

Ecosystem

Introduction

An **ecosystem** is a community of living organisms in conjunction with the nonliving components of their environment (things like air, water and mineral soil), interacting as a system. These biotic and abiotic components are regarded as linked together through nutrient cycles and energy flows. As ecosystems are defined by the network of interactions among organisms, and between organisms and their environment, they can be of any size but usually encompass specific, limited spaces (although some scientists say that the entire planet is an ecosystem).

Energy, water, nitrogen and soil minerals are other essential abiotic components of an ecosystem. The energy that flows through ecosystems is obtained primarily from the sun. It generally enters the system through photosynthesis, a process that also captures carbon from the atmosphere. By feeding on plants and on one another, animals play an important role in the movement of matter and energy through the system. They also influence the quantity of plant and microbial biomass present. By breaking down dead organic matter, decomposers release carbon back to the atmosphere and facilitate nutrient cycling by converting nutrients stored in dead biomass back to a form that can be readily used by plants and other microbes.

Ecosystems are controlled both by external and internal factors. External factors such as climate, the parent material that forms the soil, and topography control the overall structure of an ecosystem and the way things work within it, but are not themselves influenced by the ecosystem. Other external factors include time and potential biota. Ecosystems are dynamic entities—invariably, they are subject to periodic disturbances and are in the process of recovering from some past disturbance. Ecosystems in similar environments that are located in different parts of the world can have very different characteristics simply because they contain different species.

The introduction of non-native species can cause substantial shifts in ecosystem function. Internal factors not only control ecosystem processes but are also controlled by them and are often subject to feedback loops. While the resource inputs are generally controlled by external processes like climate and parent material, the availability of these resources within the ecosystem is controlled by internal factors like decomposition, root competition or shading. Other internal factors include disturbance, succession and the types of species present. Although humans exist and operate within ecosystems, their cumulative effects are large enough to influence external factors like climate.

Biodiversity affects ecosystem function, as do the processes of disturbance and succession. Ecosystems provide a variety of goods and services upon which people depend; the principles of ecosystem management suggest that rather than managing individual species, natural resources should be managed at the level of the ecosystem itself. Classifying ecosystems into ecologically homogeneous units is an important step towards effective ecosystem management, but there is no single, agreed-upon way to do this.

Ecosystem Structure

At a basic functional level, ecosystem generally contains primary producers (plants) capable of harvesting energy from the sun through the process called photosynthesis. This energy then flows through the food chain. Next come **consumers**. Consumers could be **primary consumers** (herbivores) or **secondary consumers** (carnivores).

These consumers feed on the captured energy. Decomposers work at the bottom of the food chain. Dead tissues and waste products are produced at all levels. Scavengers, detritivores and decomposers not only feed on this energy but also break organic matter back into its organic constituents. It is the microbes that finish the job of decomposition and produce organic constituents that can again be used by producers.

Energy that flows through the food chain i.e. from producers to consumers to decomposers is always inefficient. That means less energy is available at secondary consumers level than at primary producers level. Its not surprising but amount of energy produced from place to place varies a lot due to amount of solar radiation and the availability of nutrients and water.

Function of an Ecosystem

Many of the most important relationships between living organisms and the environment are controlled ultimately by the amount of available incoming energy received at the Earth's surface from the sun. It is this energy, which helps to drive biotic systems. The sun's energy allows plants to convert inorganic chemicals into organic compounds. Only a very small proportion of the sunlight received at the Earth's surface is transformed into biochemical form.

Living organisms can use energy in basically two forms: radiant or fixed. Radiant energy exists in the form of electromagnetic energy, such as light. Fixed energy is the potential Chemical energy found in organic substances. This energy can be released through respiration. Organisms that can take energy from inorganic sources and fix it into energy rich organic molecules are called autotrophs.

If this energy comes from light then these organisms are called photosynthetic autotrophs. In most ecosystems plants are the dominant photosynthetic autotroph. Organisms that require fixed energy found in organic molecules for their survival are called heterotrophs. Heterotrophs who obtain their energy from living organisms are called consumers.

Consumers can be of two basic types: Consumer and decomposers. Consumers that consume plants are known as herbivores. Carnivores are consumers who eat herbivores or other carnivores. Decomposers or detritivores are heterotrophs that obtain their energy either from dead organisms or from organic compounds dispersed in the environment.

The behaviour of energy in ecosystem can be termed energy flow due to unidirectional flow of energy, From energetic point of view it is essential to understand for an ecosystem:

- (i) the efficiency of the producers in absorption and conversion of solar energy
- (ii) the use of this converted chemical form of energy by the consumers
- (iii) the total input of energy in the form of food and its efficiency of assimilation
- (iv) the loss through respiration, heat, excretion etc.
- (v) the gross net production. Two energy models to understand typical ecosystem. They are single channel energy models and g-shaped energy flow models.

Types of Ecosystem

There are very many types of ecosystems out there, but the three major classes of ecosystems, sometimes referred to as 'biomes', which are relatively contained, are the following:

- Freshwater Ecosystems
- Terrestrial Ecosystems
- Ocean Ecosystems

Freshwater Ecosystems

These can then be broken up into smaller ecosystems. For instance, in the freshwater ecosystems we find:

- **Pond Ecosystems** – These are usually relatively small and contained. Most of the time they include various types of plants, amphibians and insects. Sometimes they include fish, but as these cannot move around as easily as amphibians and insects, it is less likely, and most of the time fish are artificially introduced to these environments by humans.
- **River Ecosystems** – Because rivers always link to the sea, they are more likely to contain fish alongside the usual plants, amphibians and insects.

These sorts of ecosystems can also include birds because birds often hunt in and around water for small fish or insects.

As is clear from the title, freshwater ecosystems are those that are contained to freshwater environments. This includes, but is not limited to, ponds, rivers and other waterways that are not the sea (which is, of course, saltwater and cannot support freshwater creatures for very long). Freshwater ecosystems are actually the smallest of the three major classes of ecosystems,

accounting for just 1.8% of the total of the Earth's surface. The ecosystems of freshwater systems include relatively small fish (bigger fish are usually found in the sea), amphibians (such as frogs, toads and newts), insects of various sorts and, of course, plants. The absolutely smallest living part of the food web of these sorts of ecosystems is plankton, a small organism that is often eaten by fish and other small creatures.



Terrestrial Ecosystems

Terrestrial ecosystems are many because there are so many different sorts of places on Earth. Some of the most common terrestrial ecosystems that are found are the following:

- **Rainforests** – Rainforests usually have extremely dense ecosystems because there are so many different types of animals all living in a very small area.
- **Tundra** – As mentioned above, tundra usually have relatively simple ecosystems because of the limited amount of life that can be supported in these harsh conditions.
- **Deserts** – Quite the opposite of tundra in many ways, but still harsh, more animals live in the extreme heat than live in the extreme cold of Antarctica, for instance.
- **Savannas** – These differ from deserts because of the amount of rain that they get each year. Whereas deserts get only a tiny amount of precipitation every year, savannas tend to be a bit wetter which is better for supporting more life.
- **Forests** – There are many different types of forests all over the world including deciduous forests and coniferous forests. These can support a lot of life and can have very complex ecosystems.

- **Grasslands** – Grasslands support a wide variety of life and can have very complex and involved ecosystems.

Since there are so many different types of terrestrial ecosystems, it can be difficult to make generalizations that cover them all.

Because terrestrial ecosystems are so diverse, it is difficult to make generalizations about them. However, a few things are true almost all of the time. For instance, most contain herbivores that eat plants (that get their sustenance from the sun and the soil) and all have carnivores that eat herbivores and other carnivores. Some places, such as the poles, contain mainly carnivores because not plant life grows. A lot of animals and plants that grow and live in terrestrial ecosystems also interact with freshwater and sometimes even ocean ecosystems.

Ocean Ecosystems

Ocean ecosystems are relatively contained, although they, like freshwater ecosystems, also include certain birds that hunt for fish and insects close to the ocean's surface. There are different sorts of ocean ecosystems:

- **Shallow water** – Some tiny fish and coral only live in the shallow waters close to land.
- **Deep water** – Big and even gigantic creatures can live deep in the waters of the oceans. Some of the strangest creatures in the world live right at the bottom of the sea.
- **Warm water** – Warmer waters, such as those of the Pacific Ocean, contain some of the most impressive and intricate ecosystems in the world.
- **Cold water** – Less diverse, cold waters still support relatively complex ecosystems. Plankton usually form the base of the food chain, followed by small fish that are either eaten by bigger fish or by other creatures such as seals or penguins.

Ocean ecosystems are amongst some of the most interesting in the world, especially in warm waters such as those of the Pacific Ocean. This is not least because around 75% of the Earth is covered by the sea, which means that there is lots of space for all sorts of different creatures to live and thrive. There are actually three different types of oceanic ecosystems: shallow waters, deep waters and the deep ocean surface. In two of these the very base of the food chain is plankton, just as it is in freshwater ecosystems.

These plankton and other plants that grow in the ocean close to the surface are responsible for 40% of all photosynthesis that occurs on Earth. From this there are herbivorous creatures that eat the plankton, such as shrimp, that are then themselves usually eaten by bigger creatures, particularly fish. Interesting, in the deep ocean, plankton cannot exist because photosynthesis cannot occur since light cannot penetrate that far into the ocean's depths. Down in the deepest depths of the ocean, therefore, creatures have adapted very strangely and are amongst some of the most fascinating and the most terrifying and intriguing living creatures on Earth.

Components of the Ecosystem

An ecosystem has two basic components

- i) Abiotic components
- ii) Biotic components

The relationship between the abiotic components and the biotic components of the ecosystem is termed 'holocoenosis'.

Abiotic Components

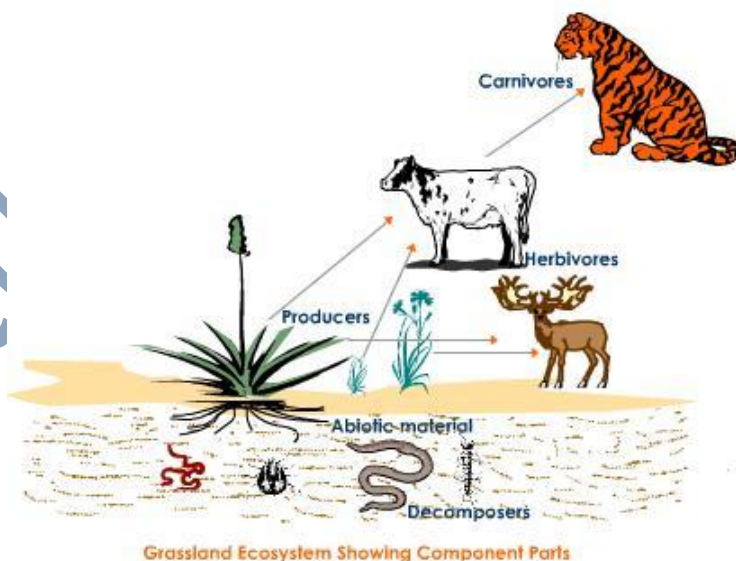
Those include the non-living or physico-chemical factors like air, soil, water and the basic compounds and elements of the environment. Abiotic factors are classified broadly under three categories: Climatic factors, including the climatic regime with physical factors in the environment such as light, atmospheric temperature, wind, humidity, etc; Edaphic factors, which relate to the composition and structure of the soil like its chemical and physical properties – like the soil type, soil profile, organic matter, minerals, soil water, and soil organisms. Inorganic substances like water, carbon, sulphur, nitrogen, phosphorus and so on. Organic substances like proteins, lipids, carbohydrates, humic substances etc.

Biotic Components

It consists of the living parts of the environment, including the association of a lot of interrelated populations that belong to different species inhabiting a common environment. The populations are those of the animal community, the plant community and the microbial community. The biotic community is divided into autotrophs, saprotrophs and heterotrophs.

Autotrophs (from Greek : auto - self, trophos - feeder) are called producers, transducers or convertors, as well.

Those are photosynthetic plants, normally chlorophyll bearing, which synthesize a high-energy complex organic compound (or food) from the inorganic raw materials utilizing the aid of the sun, and this process is called photosynthesis. Autotrophs form the core of all biotic systems.



In terrestrial ecosystems, autotrophs are usually rooted plants. In the aquatic ecosystems, the floating plants referred to as phytoplankton and the shallow water rooted plants – macrophytes - are the main producers.

Heterotrophs (from Greek: heteros - other; trophs - feeder) are the consumers, normally animals that feed on the other organisms. Consumers are also referred to as phagotrophs (phago - to swallow or ingest) while macroconsumers are normally herbivores and carnivores. Herbivores

are called First order or primary consumers, for they feed directly on green plants. For example, Terrestrial ecosystem consumers are cattle, deer, grass hopper, rabbit, etc. Aquatic ecosystem consumers are protozoans, crustaceans, etc.

Carnivores are animals that prey or feed on other animals. Second order consumers or Primary carnivores include those animals that feed on herbivorous animals. For example, fox, frog, smaller fishes, predatory birds, snakes, etc.

Third order consumers or Secondary carnivores are the animals that feed on primary carnivores. For example, wolf, owl, peacock, etc. Some larger carnivores prey on Secondary carnivores. Quaternary consumers or Tertiary carnivores include those animals which feed upon secondary carnivores. For example, the lion, the tiger, etc. Those are not eaten by any other animal. The larger carnivores which cannot be preyed on further are also called the top carnivores.

Saprotrophs (from Greek again: sapos - rotten; trophos - feeder) are called the reducers or decomposers. They break the complex organic compounds in dead matter down (dead plants and animals). Decomposers don't ingest the food. Instead they secrete a digestive enzyme into the dead, decaying plant or animal remains and digest this organic material. The enzymes act on the complex organic compounds in the dead matter. Decomposers absorb a bit of the decomposition products to provide themselves with nourishment. The remaining substance is added as minerals in the process of mineralisation to the substratum. Released minerals are utilised or reused as nutrients by plants - the producers.

Reference

www.google.com

www.wikipedia.com

www.studymafia.org