RGPVNOTES.IN

Program : **B.Tech**

Subject Name: **Energy & Environmental Engineering**

Subject Code: **ES-301**

Semester: **3rd**

UNIT 2: Ecosystems

Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem (a.)Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Ecosystem

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. It refers to both biotic factors as well as abiotic factors. An ecosystem is self-supporting. These biotic and abiotic components are regarded as linked together through nutrient cycles and energy flows

The term 'environment 'originated from the French word environner or environment meaning 'to surround'. From this etymology, environment means the things or events that surround something else. In other words, environment means the area in which something exists or lives. Environment is defined as the social, cultural and physical conditions that surround, affect and influence the survival, growth and development of people, animals or plants. Environment includes everything around us. It encompasses both the living (biotic) and non-living (abiotic) components of the Earth.

Concept of an Ecosystem:

The term ecosystem was coined in 1935 by the Oxford ecologist Arthur Tansley to encompass the interactions among biotic and abiotic components of the environment at a given site. The living and non-living components of an ecosystem are known as biotic and abiotic components, respectively.

Ecosystem was defined in its presently accepted form by Eugene Odum as, "an unit that includes all the organisms, i.e., the community in a given area interacting with the physical environment so that a flow of energy leads to clearly defined trophic structure, biotic diversity and material cycles, i.e., exchange of materials between living and non-living, within the system".

Smith (1966) has summarized common characteristics of most of the ecosystems as follows:

1. The ecosystem is a major structural and functional unit of ecology.

2. The structure of an ecosystem is related to its species diversity in the sense that complex ecosystem have high species diversity.

3. The function of ecosystem is related to energy flow and material cycles within and outside the system.

4. The relative amount of energy needed to maintain an ecosystem depends on its structure. Complex ecosystems needed less energy to maintain themselves.

5. Young ecosystems develop and change from less complex to more complex ecosystems, through the process called succession.

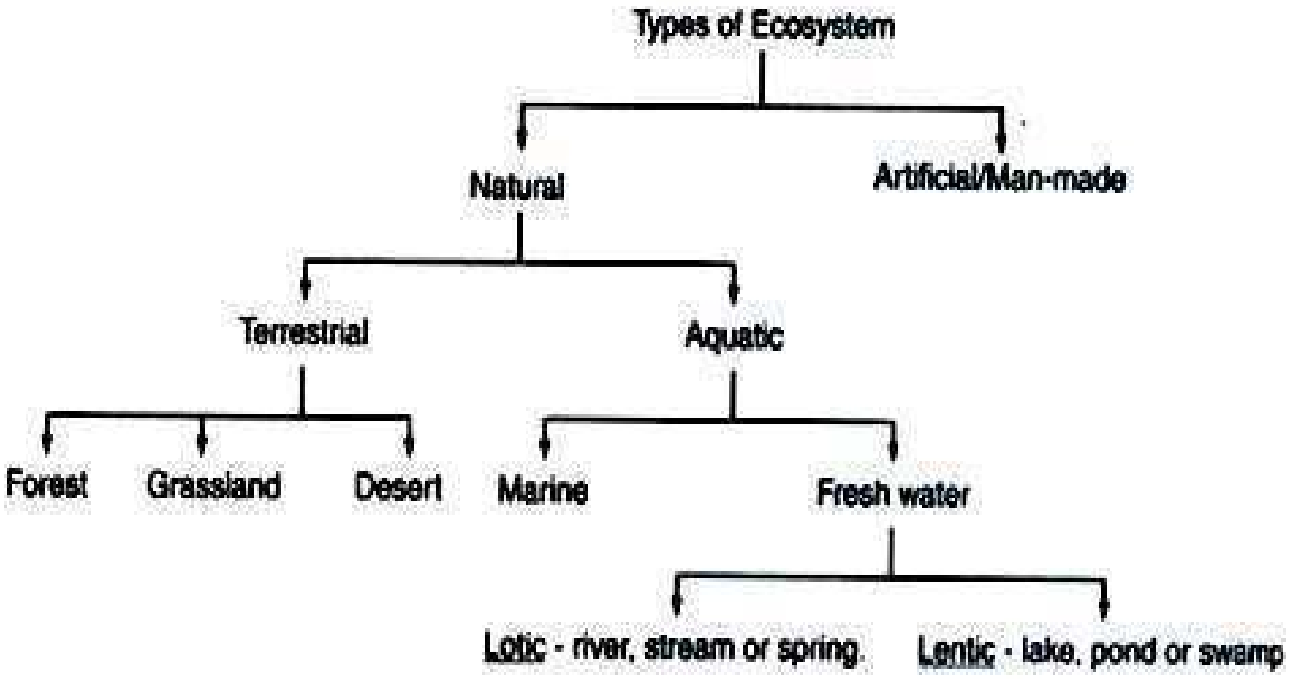
6. Each ecosystem has its own energy budget, which cannot be exceeded.

7. Adaptation to local environmental conditions is the important feature of the biotic components of an ecosystem, failing which they might perish.

8. The function of every ecosystem involves a series of cycles, e.g., water cycle, nitrogen cycle, oxygen cycle, etc. these cycles are driven by energy. A continuation or existence of ecosystem demands exchange of materials/nutrients to and from the different components.

Types of Ecosystem:

We can classify ecosystems as follows:



Types of Ecosystem

(a) Natural Ecosystems:

These ecosystems are capable of operating and maintaining themselves without any major interference by man.

A classification based on their habitat can further be made:

1. Terrestrial ecosystems: forest, grassland and desert.

2. Aquatic ecosystems: fresh water ecosystem, viz. pond, lake, river and marine ecosystems, viz. ocean, sea or estuary.

(b) Artificial Ecosystem:

These are maintained by man. These are manipulated by man for different purposes, e.g., croplands, artificial lakes and reservoirs, townships and cities.

Basic Structure of an Ecosystem:

Every ecosystem has a non-living (abiotic) and living (biotic) components.

Abiotic Components:

Basic inorganic compounds of an organism, habitat or an area like carbon dioxide, water, nitrogen, calcium, phosphorus, etc. that are involved in the material cycles are collectively called as abiotic component. The amount of these inorganic substances present at any given time, in an ecosystem is called as the standing state or standing quality of an ecosystem.

Whereas, organic components e.g., proteins, amino acids, carbohydrates and lipids that are synthesized by the biotic counterpart of an ecosystem make the biochemical structure of the ecosystem. The physical environment, viz. climatic and weather conditions are also included in the abiotic structure of the ecosystem.

Biotic Components:

From the trophic (nutritional) point of view, an ecosystem has autotrophic (self-nourishing) and a heterotrophic (other nourishing) components:

(a) Autotrophic component (Producers):

This component is mainly constituted by the green plants, algae and all photosynthetic organisms. Chemosynthetic bacteria, photosynthetic bacteria, algae, grasses, mosses, shrubs, herbs and trees manufacture food from simple inorganic substances by fixing energy and are therefore called as producers.

(b) Heterotrophic component (Consumers):

The members of this component cannot make their own food. They consume the matter built by the producers and are therefore called as consumers. They may be herbivores, carnivores or omnivores. Herbivores are called as primary consumers whereas carnivores and omnivores are called as secondary consumers. Collectively we can call them as macro-consumers.

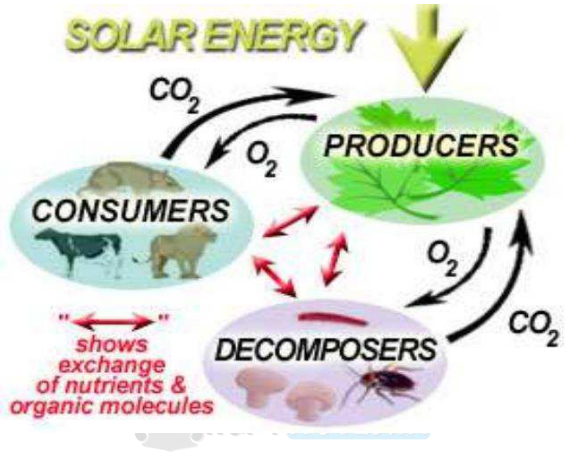
(c) Decomposers:

Heterotrophic organisms chiefly bacteria and fungi that breakdown the complex compounds of dead protoplasm, absorb some of the products and release simple substances usable by the producers are called as decomposers or reducers. Collectively we call them as micro consumers.

Energy flow in Ecosystem:

Organisms can be either producers or consumers in terms of energy flow through an ecosystem. Producers convert energy from the environment into carbon bonds, such as those found in the sugar glucose. Plants are the most obvious examples of producers; plants take energy from sunlight and use it to convert carbon dioxide into glucose (or other sugars). Algae and cyanobacteria are also photo- synthetic producers, like plants.

Other producers include bacteria living around deep-sea vents. These bacteria take energy from chemicals coming from the Earth's interior and use it to make sugars. Other bacteria living deep under-ground can also produce sugars from such inorganic sources. Another word for producers is autotrophs.



Routes of Usage:

Consumers get their energy from the carbon bonds made by the producers. Another word for a consumer is a heterotroph.

Based on what they eat, we can distinguish between 4 types of heterotrophs:

Routes of Usage

A trophic level refers to the organisms position in the food chain. Autotrophs are at the base. Organisms that eat autotrophs are called herbivores or primary consumers. An organism that eats herbivores is a carnivore and a secondary consumer. A carnivore which eats a carnivore which eats a herbivore is a terti-ary consumer, and so on.

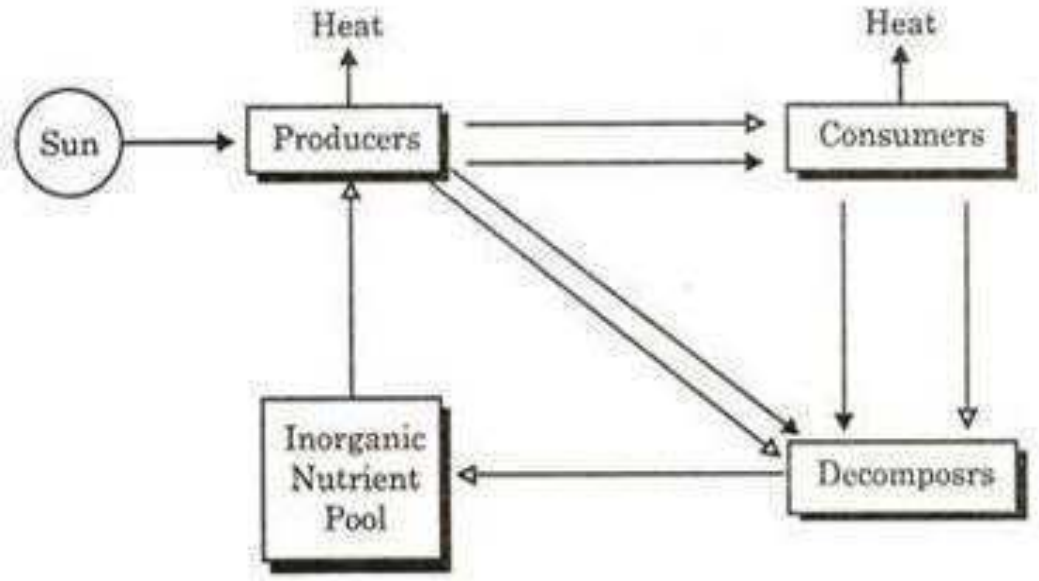
It is important to note that many animals do not specialize in their diets. Omnivores (such as humans) eat both animals and plants. Further, except for some specialists, most carnivores don't discriminate between herbivorous and carnivorous bugs in their diet. If it's the right size, and moving at the right distance, chances are the frog will eat it.

<u>Flow of Energy and its Utilisation:</u>

The diagram 3.5 shows how both energy and inorganic nutrients flow through the ecosystem. Energy "flows" through the ecosystem in the form of carbon- carbon bonds. When respiration occurs, the carbon-carbon bonds are broken and the carbon is combined with oxygen to form carbon dioxide.

This process releases the energy, which is either used by the organism (to move its muscles, digest food, excrete wastes, think, etc.) or the energy may be lost as heat. The dark arrows represent the movement of this energy. Note that all energy comes from the sun, and that the ultimate fate of all energy in ecosystems is to be lost as heat. Energy does not recycle.

The other component shown in the diagram is the inorganic nutrients. They are inorganic because they do not contain carbon-carbon bonds. These inorganic nutrients include the phosphorous in your teeth, bones, and cellular membranes the nitrogen in your amino acids (the building blocks of protein); and the iron in your blood (to name just a few of the inorganic nutrients).



Flow of Energy and its Utilisation

The movement of the inorganic nutrients is represented by the open arrows. Note that the autotrophs obtain these inorganic nutrients from the inorganic nutrient pool, which is usually the soil or water surrounding the plants or algae.

These inorganic nutrients are passed from organism to organism as one organ-ism is consumed by another. Ultimately, all organisms die and become detritus, food for the decomposers. At this stage, the last of the energy is extracted (and lost as heat) and the inorganic nutrients are returned to the soil or water to be taken up again. The inorganic nutrients are recycled, the energy is not.

Ecological succession

Ecological succession is the process of change in the species structure of an ecological community over time. The time scale can be decades (for example, after a wildfire), or even millions of years after a mass extinction.

The community begins with relatively few pioneering plants and animals and develops through increasing complexity until it becomes stable or self-perpetuating as a climax

community. The "engine" of succession, the cause of ecosystem change, is the impact of established species upon their own environments. A consequence of living is the sometimes subtle and sometimes overt alteration of one's own environment.

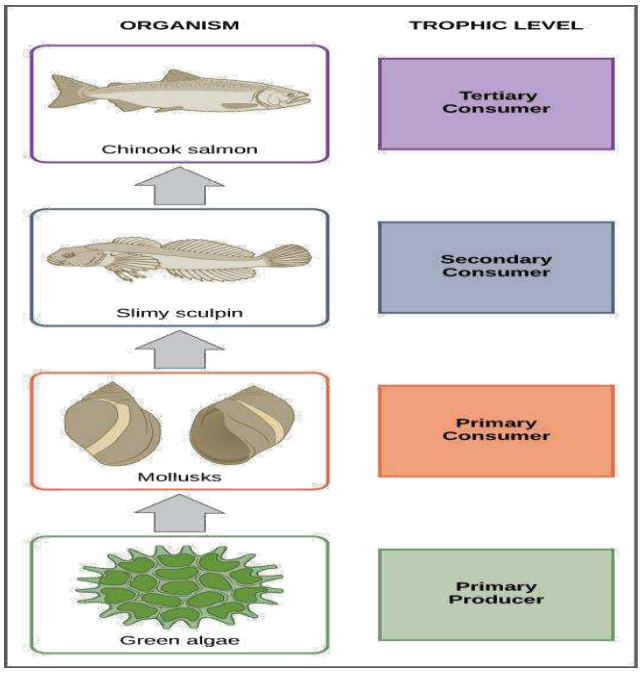
Food chain

A food chain is a linear sequence of organisms through which nutrients and energy pass as one organism eats another. In a food chain, each organism occupies a different trophic level, defined by how many energy transfers separate it from the basic input of the chain.

Parts of a typical food chain, starting from the bottom—the producers—and moving upward.

At the base of the food chain lie the primary producers. The primary producers are autotrophs and are most often photosynthetic organisms such as plants, algae, or cyanobacteria. The organisms that eat the primary producers are called primary consumers. Primary consumers are usually herbivores, plant-eaters, though they may be algae eaters or bacteria eaters. The organisms that eat the primary consumers are called secondary consumers. Secondary consumers are generally meat-eaters—carnivores. The organisms that eat the secondary consumers are called tertiary consumers. These are carnivore-eating carnivores, like eagles or big fish. Some food chains have additional levels, such as quaternary consumers—carnivores that eat tertiary consumers. Organisms at the very top of a food chain are called apex consumers.

We can see examples of these levels in the diagram below. The green algae are primary producers that get eaten by mollusks—the primary consumers. The mollusks then become lunch for the slimy sculpin fish, a secondary consumer, which is itself eaten by a larger fish, the Chinook salmon—a tertiary consumer.

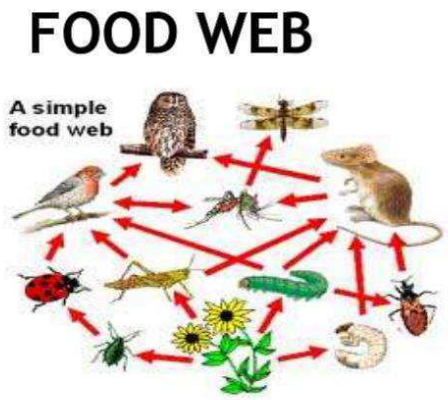


Food web

Food webs consist of many interconnected food chains and are more realistic representation of consumption relationships in ecosystems. Energy transfer between trophic levels is inefficient—with a typical efficiency around 10%. This inefficiency limits the length of food chains.

Or

Food web can be defined as, "a network of food chains which are interconnected at various tropic levels, so as to form a number of feeding connections amongst different organisms of a biotic community". It is also known as consumer-resource system. It is a graphical description of feeding relationships among species in an ecological community. It is also a mean of showing how energy and materials (e.g., carbon) flow through a community of species as a result of these feeding relationships.



Basics of food web

A node is one of the words/pictures that the arrows go toward or away from. A node may represent an individual species, or a group of related species or different stages of a single species (such as one node for adult frogs and a second for juvenile tadpoles). A link connects two nodes. Arrows represent links, and always go from prey to predator (as in food chain). The lowest trophic level are called basal species The highest trophic level are called top predators. Movement of nutrients is cyclic but of energy is unidirectional and non-cyclic.

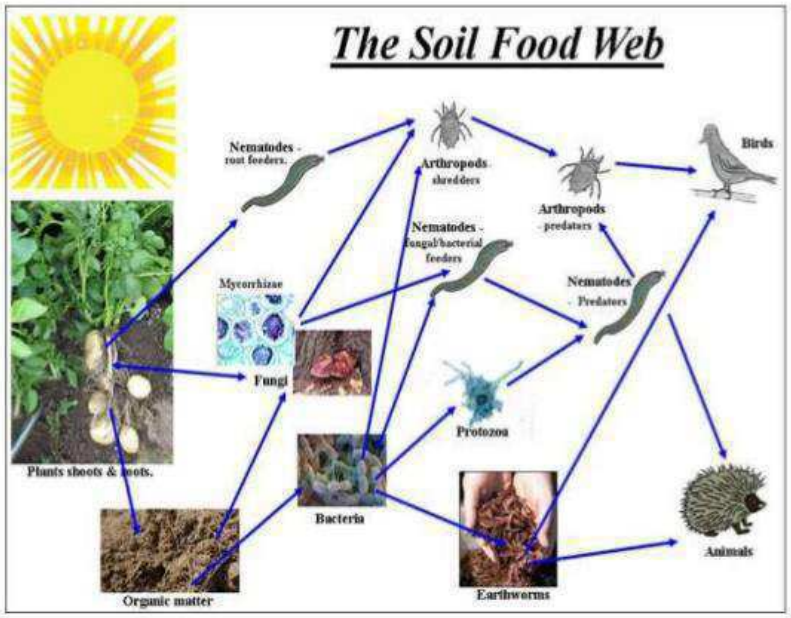
Types Of Food Web Represention

1. **Topological web :- Early food webs were topological. They simply indicate a feeding relationship.**
2. **Flow webs :- Bioenergetic webs, or flow webs, include information on the strength of the feeding interaction. This can be done in one of two ways: Vary the size of the arrow. Thicker arrows represent a larger percentage of the diet. (interactions where more prey are eaten or where more energy flows upward). The amount of energy moving between nodes next to the arrow.**

3. **Interaction webs :- An interaction web is similar to a topological web, but instead of showing the movement of energy or materials, the arrows show how one group influences another. In interaction food web models, every link has two direct effects. One of the resource on the consumer and one of the consumer on the resource. The effect of the resource on the consumer is positive, (the consumer gets to eat) and the effect on the resource by the consumer is negative (it is eaten).**

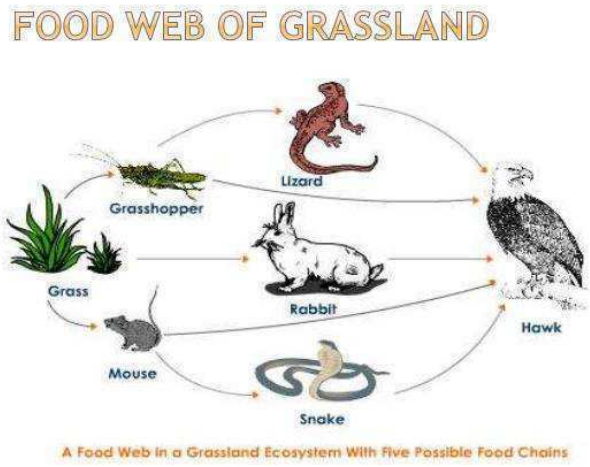
Types of food webs

1. **Soil food web:- The soil food web is the community of organisms living all or part of their lives in the soil. It describes a complex living system in the soil and how it interacts with the environment, plants, and animals.**



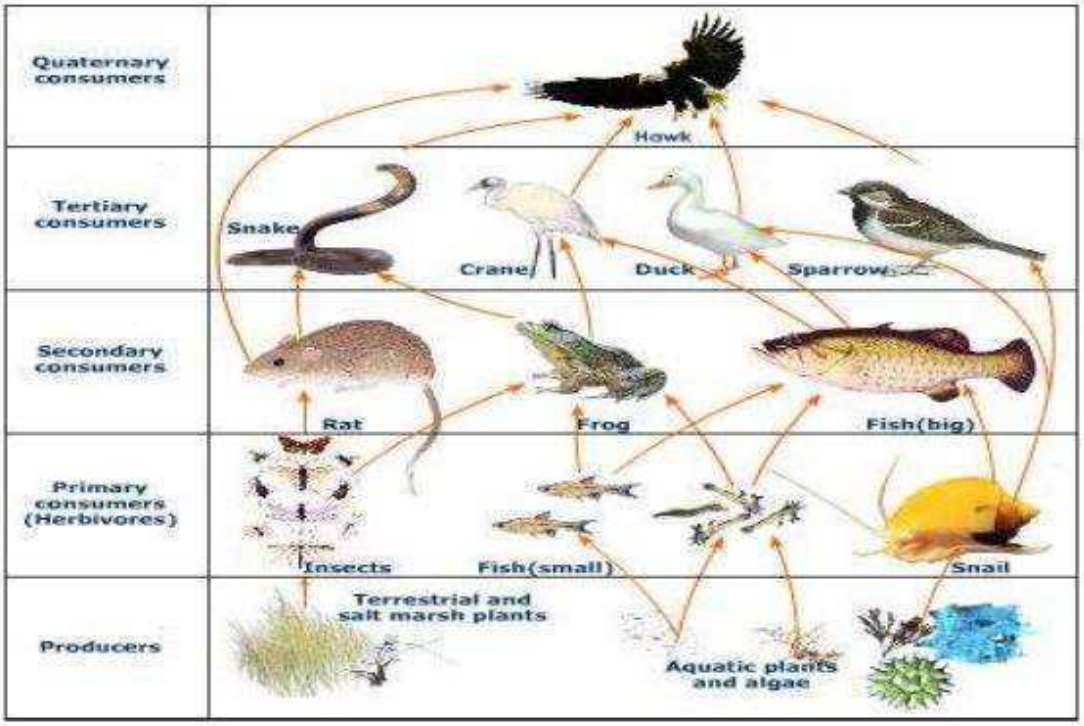
2. **Aquatic food web:- A balanced food web is essential to any marine or fresh water system, and can be an indicator of habitat quality. Planktonic algae are the foundation of aquatic food webs. The size and diversity of the planktonic algae community determines the diversity of the zooplankton community that can be supported as well as the small fish community.**
3. **Food web in forest:-**

4. **Food web of grassland**



5. **Food web in terrestrial and aquatic ecosystem**

FOOD WEB IN TERRESTRIAL AND AQUATIC ECOSYSTEM



Ecological Pyramid

An ecological pyramid is a graphical representation of the relationship between different organisms in an ecosystem. Each of the bars that make up the pyramid represents a different trophic level, and their order, which is based on who eats whom, represents the flow of energy. Energy moves up the pyramid, starting with the primary producers, or autotrophs, such as plants and algae at the very bottom, followed by the primary consumers, which feed on these plants, then secondary consumers, which feed on the primary consumers, and so on. The height of the bars should all be the same, but the width of each bar is based on the quantity of the aspect being measured.

Types of Ecological Pyramids

Pyramid of numbers

This shows the number of organisms in each trophic level without any consideration for their size. This type of pyramid can be convenient, as counting is often a simple task and can be done over the years to observe the changes in a particular ecosystem. However, some types of organisms are difficult to count, especially when it comes to some juvenile forms. Unit: number of organisms.

Pyramid of biomass

This indicates the total mass of organisms at each trophic level. Usually, this type of pyramid is largest at the bottom and gets smaller going up, but exceptions do exist. The biomass of

one trophic level is calculated by multiplying the number of individuals in the trophic level by the average mass of one individual in a particular area. This type of ecological pyramid solves some problems of the pyramid of numbers, as it shows a more accurate representation of the amount of energy contained in each trophic level, but it has its own limitations. For example, the time of year when the data are gathered is very important, since different species have different breeding seasons. Also, since it's usually impossible to measure the mass of every single organism, only a sample is taken, possibly leading to inaccuracies. Unit: g m-2 or Kg m2.

Pyramid of productivity

The pyramid of productivity looks at the total amount of energy present at each trophic level, as well as the loss of energy between trophic levels. Since this type of representation takes into account the fact that the majority of the energy present at one trophic level will not be available for the next one, it is more accurate than the other two pyramids. This idea is based on Lindeman's Ten Percent Law, which states that only about 10% of the energy in a trophic level will go towards creating biomass. In other words, only about 10% of the energy will go into making tissue, such as stems, leaves, muscles, etc. in the next trophic level. The rest is used in respiration, hunting, and other activities, or is lost to the surroundings as heat. What's interesting, however, is that toxins are passed up the pyramid very efficiently, which means that as we go up the ecological pyramid, the amount of harmful chemicals is more and more concentrated in the organisms' bodies. This is what we call biomagnification.

The pyramid of productivity is the most widely used type of ecological pyramid, and, unlike the two other types, can never be largest at the apex and smallest at the bottom. It's an important type of ecological pyramid because it examines the flow of energy in an ecosystem over time. Unit: J m-2 yr-1, where Joule is the unit for energy, which can be interchanged by other units of energy such as Kilojoule, Kilocalorie, and calorie.

While a productivity pyramid always takes an upright pyramid shape, number pyramids are sometimes inverted, or don't take the shape of an actual pyramid at all. To demonstrate, let's take an oak tree, which can feed millions of oakworms. If we consider this ecosystem as our focus, then the producers' level (one tree) will end up much smaller than the primary consumers' level (millions of insects). This is less likely to occur in biomass pyramids, but is not impossible. The pyramids below show the different types of pyramids and the shapes they can have in different ecosystems.

Ecological Pyramid Examples

The diagram below is an example of a productivity pyramid, otherwise called an energy pyramid. The sun has been included in this diagram, as it's the main source of all energy, as well the decomposers, like bacteria and fungi, which can acquire nutrients and energy from all trophic levels by breaking down dead or decaying organisms. As shown, the nutrients then go back into the soil and are taken up by plants.

The loss of energy to the surroundings is also shown in this diagram, and the total energy transfer has been calculated. We start off with the total amount of energy that the primary producers contain, which is indicated by 100%. As we go up one level, 90% of that energy is used in ways other than to create flesh. What the primary consumers end up with is just 10% of the starting energy, and, 10% of that 10% is lost in the transfer to the next level. That's 1%, and so on. The predators at the apex, then, will only receive 0.01% of the starting energy! This inefficiency in the system is the reason why productivity pyramids are always upright.

Function of Ecological Pyramid

An ecological pyramid not only shows us the feeding patterns of organisms in different ecosystems, but can also give us an insight into how inefficient energy transfer is, and show the influence that a change in numbers at one trophic level can have on the trophic levels above and below it. Also, when data are collected over the years, the effects of the changes that take place in the environment on the organisms can be studied by comparing the data. If an ecosystem's conditions are found to be worsening over the years because of pollution or overhunting by humans, action can be taken to prevent further damage and possibly reverse some of the present damage.

Related Biology Terms

Trophic level – The position that an organism occupies within a food chain or an ecological pyramid, such as a producer, or a primary consumer. Many animals feed at several different trophic levels.

Species – A group of organisms that exhibit common characteristics and can breed among themselves to produce fertile offspring.

Ecosystem – A community of interdependent living organisms in association with the nonliving elements surrounding them. The way the living organisms and the physical environment interact is by exchange of nutrients and energy.

Food web – A system of food chains that are interlocked with one another. Unlike in food chains, an organism in a food web can occupy several different trophic levels.

Or

Ecological Pyramid

An ecological pyramid (also trophic pyramid, energy pyramid, or sometimes food pyramid) is a graphical representation designed to show the biomass or bio productivity at each trophic level in a given ecosystem. Biomass is the amount of living or organic matter present in an organism. Biomass pyramids show how much biomass is present in the organisms at each trophic level, while productivity pyramids show the production or turnover in biomass. Ecological pyramids begin with producers on the bottom (such as plants) and proceed

through the various trophic levels (such as herbivores that eat plants, then carnivores that eat herbivores, then carnivores that eat those carnivores, and so on). The highest level is the top of the chain. An ecological pyramid of biomass shows the relationship between biomass and trophic level by quantifying the biomass present at each trophic level of an ecological community at a particular time. It is a graphical representation of biomass (total amount of living or organic matter in an ecosystem) present in unit area in different tropic levels. Typical units are grams per meter2, or calories per meter2.

General concepts

Energy flows through the food chain in a predictable way, entering at the base of the food chain, by photosynthesis in primary producers, and then moving up the food chain to higher trophic levels. Because the transfer of energy from one trophic level to the next is inefficient, there is less energy entering higher trophic levels.

It may also be useful and productive to examine how the number and biomass of organisms vary across trophic levels. Both the number and biomass of organisms at each trophic level should be influenced by the amount of energy entering that trophic level. When there is a direct correlation between energy, numbers, and biomass then biomass pyramids and numbers pyramids will result. However, the relationship between energy, biomass, and number can be complicated by the growth form and size of organisms and ecological relationships occurring among trophic levels. Thus, it is possible, and common that biomass pyramids and numbers pyramids do not look like pyramids at all

Types

There are 3 types of ecological pyramids as described as follows:
Pyramid of Energy
Pyramid of numbers
Pyramid of biomass.

Pyramid of Energy

The pyramid of energy or the energy pyramid describes the overall nature of the ecosystem. During the flow of energy from organism to other, there is considerable loss of energy in the form of heat. The primary producers like the autotrophs there is more amount of energy available. The least energy is available in the tertiary consumers. Thus, shorter food chain has more amount of energy available even at the highest trophic level.

1. The energy pyramid always upright and vertical.
2. This pyramid shows the flow of energy at different trophic levels. It depicts the energy is minimum as the highest trophic level and is maximum at the lowest trophic level.
3. At each trophic level, there is successive loss of energy in the form of heat and respiration, etc.

Pyramid of Numbers

The pyramid of numbers depicts the relationship in terms of the number of producers, herbivores and the carnivores at their successive trophic levels. There is a decrease in the number of individuals from the lower to the higher trophic levels. The number pyramid varies from ecosystem to ecosystem.

There are three of pyramid of numbers:

1. **Upright pyramid of number**
2. **Partly upright pyramid of number and**
3. **Inverted pyramid of number.**

1. **Upright Pyramid of Number :- This type of pyramid number is found in the aquatic and grassland ecosystem, in these ecosystems there are numerous small autotrophs which support lesser herbivores which in turn support smaller number of carnivores and hence this pyramid is upright.**
2. **Partly Upright pyramid of Number :- It is seen in the forest ecosystem where the number of producers are lesser in number and support a greater number of herbivores and which in turn support a fewer number of carnivores.**
3. **Inverted Pyramid of Number :- This type of ecological pyramid is seen in parasitic food chain where one primary producer supports numerous parasites which support more hyperparasites.**

Pyramid of Biomass

The pyramid of biomass is more fundamental, they represent the quantitative relationships of the standing crops. In this pyramid there is a gradual decrease in the biomass from the producers to the higher trophic levels. The biomass here the net organisms collected from each feeding level and are then dried and weighed. This dry weight is the biomass and it represents the amount of energy available in the form of organic matter of the organisms. In this pyramid the net dry weight is plotted to that of the producers, herbivores, carnivores, etc.

There are two types of pyramid of biomass, they are:

1. **Upright pyramid of biomass and**
2. **Inverted pyramid of biomass.**

1. **Upright Pyramid of Biomass:- This occurs when the larger net biomass of producers support a smaller weight of consumers.**

   Example: Forest ecosystem.

2. **Inverted Pyramid of Biomass: - This happens when the smaller weight of producers support consumers of larger weight.**

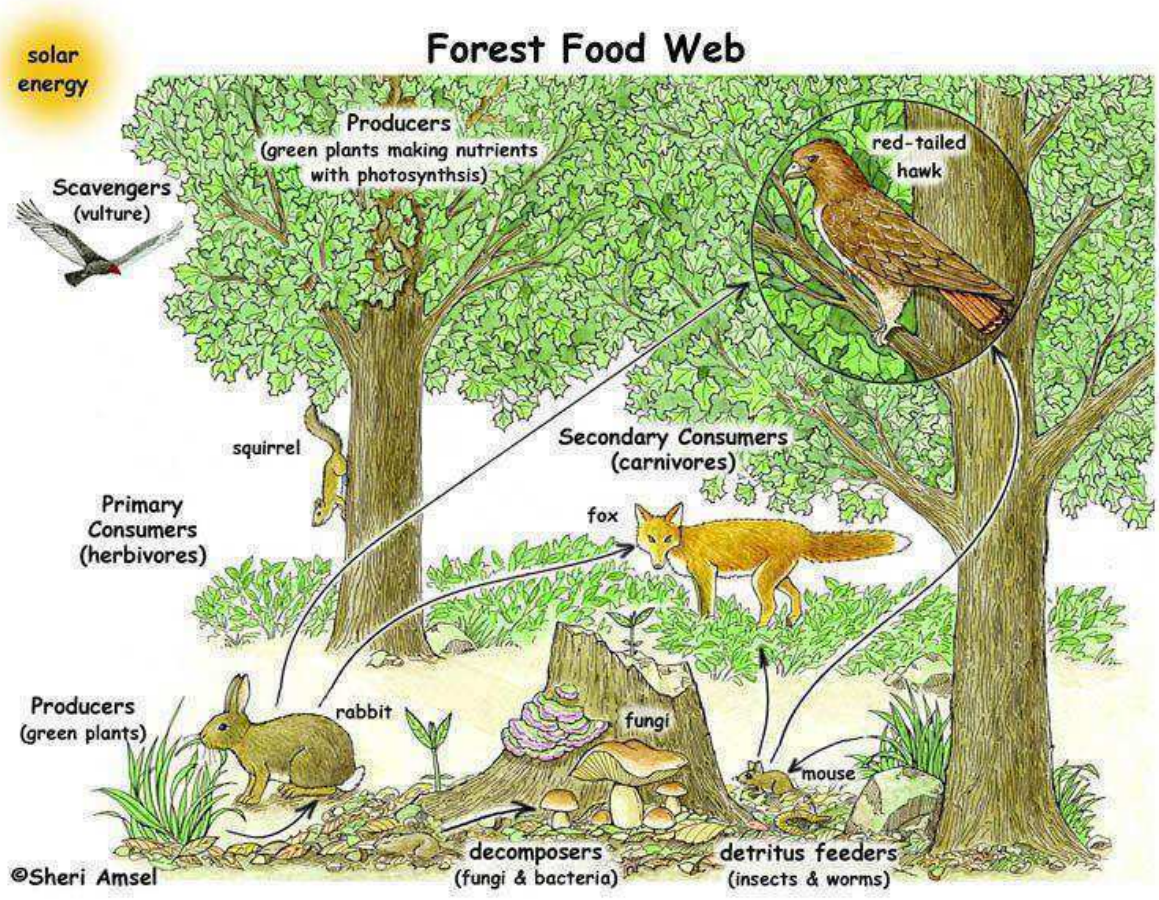
   Example: Aquatic ecosystem.

Types of Ecosystem

Forest Ecosystem

The word forest means a wooded area. This word comes from the Latin word forus which simply means outside (and it is where we get the English word foreign).

However, over the years, via the Latin phrase 'forestis silva' (which means a wood outside) the word forest came to mean a group of trees. An ecosystem is an ecological system: i.e. a group of organisms (this can include animals and plants as well as birds, bacteria and insects) that live together as a community.



An ecosystem is usually a distinct system with its own special characteristics. So, a forest ecosystem is:

There are many types of forests throughout the world. Below, you can find some of the main categories of forest ecosystem that are used by scientists. One thing to remember throughout this discussion is that trees in a forest can be either deciduous or evergreen. i.e. they can either shed their leave in autumn and grow them again in the spring or they will keep their flourishing leaves throughout the year.

Taiga: this thin, sparse forest exists at the extreme north of the world, in countries such as Canada and Finland and in the Arctic Circle. It is characterized by chilly conditions and the fact

that the animals and birds and other organisms that live there have adapted to the cold. The taiga is a very ancient forest.

Rain forests: rain forests are huge, humid highly bio-diverse swathes of forest that are usually found within the global South. Due to the thick canopy created by their leaves, rain forests usually create their own mini ecosystem that seals off heat and humidity.

Boreal forests: boreal forests exist in the sub Arctic zones of the world (i.e. less far north than the Taiga). Here, you can find a mix of deciduous and evergreen trees and plenty of different animals, insects, birds and so on.

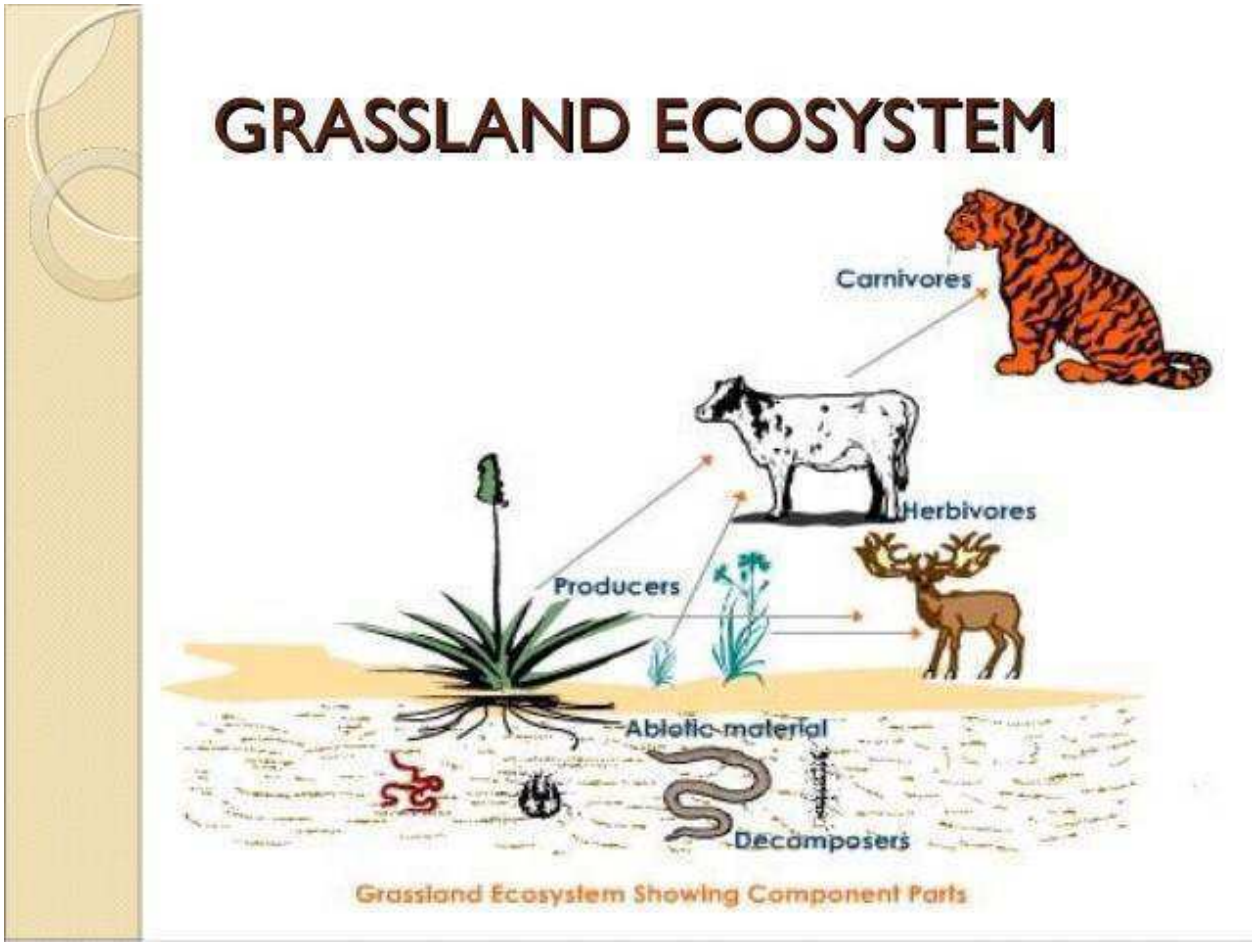
Forests of the temperate zone: located between the freezing cold of the polar zones and the scorching heat of the equator, the temperate zone is somewhere where forests can truly flourish. Some very ancient forests, such as the New Forest in Britain, are example of how in the temperate zone conditions are just right for huge amounts of biodiversity to occur. Again, in this zone, forests can be made of a mix of deciduous and evergreen trees – or of mainly one or mainly the other type of tree.

- **A community of organisms living together in a forest.**
- **A distinct system, that can be defined as having certain distinctive characteristics.**
- **Variable depending on where the forest is located.**
- **Vulnerable to climate change and deforestation.**
- **Important to protect.**

Grassland Ecosystem

The word grassland is somewhat self explanatory. A grassland is a wide open grassy space. A grassland may also contain low shrubs and other plants, but its predominant feature is that it is a place where plenty of grass grows.

A grassland ecosystem is a community of creatures living together within a grassy space. These creatures can include various types of grasses, insects, and animals, etc.



The importance of grassland ecosystems.

Grassland ecosystems are very important for a wide variety of different reasons. Below, you will find some of the main ones.

1. Habitat. Grassland ecosystems are key habitats for huge numbers of different animals including zebras, bison, lions and elephants.

2. Soil quality. The delicate balance of plants and animals in grassland ecosystems maintains a high soil quality. When humans intervene in grasslands and use them for crop based agriculture they alter the mineral composition of the soil and its quality and hence fertility declines.

3. Beauty. Grassland ecosystems should be important to us, too, because they are quite simply very beautiful open spaces.

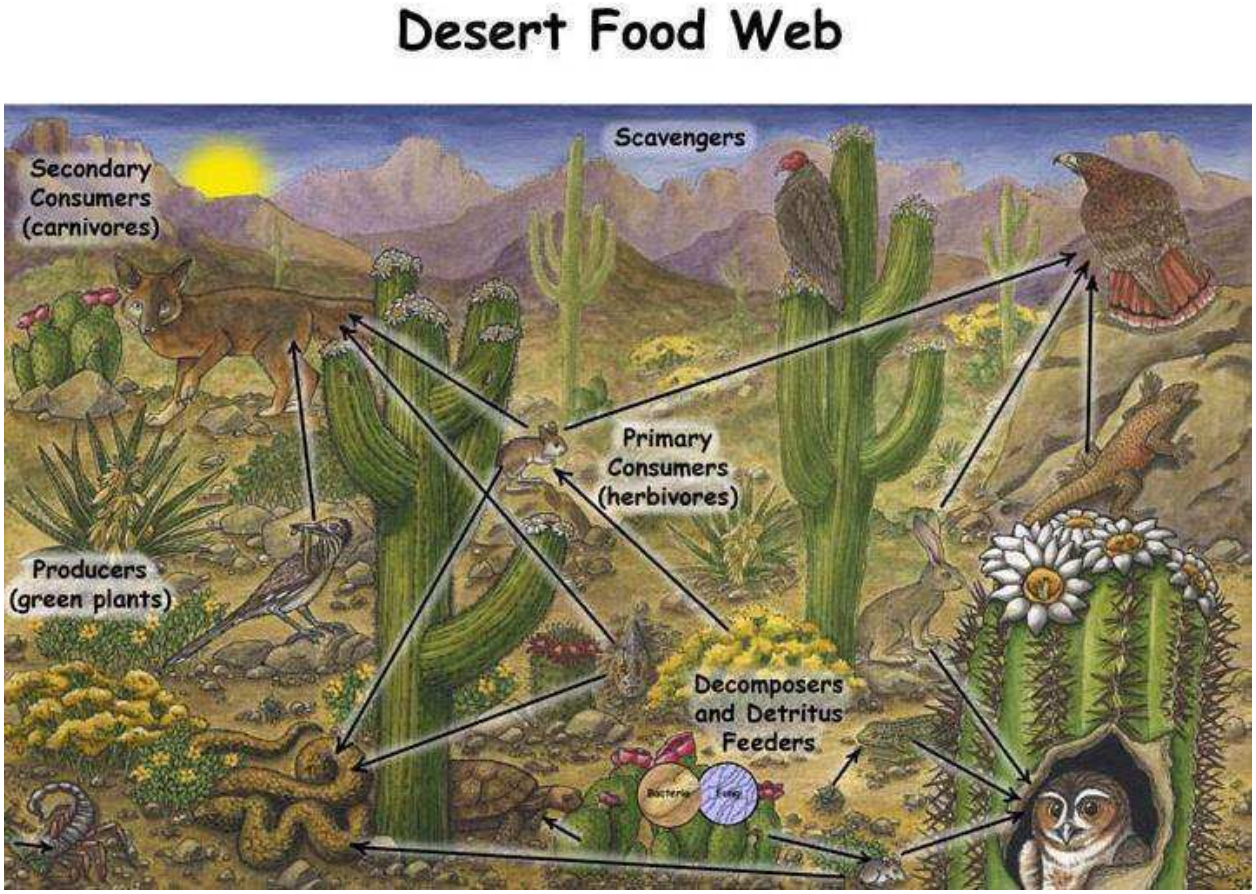
4. Large area. Around a quarter of the earth's total landmass is taken up by grassland ecosystems. That makes the grassland ecosystem one of the largest and most important types of ecosystem in the world.

5. Useful to humans. Grassland ecosystems are very useful to humans, particularly as pasture for cattle. The prairies of North America, for example, have traditionally been used as pasture grounds for many centuries.

Desert Ecosystem

The word desert comes from the Latin word 'desertus'. 'Desertus' means waste, or something that has been left. From this we get English words such as desert and deserted.

An ecosystem is a system of organisms that live together as a community. So, putting these words together, we can say that a desert ecosystem is a community of organisms that live together in an environment that seems to be deserted wasteland.



A desert is any place that is difficult to inhabit. Desert ecosystems can be hot (as in the sandy Sahara) or cold (as on the peaks of mountains where the high altitude makes conditions very harsh) but both hot and cold deserts have in common the fact that they are difficult for organisms to inhabit.

A desert ecosystem is generally witnesses little rainfall, resulting in less vegetation than in more humid areas of the globe. Look closely at any seemingly deserted piece of land and you will usually be able to see:

- **Numerous insects living in communities.**
- **An abundance of plant life.**
- **Mammals and birds.**
- **In addition, micro organisms such as bacteria will also be present in this ecosystem, though they are not visible to the naked human eye.**

In desert ecosystems, the plant and animal life that lives there will have evolved so that they can combat the harsh conditions (for example, they will have evolved to store water supplies in their bodies as water is very scarce in deserts).

There are so many different types of desert ecosystems. Let us look at each of them in turn.

Types of desert ecosystems.

When we hear the word desert, we usually think of a very hot, sandy environment. But, this is just one type of desert ecosystem. Read on to find out about this, and all the other key types of desert ecosystems.

1. Hot deserts.

Hot deserts can be found close to the equator. The Sahara is a good example of a hot desert. Hot deserts tend to feature scorching hot ground which many plants may struggle to grow on, little shade, and a shortage of water. The plants and animals that live here have evolved in order to adapt to these very hot conditions. For example, cacti have grown a tough outer skin and interiors which can store up any fluid that they absorb so that they can stay hydrated during droughts.

2. Cold deserts.

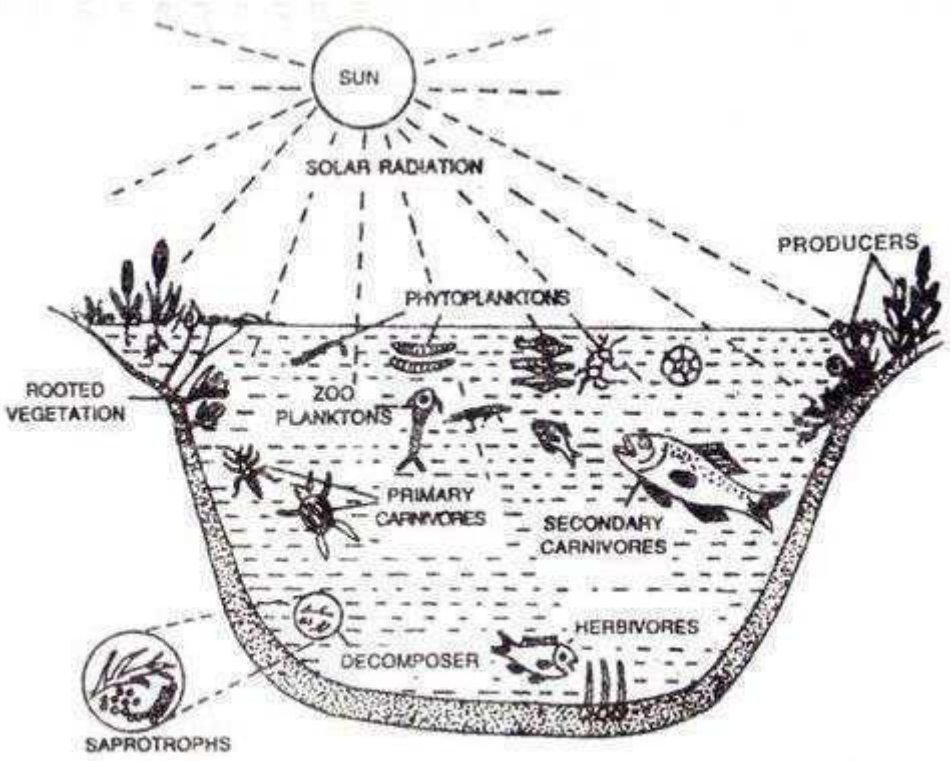
Hot deserts usually exist at low altitudes. Desertification can exist at high altitudes too, however – and when this happens, the desert will be cold. A good example is the deserted rocky peaks of a mountain. A cold desert may be sandy or rocky, but it will be a harsh environment where organisms have adapted in weird and wonderful ways so that they can survive.

3. Ice deserts.

Ice deserts are another type of cold desert. Here, instead of a sandy or rocky wasteland, we have a seemingly uninhabited region that is composed of ice. Ice deserts can be found towards the north and south poles of the planet, though they may also be located high up on mountain peaks.

Aquatic ecosystem

An aquatic ecosystem is an ecosystem that is water based. The word 'aquatic' comes from the Latin word for water. An ecosystem is a distinct community of organisms in a specific environment.



PONDS AS ECO-SYSTEM

So, we can say that an aquatic ecosystem is a community of organisms that live together, interact, and to an extent depend on each other in a water based environment.

There are various different types of aquatic ecosystem and this article explains all about four main types of aquatic habitats for animals. So, read on to find out all about them.

Characteristics of aquatic ecosystems.

Characteristics of aquatic ecosystems include:

1. **Being underwater, or**
2. **Being based around water.**
3. **Being a community of organisms.**
4. **Being a distinct community that is more or less self contained.**

Types of aquatic ecosystems.

It includes marine ecosystem and freshwater ecosystem – pond ecosystems, lake ecosystems and river ecosystems.

A. Marine ecosystems – salty water

Marine is a word that comes from the Latin word for sea – mar. So, a marine ecosystem is any ecosystem that exists within the sea. Our seas and oceans are vast bodies of salt water and so – while it may be argued that the whole ocean is one giant ecosystem – it may be also argued

that several different ecosystems can coexist within a single ocean. A whole host of different organisms live in marine ecosystems. When it comes to plant life, for example, we have seaweeds and marine algae. Invertebrates that live in the marine ecosystem include jellyfish and crustaceans. Meanwhile, there are fish such as sharks and eels, and mammals such as whales and seals. There are also various sea birds in all parts of the sea: they feed off the fish and other organisms that live there. Humans may also form part of the marine ecosystem if they fish in the sea for food.

B. Freshwater ecosystems

Contrary to the marine water ecosystem that contains salty water, freshwater ecosystem has little or no salt. The major types of freshwater ecosystem includes pond ecosystem, lake ecosystem and river ecosystem.

C. Pond ecosystems

A pond is discernibly a closed, self contained environment which houses a community of organisms. Ponds are usually freshwater ecosystems, however they can also be made up of brackish (salty or briny) water. Many different plants, fish and animals can live in these types of ecosystems. Frogs, newts, water weeds and water lilies are all examples of pond creatures. In addition, various types of fish can live in a pond. Ponds can be natural or human made ecosystems; if human made, it is not uncommon for goldfish or ornamental carp (such as koi carp) to live in a pond ecosystem. In addition, certain birds and insects may visit the pond ecosystem with regularity. For example, we might see dragonflies or herons around the pond. It may be up for debate whether these visitors are truly part of the ecosystem as they may also visit other ecosystems. But, it is certain that they have an impact on the ecosystem – and that it has an impact on them.

D. Lake ecosystems

Because they tend to be physically enclosed by the earth, rock or mountains around them, freshwater lakes are also identifiable as a distinct habitat that is inhabited by a distinct community of organisms. In a freshwater lake ecosystem, we can find all kinds of different organisms, including crustaceans (such as shrimp and crayfish), fish (like carp, trout and pike) and many birds, reptiles and amphibians. Freshwater lakes can be home to some beautiful plant life, such as tall purple irises, and the flora and fauna that abound within them may also change with the seasons. Some animals may only use lakes for looking after their offspring in, such as frogs that may leave frogspawn in a lake before leaving to inhabit other ecosystems.

E. Freshwater river ecosystems

River ecosystems are slightly different to ponds and lakes because whilst the latter two ecosystems offer stagnant (static) water, river water is always flowing. That means that these river ecosystems are the homes of animals and plants that are best adapted to living in flowing water. Salmon are a key example, as they use the flowing motion of a river to help them with their annual migration. And, in general, organisms that prefer to migrate – whether to seek food or to seek a partner – are often to be found in freshwater river

ecosystems because the motion of the river suits their style of life (whilst they, in their turn, have evolved to suit a flowing environment). Rivers tend to flow into the sea, and in this way river ecosystems and marine ecosystems meet each other. It may well, therefore, be up for debate to what extent river ecosystems are closed systems. But it is definitely clear that these are distinct types of fresh water ecosystems.

Importance of aquatic ecosystems.

The health of aquatic ecosystems is crucial to the health of the planet as a whole. Our earth is not called the blue planet for nothing: the seas with their fish, weeds, invertebrates and mammals and the rivers, lakes, streams, swamps and ponds of this world are all precious repositories of biodiversity. The seas help to regulate the world's temperature, too, and to lock carbon away from the atmosphere. Though we should all try and cut down on fish as a food source, there is no denying that fish and other aquatic organisms are irreplaceable links in the food chain for many terrestrial animals (i.e. animals that live on earth) as well.

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