CONCEPT OF ENVIRONMENT

- Term Environment – In English discourse, ***Environment*** borrowed from old French word ***Environne****r* (1603 AD)
- ***Environner*** means to encircle or to surround
- ***Environment*** means the surrounding things and conditions affecting the plants and animals by Thomas Carlyle (1828)
- The emergence of the modern concept of environment started from **Thomas Carlyle's** translation of **Goethe's** work in1828.

➢ **Environment:** is defined as sum total of all conditions that surround a particular organism at a particular point of time in space.

Or

➢ **Environment:** is defined as "all the physical, chemical, biological factors external to the organisms, that governs the growth and development.

Or

➢ **Environment:** is defined as "the aggregate of all external conditions and influences affecting life and development of an organism"

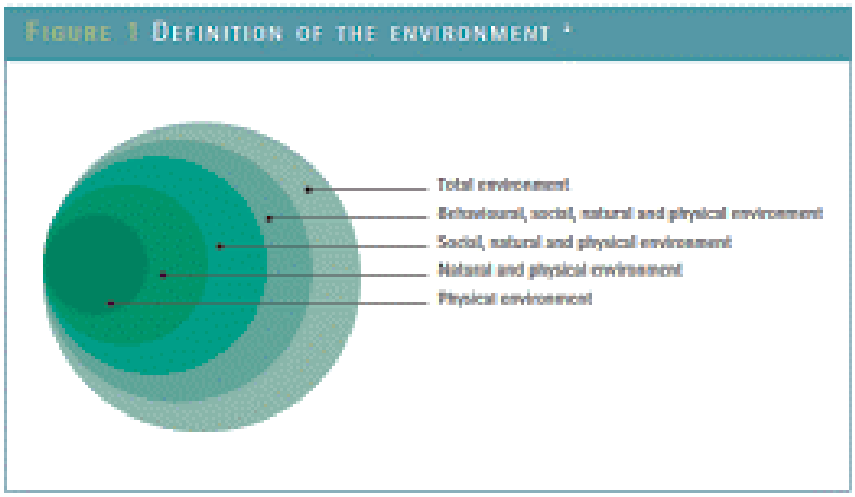


FIGURE 1 DEFINITION OF THE ENVIRONMENT [a]

[a] (Adapted from Smith, Corvalán and Kjellström, 1999)

Environmental Factors Affecting Living Organisms

➢ **Environmental Factors (Terrestrial)**

- **Abiotic factors:** non-living factors e.g. aspect: north-facing slopes are cooler and darker than south facing slopes in Northern hemisphere

- **Biotic factors:** living factors, e.g. food availability: more food will enable more organisms to live
- **Climatic factors:** effects of weather, e.g. rain: more rain means more water, which supports more life
- **Edaphic factors:** effects of soil, e.g. soil pH: pH affects growth of particular plants as pH affects enzyme action. Most plants grow at soil pH of 6.5 to 8.5

➢ **Environmental Factors (Aquatic)** Aquatic habitats have unique problems in comparison to terrestrial habitats. These problems include:

- **Light penetration** e.g. plankton grows better in the upper layers of water due to higher light intensity.
- **Currents** transport organisms. Plants and animals subsequently get washed away unless they attach themselves to objects (e.g. limpets and many seaweeds).
- **Wave action** moves and damages organisms
- **Salt content** results in organisms adapting to freshwater or saltwater. This causes issues with water moving in or out of organisms and their cells.
- **Tides** e.g. the amount of time organisms are exposed or submerged. Shore plants lose water at low tide. Organisms on shore have shells or mucilage to retain water

➢ **Temperature**: influences most plant processes, including photosynthesis, transpiration, respiration, germination, and flowering. As temperature increases (up to a point), photosynthesis, transpiration, and respiration increase. When combined with day-length, temperature also affects the change from vegetative (leafy) to reproductive (flowering) growth.

➢ **Water and Humidity:** Most growing plants contain about 90 percent water. Water plays many roles in plants. It is:

- A primary component in photosynthesis and respiration
- Responsible for turgor pressure in cells (Like air in an inflated balloon, water is responsible for the fullness and firmness of plant tissue.
- A solvent for minerals and carbohydrates moving through the plant
- Responsible for cooling leaves as it evaporates from leaf tissue during transpiration

- A regulator of stomatal opening and closing, thus controlling transpiration and, to some degree, photosynthesis
- The source of pressure to move roots through the soil
- The medium in which most biochemical reactions take place

TYPES OF ENVIRONMENT

- ***Bio-physical environment:*** It is essential life-supporting environment. The bio-physical environment includes land, air, water, plants and animals, buildings and other infrastructure, and all of the natural resources that provide our basic needs and opportunities for social and economic development. A clean, healthy environment is important for people's physical and emotional wellbeing. At a fundamental level, factors such as clean air and good quality drinking water are vital for people's physical health.
- ***Social environment***: social environments includes the immediate social relationships, and cultural settings within which defined groups of people function and interact. Components of the social environment include built infrastructure; industrial and occupational structure; labor markets; social and economic processes; wealth; social, human, and health services; power relations; government; race relations; social inequality; cultural practices; the arts; religious institutions and practices; and beliefs about place and community
- ***Economic environment:*** The economic environment is the sum total of the economic conditions and the nature of the economy in which the people has to live and compete. The economic conditions of people also have a huge impact on their physical health, mental health and education. People with low income, don't have access to good education and health facilities
- ***Psychological environment****:* is the interaction of the various sources of stress in our lives and how we respond to them, both individually and as communities. The Psychological environment enables us to understand the personality of an individual.

Components of Environment

The four major components of environment include lithosphere, hydrosphere, atmosphere and biosphere, corresponding to rocks, water, air and life respectively.

- Lithosphere is derived from the word "sphere," combined with the Greek word "lithos" which means rock. The lithosphere is the solid outer section of Earth which includes Earth's crust (the "skin" of rock on the outer layer of planet Earth), as well as the underlying cool, dense, and fairly rigid upper part of the upper mantle. The lithosphere extends from the surface of Earth to a depth of about 44-62 mi (70-100 km). The main component of lithosphere is earth's tectonic plates.
- Hydrosphere comprises of all forms of water bodies on earth including marine (oceans, seas) freshwater (rivers, lakes, ponds, streams) and groundwater resources etc. It covers 71% of earth's surface. 97% of water found on Earth is in the oceans in the form of salt water. Only 3 % of water on Earth is freshwater. Out of this, 30.8% is available as groundwater and 68.9% is in frozen forms as in glaciers. Amount of 0.3% is available in rivers, reservoirs and lakes and is easily accessible to man.
- Atmosphere is gaseous layer enveloping the Earth. The atmosphere with oxygen in abundance is unique to Earth and sustains life. It mainly comprises 78.08% nitrogen, 20.95% oxygen, 0.93% argon, 0.039% carbon dioxide, and traces of hydrogen, helium, and noble gases. The amount of water vapor present is variable (0-3%).Earth's atmosphere has a series of layers, each with its own specific traits. Moving upward from ground level, these layers are named the troposphere, stratosphere, mesosphere, thermosphere and exosphere. The troposphere is the lowest layer of our atmosphere. Starting at ground level, it extends upward to about 11 km (about 33,000 feet) above sea level. The next layer up is called the stratosphere. The stratosphere extends from the top of the troposphere to about 52 km (32 miles) above the ground. The infamous ozone layer is found within the stratosphere. Ozone molecules in this layer absorb high-energy ultraviolet (UV) light from the Sun, converting the UV energy into heat. Above the stratosphere is the mesosphere. It extends upward to a height of about 85 km (53 miles) above our planet. Most meteors burn up in the mesosphere. The layer of very rare air above the mesosphere is called the thermosphere. High-energy X-rays and UV radiation from the Sun are absorbed in the thermosphere, raising its temperature to hundreds or at times thousands of degrees. At the top of the

thermosphere temperatures can be found anywhere between 500 and 1,000 km (311 to 621 miles) above the ground. Temperatures in the upper thermosphere can range from about 500° C (932° F) to 2,000° C (3,632° F) or higher.

- Biosphere refers to all the regions on Earth where life exists. The ecosystems that support life could be in soil, air, water or land. The term Biosphere was coined by Geologist Edward Suess who used this term for place on Earth where life can be found. Biosphere refers to the sum total of all living matter, the biomass or biota. It extends from the polar ice caps to the equator, with each region harboring some life form suitable to the conditions there.

ENVIRONMENTAL SCIENCE

- Definition:

Environmental Science- an interdisciplinary and multidisciplinary subject that studies how the earth works, how we interact with the earth, and how we can deal with the environmental problems we face.

Or

Environmental science is the systematic study of the environment and human existence in it, using scientific methods and provide a socially acceptable, economically viable and scientifically reliable solution to environmental problems.

- Multidisciplinary: people from different disciplines or subjects work together, each drawing on their disciplinary knowledge.
- Interdisciplinary: integrating knowledge and methods from different disciplines or subjects, using a real synthesis of approaches.
- Environmental science is also referred to as an interdisciplinary field because it incorporates information and ideas from multiple disciplines such as biology, chemistry, geology, geography, economics, mathematics, political science, philosophy, and ethics.
- By combining subjects of the natural sciences, social sciences, and the humanities, the field of environmental science can cover more concepts and also examine problems and topics from many different points of view.
- Difference between Environmental Science and Environmental Studies
- Environmental Science-uses fundamental knowledge from mathematics, chemistry, biology, and physics coupled with specialization in a particular area of science

to provide advanced scientific understanding of environmental problems and provide solutions.

For Example-if there is an oil spill in a lake caused by an equipment failure

Environmental science asks questions such as:

- How much oil was spilled?
- How will it impact physical, chemical, and biological systems?
- What are the risks to humans, animals, and habitats?
- What is the long-term outcome of the oil spill and how can we prevent this from happening in the future from a scientific point of view

 Environmental studies-is the subject that provides an integrated understanding of social, political, and historical aspects of our environmental issues with a focus on policy, law, and social aspects of these issues.

For Example-if there is an oil spill in a lake caused by an equipment failure

Environmental Studies asks questions such as:

- What are the economic and social impacts of the oil spill?
- What policies, laws, and regulations are in place that were/were not followed in this situation? if there aren't any policies, regulations, or laws in place, how can we work with local governments to improve this situation?
- How can we educate common people about the effects of the oil spill?
- How can we prevent this from happening in the future?

IMPORTANCE OF ENVIRONMENTAL SCIENCE

 Since industrial revolution (1760-1840)-the world has changed at a very rapid pace, some changes were beneficial (eradicating previously incurable disease, reducing infant mortality, providing security from invasion, reducing poverty, and securing resources such as water, energy, and minerals), but many of the changes were causing damage to our environment. Due to this increase in industrialization and the human population, there has also been an increase in pressure on the natural resources and ecosystem services that we rely on for survival.

 It was the fossil fuel coal that initiated the Industrial Revolution, forever changing the way people would live and utilize energy. While this pushed human progress to

extraordinary levels, it came at extraordinary costs to our environment, and ultimately to the health of all living things.

- In the recent past- several environmental problems—such as pollution, global warming, ozone layer depletion, acid rain, deforestation, and desertification—have remained a major focus of scientists, policymakers, and common public across the world.
- These problems are perceived as the major threats to the life-supporting environment of the earth, thus making our survival on the planet increasingly unsafe.
- To tackle these challenges, holistic knowledge about the working of our life-supporting environment and thorough understanding of the dynamics of these problems become imperative.
- Since no other academic discipline covers the above two knowledge requirements completely, environmental science evolved as an academic discipline to fill in this gap.
- The field of environmental science is a valuable resource for learning more about these changes and how they affect the world we live in.
- Importance of environmental science.

• To realize that environmental problems are global: Environmental science makes us realize that environmental problems such as climate change, global warming, ozone layer depletion, acid rains, and impacts on biodiversity and marine life are not just national problems, but global problems as well.

• It aware us how our developmental and day-to-day activities affect environment and how we are affected by changes in the environmental conditions.

• It encourages us to create a pollution-free environment (that is, clean air, water, land, and food) by adopting different methods of preventing and controlling pollution.

• It guides us to utilize our natural resources such as water, forest, minerals, and fossil fuels in a judicious manner

• To adopt eco-friendly lifestyle by preventing and controlling pollution, and utilizing the resources efficiently in day-to-day activities

• Industries to adopt an eco-friendly mode by adopting clean and efficient technologies and installing pollution control systems.

- To solve complex global environmental problems such as climate change, ozone-layer depletion, desertification, and energy crisis by using different interdisciplinary tools and approaches.
- To discover sustainable ways of living: Environmental science is more concerned with discovering ways to live more sustainably. This includes minimizing household energy consumption, eating locally, recycling more, growing your own food, drinking from the tap, conserving household water, and driving your car less.
- To learn and create awareness about environmental problems at local, national and international levels. Environmental awareness can be created through social media, creating a blog dedicated to creating awareness, community centered green clubs, women forums, and religious podiums.

Ecosystem concept

The ecosystem is the structural and functional unit of ecology where the living organisms interact with each other and their abiotic environment, characterized by nutrient cycling and unidirectional flow of energy. 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 the year 1935.

Types of ecosystems

Ecosystems are classified as follows:

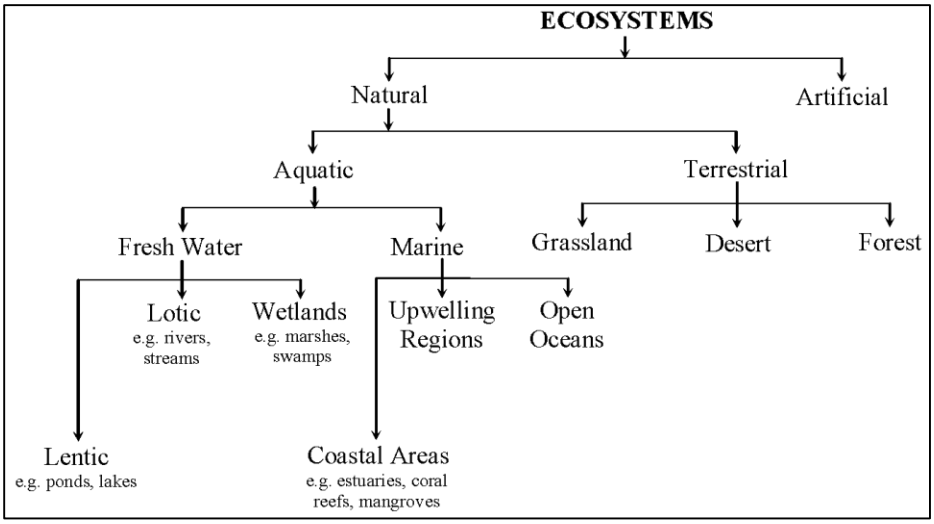
TYPES OF ECOSYSTEM

In the biosphere, Ecosystems may be classified based on their nature, duration, and size:

(I) NATURE: Based on nature, ecosystems may be classified as:

(A) NATURAL ECOSYSTEMS: These Ecosystems operate in nature by themselves without any human interference. Common examples of natural ecosystems are: a pond, a lake, a meadow, a desert, a grassland, a forest, an ocean, etc.

(B) ARTIFICIAL ECOSYSTEMS: These are maintained by man and hence are also termed man-made or Man-Engineered Ecosystem. In these ecosystems, man maintains the natural balance by the addition of energy and planned manipulations. Common examples of artificial ecosystems are cropland, orchard, garden, aquarium, etc.



Types of Natural Ecosystem

1. 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:

- Forest Ecosystems
- Grassland Ecosystems
- Tundra Ecosystems
- 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 climate 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.

2. Aquatic Ecosystem

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

- Freshwater Ecosystem
- Marine Ecosystem
- Freshwater Ecosystem: The freshwater ecosystem is an aquatic ecosystem that includes lakes, ponds, rivers, streams, and wetlands. Average salinity less than 0.05%. Freshwater ecosystems are further divided into Lentic and Lotic ecosystems

 Lentic Ecosystem: Lentic is a class of aquatic ecosystems that are found on land, such as ponds, rivers, lakes, swamps and streams. Mostly, lentic ecosystems are described as still or standing bodies of freshwater, and they are smaller ecosystems.

 Lotic Ecosystem: The lotic systems are moving bodies of water that flow to other bodies of water and eventually to the ocean. These systems can include springs, rivers and streams, or any body of water that flows to marine like waters or the ocean

- Marine Ecosystem: The marine ecosystem includes seas and oceans. These have a larger salt content and greater biodiversity in comparison to the freshwater ecosystem. Average salinity is 3.5% or 35grams/Liter

 DURATION: Based on duration, Ecosystems may be classified as:

- TEMPORARY ECOSYSTEMS: These are short-lived ecosystems which may be natural or man-made. Common examples include rainfed pond and laboratory culture of protozoans.
- PERMANENT ECOSYSTEMS: These are self-supporting Natural Ecosystems that maintain themselves for a relatively long duration, e.g., a lake, a forest, a desert, etc.

 SIZE: Based on size, ecosystems may be classified as:

- SMALL ECOSYSTEMS: Small-sized ecosystems are also termed as Micro-ecosystems, e.g. a flowerpot, water in a dish, a site under a stone, etc.
- LARGE ECOSYSTEMS: Very large-sized ecosystems are also termed Macro-ecosystems, e.g., an ocean, a forest, a desert, etc.

 The two major aspects of an ecosystem are the structure and function.

By structure we mean:

(i) the composition of the biological community including species, numbers, biomass, life history and distribution in space, etc.

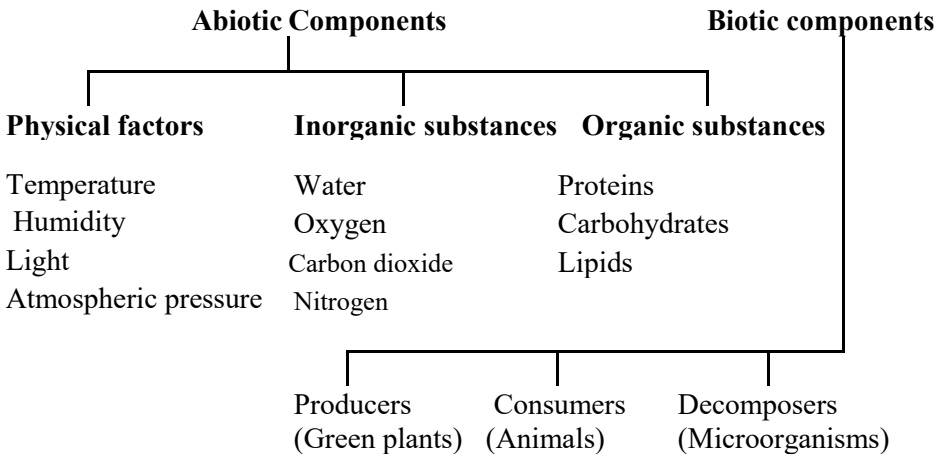
(ii) the quantity and distribution of the non-living materials, such as nutrients, water, etc., and

(iii) the range, or gradient of conditions of existence, such as temperature, light, etc.

Structure of the ecosystem: They are broadly grouped into: -

1) Abiotic and (b) Biotic components

Components of Ecosystem



(a) **Abiotic components (Non-living):** The abiotic component can be grouped into the following three categories: -

- Physical factors: Sunlight, temperature, rainfall, humidity and pressure. They sustain and limit the growth of organisms in an ecosystem.
- Inorganic substances: Carbon dioxide, nitrogen, oxygen, phosphorus, sulfur, water, rock, soil and other minerals. Standing state is defined as the amount of inorganic nutrients present in an ecosystem.
- Organic compounds: Carbohydrates, proteins, lipids and humic substances. They are the building blocks of living systems and therefore, link the biotic and abiotic components. Standing crop is defined as biomass of living material in an ecosystem at a particular time.

(b) Biotic components (Living)

- Producers: The green plants manufacture food for the entire ecosystem through the process of photosynthesis. Green plants are called autotrophs, as they absorb water and nutrients from the soil, carbon dioxide from the air, and capture solar energy for this process.
- Consumers (Macro-consumers) or heterotrophs are organisms that depend on other organisms for food. Consumers are further classified into primary consumers, secondary consumers, tertiary consumers, and Quaternary.

1) Primary consumers are always herbivores that they rely on producers for food. For example, rabbits, tadpoles, ants, zooplankton, mice
2) Secondary consumers depend on primary consumers for energy. They can either be a carnivore or an omnivore. For Example, frogs, small fish, krill, spiders
3) Tertiary consumers are organisms that depend on secondary consumers for food. Tertiary consumers can also be an omnivore. For Example, snakes, raccoons, foxes, fish.
4) 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. For Example, wolves, sharks, coyotes, hawks, bobcats.

- Decomposers (Micro consumers): Also called saprotrophs. These are mostly bacteria and fungi that feed on dead decomposed and the dead organic matter of plants and animals by secreting enzymes outside their body on the decaying matter. They play a very important role in the recycling of nutrients.
- Detritivores or detritus feeders: detritus eaters or debris eaters. These are usually multicellular animals such as earthworms, crabs, slugs, or vultures.

Trophic Levels in a Food Chain

The producers and consumers in an ecosystem can be arranged into different feeding groups/levels and are known as trophic level or the feeding level.

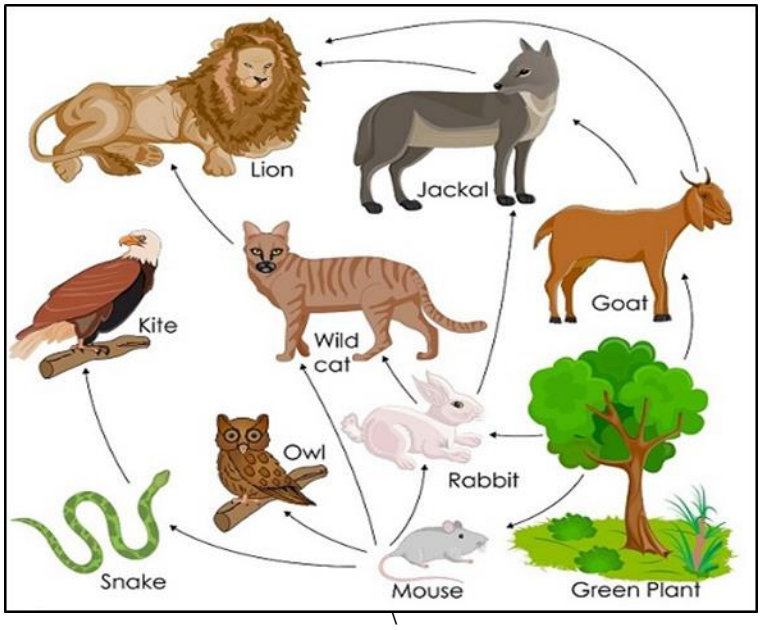
1. The producers (plants) represent the first trophic level.
2. Herbivores (primary consumers) present the second trophic level.
3. Primary carnivores (secondary consumers) represent the third trophic level
4. Top carnivores (tertiary consumers) represent the last level.

Food Web

The word ‘web’ means network. Food web can be defined as ‘a network of interconnected food chains so as to form a number of feeding relationships amongst different organism of a biotic community.

A food chain cannot stand isolated in an ecosystem. The same food resource may be a part of more than one chain. This is possible when the resource is at the lower tropic level.

A food web comprises all the food chains in a single ecosystem. It is essential to know that each living thing in an ecosystem is a part of multiple food chains. The food web provides stability to the ecosystem.



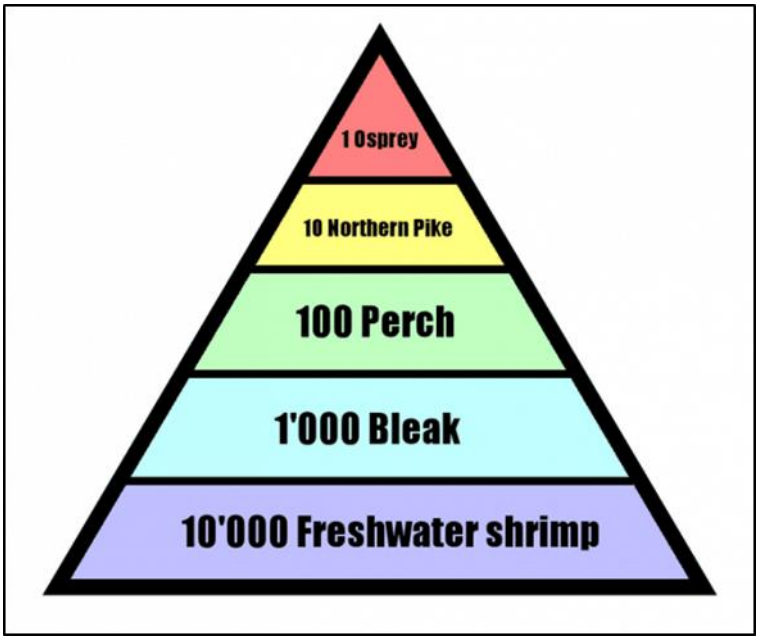
Food Web

Ecological Pyramid

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

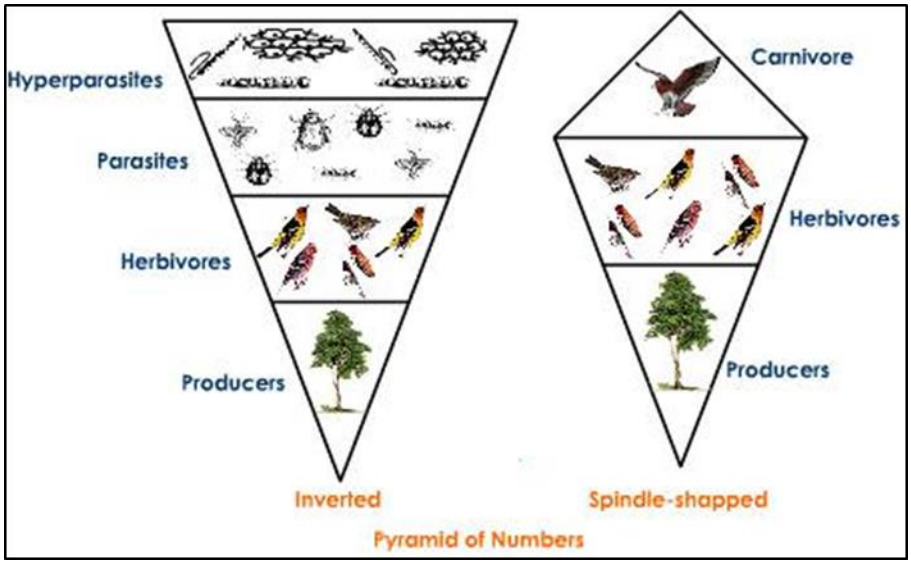
They are pyramidal in shape and they are of three types: The producers make the base of the pyramid and the subsequent tiers of the pyramid represent herbivore, carnivore and top carnivore levels.

Pyramid of number: This represents the number of organisms at each trophic level. For example, in a grassland the number of grasses is more than the number of herbivores that feed on them and the number of herbivores is more than the number of carnivores.



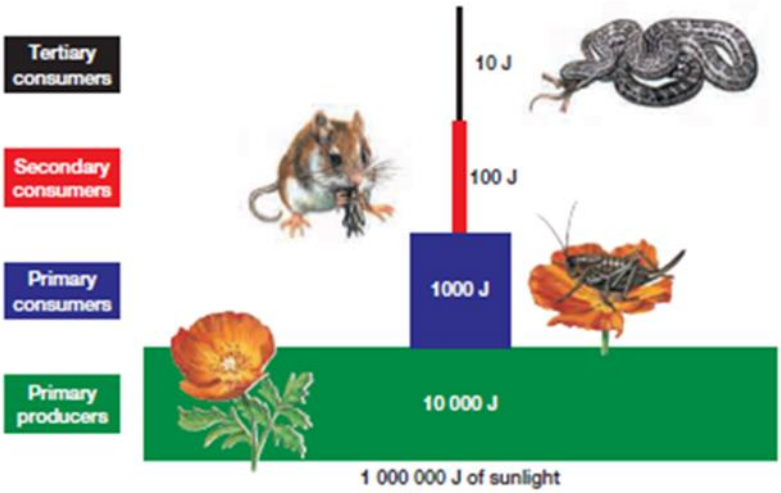
Source: en.wikipedia.org/wiki/File:Pyramid_of_numbers.png

Pyramid of numbers is always upright in case of pond, grassland, forest ecosystem. However, in a parasitic food chain or single tree, the pyramid of number is either inverted or spindle shaped. This is due to the fact that a single plant may support the growth of many herbivores and each herbivore, in turn, may provide nutrition to several parasites which support many hyper parasites. Thus, from the producer towards consumers, there is a reverse position, i.e. the number of organisms gradually shows an increase making the pyramid inverted in shape.



Pyramid of biomass: This represents the total standing crop biomass at each trophic level. Standing crop biomass is the amount of the living matter at any given time. It is expressed as gm/unit area or kilo cal/unit area. In most of the terrestrial ecosystems (grasslands, forests) the pyramid of biomass is upright. However, in case of aquatic ecosystems the pyramid of biomass may be inverted e.g. in a pond phytoplankton are the main producers, they have very short life cycles and a rapid turnover rate (i.e. they are rapidly replaced by new plants). Therefore, their total biomass at any given time is less than the biomass of herbivores supported by them.

Pyramid of energy: This pyramid represents the total amount of energy at each trophic level. Energy pyramid is always upright.



Pyramid of Energy

Since there is a successive reduction in energy flow at successive trophic levels, shorter the food chain, greater would be the available food energy.

Significance of studying food chains

- It helps in understanding the feeding relations and interactions among different organisms of an ecosystem.
- It explains the flow of energy and circulation of materials in ecosystems.
- It helps in understanding the concept of biomagnification in ecosystems.

ECOSYSTEM SERVICES

- As a part of an ecosystem, humans derive lots of benefits from the biotic and abiotic components. These benefits are collectively termed as ecosystem services. These benefits include products like clean drinking water and processes such as the decomposition of wastes.
- These services were popularized and their definitions formalized by the United Nations 2004 Millennium Ecosystem Assessment (MA), a four-year study involving more than 1,300 scientists worldwide.
- **Ecosystem services are classified into four types:**

• **Provisioning Services:** This includes the products/raw materials or energy outputs like food, water, medicines and other resources from ecosystems. Ecosystems are a source of food, water, medicines, wood, biofuels, etc. Also, they provide conditions for these resources to grow.

• **Regulating Services:** This includes the services which regulate the ecological balance. For example, carbon sequestration and climate regulation, terrestrial environs like forest purify and regulates air quality, prevent soil erosion, and control greenhouse gases. Biotic components such as birds, rats, frogs, act as natural controllers and thus help in pest and disease control. Hence, ecosystems act as regulators.

• **Supporting Services:** Supporting services form the basis for other services. They provide habitat for different life forms, retain biodiversity, nutrient cycling, and other services for supporting life on the earth.

• **Cultural Services:** It includes tourism; provides recreational, aesthetic, cultural and spiritual services. Most natural elements such as landscapes, mountains, caves, are

used as a place for cultural and artistic purposes. Even a few of them are considered sacred. Moreover, ecosystems provide enormous economic benefits in the name of tourism.

- The price tagging of the ecosystems and their services is quite unfeasible. Among all the ecosystem services, supporting services alone contribute about 50% and the rest of the services account for less than 10% in the same.

POND ECOSYSTEM

A pond ecosystem refers to the freshwater ecosystem where there are communities of organism dependent on each other with the prevailing water environment for their nutrients and survival. Ponds are shallow water bodies with a depth of 12-15 feet in which the sun rays can penetrate to the bottom permitting the growth of plants there. Ponds are artificial or natural body of water.

Light zonation of pond

On the basis of the depth of water, penetration of light and the types of plants and animals in the pond, the pond is divided into different zones. They are:

Littoral Zone

It is a peripheral shallow water zone in which light can reach up to the bottom. It contains warm and oxygen rich circulating water. So, this zone includes abundant rooted vegetation's and different types of consumers.

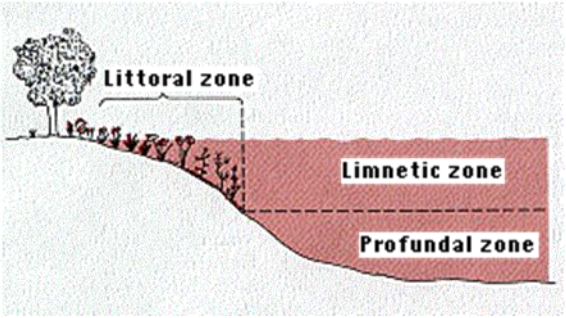
Limnetic Zone

The limnetic zone is a central part of a pond up to where there is penetration of effective light. The associated organisms are small crustaceans, rotifers, insects and their larvae and algae. The water level, oxygen content, and temperature in this zone varies time to time. Decomposers are almost absent here.

Profundal Zone

This is the deep-water region where there is no effective light penetration. There the microscopic plants and decomposers are present.

Zones of Pond Ecosystem



STRUCTURE OF POND ECOSYSTEM

It contains two main components i.e. abiotic and biotic.

Abiotic components

The abiotic substances of Pond ecosystem are formed as a result of the mixture of some organic and inorganic materials. They have directly or indirectly effect in
aquatic organisms of the pond. These includes:

Light

Temperature

Dissolved oxygen

Carbon dioxide

Other gases

pH of water

Turbidity

Dissolved minerals

Biotic components

The biotic components of Pond ecosystem are the living components which consist of:

Producers: The producers are the aquatic green plants, which may be divided into two groups.

Microphytes (phytoplankton's): They are microscopic autotrophs, which fix solar energy. Eg. *Spirogyra*, *Zygnema*, *Volvox*, *Oedogonium*.

Macrophytes: They are large plants, which manufacture complex food. Eg; Azolla. Ceratophyllum, Pistea, Hydrilla.

Consumers

The consumers are those heterotrophic organisms, which consume producers as food. Their types are:

Primary consumer: These herbivorous animals depend on autotrophic organisms such as microscopic plant eaters or zooplanktons, Mollusks, Beetles, Cyclops, and Daphnia etc.

Secondary consumer: These are primary carnivores, which depend on herbivorous animals for food. Eg: Insects, fishes, frogs, crab etc.

consumer:

Tertiary consumers: These are the second grade of carnivores. They feed upon plants or animals (secondary consumer) therefore are called omnivores. Eg: Large fishes and frogs.

Decomposers: Most of the decomposers of Pond ecosystem are saprophytes but some parasites are also found. Bacteria, fungi like *Aspergillus Cladosporium Rhizopus, Alternaria, Fusarium, Saprolegnia* etc. are decomposers. Generally, the decomposers either live in the soil layer beneath water or in the mud. They act on dead and decayed organic matter of plants and animals and supply raw materials to the producers.

Functional aspect of pond ecosystem

Interactions: They are the food chains and food web formed by biotic communities. The food chain is of two types which are given below:

1. Predatory food chain: In a predatory food chain, food chain starts with aquatic green plants (autotrophs) whose source of energy is the sun and this autotroph becomes the source of energy for herbivorous which are the source of energy for primary carnivorous and then the secondary carnivorous.

2. Detritus (saprophytic) food chain: Here organic matter (dead plants and animals) are first converted into detritus food by microorganisms like bacteria and fungi which is then consumed by the consumer as a source of energy. There is no predatory and parasitic form.