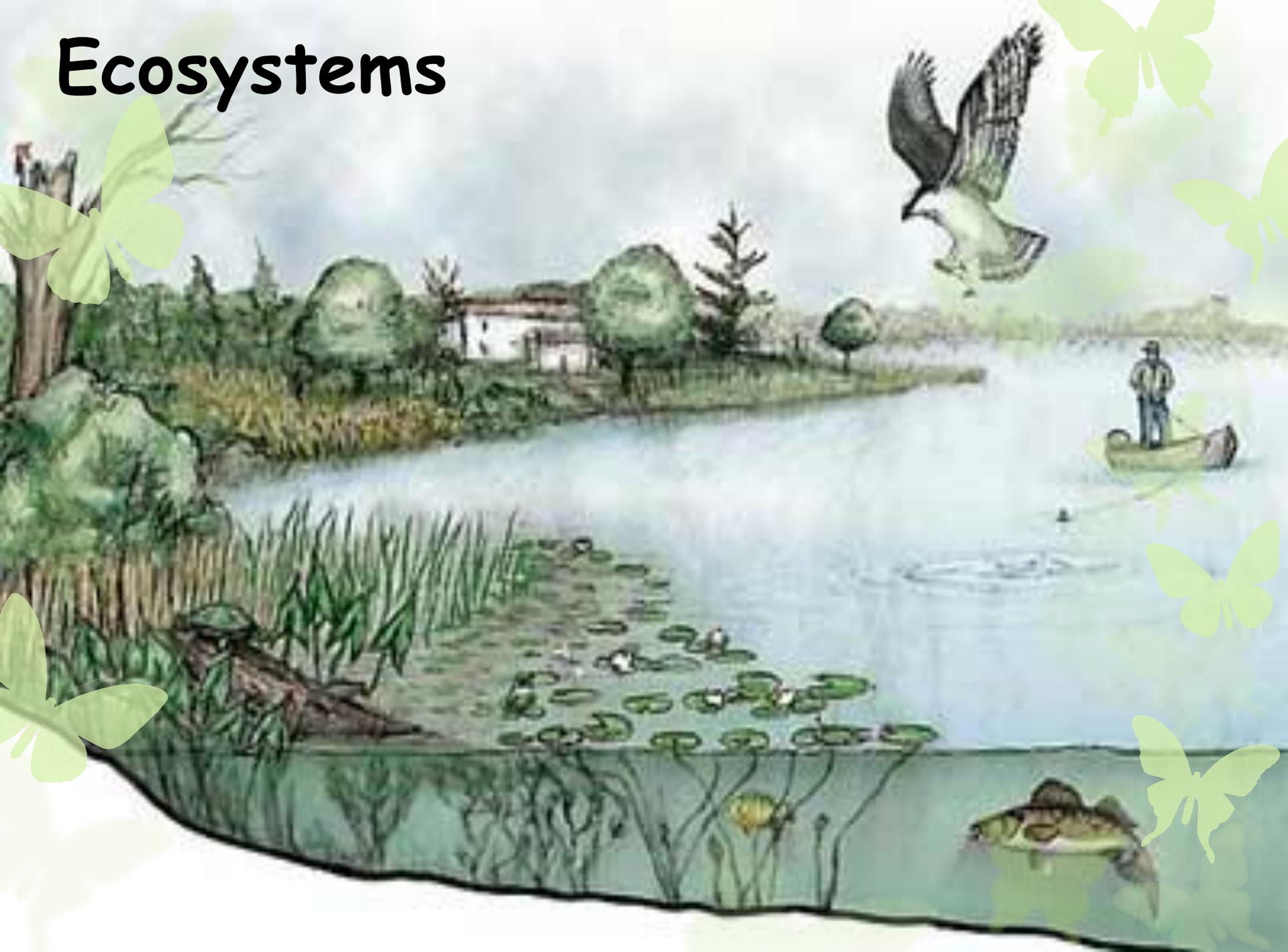


# Ecosystems



# Contents

- ❑ Concept of an Ecosystems and their Classification
- ❑ Structure and function of an ecosystem
- ❑ Energy flow in the ecosystems
- ❑ Carbon and Nitrogen Cycles
- ❑ Food chain, food web and ecological pyramids
- ❑ Ecological succession
- ❑ Study of common ecosystems

# Concept of an Ecosystems

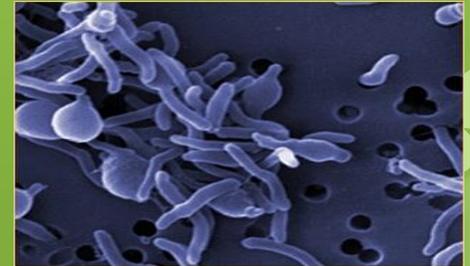
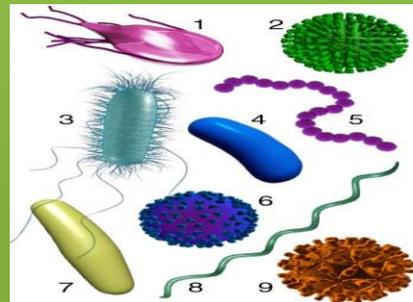
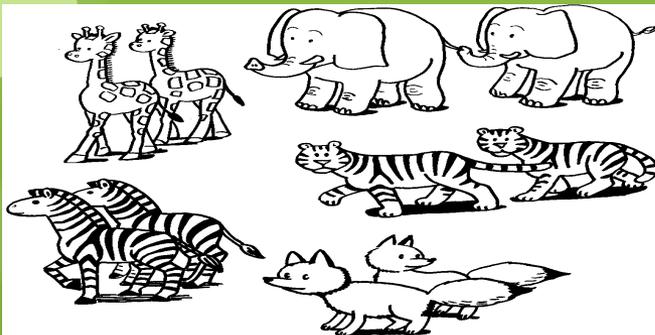
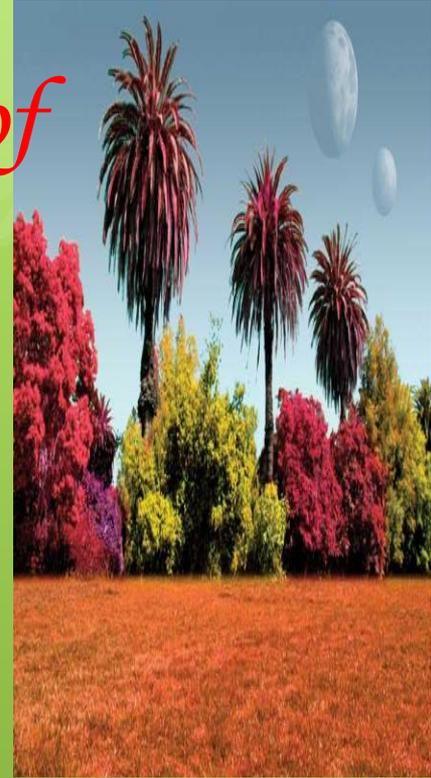
- ❑ Is being studied because of:
- ❑ 1. variation of Geographical Features
- ❑ 2. variation of Climatic conditions
- ❑ 3. soil characteristics

- ❑ Organism: cell is basic component of organism; accordingly we have single cell/multi cell organisms
- ❑ Species: a set of organisms that resemble(/same) one another ,are capable of reproducing naturally and produce a fertile/rich and live off (/rotten/bad) spring;
- ❑ Populaton: all the members of a species living and inteacting within a specific geographical region.
  - ❑ Ex., neem trees in a forest, people in country, gold fish in a pond.

- 
- Community: is the assemblage of all the interacting populations of different species existing in a geographical area and each population plays a different role in a community.

# ECOSYSTEM

*An ecosystem is a biotic assemblage of plants, animals, and microbes, taken together with their physicochemical environment.*



## Cont..

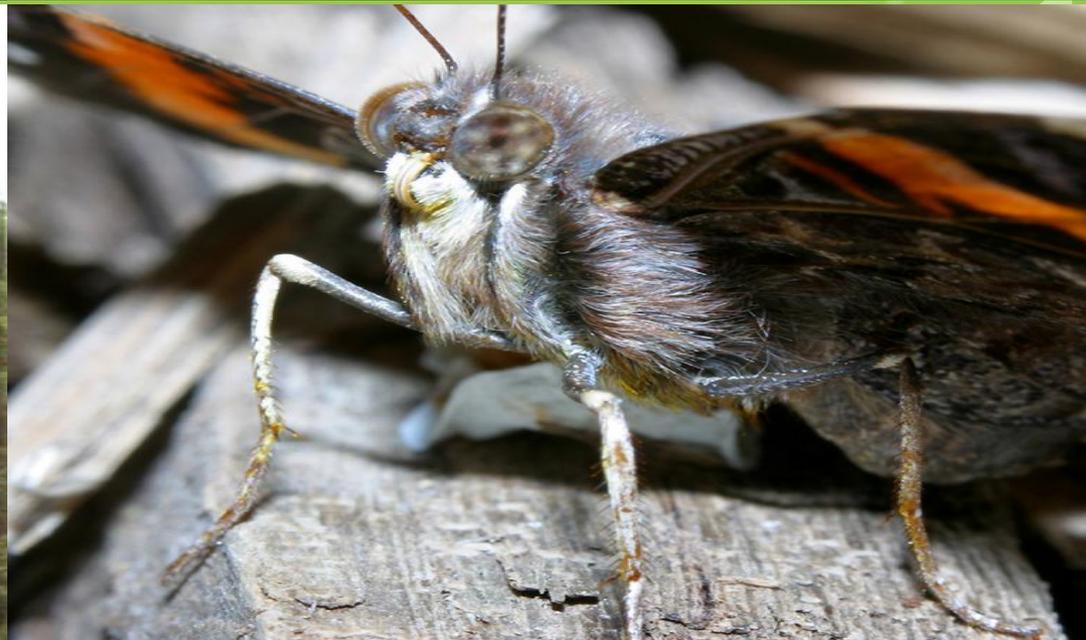
- ❑ It is a group of biotic communities of species(**living**) interacting with one another and with their **non living** environment exchanging energy and matter.
- ❑ So the study of these ecosystems is often known as **ECOLOGY**

Living things



Living things





# Non-living things



Photo: Whitsand Bay, thesurfgallery.co.uk



www.toddadams.net



www.surfshacks.co.uk



Sunlight  
© 1997 calyxa@chucko.com

NON-Living things



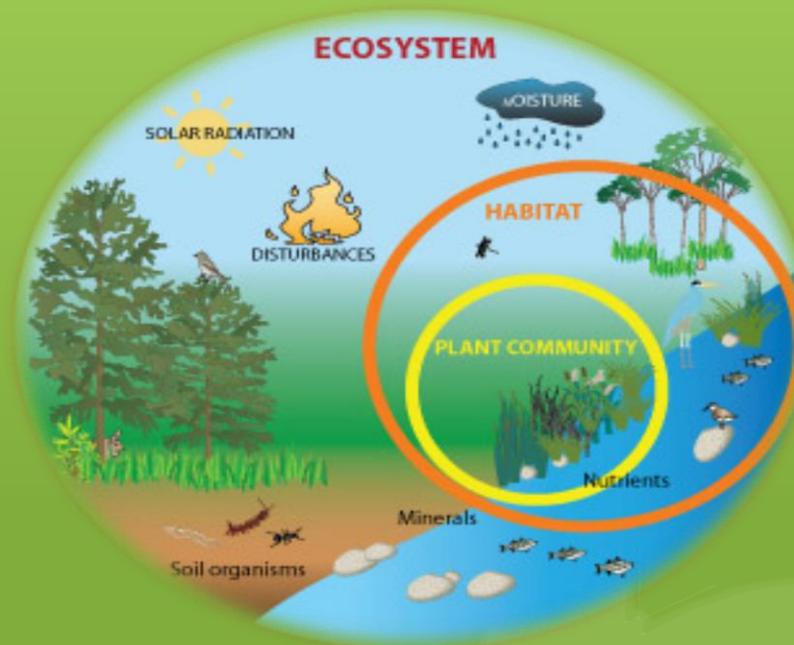
**Living things**

**+ Nonliving things**

***ECOSYSTEM***

# Definition of ecosystem

- ❑ The living community of plants and animals in any area together with the non-living components of the environment such as soil, air and water, constitute the ecosystem.
- ❑ Natural ecosystems include the forests, grass-lands, deserts, and aquatic ecosystems such as ponds, rivers, lakes, and the sea.
- ❑ Man modified ecosystems include agricultural land and urban or industrial land use patterns.



# Concept of an Ecosystem

Life supporting systems  
(Forests, Grasslands, Oceans,  
Lakes, Rivers, Mountains,  
Deserts...)

show wide variations in  
their structural  
composition & functions

However, they are alike ...  
*in the fact that they all consist  
of living entities interacting with  
their surrounding exchanging  
matter and energy*

# Concept of an ecosystem

- ❑ The nature of the ecosystem is based on its geographical features such as hills, mountains, plains, rivers, lakes, coastal areas or islands.-----constitutes

## GEOGRAPHICAL FEATURES OF THE AREA

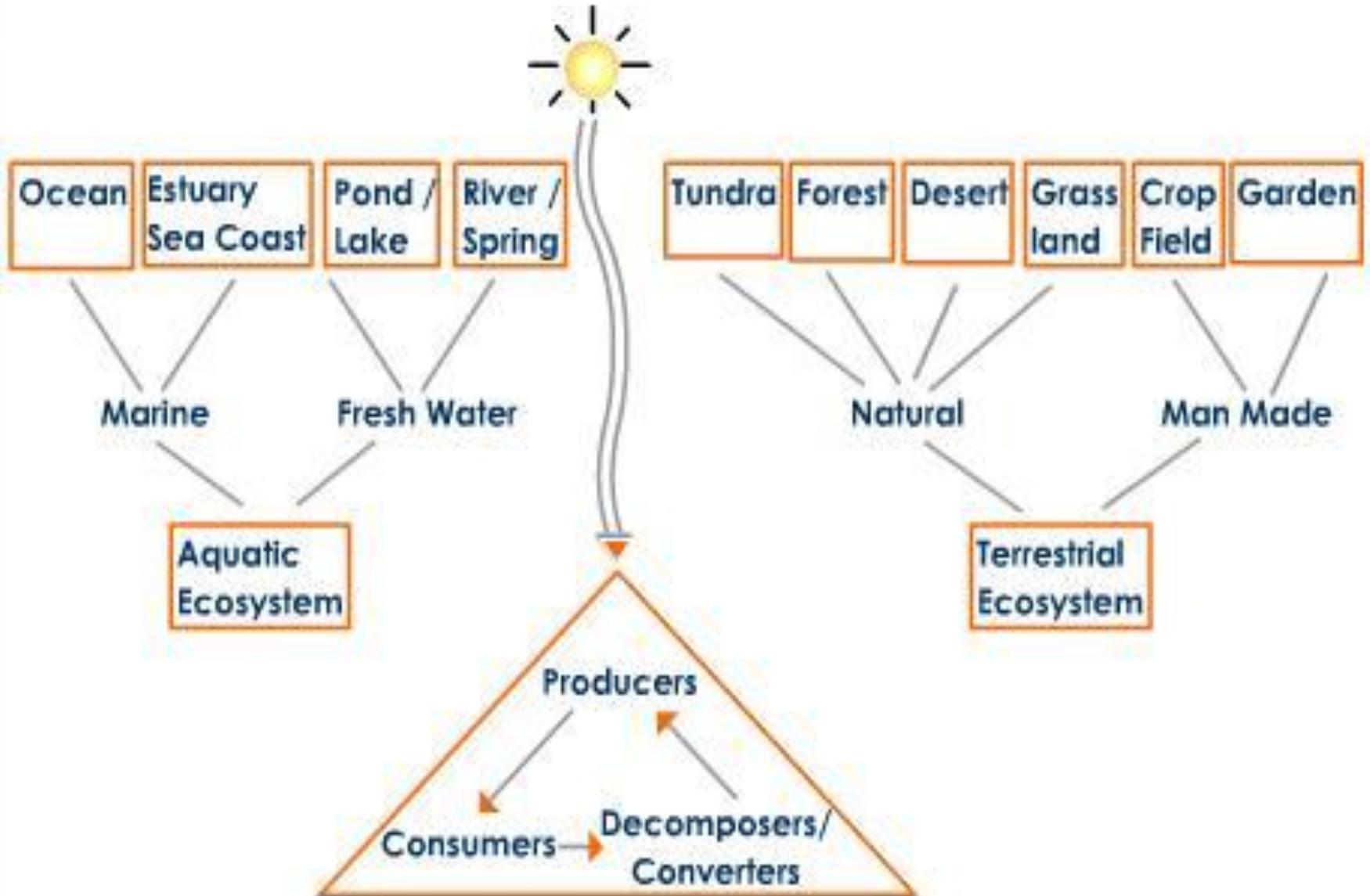
- ❑ It is also controlled by climatic conditions such as the amount of sunlight, the temperature and the rainfall in the region.

## Contd...

- ❑ Ecosystems are divided into terrestrial or land-based ecosystems, and aquatic ecosystems in water.
- ❑ These form the two major habitat conditions for the Earth's living organisms.
- ❑ Ecosystems have been formed on land and in the sea by evolution/growth that has created species to live together in a specific region.
- ❑ Thus ecosystems have both non-living and living components that are typical to an area giving it its own special characteristics that are easily observed.

# Understanding Ecosystems

## Types of Ecosystem



- ❑ Different biogeographic regions in India - the Himalayas, the Gangetic Plains, the Highlands of Central India, the Western and Eastern Ghats, the semi-arid desert in the West, the Deccan Plateau, the Coastal Belts, and the Andaman and Nicobar Islands.
- ❑ Each area has structurally and functionally identifiable ecosystems such as different types of forests, grasslands, river catchments, mangrove swamps in deltas, seashores, islands, etc.

- ❑ **Robust ecosystem** - less affected by a certain level of human disturbance.
- ❑ **Fragile ecosystem** - are quickly destroyed by human activities.
- ❑ **Mountain ecosystems** are extremely fragile/delicate - degradation of forest cover leads to severe erosion of soil and changes in river courses.
- ❑ **Island ecosystems** are easily affected by any form of human activity which can lead to the rapid extinction of several of their unique species of plants and animals.
- ❑ **River and wetland ecosystems** can be seriously affected by pollution and changes in surrounding land use.

# Ecosystem degradation

- ❑ Ecosystems are the basis of life itself!
- ❑ Some species, if eliminated seriously affect the ecosystem. These are called 'keystone' species.
- ❑ Ecosystems are however frequently disrupted by human actions which lead to the extinction of species of plants and animals that can live only in the different natural ecosystems.
  - ❑ Extinction occurs due to changes in land use.
  - ❑ Forests are deforested for timber
  - ❑ Wetlands are drained to create more agricultural land
  - ❑ Pollution from industry and waste from urban settings can also lead to extinction of several species

## Contd..

- ❑ The reason for the depletion of natural resources is twofold
  - ❑ our rapidly **exploding population**
  - ❑ **consumerism** or the growth of affluent societies, which consume and waste a very large proportion of resources and energy

# What makes ecosystems different?

1



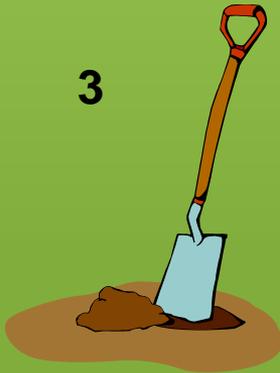
*Amount of water*

2



*Amount of sunlight*

3

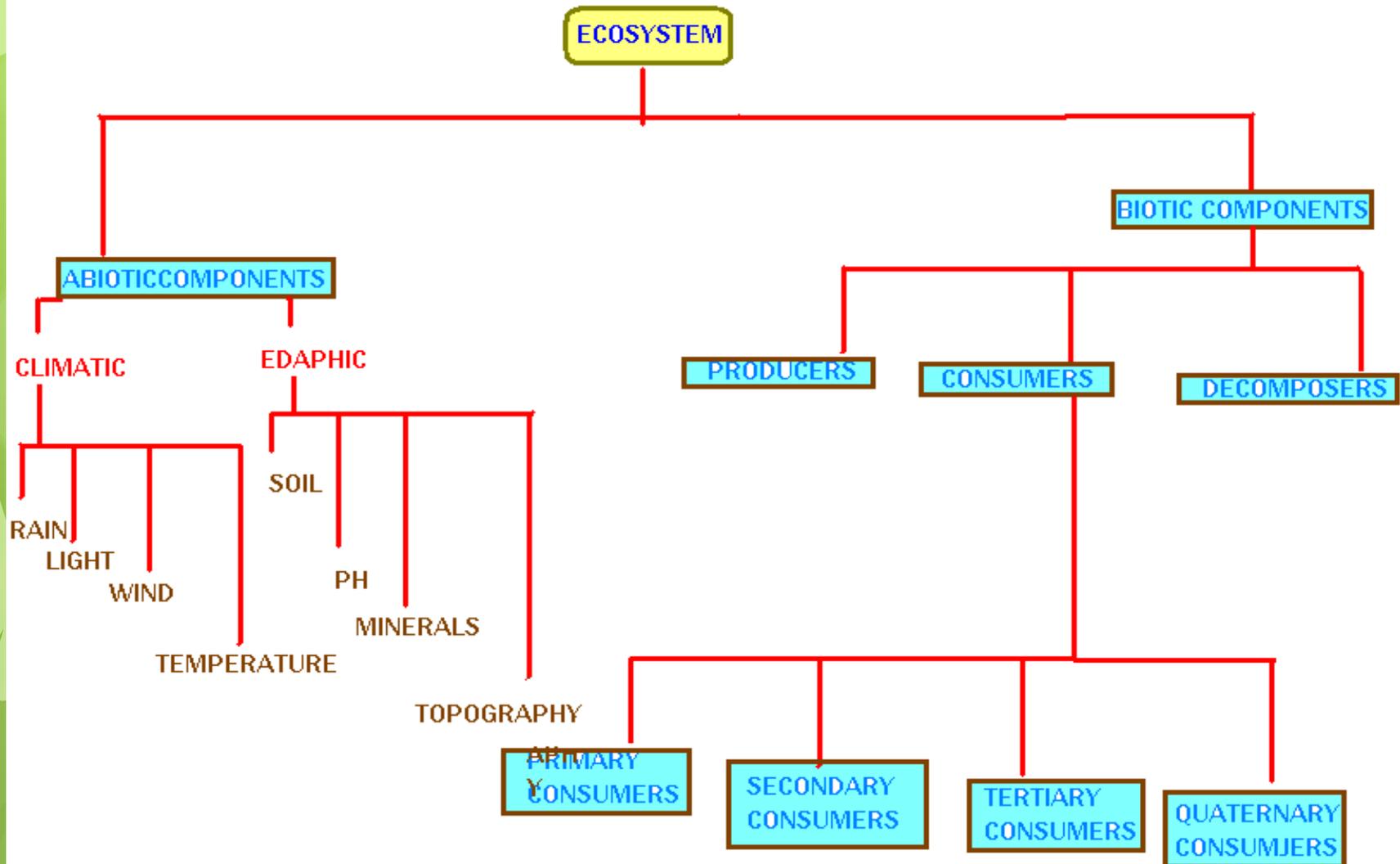


*Type of soil*

# Structure of an Ecosystem

- ❑ Structural aspects
- ❑ Components that make up the structural aspects of an ecosystem include:
  - ❑ Inorganic compounds - C, N, CO<sub>2</sub>, H<sub>2</sub>O
  - ❑ Organic compounds - Protein, Carbohydrates, Lipids - link abiotic to biotic aspects.
  - ❑ Climatic regimes - Temperature, Moisture, Light & Topography.
  - ❑ Producers - Plants.
  - ❑ Macro consumers - Phagotrophs - Large animals.
  - ❑ Micro consumers - Saprotrophs, absorbers like fungi

# STRUCTURE OF ECOSYSTEM



# ABIOTIC FACTORS

□ This is broken down into 4 different areas.

□ 1: CLIMATIC FACTORS:

Light, temperature, water availability, wind

□ 2: EDAPHIC FACTORS: (soil)

Aeration, drainage, humus content, mineral content, soil pH

□ 3: GEOGRAPHIC FACTORS/FEATURES:

Aspect (direction), slope, altitude, shelter.

Ex: Hills, mountains, plains, rivers, lakes, coastal areas, islands, estuary

□ 4: CHEMICAL FACTORS:

Oxygen, pH, mineral availability, salinity

# Functions of Ecosystem

- ❑ All the Functional aspects of Ecosystem(every) relates to the growth and Regeneration of Plants and Animals.
- ❑ This is possible through the Mechanism(in-built system) of biogeological cycles and other functions of Ecosystem(every)
- ❑ The in -built mechanism also controls the population size of all the species contained in it.
- ❑ They leads to maintain distinct abiotic/biotic components and Ultimately influence the Quality of Human life.

# Functions of Ecosystem

- ❑ Functional aspects of ecosystem:
  - ❑ 1) Productivity & Energy cycles.
    - ❑ Productivity is measured in  $\text{Kcal}/(\text{m}^2.\text{year})$
    - ❑ The rate of biological energy flow i.e. production and respiration rates of the community.
  - ❑ 2) Food chains.
    - ❑ Rate of materials or nutrient cycles.
  - ❑ 3) Diversity-inter linkages between organisms.
    - ❑ Biological or ecological regulations which include regulations on organisms by the environment and regulations on environment by the organisms ( $\text{N}_2$  fixation by organisms).
  - ❑ 4) Nutrient cycles-biogeochemical cycles.
  - ❑ 5) Evolution

# Functions of Ecosystem

- ❑ Functional aspects of ecosystem:
- ❑ 1) Productivity:
  - ❑ i) Primary : The rate at which the Solar energy captured by the plants through Photosynthesis
  - ❑ Ii) Secondary: the biomass available for consumers

# Producers, Consumers and decomposers

- ❑ Ecosystem consists of basically following biotic components:
  1. Producers
  2. Consumers
  3. Decomposers

## Contd...

- ❑ Every living organism is in some way dependent on other organisms.
- ❑ Plants are food for herbivorous animals which are in turn food for carnivorous animals.
- ❑ Thus there are different trophic levels (specific feeding stage/level) in the ecosystem.

# Producers

- ❑ Plants are the 'producers' in the ecosystem as they manufacture their food by using energy from the sun.
- ❑ Plants manufacturer organic compounds from inorganic substances from their environment.
- ❑ Green Plants are able to do this by photosynthesis where the sun provides necessary energy.
- ❑ Green Plants are autotrophic organisms or primary producers.



## I. Procedures (Autotrophs)

Procedures synthesize their food themselves through photosynthesis

**Example :** All green plants, trees.

### Photosynthesis

The green pigments called chlorophyll, present in the leaves of plants, converts  $\text{CO}_2$  and  $\text{H}_2\text{O}$  in the presence of sunlight into carbohydrates.



$\square$  This process is called photosynthesis

# Consumers (heterotrophs)

Consumers are organisms which can not prepare their own food and depend directly or indirectly on the producers.

Ex:

## **Plant eating species**

Insects, rabbit, goat, deer, cow, etc.

## **Animal eating species**

Lions, tigers etc

# Classification of consumers

Consumers are further classified as

(i) **Primary consumers (Herbivores) (Plant eaters)** Primary consumers are also called herbivores, they directly depend on the plants for their food. So they are called plant eaters.

**Examples :** Insects, rat, goat, deer, cow, horse, etc.,



## ❑ Secondary consumers (primary carnivores)

Secondary consumers are primary carnivores, they feed on primary consumers. They directly depend on the herbivores for their food.

### Example

Frog, cat, snakes, foxes, etc.,

## Tertiary consumers (Secondary carnivores) (Meateaters)

Tertiary consumers are secondary carnivores, they feed on secondary consumers.

They depend on the primary carnivores for their food.

### Examples

Tigers, lions, etc.,



## Omnivore:

They feed on both plants and animals.

## Detritivores:

They feed on the parts of dead organisms, wastes of living organisms, their castoff and partially decomposed matter.

Ex: beetels, termites, ants, crabs

← Detritus feeders →

← Decomposers →



Long-horned beetle



Bark beetle engraving



Carpenter ant galleries



Termite and carpenter ant work



Dry rot fungus

Wood reduced to powder

Mushroom



Time progression →

Powder broken down by decomposers into plant nutrients in soil

## Decomposers

- ❑ They derive their nutrition by breaking down the complex organic molecules to simpler organic compounds and ultimately in to inorganic nutrients.
- ❑ Even after animals and plants have died they serve as food for the **decomposers**. Bacteria and fungi feed off dead, decaying, organic material and break it down into simple nutrients that are returned to the soil or water. These substances are then re-used by the producers.

# Decomposers

- Saprophytic organisms (Bacteria & Fungi) that obtain their energy by decomposing the dead parts of the living organisms.

