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ENVIRONMENTAL SCIENCE

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Environmental Studies

UNIT NUMBER: 1

Definition and Scope of Environmental Studies

Definition and Scope of Environmental Studies

AIM

This module will help in understanding environmental science and its multidisciplinary nature

Definition and Scope of Environmental Studies

LEARNING OBJECTIVES

1. Explain Concept of Sustainability
2. Appraise about the concept of Ecology and Environment
3. Help the learners understand the Ecosystem and its structure

Definition and Scope of Environmental Studies

LEARNING OUTCOMES

1. Understand the Food chain and Food web
2. Identify Ecological succession
3. Apply their learnings to save the Ecosystem

Definition and Scope of Environmental Studies

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Multidisciplinary Nature of Environmental Science

Environmental studies refers to the study of environment whereas environmental studies deals with every issue that affects a living organism. It is a multidisciplinary approach that brings about an appreciation of our natural world and human impact of its integrity. It is an applied science which involves understanding human interactions with the environment. It requires an integrated approach to several disciplines of science and social approach. It is a broad study that includes the natural environment, the built environment, and the sets of relationships between them.

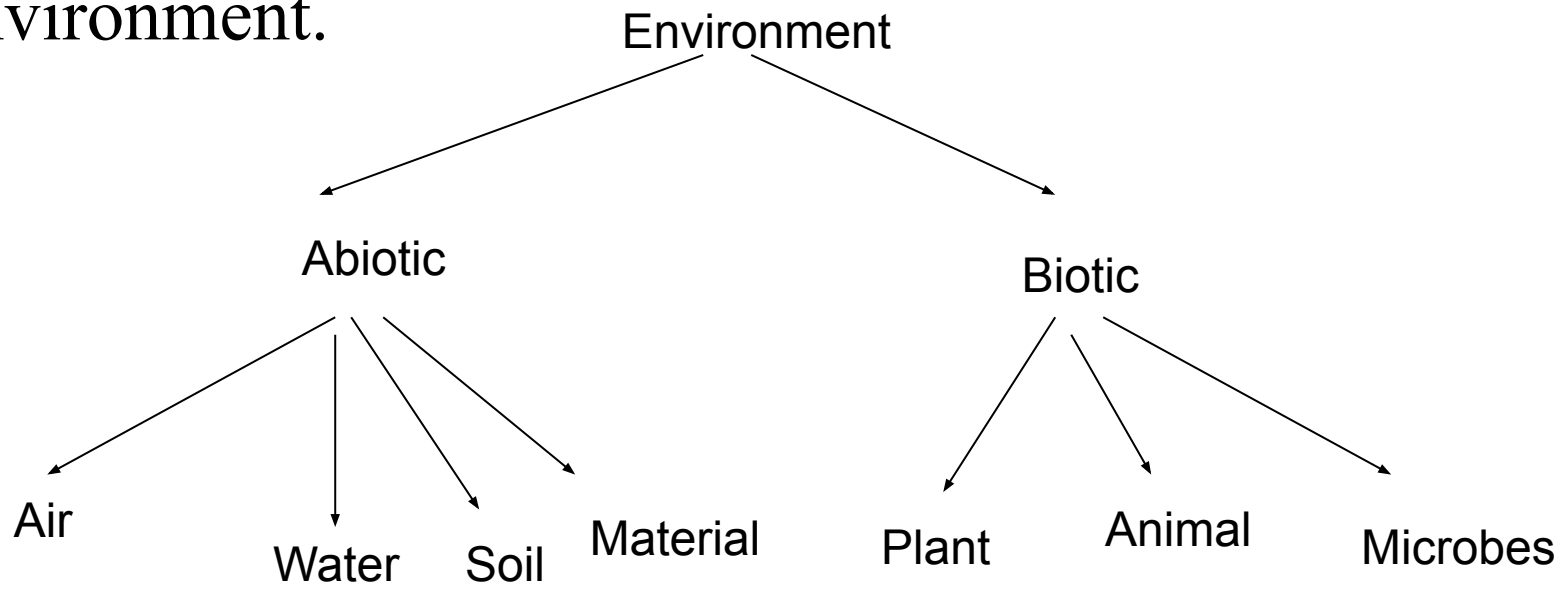
Definition and Scope of Environmental Studies

The scope of environmental studies is extremely wide and covers some aspects of nearly every major discipline. We need to understand biology, chemistry, physics, geography, resource management, economics and population issues to understand all the different aspects of our environment.

For Example: We use water to drink and for other day to day activities. We breathe air, we use resources from which food is made, and we depend on the community of living plants and animals which form a web of life of which we are also a part. Everything around us forms our environment and our lives depend on keeping its vital systems as intact as possible.

Definition and Scope of Environmental Studies

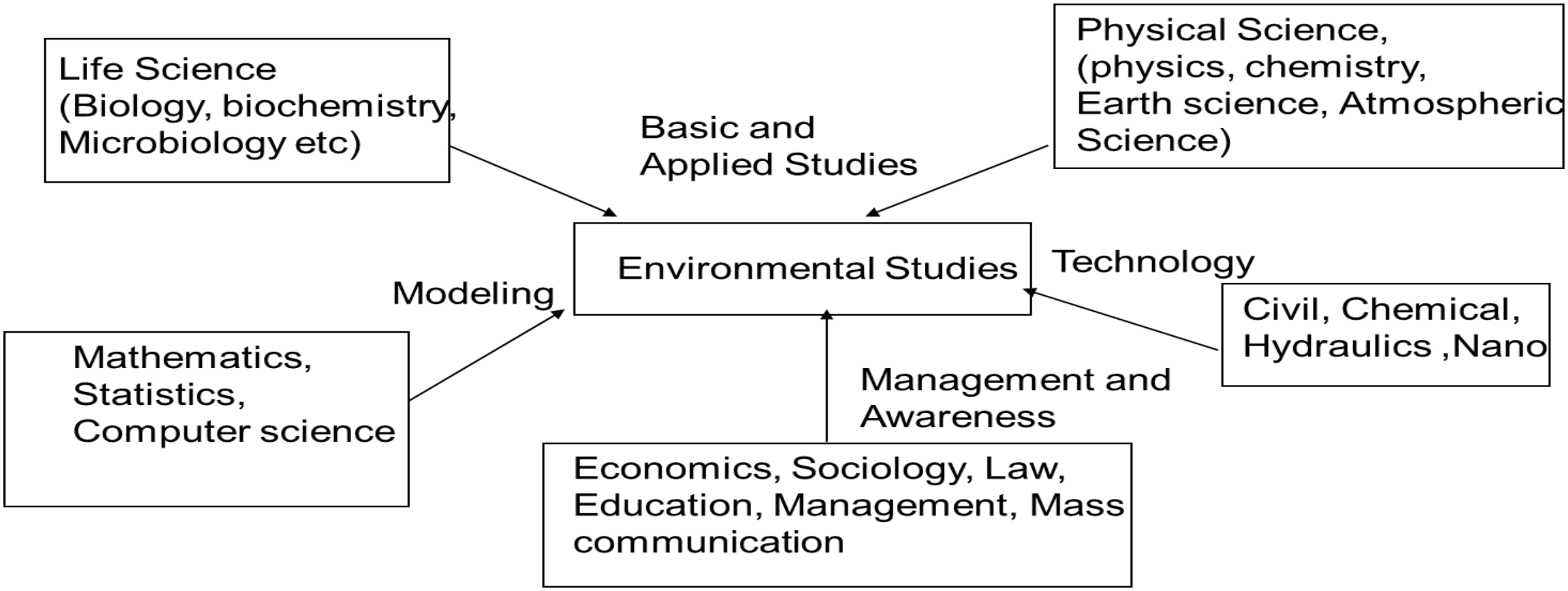
Environment is French word "**Environner"**, which mean to encircle or surround i.e., all the physical and biological surroundings of an organism along with their interactions such as atmosphere, hydrosphere and lithosphere, which surround us is known as our environment.



Interaction occur between abiotic and biotic component, such as transfer of material and energy.

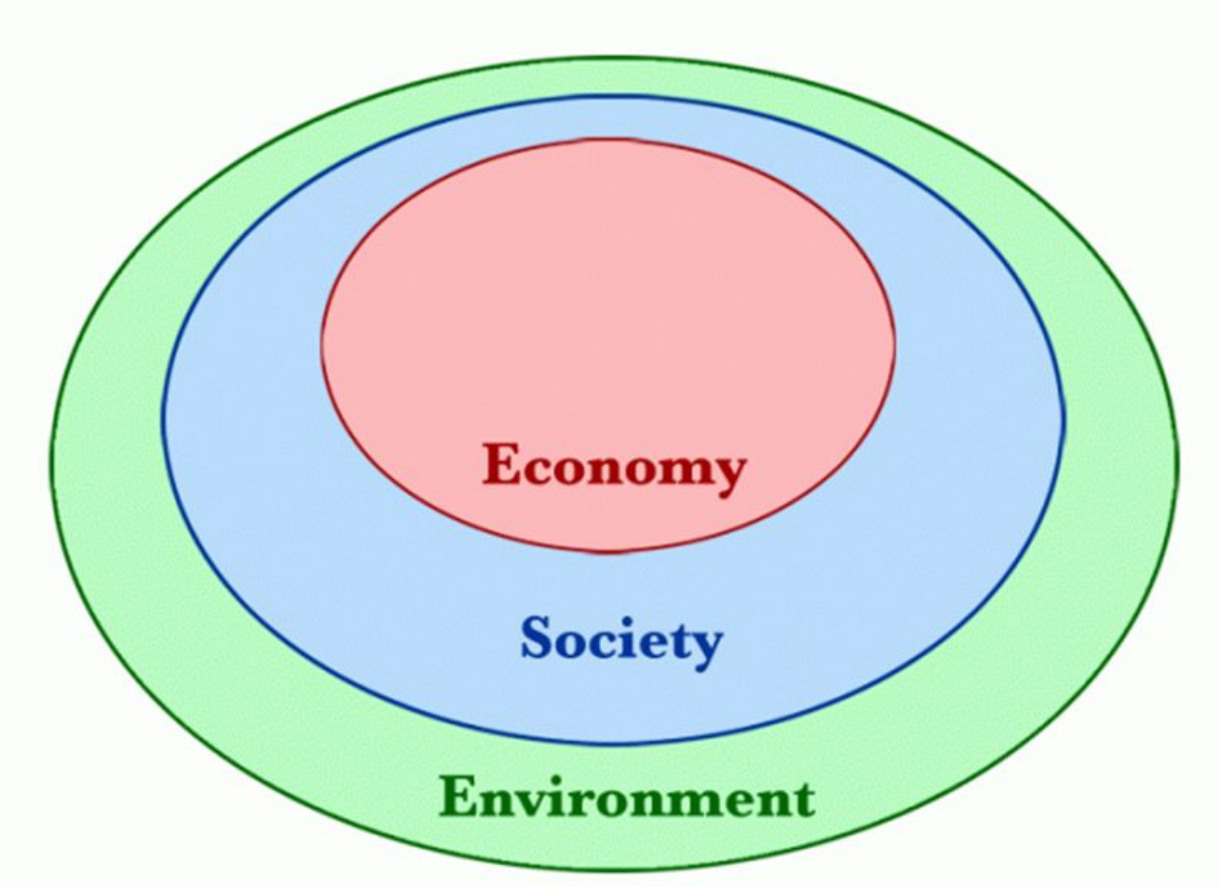
Definition and Scope of Environmental Studies

The multidisciplinary nature of environmental science is illustrated in following diagram



Concept of Sustainability

Sustainability brings three elements into harmony:



Definition and Scope of Environmental Studies

In a sustainable society, nature is not subject to systematically increasing...

...concentrations of substances extracted from the Earth's crust,

...concentrations of substances produced by society,

...degradation by physical means,

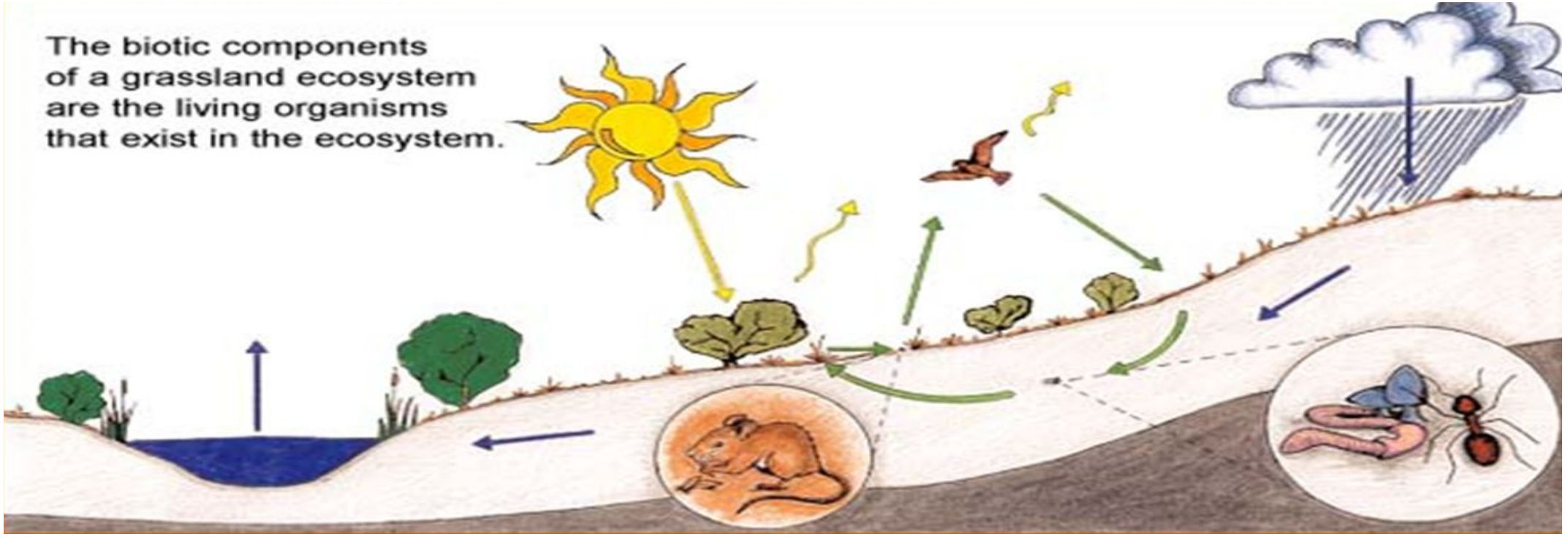
and, in that society...

...people are not subject to conditions that systematically undermine their capacity to meet their needs.

Ecology and Environment

- Ecology—the scientific study of interactions between different organisms and between organisms and their environment or surroundings

- Biotic—living factors that influence an ecosystem:



- Abiotic—non-living factors that influence an ecosystem:

Producers:

- **Sunlight** is the **main** energy source for life on earth
- Also called **autotrophs**
- Use **light** or **chemical** energy to make food
- 1. **Plants**
- 2. **plant-like protists (algae)**
- 3. **Bacteria**

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Photosynthesis—use **light energy** to convert **carbon dioxide** and **water** into **oxygen** and **carbohydrates**

(Remember: $6CO_2 + 6H_2O \quad 6O_2 + C_6H_{12}O_6$)

Chemosynthesis—performed by **bacteria**, use **chemical energy** to produce **carbohydrates**

Consumers

Organisms that rely on other organisms for their **energy** and **food** supply are also called **heterotrophs**

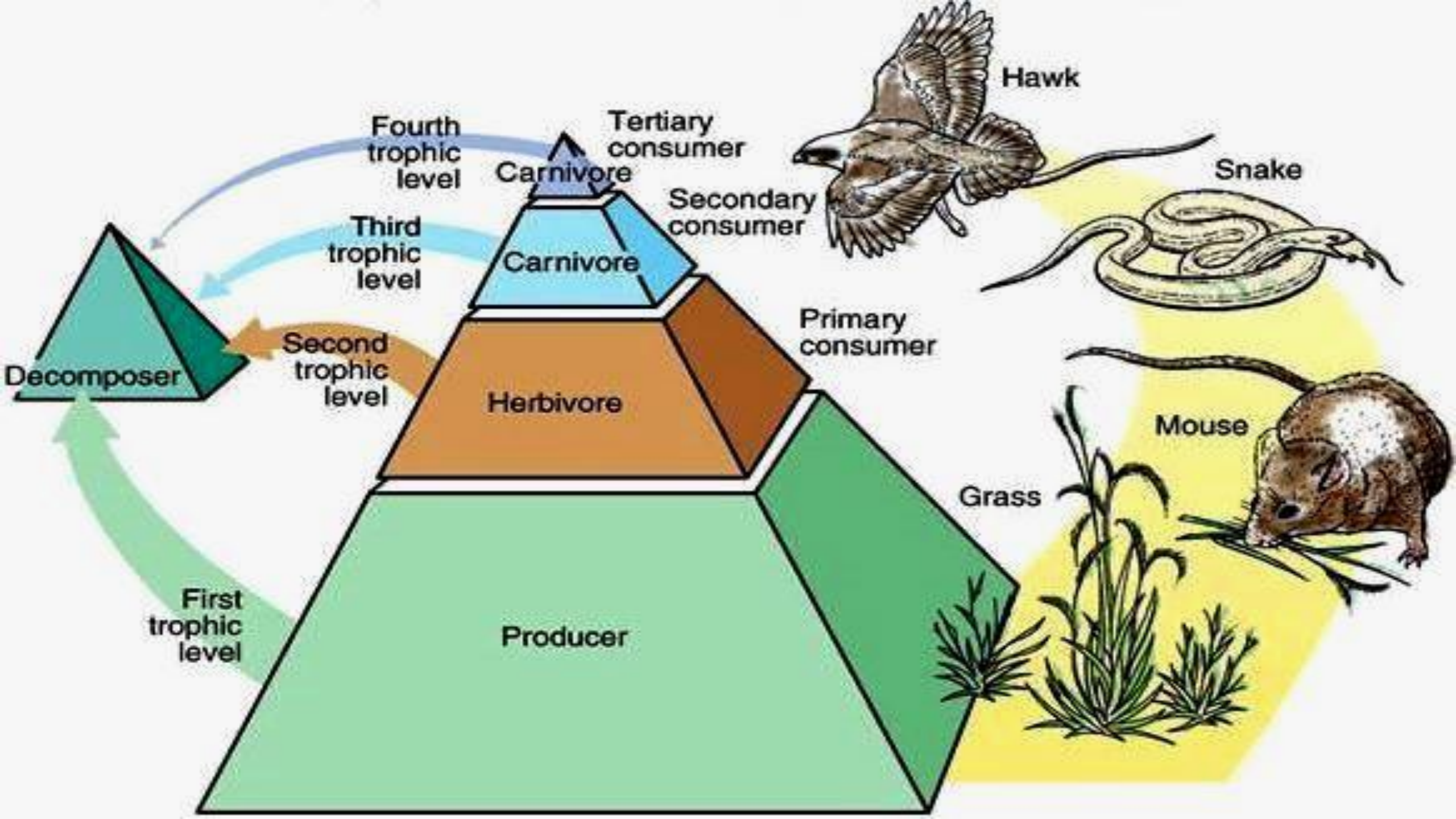
- Herbivores—obtain energy by eating only plants
- Carnivores—eat only animals
- Omnivores—eat both plants and animals
- Decomposers—breaks down dead organic matter

Food Chain—series of steps in which organisms **transfer energy** by eating and being eaten.

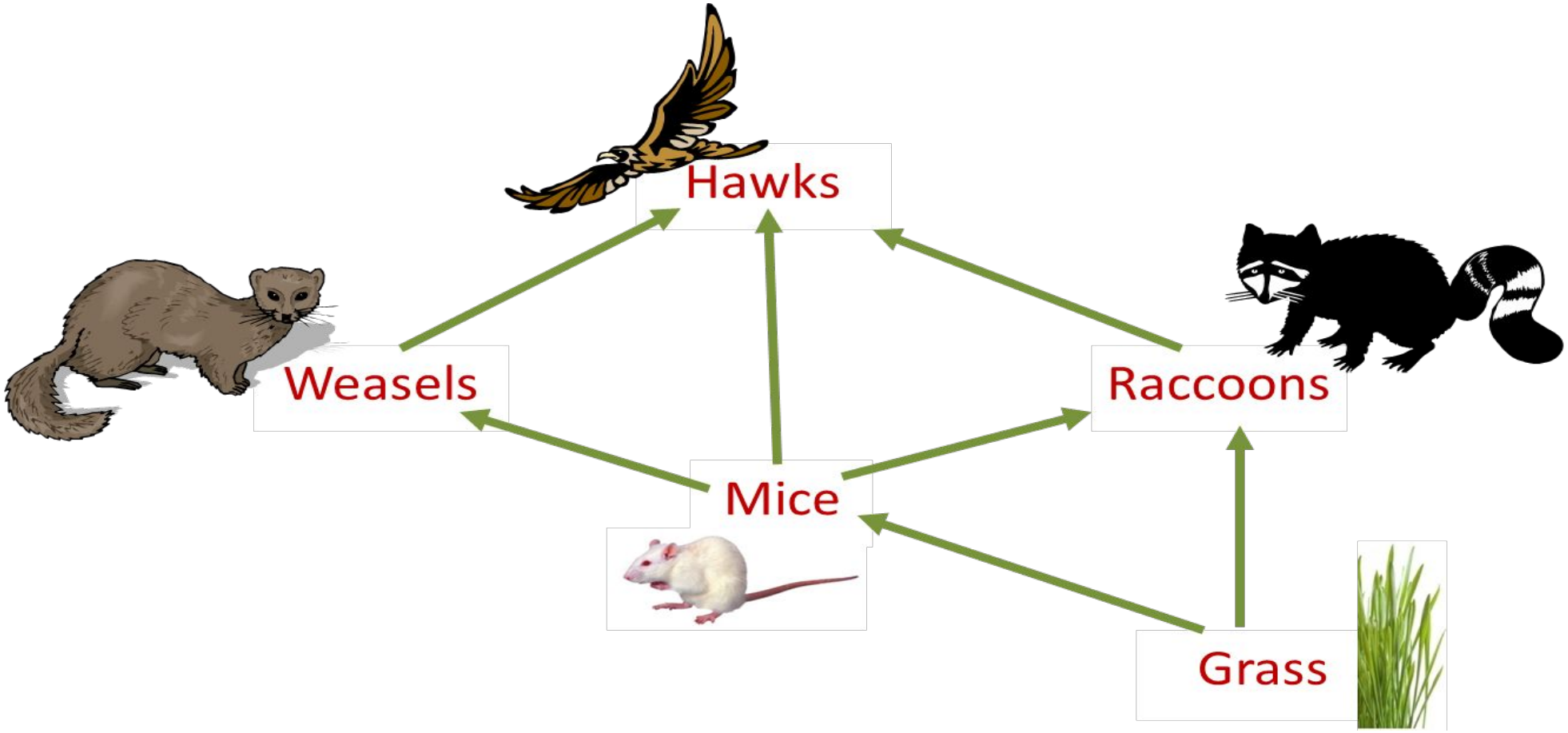
1. Arrows go in the **direction** of how energy is **transferred**
2. Start with **producer** and end with top **consumer** or carnivore

Ex: **grass** → **cricket** → **frog** → **raccoon**





Hawk
Fourth trophic level
Tertiary consumer
Carnivore
Secondary consumer
Snake
Third trophic level
Carnivore
Primary consumer
Second trophic level
Decomposer
Herbivore
Mouse
Grass
First trophic level
Producer

Food Web



Which of the organisms above is the producer? Grass

Which of the organisms above is the top consumer? Hawks

Definition and Scope of Environmental Studies

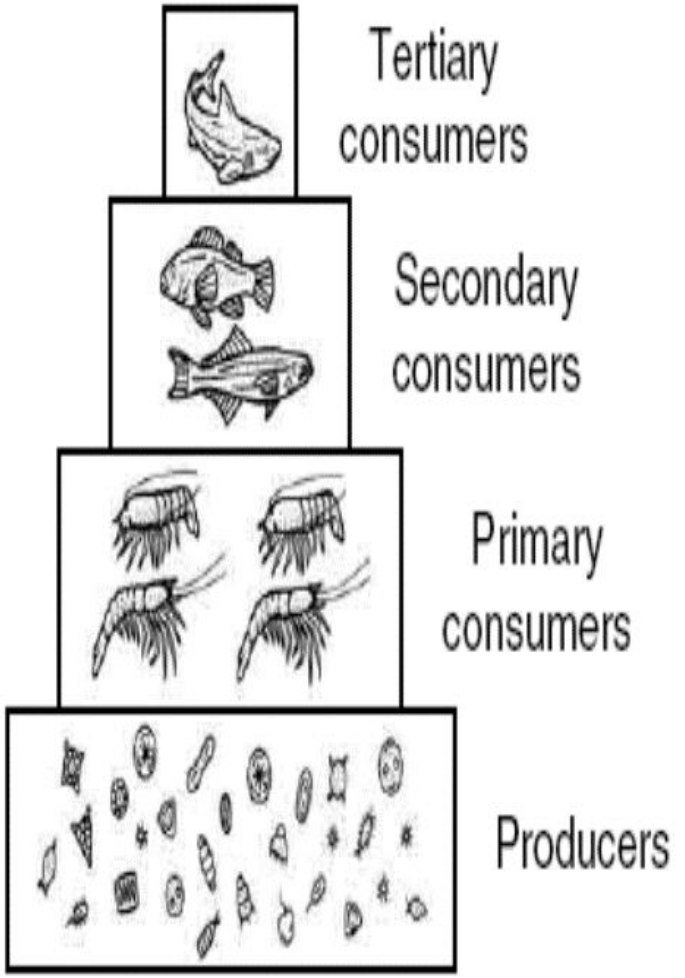
D. Trophic Levels—each step in a food chain or food web

1. Level 1—**Producers** (autotrophs)

2. Level 2—**Primary** Consumers (**herbivores**)

3. Level 3—**Secondary** Consumers
   (**carnivores or omnivores**)

4. Level 4—**Tertiary** Consumers
   (carnivore—usually **top carnivore**)



Energy Pyramid

Energy Pyramid shows relative amount of energy available at each trophic level

Organisms in a trophic level use the available **energy** for life processes (such as growth, photosynthesis, cellular respiration, metabolism, etc.)and release some energy as **heat**

Note: Every chemical process that happens in your body **releases heat** as a byproduct (ex: burning calories).

Rule of 10—only **about 10%** of the available energy within a trophic level is **transferred** to the next higher trophic level

Biomass Pyramid—represents the amount of **living organic matter** at each trophic level

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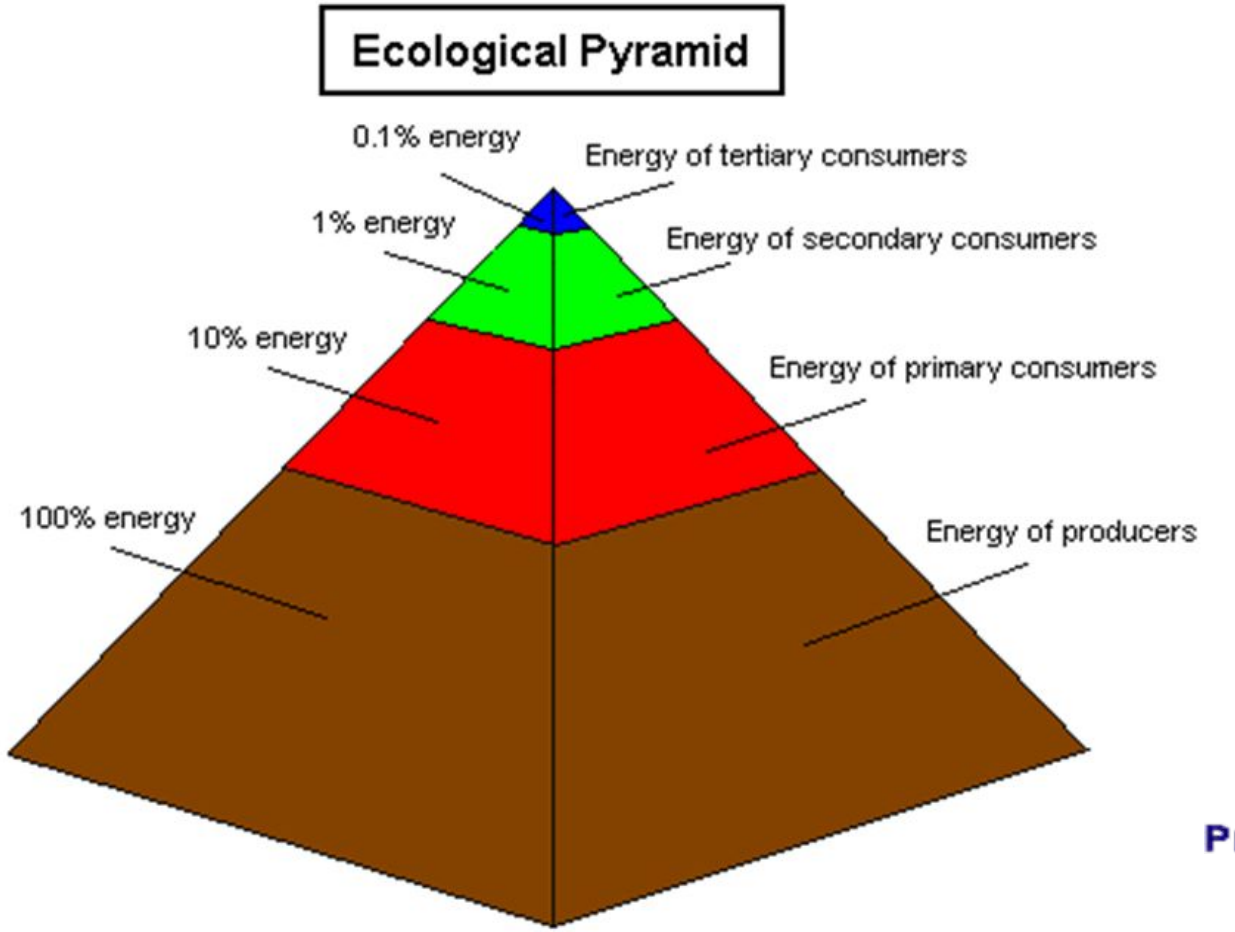
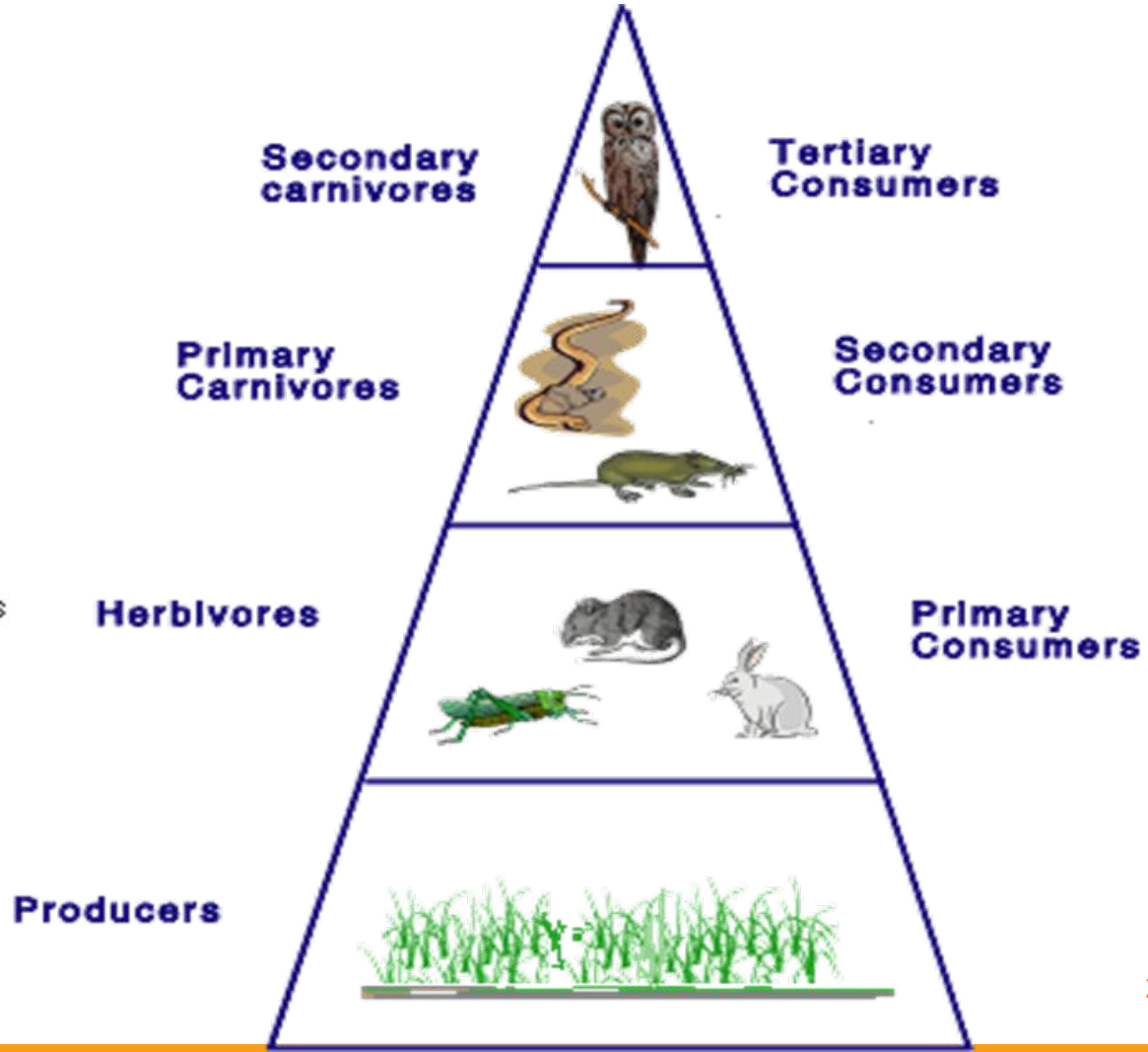
Diagram shows the relative amount of **energy** or **organisms** contained within each **trophic level** of a food chain or web.





Ecosystem- Structure and Functions

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

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

1. Terrestrial Ecosystem
2. Aquatic Ecosystem

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

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

Forest Ecosystem

A forest is an area with a high density of trees. A forest ecosystem is one in which tall trees grow that support many animals and birds. The forests are found in undisturbed areas receiving moderate to high rainfall. The forest occupies nearly 31% of the world's land in India it is only 19% of total land area. Types of forest ecosystem Based upon the climate conditions, forests are classified into:

- Tropical Rain forests
- Tropical deciduous forests

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- Tropical scrub forests.
- Temperate rain forests.
- Temperate deciduous forests

Characteristics of Forest Ecosystems

Forests are characterized by warm temperature and adequate rainfall, which make the generation of number of ponds, lakes etc.,

The forest maintains climate and rainfall.

The forest support many wild animals and protect biodiversity.

The soil is rich in organic matter and nutrients which support the growth of trees. Since penetration of light is so poor, the conversion of organic matter into nutrients is very fast. It provides the following environmental services:

Definition and Scope of Environmental Studies

- Nutrient cycling
- Maintaining biodiversity and providing wildlife habitat
- Affecting rainfall patterns and regulating stream flow
- Storing water
- Reducing flooding
- Preventing soil erosion
- Reclaiming degraded land & many more
- Fire Wood & Timber
- Fruits, Gums, Herbs & drugs

Grassland Ecosystem

- Grassland occupies about 20% of earth's surface. In addition to grass some trees and shrubs are/also present in grasslands.
- Limited grazing helps to improve the net primary production of the grasslands. But, overgrazing leads degradation of these grasslands resulting in desertification.
- **Types of grassland ecosystem**: Depending upon the climate conditions grassland are classified into three types: Tropical grasslands, Temperate grasslands, Polar grasslands

- Grassland ecosystem is a plain land occupied by grasses.
- Soil is very rich in nutrients and organic matter.
- Since it has tall grass, it is ideal place for grazing animals.
- It is characterised by low or uneven rainfall.

Importance

- Grasslands are of vital importance for raising livestock for human consumption and for milk and other dairy products

Definition and Scope of Environmental Studies

- Grasslands provided home to many different animals that were hunted and domesticated
- They are used as grazing area for cattle
- They maintain biodiversity
- Protects restored habitat for many plants and animals including pheasant, ducks, songbirds and endangered species

Desert Ecosystem

Desert occupies about 14% of our world's land area. It is characterised by less than 25 cm rainfall. The atmosphere is dry and hence it is a poor insulator.

Types of desert ecosystems: Based on the climatic conditions, deserts are classified into three types.

1. Tropical deserts
2. Temperate deserts
3. Cold deserts

Characteristics of Desert ecosystem:

- The desert air is dry and the climate is hot. Annual rainfall is less than 25 cm.
- The soil is very poor in nutrients and organic matter, vegetation is poor.

Aquatic Ecosystem

- The aquatic ecosystem deals with water bodies. The major types of organisms found in aquatic environments are determined by the water's salinity.
- Types of aquatic life zone Aquatic life zones are divided into two types.

1. Freshwater life zones Eg. Ponds, streams, lakes, rivers.
2. Saltwater life zones Eg. Oceans, estuaries.

- Freshwater Ecosystem The freshwater ecosystem is an aquatic ecosystem that includes lakes, ponds, rivers, streams and wetlands. These have no

salt content in contrast with the marine ecosystem.

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

River/Stream Ecosystem

The running water of a stream or a river is usually well oxygenated, because it absorbs oxygen from the air.

- The number of animals are low in river or stream.

Characteristics of River or Stream: It is a fresh water, and free flowing water systems. Due to mixing of water, dissolved oxygen content is more. River deposits large amount of nutrients.

Salt Water/Ocean (Marine) Ecosystem

Oceans cover more than two thirds of the earth's surface. ocean environment is characterised by its high concentration of salts and minerals. It supplies huge variety of products and drugs. It also provides us iron, magnesium, iron, natural gas. The oceans have two major life zones

Coastal zone: It is relatively warm, nutrient rich shallow water. It has high primary productivity because of high nutrients and sunlight.

Open sea: It is the deeper part of the ocean. It is vertically divided into three regions.

1. Euphotic zone: It receives abundant light and shows high photosynthetic activity.
2. Bathyal zone: It receives dim light and is usually geologically active.
3. Abyssal zone: It is the dark zone and is very deep (2000 to metres).

Characteristics of Ocean Ecosystem

- It occupies a large surface area with saline water.
- Since ship, submarines can sail in ocean,
- commercial activities may be earned out.
- It is rich in biodiversity.
- It moderates the- temperature

Definition and Scope of Environmental Studies (Summary)

The scope of environmental studies is very wide and it deals with many areas like:

i) Conservation of natural resources,

ii) ecological aspects,

iii) pollution of the surrounding natural resources,

iv) controlling the pollution,

v) social issues connected to it, and

vi) impacts of human population on the environment

Self Assessment Question

1. **Deserts, grasslands, forests and tundra regions are the examples of**

   a. Biomes

   b. Biogeographical regions

   c. Ecosystems

   d. Biospheres

Answer: c

Self Assessment Question

2. The word ‘Environment’ is derived from

a. Greek

b. French

c. Spanish

d. English

Answer: b

Self Assessment Question

3. Which among the following is a climatic factor?

a. pressure

b. humidity

c. temperature

d. all of the above

Answer: d

Self Assessment Question

4. **Sustainable development means**

   a. meeting present needs without compromising on future needs

   b. progress of human beings

   c. balance between human needs and the ability of earth to provide the resources

   d. all of the above

Answer: c

Self Assessment Question

5. Environment is the life support system that includes:

a. Air

b. Water

c. Land

d. All of the above

Answer: d

Definition and Scope of Environmental Studies

Document Links

Sl.No	Topic	URL	Summary
1	Environmental Studies	https://smartprep.in/2017/08/ugc-environmental-studies-textbook-erach-bharucha-pdf-free-download/	Concepts of EVS and related topics
2	Chemosynthesis	http://txforestservice.tamu.edu/	Concepts and method of Chemosynthesis
3	Ecosystem	http://sves.org.in/ecap/Resources/Ecosystem%20PPT_735.pdf	Concepts of Ecosystems and its type
4	Ecosystem	https://gacbe.ac.in/pdf/ematerial/18BZO63C-U2.pdf	Ecosystem Structure
5	Ecosystem	https://www.slideserve.com/abril/the-forest-ecosystem	Forest Ecosystem
6	Ecosystem	https://www.powershow.com/viewfl/57d861-MTExY/Forest_Ecosystem_powerpoint_ppt_presentation	Forest Ecosystem

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Video Links

Sl.No	Topic	Video Links
1	Ecological Pyramid	https://www.youtube.com/watch?v=wGfOoRrICto
2	Food chain and food web	https://www.youtube.com/watch?v=j78g5iRnYBM

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