical wetlands that have been lost, is a growing activity. It can improve water quality and wildlife habitat across the nation.

Restoration is the return of a lost wetland or former wetland to its preexisting naturally functioning condition, or a condition as close to that as possible. It is a complex process that requires expertise, and resources. Ideally, a successfully restored wetland will mimic the functions of a healthy natural wetland. All restoration projects require planning, implementation, monitoring, and management. Many projects require a team with expertise in ecology, hydrology, engineering, and environmental planning. Getting local experts and the community involved gives the project local ownership, which is important for restoration success. Why Restore Wetlands? Restoring our lost wetlands to their natural state is essential to ensure the health of America's watersheds. Unless we reverse the tide of wetland loss, the quality of our waters will continue to be threatened and a part of our natural heritage will be lost. The quality of America's waters is closely linked to the integrity of America's wetlands.

Three Important Components of A Wetland

All wetlands share three important characteristics: hydric soils, hydrophytic plants, and a hydroperiod. Note that this is all about ***water***!

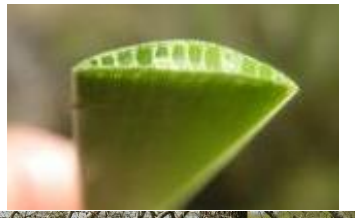
Hydric soils

Hydric soils are saturated for a long enough period (seasonally or permanently) during the growing season that oxygen levels become very low and result in anaerobic conditions in the upper soil layers. Essentially, pore spaces normally filled with air are filled with water instead. Anaerobic conditions limit the plant species that are able to thrive and reproduce in these soils. Some characteristics of hydric soils include:

- The distinctive "rotten egg" smell of hydrogen sulfide gas associated with anaerobic decomposition
- Dark soil colors especially grays, greens, and blacks
- Mottling of red and/or black from mineral concentrations
- Reddish mottling along rootlets as escaping oxygen oxidizes iron in the soil
- Fine soil texture and reduced soil permeability. Silts and clays are typical of wetlands and their very fine texture results in poor drainage.
- And water! Soils may squish underfoot, mire tires, readily form a ball, ooze through fingers, or show standing water in holes.

Hydrophytic plants

"Hydrophytic" literally means water-loving. These plants employ various adaptations for survival in a waterlogged and anaerobic environment. Upland plants typically absorb oxygen through roots. Wetland plants are unable to do this so they have developed fascinating alternatives to obtain and transport oxygen. Adaptations of these hydrophytic plants include:



- Stems and roots containing hollow tubes (aerenchyma) for oxygen transport as well as physical support. Aerenchyma are found in rushes, sedges, and grasses. Cattails provide a great example.

- Very shallow or emergent parts of a tree's root system are called "knees." Cypress knees, for example, allow a bald cypress tree to obtain oxygen from the uppermost aerobic soil layers or atmosphere. Cypress knees often look like thick foot-high woody fingers extending above the waterline around the base of a tree. Village Greens Mini Golf in Strasburg has beautiful bald cypress trees, especially on their gold course.

- Wetland plants that are buoyant and float in water. Duckweed is a great example. With leaves that are less than ¼ inch across and roots that dangle in the water, duckweeds are also the smallest true plants (has leaves, roots, and stems) in the world. Look for them in the green "scum" on area ponds. Water lilies are more showy examples of buoyant wetland plants.

- Trees in swamps often exhibit "buttressed" trunks. Buttressed trunks are thickened or flared out around the base of the tree. This serves mainly to stabilize the tree in saturated soils that offer little support. The picture of bald cypress knees shows buttressing as well. The height of the buttressing usually indicates typical high water levels.

- Shallow or exposed roots. Roots of wetland trees are often visible right on the soil surface. In a similar manner to the buttressed trunks, shallow or exposed roots not only allow oxygen uptake but also assist in stabilization of the trunk. This black willow tree is an excellent example of this feature of wetland plants.

Wetland hydroperiod

Hydroperiod refers to the pattern of water levels in any one particular wetland. Wetland water levels may vary daily, seasonally, or more irregularly. Alternately, wetlands may be permanently wet. In any case, the hydroperiod is a defining feature of each wetland. It is the presence of water at or near the soil surface that causes the soil saturation and anaerobic conditions that favor the hydrophytic vegetation.

Wetlands may gain water from precipitation, rising tides, runoff, ground water seeps, and ponding on poorly draining soils. Water is lost from wetlands through falling tides, and evaporation in normal dry seasons or droughts.

Not all wetlands will necessarily look wet. Nevertheless, the wetland signature is often evident in:

- Squishy ground. Are your shoes getting wet? If you kneel, are your knees wet?
- Mud or mud cracks. Mud cracks show where wet areas have dried.
- High water marks or water stains on vegetation, tree trunks for example.
- Topographic features like depressions, gullies, or dry stream beds
- And – the hydric soils and hydrophytes!