

# Environmental Science and Engineering

# Module-I

- Ecology & Biogeochemical Cycles: Introduction to environmental science, Ecological perspective and value of environment, biodiversity of species, Biotic components, Energy, Food Chain, biogeochemical cycles like water, oxygen, nitrogen and carbon cycle.

# Module-II

- Environmental gradients & Laws:  
Environmental gradients, Tolerance levels of environment factors, Indian Environmental Laws.

# Text Book

- An Introduction to Environmental Engineering and Science, by Gilbert M. Masters & Wendell P. Ela, PHI Publication.
- Environmental Engineering, by G. Kiely, McGraw Hill International Edition.

## Origin

- The word “**Environment**” has come from an old french word **environ** or **environner** to be exact which literally means “**to encircle**” or “**to surround**”.

# Definition

- The word “**environment**” can be defined as “our life support system which includes air, water, land/soil & all other natural resources present around us”.

# Definition

- According to ISO:14001( International Organization for Standardization), **environment** can be defined as, “Surroundings in which an organization operates, including air, water, land, natural resources, flora(plants), fauna(animals), human beings and interrelations”.

# Related Terms

- Environmental Science
- Environmental Engineering
- Environmental Management
- Environmental Laws



# Environmental Science

- It is the study of human beings impact on the environment and the physical, chemical and biological changes occurring in nature which focuses on pollution.
- It is highly interdisciplinary & it collects information from various fields such as biology, chemistry, geography, agriculture, geology etc.

# Environmental Engineering

- It is defined as that branch of engineering which is concerned with protecting the environment from the potentially deleterious or harmful effects of human activities, protecting the human population from the effects of environmental pollution and improving the environmental quality for better human health & well being.

# Environmental Management

- It consist of auditing of EIA (Environmental Impact Assessment), Planning, Preparing EIS (Environmental Impact Statement) & pollution management.

# Environmental Laws

- It involves the body of statutes, policies those are made in order to protect the nature from being misused by human beings.
- Some laws are regulative or controlling in nature while some are for preventive measure & some are binding on us.

# Sustainable Development (SD)

- It can be defined as **“the ability to meet the needs of present generation without compromising the ability of future generation to meet their needs”** i.e. the balance or proper use of resources, so that our future generation will not face any problem for their survival, after taking care of our own survival needs.

# Pillars or Components of SD

- There are **three** pillars or components of Sustainable Development (SD)
  - a) Economical Development
  - b) Society or community Development
  - c) Environmental Protection

# Human Dimension in Env. Engg.

- It is also known as **Three factor model** for assessing environmental degradation.
- To estimate or assess the extent of environmental degradation **John Holdern** (a physicist) and **Paul Ehrlich** (a biologist) has given a three factor model.

# Human Dimension in Env. Engg.

- According to this model, total environmental Impact (I) of degradation and pollution due to population in a given area depends on three factors i.e. P, A, T.

P represents Size of population

A represents Affluence or Per capita Consumption or per person consumption

T represents Technology used.



# Human Dimension in Env. Engg.

- The relationship is,  $I = PAT$
- In the developing countries, **P<sup>3</sup> syndrome** i.e.(Population, Pollution, Poverty) and in the rich developed countries **overuse of natural resources** are the key or important factors leading to environmental degradation.

# Environmental Problems

- The major environmental problems that we are facing are –
  - a) Water Pollution
  - b) Air Pollution
  - c) Biodiversity Depletion
  - d) Large amount of Waste Production
  - e) Food Supply Problems

# Causes of Environmental Problems

- Many Environmental Problems presently we are facing are mainly due to –
  - a) Over Population
  - b) Wasteful use of Resources
  - c) Destruction & Degradation of Wildlife Habitats
  - d) Depletion & Contamination of Surface Water & Ground Water

# Causes of Environmental Problems

- e) Depletion of Non-Renewable resources or minerals
- f) Deforestation
- g) Soil Erosion
- h) Loss of Biodiversity

# Definition of Pollution

- It is an undesirable change in physical, chemical or biological characteristics of air, water & soil, that may harmfully affect human beings, animals, the plant life, industrial progress, living conditions & cultural assets.

# Definition of Pollutant

- It is an undesirable harmful solid, liquid or gaseous substance present in such a concentration in the environment which tends to be injurious for the whole living organisms.

# Ecological Concepts

- The word **ecology** was coined by Ernst Haeckel from two Greek words, Oikos & Logos.
- Oikos means House or Living Space & Logos means Study
- Ecology is the branch of Biology concerned with the relations of various species to one another & to their physical surroundings

# Ecological Perspective

- Ecological perspective demands a greater understanding of the functioning of living systems & their interactions with the environment.
- It gives a qualitative emphasis on ecological concepts.



# Principles of ecology

- Living organisms can't exist with total disregard to their environment.
- All living organisms & their physical environment are interdependent upon each other & also affect each other.

# Principles of ecology

- Every living organisms has certain limits of tolerance towards the various factors of environment & only within these limits the organisms can survive.
- The existence of life depends upon flow of energy through food chains & the cycling of nutrients.

# Aspects of ecology

- The two important aspects of ecology are –
  - a) Autecology or species ecology
  - b) Synecology or community ecology

## a) Autecology

- It is concerned with the ecology of an individual species & it's population.

## b) Synecology

- It is the study of communities, their composition, their behaviour & the relation to the environment.
- Synecology is further subdivided into three categories –
  - i) Population Ecology
  - ii) Genetic Ecology
  - iii) Taxonomic Ecology

## i) Population Ecology

- It relates with individual organisms with different groups of organisms within the ecosystem of different levels & the interrelationship among themselves

## ii) Genetic Ecology

- It is also known as Gene Ecology.
- Different organisms have different genes & chromosomes, hence they live in different places.
- The relationship due to the variation in genes among biotic components with their surroundings non-biotic environment is known as Genetic Ecology.

### iii) Taxonomic Ecology

- It includes ecology of taxonomic groups such as microbes, vertebrates (with backbone), invertebrates (without backbone) & insects etc.



# Ecosystem

- An ecosystem is defined as a natural functional ecological unit comprising of living organisms (i.e. biotic community) & their non-living (i.e. abiotic) environment that interact to form a stable self-supporting system.
- Example: Pond ecosystem, Forest ecosystem etc.

# Ecosystem

- The ecosystems are characterized by a diversity of species, but in an ecosystem there must be representatives from the three functional or metabolic groups such as Primary Producers, Consumers & Decomposers.
- The ecosystems can vary in sizes.

# Properties of Ecosystem

- An Ecosystem exists independent of specific components i.e. an individual tree may die, but a forest persist.
- The components of an ecosystem are interdependent.
- The nature of ecosystem depends on the species biodiversity of the ecosystem.

# Properties of Ecosystem

- The function of ecosystem depends on the energy flow & cycling of chemical elements within the ecosystems.
- The ecosystem can be disturbed by human activities & the most adverse effect of disturbance is the loss of biodiversity.

# Types of Ecosystem

1. Natural Ecosystem
2. Artificial or Man-made or Man-engineered Ecosystem

# 1. Natural Ecosystem

- These ecosystems operate by themselves under natural conditions.
- Depending on the type of habitats, these are further sub-divided into –
  - I) Terrestrial Ecosystem
  - II) Aquatic Ecosystem

# I) Terrestrial Ecosystem

- It includes forest, grassland, desert ecosystems.

## II) Aquatic Ecosystem

- These ecosystems found in the aquatic environment.
- It can be divided into two categories –
  - a) Fresh water ecosystem
  - b) Marine water ecosystem



## a) Fresh water ecosystem

- The Fresh water ecosystem can be

- i) Lotic &

- ii) Lentic

Lotic means (moving or running water)

e.g. River or Stream ecosystem

Lentic means (Still or Standing water)

e.g. Pond, Lake ecosystem

## b) Marine water ecosystem

- These include salt water bodies which may be Ocean ecosystem, Sea ecosystem.

## 2. Artificial ecosystem

- These are maintained artificially by human beings.
- e.g. garden, park.

# Structure or components of ecosystem

- Ecosystem has two major components.
  1. Abiotic & 2. Biotic
- Abiotic can be classified into hydrosphere, atmosphere & lithosphere
- Biotic can be classified into producer, consumer & decomposer.
- Consumer can be primary, secondary, tertiary consumers.

# Functions of ecosystem

- Energy flow : It regulates the flow of energy from one level to the other.
- Nutrient cycling : It regulates cycling of nutrients.
- Environmental gradients : The ecosystem fix the limit of tolerance for each organism towards various factors of environment.

# Functions of ecosystem

- Food Chain & Food Web : The energy produced by green plants are passed to next levels by a chain of consumers leading to formation of food chain &
- interlinking of food chain will lead to formation of food web.
- Biodiversity : The ecosystem regulates the species diversity to acquire a stable system.

# Natural Resources

- The materials those occur in the environment or those are created by the environment & useful for supporting life or promoting the well-being of human beings are termed as natural resources

# Natural Resources

- Natural Resources are the naturally occurring substances those are considered valuable in their natural form & their value rest in the amount of material available & the demand for it.



# Types of Natural Resources

- There are three types of natural resources –
  - 1) Renewable or Inexhaustible  
i.e. available in unlimited quantity.  
Ex – Solar energy, wind power etc.
  - 2) Non-renewable or exhaustible  
i.e. available in limited quantity  
Ex – coal, petrol, diesel etc.

# Types of Natural Resources

## 3) Abstract Natural Resources :

It includes animals, plants & natural landscapes as part of countryside used for recreation & tourism activities.

Ex – Bird watching, sight-seeing

# Value of environment

- The value of the environment is considered on the basis of the economic status of the particular region.
- Natural resources existing in the region are the backbone on the economic status.

# Value of environment

- The following four points will help in evaluating the environment –
  1. Environmental Auditing
  2. Biodiversity
  3. Cost-Benefit Analysis
  4. Environmental Ethics

# 1. Environmental Auditing

- Environmental Audit is defined as a systematic listing of natural resources in an area playing a key role for economic status & sustainable developments of mankind in that area following definite management & regulatory systems.

# 1. Environmental Auditing

- Generally, it provides a list of all the resources present in the area.
- The audit activities are carried out in three phases –
  - a) Pre-audit activities
  - b) On-site audit activities
  - c) Off-site or Post audit activities

# 1(a) Pre-audit activities

- It includes planning,  
scheduling the audit activities &  
selecting the audit team.

# 1(b) Onsite audit activities

- It includes interviewing of the site personnel &
- Inspecting the site.



# 1(c ) Post audit activities

- It includes –
- Preparing & distributing audit reports
- Determining potential solutions
- Assigning responsibilities
- Implementing actions &
- Conducting follow-up of the action plan.

## 2.Biodiversity

- It doesn't imply just a collection of species, but is a basic resource which acts as a human life support system.
- Biodiversity plays an important role in biogeochemical cycles.

## 2.Biodiversity

- Biodiversity has three hierarchical levels i.e.
  - i) Genetic Biodiversity
  - ii) Species Biodiversity
  - iii) Ecosystem Biodiversity

## 2.Biodiversity

- There can be three kinds of losses of biological resources.
  - i) Depletion of a once common species
  - ii) Local or global extinction
  - iii) Ecosystem disruption.

# 3. Cost-Benefit Analysis

- Working principles for Cost-Benefit Analysis include –
  - i) The SMS approach  
SMS stands for Safe Minimum Standard
  - ii) The Minimax rule  
Minimax stands for minimizing maximum losses

# 3. Cost-Benefit Analysis

- i) The SMS approach –

It attempts to provide a decision making process for problems involving long period of time & large uncertainties.

This approach makes conservation the preferred option.

# 3. Cost-Benefit Analysis

- ii) The Minimax rule –

It is a necessarily pessimistic decision rule biased towards conservation.

## 4. Environmental Ethics

- It gives the attitude of people towards other living beings & the natural environment.
- We, human beings must eradicate our feelings of superiority over the rest of natural world & develop an “I-Thou” relationship rather than “I-It” relationship with the environment.



# Levels of organization in Biotic Components

- There are **six** major levels of ecological organization are recognized in the biotic components of the environment.
  - 1) Individual
  - 2) Population
  - 3) Community
  - 4) Ecosystem
  - 5) Biomes &
  - 6) Biosphere

# 1) Individual

- These are single species.
- Individuals have physiological functions & respond to environmental conditions

## 2) Population

- Population consists of a group of individuals of the same species living in a particular area at the same time.
- Birth rate, death rate plays an important role in the size of population.

### 3) Community

- Population of different species living together interact with each other to form a community.
- Niche :-

A suitable or comfortable position in the ecological hierarchy for a species.

Ex- Phytoplankton→Zooplankton→Fish→Whale

Niche of fish in the above ecological hierarchy is three or 3<sup>rd</sup> position.

## 4) Ecosystem

- It includes both biotic & abiotic components of an area.
- The major or important feature of this ecological level is the strong interaction between the various biotic & abiotic components present.
- Nutrient cycling & energy flow occur in this ecological level.

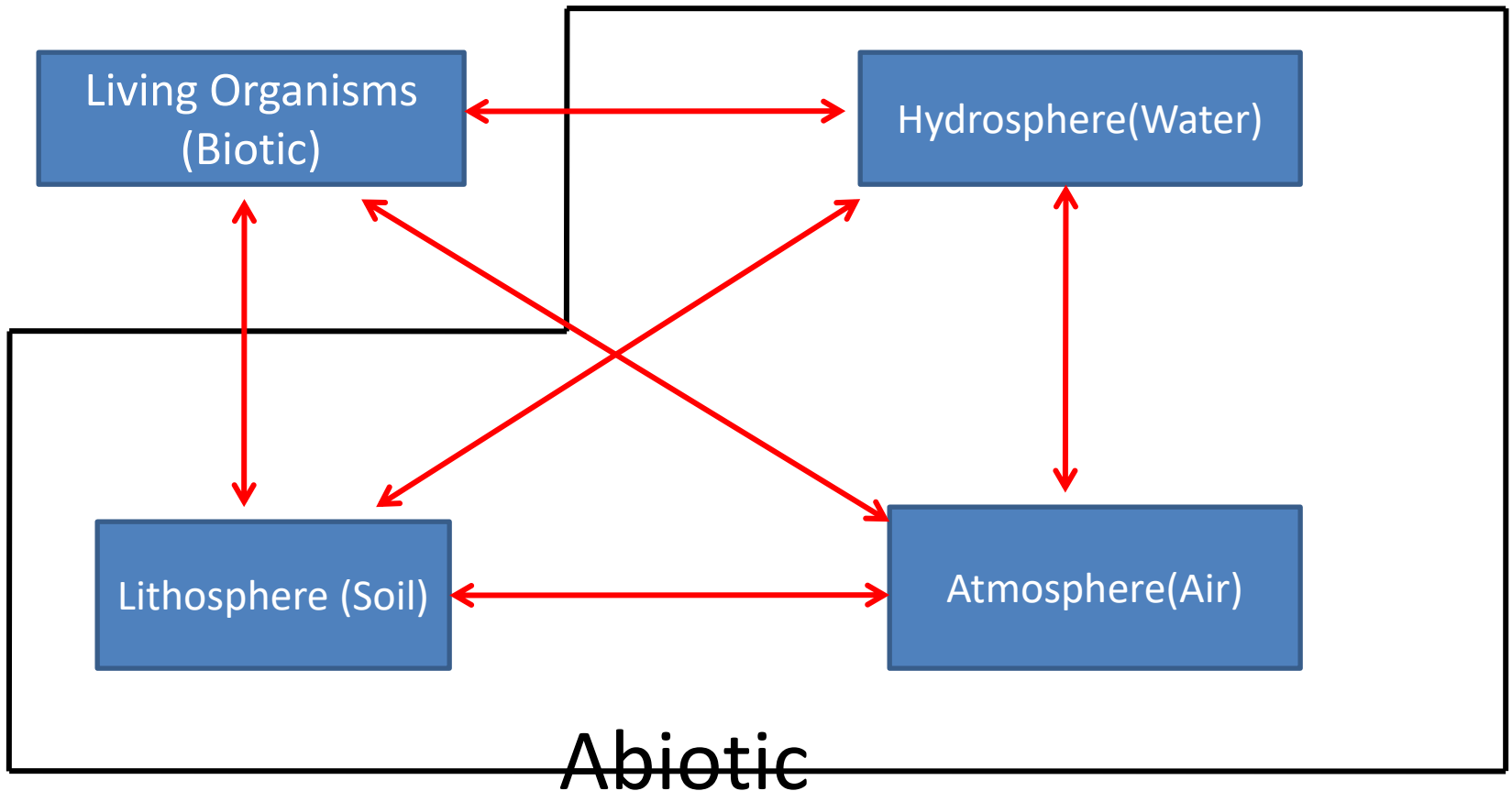
## 5) Biomes

- When environmental conditions are similar in different parts of the country or around the globe, the habitats & communities are also often similar, giving rise to a higher level of biotic organization known as **biomes**.
- Ex- a) **Tropical Rainforest**(High temp.& High rainfall)  
b) **Desert Scrub**(High temp. & low rainfall)

## 6) Biosphere

- The highest organizational level is the biosphere & it extends from bottom of the sea to the top of the sky where life exists.
- Biogeochemical cycles occur at this ecological level.

# Diagram





# Diagram

- This diagram represents dynamic nature of ecosystem due to interactions and interdependence of the various components present.

# Ecosystem Process

- In the ecosystem process, the following processes are essential for the survival & maintenance of biotic components.
  1. Energy flow &
  2. Nutrient cycling

# 1. Energy flow

- On the earth, the ultimate source of energy for life is solar radiation.
- There are two sources of energy –
  - a) Autotrophic
  - b) Heterotrophic

# 1.(a) Autotrophic

- Autotrophic production of energy is carried out within the ecosystem by green plants in the presence of sunlight using photosynthesis process.

## 1.(b) Heterotrophic

- Heterotrophic energy source is the one, where the chemical energy is imported as organic matter which is originated from primary production in some other ecosystem.
- This imported organic matter is called **allochthonous**.

# Photosynthesis

- $12\text{H}_2\text{O} + 6\text{CO}_2 + 709\text{kcal}(\text{from sunlight})$   
 $\xrightarrow{\text{Chlorophyll}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + 6\text{H}_2\text{O}$   
(Carbohydrate)
- Out of total amount of solar radiation available,  
only 1 to 5% is used in the photosynthesis process.

# Photosynthesis

- The organic matter produced by green plants in the Photosynthesis process is called Primary Production or (PP)
- PP is affected by various environmental factors like water, light, temperature & soil nutrients.
- PP is of 2 types.
  - 1) GPP (Gross Primary Production)
  - 2) NPP (Net Primary Production)

# Photosynthesis

- $GPP - R(\text{Respiration}) = NPP$
- GPP is the total amount of chemical energy or biomass stored by plants per unit area per unit time.
- Since plant requires energy for synthesis of organic matter & functioning of plant itself, some of GPP is used in the process of respiration.



# Photosynthesis

- NPP is used for plant growth & reproduction.
- NPP is normally 80 to 90% of GPP.
- As various environmental factors affect PP, hence GPP & NPP vary over the globe.
- NPP can be classified into **four** broad groups each with a characteristic productivity range.

# Photosynthesis

1. Low range – 0 to 250 gm/m<sup>2</sup> – year  
Ex- Desert, semi-desert
2. Middle range – 250 to 1000 gm/m<sup>2</sup> – year  
Ex- Non-forest communities like shrubland, grassland
3. Normal range – 1000 to 2000 gm/m<sup>2</sup> – year  
Ex- Forest
4. High range – 2000 to 3000 gm/m<sup>2</sup> – year  
Ex- Rainforest

# Respiration

- When any organism requires energy, the reverse chemical reaction of photosynthesis occurs, known as **respiration**, where the glucose molecule is broken down in the presence of oxygen to produce  $\text{CO}_2$ ,  $\text{H}_2\text{O}$  & energy for work done & maintenance. The reaction is –  
$$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \xrightarrow[\text{enzymes}]{\text{Metabolic}} 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy for work done \& maintenance}$$

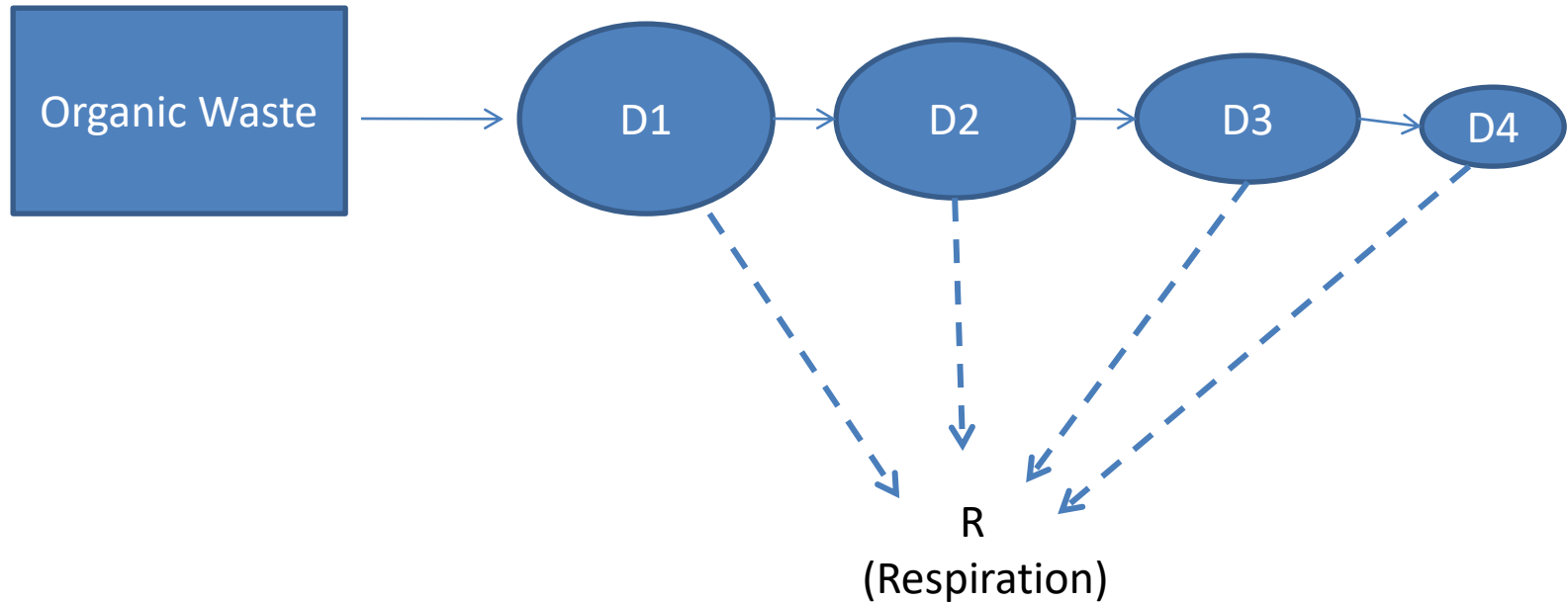
## 2. Nutrient cycling

- During decomposition, the complex organic molecules in the original detritus or waste are gradually broken down to much simpler constituents & inorganic molecules like nitrates & phosphates, as the material moves through the decomposer or detritus food chain.

## 2. Nutrient cycling

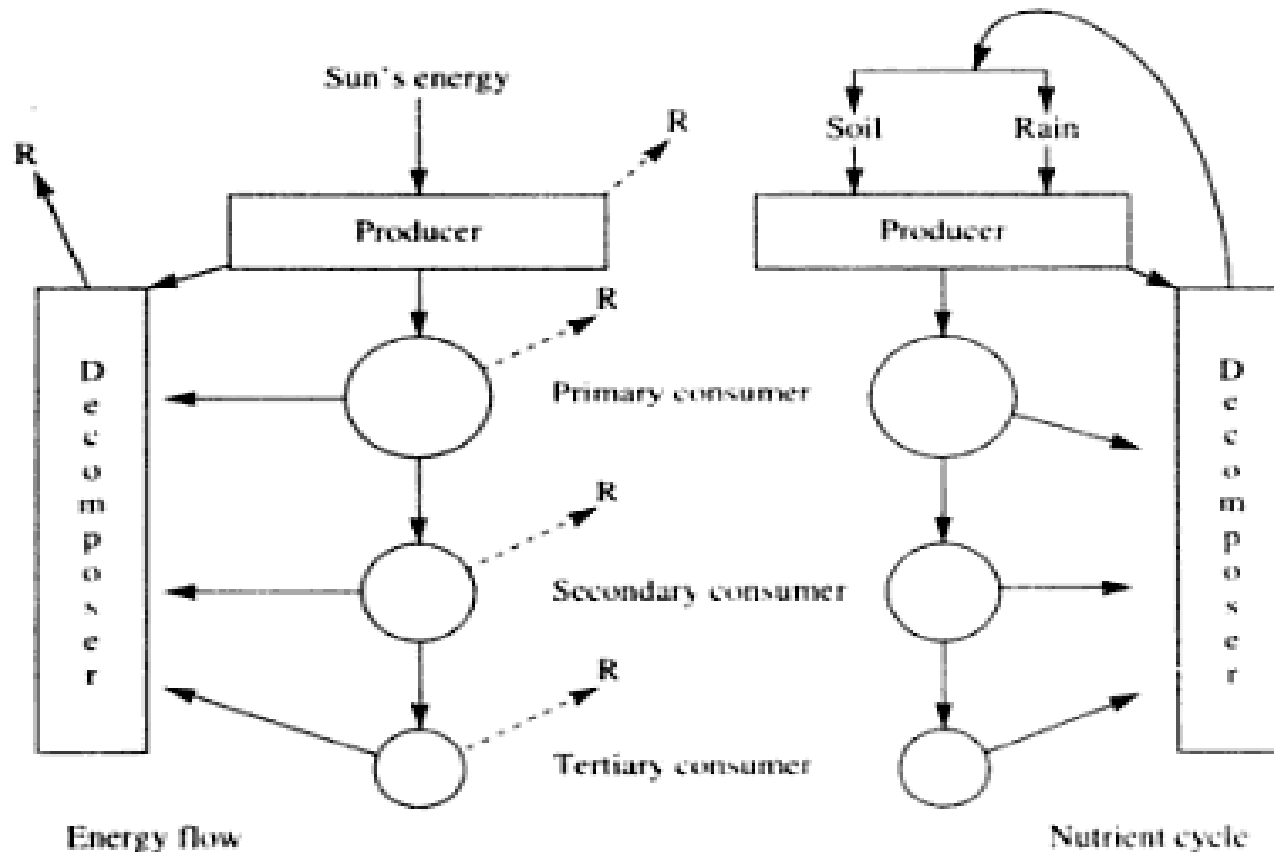
- These are then, enter into the soil or sediment or dissolved in water, where they become the nutrients available for reuse by green plants.
- This whole process of recycling of nutrients within the ecosystem is known as **nutrient cycling**.

# Detritus chain energy flow



(D1 to D4 are different levels in the detritus chain & size of circles indicate the relative amount of energy present in the level.)

# Overview of 2 major ecosystem process of energy flow, nutrient cycling



# Food Chain

- Chemical energy produced by primary producers & the nutrients used by plants to build plant tissues, are passed up by a chain of consumers leading to formation of food chain, where each link in the chain is provided with energy & nutrients.



# Food Chain

- Depending on the types of foods, there are **three** types of food chain available.
  - a) Predator or Grazing Food Chain
  - b) Saprophytic or Detritus Food Chain
  - c) Parasitic Food Chain

## a) Predator or Grazing Food Chain

- Predator means an animal that naturally preys on others.

Ex:-



## b) Saprophytic or Detritus Food Chain

- It starts from DOM

(Dead Organic Matter) & goes to detritus feeding organisms i.e.

detritivores i.e.

bacteria, worms etc. & on to their predators.

Ex:-

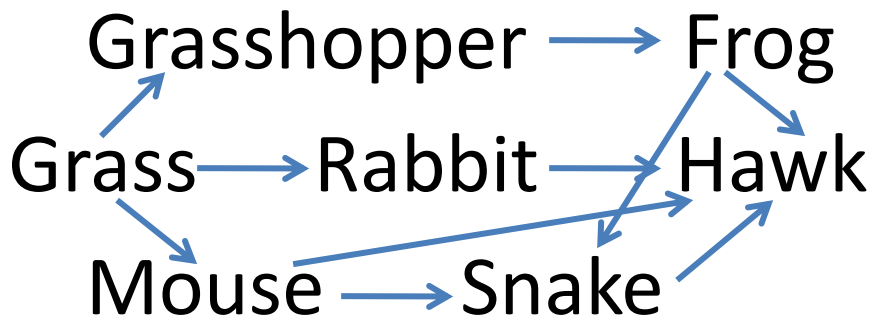
Dead leaves → Soil mites → Insects → Lizard

## c) Parasitic Food Chain

- It is a food chain in which parasites live on the host body or within the host body to get energy.
- This food chain also starts from the green plants & animals to parasitic microbes.

# Food Web

- In most ecosystems, food chains interlink with each other to produce food web.
- Food web shows the food pattern of energy flow in the ecosystem.



(Terrestrial Food Web)

# Tropic Level

- Tropic level or nutritional level or tier gives the feeding status of an organism in an ecosystem.
- It is based on the concept who feeds on whom.
- It can be -

# Tropic Level

i)First tropic level or primary producer level

Ex: - Green plants

ii)Second tropic level or primary consumer level

Ex: - Herbivores

iii)Third tropic level or secondary consumer level

Ex: - Carnivores

# Ecological pyramid

- The graphical representation of trophic levels is called the ecological pyramid.
- The arrangement of organisms in a food chain according to trophic levels forms a pyramid.
- Generally, pyramids are of **three** types.



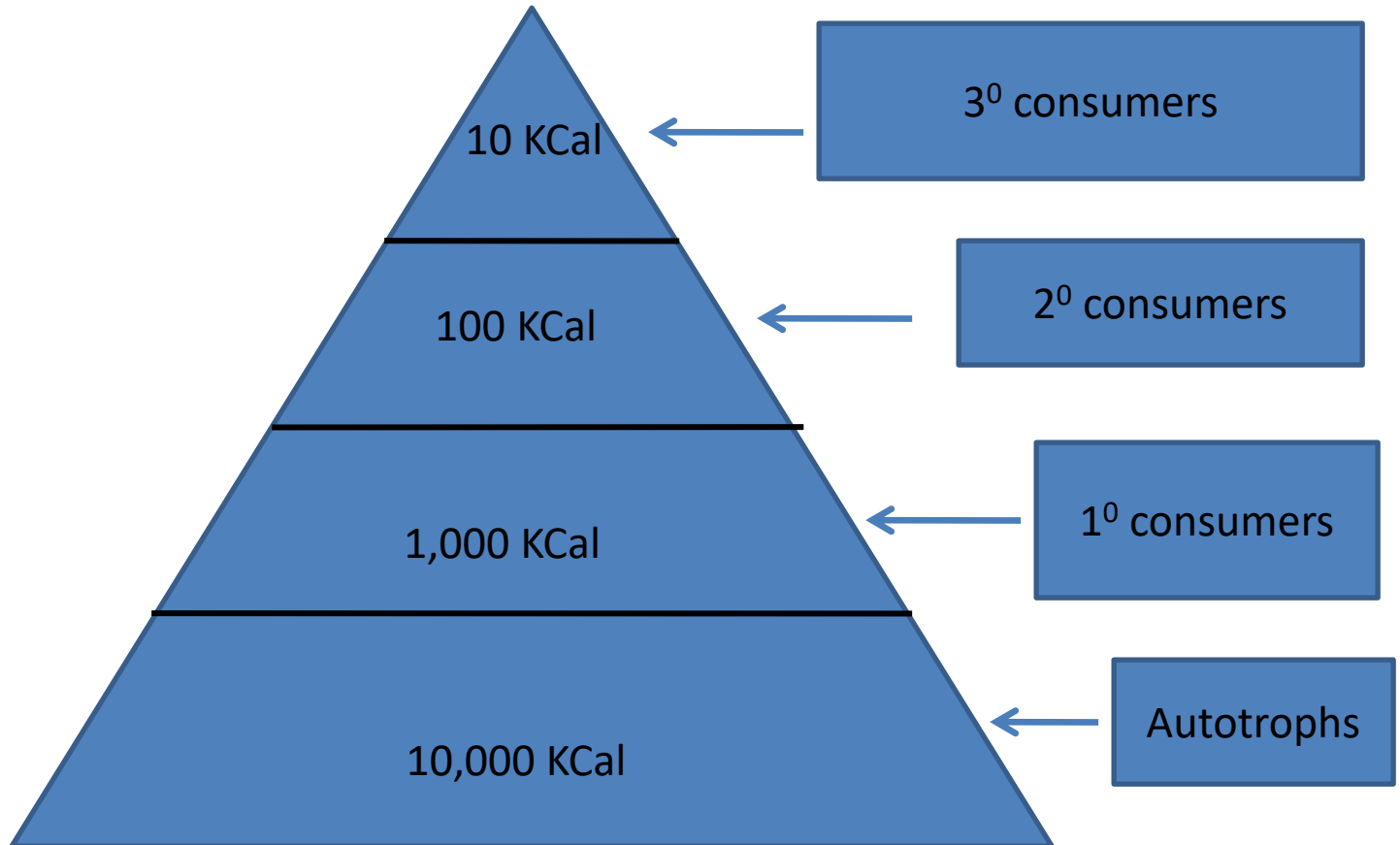
# Ecological pyramid

1. Pyramid of energy
2. Pyramid of biomass
3. Pyramid of numbers.

# 1. Pyramid of energy

- Generally, 10% energy is transferred between adjacent trophic levels & rest 90% of energy is used up in that trophic level giving rise to energy pyramid. This is called **10% rule of ecosystem**.
- It is based on rate of energy flow & productivity at each successive trophic level.
- It decreases from autotrophs to higher trophic level.

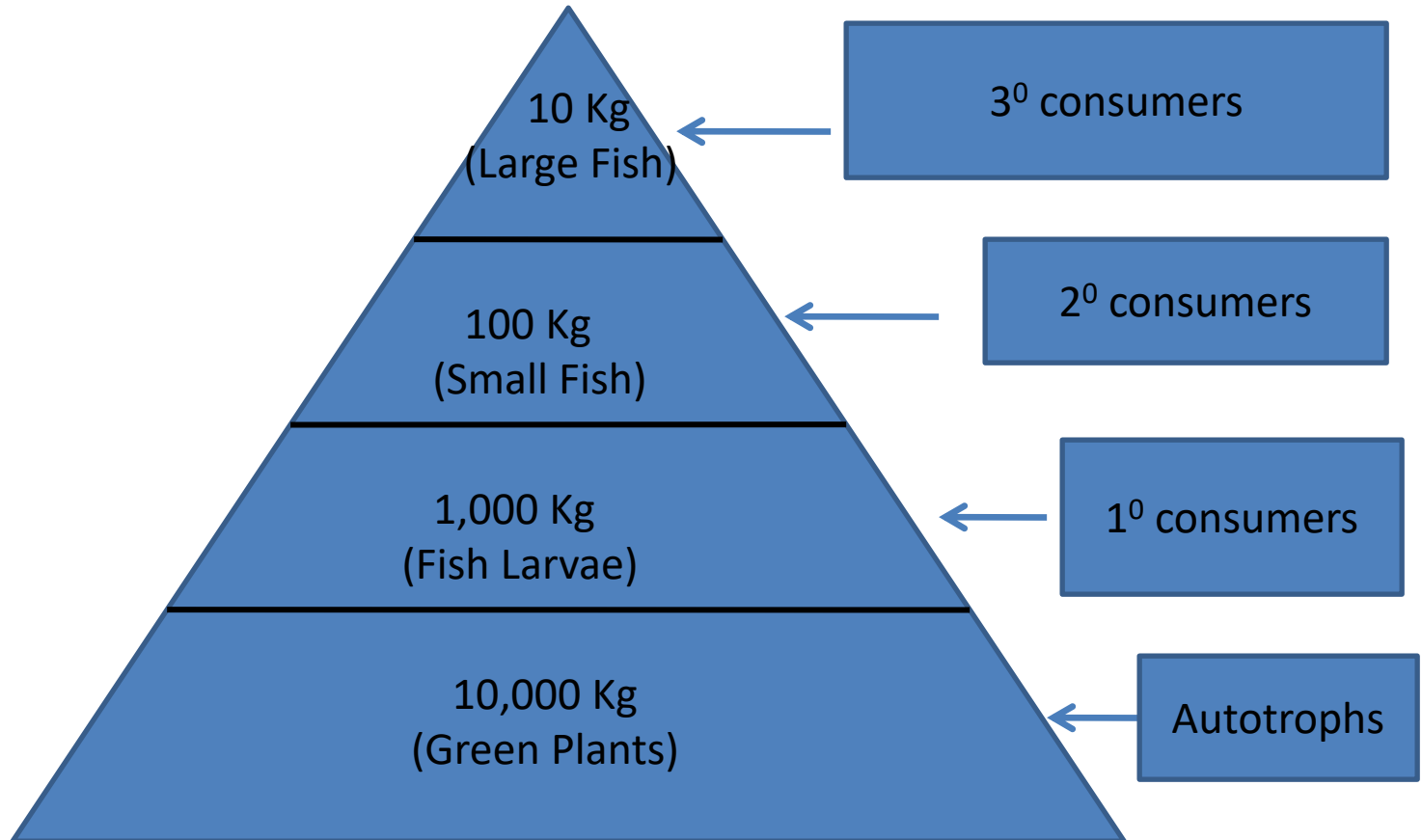
# 1. Pyramid of energy



## 2. Pyramid of biomass

- It shows the total mass of the organisms in each trophic level.
- It is based on total dry weight present in the level.
- It decreases from autotrophs to higher trophic level.

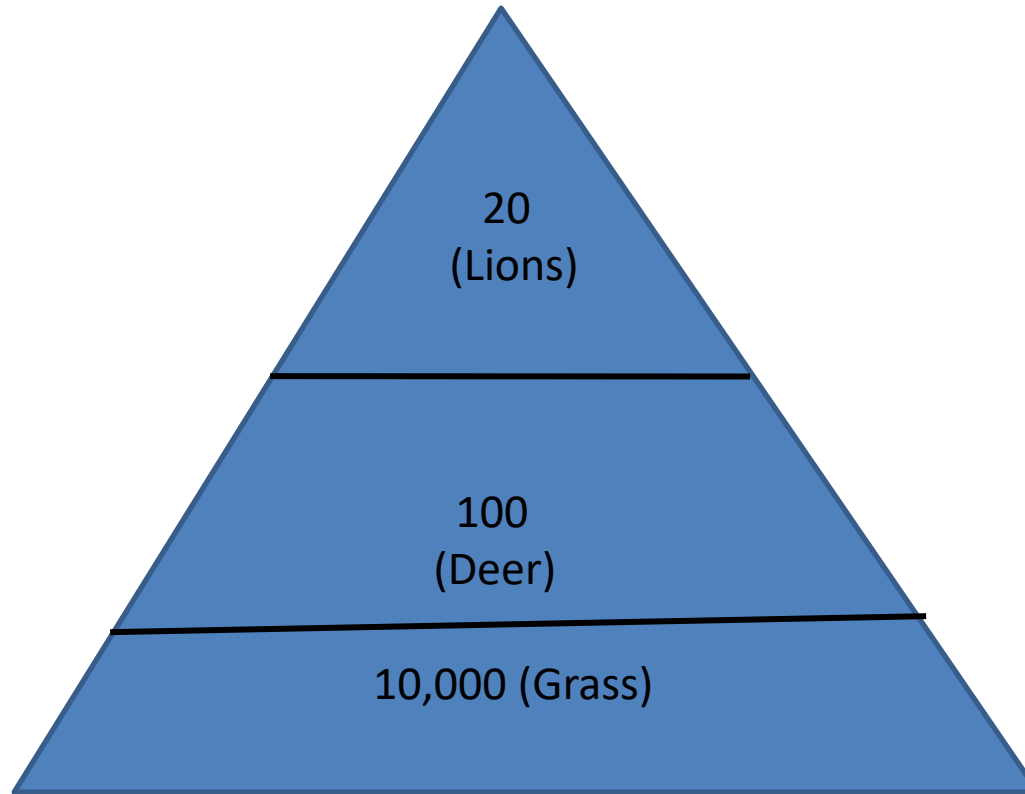
## 2. Pyramid of biomass



# 3. Pyramid of Numbers

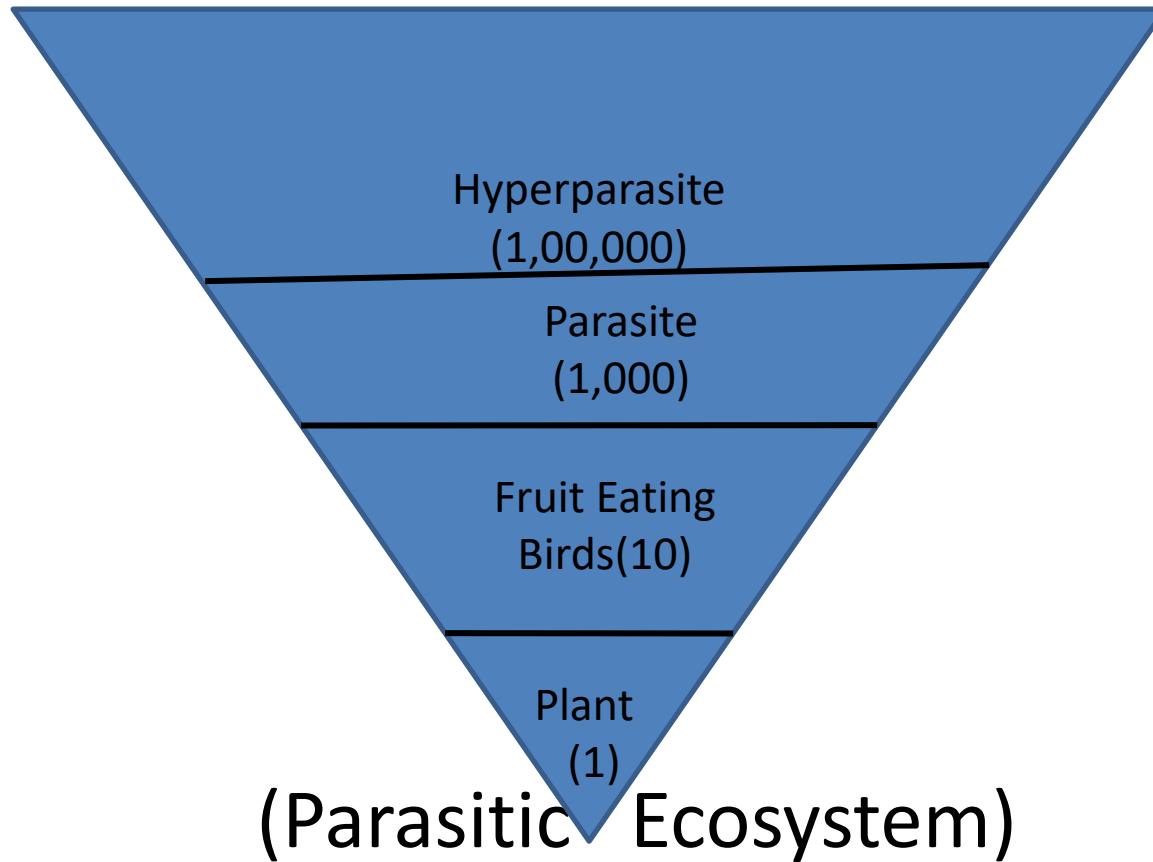
- It shows the number of organisms in each trophic level.
- There may be gradual decrease or increase in the number of individuals.

### 3. Pyramid of Numbers



(Grassland Ecosystem)

### 3. Pyramid of Numbers (Inverted Pyramid)





# Standing Crop

- The amount of living materials in different trophic level or in any component population is known as standing crop.
- It can be expressed as number/unit area or as biomass.

# Ecological Succession

- In an ecosystem, new species may succeed older species.
- The process of gradual change in the conditions of physical environment, leading to the change in the species structure of an ecological community (i.e. replacement of one species by the other) over space & time, is called **Ecological Succession** or **Ecological Development**.

# Biogeochemical Cycles

- Bio means living beings
- Geo means earth extended to air & water, where life exists.
- Chemical means chemical elements which continuously move in the cycles.
- The cyclic pathways through which chemical elements move from environment to the organisms & back to the environment are called bio-geochemical cycles.

# Biogeochemical Cycles

- All parts or components of different ecological systems, on a local or global scale are linked with the Biogeochemical Cycles.
- Biogeochemical Cycles can have a number of phases & reservoirs.
  - 1) Organic Phase
  - 2) Inorganic Phase

# Biogeochemical Cycles

## 1) Organic Phase :-

In this phase, nutrients pass rapidly through biotic communities using food chain.

## 2) Inorganic Phase :-

It contains all nutrient elements & are external to food chain.

# Biogeochemical Cycles

- The various sub-phases of the inorganic phase are –
  - a) Sedimentary Phase
  - b) Atmospheric Phase
  - c) Aquatic Phase or Aquatic Reservoir

# Biogeochemical Cycles

## a) Sedimentary Phase :-

It involves interactions with the solid earth or rocks & results of geological activities such as weathering.

## b) Atmospheric Phase :-

It forms major part of some cycles like 'N' cycle & 'C' cycle & minor parts of some cycles like 'P' Cycle.

# Biogeochemical Cycles

c) Aquatic Phase or Aquatic Reservoir :-

It involves plant nutrients.

Types of biogeochemical cycles:-

There are two types of biogeochemical cycles.

I) Water or Hydrological Cycle

II) Air or Atmospheric Cycle.



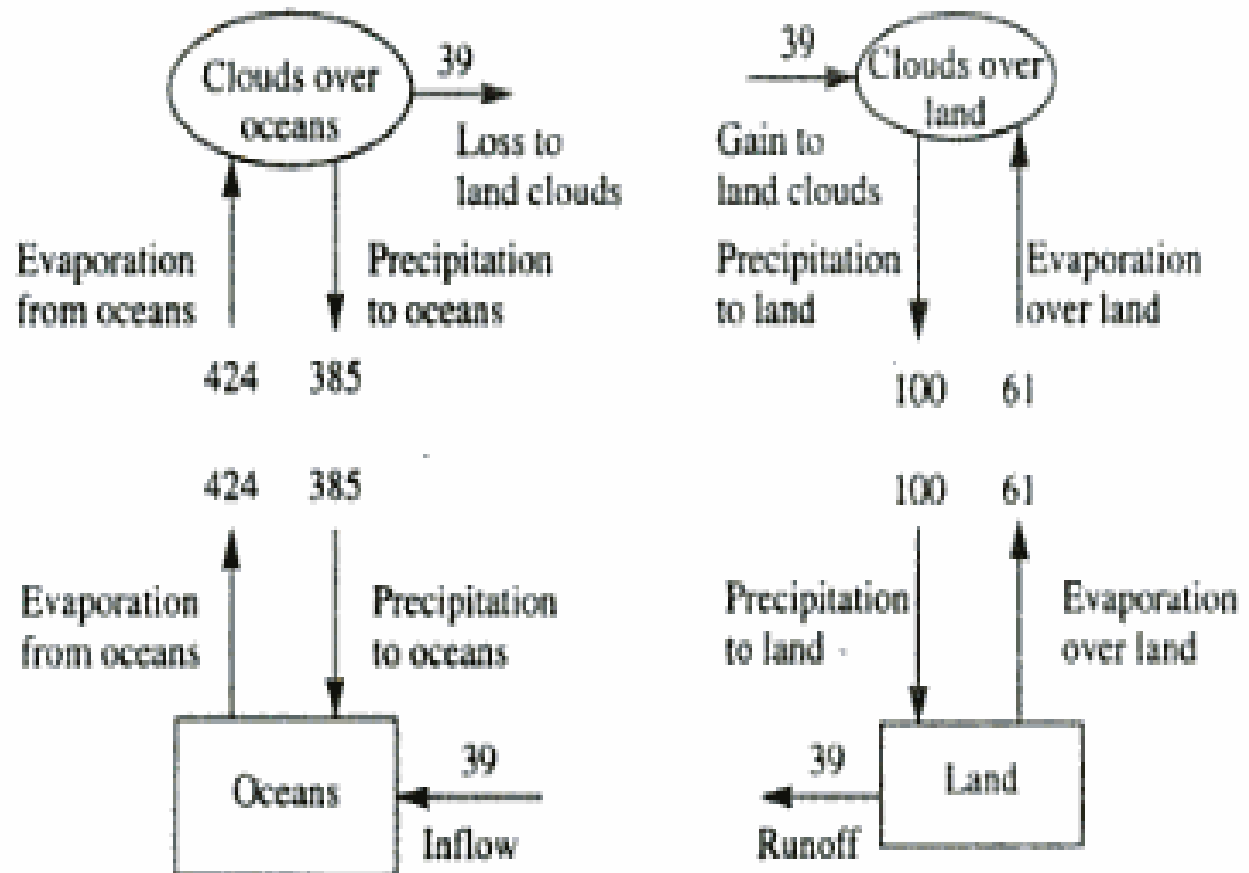
# Biogeochemical Cycles

## II) Air or Atmospheric Cycle :-

It can be classified into –

- i) C – Carbon
- ii) N – Nitrogen
- iii) O – Oxygen
- iv) P – Phosphorous
- v) S – Sulphur

# Hydrological Cycle



**Figure 4.2** Material balance on aspects of the hydrological cycle.

# Hydrological Cycle

- Interception:-

It is the evaporation of water from the outer surface of leaves during & after rainfall.

- Transpiration:-

It is the evaporation of water through foliage.

- Evapotranspiration:-

It is the combination of Evaporation from water bodies & transpiration from leaves.

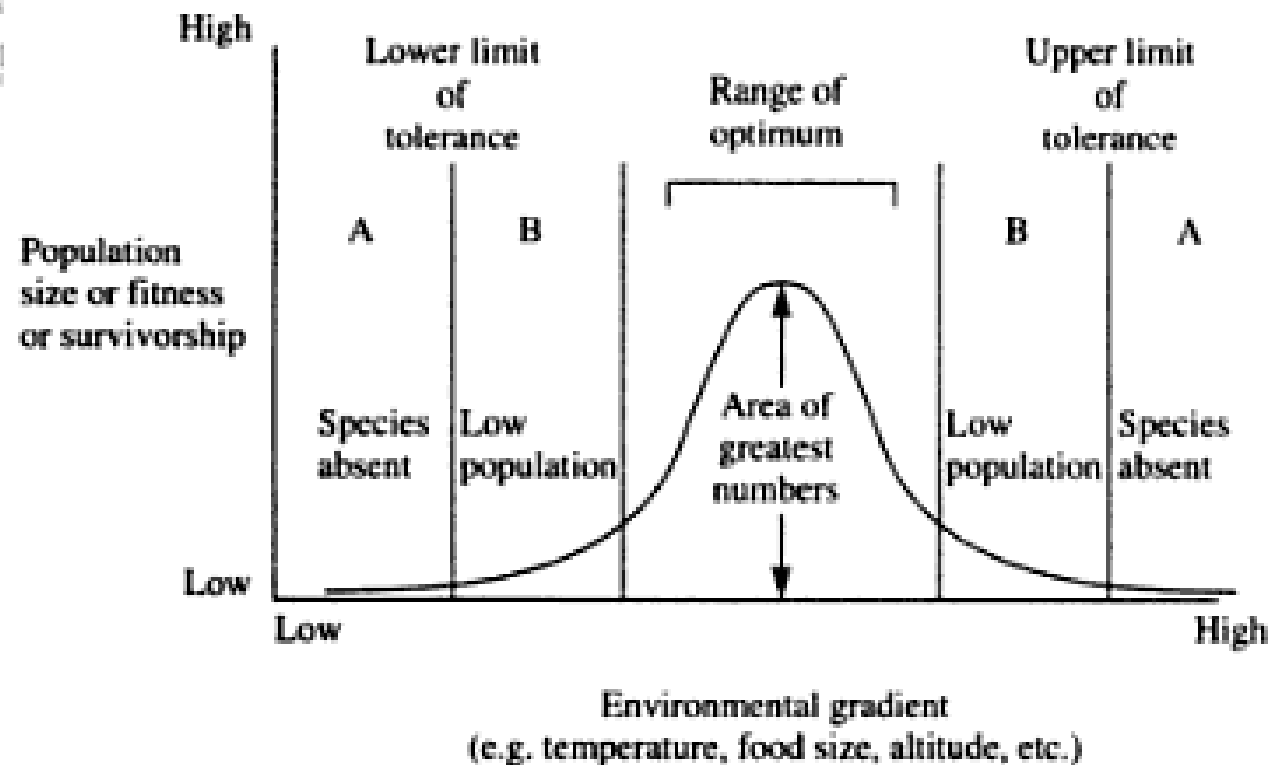
# Environmental Gradients

- The environment or environmental factors are not similar over the globe or around the earth, giving rise to Environmental Gradients & due to which different species live in different places.

# Environmental Gradients

- The physical, chemical factors like light, temperature &  $P^H$  are known as **conditions** & the factors the organism actually uses like food, water, shelter are known as **resources**.
- There is a global gradient change from the equator towards north or south.

# Environmental Gradients



**A = zone of intolerance**

**B = zone of physiological stress**

**Fitness = number of offspring contributed to next generation**

**2.8** A schematic tolerance curve for a single species population existing on a single environmental gradient.

# Environmental Gradients

- This is a normally distributed bell-shaped curve, as the change in environmental conditions are gradual from equator towards north or south.
- This curve is best described by a Gaussian (Normal) Distribution function, of the form  $f(x)=e^{-x^2}$ .
- But, pollution can make it **skew-shaped** i.e. sharp decrease of curve towards left or right from range of optimum.

# Environmental Gradients

## Limiting Factors:-

The resources in shortage of supply or the conditions over which the species has the smallest range of optimum will limit the species function & is called the limiting factor.



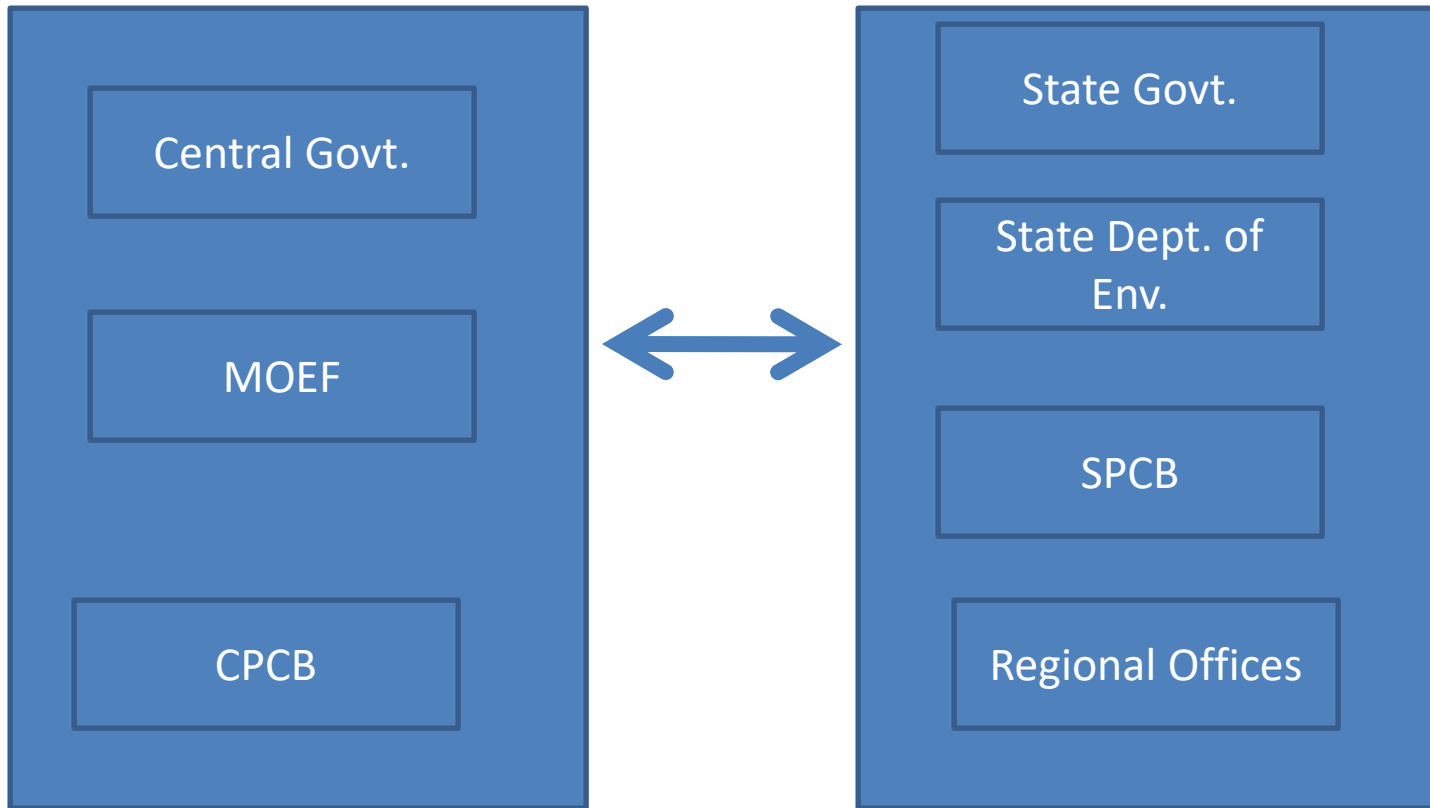
# Environmental Gradients

- Ex:- Plant growth is strongly correlated with rain, but in arid region sufficient light is available, but water scarcity is there which is the limiting factor.
- The tolerance of species to different environmental conditions or resources level vary from each other.

# Environmental Gradients

- The **favourable** environmental factors to a species provide wide tolerance curve & broad range of optimum known as **Eurytopic** factors.
- The **unfavourable** environmental factors to a species provide narrow tolerance curve & narrow range of optimum known as **Stenotopic** factors.

# Regulatory Structure of Indian Env. Laws



# Regulatory Structure of Indian Env. Laws

- MoEF – Ministry of Environment & Forest,  
Government of India
- CPCB – Central Pollution Control Board
- SPCB – State Pollution Control Board

# Indian Env. Laws

- Water Laws
- Air Laws
- Wildlife & Forest Laws
- General Env. Laws

# Water Laws

- The various env. Laws on water are –
  - 1) The Water(Prevention & Control of Pollution) Act – 1974
  - 2) The Water(Prevention & Control of Pollution) Act rules – 1975
  - 3) The Water(Prevention & Control of Pollution) Cess Act – 1977
  - 4) The Water(Prevention & Control of Pollution) Act, rules & amendments – 1992

# Objectives of Water Law

- The objectives are –
  - a) Prevention & control of water pollution
  - b) Maintaining good quality of water
  - c) Establishment of boards for the prevention & control of water pollution.

# Air Laws

- The various env. Laws on air are –
  - 1) The air(Prevention & Control of Pollution) Act – 1981
  - 2)The air(Prevention & Control of Pollution) Act rules – 1982
  - 3) Atomic Energy Act – 1982
  - 4) Motor Vehicles Act – 1988



# Objectives of Air Law

- The objectives are –
  - a) Prevention & control of air pollution
  - b) Maintaining good quality of air
  - c) Establishment of boards for the prevention & control of air pollution

# Wildlife & Forest Laws

- The various env. Laws for wildlife & forest are-
  - 1) The wildlife protection act – 1972
  - 2) The wildlife protection act and amendments – 1991
  - 3) The forest conservation act – 1980
  - 4) The national forest policy – 1988

# Objectives of Wildlife & Forest Laws

- The Objectives are –
  - a) Protection & conservation of wildlife
  - b) To preserve biodiversity
  - c) To maintain essential ecological processes & life supporting systems.

# General Env. Laws

- The various laws in this category are –
  - 1) The environmental protection act (EPA) – 1986 or Umbrella act
  - 2) Hazardous waste (management & handling) rules – 1989
  - 3) Biomedical waste(management & handling) rules – 1998

# Objectives of Umbrella act

- Protection & improvement of environment & prevention of hazards to all living creatures.
- Maintenance of harmonious relationship between human beings & their environment.

# National Green Tribunal(NGT)

- The Indian govt. established a National Green Tribunal in October 2010, headed by a former judge of the supreme court. It is a tribunal exclusively dedicated to environmental issues. This body was established by an act of parliament i.e. National Green Tribunal Act of 2010, which will deal with all matters related to and arising out of environmental issues.

# Eco-labelling of products

- An eco-label is used to mark a consumer product to indicate that it is environment-friendly with regards to its manufacture and use. The label means that the product satisfies certain eco-friendly criteria laid down by the govt. In 1991, the govt. of india launched its first eco-label called Eco-mark for easy identification of environment-friendly products.

# CTBT

- Comprehensive Nuclear-Test-Ban Treaty or CTBT bans nuclear explosive testing for everyone, everywhere, in all environments. CTBT makes very difficult for the countries to test or develop any nuclear weapon.



# Some other env. laws

- 1. London Law of Sea (1962) is for prevention of sea pollution by oil.
- 2. Stockholm Agreement (1972) is for banning of ocean dumping wastes.
- 3. Montreal Protocol (1987) is for eliminating CFCs & other ozone depleting substances.
- 4. Rio Summit (1992) is with its objectives on sustainable development.

# Kyoto Protocol

- The Kyoto Protocol (1992) was signed to try and limit Greenhouse gases, based on the premise that Global Warming is occurring due to increased Greenhouse gas emissions.

# Paris Agreement

- The Paris Agreement of 2015 is to combat climate change and reduce the temperature rise to less than 2°C per century.

# Environmental Institutions in India

- 1. TERI(Tata Energy Research Institute) established in1974.
- 2. NEERI(National Environment Engineering Research Institute) established in1958.
- 3. EPTRI(Environmental Protection Training and Research Institute) established in 1990.
- 4. IIFM(Indian Institute of Forest Management) established in 1982.
- 5. WII(Wildlife Institution of India) established in 1982 etc.

# Environmental movements in India.

- 1. Chipko movement started in 1973 to fight against deforestation.
- 2. Silent valley movement started against setting up of a 75MW hydroelectric project to protect species of flora and fauna.
- 3. Narmada Bachao Andolan started against a multipurpose project over river narmada by Baba Amte & Medha Patker.
- 4. Baliyapal Movement started against acquiring cultivated lands for testing missiles etc.

# Env. Data

- The idea of sustainable development was defined for the first time by the world commission on environment and development in the year-----
- **1987**
- World Wildlife Fund was founded in ----
- **1961**

# Env. Data

- Earth day is observed on ----
- **April 22.**
- World environment day is celebrated every year on -----
- **5th June.**
- First International Conference on environment was held on ----
- **June,1972.**

# Green Revolution

- The Green Revolution within India commenced in the early 1960s that led to an increase in food grain production, especially in Punjab, Haryana, and Uttar Pradesh. Major milestones in this undertaking were the development of high-yielding varieties of wheat, and rust resistant strains of wheat.