1 Wetlands 101

"All Life has its roots in the meeting of earth and water" ~ T.H. Watkins

What's Your Watershed Address?

To find out what watershed you live in, visit the U.S. Environmental Protection Agency's (EPA's) "Surf Your Watershed" web site: **http://www.epa.gov/surf/**

Introduction to Wetlands

Before trekking off into the world of wetlands, it is necessary to define a word that most of you know but some may not! This word is **watershed**. A watershed is an area of land that drains to a common waterway, including a wetland, stream, river, lake, or even an ocean. Imagine that when it rains, all the water within a watershed ultimately flows to the same waterway. Watersheds can vary in size, from just a few square feet for a **vernal pool** or for thousands of square miles for huge watersheds such as the Chesapeake Bay. Recent environmental movements have focused their attention on watershed stewardship and restoration. Wetlands make up an integral part of watersheds no matter how large or small!

Virginians use their diverse land types in many different ways — for living, working, farming, ranching, and recreation, to name a few. These uses often encroach on and affect wetlands, lands where water is the dominant factor determining soil, plant and wildlife diversity. These impacts raise difficult questions of balancing land use needs and environmental effects: How can we balance the needs of property owners to farm or build on their land while maintaining the beneficial functions of natural wetlands? How can we respect individual property rights and assure that necessary development and traditional land uses continue while conserving both publicly and privately owned wetlands? The answers to these questions will continue to be addressed with public education on the values and functions of wetlands and how our land-use choices affect these precious environmental resources (McCarthy, 2001).

It is obvious that wetlands offer much more subtlety, surprise, mystery and value than superficial observations may suggest. We encourage you to continue to learn about the wondrous areas where land meets the water, where life abounds and the sights and sounds of the natural world come alive. That way you can better appreciate just how unique and valuable they are to Virginia's natural resources!

What is a Wetland?

Wetlands…the word alone invites your senses to travel to a wet and wonderful place teeming with life. Wetlands are magical wet, soggy or boggy places. Wetlands force you to slow down and take notice of the sights, smells, and sounds of nature as your boots get stuck in the muddy ground below. When you enter a wetland it is as if a curtain is pulled back revealing a secret oasis and a symphony of sound; tall grasses sway in the breeze creating soothing music, the moist ground provides a rich home for melodious spring peepers, beautiful yet endangered lady slipper orchids, or the elusive Virginia rail. They are places of diversity and beauty, where odd-shaped pitcher plants capture insects for nutrients, a chorus of bullfrogs fill the night air, or the call of the Prothonotary Warbler echoes in the spring (Thomson & Luthin, 2004). Wetlands fill the onlooker with awe and a reverence for the diversity and beauty of nature.

Wetlands are the link between the water and the land. "Wetlands" is the collective term for marshes, swamps, bogs, and similar areas typically found between land and water along the edges of streams, rivers, lakes and coastlines. Although most wetlands have standing or flowing water for at least part of the year, many are dry for part of the year. In fact, some of the most important wetlands are only seasonally wet. Many different wetland types occur throughout Virginia due to our commonwealth's variability in **topography**, climate, soil, **hydrology**, **salinity**, vegetation and other factors (White, 1989). Wetlands provide vital habitat for thousands of aquatic plants and animals, providing food as well as critical nursery grounds for these species. Wetlands help absorb excess nutrients and sediment before they reach streams and rivers. They slow and absorb floodwaters and recharge groundwater supplies. Wetlands serve as rich educational venues for all ages as well as serene places to canoe, bird watch, hike, fish or to just "be" in the silence of nature (United States Environmental Protection Agency [EPA], September 2001).

Wetland Definitions

Part of the complexity and confusion with defining wetlands is that they are very diverse. Additionally, the definition varies depending on the audience and the purpose. Due to the sheer diversity of wetlands, the need to perform periodic inventories, of them and the regulation of their uses, science and politics both play a role in the "tweaking" of wetland definitions (Firehock, Graff, Middleton, Starinchak & Williams, 1998).

Regulatory Definitions

The following is a regulatory definition used by the U.S. Army Corps of Engineers (Corps), EPA and the Virginia Department of Environmental Quality (DEQ) to legally define wetlands and enforce Section 404 of the Clean Water Act, which is discussed in detail in *Section 3, Regulations*:

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

The Natural Resource Conservation Service (NRCS) modified this wetland definition with a focus on wetlands soils for the purpose of protecting wetlands on agricultural lands. This definition helped implement the "Swampbuster" provision of the Food Securities Act of 1985 preventing some agricultural lands from being drained (Firehock et al., 1998). According to the NRCS:

> "Wetlands are defined as areas that have a predominance of **hydric soils** and that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of **hydrophytic vegetation** typically adapted for life in saturated soil conditions…"

Scientific Definition

The most commonly used scientific definition was published in 1979 in the report, "Classification of Wetlands and Deepwater Habitats of the United States (Cowardin, Carter, Golet & LaRoe, 1979), for the U.S. Fish and Wildlife Service (FWS). This definition is utilized by the FWS to conduct wetland inventories within the United States:

> " Wetlands are lands transitional between terrestrial and aquatic systems where the **water table** is usually at or near the surface or the land is covered by shallow water…Wetlands must have one or more of the following three attributes: 1) at least periodically, the land supports predominately **hydrophytes**, 2) the substrate is predominately undrained hydric soil, and 3) the substrate is nonsoil and is saturated with water or covered by shallow water at sometime during the growing season of each year."

Despite the subtle wording variations and focus of each of the definitions provided above, three features are common to all:

- **Presence of water** above or near the soil surface for at least a portion of the growing season (referred to as wetland hydrology)
- **Specific types of soils** that develop under wet conditions (referred to as hydric soils)
- **Distinctive plants** adapted to wet conditions (referred to as hydrophytes, or wetland vegetation)

One important thing to note is that the two regulatory definitions require that all three features be present (under normal circumstances) for a wetland to be defined as such. In the scientific definition, only one feature is required.

There is no need to get "bogged down" with wetland definitions! These three definitions are simply ways of describing the physical attributes of wetlands and are used chiefly to identify wetlands for regulatory or scientific purposes.

Perhaps the best way to truly understand a wetland is to listen to the more eloquent descriptions of non-scientists: Writer Phillip Johnson, a leading author on Darwinian evolution, calls wetlands "mysteriously fertile couplings of land and water." Author B. Douglass Richter describes how, in ages long past, these unique areas at the edges of continents and rivers served as nurseries for the beginnings of terrestrial plant life. Alternatively, as T. H. Watkins, another prominent environmental writer, put it: "All life has its roots in the meeting of earth and water." (Alliance for the Chesapeake Bay [Alliance], n.d.).

What Makes it a Wetland? A more in depth look at wetland hydrology, soils, vegetation and animals

"Hydrology is probably the single most important determinant of the establishment and maintenance of specific types of wetlands and wetland processes" ~Mitsch & Gosselink

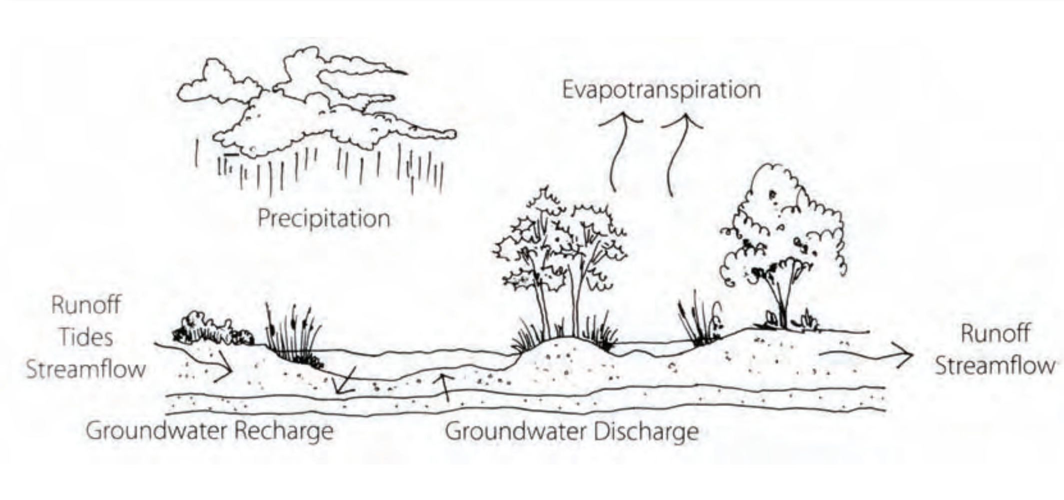
Some people may think that determining if an area is a wetland should be an easy task. If the area is wet – it is a wetland, if the area is dry – it is not. If only it were that simple! The truth is, wetlands have many distinguishing characteristics other than the presence of standing water, which are used for identification and classification. In fact, many wetlands only have standing water or saturated soils for a small portion of the growing season and appear dry for most of the time.

Therefore, it is important to look closely at the combined hydrology, soils and vegetation of an area to determine if it is a wetland. In the following section, we will examine these three features used to identify and classify wetlands.

How are Wetlands Wet? Understanding Wetland Hydrology

Hydrology is used to describe the movement and storage of water in an area (Black, 1996). When applied to wetlands – hydrology describes water movement and storage in a wetland. Wetlands become saturated and inundated with water from precipitation, groundwater inputs, surface runoff, tides and floodwaters (Mitsch & Gosselink, 2000).

As the diagram to the right shows, inputs of water to a wetland include: precipitation, surface runoff, tides, stream flow and groundwater inputs. Water exits wetlands through **evapotranspiration**, surface runoff, stream flow and groundwater. It is important to recognize that many of these inputs and outputs of water in a wetland are occurring simultaneously and are interrelated. Water in a wetland can be present above the soil surface, at the soil surface or just below the soil surface in the root zone for a portion of the growing season (Firehock et al., 1998). This is why wetlands may not always appear wet, which can make identification and **delineation** difficult and has led to many common wetland "misconceptions".



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Water collects in a wetland because it is usually a transitional zone between terrestrial and aquatic systems where water collects and is poorly drained (Mitsch & Gosselink, 2000). There are many different types of wetlands each with a unique **hydroperiod** (Mitsch & Gosselink, 2000). A hydroperiod describes water movement and transfer within a wetland over time. It can also be thought of as the "seasonal fluctuating pattern of the water level" (Firehock et al., 1998, p. 18). Hydroperiods are affected by both weather and wetland inputs and outputs, which cause changes in wetland "wetness" over time.

Signs of Wetland Hydrology

Wetland hydrology is easy to identify if the area has water above the ground surface. However, when there is no surface water present, it becomes more difficult and you must look more closely at the hydrology of the site.

Before discussing signs of wetland hydrology it is important to understand the difference between two words used frequently when discussing wetlands: inundation and saturation. Areas that are inundated have standing water, whereas, areas that are saturated have no standing water but do have wet soils.

To more fully understand the distinction, picture yourself outside after a big rainstorm. If you are walking through a large puddle wishing you had on rain boots you are walking through an inundated wetland. If you waited a few hours to a few days and went back outside to the same spot, there may no longer be a puddle. If you took off your sneakers and walked through the same area in your socks, they would probably become saturated with water, indicating saturation at the ground surface. Depending on the wetland, if you waited a couple more hours or days and visited the same spot, your socks may not get wet at all. However, if you dug a hole about a foot into the ground, water would seep in from the sides or the hole would fill with water, indicating saturation within a foot of the surface.

Example Field Indicators of Wetland Hydrology

- Inundation – Standing water
- Saturation – Damp or wet feeling soils
- Water Pooling or Water Seeps – if hole dug into the ground (12-18” deep), fills with water or seeps from the walls
- Water Marks – Trees have water lines or other evidence of high water
- Sediment Deposits – Evidence on leaves and other materials that suggests flooding
- Drift lines – Leaves and trashy debris that looks like its been washed up against roots, tree trunks, fences and other obstacles by moving flooded water.
- Swollen Bases on Tree Trunks

Going Down Under- Understanding Wetland Soils

“Each soil has had its own history. Like a river, a mountain, a forest or any natural thing, its present condition is due to the influences of many things and events of the past.” ~Charles Kellogg

Wetland soils have unique characteristics resulting from the presence of water above, below or at the soil surface. Due to the unique hydrology of a wetland, wetland soils are known as hydric soils. Hydric soils form from a lack of oxygen present in the soil due to the presence of water (Mitsch & Gosselink, 2000). When oxygen is low or absent it is referred to as an anoxic environment or **anaerobic condition**. There are two main types of wetland soils that result from the lack of oxygen in the soil: **mineral** and **organic soils**. Without getting into complicated definitions describing the percent of carbon in the soil, mineral and organic soils differ in a number of ways.

Signs of Hydric Soils

(*To Observe Soils*: Dig a hole in the ground that is 12-18”)

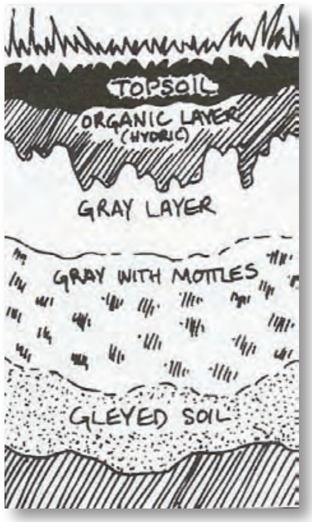
- *Rotten Egg Smell* – Caused by sulfur in soil
- *Soil Color* – Look for soils with a grayish or greenish hue
- *Mottling* – Concentrations of highly oxidized particles
- *Oxidized* **Rhizospheres** – Rusty orange material around the roots in the root zone

Organic Soils

Organic soils result from the decomposition of plant material that accumulates in anaerobic conditions (Mitsch & Gosselink, 2000). Organic soils have more organic carbon, lower densities and higher water-holding capacities (Mitsch & Gosselink, 2000). The plant materials usually accumulate rather than decompose because composting is slow and difficult in cool anoxic environments, which are characteristic of wetlands with organic soils (Ripple & Garbisch, 2000). Organic soils are often referred to as peats and mucks and are characteristic of areas with mosses or herbaceous emergent vegetation (Ripple & Garbisch, 2000).

Mineral Soils

Mineral soils are often composed of sands, silts and clays (Ripple & Garbisch, 2000). Mineral soils are present in areas where organic soils do not have time to accumulate, typically in areas with flowing water, warmer climates, woody vegetation and seasonal saturation. Mineral soils have two distinct characteristics: gleying and mottling (Ripple & Garbisch, 2000)



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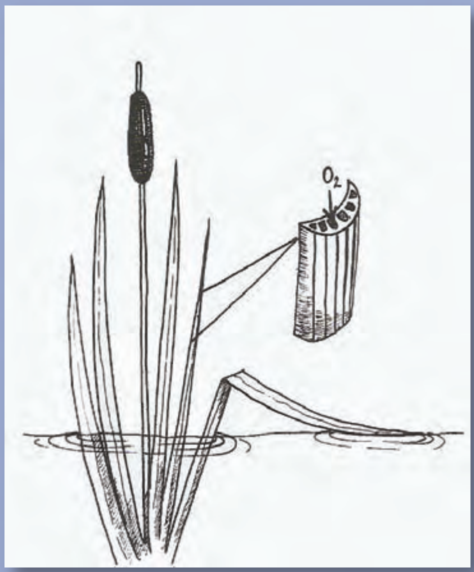
Typical soil profile in a wetland

Gleying results from the reduction of iron and gives the soil a black, gray or greenish bluish-gray appearance or tint (Mitsch & Gosselink, 2000). If you were to examine the soils in a dry upland area, you would they would most likely be orangish-red in color, which results from the **oxidation** of iron (exposure to air) in the soil. You can think of this process as “rusting” because it is similar to what occurs on garden tools left outside. This “rusting” process does not happen in wetland soils that are permanently inundated or saturated because of the lack of oxygen in soil pores, due to the presence of water. Rather than the iron oxidizing in wetland soils it is reduced from the lack of oxygen in the soil and has the characteristic gleyed appearance (Mitsch & Gosselink, 2000).

Mottling occurs when highly oxidized materials are concentrated in the soil (Mitsch & Gosselink, 2000). Mottles look either orange or reddish-brown in soils containing iron or look black or dark reddish-brown in soils with manganese (Mitsch & Gosselink, 2000). Your next question may already be brewing… How are highly oxidized particles found under anaerobic conditions? Here is where we need to go back to our initial discussion of a wetland. As you will remember many wetlands are only periodically inundated or saturated with water. Therefore oxidizing conditions can occur when the wetland is dry, thus allowing the formation of mottles (Ripple & Garbisch, 2000). So, mottling occurs in mineral wetland soils that are dry for part of the time.

Botany Lesson- Understanding Wetland Vegetation

We have already seen that wetland hydrology affects the development of unique soil characteristics. The presence of wetland hydrology also affects the types of plants found in wetlands, known as hydrophytes, or hydrophytic vegetation. Conditions in a wetland are stressful for plants as they struggle to adapt to fluctuating water levels and flooding (Firehock et al., 1998). Plants usually take oxygen into their root system and distribute it throughout their stems and leaves (Kesselheim & Slattery, 1995). Due to the lack of oxygen in the root zone, wetland plants have developed special adaptations that allow them to survive and reproduce in an anoxic environment (Firehock et al., 1998).



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Cattail diagram, showing hypertrophied lenticels

Moulds

Bald Cypress "knees," or pneumatophores

Moulds

Floating Lilypad leaves

FWS/Shallenberger

Buttressed tree trunk in the Great Dismal Swamp

Plant Adaptations to Wetland Hydrology

Morphological

- *Shallow Root Systems* – Root systems that grow close to the soil surface to obtain oxygen
- *Adventitious Roots* – Roots that grow out of the stem above fluctuating water levels
- *Buttressed Tree Trunks* – Swollen tree trunks that provide stability
- *Pneumatophores* – Vertical roots for respiration. Root is erect and protrudes above the soil surface. Common example are Bald cypress "knees"
- *Floating Leaves* – Leaves with a thick waxy coat to prevent water penetration that float on the water surface
- *Inflated Leaves and Stems* – stems and roots with sponge-like tissues, which provide buoyancy and oxygen storage
- *Floating Stems* – Stems that can root and float on the water surface because of large internal air spaces
- *Hypertrophied Lenticels* – pore space on plant stems used for oxygen exchange

Physiological

- Ability to grow in anoxic conditions
- Chemical production adaptations

Reproductive

- *Seed Viability* – Extended seed viability which allows the germination of seeds during a dry time when exposed to air
- *Seed Germination* – the ability to germinate under anoxic conditions while underwater and not exposed to air
- *Changes in Seeds and Seedlings* – floating seeds and flood tolerant seedlings

Morphological adaptations are changes involving the physical structure of the plant, which provide physical support and increased uptake of both oxygen and nutrients (Firehock et al., 1998). Many morphological adaptations involve modifications to root structure and function to increase oxygen uptake. **Physiological** adaptations involve alterations of life processes including the ability to grow in low oxygen conditions (Firehock et al., 1998). Plants also use reproductive adaptations to improve seed viability and germination (Firehock et al., 1998).

Adaptations to salinity: Some wetlands plants not only have to adapt to fluctuating water levels but also the affects of salinity. In order to adapt, plants have root adaptations that prevent them from taking up salt or specialized cells used to excrete salt (Firehock et al., 1998).

Resources for More Information about Wetland Plants and Animals

Life in the Chesapeake Bay: An Illustrated Guide to Fishes, Invertebrates, and Plants of Bays and Inlets from Cape Code to Cape Hatteras. Lippson, A.J. & Lippson, R.L. (1984). Baltimore: The Johns Hopkins University Press.

Chesapeake Bay A Field Guide: Nature of the Estuary. White, C.P. (1989). Centerville, MD: Tidewater Publishers.

Tidal Wetland Plants of Virginia. Silberhorn, G.M. (1976, April). Gloucester Point, VA: Virginia Institute of Marine Science.

Wetland Planting Guide for the Northeastern United States: Plants for Wetland Creation, Restoration and Enhancement. Thunhorst, G.A. (1993). St. Michaels, MD: Environmental Concern Inc.

Animal Adaptations

Animals also have adaptations that allow them to function in a wetland. Some aquatic animal adaptations include higher concentrations of blood pigment used to transport oxygen throughout the body and gills that do not collapse when exposed to air (Firehock et al., 1998). Certain frogs and salamanders have adapted to reproduce in shallow, temporary wetlands that are only seasonally wet. Animals living in salt marshes are often highly specialized to withstand salinity as well as both tidal inundation (White, 1989).

What types of plants and animals are found in wetlands?

Common Wetland Plants and Animals of Virginia

Plants	Animals
Cypress	Bald eagle
Red maple	Osprey
Black willow	Red-bellied woodpecker
Swamp rose	Great blue heron
Buttonbush	Mallard duck
Cattail	Spring Peeper
Soft rush	Bullfrog
Saltmarsh cordgrass	Eastern mud turtle
Salt meadow hay	Beaver
Jewel weed	River otter
Lizard's tail	Raccoon
Skunk Cabbage	White-tailed deer

Wetlands are very important habitats for many plants and animals. The plants and animals found in wetlands vary among the different wetland types. Wetland animals can vary from small, barely recognizable insect larvae to bald eagles and white-tailed deer. Plants can vary from lush, tropical-looking vines and floating vegetation to blueberries, shrubs and trees.

One of the most interesting attributes of wetlands is that many of the plants and animals living in them are transitional in nature, meaning that they have adapted to both wet and dry areas. Wetlands are especially important for animals that seek shelter, food and reproductive habitat in these transitional areas. Plant identification and bird watching are two popular recreational activities that many people partake in while visiting a wetland.

How can I tell if my site is a wetland?

Hopefully, now you are able to understand why you cannot identify a wetland based solely on the presence of standing water. Wetland hydrology drives the changes that take place in the soil and those adaptations of plants and animals. Without examining the hydrology, soils and vegetation of an area collectively, identification of wetland systems is difficult. All of the processes and changes occurring within a wetland system are unique to that environment making wetlands an interesting area to study, recreate and appreciate.

Now that you have successfully read this section, identification of a wetland should be a piece of cake… right? The table below includes a checklist of signs that your site may be a wetland.

Although you should now be better equipped to recognize a wetland, it is still a good idea to consult with a professional to verify that your site is a wetland and to classify it. A professional will also be able to **delineate**, or mark, the boundaries of your wetland. Delineation is discussed in more detail in the *Section 4*, under *Permitting.*

Signs That Your Site May Be A Wetland

- Is there standing, shallow water permanently, or for long periods of time?
- Is there evidence of watermarks or water stains on the trees and woody vegetation?
- Has sediment been deposited on leaves that may suggest flooding?
- Are the leaves matted and grayer in appearance than those on higher ground?
- Can you see drift lines or evidence that leaves and trashy debris were washed against roots, fences or other obstacles?
- Are there depressions and mounds evident in the area?
- Are there distinguishable shallow channels that may have been created during the wet season?
- Are bottles and can filled with sediment?
- Are the bases of trees swollen and bloated looking?
- Are tree and shrub roots shallow and exposed?
- Are cattails present or other vegetation that is adapted to wet environments?
- Are the soils mottled or gleyed?

Wetland Functions and Values

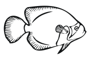
"Wetlands are more than physical places where water is present, soils have unique characteristics and certain plants grow" (Welsch et al., n.d, p.3).

Environmentalists, ecologists, biologists, naturalists and citizens have recognized and defined many of the functions and values that people attribute to wetlands today. Thomas and Luthin (2004) have concisely summed up wetland value and function in the following excerpt:

> *Scientists investigating wetland ecosystems have found that wetlands have many functions and provide numerous benefits to the environment and to us. These benefits may vary from wetland to wetland, and depend on the type of wetland, its size, its proximity to other wetlands and natural ecosystems, and the degree of disturbance, among other factors (p.10).*

Functions of Wetlands

Typical wetland functions include:



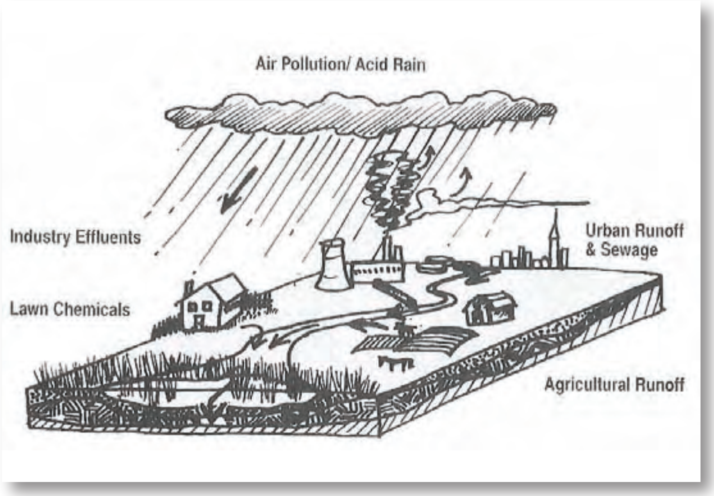
Food Production — The wetlands ecosystem provides critical food sources for a variety of aquatic species such as fish, shell fish, various birds and small mammals

Fish and Wildlife Habitat — Wetlands provide shelter, food, spawning and nesting sites for a multitude of birds, fish, mammals, reptiles and invertebrates

Flood Reduction — Wetlands help to absorb and slow floodwaters acting as a natural "sponge"

Ground Water Recharge and Water Storage — Wetlands, acting as a natural "sponge", hold precipitation, flood waters, and snow melt which recharges ground water supplies

Water Filtration and Cleansing — Wetlands serve as nature's "kidneys," removing and filtering excess nutrients and sediments from entering waterways



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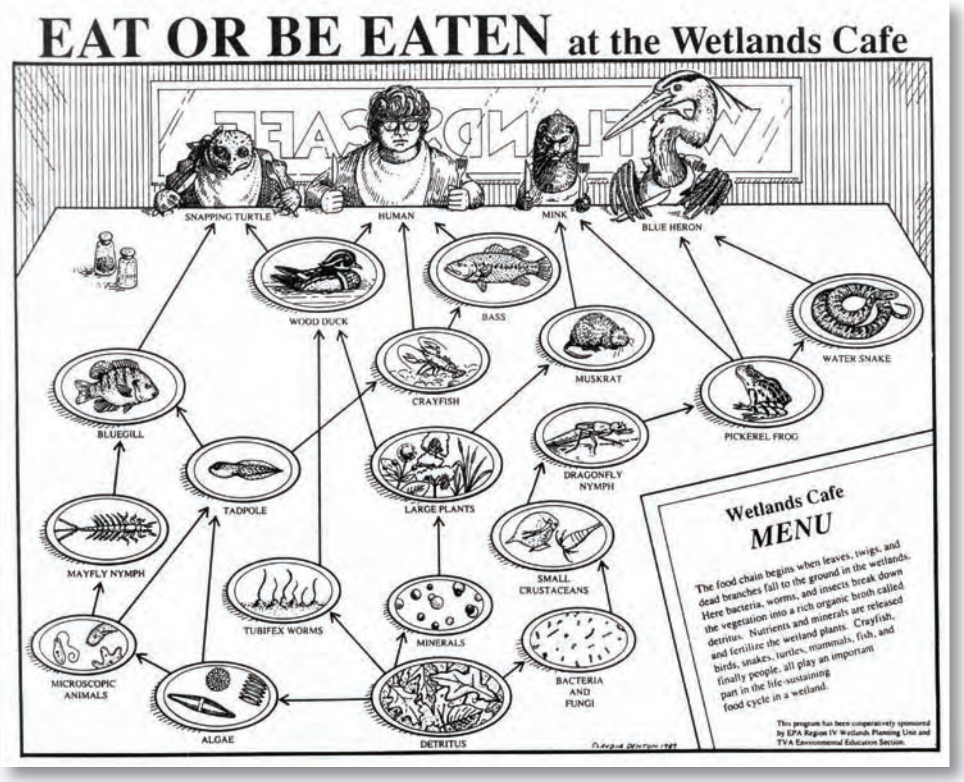
Wetlands serve as nature's kidneys



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Wetland Values

The functions that wetlands provide, give them the attributes that we value so much. According to Thomas and Luthin (2004):

> *Many values are associated with these wetland functions. Hunting, fishing, canoeing, bird watching, and aesthetic enjoyment are direct wetland values that offer us obvious and immediate benefits. In addition, wetland functions such as water filtration, flood control, and reduced soil erosion may provide direct or indirect benefits to society and to the environment in general. Some wetland values are subtle and understanding their importance requires a good working knowledge of the land, soils, and hydrology (p.10).*

Primary wetland values include ecological, economic, environmental, aesthetic and recreational.

Moulds

Ecological Values

"Wetlands are our most biologically productive ecosystems, providing habitat for a rich diversity of plant and animal species"(Thomson & Luthin, 2004, p.10). Wetlands serve as spawning grounds for many species of Virginia's fish and aquatic organisms, vital nesting habitat for waterfowl, and are home to a variety of snakes, salamanders, frogs, insects and other organisms that play a vital role in the ecological web of wetland life (Thomson & Luthin, 2004).

Economic Values

It is virtually impossible to put a price tag on the tremendous value wetlands provide. Wetlands often provide direct economic benefits to all of us whether we are aware of them or not. Private properties containing wetlands are greatly valued for their open space, wildlife habitat and aesthetic value. Communities with healthy and protected wetlands benefit from flood control, groundwater recharge, erosion control, improved water quality and recreational opportunities. Many trees and shrubs found in wetland habitats are used for medicinal uses, and food such as blueberries and wild rice are harvested in these habitats as well.

A significant source of income for communities in proximity to wetlands relies on recreational users. Bird watchers, hunters, canoeers, kayakers and sport fishermen spend a significant amount of money on travel related costs such as food and lodging, gas, local crafts and other equipment. (Chesapeake Bay Program [CBP], 1997) Considering the important part wetlands play in maintaining the health of costal waters, it is evident that Virginia's coastal wetlands are essential for supporting the state's fishing industry. Important commercial and recreational species, such as menhaden, flounder, striped bass and clams are dependant on Virginia's wetlands for nursery areas, food sources, and spawning grounds (Stedman & Hanson, n.d.).

According to the CBP (1997), other economic factors include:

- Over 95% of the commercially harvested fish and shellfish species in the United States are at least partially wetland dependant
- Nationally, waterfowl hunters spend over $59.5 billion annually on hunting, fishing, bird watching and photographing wildlife (EPA, 1995).
- Over $100 million worth of seafood is removed from the waters of the Chesapeake Bay annually- many of these species rely on wetlands for critical habitat and food sources

Environmental Values

Wetlands are often considered the first defense in helping to reduce the frequency and intensity of flooding. They filter the excess nutrients, sediment, and chemical pollutants from storm water runoff thereby improving water quality. Wetlands reduce the impact of soil erosion by buffering coastlines and absorbing floodwaters and precipitation and slowly releasing it. Furthermore, wetlands protect stream banks and shorelines from erosion and serve as a source of fresh water to maintain base flows in streams and rivers. (Thomson & Luthin, 2004).

Aesthetic and Recreational Values

Wetlands offer a silent retreat from our busy lives. They provide an opportunity to tune in to the sights and sounds of the natural world. Wetlands can offer a place of solace and allow the visitor a chance for enhanced observation, contemplation, or perhaps a scenic place to paint, draw or take photographs. Wetlands offer a venue for fishing, canoeing, birding, and other recreational uses. Oftentimes, public lands such as national wildlife refuges, state parks, and state natural areas contain extensive wetland areas attractive to visitors for a variety of uses (Thomson & Luthin, 2004).

FWS/Smith

What are wetlands Bad for?

It has already been established that wetlands benefit our environment, economy and wellbeing… So why not build our houses and business on a wetland? According to Thomas and Luthin (2004):

> *Wetlands are <u>not</u> good places for development. High water tables, the potential for flooding, and soils that seasonally shrink and swell can pose severe problems when a home, commercial enterprise, or road is built in a former wetland. Development in wetlands exacerbates flooding and runoff problems. The best thing for a wetland to be is what it was naturally meant to be: a wetland (p.11).*