WETLANDS

Junior Varsity
Lake Shelbyville Eco-Meet 2013

US Army Corps of Engineers

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Wetlands, they've always been around, but it seems that we're hearing more and more about them these days—some good news, some bad news, and most of it confusing. Throughout the history of the world, wetlands have been considered sacred and horrible at the same time: used- as a source of income, food and other resources, and misused – dredged, drained, filled in, built upon and used as a dumping ground for trash and debris. Wetland issues pop up in the newspaper and magazines, on television, and even on bumpers: "Save the Wetlands!" So what's this all about anyway? Wetlands are just swampy, smelly, bug infested wastelands, aren't they?---or so many have thought throughout history:

A curse from Caliban in William Shakespeare's, *The Tempest*, indicates the general attitude toward wetlands as far back as the fourteenth century:

> "As wicked dew as e'er my mother brushed
> With raven's feather from unwholesome **fen**,
> Drop on you both! A southwest blow on ye,
> And blister you all o'er…
>
> All the infections that the sun sucks up
> From **bogs, fens, flats**, on Prosper fall, and make him
> By inch-meal a disease."

By the nineteenth century there were occasional progressive thinkers whose attitudes toward wetlands were starting to change.

Henry David Thoreau, born in 1817 at Concord, MA, was an American author, philosopher and naturalist. His best know book, *Walden*, is based on the two years that he spent living the simple life in a small cabin he built for himself at Walden Pond near Concord, MA. His view of the intrinsic value of swamps is made clear in the following passage:

> "When I would recreate myself, I seek the darkest wood, the thickest and most interminable and most dismal **swamp**. I enter the **swamp** as a sacred place—a sanctum sanctorum. There is the strength, the marrow of nature."
> Henry David Thoreau

Aldo Leopold was born in 1887, in Burlington, Iowa. He received a graduate degree from the Yale School of Forestry in 1907. He served as a conservation advisor to the United Nations and was named to the National Wildlife Federation Conservation Hall of Fame. As a conservationist, he was ahead of his time. The

importance of wetlands to both humans and animals was not fully understood by the majority of people in the United States; however, Leopold recognized wetlands for their intrinsic value as well as their economic value. He is best known for the classic, *A Sand County Almanac,* considered the bible of the modern American conservation movement.

> "One of the penalties of an ecological education is that one lives alone in a world of wounds. Much of the damage inflicted on land is quite invisible to laymen. An ecologist must either, harden his shell and make believe that the consequences of science are none of his business, or he must be the doctor who sees the marks of death in a community that believes itself well and does not want to be told otherwise.
> The government tells us we need flood control and comes to straighten the creek in our pasture. The engineer on the job tells us the creek is now able to carry off more flood water, but in the process we lost our old willows where the cows switched flies in the noon shade, and where the owl hooted on a winter night. We lost the little marshy spot where our fringed gentians bloomed.
> Some engineers are beginning to have a feeling in their bones that the meanderings of a creek not only improve the landscape but are a necessary part of the hydrologic functioning. The ecologist sees clearly that for similar reasons we can get along with less channel improvement on Round River."
> From The Round River by Aldo Leopold (p. 237)

Fortunately, there has always been, at least, a minority group of thinkers who have recognized the values of wetlands. Many more are following this more sensible or sensitive school of thought today

The devastation, caused by the hurricanes in 2003-2005, to the Gulf Coast of the United States along with a large oil spill has given rise to a renewed urgency in the concern for the destruction of coastal wetlands and the importance of the wetland as a source of natural protection for the mainland. It will be years before the impact of the hurricanes and he oil spill will be totally understood. All ecosystems, left alone, recover from natural disasters. That is not to say that the new ecosystem will be identical to the pre-disaster one. Recovery does not rule out change and adaptation by the myriad of species found in a wetland.

Wetlands began disappearing soon after permanent European colonization of the United States. More than half of the 215 million acres of wetlands that existed at the time of settlement have been destroyed. Only 100 million

acres remain today. Throughout much of our nation's history, wetlands were viewed as obstacles to development that should be eliminated. Federal laws provided incentives for draining and destroying wetlands. Only in the last thirty years have public and government understanding of the importance of wetlands grown enough to begin to change some incentives to protecting and restoring wetlands.

Despite their now well-understood importance to ecosystem health, communities, and wildlife, wetlands continue to be destroyed at an alarming rate, over 100,000 acres per year in watersheds across the country. As wetlands are destroyed, so too, are vital natural habitats for many species of songbirds, frogs, fish and other birds and wildlife. As these species and their insect-based food chain disappear, whole ecosystems are disrupted.

So what is a wetland? "Wetland is a generic term for all the different kinds of habitats where the land is wet for some period of time each year but not necessarily permanently wet. A wetland is an area that is covered by shallow water or has waterlogged soils for long periods during the growing season in most years. Many wetlands occur in areas where surface water collects or where underground water discharges to the surface, making the area wet for extended periods of time. Other wetlands occur along our coasts, such as salt marshes, and are created by the tide. The federal Clean Water Act defines wetlands as '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 types of wetlands we will cover in this study guide include: swamps, marshes, bogs, fens, prairie pot holes, and vernal pools. What these areas have in common is what defines them as wetlands: water, special soil, and specialized plants. The arrangement of these three characteristics is what makes one kind of wetland distinct from another.

Ponds, lakes, rivers and streams are not considered wetlands but rather, bodies of water. Although they share many species of plants and animals, for the purposes of this study guide we will not include ponds, lakes, rivers or streams.

Wetlands may be any size or shape, coastal or inland, tidal or nontidal and many contain fresh, salty, or brackish, (slightly salty) water. They may be always wet, regularly or infrequently flooded, or even seasonal, (usually wet in the spring). Standing surface water is not necessary for an area to be classified as a wetland; an area need only be wet for 7-30 consecutive days or more, and have soil that is saturated within 6-18 inches of the surface, during the growing season (usually spring through fall). Many wetlands are actually fairly dry throughout most of the year. When you visit a wetland, you may not see water because the water may have dried up or may only be saturating the soil.

Wetlands are fed water from two main sources: surface water and ground water. Surface water is rainwater, runoff (rain that runs off of the land), or water from waterbodies, such as streams, rivers, ponds or the ocean. Surface water finds its way to wetlands by gravity; it runs downhill until it finds a low spot in which to rest. In some cases, the surface water is overflow from a water body; wetlands along the shores of a river that are wetted by floodwater are called floodplain wetlands. The water in wetlands can also come from under the ground such as seeping groundwater or even underground springs. A wetland may form on a hillside or slope from groundwater that seeps out to the surface. Other wetlands may occur in low-lying areas where the groundwater table is very high, keeping the soil saturated from below. Many wetlands are fed by both surface and ground water.

Soil:

Because of the prolonged presence of water, the soil in these areas, called hydric soil, develops special conditions. When the soil is saturated, most or all of the pore spaces are filled with water, which means that there is little or no room for oxygen. This means that the soil is anaerobic (lacks oxygen). Because it is water saturated and anaerobic, a variety of chemical reactions occur in hydric soil. These reactions affect the nature of the soil over time, changing some of its physical properties such as the color. The initial composition of the soil (minerals and/or organic materials), degree of wetness, and frequency and duration of flooding, determine what the soil will look and feel like. Because of the lack of oxygen, many organisms living in the soil must carry out anaerobic respiration. Certain bacteria, for example, perform their metabolic processes with the help of sulfur compounds—releasing sulfides that give the soil a characteristics rotten egg smell.

A Valuable Resource:

Wetlands are important to us in many ways. In general, they help keep our environment in balance. Wetlands provide habitat to numerous species of fish,

birds, and other wildlife, including one third of America's threatened and endangered species. Many creatures that live most of their lives in other types of areas are born and raised in wetlands. Wetlands are one of the most productive habitats on Earth, providing a strong base of plants and animals for the world's food web. There is economic strength in the harvest of fur-bearers such as muskrat, raccoon, mink, beaver and otter. Alligators, sought for their pelts and meat, waterfowl, fish, shellfish, peat, other vegetation, and even timber from wetland areas brings millions of dollars to the U.S. annually. Recreational attractions, such as fishing, hunting, boating and bird watching mean that people spend a lot of money in local economies on sporting goods, clothes, gasoline (boat and auto), photographic equipment, film and processing, travel, food and lodging.

The ecological functioning of wetlands provides many other benefits. Wetlands act in preventing floods—they catch, store, and slowly release runoff, particularly important during storms (this reduces the danger of the adjacent water way overflowing from increased input); if the waterway does overflow, bordering wetlands will catch and hold the floodwaters, protecting the upland area. Wetlands protect against storm damage—in coastal areas, wetlands absorb the brunt of ocean storms as they hit shore; where wetlands have been replaced by development, the homes and beach houses receive the initial shock of the storm instead and are often destroyed. The consequence of the loss of wetlands on the Gulf Coast was very apparent in the damage caused by the recent hurricanes.

Wetlands are also vital to our water supply. In fact, many people consider this the most important function or benefit of wetlands. Wetlands sometimes recharge or replenish the aquifer by slowly releasing stored water to the groundwater supply. During periods of drier weather or drought, wetlands keep our drinking water flowing. Wetlands and wetland plants are efficient sinks and traps for sediment and other pollutants that are washed off of the land. Caught in wetlands, these pollutants are kept from degrading the quality of surface and groundwater, including our drinking water. Excess nutrients will stress an aquatic system but wetland plants filter nutrients from passing water and use them in their own metabolism.

Types of Wetlands:

Freshwater marshes are teeming with both animal and plant life. Freshwater marshes are usually low-lying, open areas, located near creeks, streams, rivers and

lakes, where water flows into the marsh. Marshes are especially common at the mouths of rivers. The level of the mineral rich water in freshwater marshes usually ranges from 1 to 6 feet deep for most of the year.

Marshes have an interesting mix of plant and animal life, one that effectively demonstrates the interconnectedness of living things. Marshes are home to yellow-headed and red-winged blackbirds, herons, egrets, rails, bitterns, moorhens, ducks and geese. Most migratory species, in fact, rely on a network of wetlands to get from their southern habitats to nest sites further north.

The waterlogged land in marshes supports many low-growing plants, such as grasses and sedges; there are few trees in marshes. Some marsh indicator plants are cattail, sawgrass, water lily, pickerel weed, spike rush, and bullrush.

There are many animal species that use the marsh for feeding, shelter and /or nesting. Some of those living in the water include fish, crabs, shrimp, tadpoles, and insect larvae. Among the animals living at the surface of the water are frogs, turtles, and beaver. Animals living above the water include birds and insects. Other animals live in the spongy areas of land surrounding the swamp such as raccoons, opossums, muskrats, deer, snails, and earthworms.

Marshes were once common throughout Illinois, but today, only a few remnants remain. Many of these areas are part of larger wetland complexes, occurring along the border of a pond or within the floodplain of a stream.

Riparian marshes, those that occur along rivers serve two ecological roles: to absorb excess water when river levels are high and to release water when river levels are low. These balancing forces help prevent floods and droughts.

For the past 100 years mankind has straightened and deepened rivers in order to make them more accessible for commerce. The unfortunate side effect is the loss of riparian marshes. Today, very few riparian marshes are left. Some scientists believe that the great Mississippi River flood of 1993 was worsened, in part, by the loss of these wetlands.

Prairie potholes are depressional wetlands (primarily freshwater marshes) found most often in the Upper Midwest, especially North Dakota, South Dakota, Wisconsin, and Minnesota. This formerly glaciated landscape is pockmarked with an immense number of potholes, which fill with snowmelt and rain in the spring. Some prairie pothole marshes are temporary, while others may be essentially permanent. Growing in concentric circles, 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, sedgy marshes lie next to the upland.

Prairie Pothole

Swamps, unlike marshes, are actually small forests covered by water. In order for a wetland to qualify as a swamp it must have thirty percent tree cover. Swamps are dominated by woody shrubs and trees, some with hardwoods such as red maple, pin oak and ash, and others with softwoods like cedar and spruce. In hardwood swamps, a variety of shrubs and plants, such as skunk cabbage, grow beneath the forest canopy. Shrub swamps are dominated by willows, alders, shrubby dogwoods, and sweet pepper bush. Some shrub swamps are permanent, while others slowly transform themselves into true forested swamps.

Over one hundred years ago, loggers and developers reduced the number of swamps by thirty-five percent without understanding the damage they were causing.

Swamps, like marshes, are beneficial in a number of ways: They control floods; when rivers flood, swamps help control the overflow by holding water longer. They help to clean the water. As the water flows, plant roots trap pollutants and sediment which then sinks and settles on the bottom allowing the cleaner water to flow out. Swamps support food chains; plants in the swamp process nutrients which help to feed wildlife downstream.

Shrub swamp

Forested swamp

Bogs are standing bodies of water with no underground spring of fresh water. Bogs were formed when huge chunks of ice broke away from a glacier as it receded. Over time, the ice was surrounded by soil. When the ice melted, a glacial lake was formed. The water is generally cold, extremely acidic and low in oxygen. A form of moss, sphagnum, or peat moss, grows and forms a thick mat of floating plants. These plants, over time, can fill in the bog with peat that will eventually be firm enough to support trees. The spongy sphagnum moss soaks up warmth, oxygen, and rain water, keeping the elements from reaching the bog water below. Sphagnum is so absorbent it was used as diapers by the Indians and bandages in battlefield hospitals during World War I. When sphagnum dies and decays, it makes the water in the bog as acid as orange juice.

Bogs occur primarily in formerly glaciated areas of the Northeastern U.S., the north-central states, and Canada. The current landscape of the northeast corner of Illinois was shaped principally by glacial activity, particularly when the Wisconsin glacier began its final stages of melting thousands of years ago. As it receded, it deposited a blanket of unsorted debris, including clay, sand, gravel and boulders, collectively called glacial till. Embedded in the till were large chunks of ice that broke off the melting glacier. As the climate continued to warm, the ice blocks melted, forming depressions which developed into lakes, bogs and marshes.

A bog can support snapping turtles, frogs, insects, and birds such as wood warblers and swamp sparrows, but few fish can live where oxygen is in such short supply. Snowshoe hares, beavers, muskrats, and bog lemmings are some of the mammals that come to nibble on the wetland plants near a bog.

The stages in bog development are shown by a series of circles that can be easily identified as you look out over a bog. In the middle of the bog is an area of open water. Around that is a mat of Sphagnum moss and other plants that are so thick in spots a person can walk on top of the mat without falling into the water. The whole mat moves up and down. As a result, they are sometimes called "quaking bogs". The outside circle is made up of tall shrubs that give way to a forest of tamaracks or other trees.

Bog in the fall

Bog covered in peat mat

Open water in bog

Fens are wetlands characterized by continuous sources of ground water rich in magnesium and calcium. This groundwater comes from glaciers that have melted, depositing their water in layers of gravel and sand. The water sits upon layers of soil (glacial drift) that are not permeable; thus keeping the water from sinking beneath the surface. The water is then forced to flow sideways along the surface, where it picks up minerals in its path that contribute to the special chemical make-up of fens.

Sometimes, there are so many minerals in the water that some of them congregate to make a very porous rock called tufa. Marl, a crumbly kind of rock, can also accumulate from excess calcium mixed with other kinds of minerals. The soil in a fen is made up of peat.

The exact make-up of a fen is decided not only by the concentration of minerals, but, also by the amount of water flow, and by the terrain itself. It is different from a bog. Where a bog is more acidic, a fen is very alkaline. The pH of soil in a fen ranges from 7.35 to 8.00. The species of organisms that survive in fens must be able to adapt to these alkaline conditions present in the fens. Many of the fens in Illinois are found along the Fox River on the slopes of kames, gravel terraces, and hills formed from glacial moraines.

Fen

Vernal pools are spring pools that tend to fill up in spring, when biological activity peaks, and dry up in summer. In general, vernal pools are small, temporary, and isolated from other wetlands, streams, or other water bodies. They provide essential breeding habitat for certain animals, such as salamanders. While not all vernal pools dry up completely, they do not support fish.

Vernal Pool

There are many important reasons to save our remaining wetlands, among them are: ***Habitat for birds and other wildlife***. Up to one-half of North American bird species nest, feed, or rest in wetlands. As our wetlands have been destroyed, bird populations have slowly declined. This includes the continental duck breeding populations, and the forest dwelling migrants that rely on coastal wetland habitats during their arduous migrations. The number of birds migrating over the Gulf of Mexico, which rely on coastal wetlands as staging areas in Louisiana and Mississippi especially, has decreased dramatically.

Nearly half of all federally threatened and endangered species rely on wetlands. A majority of fish and many species of amphibians, insects and plants are wetland dependent. In dry climates, the value of wetlands to birds and other wildlife is magnified. For example, in the Rocky Mountains, wetlands occupy only one percent of the landscape but support 81 percent of the area's migratory bird populations.

Clean water. Wetlands are vital to cleansing the nation's water, trapping sediment and capturing nutrients from waters that flow through them. Wetlands save communities millions every year that otherwise would be spent on drinking water treatment plants. For example, if the wetlands of the Congaree bottomland hardwood swamp in South Carolina were destroyed, the cost to the community to install a water treatment plant would be $5 million.

Flood prevention. By soaking up and storing storm water, wetlands help prevent flooding. This saves families and communities from tragedy and great expense. In a 1983 study, the U.S. Army Corps of Engineers found that protecting wetlands along the Charles River near Boston resulted in annual savings of $17 million in flood damage prevented.

Fisheries and jobs. Fishing is big business and is the economic engine for many communities. All species of freshwater fish depend on wetlands either directly for food, habitat or breeding or indirectly by consuming prey that are wetland dependent. Seventy-five percent of all commercial marine fish and shellfish depend on wetlands. Sport and commercial fishing pumps about $152 billion annually into local communities, providing two million jobs.

Tourism. In 1991, more than 24 million Americans reported they traveled to watch birds. Bird watching and hunting now

generate over $19 billion and 220,000 jobs annually. In Grand Island, Nebraska, the annual Sand Hill Crane festival brings in tourists who give a $40 million boost to the economy.

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Flora and Fauna

Without realizing it, you probably have already recognized that there are special plants growing in wetlands. Have you ever seen a cattail growing anywhere but in wet areas? Can you tell the difference between a marsh (with reedy, grass like plants) and a dry meadow (mostly "weeds," dotted with wild flowers)? In many instances, it is the plants that make us recognize wetlands, because they are a particular type that we expect to see in wet areas.

The plants that grow in wetlands are specially adapted to life in wet conditions. After all, wetland environments are very stressful—many are alternately wet and drained, some are flooded periodically with salt water, and the soil is saturated and lacks oxygen. Many wetland areas receive soil and chemicals that wash off of the land. Soft-bodied plants that grow in the water must be lightweight so they can float upright, yet sturdy enough to keep their shape. Many aquatic plants have special channels for holding water to give their leaves and stems support. Plants that grow with their "feet" wet but stick up above the surface of the water (called emergent plants) must be able to support themselves above the water. Plants growing in salty conditions have developed specialized tissue organs that control the amount of salt taken in, or excrete the salt.

Although plants take carbon dioxide out of the air and release oxygen (which is why they help keep our air "clean"), they also need to take oxygen in through their roots. In wetland soil, however, there is little oxygen available, so, wetland plants have adapted special air spaces (called aerenchyma) for transporting oxygen from their leaves down through their stems and to their roots. Trees that grow in wetlands have adapted other physical features that help them survive in wet conditions—pneumatophors or "knees" (a secondary root system that pokes above

the surface of the water) for gas exchange; buttresses or swollen bases (trees look like they are wearing bell bottoms) help aerate the trees; shallow adventitious roots (growing from stem tissue) grow in the aerobic soil near the surface or prop roots, such as on a mangrove tree, that have pores above the water level, where oxygen can be taken from the air.

Types of Wetland Plants: **Aquatic** - An aquatic plant can be defined as one that is normally found growing in association with standing water whose level is at or above the surface of the soil. Standing water includes ponds, shallow lakes, marshes, ditches, reservoirs, swamps, bogs, canals, and sewage lagoons.

Duckweeds - are floating aquatic plants that form dense mats on the surface of some wetlands. They are found throughout Illinois and are an important source of food for fish and birds. Duckweeds are among the smallest of the seed-producing plants.

Water lilies - are found in shallow, clear, calm waters. The leaves are nearly round and have a deep cleft. The flowers of this species are white and open when the sun is not too bright. This species is sometimes fragrant and is common in Illinois.

Coontail - is a completely submersed plant commonly seen in Illinois wetlands. The serrated, forked leaves of coontail are arranged on the stems in whorls, with usually 5-12 leaves in each whorl. It is generally a dark, olive green color, and is often rather hard and crusty to the touch.

Coontail does not produce roots, instead it absorbs all the nutrients it requires from the surrounding water. If it is growing near the lake bottom, it will form modified leaves, which it uses to anchor to the sediment. However, it can float free in the water, and sometimes forms dense mats just below the surface.

Emergent Plants - are rooted plants often along the shoreline that stand above the surface of the water such as cattails. The stems of emergent plants are somewhat stiff or firm.

Cattails - are so widespread, abundant and aggressive that some people consider them to be weeds. They spread by both rhizomes and seeds. They provide cover and food to both birds and wildlife. The pollen makes a delicious addition to pancake batter and the young shoots are very tender and tasty.

Arrowheads - get their name from the shape of the leaves. One species of arrowhead is known as Duck Potato. Male and female flowers are separate with the male flowers above or sometimes on separate plants. Arrowheads are vigorous aquatic perennials that typically grows 2-4' tall. It commonly grows submerged in shallow water or out of water on wet muddy banks, sloughs, swamps, marshes and margins of streams and ponds. Plants are easy to naturalize and will colonize by spreading rhizomes as well as self seed. The Duck potato is a valuable food source for water fowl and can also be enjoyed with olive oil and garlic.

Common Reed - is a cane-like perennial grass that commonly grows from 12 to 16 feet tall, forming dense stands. Stems are round and hollow with flat leaves along its length. Leaves are long (up to 24 inches by 2 inches wide) and gradually taper to a point. The seed head is at the end of the stem and is multi-branched, 8 to 16 inches long. Common reed can propagate from seeds or creeping rhizomes.

Pitcher Plant - An endangered species in Illinois, the pitcher plant grows in the bogs and fens of northeastern Illinois. Populations of this unusual plant have declined because of habitat destruction, over-collecting, and possibly nitrogen deposition from air pollution (particularly nitrous oxide).
The leaves of this plant are developed into a pitfall trap. When an insect enters, it is trapped inside and will be digested by this carnivorous plant. The upper interior surface of each leaf is similarly colored; it is covered with stiff bristly hairs that point downward. These hairs impede the ability of small insects to escape from the interior of the leaf; some of them eventually fall into a watery fluid at the bottom of the leaf, where the nutrients of their decaying bodies are absorbed by this carnivorous plant. Extra-floral nectaries along the upper interior and rim of each leaf often lure such insects to their doom.

Skunk cabbage - is a large leafed plant that grows in wet areas, especially near marshes and wet woods. It is easy to recognize, with its huge leaves rising directly from the ground. It is one of the first plants to bloom in the spring. The spathe, a brownish-purple, shell like pod with green splotches, emerges from the ground

looking like something from a science fiction movie. By late spring, the skunk cabbage sends up a tightly rolled leaf, when unfurled it may be 1 -2 feet long and a foot wide. The common yellow throat will sometimes build a nest in the hollow of the large skunk cabbage leaves. When the leaves are crushed or bruised, the plant releases a strong odor, which smells like rotten meat, attracting insects that pollinate the plant. In the fall, the leaves fall over providing food and shelter for a variety of species. Wood ducks and Bobwhites eat skunk cabbage seeds.

Blue flag iris - is perennial plant found in shallow water along shorelines and in wet areas. Stems grow in clusters from the base, usually single or double-branched, and can be from less than a foot tall to over 3 feet. Leaves are sword or blade-like. Flowers are on an elongated stem that usually rises above the leaves. Six-petaled iris-like flowers can be bluish-purple to violet. Flowers are fragrant. Irises have shallow roots and can spread from the roots.

Submerged portions of all aquatic plants provide habitats for many micro and macro invertebrates. These invertebrates, in turn, are used as food by fish and other wildlife species

Soft Rush - is grass-like and grows in dense clusters, up to 3 1/2 feet in height. Stems are dark green, singular (not branched), soft, with fine vertical lines, round in cross section, with a sharp tip, and with sheaths around the base. Flowers are borne in a single cluster along the upper half of the stem but not near the stem tip. Rushes can grow in shallow water or moist soils.

Shrubs

Sweet pepperbush - (or summer sweet) is a spreading deciduous shrub that grows 4-8 feet tall and blooms in summer with showy upright clusters of little white flowers. The flowers have five petals and are about a third of an inch across, at the ends of the twigs. They have a wonderful sweet, spicy, slightly pungent fragrance. The leaves are alternate, 2-3 inches long and serrated towards their tips. Sweet pepperbush grows naturally in wet forests, swamps, bogs, and along woodland streams.

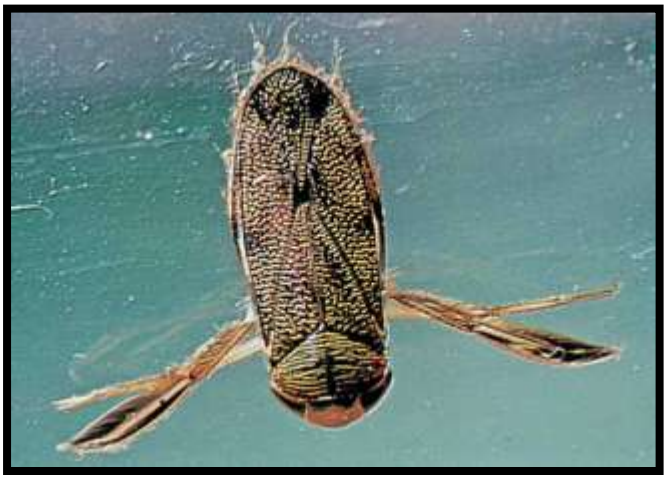
Trees

Pin oak - A medium sized tree that is very pyramidal; lower branches are pendulous and middle branches grow at right angles; a fast growing tree that grows near wetlands.

Whirligig beetle - They like to swim in large groups on the surfaces of water. They can live in ponds, swamps, bogs, lakes, streams and rivers. They get the name "Whirligigs" from their ability to swim very quickly and whirl around on the surface of the water. If you disturb them, Whirligigs dive under the water to safety. Whirligig beetles are active and feed during the day.

Whirligig beetles are beneficial bugs because the adults eat other dead or dying insects that get trapped on the surface of a lake or pond. They are scavengers that keep the surface of water ways clean. The larvae prey on other insects that live in the water.

Water-Boatman Water boatmen have flat bodies and four oar-like rear legs which are covered in hairs, making them look like mini boats. Water boatmen also have a pair of scoping front legs, these coupled with their powerful rear limbs allows gracefully skimming under the water's surface as well as diving deep into watery depths.



All aquatic bugs lack gills and therefore have to come to the water's surface to breathe air. However, Water boatmen have a clever trick that allows them to remain under water for longer. They hang upside down below the water's surface and collect air, they then carry this air as a bubble on their body or under their wings; this allows them to breathe when underwater.

Water boatmen often swim in open water. They can be seen in groups or clusters swimming through a pond. They feed on plant material, including algae

Most Water boatman are vegetarians. If you look closely you will notice their triangular shaped heads have a straw-like mouthpart (a proboscis); which is used to inject plants with digestive saliva. The saliva creates a plant smoothie which is sucked back up and eaten by the boatman. However, a few water boatmen are predators and will eat other insects. Water boatmen are also food for a number of aquatic animals and are eaten by water beetles and dragonflies In Mexico they are actually considered a delicacy, where they are harvested and eaten in large numbers.

They are beneficial because they are an important part of the diet of fish.

Dragonfly Dragonflies are usually found around marshes, lakes, ponds, streams, and wetlands because their larvae, known as "nymphs", are aquatic. Some 5680 different species of dragonflies (Odonata) are known in the world today.

Dragonflies start their life in water, therefore they are often found near water: ponds, lakes, canals, streams, rivers and swamps. Some dragonflies with a short larvae cycle (a few weeks) also can live in rain puddles. Since dragonflies are very good flyers they can sometimes be found a very long way from water.

It is estimated that the top speed for a dragonfly is between 30 and 60 km/h (19 to 38 m.p.h.). The maximum speed varies a lot between different species, with bigger dragonflies generally flying faster than smaller ones.

Most temperate-zone species live as adults less than a month, though some species can live as long as six months

Dragonflies are important predators that eat mosquitoes, and other small insects like flies, bees, ants, wasps, and very rarely butterflies. Dragon flies are also known as, mosquito hawks due to their eating of mosquitoes. Larger dragonfly larvae sometimes eat small fish or fry. The larvae, which live in water, eat almost any living thing smaller than themselves. Usually they eat bloodworms or other aquatic insect larvae.

Though dragonflies are predators, they themselves are subject to predation by birds, lizards, frogs, spiders, fish, water bugs, and even other large dragonflies

Great Blue Heron Great blue herons always live near sources of water, including rivers, lake edges, marshes, saltwater seacoasts, and swamps. They usually nest in trees or bushes that stand near water, breeding at elevations of up to 1,500 m. They tend to avoid marine habitats along the east coast and instead live inland.

The oldest wild great blue heron was said to be 23 years old, but most do not live so long. The average lifespan for a great blue heron is around 15 years. As with most animals, they are most vulnerable when they are young. More than half (69%) of the great blue herons born in one year will die before they are a year old.

Great blue herons fish in both the night and the day, with most of their activity occurring around dawn and dusk. Herons use their

long legs to wade in shallow water and their sharp "spearlike" bills to catch their food. They do not spear their food, they catch between the beaks. Great blue herons' diet consists of mainly fish, but also includes frogs, salamanders, lizards, snakes, birds, small mammals, shrimps, crabs, crayfish , dragonflies, grasshoppers, and many other aquatic insects. Herons locate their food by sight and usually swallow it whole. Herons have been known to choke on prey that is too large.

Northwest crows and common ravens have been reported eating heron eggs. Eagles, racoons, bears, turkey vultures, and red-tailed hawks prey on the young birds and sometimes even the adults. Birds will abandon a colony where they have been living after a predator has killed an adult or chick in the area.

Great blue herons control fish and insect populations in many different habitats.

American Bittern In the breeding range, the American Bittern inhabits areas of freshwater wetlands with tall emergent vegetation, shorelines, and vegetative fringes. The bird prefers beaver-created wetlands to those of glacial origin.

The American Bittern is a medium-sized heron with a stout body and a neck, short legs, and a white neck. The upperside of the bird is brown finely speckled with black. The undersides are heavily streaked with brown and white. There is a long black patch that extends from below the eye down the side of the neck.

The basic diet of the American Bittern includes insects, amphibians, crayfish, and small fish and mammals. When foraging, it relies mostly on stealth, waiting motionless for its prey to pass by. Its coloration adds to its ability to go undetected by prey. When its prey is in reach, the bird darts forward and seizes the prey in its bill. The prey is then killed by biting or shaking and is swallowed head first. Microhabitats for foraging include vegetation fringes and shorelines. Even-aged stands of older, dense or dry vegetation are avoided.

The American Bittern population is undergoing a substantial decline due to loss and degredation of habitat. The species was listed as a Nongame Species of Management Concern by the United States Fish and Wildlife Service in 1982 and 1987. It is listed as a species of special concern in the state of Michigan. Eutrophication, siltation, chemical contamination, and human disturbance have significantly reduced habitat quality by damaging the food supply. Changes in wetland isolation and stabilized water regimes are also eroding habitat quality. Acid rain is also another significant threat to the species due to its damaging effects on wetlands.

American Beaver - Beavers are found throughout all of North America except for the northern regions of Canada and the deserts of the southern United States and Mexico.

Beavers live in lodges, of which there are three types: those built on islands, those built on the banks of ponds, and those built on the shores of lakes. The lodge, itself, is an oven-shaped house of sticks, grass, and moss, woven together and plastered with mud. Over the years, repair and elaboration leads to an increase in hut size. The

room inside may measure 2.4 m (8 ft) wide and up to 1 m (3 ft) high. The floor is blanketed with bark, grass, and wood chips.

The pond lodge is built either a short way back from the edge of the bank, or partly hanging over it, with the front wall built up from the bottom of the pond. The lake lodge is built on the shelving shores of lakes. To ensure adequate water depth surrounding the lodge, beavers dam streams with logs, branches, mud, and stones

Beavers are primarily aquatic animals, and the largest rodents in North America. They have a waterproof, rich, glossy, reddish brown or blackish brown coat. The underhairs are much finer than the outer, protective, guard-hairs. The ears are short, round, and dark brown in coloration. A beaver's hind legs are longer than its front legs, thus making the rear end to be higher than the front end while walking.

Beaver skulls and teeth are disproportionately large. This is crucial for cutting through hard woods like maple and oak. Most noteably, the upper incisors, bright orange in color, are at least 5 mm wide and 20-25 mm long. These teeth grow throughout the animal's lifetime and are a necessity to survival, just as the animal's closable nostrils, closable ears, and transparent eye membranes are for aquatic existence

Under favorable conditions, beavers will produce their first litters at two or three years of age. The average lifespan of a beaver in the wild is 10 to 20 years. While its size saves it from most predators, a beaver's lifespan can be cut short by predators, most commonly humans, wolves, and coyotes. Parasites and disease also play a factor in mortality.

Beavers are primarily nocturnal. They are only occasionally seen during the day, usually around dusk. Beavers travel good distances from their homes to find food. If they find a good source, they build canals to the food source as a way to float the food back to their lodges. Logs and twigs are often stored underwater for winter feeding

Young beavers are very vulnerable, and are threatened by bears, wolves, wolverines, lynx, fishers and otters. An adult beaver's size is a deterrent to most predators, and though natural predators pose a very real danger to kits, man has proven to be, by far, the most dangerous predator to beavers. Killing beavers for their pelts, disrupting them through a change in habitat, and slowly poisoning them through pollution, which is known to infect wounds, all have lead to the threat which man poses on beavers

Beavers maintain wetlands that can slow the flow of floodwaters. They prevent erosion, and they raise the water table, which acts as a purifying system for the water. This happens because silt occurs upstream from dams, and toxins are then broken down. As ponds grow from water backed up by the damn, pond weeds and lilies take over. After beavers leave their homes, the dams decay, and meadows appears.

Muskrat The muskrat is found in swamps, marshes, and wetlands from northern North America to the Gulf coast and the Mexican border.

Muskrats are found in wet environments, favoring locations with four to six feet of water. While muskrats are found in ponds, lakes, and swamps, their favorite

locations are marshes, where the water level stays constant. Marshes provide the best vegetation for muskrats. They find shelter in bank burrows and their distinctive nests. Bank burrows are tunnels excavated in a bank. The nests of the muskrats are formed by piles of vegetation placed on top of a good base, for example a tree stump, generally in 15 to 40 inches of water.

Muskrats have large, robust bodies, with a total body length of twelve and a half inches. The tail is flat and scaly and is nine and a half inches in length. Muskrats have dense fur that traps air underneath for insulation and buoyancy. Their heads are very large and their ears are almost invisible underneath the fur. The whiskers are medium size. Muskrats have short legs and big feet; the back feet are slightly webbed for swimming. Adult muskrats have glossy upperparts that are dark brown, darker in winter and paler in the summer.

Although muskrats have been known to live to 10 years old in captivity, they probably live about 3 years in the wild.

Muskrats are active at all times of the day but most active from mid-afternoon until just after dusk. Muskrats are good swimmers and can stay underwater for 12 - 17 minutes. Muskrats, however, move relatively slowly on land. Muskrats have poorly developed senses of sight, hearing, and smell. They are affected by quick changes in temperature, and dry, hot weather is especially bad for them. Their homes and burrows protect them from the elements.

Muskrats are mainly vegetarians but will eat animals as well. Muskrats consume about one-third of their weight every day. Their digestive system is designed for green vegetation. In the summer they eat the roots of aquatic plants. In the winter, they swim under the surface ice to get to the plants. Muskrats also eat agricultural crops.

Muskrats are excellent swimmers and can evade many predators by escaping into water or into their burrows and nests. They can remain under water for up to 15 minutes.

Muskrats are preyed on by the following creatures: minks, raccoons, northern river otters, coyotes, barn owls, barred owls, northern harriers, American alligators and cottonmouth water moccasins

Muskrats are very abundant in areas of good habitat, making them important prey animals for predator populations. By grazing on vegetation, muskrats influence the composition of local plant communities.