

**ENVIRONMENT & ECOLOGY**

**BAS104/204**

**UNIT-1**

**POWERPOINT PRESENTATION**

**BY: Mr. ANUPAM RATN,**

**ASTT. PROFESSOR,**

**APPLIED SCIENCE DEPT.**

## UNIT-1: SYLLABUS

**Environment:** Definition, Types of Environment, Components of environment, Segments of environment, Scope and importance, Need for Public Awareness.

**Ecosystem:** Definition, Types of ecosystem, Structure of ecosystem, Food Chain, Food Web, Ecological pyramid. Balance Ecosystem.

**Effects of Human Activities:** Effects of Human Activities such as Food, Shelter, Housing, **Agriculture**, Industry, **Mining**, Transportation, Economic and Social security **on Environment, Environmental Impact Assessment, Sustainable Development.**

# LECTURE-1: ENVIRONMENT- DEFINITION; TYPES, COMPONENTS & SEGMENTS OF ENVIRONMENT

## ENVIRONMENT?

In simple way environment may be defined as everything that surrounds us.

### OTHER DEFINITIONS:

- *“Our surrounding which is formed by the interaction of living and non-living things, collectively known as our environment”.*
- According to Mc. Naughton and Wolf-*“Environment denotes the sum total of physical and biological factors that directly influence the survival, growth, development and reproduction of organisms.”*

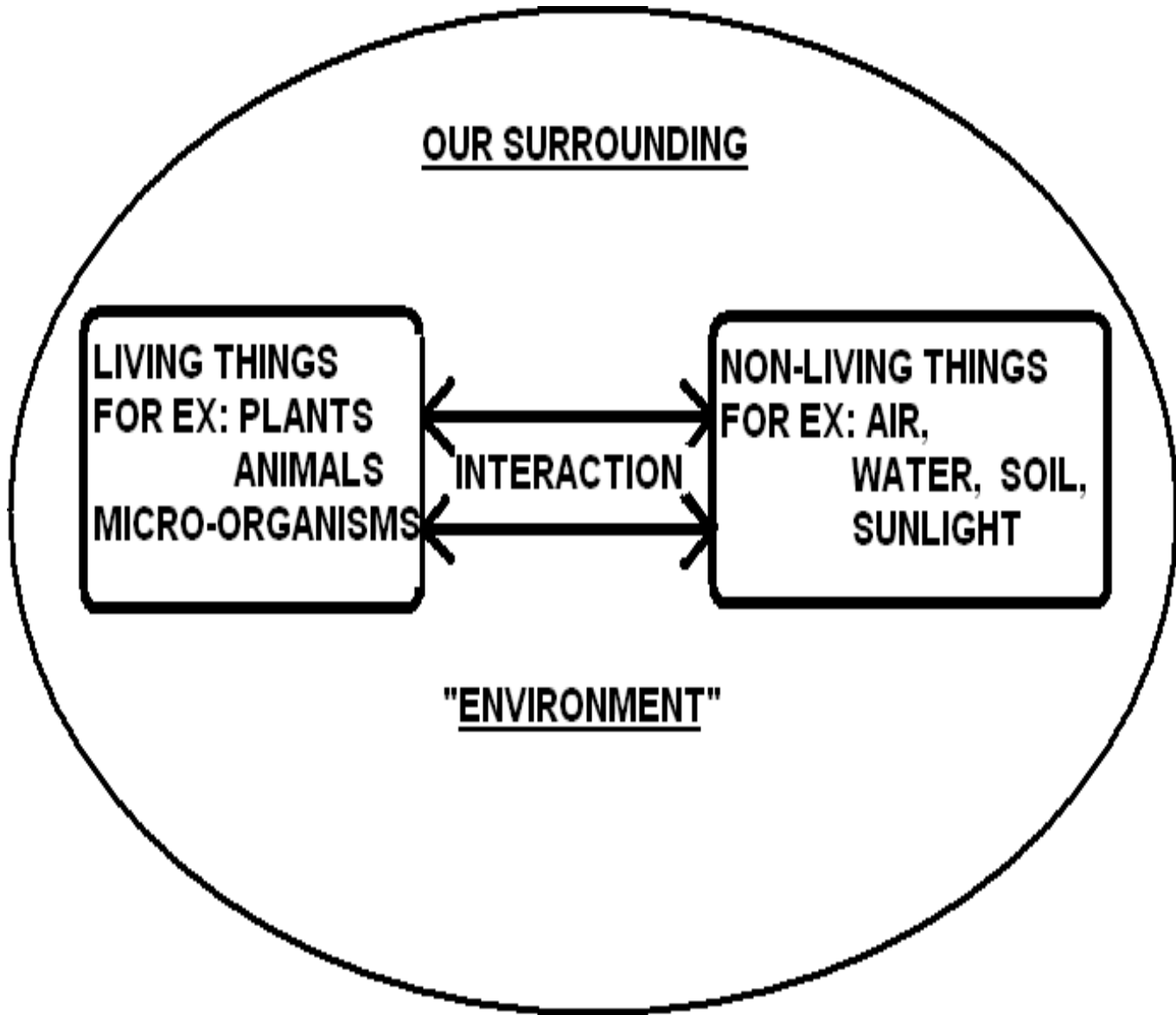
OUR SURROUNDING

LIVING THINGS  
FOR EX: PLANTS  
ANIMALS  
MICRO-ORGANISMS

INTERACTION

NON-LIVING THINGS  
FOR EX: AIR,  
WATER, SOIL,  
SUNLIGHT

"ENVIRONMENT"



# TYPES OF ENVIRONMENT?

- 1) **Natural environment:----??**
- 2) **Man-made environment :----??**
- 3) **Socio- cultural environment:.....??**

# THE BASIC CONSTITUENTS (=COMPONENTS) OF ENVIRONMENT?

The environment of an organism has two basic components:

- ❑ **Living (= Biotic)-for example: Plants, Animals, Human beings and Microorganisms.**
- ❑ **Non-living (=Abiotic)-for example: Air, water, soil, minerals, metals, rocks, rivers, fossil fuels, sunlight etc.**

# THE SEGMENTS/PARTS OF ENVIRONMENT?

## The environment consists of four segments:

1. Atmosphere: *“Atmosphere is the gaseous cover around the earth surface.”*

Composition: Atmosphere comprises of air. Air is a mixture of gases. For example: Nitrogen (78.03%), Oxygen (20.99%), Carbon-di-oxide (0.034%), inert gases (0.95%), water vapours and dust particles (variable).

2. Hydrosphere: Hydrosphere comprises of water. *More than 70% of the earth's surface is covered with water; therefore earth is called blue planet.* Of the total water available on the earth 97% water is salty and only 3% water is fresh.

3. Lithosphere: Lithosphere comprises of soil, minerals and rocks.

4. Biosphere: Biosphere is the part of earth/environment which supports life.

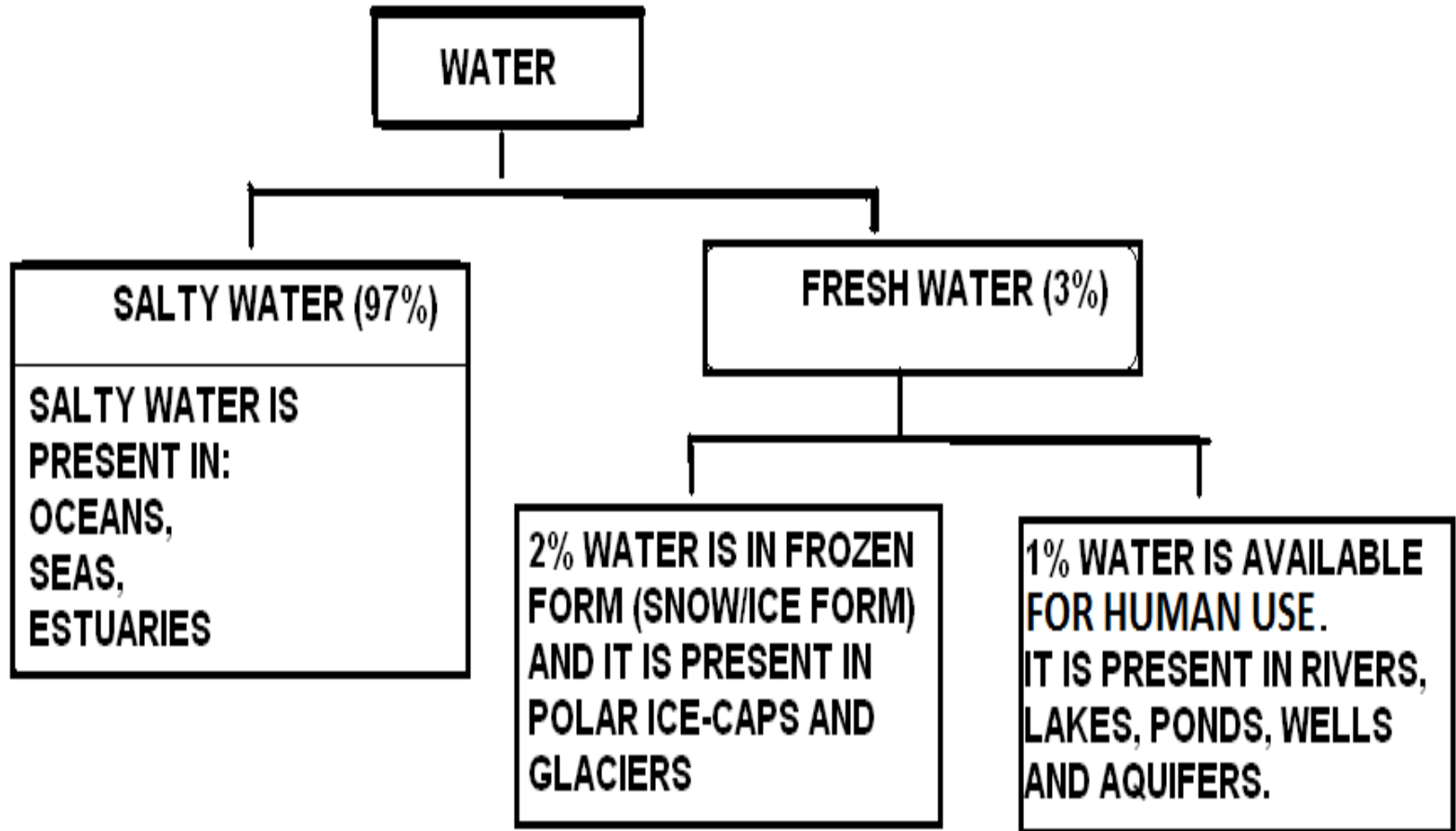
# ATMOSPHERE= SPHERE OF AIR

On the basis of temperature variation, the atmosphere can be segmented as follows:

1. Troposphere
2. Stratosphere
3. Mesosphere
4. Thermosphere (sub-divided into ionosphere and exosphere)



# HYDROSPHERE=SPHERE OF WATER



# LITHOSPHERE= SPHERE OF SOIL & ROCKS

Lithosphere comprises of soil, minerals and rocks.

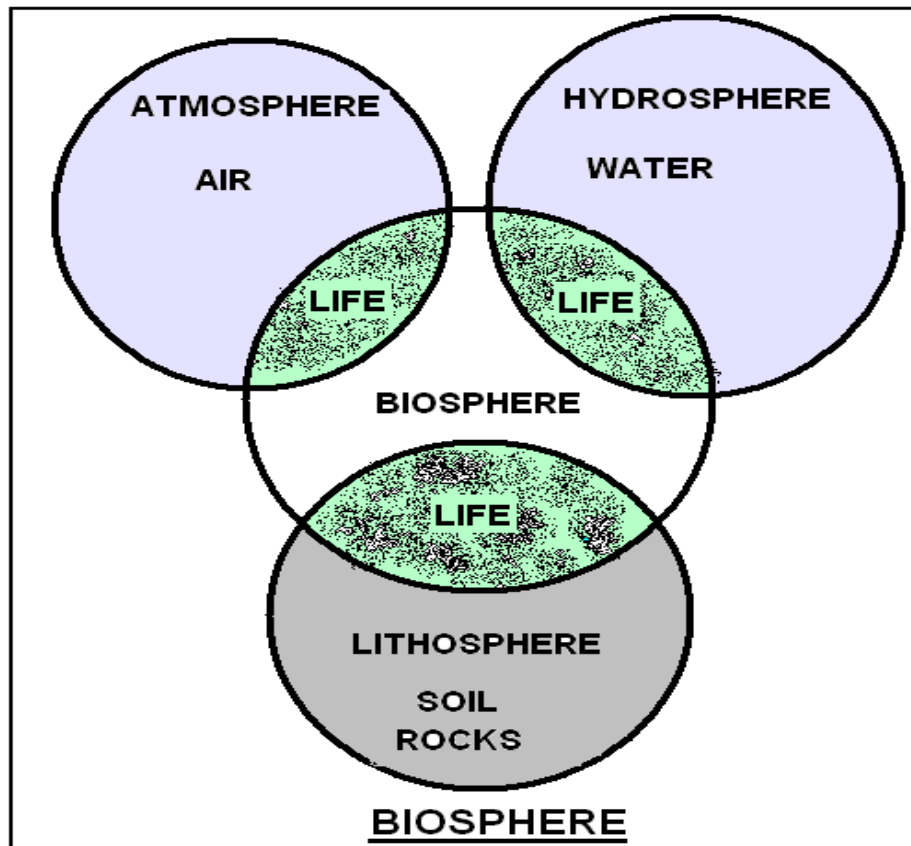
- ✓ Soil is the upper fertile layer of earth which is capable of growing plants.
- ✓ Rocks are the hardest part of earth's crust.  
Rocks are of three types: -  
*igneous, sedimentary and metamorphic.*

# BIOSPHERE= SPHERE OF LIFE

Biosphere is the part of earth/environment which supports life.

Biosphere extends to only 14 kilometers.

This includes 6 kilometers in air and 8 kilometers in sea.



# STRUCTURE OF ATMOSPHERE (ATMOSPHERIC PROFILE)

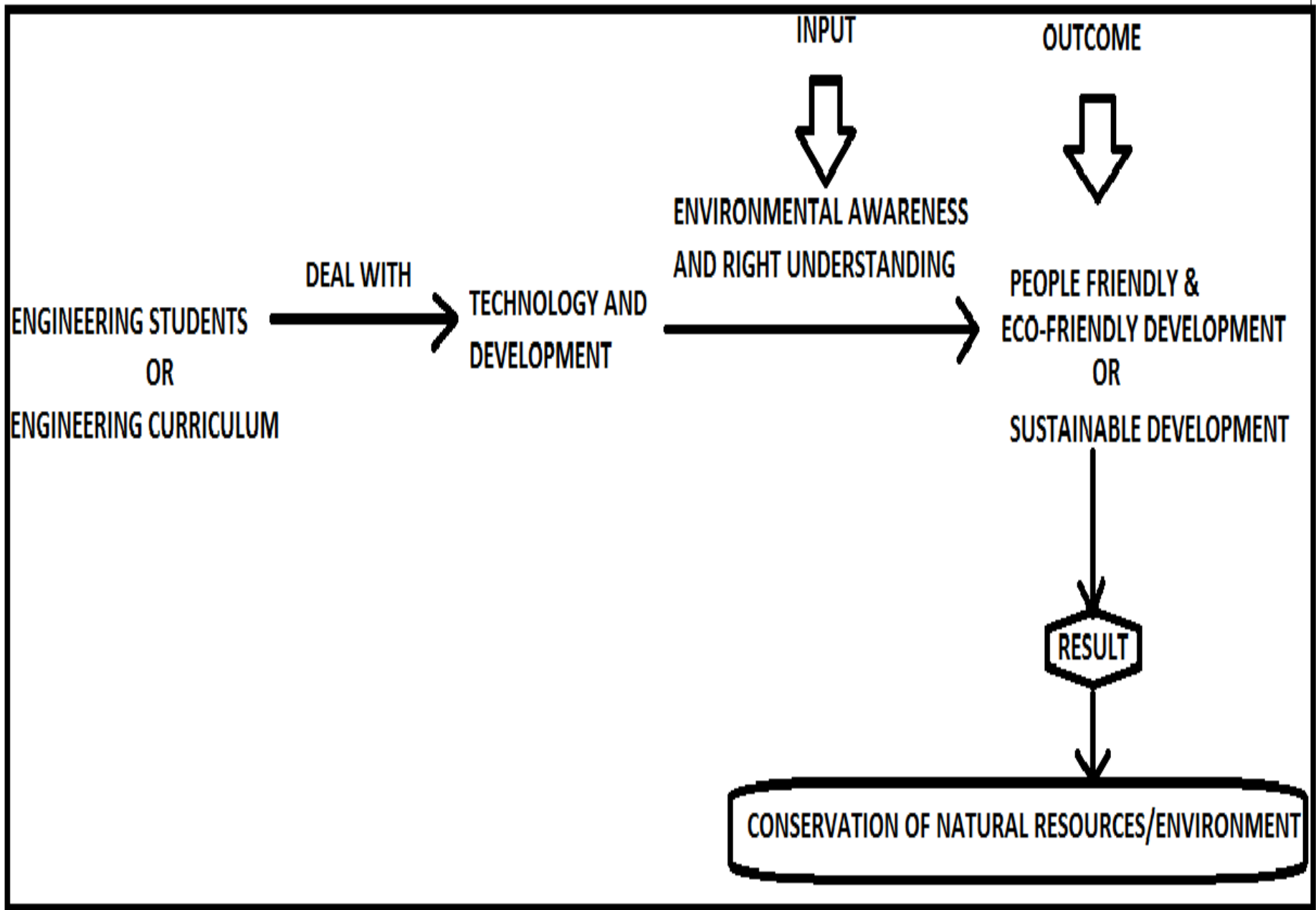
**NOTE:-Lapse rate: Change in atmospheric temperature with respect to height. It may be +ive or -ive.**

REGION	ALTITUDE (HEIGHT), Km	TEMPERATURE RANGE, °C	MAIN ACTIVITY	LAPSE RATE
Troposphere	0 to 12	17 to -55	Clouds formation, rainfall	+ive
Stratosphere (Ozonosphere)	12 to 50	-55 to 0	O <sub>3</sub> formation	-ive
Mesosphere	50 to 80	0 to -75	Meteors burning	+ive
Thermosphere	80 to 500	-75 to more than 1200	Very high temperature	-ive

# **LECTURE-2: SCOPE & IMPORTANCE OF ENVIRONMENTAL SCIENCE/STUDIES, NEED FOR PUBLIC AWARENESS**

## **IMPORTANCE OF ENVIRONMENTAL SCIENCE :**

- **Environmental studies aware us about the valuable natural resources, their importance and conservation methods.**
- **Environmental studies provide knowledge about the ecology and biodiversity.**
- **Environmental studies help us to find ways to maintain ecological balance.**
- **Environmental studies help us to solve the big environmental problems like Environmental Pollution, Urbanization, Deforestation, Desertification, Global Warming, Acid Rain, Ozone Layer Depletion etc.**



# **SCOPE OF ENVIRONMENTAL SCIENCE/STUDIES:**

**There are various fields/areas in which we can see the scope of environmental science.**

- Natural Resources, their conservation and management.**
- Ecology and Biodiversity conservation**
- Environmental pollution and its control**
- Global environmental issues and their control measures: Such as-Global warming, Ozone layer depletion, Acid rain, Desertification, Deforestation, Urbanization etc.**

# THE NEED OF PUBLIC AWARENESS ABOUT THE ENVIRONMENT

- The environment is degrading day by day because of, increasing population, rapid industrialization, urbanization, deforestation and environmental pollution.
- All these problems have disturbed the ecological balance in such a way that the survival of life on earth has been seriously threatened. Therefore public awareness is must for protection of environment.
- Public awareness can be achieved through environmental education i.e. people should be told about environment and its importance.
- Environmental education or environmental awareness among public can be spread through books, magazines (for ex: down to earth), schools/ colleges/institutes/university, news paper, media, television, radio, eco-clubs, Government and Non-Governmental Organizations (NGO'S).
- Public participation is possible only when the public is aware about the environment and environmental issues (problems)".



## **PUBLIC PARTICIPATION IN/WITH:**

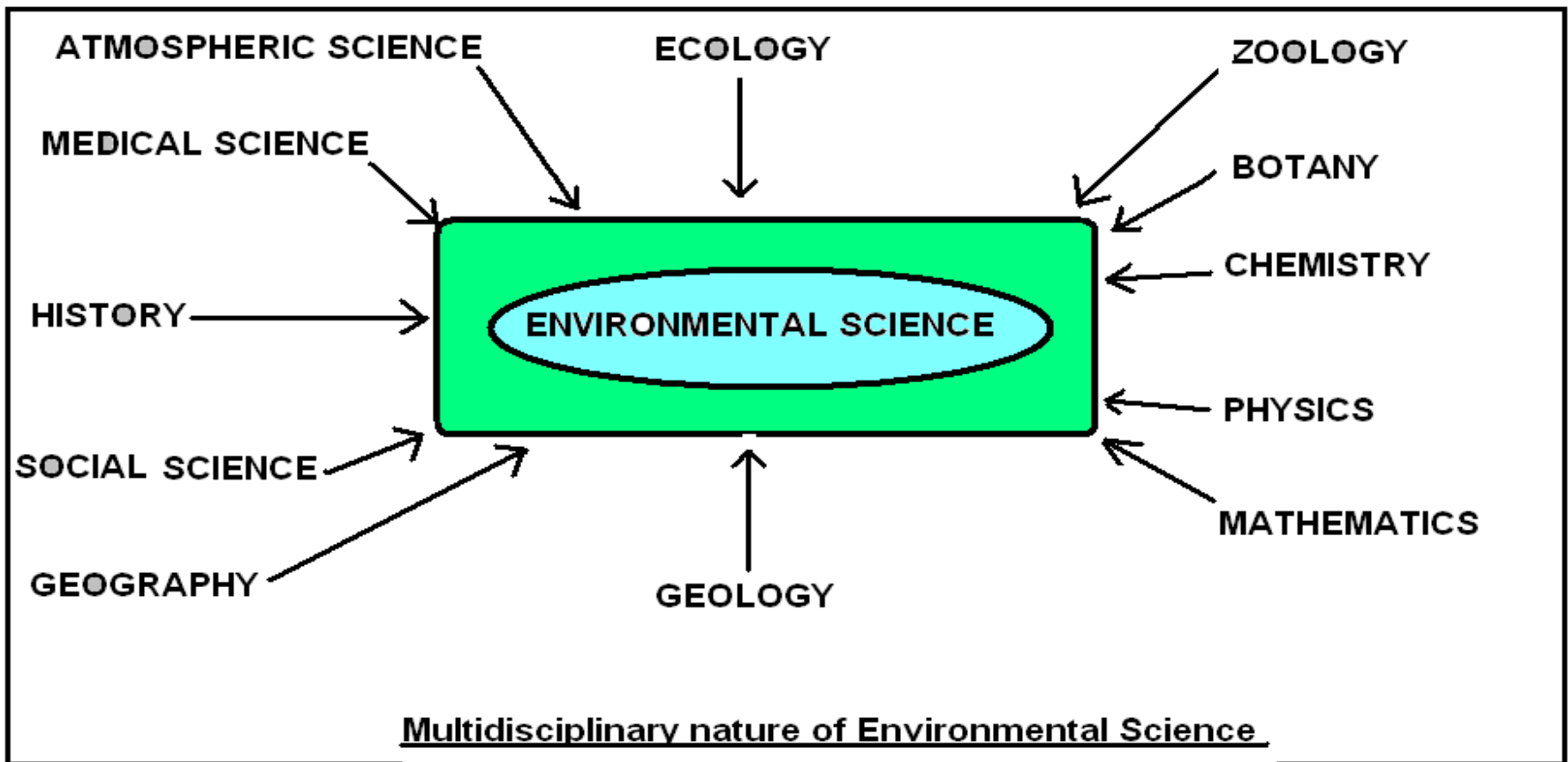


- In tree plantation
- In Joint Forest Management Programme
- In Environmental movements for example:
  - Bishnoi Movement
  - Chipko Movement,
  - Appiko Movement,
  - Silent Valley Movement,
  - Narmada Bachao Andolan
  - Save seed movement

- With Eco-clubs/nature clubs
- Public can work with Non-Governmental Organizations (NGO's) for example-
  - Kalpvriksh (New Delhi)
  - Dasholi Gram Swaraj Mandal (DGSM), Uttrakhand
  - Kerala Sastra Sahitya Parishad (KSSP), Kerala
  - World Wide Fund for Nature-India (WWF-I), New Delhi
  - Bombay Natural History Society (BNHS), Mumbai
  - Centre for Science and Environment (CSE), New Delhi

# MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Environmental science is a multidisciplinary science and it includes not only life science (i.e. zoology, botany) but also chemistry, physics, mathematics, geology, geography, atmospheric science, medical science, history, social science and statistics etc.



## LECTURE-3: ECOLOGY, ECOSYSTEM (DEFINITION), TYPES, STRUCTURE & FUNCTIONS

### Ecology??

The term ecology was given by Ernst Haeckel in 1869.

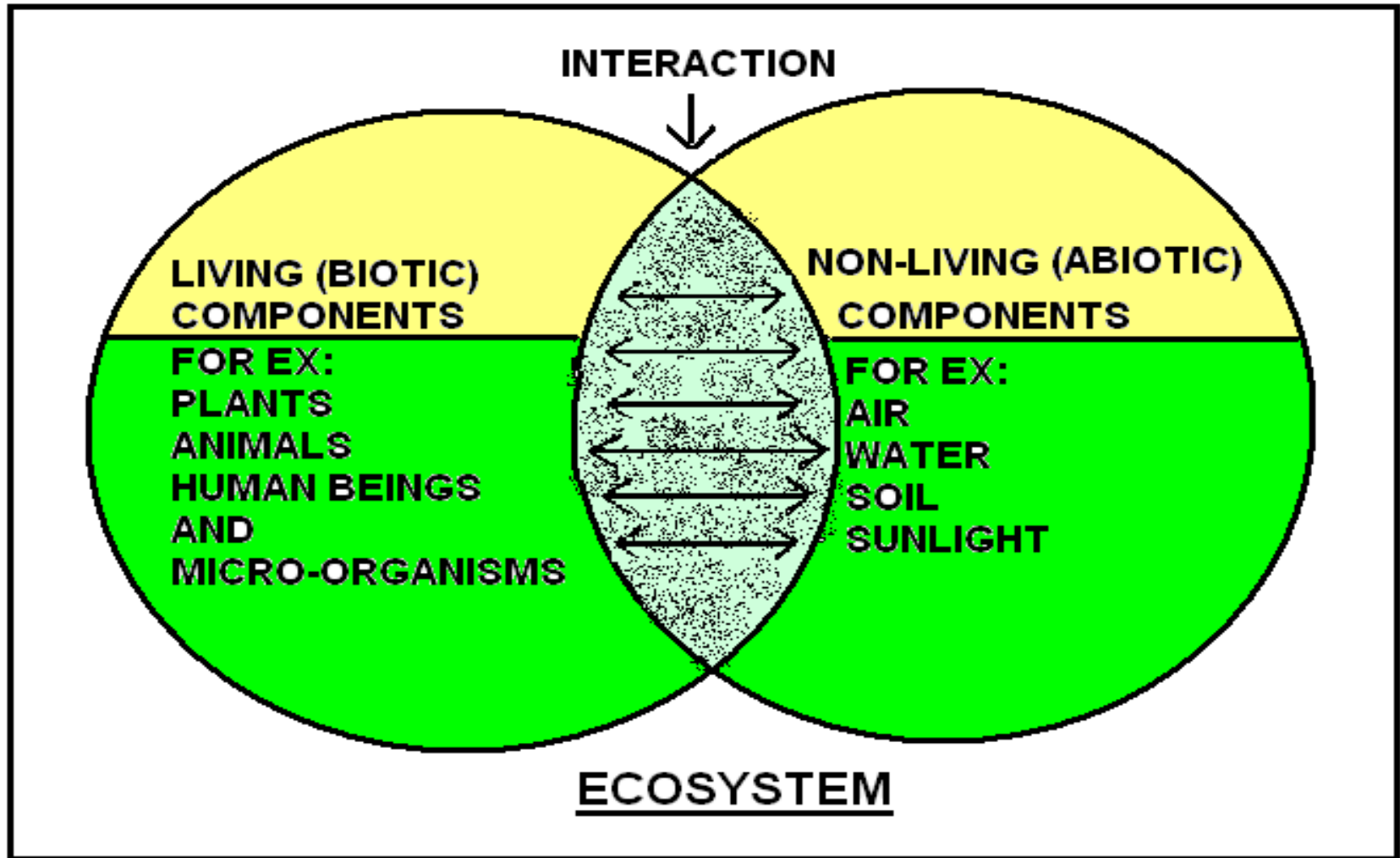
The term ecology has been derived from two Greek words- “oikos” and “logos”, where oikos = house or habitat and logos= to study. Therefore Ecology is the scientific study of house (=habitat).

*Ecology is the study of interaction (relationship) between organisms and their environment”.*

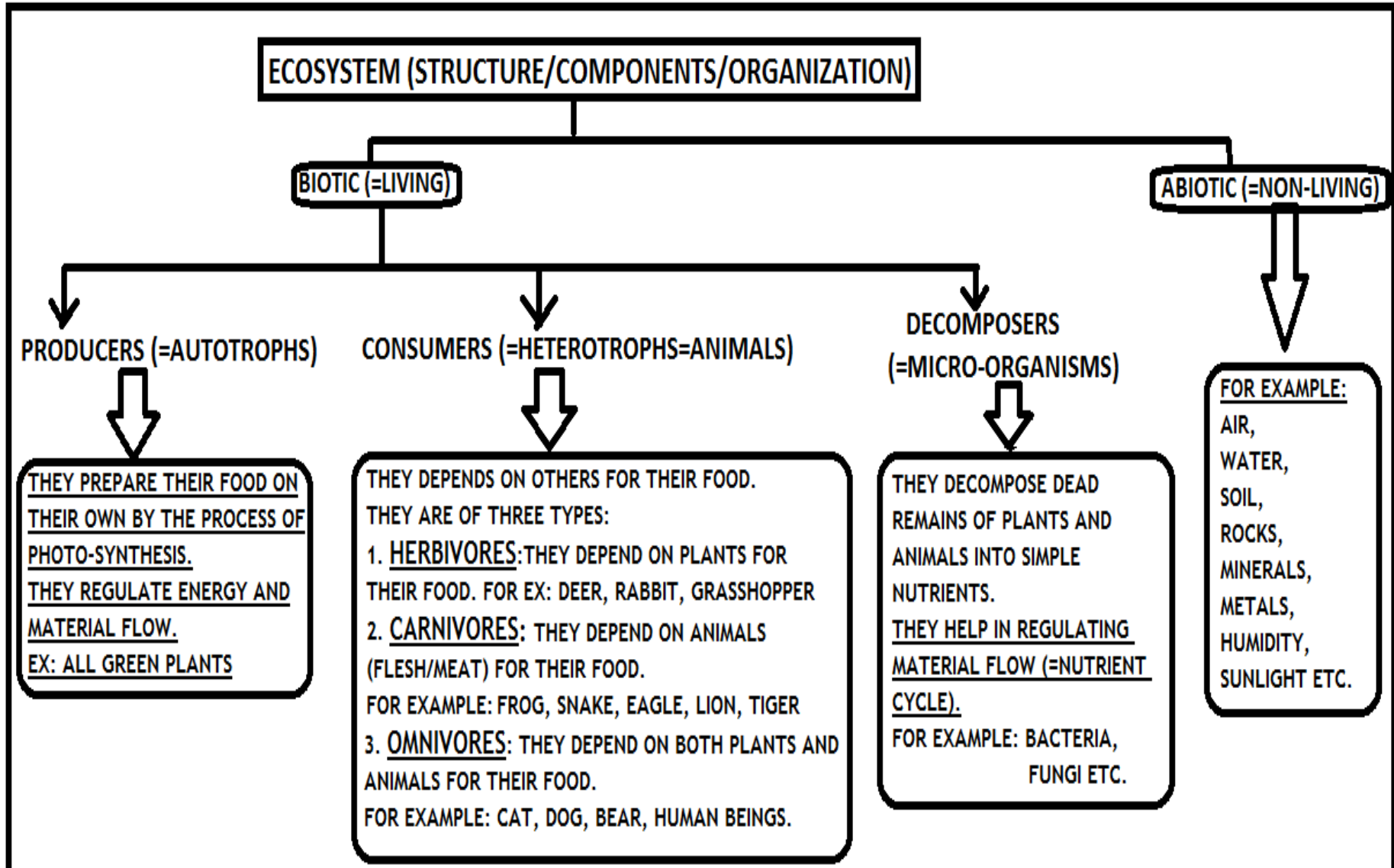
# CONCEPT OF ECOSYSTEM

- The living (biotic) and non-living or physical (abiotic) components of the earth (environment) are linked and function (interaction) together as an ecological system or ecosystem. Therefore-
- “The ecological system which is formed by the interaction of living (biotic) and non-living (abiotic) things is known as ecosystem”. The term ecosystem was proposed by A.G.Tansley (1935).

# ECOSYSTEM.....



# STRUCTURE/COMPONENTS/ ORGANIZATION OF AN ECOSYSTEM



# ROLE OF PRODUCERS, CONSUMERS AND DECOMPOSERS IN AN ECOSYSTEM

ROLE OF PRODUCERS: Producers are Autotrophs.

## Auto/trophs

(Auto=self, troph=food/nourishment):

- The organisms which make their own food with the help of sunlight by the process of photosynthesis are called autotrophs (i.e. self food producing). Therefore these organisms are also called producers.
- For example: **All green plants and photosynthetic bacteria.**
- Producers form first trophic level of a food chain.

# ROLE OF PRODUCERS, CONSUMERS AND DECOMPOSERS.....

ROLE OF CONSUMERS: Consumers (=animals) are Heterotrophs

## Hetero/trophs

(Hetero= others, troph = food/nourishment)

- The organisms which depend on others for their food are called heterotrophs. These are also called consumers or animals. consumers are of following different kinds:
- Herbivores or primary consumers:
  - The animals that eat plants or plant products are called herbivores.
  - For example: grass-hopper, rabbit, goat, cow, buffaloes, deer, zooplanktons etc.
- Carnivores:
  - The animals that eat other animals (flesh) are called carnivores.
- Omnivores:
  - The animals which feed upon both plants and animals are called omnivores.
  - For example: Human beings, cat , dog , bear, crow, cockroach etc.



# ROLE OF PRODUCERS, CONSUMERS AND DECOMPOSERS.....

## ROLE OF DECOMPOSERS:

### **(Decomposers= Saprotrophs or Reducers)**

- Decomposers are the micro-organisms (for example: bacteria, fungi etc.) which decompose (=break down) the organic compounds present in the dead remains of plants and animals into simple inorganic compounds (=nutrients) which are returned back to the soil and atmosphere.
- Decomposers play a vital role in maintaining the soil fertility.
- If all the decomposers or all the bacteria and fungi are destroyed/removed from ecosystem then the world will be packed with dead bodies and the mineral circulation (nutrient cycling/material flow) will be blocked.

# FUNCTIONS OF AN ECOSYSTEM:

The main functions of an ecosystem are:

❑ Energy flow:

It takes place with the help of food chain and food web. The energy flow is unidirectional and non-cyclic.

❑ Material flow or nutrient cycling or biogeochemical cycling:

It means the circulation or movement of nutrients between living and non-living components of ecosystem. For example-Nitrogen cycle, sulphur cycle, carbon cycle (= CO<sub>2</sub> cycle), oxygen cycle, water cycle, Phosphorus cycle etc.

❑ Productivity:

It means the production of biomass at producers and consumers level.

❑ Homeostasis (=Ecological balance):

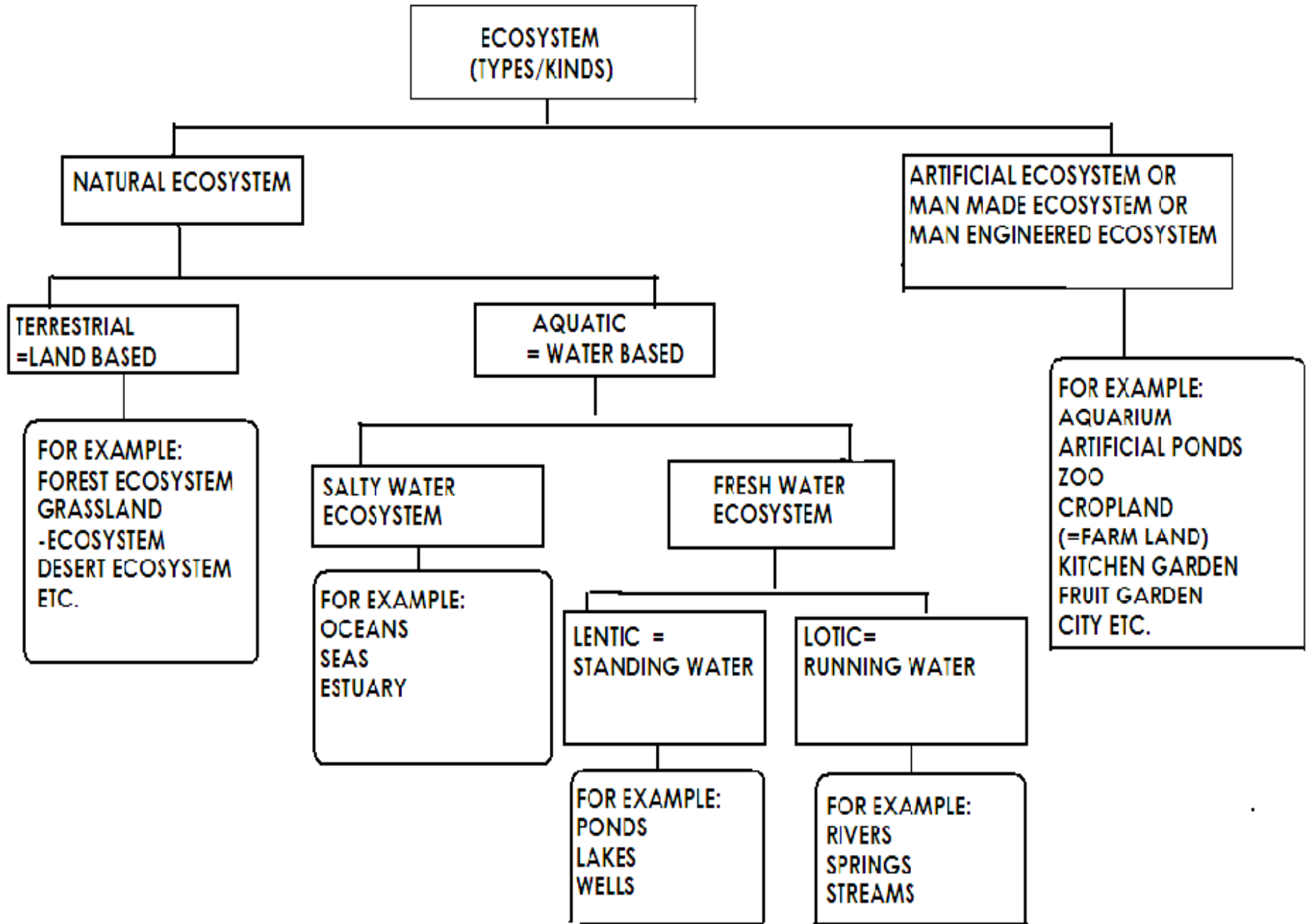
It means a balance between living and non-living components of ecosystem.

# FUNCTIONS OF AN ECOSYSTEM.....

## ❑ Regulatory functions or ecological services:

- Regulation of climatic conditions (rain, temperature etc.)
- Regulation of nutrient cycling (=biogeochemical cycling)
- Regulation of hydrological cycle (water cycle)
- Purification of air
- Control of environmental pollution
- Soil formation
- Pollination etc.

# TYPES OF ECOSYSTEM



# SALIENT FEATURES OF FOREST ECOSYSTEM

Abiotic components	Biotic components				
	Producers	Herbivore or Primary consumers	Secondary consumers or carnivore <sup>1</sup>	Tertiary consumers or carnivore <sup>2</sup>	Decomposers
Soil, humus, water, sunlight, air	Mainly Trees Shrubs And Grass	Flies, Mouse, Deer, Rabbit, Sheep, Cow	Lizards, Birds Snakes, Fox	Lion, Tiger, Wild Cat	Bacteria and Fungi

# SALIENT FEATURES OF DESERT ECOSYSTEM

Abiotic components	Biotic components				
	Producers	Primary consumers OR HERBIVORE	Secondary consumers or carnivore 1	Tertiary consumers or carnivore 2	Decomposers
High temperature, less rainfall, less water and poor Soil nutrients	Shrubs, Cactus	Camel, Kangaroo rat, Rabbits	Reptiles, Snakes	Vultures	Thermophilic bacteria and fungi

# SALIENT FEATURES OF GRASSLAND ECOSYSTEM

Abiotic components	Biotic components				
	Producers	Primary consumers or HERBIVORE	Secondary consumers or carnivore1	Tertiary consumers or carnivore2	Decomposers
Soil, Water, Sunlight, Air	Grasses, Herbs and Shrubs	Grasshopper, Rabbit, Mouse, Deer, Sheep Etc.	Frog, Snake, Lizards, Birds, Fox, Jackal Etc.	Hawk/ Eagle and Vultures Etc.	Bacteria and Fungi

# SALIENT FEATURES OF POND ECOSYSTEM

Abiotic components	Producers	Biotic components			
		Primary consumers or HERBIVORES	Secondary consumers or carnivore <sup>1</sup>	Tertiary consumers or carnivore <sup>2</sup>	Decomposers
Water, mud, dissolved gases and nutrients in water, sunlight, air etc.	Phytoplanktons (Algae) and Aquatic plants	Zooplanktons	small fish	Large fish	Bacteria and Fungi



# LECTURE-4: CONCEPT OF FOOD CHAIN, FOOD WEB & ENERGY FLOW

## FOOD CHAIN & ITS TYPES

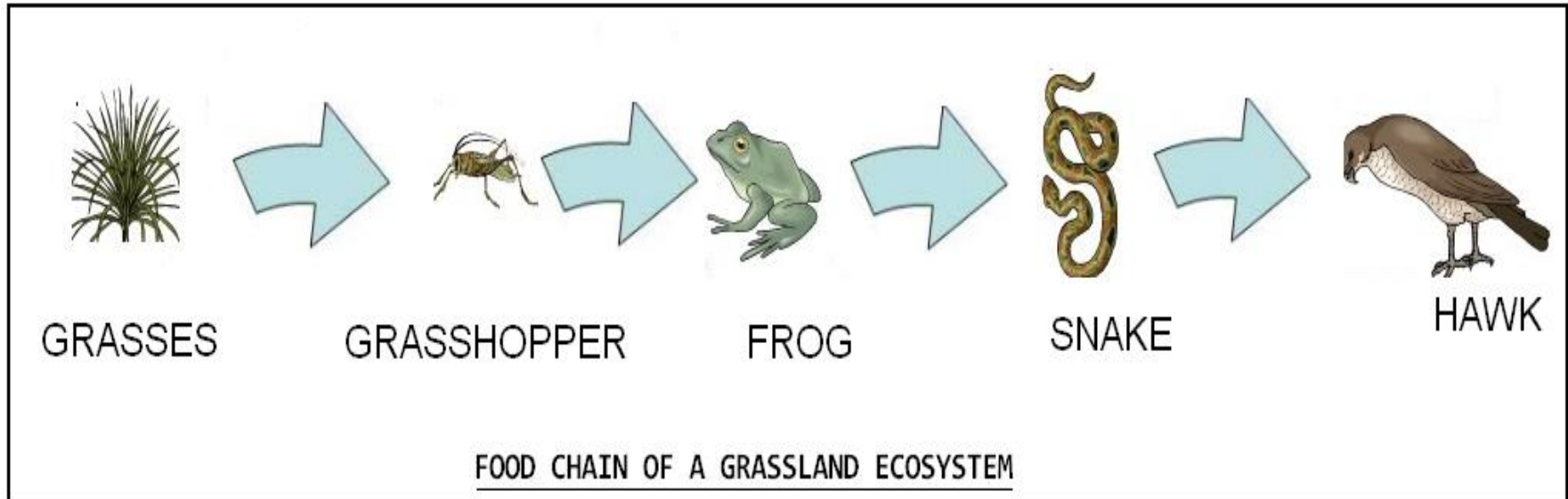
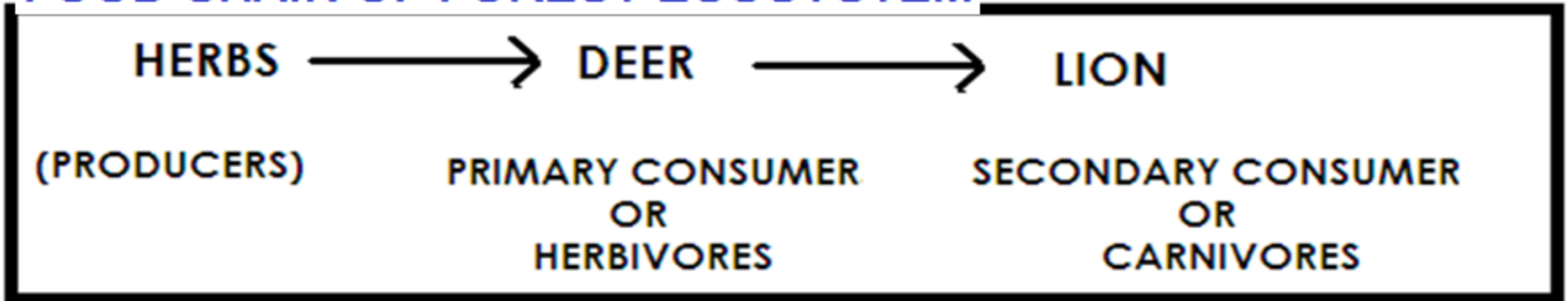
- The food energy produced by green plants (producers) is consumed by herbivores and herbivores in turn are consumed by carnivores. This sequential process of eating and being eaten is called food chain.
- Definition: “The transfer of food energy from organism to organism i.e. from producers to consumers to decomposers in an ecosystem is known as food chain”.

# FOOD CHAIN.....

## EXAMPLES OF FOOD CHAIN:

### FOOD CHAIN OF FOREST ECOSYSTEM

||



# FOOD CHAIN.....

## EXAMPLES OF FOOD CHAIN:

### FOOD CHAIN OF A POND ECOSYSTEM:

PHYTOPLANKTONS → ZOOPLANKTONS → SMALL FISH → LARGE FISH

# TYPES OF FOOD CHAIN:

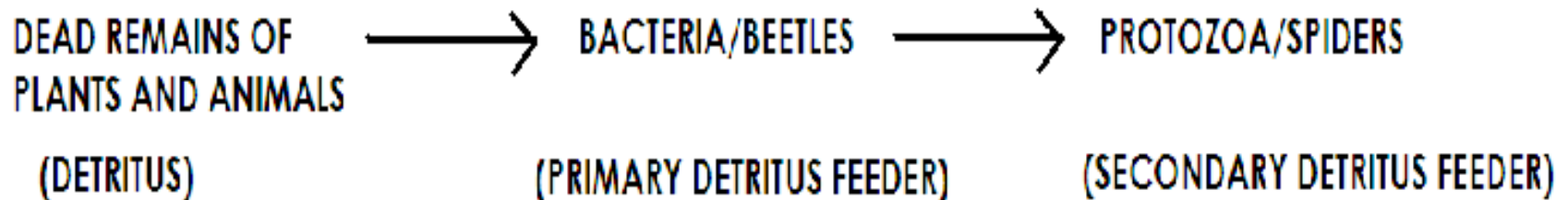
Food chains are mainly of two types:

1. Grazing food chain: it starts from producers and ends up at carnivores.

EX: Plants → Deer → Lion

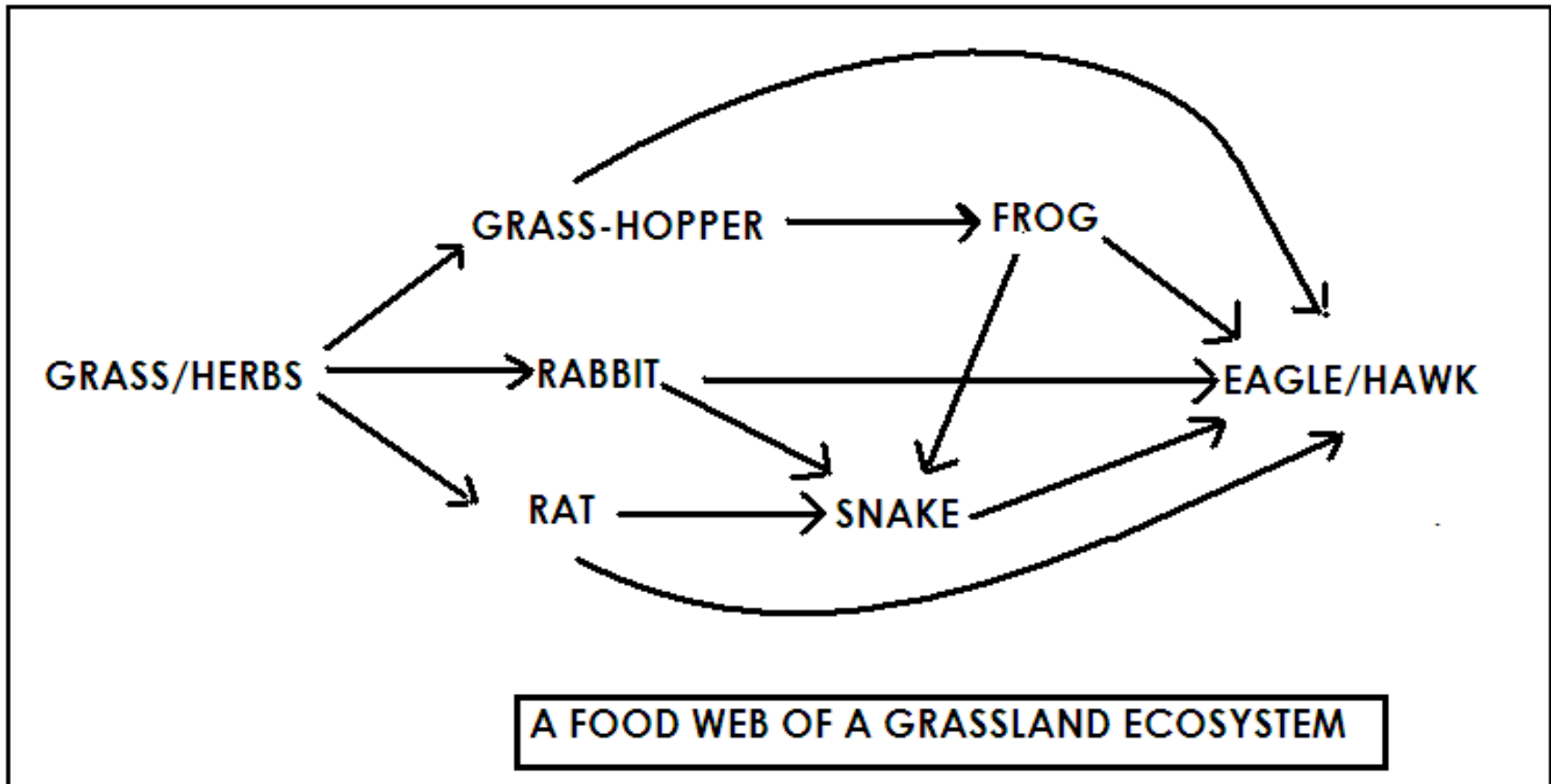
2. Detritus food chain: it starts from detritus and ends up at detritus feeder.

This type of food chain starts from dead organic matter (=detritus) and goes to primary detritus feeder (decomposers) and then on to secondary detritus feeders.



# FOOD WEB

- The existence of single food chain is not possible in any ecosystem. Food chains are not always simple and isolated but are interconnected with one another.
- *THEREFORE, several food chains are combined (=linked together) to form a network which is called food web.*



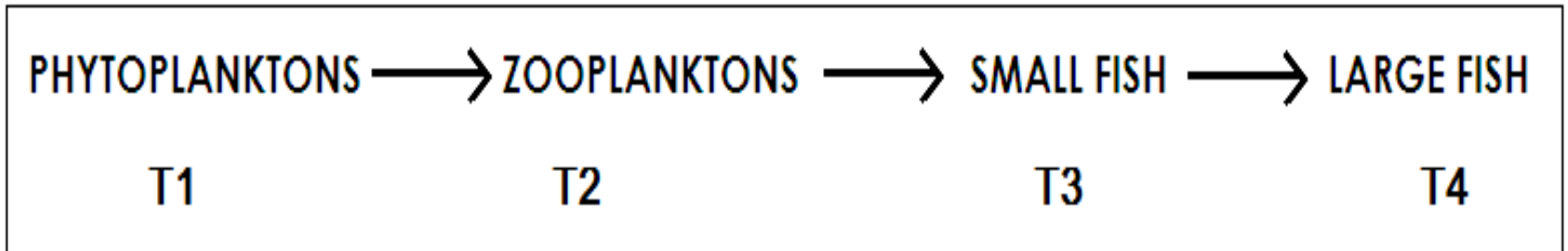
# THE CONCEPT OF TROPHIC LEVEL

- ❑ The concept of trophic level was first given by Lindeman (1942).
- ❑ According to him- a food chain consists of steps/levels/links. These steps or links are called trophic levels or food levels.

Type of organism	Trophic level
Producers	First Trophic Level (T1)
Herbivores Or Primary Consumers	Second Trophic Level (T2)
Secondary Consumers Or Carnivore <sup>1</sup>	Third Trophic Level (T3)
Tertiary Consumers Or Carnivore <sup>2</sup>	Fourth Trophic Level (T4)
Quaternary Consumers Or Top Carnivores or Carnivore <sup>3</sup> .....	Fifth Trophic Level (T5)

# THE CONCEPT OF TROPHIC LEVEL.....

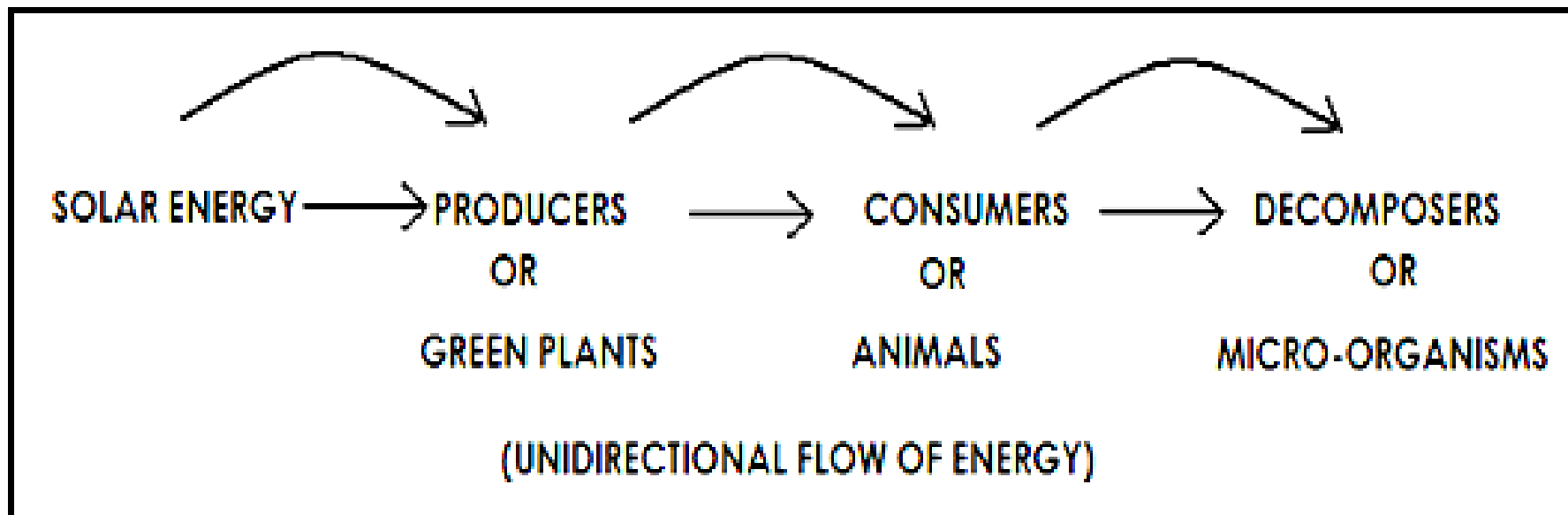
Food chain of a pond ecosystem with 4 Trophic Levels:-T1, T2, T3 & T4.



# ENERGY FLOW IN AN ECOSYSTEM

Flow of food energy from one trophic level to another in an ecosystem is called energy flow.

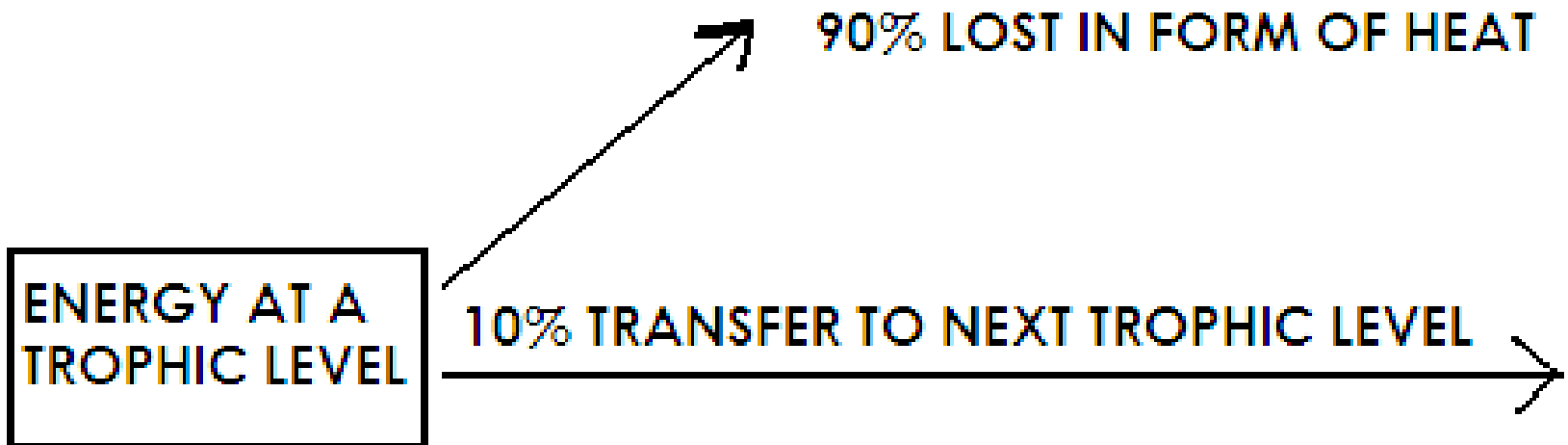
- ❑ Energy flow takes place with the help of food chain and food web.
- ❑ Sun is the ultimate source of energy in an ecosystem.
- ❑ The flow of energy in an ecosystem is unidirectional.
- ❑ The flow of energy in an ecosystem is non-cyclic.

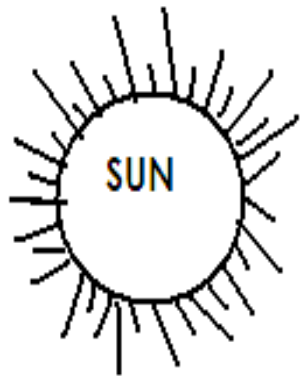




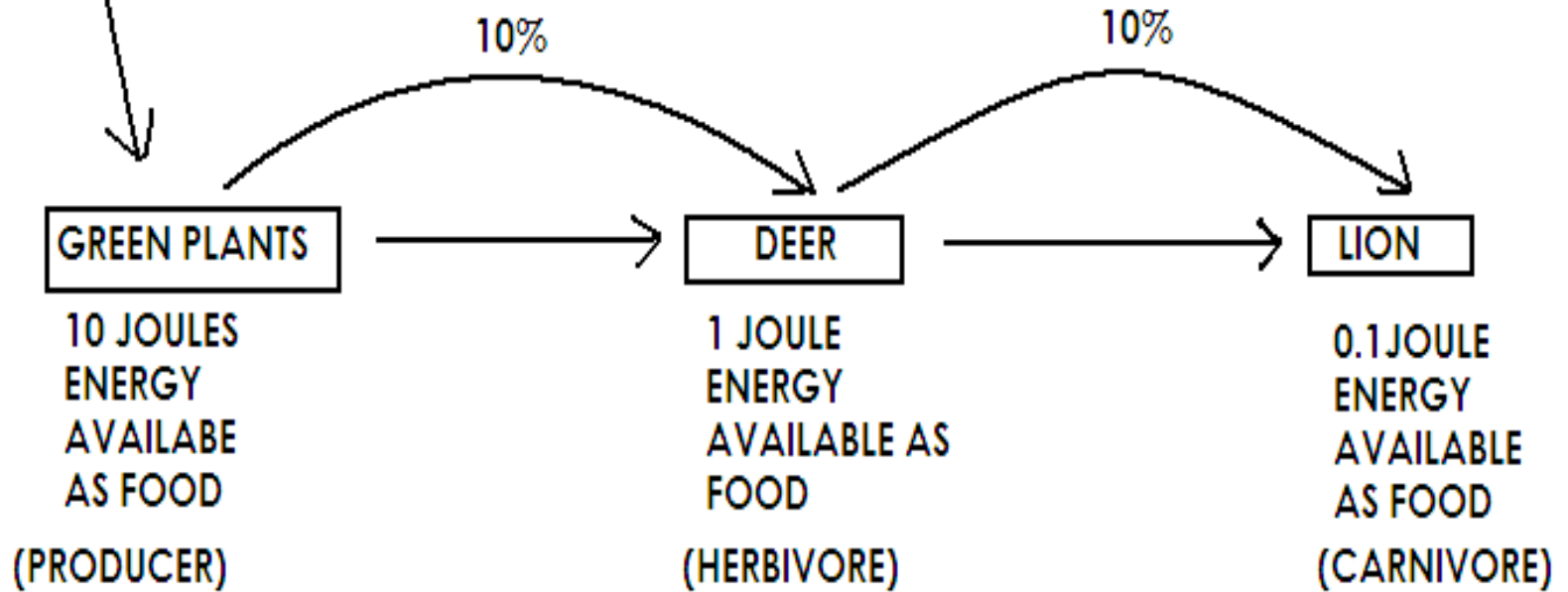
# 10% ENERGY LAW:

- The ten percent energy law was given by Lindeman (1942).
- According to this law “The energy available at a particular trophic level is 10% of its previous trophic level”





1000 JOULES OF  
LIGHT ENERGY



TEN PERCENT LAW

# **LECTURE-5: ECOLOGICAL PYRAMIDS** **AND THEIR TYPES**

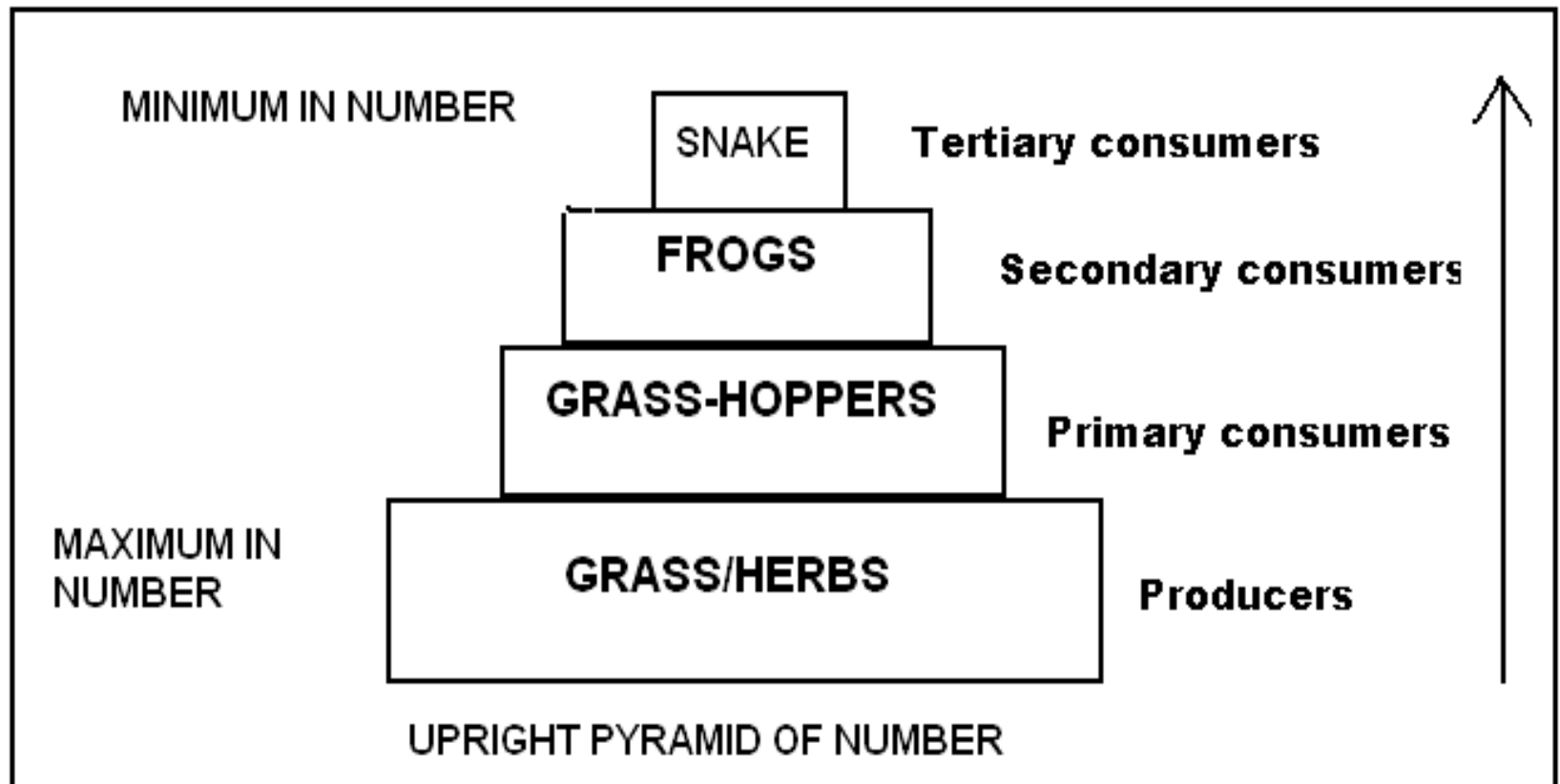
**Ecological pyramids are the graphical representation of various trophic levels of the food chains in an ecosystem.**

**Types of pyramids:**

- 1) Pyramid of number**
- 2) Pyramid of biomass**
- 3) Pyramid of energy**

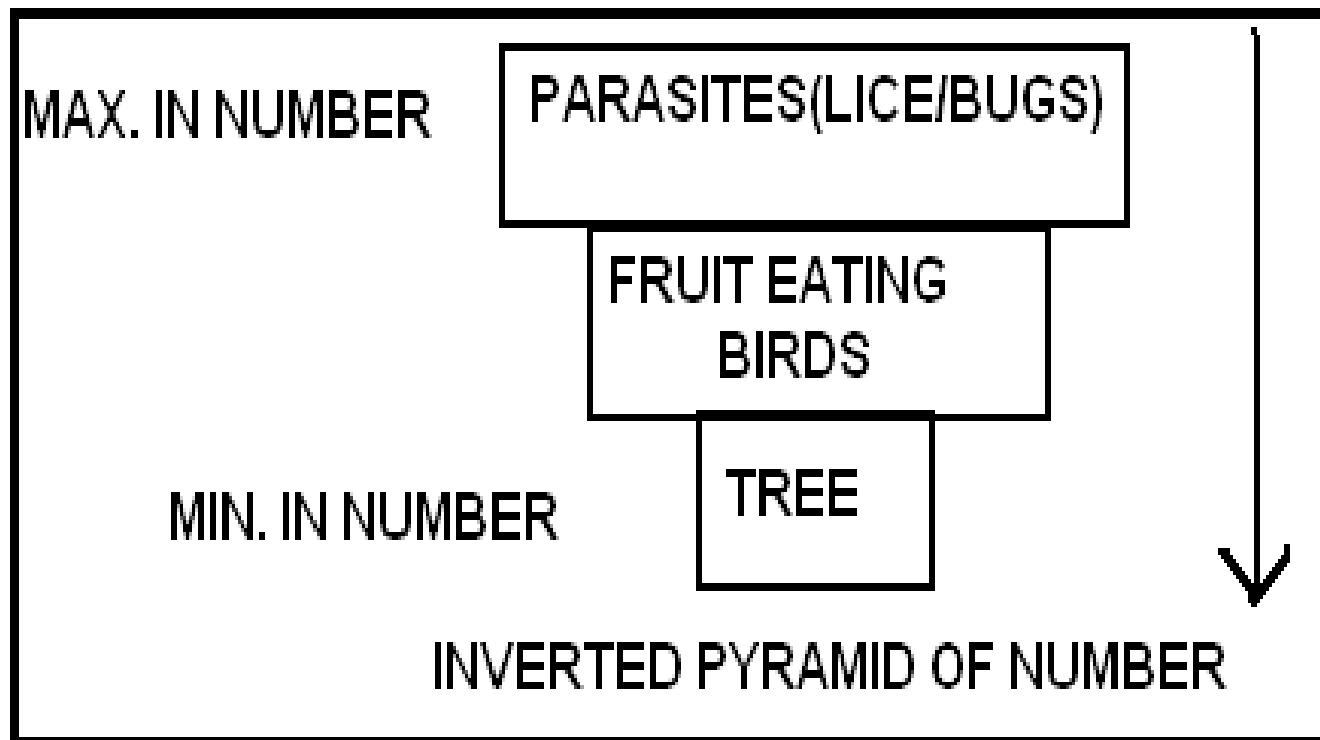
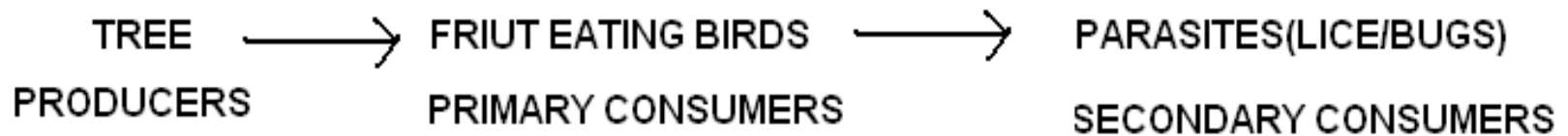
1. Pyramid of number: “It is the graphical representation of number of organisms at each trophic level of the food chain in an ecosystem.”  
The pyramid of number may be upright or inverted.

Example 1: Pyramid of number of grassland ecosystem is upright



**EXAMPLE-2:** In an ecosystem of a single tree, the pyramid of number is inverted.

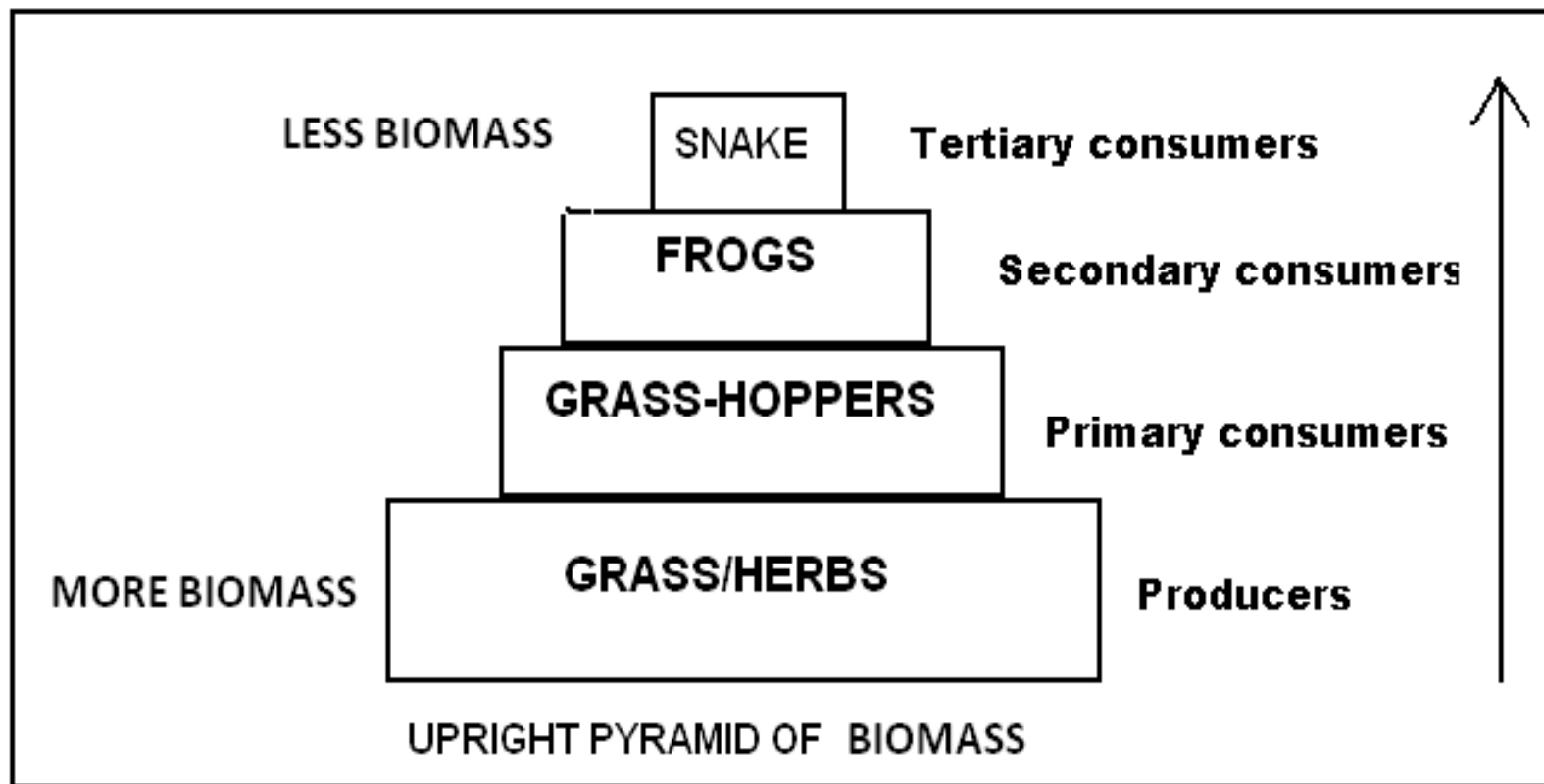
For example: In the food chain of a single tree ecosystem, the pyramid is inverted.



2. Pyramid of biomass: "it is the graphical representation of amount of biomass (=dry mass) available at each trophic level in an ecosystem".

The pyramid of biomass may be upright or inverted.

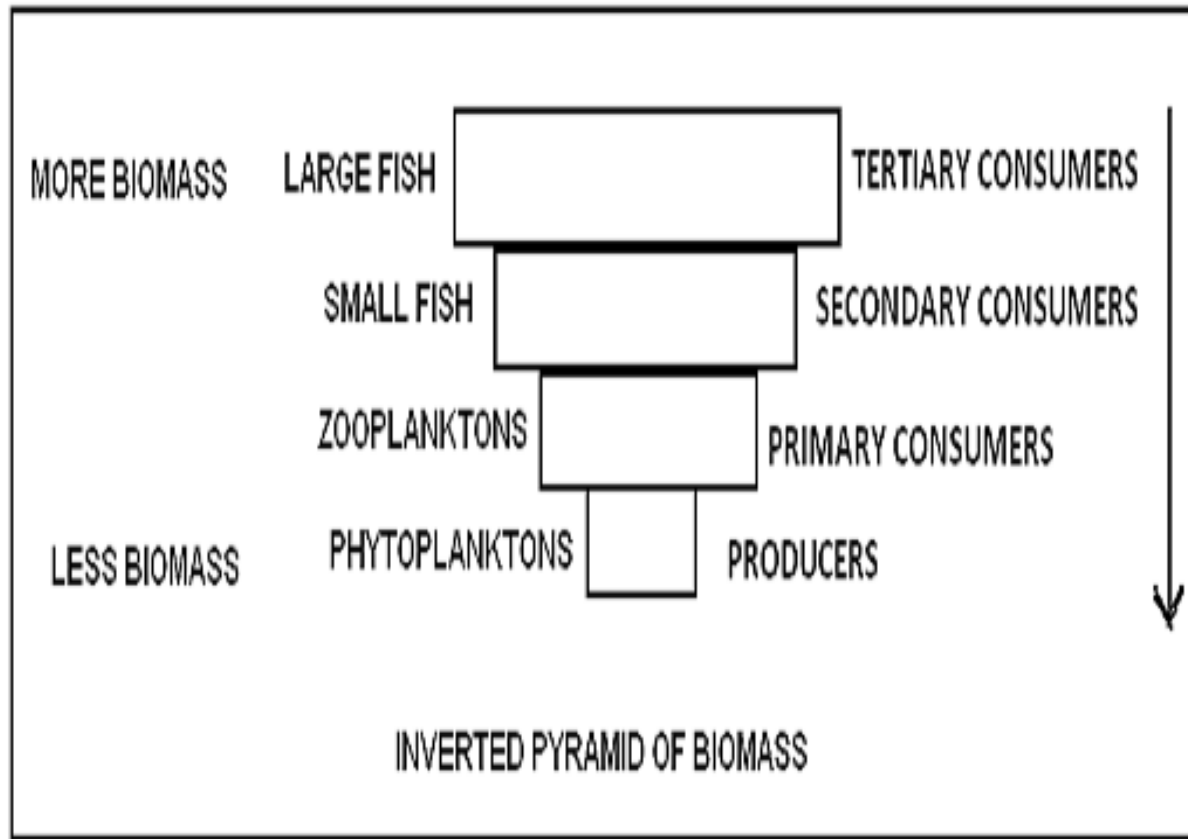
Example 1: In the food chain of grassland ecosystem, the pyramid is upright.



**EXAMPLE-2:** However in aquatic ecosystem for example: pond, lake, ocean and sea the pyramid of biomass is inverted.

For example: In the food chain of a pond ecosystem-inverted pyramid.

PHYTOPLANKTONS → ZOOPLANKTONS → SMALL FISH → LARGE FISH

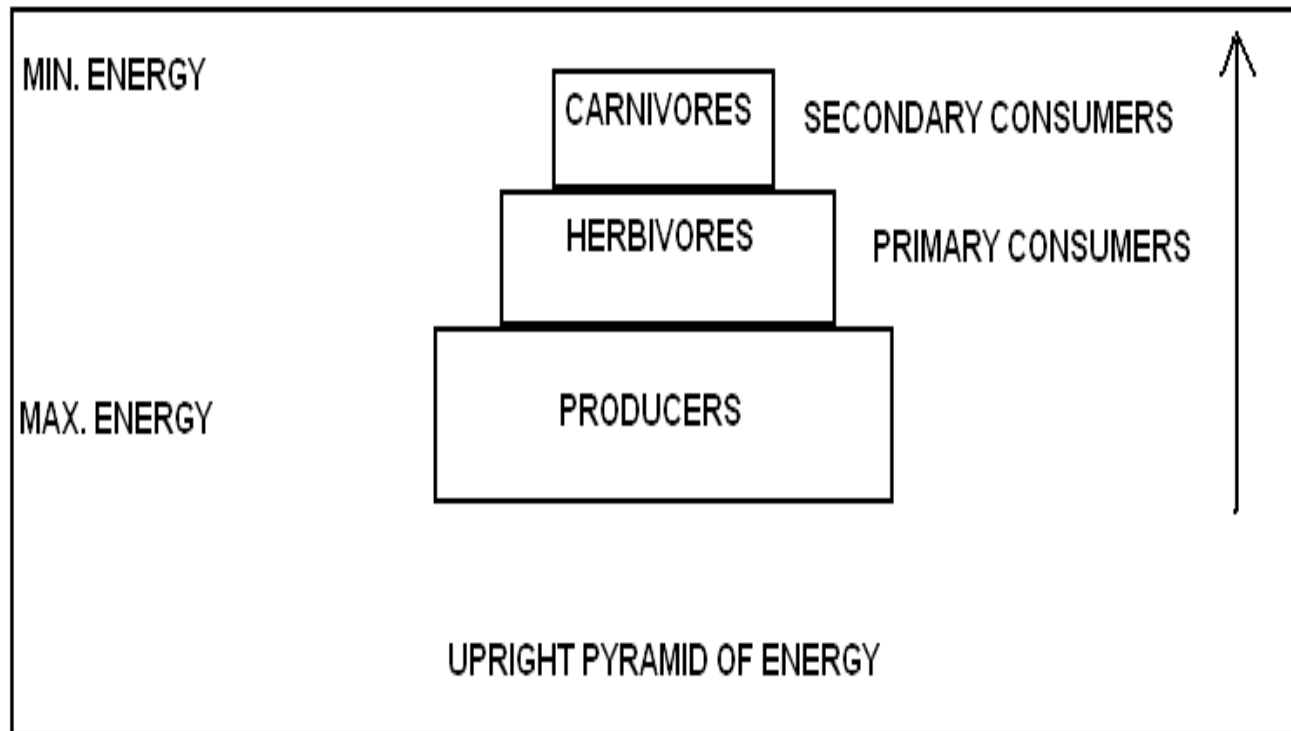


### 3. Pyramid of energy:

"it is the graphical representation of amount of energy content available at each trophic level in an ecosystem".

The pyramid of energy is always upright (i.e. the energy pyramid can not be inverted in a stable ecosystem) because there is a gradual decline in the amount of energy as we move from producers to consumers (as per 10% energy law).

- ✓ The energy available is maximum at producer level
- ✓ The energy available is minimum at consumer level





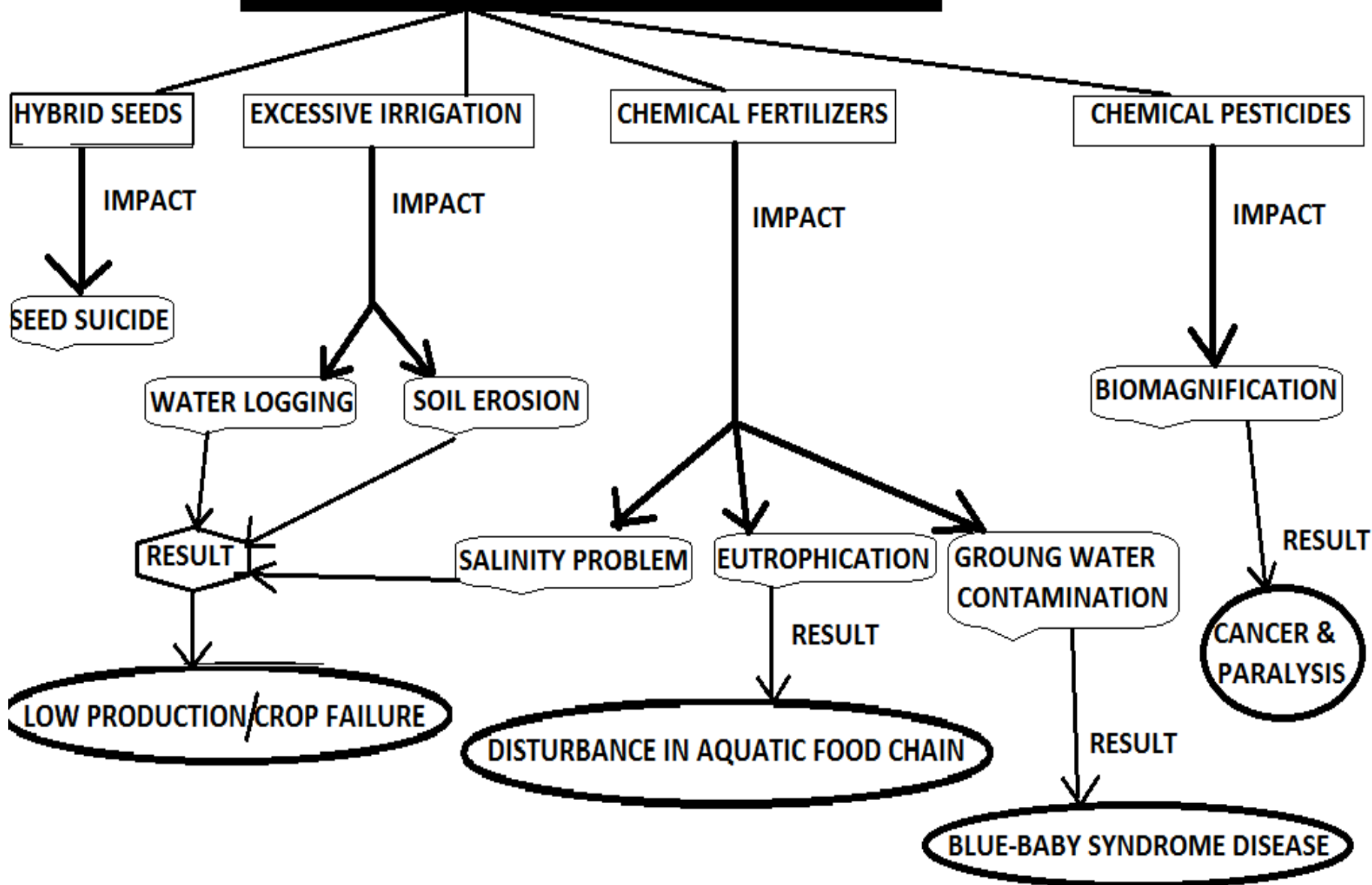
# LECTURE-6: IMPACT OF HUMAN ACTIVITIES (MINING AND MODERN AGRICULTURE) ON ENVIRONMENT, SUSTAINABLE AGRICULTURE

## (A) ILL EFFECTS OF MODERN AGRICULTURE ON ENVIRONMENT:

In modern agriculture system, excess amount of fossil fuel, water, chemical fertilizers and pesticides are used to get higher yield. In modern agriculture high yielding crop varieties (HYV) are grown which require large amount of water supply, chemical fertilizers and chemical pesticides.

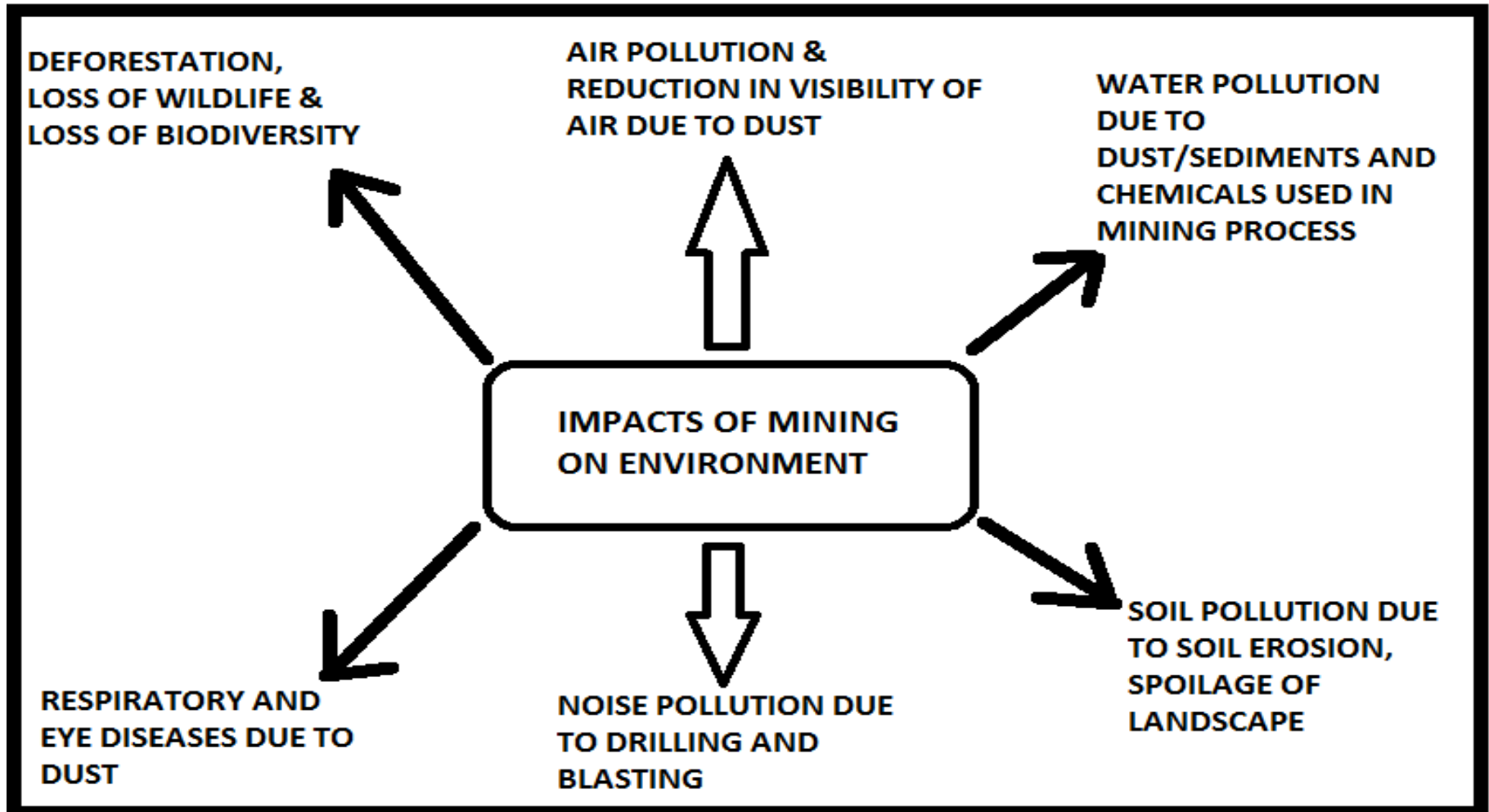
Modern agriculture has adversely affected the fertility of soil, which became the cause of degradation of land. Some of the harmful effects of modern agriculture are as follows:

# MODERN AGRICULTURE IS BASED ON THE USE OF



## **(B) IMPACT OF MINING ON ENVIRONMENT**

Mining refers to the process of extracting metals and minerals from the earth. It disturbs the physical, chemical and biological features of the soil.



# LECTURE-7: IMPACT OF HUMAN ACTIVITIES: URBANIZATION, HOUSING, TRANSPORTATION AND INDUSTRIALIZATION ON ENVIRONMENT

## URBANIZATION:

- Urbanization is a situation of high rate of population growth in cities. People migrate from villages to cities in search of jobs as the only form of employment available in rural areas is agriculture.

## URBAN SPRAWLING:

- it is a process of human settlement in sub-urban area (=area outside of urban zone)

# LECTURE-7: IMPACT OF HUMAN ACTIVITIES: URBANIZATION, HOUSING, TRANSPORTATION AND INDUSTRIALIZATION ON ENVIRONMENT.....

## IMPACTS OF URBANIZATION ON ENVIRONMENT:

- Change in land use pattern
- Deforestation
- Depletion of wildlife
- Loss of biodiversity
- Loss of greenery.
- Ecological imbalance
- Air pollution due to housing, industries and transportation
- Air borne diseases
- Water pollution due to sewage (waste water from houses) and effluent (waste water from industries)
- Water borne and water induced diseases.
- Soil pollution due to solid waste from houses and industries.
- Noise pollution due to housing, industries and transportation.
- Problem of Global warming, acid rain and ozone layer depletion.

# LECTURE-8: EIA AND ITS PROCEDURE

## EIA (Environmental Impact Assessment)

**EIA** is a systematic process of assessment of impacts of any development project (for ex: factory/industry/dam etc.) on environment.

- ❑ EIA is one of the recent the branch of environmental engineering.
- ❑ In India, EIA is conducted by MoEF (Ministry Of Environment And Forest).

### AIMS/OBJECTIVES OF EIA:

- To achieve sustainable development.
- Minimum (minimal) environmental degradation.
- Prevention from long term adverse impacts.

# EIA PROCESS FLOW CHART

**BASELINE STUDY**

**IDENTIFICATION OF PROJECT IMPACTS**

**MEASUREMENT OF MAGNITUDE OF PROJECT IMPACTS**

**AGGREGATION OF PROJECT IMPACTS**

**PREPARATION OF EIA REPORT OR ENVIRONMENTAL IMPACT STATEMENT [EIS]**

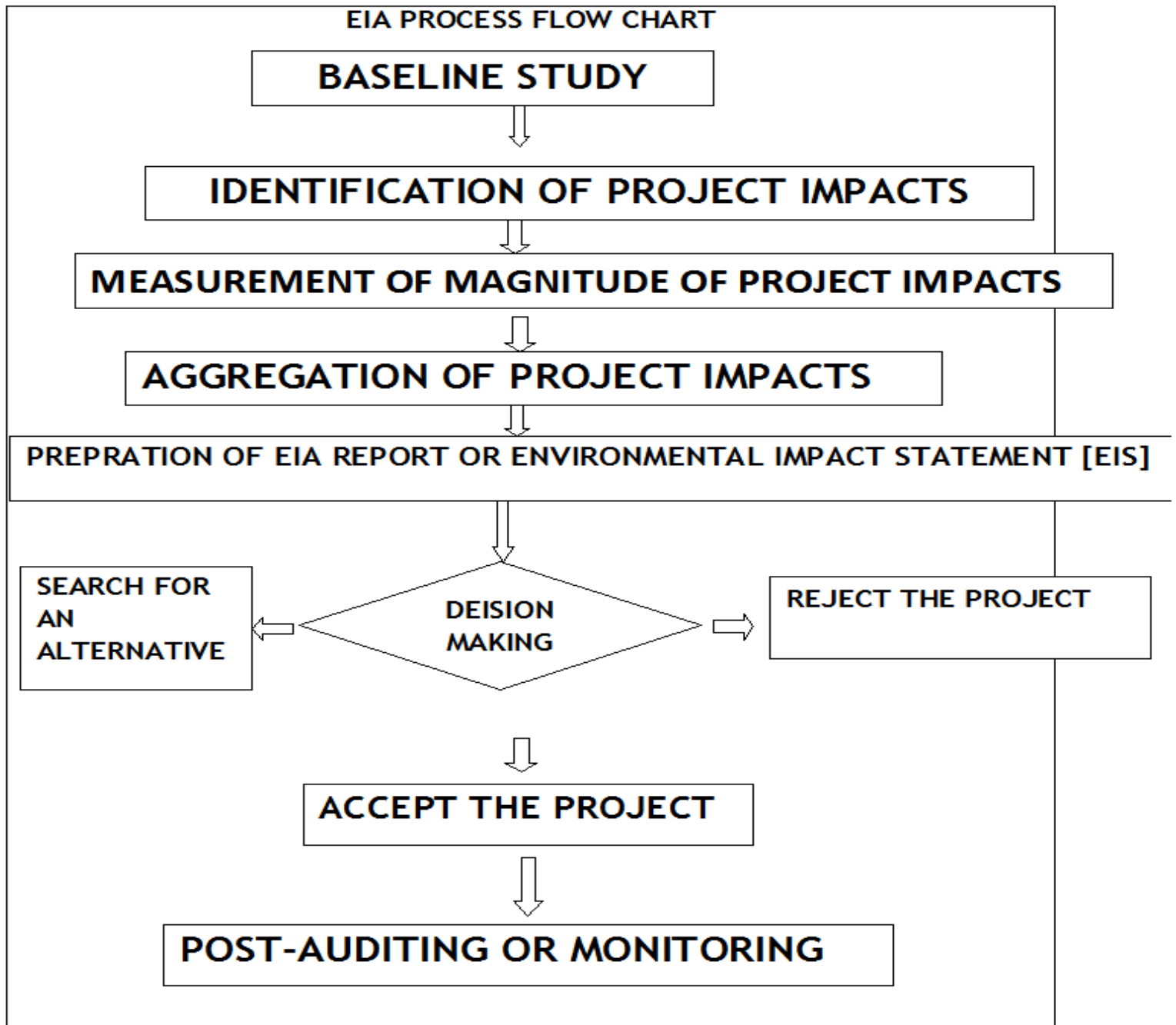
**SEARCH FOR  
AN  
ALTERNATIVE**

**DEISION  
MAKING**

**REJECT THE PROJECT**

**ACCEPT THE PROJECT**

**POST-AUDITING OR MONITORING**



# EIS (Environmental Impact Statement)

**EIS** is a document written in the format as specified by Department of Environment. EIS is a part of EIA process and it consists of *data regarding the impacts of development project on environment*. It includes:-----

- Impact of project on land quality.
- Impact of project on water quality.
- Impact of project on air quality.
- The extent of noise produced.
- Impact of project on plants and animals (i.e. biodiversity).
- Impact of project on National Parks, Wildlife Sanctuaries.
- Impact of project on society.
- Impact of project on public health.
- Impact of project on agriculture and tourism



## LIST SOME MAJOR PROJECTS FOR WHICH EIA IS MANDATORY

- Major irrigation projects/ river valley projects
- Hydel power projects
- Thermal power projects
- Chemical/metallurgical industries
- Nuclear power plants
- Tourism projects
- Mining projects
- Food processing industries
- Paper and pulp industries
- Oil refineries
- Textile industries etc.

# **LECTURE-9: CONCEPT OF SUSTAINABLE DEVELOPMENT, ECONOMIC AND SOCIAL -SECURITY**

## **Sustainable development is:-----**

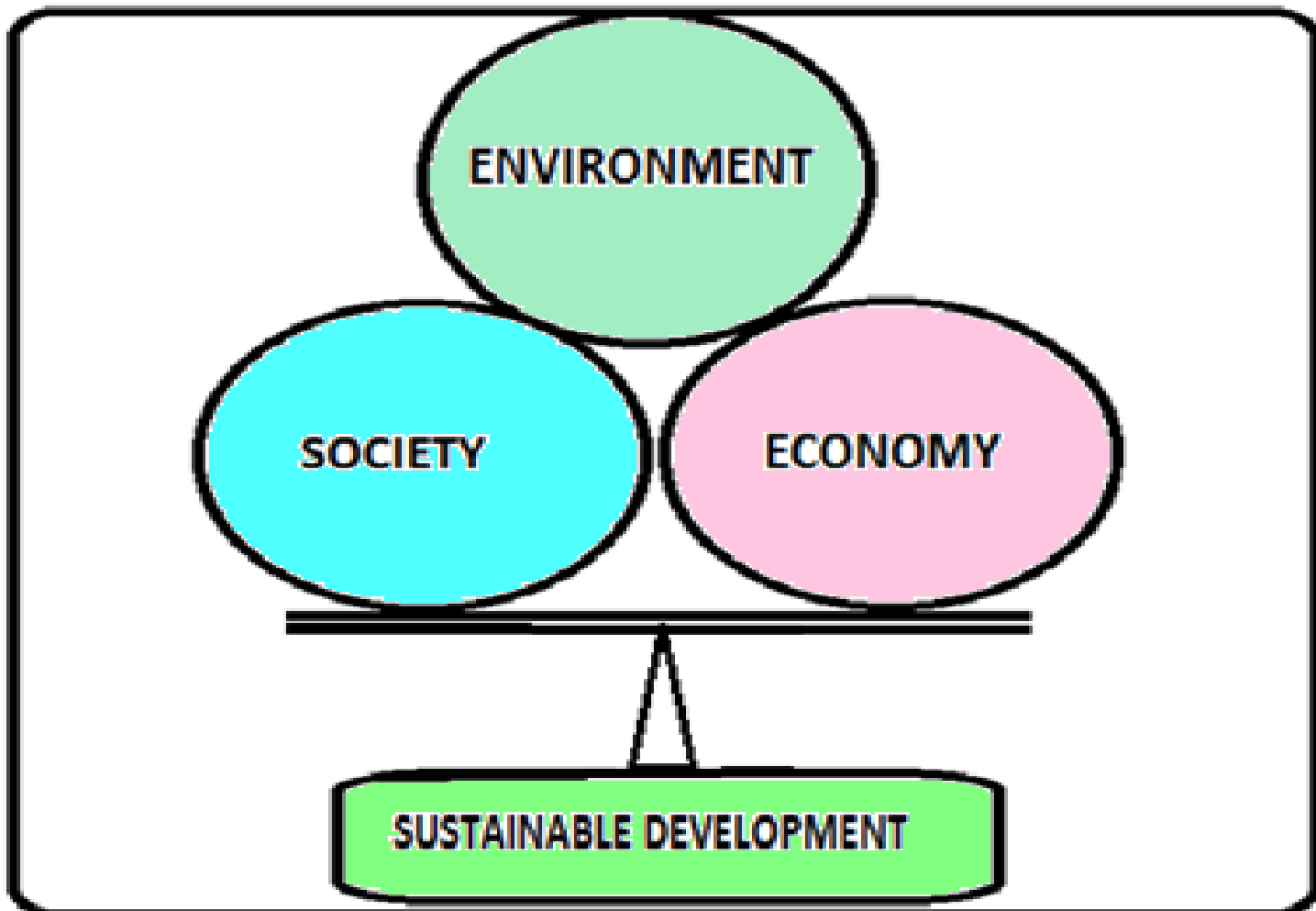
- An eco-friendly development
- A long-term development
- Such a development which helps in maintaining/sustaining the availability of natural resources for present generation as well as future generation without affecting their quality.

**The World Commission on Environment and Development, in 1987, submitted a report entitled “Our Common Future”, which defined the term Sustainable Development as:”Development that meets the needs of present without compromising the ability of the future generations to meet their own needs”.**

- This Commission is known as Brundtland Commission, named after G.H.Brundtland, former minister of Norway.

## GOALS OR PILLARS OR KEY COMPONENTS OF SUSTAINABLE DEVELOPMENT

ELEMENTS/PILLARS OF SUSTAINABLE DEVELOPMENT	FOCUS ON (OBJECTIVE)
1. Economy	Economic development of country by right utilization of natural resources for cultivation, industrialization, creating job opportunities and thereby raising the quality of life.
2. Society	Social development of country by providing basic needs like food, clothes, shelter, health, education etc.
3. Environment	Environmental protection of country so as to provide clean water, air and soil to present as well as future generation.



*Sustainable development can be ensured only when equilibrium (balance) is maintained among Economic, Social and Environmental needs.*

# WAYS TO ACHIEVE SUSTAINABLE DEVELOPMENT:

1. By checking population explosion
2. By implementing 4 “R” policy i.e.
  - Reduce
  - Reuse
  - Recycle
  - Recovery
3. By using appropriate technology (=eco-friendly technology)
4. By judicious use of natural resources.
5. Through environmental awareness, environmental education and public participation.
6. By implementing laws (Acts) and legislation.

# OBSTACLES IN THE PATH OF SUSTAINABLE DEVELOPMENT:

- **Pollution**
- **Over-Population**
- **Poverty**
- **Discrimination (=inequity) against women**
- **Caste based fight**
- **Religion based fights**
- **Dirty politics**
- **Problems of female infanticide, child marriage, child labour and dowry**
- **Illiteracy (lack of education)**
- **Corruption**

THANK YOU