Wetland Ecosystems (C.C)

Introduction

Wetlands comprise areas that transition between terrestrial (land) areas and aquatic (water) areas. The wetlands ecosystem represents a richly diverse web of plants and animals interacting together. Wetlands ecosystems also exhibit great sensitivity to disturbance from outside influence, particularly by human development and environmental damage. Wetlands ecosystems provide the world with natural storm barriers, environmental cleansers, and food and water resources for many forms of life.

Characteristics of wetland

1. Wetlands can be found throughout the world, in areas intersecting bodies of water and land.
2. A wetland can take many forms. Some types of wetlands include marshes, fens, bogs, riparian wetlands, swamps and estuaries.
3. Wetlands that exist away from oceans obtain their water from ground water and precipitation.
4. Wetlands in coastal environments receive precipitation and ground water, but they are also affected by seawater and tides.
5. In wetlands, the water table sits at or close to the surface of the land, and shallow water often covers the area.
6. Wetlands support aquatic vegetation, a substrate of saturated soil and substrates not comprised of soil but inundated with water during the growing season.
7. The water in wetlands ecosystems can be freshwater, saltwater, brackish water or flowing water. Wetlands contain wet soils and typically anaerobic environments, and rooted plants and other forms of life used to those conditions. While remaining distinct, the characteristics of wetlands may blend both terrestrial and aquatic environments.

Types of Wetlands

1. **Emergent wetlands** - Wetlands that contain rooted vegetation are called emergent wetlands, which include marshes and fens. Emergent wetlands include such plants as cattails, rushes and water lilies.
2. **Scrub-shrub wetlands** - Here small saplings under 20 feet in height coincide with shrubs. Flooding may be seasonal or permanent. Example of a scrub-shrub wetland is the bog, which contains peat mats that float away from the shore. The water of bogs tends toward higher acidity and lower oxygen levels, and it is not favorable for fish.
3. **Riparian wetlands** -When the water table reaches the surface, springs and seeps occur and provide Riparian wetlands , important to plants and wildlife. Riparian wetlands comprise those areas alongside flowing waters such as streams and rivers; typically soils erode in such areas.

Abiotic Factors

A natural wetland is a complex ecosystem. Like other ecosystems, both ***biotic and abiotic factors and processes*** are integral to the natural wetland ecosystem. The term "biotic" refers to living things. The term "abiotic" refers to the materials, processes or factors that are nonliving.

Water

Water is the essential abiotic factor in natural wetlands. In natural wetlands, water is the medium in which the entire ecosystem exists and functions. The movement, distribution, and quality of water is the primary factor influencing wetland structure and function. To be classified as a wetland, the presence of water must contribute to the formation of hydric soils, which are formed under flooded or saturated conditions persisting long enough for the development of anaerobic conditions during the growing season. Water conditions in wetlands can vary tremendously with respect to the timing and duration of surface water inundation as well as seasonal patterns of inundation. In coastal wetlands, tidal

influence drives the movement and distribution of water and can range from permanent flooding in subtidal wetlands to less frequent flooding in others, with changes in water level occurring daily or semi-daily. Inland wetlands, which lack daily tidal influences, can also be permanently flooded on one extreme or intermittently flooded on the other extreme, with fluctuations over time often occurring seasonally. Flooding can affect the physiochemistry of wetlands in various ways. Water can introduce or remove sediment, salt, nutrients or other materials from wetlands, thereby influencing its soil and water chemistry. Hydrology also influences the structure and function of wetland ecosystems through its influence on species richness, productivity, rates of organic matter accumulation, and nutrient cycling. Hydrology may restrict species richness in areas subject to long-term flooding. Productivity is typically lower in permanently flooded, stagnant wetlands

O_2 availability

The inundation or saturation of wetland soils by water leads to the formation of anaerobic conditions as oxygen is depleted faster than it can be replaced by diffusion. The rate of oxygen loss in flooded soils can vary depending on other soil conditions, such as temperature and rates of microbial respiration. In most wetlands, small, oxidized layers of soils may persist on the surface or around the roots of vascular plants, but generally, anaerobic, or reduced, conditions prevail.

The prevalence of anaerobic conditions in wetlands has a tremendous impact on their biogeochemistry, with important implications for carbon, nitrogen, phosphorus, iron, manganese, and sulfur transformations. Wetlands can function as sources, sinks, or transformers of these materials, depending on inflows, outflows, and internal cycling rates. One of the most important biogeochemical cycles in wetlands is the nitrogen cycle, and while the potential transformations are not unique to wetlands, the dominance of anaerobic transformations does set wetlands apart from other ecosystems.

Sunlight

Light from the sun is an essential abiotic factor in natural wetlands. Sunlight provides the energy that plants need to carry out photosynthesis. That same energy is transmitted to other organisms in the wetland through the food chain or food web. And temperature, of course, is an abiotic factor directly related to the amount of energy the wetland receives from the sun.

Minerals

Beneath the water, at the bottom of a natural wetland, are sedimentary materials of various kinds. Much of this material is organic or biotic and arises from the decomposing remains of living organisms in the wetland. But there is also a mineral component to this sedimentary material. Mineral particles of various kinds and sizes intermix with the organic material. Just as in terrestrial ecosystems, plants in the natural wetland must obtain abiotic mineral nutrients in order to live and grow. And minerals are not limited to the bottom sediments; they can be dissolved directly into the water, where they form a complex natural chemical mix that has a bearing on factors like pH, a measure of the acidity in the water.

Rocks

In addition to the relatively small particles of mineral sediments, there are often larger rocks of various sizes and kinds in wetlands. Whether a massive, continuous layer of bedrock underlying the wetland and forming its foundation, or relatively smaller rocks that are under the water or that protrude above the surface, rocks are a significant abiotic factor in many wetlands. Besides providing substrates for plants and animals to either grow on or perch on, rocks -- through natural weathering processes -- gradually break down and provide mineral nutrients to the wetland ecosystem.

Communities

a. Because of the predominance of water and anaerobic conditions in wetlands, the organisms living there, especially rooted plants, often exhibit remarkable adaptations to deal with the stresses imposed by flooding. These adaptations, including pressurized gas flow , creation of oxidized root zones, and anaerobic respiration, allow wetland plants to remain productive under otherwise stressful conditions, making wetlands among the most productive ecosystems in the world . This high primary production, in turn, supports high rates of secondary production, rates that can exceed those of terrestrial ecosystems.

b. Wetland plant communities develop in response to this environmental gradient based primarily on their individual abilities to tolerate flooding and anaerobic soils but also in response to biotic interactions with other species. Establishment of plant species along an environmental gradient can contribute to sharp plant zonation patterns.

c. The development of diverse plant communities results in complex food webs that not only sustain microbial communities but also support diverse communities of animals that utilize wetlands for part or all of their lives. Detritivores, such as shredding insects and crayfish, can utilize dead plant material as their primary energy source, while others (e.g., marsh snails) help process organic matter for subsequent use by other organisms. Herbivory of algae by invertebrates and small fish and of plant biomass by some invertebrates, birds, and mammals (e.g., grasshoppers, geese and muskrats) is a significant energy source for primary consumers in many wetlands. Secondary production by these primary consumers supports higher trophic levels, including predatory insects, fishes, reptiles, amphibians, birds, and mammals.