Ecosystem structure and function

What is an Ecosystem?

The ecosystem is the structural and functional unit of ecology where the living organisms interact with each other and the surrounding environment. In other words, an ecosystem is a chain of interaction between organisms and their environment. The term “Ecosystem” was first coined by A.G.Tansley, an English botanist, in 1935.

Types of Ecosystem

An ecosystem can be as small as an oasis in a desert, or as big as an ocean, spanning thousands of miles. There are two types of ecosystem:

- Terrestrial Ecosystem
- Aquatic Ecosystem

Terrestrial Ecosystems

Terrestrial ecosystems are exclusively land-based ecosystems. There are different types of terrestrial ecosystems distributed around various geological zones. They are as follows:

1. Forest Ecosystems
2. Grassland Ecosystems
3. Tundra Ecosystems
4. Desert Ecosystem

Forest Ecosystem

A forest ecosystem consists of several plants, animals and microorganisms that live in coordination with the abiotic factors of the environment. Forests help in maintaining the temperature of the earth and are the major carbon sink.

Grassland Ecosystem

In a grassland ecosystem, the vegetation is dominated by grasses and herbs. Temperate grasslands, savanna grasslands are some of the examples of grassland ecosystems.

Tundra Ecosystem

Tundra ecosystems are devoid of trees and are found in cold climates or where rainfall is scarce. These are covered with snow for most of the year. The ecosystem in the Arctic or mountain tops is tundra type.

Desert Ecosystem

Deserts are found throughout the world. These are regions with very little rainfall. The days are hot and the nights are cold.

Aquatic Ecosystem

Aquatic ecosystems are ecosystems present in a body of water. These can be further divided into two types, namely:

1. Freshwater Ecosystem
2. Marine Ecosystem

Freshwater Ecosystem

The freshwater ecosystem is an aquatic ecosystem that includes lakes, ponds, rivers, streams and wetlands. These have no salt content in contrast with the marine ecosystem.

Marine Ecosystem

The marine ecosystem includes seas and oceans. These have a more substantial salt content and greater biodiversity in comparison to the freshwater ecosystem.

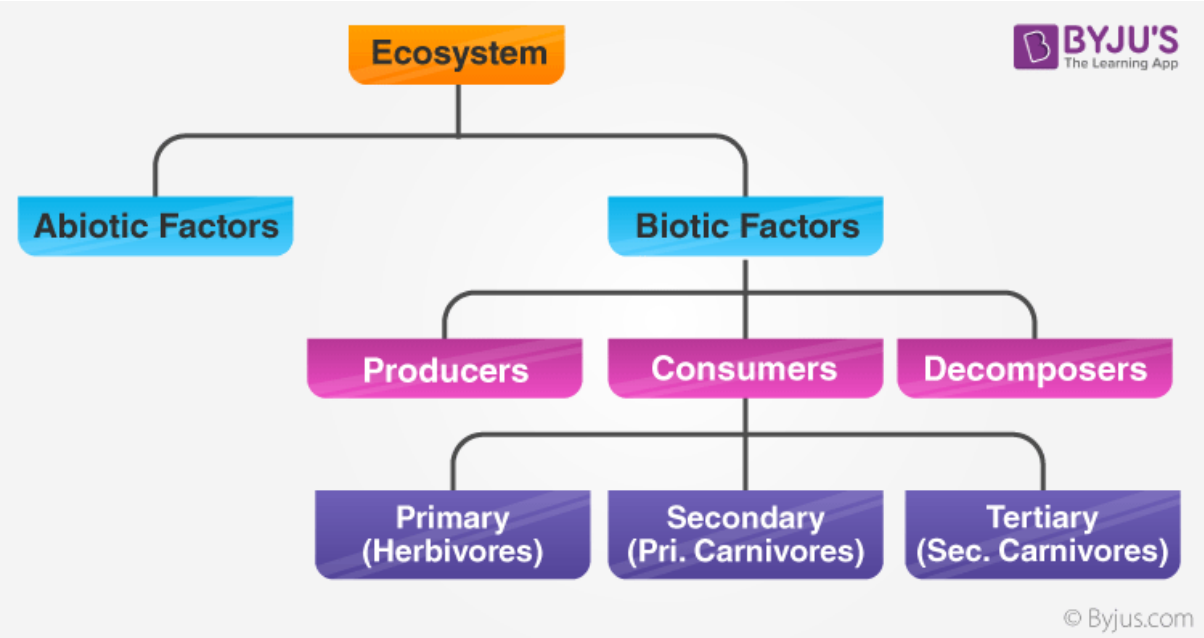
Structure of the Ecosystem

The structure of an ecosystem is characterised by the organisation of both biotic and abiotic components. This includes the distribution of energy in our environment. It also includes the climatic conditions prevailing in that particular environment.

The structure of an ecosystem can be split into two main components, namely:

- Biotic Components
- Abiotic Components

The biotic and abiotic components are interrelated in an ecosystem. It is an open system where the energy and components can flow throughout the boundaries.



Structure of Ecosystem highlighting the biotic and abiotic factors

Biotic Components

Biotic components refer to all life in an ecosystem. Based on nutrition, biotic components can be categorised into autotrophs, heterotrophs and saprotrophs (or decomposers).

- Producers include all autotrophs such as plants. They are called autotrophs as they can produce food through the process of photosynthesis. Consequently, all other organisms higher up on the food chain rely on producers for food.
- Consumers or heterotrophs are organisms that depend on other organisms for food. Consumers are further classified into primary consumers, secondary consumers and tertiary consumers.
    - *Primary consumers* are always herbivores that they rely on producers for food.
    - *Secondary consumers* depend on primary consumers for energy. They can either be a carnivore or an omnivore.
    - *Tertiary consumers* are organisms that depend on secondary consumers for food. Tertiary consumers can also be an omnivore.

- *Quaternary consumers* are present in some food chains. These organisms prey on tertiary consumers for energy. Furthermore, they are usually at the top of a food chain as they have no natural predators.

- Decomposers include saprophytes such as fungi and bacteria. They directly thrive on the dead and decaying organic matter. Decomposers are essential for the ecosystem as they help in recycling nutrients to be reused by plants.

Abiotic Components

Abiotic components are the non-living component of an ecosystem. It includes air, water, soil, minerals, sunlight, temperature, nutrients, wind, altitude, turbidity, etc.

Functions of Ecosystem

The functions of the ecosystem are as follows:

1. It regulates the essential ecological processes, supports life systems and renders stability.
2. It is also responsible for the cycling of nutrients between biotic and abiotic components.
3. It maintains a balance among the various trophic levels in the ecosystem.
4. It cycles the minerals through the biosphere.
5. The abiotic components help in the synthesis of organic components that involves the exchange of energy.

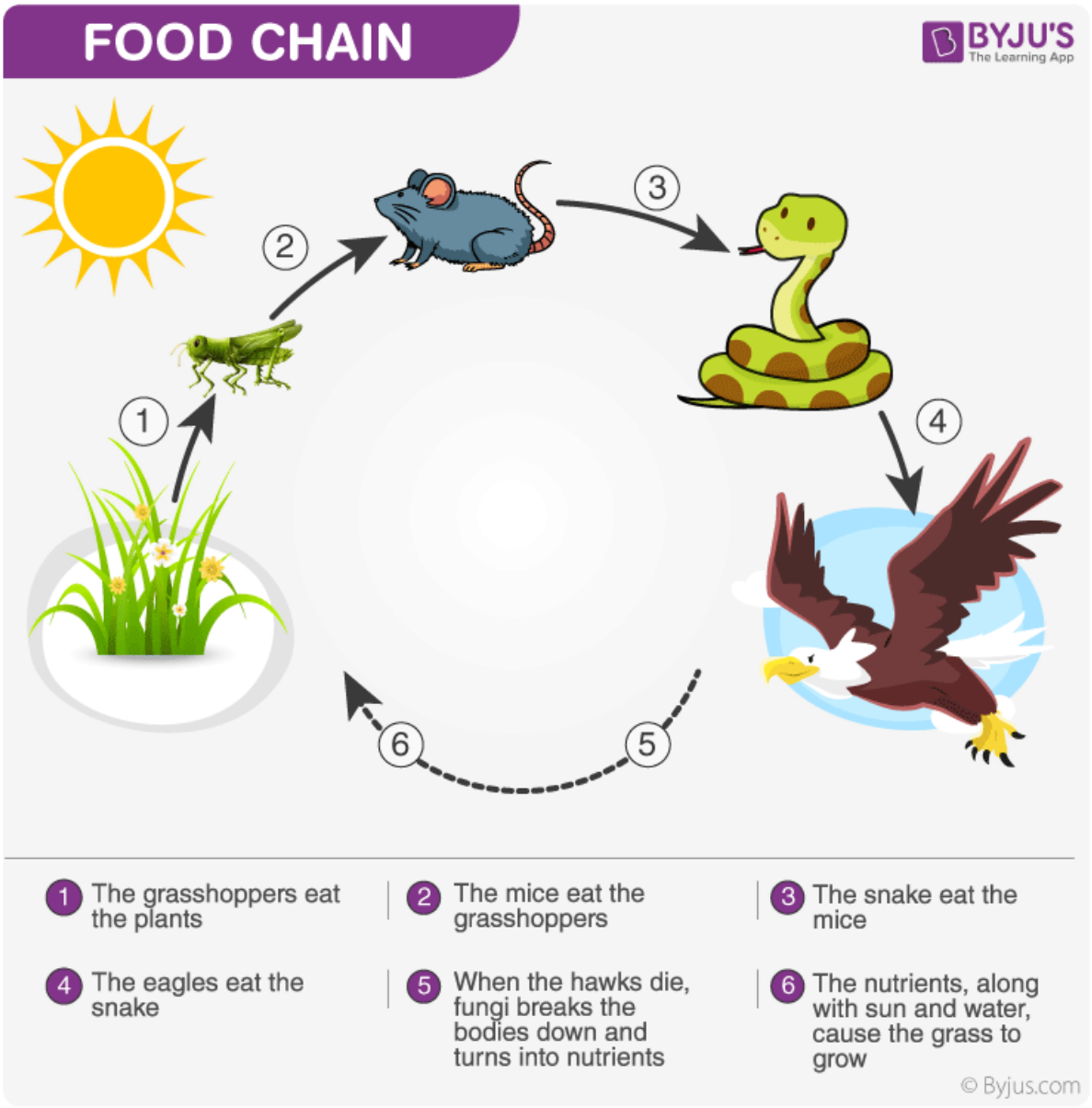
Important Ecological Concepts

1. Food Chain

The sun is the ultimate source of energy on earth. It provides the energy required for all plant life. The plants utilise this energy for the process of photosynthesis, which is used to synthesise their food.

During this biological process, light energy is converted into chemical energy and is passed on through successive levels. The flow of energy from a producer, to a consumer and eventually, to an apex predator or a detritivore is called the food chain.

Dead and decaying matter, along with organic debris, is broken down into its constituents by scavengers. The reducers then absorb these constituents. After gaining the energy, the reducers liberate molecules to the environment, which can be utilised again by the producers.



A classic example of a food chain in an ecosystem

2. Ecological Pyramids

An ecological pyramid is the graphical representation of the number, energy, and biomass of the successive trophic levels of an ecosystem. Charles Elton was the first ecologist to describe the ecological pyramid and its principals in 1927.

The biomass, number, and energy of organisms ranging from the producer level to the consumer level are represented in the form of a pyramid; hence, it is known as the ecological pyramid.

The base of the ecological pyramid comprises the producers, followed by primary and secondary consumers. The tertiary consumers hold the apex. In some food chains, the quaternary consumers are at the very apex of the food chain.

The producers generally outnumber the primary consumers and similarly, the primary consumers outnumber the secondary consumers. And lastly, apex predators also follow the same trend as the other consumers; wherein, their numbers are considerably lower than the secondary consumers.

For example, Grasshoppers feed on crops such as cotton and wheat, which are plentiful. These grasshoppers are then preyed upon by common mice, which are comparatively less in number. The mice are preyed upon by snakes such as cobras. Snakes are ultimately preyed on by apex predators such as the brown snake eagle.

In essence:

> Grasshopper →Mice→ Cobra → Brown Snake Eagle

3. Food Web

Food web is a network of interconnected food chains. It comprises all the food chains within a single ecosystem. It helps in understanding that plants lay the foundation of all the food chains. In a marine environment, phytoplankton forms the primary producer.

DESERT ECOSYSTEM

Deserts experience a wide range of temperatures and weather conditions, and can be classified into four types: hot, semiarid, coastal, and cold. Hot deserts experience warm temperatures year round, and low annual precipitation. Low levels of humidity in hot deserts contribute to high daytime temperatures, and extensive night time heat loss. The average annual temperature in hot deserts is approximately 20 to 25 °C, however, extreme weather conditions can lead to temperatures ranging from -18 to 49 °C.

Rainfall generally occurs, followed by long periods of dryness. Semiarid deserts experience similar conditions to hot deserts, however, the maximum and minimum temperatures tend to be less extreme, and generally range from 10 to 38 °C. Coastal deserts are cooler than hot and semiarid deserts, with average summer temperatures ranging between 13 and 24 °C. They also feature higher total rainfall values. Cold deserts are similar in temperature to coastal deserts, however, they receive more annual precipitation in the form of snowfall.[1] Deserts are most notable for their dry climates; usually a result from their surrounding geography. For example, rain-blocking mountain ranges, and distance from oceans are two geographic features that contribute to desert aridity. Rain-blocking mountain ranges create Rain Shadows. As air rises and cools, its relative humidity increases and some or most moisture rains out, leaving little to no water vapor to form precipitation on the other side of the mountain range.

Deserts occupy one-fifth of the Earth's land surface and occur in two belts: between 15° and 35° latitude in both the southern and northern hemispheres.[2] These bands are associated with the high solar intensities that all areas in the tropics receive, and with the dry air brought down by the descending arms of both the Hadley and Ferell atmospheric circulation cells. Dry winds hold little moisture for these areas, and also tend to evaporate any water present.

Many desert ecosystems are limited by available water levels, rather than rates of radiation or temperature. Water flow in these ecosystems can be thought of as similar to energy flow; in fact, it is often useful to look at water and energy flow together when studying desert ecosystems and ecology.[3]

Water availability in deserts may also be hindered by loose sediments. Dust clouds commonly form in windy, arid climates. Scientists have previously theorised that desert dust clouds would enhance rainfall, however, some more recent studies have shown that precipitation is actually inhibited by this phenomenon by absorbing moisture from the atmosphere. This absorption of

atmospheric moisture can result in a positive feedback loop, which leads to further desertification.[4]

Landscape[edit]

Erosion over time due to wind and rains have created beautiful canyons in the landscape. Antelope Canyon, AZ

Desert landscapes can contain a wide variety of geological features, such as oases, rock outcrops, dunes, and mountains.[5] Dunes are structures formed by wind moving sediments into mounds. Desert dunes are generally classified based on their orientation relative to wind directly. Possibly the most recognizable dune type are transverse dunes, characterized by crests transverse to the wind direction. Many dunes are considered to be *active*, meaning that they can travel and change over time due to the influence of the wind. However, some dunes can be anchored in place by vegetation or topography, preventing their movement.[6] Some dunes may also be referred to as *sticky.* These types of dunes occur when individual grains of sand become cemented together. Sticky dunes tend to be more stable, and resistant to wind reworking than loose dunes.[7] Barchan, and Seif dunes are among the most common of desert dunes. Barchan dunes are formed as winds continuously blow in the same direction, and are characterized by a crescent-shape atop the dune. Seif dunes are long and narrow, featuring a sharp crest, and are more common in the Sahara Desert.[8]

Analysis of geological features in desert environments can reveal a lot about the geologic history of the area. Through observation and identification of rock deposits, geologists are able to interpret the order of events that occurred during desert formation. For example, research conducted on the surface geology of the Namib Desert allowed geologists to interpret ancient movements of the Kuiseb River based on rock ages and features identified in the area.[9]

Organism adaptation[edit]

The high body temperatures of bactrian camels allow them to preserve water.

Animals[edit]

Main article: Xerocole

Deserts support diverse communities of plant and animals that have evolved resistance, and circumventing methods of extreme temperatures and arid conditions. For example, desert grasslands are more humid and slightly cooler than its surrounding ecosystems. Many animals obtain energy by eating the surrounding vegetation, however, desert plants are much more difficult for organisms to consume.[10] To avoid intense temperatures, the majority of small desert mammals are nocturnal, living in burrows to avoid the intense desert sun during the daytime. These burrows prevent overheating and dehydration as they maintain an optimal temperature for the mammal.[11] Desert ecology is characterized by dry, alkaline soils, low net production and opportunistic feeding patterns by herbivores and carnivores. Other organisms' survival tactics are physiologically based. Such tactics include the completion of life cycles ahead of anticipated drought seasons, and storing water with the help of specialized organs.[12]

Desert climates are particularly demanding on endothermic organisms. However, endothermic organisms have adapted mechanisms to aid in water retention in habitats such as desert ecosystems which are commonly affected by drought.[13] In environments where the external temperature is less than their body temperature, most endotherms are able to balance heat production and heat loss to maintain a comfortable temperature. However, in deserts where air and ground temperatures exceed body temperature, endotherms must be able to dissipate the large amounts of heat being absorbed in these environments. In order to cope with extreme conditions, desert endotherms have adapted through the means of avoidance, relaxation

of homeostasis, and specializations. Nocturnal desert rodents, like the kangaroo rat, will spend the daytime in cool burrows deep underground, and emerge at night to seek food. Birds are much more mobile than ground-dwelling endotherms, and can therefore avoid heat-induced dehydration by flying between water sources. To prevent overheating, the body temperatures of many desert mammals have adapted to be much higher than non-desert mammals. Camels, for example, can maintain body temperatures that are about equal to typical desert air temperatures. This adaptations allows camels to retain large amounts of water for extended periods of time. Other examples of higher body temperature in desert mammals include the diurnal antelope ground squirrel, and the oryx. Certain desert endotherms have evolved very specific and unique characteristics to combat dehydration. Male sandgrouse have specialized belly feathers that are able to trap and carry water. This allows the sandgrouse to provide a source of hydration for their chicks, who do not yet have the ability to fly to water sources themselves.[14]

The hairy, white bristles of the old man cactus help deflect strong desert sunlight.

Plants[edit]

Main article: Xerophyte

Although deserts have severe climates, some plants still manage to grow. Plants that can survive in arid deserts are called xerophytes, meaning they are able to survive long dry periods. Such plants may close their stomata during the daytime and open them again at night. During

the night, temperatures are much cooler, and plants will experience less water loss, and intake larger amounts of carbon dioxide for photosynthesis.

Adaptations in xerophytes include resistance to heat and water loss, increased water storage capabilities, and reduced surface area of leaves. One of the most common families of desert plants are the cacti, which are covered in sharp spines or bristles for defence against herbivory. The bristles on certain cacti also have the ability to reflect sunlight, such as those of the old man cactus. Certain xerophytes, like oleander, feature stomata that are recessed as a form of protection against hot, dry desert winds, which allows the leaves to retain water more effectively. Another unique adaptation can be found in xerophytes like ocotillo, which are "leafless during most of the year, thereby avoiding excessive water loss".

There are also plants called phreatophytes which have adapted to the harsh desert conditions by developing extremely long root systems, some of which are 80 ft. long; to reach the water table which ensures a water supply to the plant.

The harsh climate of most desert regions is a major obstacle in conducting research into these ecosystems. In the environments requiring special adaptations to survive, it is often difficult or even impossible for researchers to spend extended periods of time investigating the ecology of such regions. To overcome the limitations imposed by desert climates, some scientists have used technological advancements in the area of remote sensing and robotics. One such experiment, conducted in 1997, had a specialised robot named Nomad travel through a portion of the Atacama Desert. During this expedition, Nomad travelled over 200 kilometres and provided the researchers with many photographs of sites visited along its path

GRASS LAND ECOSYSTEM

The Grassland Ecosystem is also called transitional landscape because grassland ecosystems are dominated by the grass with few or no trees in the area where there is not enough for a forest and too much of a forest. These are known by different names in different region of the world like steppes in Europe and Asia, pampas in South America, Veldt in South Africa and Downs in Australia. In this article, we are giving the components, functions and economic importance of the Grassland Ecosystem.

The Grassland Ecosystem covers about 10 percent of the Earth's surface. It is found where rainfall is about 15-75 cm per year not enough to support a forest, but more than that of true desert. Typical grasslands are vegetation formations that are generally found in temperate climates.

These are known by different names in different region of the world like steppes in Europe and Asia, pampas in South America, Veldt in South Africa and Downs in Australia. In India, they are found mainly high Himalayas. The rest of India’s grasslands are mainly composed of the Steppes and Savana. Steppe formations occupy large areas of sandy and saline soils.

What is Grassland Ecosystem?

Grassland Ecosystem is an area where the vegetation is dominated by grasses and other herbaceous (non-woody) plants. It is also called transitional landscape because grassland ecosystems are dominated by the grass with few or no trees in the area where there is not enough for a forest and too much of a forest.

Components of Grassland Ecosystem

The components of the Grassland Ecosystem are discussed below:

1. Abiotic Components: These are non-living thing components consist of carbon, hydrogen, sulphur, nitrogen and phosphorous etc.
2. Biotic Components: These are living components and its sub-components are discussed below-

(I) Producers: The primary producers of food are the grasses such as Aristida, Cynodon, Digitaria, Desmodium, Setaria etc. If herbs and shrubs are present, they also contribute to the primary production of food.

(II) Consumers: The consumers in a grassland ecosystem are of three levels.

(a) Primary consumers: These feed directly from the grasses (grazing) and include herbivores such as Cows, Buffaloes, Goats, Rabbits, Mouse etc. and also insects, termites, centipede, millipedes etc.

(b) Secondary consumers: These consumers are the carnivorous animals such as snakes, lizard, jackal, foxes, frogs etc. which feed on the primary consumers.

(c) Tertiary consumers: Hawk, Eagles and vultures constitute the tertiary consumer in the grassland ecosystem which preys upon the secondary and primary consumer.

(III) Decomposers: The organic matter of the grassland is decomposed by the microbes like actinomycetes, fungi (Mucor, Aspergillus, Rhizopus, Penincillium, and Cladosporium), aerobic and anaerobic soil bacteria etc. They release the minerals back into the soil thus making the soil fertile.

Functions of the Grassland Ecosystem

The primary function of an ecosystem is productivity. The producers fix the solar energy and produce the complex organic matter with the help of minerals. It provides forage for livestock, protection and conservation of soil and water resources, furnishing a habitat for wildlife, both flora and fauna and (contribution to the attractiveness of the landscape. The functional aspects of the Grassland can be studied by two means:

1. Food Chain in an ecosystem: There is an important feature of the ecosystem that one level of an organism serves as food for another level of the organism. A series is formed which is known as Food Chain. In an ecosystem, the food chain does not follow the linear pattern, but an organism may feed upon more than one organism in the same food chain or upon organisms of different food chains. Thus interconnected food chain system is formed known as a food web.

2. Nutrient cycle in an ecosystem: For any ecosystem to be successful, it is important that the constituent materials move in a cyclic manner. The producers (green plant) takes up the mineral elements from the soil and air, convert them into organic form and after passing through the different trophic levels, are again returned to the soil and air.

Economic importance of Grassland Ecosystem

Grass lands biomes are important to maintain the crop of many domesticated and wild herbivores such as horse, mule, ass, cow, pig, sheep, goat, buffalo, camel, deer, zebra etc. which provides food, milk, wool and transportation to man.

Hence, we can say that the Grassland Ecosystem is a mixture of grass, clover and other leguminous species, dicotyledonous, herbs and shrubs which contribute to a high degree of the preservation.

FRESHWATER ECOSYSTEM

LENTIC AND LOTIC ECOSYSTEM

Lentic ecosystem (also called the lacustrine ecosystem or the still water ecosystem) and lotic ecosystem (also called the riverine ecosystem) are two types of water ecosystems, the first dealing with still water ecosystems and the second dealing with flowing water ecosystems. Together, they are the two ecosystems that make up the study of freshwater ecology, also known as aquatic ecology.

Lentic Features

A lentic ecosystem entails a body of standing water, ranging from ditches, seeps, ponds, seasonal pools, basin marshes and lakes. Deeper waters, such as lakes, may have layers of ecosystems, influenced by light. Ponds, due to their having more light penetration, are able to support a diverse range of water plants.

Lotic Features

A lotic ecosystem can be any kind of moving water, such as a run, creek, brook, river, spring, channel or stream. The water in a lotic ecosystem, from source to mouth, must have atmospheric gases, turbidity, longitudinal temperature gradation and material dissolved in it.

Lotic ecosystems have two main zones, rapids and pools. Rapids are the areas where the water is fast enough to keep the bottom clear of materials, while pools are deeper areas of water where the currents are slower and silt builds up.

Considerations

Like any ecosystems, lentic and lotic ecosystems can be destroyed through natural or human interaction. Lentic and lotic systems may succumb to such things as climate change, being dammed, drained, filled or undergo an invasive species invasion.

MARINE ECOSYTEM

Marine ecosystems are the largest of Earth's aquatic ecosystems and are distinguished by waters that have a high salt content. These systems contrast with freshwater ecosystems, which have a lower salt content. Marine waters cover more than 70% of the surface of the Earth and account for more than 97% of Earth's water supply[1][2] and 90% of habitable space on Earth.[3] Marine ecosystems include nearshore systems, such as the salt marshes, mudflats, seagrass meadows, mangroves, rocky intertidal systems and coral reefs. They also extend outwards from the coast to include offshore systems, such as the surface ocean, pelagic ocean waters, the deep sea, oceanic hydrothermal vents, and the sea floor. Marine ecosystems are characterized by the biological community of organisms that they are associated with and their physical environment.

Marine ecosystems are important sources of ecosystem services and food and jobs for significant portions of the global population. Human uses of marine ecosystems and pollution in marine ecosystems are significantly threats to the stability of these ecosystems. Moreover, much of the carbon dioxide causing global warming and heat captured by global warming are absorbed by the ocean, ocean chemistry is changing through processes like ocean acidification which in turn threatens marine ecosystems. Because of these opportunities in marine ecosystems for humans and the threats created by humans, the international community has prioritized "Life below water" as Sustainable Development Goal 14 to "Conserve and sustainably use the oceans, seas and marine resources for sustainable development".

Coral reefs[edit]

Coral reef

Main article: Coral reef

Coral reefs are one of the most well-known marine ecosystems in the world, with the largest being the Great Barrier Reef. These reefs are composed of large coral colonies of a variety of

species living together. The corals from multiple symbiotic relationships with the organisms around them.

Mangroves

Mangrove forests

Main article: Mangrove

Mangroves are trees or shrubs that grow in low-oxygen soil near coastlines in tropical or subtropical latitudes. They are an extremely productive and complex ecosystem that connects the land and sea. Mangroves consist of species that are not necessarily related to each other and are often grouped for the characteristics they share rather than genetic similarity.[7] Because of their proximity to the coast, they have all developed adaptions such as salt excretion and root aeration to live in salty, oxygen-depleted water. Mangroves can often be recognized by their dense tangle of roots that act to protect the coast by reducing erosion from storm surges, currents, wave, and tides. The mangrove ecosystem is also an important source of food for many species as well as excellent at sequestering carbon dioxide from the atmosphere with global mangrove carbon storage is estimated at 34 million metric tons per year.

Seagrass meadows

Seagrass meadow

Main article: Seagrass meadows

Seagrasses form dense underwater meadows which are among the most productive ecosystems in the world. They provide habitats and food for a diversity of marine life comparable to coral reefs. This includes invertebrates like shrimp and crabs, cod and flatfish, marine mammals and birds. They provide refuges for endangered species such as seahorses, turtles, and dulongs. They function as nursery habitats for shrimps, scallops and many commercial fish species. Seagrass meadows provide coastal storm protection by the way their leaves absorb energy from waves as they hit the coast. They keep coastal waters healthy by absorbing bacteria and nutrients, and slow the speed of climate change by sequestering carbon dioxide into the sediment of the ocean floor.

Seagrasses evolved from marine algae which colonized land and became land plants, and then returned to the ocean about 100 million years ago. However, today seagrass meadows are being damaged by human activities such as pollution from land runoff, fishing boats that drag dredges or trawls across the meadows uprooting the grass, and overfishing which unbalances the ecosystem. Seagrass meadows are currently being destroyed at a rate of about two football fields every hour.

Kelp forests[edit]

Kelp forest

Main article: Kelp forest

Kelp forests occur worldwide throughout temperate and polar coastal oceans.[8] In 2007, kelp forests were also discovered in tropical waters near Ecuador.[9]

Physically formed by brown macroalgae, kelp forests provide a unique habitat for marine organisms[10] and are a source for understanding many ecological processes. Over the last century, they have been the focus of extensive research, particularly in trophic ecology, and continue to provoke important ideas that are relevant beyond this unique ecosystem. For

example, kelp forests can influence coastal oceanographic patterns[11] and provide many ecosystem services.[12]

However, the influence of humans has often contributed to kelp forest degradation. Of particular concern are the effects of overfishing nearshore ecosystems, which can release herbivores from their normal population regulation and result in the overgrazing of kelp and other algae.[13] This can rapidly result in transitions to barren landscapes where relatively few species persist.[14][15] Already due to the combined effects of overfishing and climate change, kelp forests have all but disappeared in many especially vulnerable places, such as Tasmania's east coast and the coast of Northern California.[16][17] The implementation of marine protected areas is one management strategy useful for addressing such issues, since it may limit the impacts of fishing and buffer the ecosystem from additive effects of other environmental stressors.

Estuaries[edit]

Estuaries

Main article: Estuaries

Estuaries occur where there is a noticeable change in salinity between saltwater and freshwater sources. This is typically found where rivers meet the ocean or sea. The wildlife found within estuaries is unique as the water in these areas is brackish - a mix of freshwater flowing to the ocean and salty seawater. Other types of estuaries also exist and have similar characteristics as traditional brackish estuaries. The Great Lakes are a prime example. There, river water mixes with lake water and creates freshwater estuaries.[18] Estuaries are extremely productive ecosystems that many humans and animal species rely on for various activities. This can be seen as, of the 32 largest cities in the world, 22 are located on estuaries as they provide many environmental and economic benefits such as crucial habitat for many species, and being economic hubs for many coastal communities. Estuaries also provide essential ecosystem

services such as water filtration, habitat protection, erosion control, gas regulation nutrient cycling, and it even gives education, recreation and tourism opportunities to people.

Lagoon

Lagoons[edit]

Main article: Lagoons

Lagoons are areas that are separated from larger water by natural barriers such as coral reefs or sandbars. There are two types of lagoons, coastal and oceanic/atoll lagoons. A coastal lagoon is, as the definition above, simply a body of water that is separated from the ocean by a barrier. An atoll lagoon is a circular coral reef or several coral islands that surround a lagoon. Atoll lagoons are often much deeper than coastal lagoons. Most lagoons are very shallow meaning that they are greatly affected by changed in precipitation, evaporation and wind. This means that salinity and temperature are widely varied in lagoons and that they can have water that ranges from fresh to hypersaline. Lagoons can be found in on coasts all over the world, on every continent except Antarctica and is an extremely diverse habitat being home to a wide array of species including birds, fish, crabs, plankton and more. Lagoons are also important to the economy as they provide a wide array of ecosystem services in addition to being the home of so many different species. Some of these services include fisheries, nutrient cycling, flood protection, water filtration, and even human tradition.

Salt marsh

Salt marshes

Main article: Salt marsh

Salt marshes are a transition from the ocean to the land, where fresh and saltwater mix. The soil in these marshes is often made up of mud and a layer of organic material called peat. Peat is characterized as waterlogged and root-filled decomposing plant matter that often causes low oxygen levels (hypoxia). These hypoxic conditions causes growth of the bacteria that also gives salt marshes the sulfurous smell they are often known for. Salt marshes exist around the world and are needed for healthy ecosystems and a healthy economy. They are extremely productive ecosystems and they provide essential services for more than 75 percent of fishery species and protect shorelines from erosion and flooding.[24] Salt marshes can be generally divided into the high marsh, low marsh, and the upland border. The low marsh is closer to the ocean, with it being flooded at nearly every tide except low tide. The high marsh is located between the low marsh and the upland border and it usually only flooded when higher than usual tides are present. The upland border is the freshwater edge of the marsh and is usually located at elevations slightly higher than the high marsh. This region is usually only flooded under extreme weather conditions and experiences much less waterlogged conditions and salt stress than other areas of the marsh.

Intertidal zones[edit]

Intertidal zones

Main article: Intertidal zone

Intertidal zones are the areas that are visible and exposed to air during low tide and covered up by saltwater during high tide. There are four physical divisions of the intertidal zone with each one having its distinct characteristics and wildlife. These divisions are the Spray zone, High intertidal zone, Middle Intertidal zone, and Low intertidal zone. The Spray zone is a damp area that is usually only reached by the ocean and submerged only under high tides or storms. The high intertidal zone is submerged at high tide but remains dry for long periods between high tides. Due to the large variance of conditions possible in this region, it is inhabited by resilient wildlife that can withstand these changes such as barnacles, marine snails, mussels and hermit crabs. Tides flow over the middle intertidal zone two times a day and this zone has a larger variety of wildlife. The low intertidal zone is submerged nearly all the time except during the lowest tides and life is more abundant here due to the protection that the water gives.

Estuary ecosytem

An estuary is a partially enclosed body of water, and its surrounding coastal habitats, where salt water from the ocean typically mixes with fresh water from rivers or streams. They are classified by the geology that defines them or the way in which water circulates throughout them. The habitats that surround an estuary as well as the populations of plants and animals that inhabit them are specially adapted to their environment.

Estuarine Populations

Because species living in most estuaries have to deal with constant changes in salinity, these environments harbor many unique populations of organisms. Salt marshes are covered with salt-tolerant plants, such as smooth cordgrass. Mangrove trees that grow in oxygen-poor soils populate mangrove forests. Oysters, such as those found in the Chesapeake Bay, are often found in estuaries because they are able to adapt their behavior to the changing environment.

Estuarine Habitats

A rich array of habitats surrounds estuaries. The type of habitat is usually determined by the local geology and climate. Habitats associated with estuaries include salt marshes, mangrove forests, mudflats, tidal streams, rocky intertidal shores, and barrier beaches.

Classifying Estuaries

While each estuary is unique, they are classified into a few broad types based on their geology and patterns of water circulation. The features of an estuary are determined by a region’s geology and its physical, chemical, and climatic conditions. Water movements in estuaries transport organisms, circulate and renew nutrients and oxygen, and remove wastes. The daily mixing of fresh water and salt water in estuaries leads to variable and dynamic chemical conditions (especially salinity).