

# B.Tech I Year

Regular Course Handbook

**Subject Name: Environment & Ecology (All Units)**

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## BAS104 / BAS204: ENVIRONMENT AND ECOLOGY

### **Course Objectives:**

1. Aims and objectives of environmental education emphasize the relationship between man and the environment and educate young people about the importance of nature and the environment.
2. Environmental education aims to impart ecological knowledge and promote environmentally conscious behavior towards nature.
3. It encourages young minds to take responsibility for protecting the natural environment protection through information and knowledge and to develop environmental awareness.
4. Incidentally, promoting awareness and a sense of respect for nature leads to a comprehensive understanding of the environment and a reasonable attitude towards protecting it.
5. The focus of environmental education is Awareness, Knowledge, Attitude, Skills, Capacity Building and Participation.

Topics	Contact Hours
<b>Unit-1</b>	<b>8</b>
<b>Environment:</b> Definition, Types of Environment, Components of environment, Segments of environment, Scope and importance, Need for Public Awareness. <b>Ecosystem:</b> Definition, Types of ecosystem, Structure of ecosystem, Food Chain, Food Web, Ecological pyramid, Balance Ecosystem. Effects of Human Activities such as Food, Shelter, Housing, Agriculture, Industry, Mining, Transportation, Economic and Social security on Environment, Environment Impact Assessment, Sustainable Development.	
<b>Unit-2</b>	<b>8</b>
<b>Natural Resources;</b> Introduction, Classification. <b>Water Resources;</b> Availability, sources and Quality Aspects, Water Borne and Water Induced Diseases, Fluoride and arsenic Problems in Drinking Water. <b>Mineral Resources;</b> Material Cycles; Carbon, Nitrogen and Sulfur cycles. <b>Energy Resources;</b> Conventional and Non conventional Sources of Energy. <b>Forest Resources;</b> Availability, Depletion of Forests, Environment impact of forest depletion on society.	
<b>Unit-3</b>	<b>8</b>
<b>Pollution and their Effects;</b> Public Health Aspects of Environmental; Water Pollution, Air Pollution, Soil Pollution, Noise Pollution, Solid waste management.	
<b>Unit-4</b>	<b>8</b>
<b>Current Environmental Issues of Importance;</b> Global Warming, Green House Effects, Climate Change, Acid Rain, Ozone Layer Formation and Depletion, Population Growth and Automobile pollution, Burning of paddy straw.	

**Unit-5**

8

**Environmental Protection;** Environmental Protection Act 1986, Initiatives by Non Governmental Organizations (NGO's), Human Population and the Environment: Population growth, Environmental Education, Women Education.

**Course Outcomes:**

- Upon completion of the course, the student will be able to:

	Course Outcomes	Bloom's Level
CO-1	Gain in-depth knowledge on natural processes that sustain life, and govern economy.	K2
CO-2	Estimate and Predict the consequences of human actions on the web of life, global economy and quality of human life.	K3
CO-3	Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.	K4
CO-4	Acquire values and attitudes towards understanding complex environmental-economic social challenges, and participate actively in solving current environmental problems and preventing the future ones.	K3
CO-5	Adopt sustainability as a practice in life, society and industry.	K3

**Reference Books:**

1. Textbook of Environment and Ecology by Dave, Katewa & Singh, 2<sup>nd</sup> Edition, Cengage Learning India Pvt Ltd Delhi.
2. Environmental Studies by S Deswal, Dhanpat rai & Co.
3. Environmental Science by VK Ahluwalia, TERI
4. Environmental Studies by R Rajgopalan, Oxford University Press.
5. Environment & Ecology by Singh & Malviya, Acme Learning

**B.Tech First Year: Regular Course Lecture Plan Session 2022-23**

Subject Name		Environment & Ecology	
Unit No.	Unit Name	Syllabus Topics	Lecture No
1	Environment	Environment Definition, Types of Environment, Components and segments, Scope	1
		Need of awareness (WHY)	
	Ecosystem	Concept, Ecosystem, structure and functions of an ecosystem	
		Forest, aquatic, marine, grasslands, deserts, estuarine ecosystem	
		Food chain (types), food web	
		Energy flow, ecological pyramids, Balance ecosystem	
	Human activities	Food, shelter, economic and social security	
	Effects of human activity on environment	Modern agriculture and its impact on environment	
		Mining and its ill effects on environment	
		Impact of housing, transportation and industries on environment	
2	Environmental Impact Assessment	Process and methodology	3
	Sustainable Development	Concept of Sustainable Development , sustainable agriculture	
	Natural resources	Classification of renewable and non renewable resources	
		Water resource, its availability and quality	1
		Causes and impacts of Water borne and Water induced diseases	1
		Arsenic and Fluoride problem in drinking water	1
		Mineral resources	2
		C, N and S cycle	2
		Conventional energy resources	3
		Problems due to conventional energy resources	3
		Non-conventional energy resources and their application	3
		Forest resources; Forest wealth, conservation	4

**B.Tech First Year: Regular Course Lecture Plan Session 2022-23**

Subject Name		Environment & Ecology	
Unit No.	Unit Name	Syllabus Topics	Lecture No
3	Environmental Pollution	Air Pollution: sources, effects, control measures (Electrostatic precipitator, cyclone separator, fabric filters, wet scrubber)	1
		Automobile pollution, causes and impacts	
		Water pollution: sources, effects, control measures (waste water treatment plant)	
		soil pollution:sources, effects, control measures	
		Noise pollution:sources, effects, control measures	
		Thermal pollution:sources, effects, control measures	
		Measures to reduce air, water ,soil and noise pollution in your area	
		Effects of animal husbandry on environment	
		Effect of urbanization on Environment	
		Solid and E-waste, types and impacts	
		Solid waste management practices	
4	Current Environmental issues of Importance	Global warming: causes, effects	1
		Measures to reduce global warming	
		Acid rain:causes, effects, control measures	
		Ozone formation and depletion, impacts of depletionon earth	
5	Environment protection through Assessment and education	Environment Protection Act, 1986	1
		The Air Pollution and prevention Act, 1981	
		The Water Pollution and prevention Act, 1974	
		The Wildlife Act, 1972	
		The Forest conservation Act 1980	
		Role of Government in environmental protection	2
		Role of NGO'S, Individual and need for women education	

Signature	
Name of Subject Head	Dr. Nalini Kant Sahoo

# **UNIT -1**

## ⇒ Environment:-

- Environment Means Surrounding and everything that affect an organism during its life-time is collectively known as its environment.
- Environment is sum total of water, air and land interrelation among themselves and also with human being, other organisms and property.
- Environmental Studies Provide an approach towards understanding the environment of our planet and the impact of human life upon the environment.
- It is a multidisciplinary subject includes Physics, Geology, geography, history, economics, Physiology, biotechnology, soil science and hydrology etc.

## ⇒ Type of environment:-

There are two different types of environment.

- i) Geographical environment
- ii) Man Made environment

i) Geographical environment :-

- It consists of all components provided by the nature, hence can be called as natural environment.
- It includes all natural resources, earth surface, Mountains, Plains, Land, Water, deserts, storms, cyclones, Volcanoes, Oceans etc.
- It also includes some biological situations such as complexities associated with plants and animals.

ii) Man made environment :-

- It is created by man in order to regulate and monitor certain environmental conditions.

- It is further divided into two types of environments.

a) Inner

b) outer

a) Inner man made environment

It is a social environment and it exists as long as a particular society exists.

### b) Outer man made environment:-

Outer environment is as a result of some modifications, which includes modern infrastructure in cities, our homes and their associated amenities, our modes of communication and transport, different kinds of industries, manufacturing, luxurious commodities, electrical appliances and so on, which ultimately aims at civilization and urbanization.

### ⇒ Components of environment:-

There are two important components of environment:-

- i) Physical / Abiotic components.
  - ii) Biological / Biotic components.
- i) Physical / Abiotic components.
- It refers to non-living part of the environment, which includes air, water, soil, climate etc.
  - Physical component can be broadly classified into 4 groups such as atmosphere, Hydrosphere, Lithosphere and also Biosphere.

## ii) Biological / Biotic Components.

- Biological / Biotic Components includes all living things such as animals, plants and microorganisms, which they interact with the abiotic components and forming various types of ecosystems.
- Organisms in these ecosystems are classified into three groups such as Producers (Autotrophs), Consumers (Herbivores/ Carnivores) and Decomposers (Detritivores).
- These groups occupy various trophic levels on the food chain.

## → Segments of environment :-

There are four (4) segments of environment which are as follows:-

- ① Atmosphere
- ② Hydrosphere
- ③ Lithosphere
- ④ Biosphere.

### (1) Atmosphere :-

- It is the segment of the environment, where life sustains.

- Atmosphere consists of mixture of gases which protect the earth from outer space.
- Atmosphere is extended from the surface of the earth and covers the region of the earth crust.
- The major gases that are constituent of the atmosphere are
  - Nitrogen (78%)
  - Oxygen (21%)
  - $\text{CO}_2$  (0.03%)
  - Argon (0.9%)
- These atmospheric gases are responsible for the absorption of dangerous rays like cosmic or UV radiations coming from the outer space and sun respectively.
- Also it helps in maintaining the heat balance, support various gaseous cycle and transferring water from atmosphere to land.
- Atmospheric acts as a source of  $\text{O}_2$ , where  $\text{O}_2$  is essential for human being and animals while  $\text{CO}_2$  is essential for plants.
- Atmosphere consists of various layers

such as Troposphere, Stratosphere, Mesosphere,  
Thermosphere, Exosphere, Magnetosphere etc.

Temperature	Atmospheric Layers	Distance	Activities
1200°C	↑ Exosphere	800 to 3000 km.	Spaceship, Satellite
-86.5°C to -1200°C	↑ Thermosphere	80-90 to 800km.	Aurora
-215°C to -86.5°C	↑ Mesosphere	40-50 to 80-90km	Meteorological rockets.
-56.5 to -215°C	↑ Stratosphere	11 to 50 km	Radiosonde
15 to -56.5°C	↑ Troposphere	0 to 12-18 km	Aircraft, clouds, mount everest.

Earth

## ② Hydrosphere:-

- Hydrosphere contributes to that part of the earth where water exists.
- About 75% of the surface of earth is a hydrosphere.
- Hydrosphere includes all water resources such as Sea, oceans, rivers, lakes, glacier, as well as ground water etc.
- Whereas 97% of water resources are unfit for drinking or irrigation purpose.

( sea water containing dissolved salts)

- From the remaining 3% of water resources 2% exists in frozen form in polar caps, glaciers etc.
- Whereas only 1% suits <sup>bare</sup> human consumption.
- Hence, water is considered to be quite precious and not worthy of getting wasted.

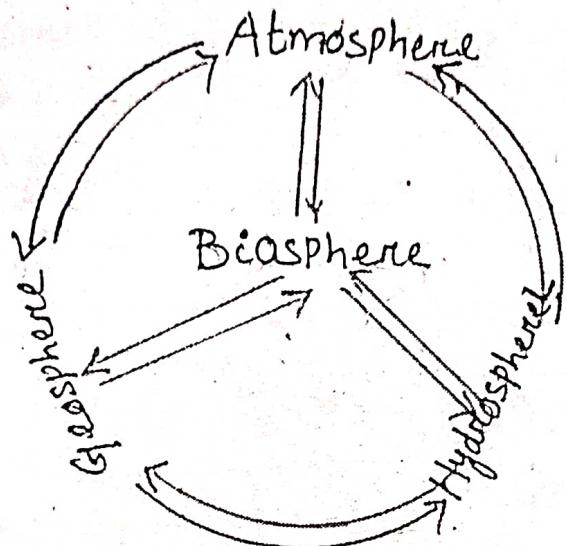
### ③ Lithosphere:-

- Also known as Geosphere.
- It belongs to the part of the earth where minerals, organic matters, metals, rocks, soils exists.
- It is the outer surface of the earth mainly containing earth's crust and soil.
- They layer constitutes the solid components of the earth.

### ④ Biosphere (Zone of life)

- Biosphere represents that portion of earth where life is possible.
- It is defined as the region on, above, and below the earth's surface where life exists.
- The biosphere is a narrow zone on the surface of the earth where soil, water and air

- Combine to sustain life
- The biosphere is related to Lithosphere, hydrosphere, and atmosphere, which are all spheres of the physical world.



- It is characterized as an environment that contains all living organisms and the product of their activities.
- As a result, it plays a vital role in the conservation of ecosystems.

- Scope and importance of Environmental Science
- i) Conservation of nature and natural resources.
  - ii) Conservation of biological diversity.
  - iii) Control of environmental pollution.
  - iv) Stabilization of human population and environment.
  - v) Social issues in relation to development and environment.
  - vi) Development of non polluting renewable energy.

B. Tech I Year [Subject Name: Environment & Ecology]  
System and Providing new dimension to security.

- Environment belongs to all the living thus each and everybody will be able to environmental issues like global warming, depletion of ozone layer, deforestation, of energy resources, loss of global etc.
- Environmental Study deals with the processes, which leads to pollution and degrades environment.
- It is helpful for establishing safe, clean and healthy natural ecosystem.
- It also deals with important issues like safe and clean drinking water, hygiene, living conditions, clean and fresh air, of land, healthy food and development.
- Along with these, environmental study provides new career opportunities such as sub environmental law, business administration, environmental engineering for environmental protection and management.

### ⇒ Need For Public Awareness:-

- With the ever increasing development by modern man, large scale degradation of

- natural resources has been occurred.
- To encourage meaningful public participation and environment, it is necessary to create awareness about environmental pollution and related adverse effects.
  - Thus Conference on environment and development followed by Earth Summit on sustainable development have been arranged to highlight the key issues of global environmental concern and have attracted general public towards the deteriorating environment.
  - Any government at its own level can't achieve the goal of environment conservation until the public has a participatory role in it.
  - Public participatory role is possible only when the public is aware about the ecological and environmental issues.
  - If we want to manage on planet earth, we would have to make the entire population, environmentally educated.
  - The main objectives of environmental awareness one should be
    - i) Improving the quality of environment.
    - ii) Creating an awareness among people on

environmental problems and conservations.

iii) Creating such an atmosphere as people find themselves fit enough to participate in decision making process of environmental development programmes.

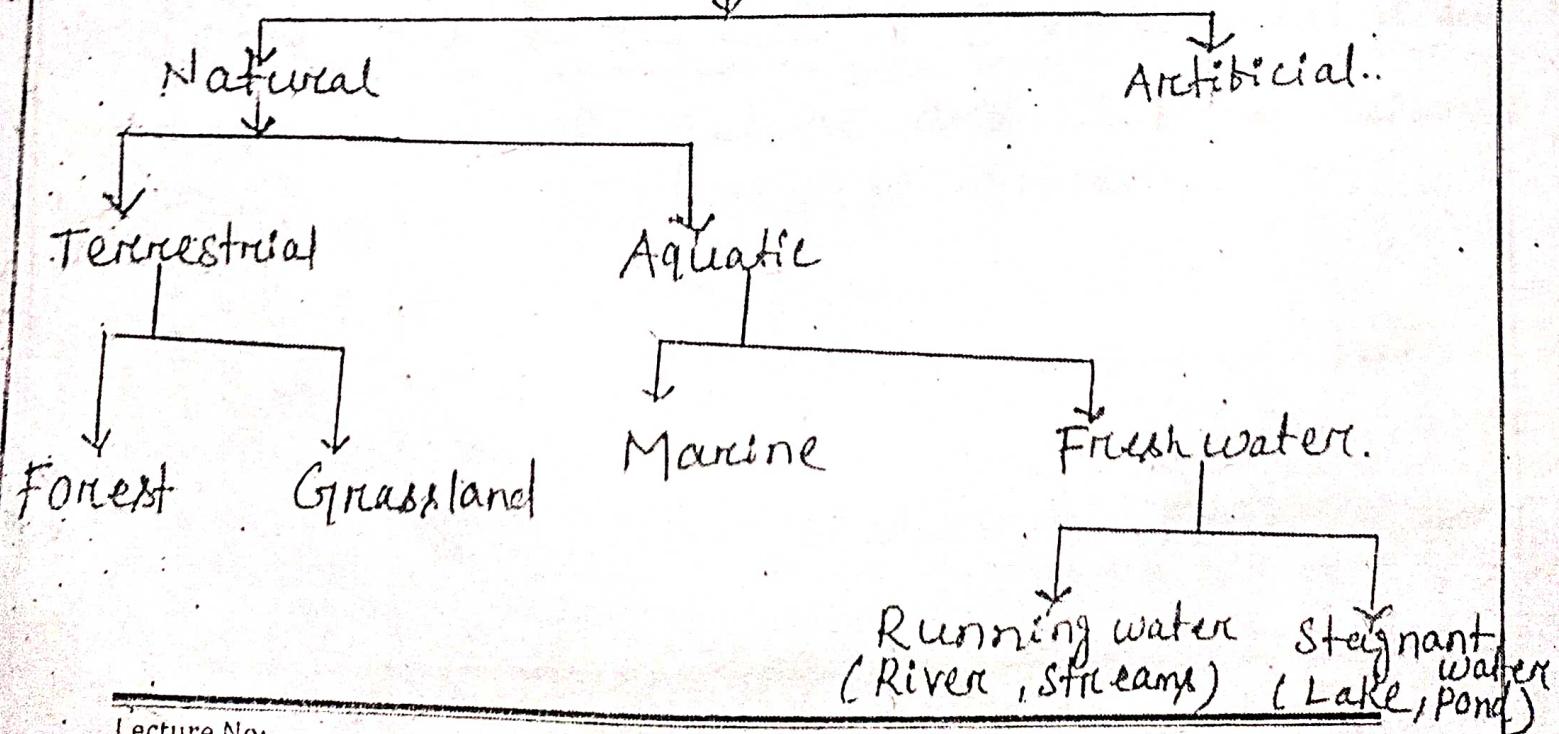
## ECOSYSTEM

### → Ecosystem

- According to A. G. Tansley (1935), An ecosystem is the ecological unit consisting of both biotic factors <sup>(living)</sup> and abiotic factors (nonliving) in a specific area.
- Examples of different types of ecosystem are Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystem etc.

### → Balanced ecosystem

- Balance of ecosystem means balance of autotrophy and heterotrophy in an ecosystem, to maintain an even distribution of sustainable energy through food chain without any external interference.



## ⇒ Structure of ecosystem

An ecosystem has two types of components:

- i) Abiotic
- ii) Biotic

### i) Abiotic

Abiotic components includes:-

#### a) Physical.

- ① Sunlight (For Photosynthesis)
- ② Water (Essential for living things)
- ③ Temperature (Necessary to get sun)
- ④ Soil (Provide base and nutrients)

#### b) Chemical.

- ① Proteins
- ② Carbohydrates
- ③ Fats
- ④ Minerals etc.

### ii) Biotic

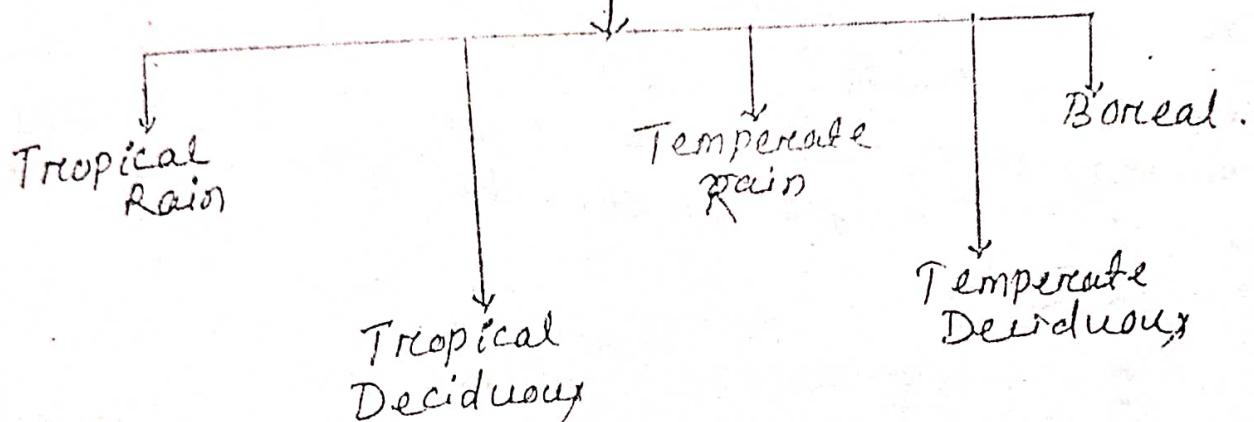
- ① Producers / Autotrophs
- ② Consumers / heterotrophs
- ③ Decomposers / Detritivores.

- Producers are the Chlorophyll containing, self-nourishing organisms, which prepare Organic

## Forest Ecosystem

The 31% of land is covered by forest. In India 1/4<sup>th</sup> area of the total land is covered by forest. They are classified as

### Forest ecosystem



### Tropical Rain Forest

- Such Forest are located in equatorial regions of the earth such as in Congo River basin of Africa, Central America where the average rainfall is high ( $\geq 150 \text{ cm/year}$ ) and average annual temperature exceeds  $23^{\circ}\text{C}$ .
- These forests are characterised by warm and humid climate, high diversity of plant and animal species, broad leaved and tall plants and abundance of insects and invertebrates.

### Tropical Deciduous Forest

- Such forest are located in continental regions of the tropics where the average rainfall ranges from  $60-120 \text{ cm/year}$ . The rainfall is

not evenly distributed and is restricted to a few months with prolonged dry season.

### Temperate Rain Forest

- It occurs in the region which are comparatively very cold and have winter rainfall, the summer are hot and dry.

### Temperate Deciduous Forest

- It occurs in very cold climate. The annual temperature is in between  $7-15^{\circ}\text{C}$ . The summer is hot and winter is very cold.
- These forests are characterised by tall deciduous trees, abundance of insects and birds, of hard wood trees which are quality furniture and building suitable for purpose.

### Boreal Forest:-

Such forest are found across east west band of north Europe, North Asia and North America. The annual rainfall varies from 100 mm to 350 mm and annual temperature ranges between  $-6^{\circ}\text{C}$  in winter to  $20^{\circ}\text{C}$  in summer.

### Functions Of Forest Ecosystem:-

Forest ecosystem enhances water resources in both quality and quantity. because of their

Capacity and ecological cleansing action. The hydrological cycle depends upon forest ecosystem and encourages absorption rather than run off and precipitation. Forest give shelter to wildlife.

- forest ecosystem considered as a pathway for the exchange and regulation of atmospheric gases, water and trace elements.

### Grassland ecosystem

It is a type of terrestrial ecosystem. It is of following types.

#### Temperate Grassland:

Temperate grasslands occur under climatic conditions that are between those that produce forests and that produce deserts. In temperate zones grasslands typically occur in regions where rainfall is 25-90 cm & less per year.

- ① According to height of the dominant vegetation there are 3 types of grasses present in temperate Grassland ecosystem such as tall grass, mixed grass and short grass.
- ② The tall grass will be developed in open forest (now rarest and most endangered species).
- ③ The mixed grass occurs where rainfall is less plentiful and it supports shorter species of grasses and other herbaceous plants.
- ④ The shorter grass develops when there is even less precipitation and it is subjected to severe drought.

### Tropical Grasslands and savannas :-

- ① Tropical grasslands are present in region as much as 120 cm (47") of rainfall per year, but under highly seasonal conditions with pronounced dry season.
- ② Savannas are dominated by grasses and other herbaceous plants.
- ③ However, they also have scattered shrubs and tree sized woody plants that form a very open canopy.

### Polar Grassland :-

- ④ Polar grassland are regions in high latitudes with almost no trees as they cannot grow because the ground is permanently frozen.
- ⑤ The vegetation consists of mostly grasses, sedges, heather, mosses and lichens.

### Desert Ecosystem :-

- ⑥ About 33% of land is covered by desert. The species composition of such ecosystem is much more varied and typical due to extremes of both temperature and water availability.
- ⑦ The various biotic components of a desert ecosystem are as follows:
  - \* Producers: These are shrubs, specially bushes, some grasses and very few trees. Sometimes few succulents like cactus and some lower plants like Lichens and Xerophytes mosses.

- \* Consumers: The animals like reptiles and insects are able to live under these desert conditions. Some nocturnal rodents and birds are also found. The camel, known as "ship of desert" feed themselves on tender shoots of plants.
- \* Decomposers: Due to poor vegetation the amount of dead organic matter is very less. Some fungi and bacteria may present which are mostly thermophilic in nature.

### Aquatic Ecosystem:-

An Aquatic ecosystem is distinguished from terrestrial one on the basis of its salt content. Such ecosystems occupy about 71% of this planet. They are classified into following categories.

#### Inland Waters (Fresh Water)

Water found on the surface of the land in rivers, streams, lakes, ponds, artificial constructions and so on is called inland water. Inland water habitats are grouped into

water habitats are standing water.

i) Lentic habitats are standing water.

ii) Lotic habitats are running water.

These (Lentic water) include ponds, ditches and lakes where water remains confined. The rooted plants project their leaves above

the water for photosynthesis. The consumers of this region are pond snail, dragon fly nymph, hydra and flat worms. Snails feed on plants and Midge larvae feed on detritus.

### Pond Ecosystem :-

- ① The Pond can be defined as a body of shallow standing water characterised by relatively quiet water and abundant vegetation with thousands of microorganisms, large plants and animals.
- ② The important components of pond ecosystem are as follows.

- Abiotic Components:

These include organic and inorganic compounds such as water,  $\text{CO}_2$ ,  $\text{O}_2$ ,  $\text{Ca}$ ,  $\text{N}$  and  $\text{P}$  and their compounds as amino acid and humic acid etc.

- Biotic Components:

→ producers are autotrophs, green plants and some photosynthetic bacteria.

→ consumers are mainly zooplankton (Euglene, heterotrophs), secondary consumers (insects, small fishes and water beetles) and tertiary consumers (big fishes).

→ Decomposers are also known as micro-organisms. They play an important role in the return of mineral elements again to the medium of the pond.

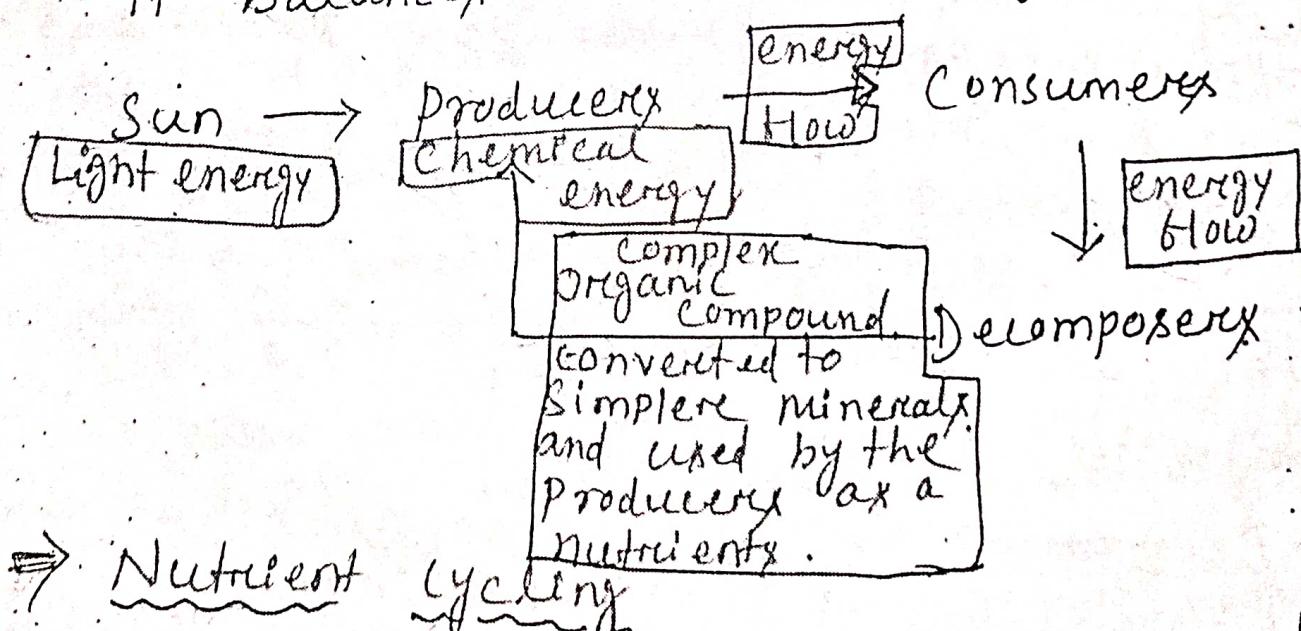
Compounds from inorganic raw materials, through the process of photosynthesis by all green plants.

a Consumer depends on the energy produced by the producer. Herbivores, carnivores and omnivores are the different categories of consumers.

• Decomposers attacks on dead animals, produce etc. and convert the complex organic compound into simple compounds by the process of decomposition and disintegration. and then recycle all the nutrient back. e.g. Bacteria and Fungi.

• Function of ecosystem:-

- \* Ecosystem balances the rate of biological energy flow.
- \* It balances the nutrient cycle.



The Producers using nutrients and

Prepare food, the consumers consume it and the decomposers recover the nutrients, keep flowing between biotic and abiotic components forming nutrient cycle known as ~~biogeo~~ ~~chemical~~ ~~cycle~~.

### ⇒ Biological Magnification

Biological magnification or biomagnification is the increasing buildup of toxic substances within organisms that happens at each stage of the food chain.

- For example, when a lion eats a crocodile. It ingests the toxins in the crocodile, which include the toxins from all the animals that the crocodile has ever eaten, which includes the toxins from all the plants that those animals have ever eaten so that at each stage of the food chain, the toxic buildup increases.
- The buildup of toxic substances within a single organism is called biological accumulation. Many biological accumulations are compounded and produce biological magnification.
- Biological magnification occurs because some toxic substances don't get broken down.

are filtered out of the body. This means that every organism that eats another gets loaded up with a lot of accumulated bad stuff

⇒ Flow Chart For Biological Magnification:-

Water ( $0.00003$  ppm toxic concentration of heavy metals)  
(Phytoplankton)

Eaten by

Zooplankton ( $0.04$  ppm of heavy metal conc.)

Eaten by

Small Fish ( $0.5$  ppm of heavy metal conc.)

Eaten by

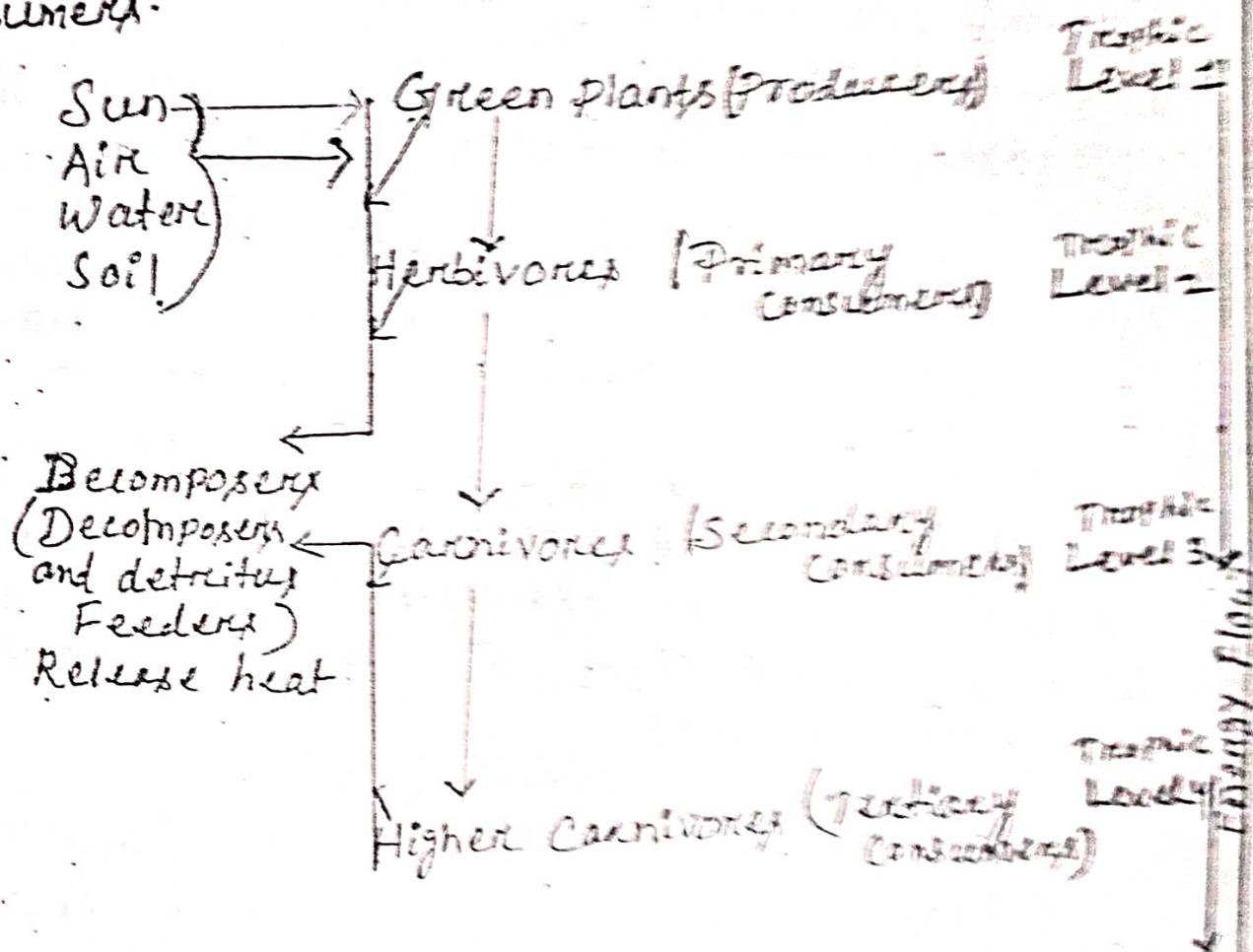
Large Fish ( $2$  ppm. of heavy metal conc.)

Eaten by

Eagle / Human beings / (  $25$  ppm heavy metal conc.)  
any other tertiary  
consumers.

## ⇒ Food Chain

- The process of eating and being eaten by the successive creatures is known as food chain from Producer to tertiary consumers.
- It is the flow of energy.
- Consumers.

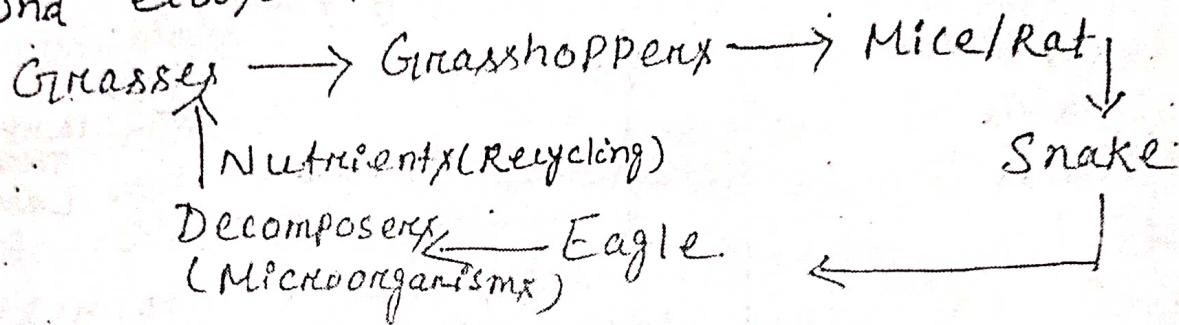


## Type of ecosystem

- Grazing Food chain
- parasitic Food chain
- Detritus Food chain

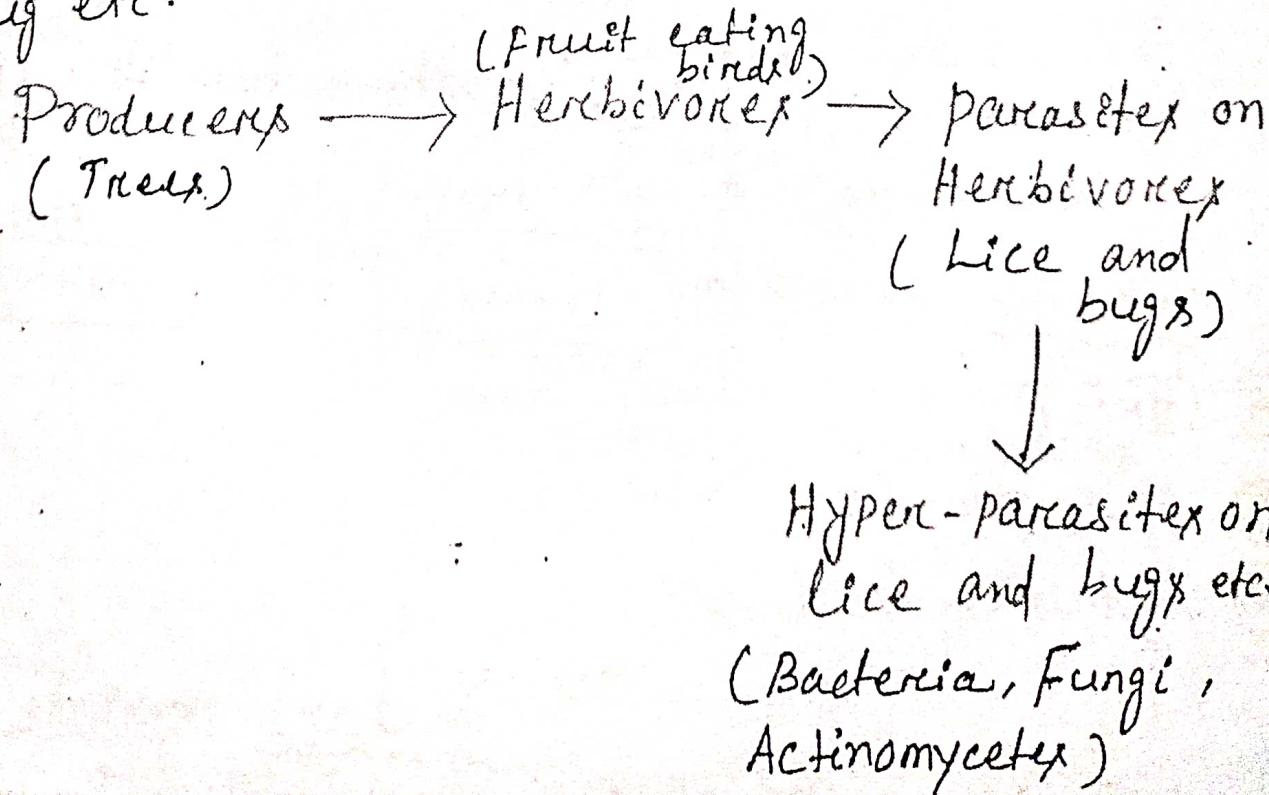
(A) Grazing Food Chain

It starts from green plants and through carnivores it reaches to the decomposers for final breakdown of the complex into simpler minerals for example grassland ecosystem and pond ecosystem etc.



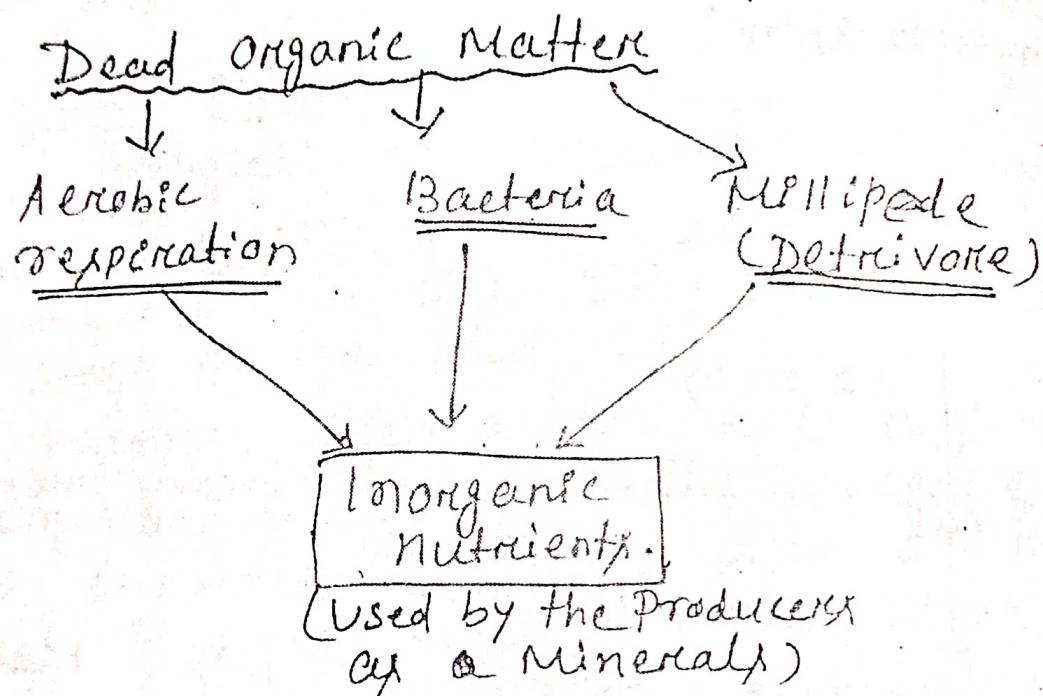
(B) Parasitic Food Chain

When plants and animals get infected by parasites. Smaller organisms consume them without killing them. For example Nematode, bug etc.



### ③ Detritus Food chain:-

Food chain that starts from dead and decayed organisms, to the microorganisms, to the detritivores or saprovoivores and these predators form a chain called detritus Food Chain.



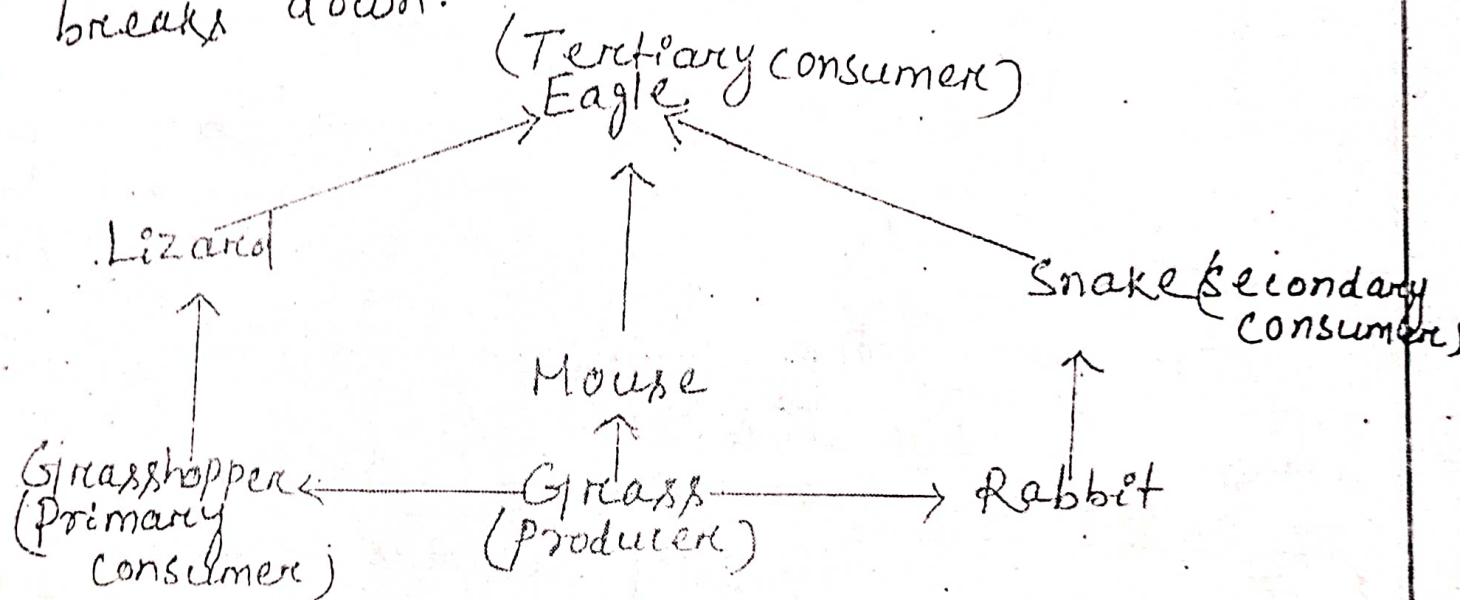
### Example of detritus Food chain

① Dead leaves  $\xrightarrow[\text{by}]{\text{eaten}} \text{Woodlouse} \xrightarrow[\text{(insects/worms)}]{\text{eaten by}} \text{Black birds}$

② Detritus  $\longrightarrow$  Primary detritus Feeder (Earthworm)  $\longrightarrow$  Secondary detritus Feeder (Rat/bird)

### Food Web:-

- When different food chains are interconnected with each other in a specific pattern then these long interlinked chain processes in an ecosystem is called as Food Web.
- If the chain gets disturbed a little, then it leads to the loss of species and the web breaks down.



### Ecological Succession:-

- The slow but continuous replacement of ecosystem over a period of time in any particular area is called ecological succession.
- It occurs due to environmental changes.

### Types of Succession

- ① Primary
- ② Secondary

① Primary Succession:-

The area which is the lifeless and unexposed to any life is occupied by a living community for the first time is known as primary succession of that land.

② Secondary Succession:-

When a new biotic community replaces an already existing biotic community then this type of replacement is known as secondary succession. For example bare garden or park etc.

Bare Rock → Lichens → Small annual plants and.

Lichens



Grasses, Shrubs and shade-intolerant trees such as pines.

Grasses and Perennials

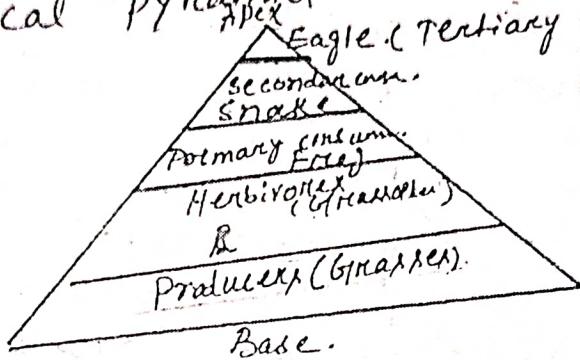


Shade-tolerant trees such as Oak and Hickory.

### ⇒ Ecological Pyramid :-

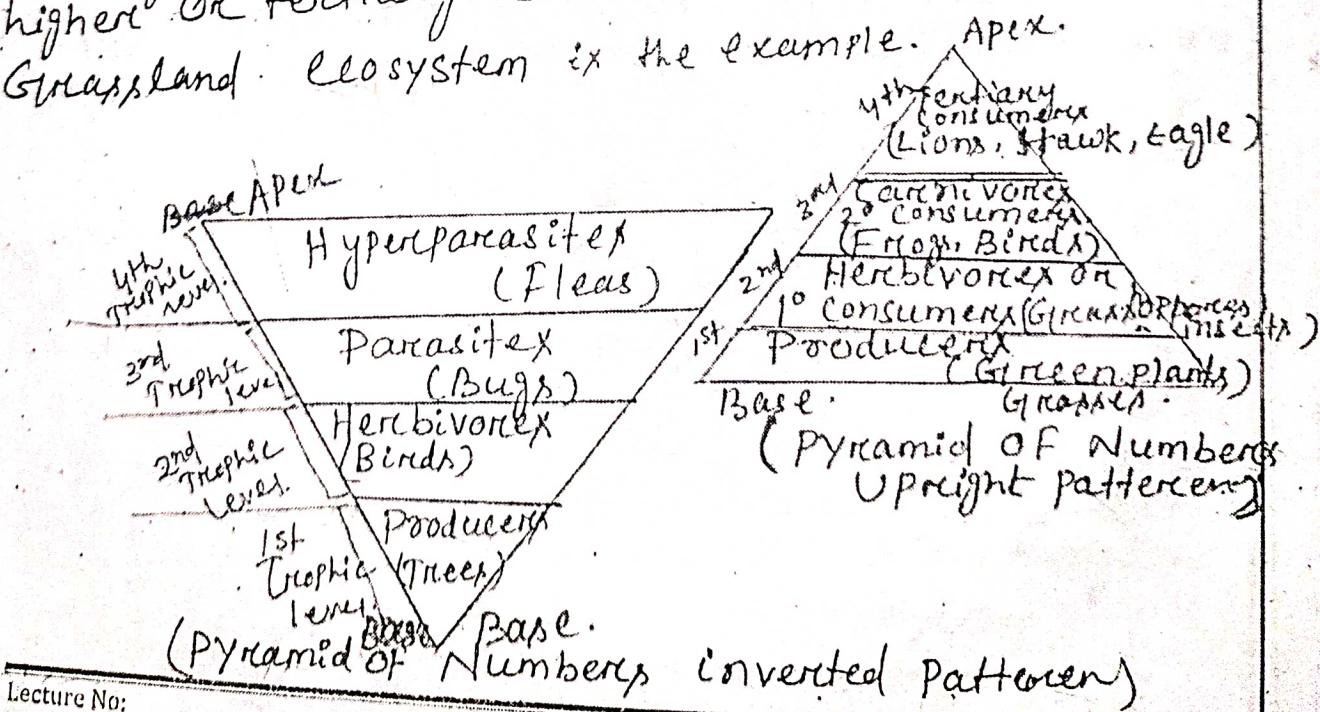
It is used to represent the status of the ecosystem for different parameters such as number, biomass and energy.

Ecological pyramid in Grassland ecosystem.



### ⇒ Pyramid of Numbers

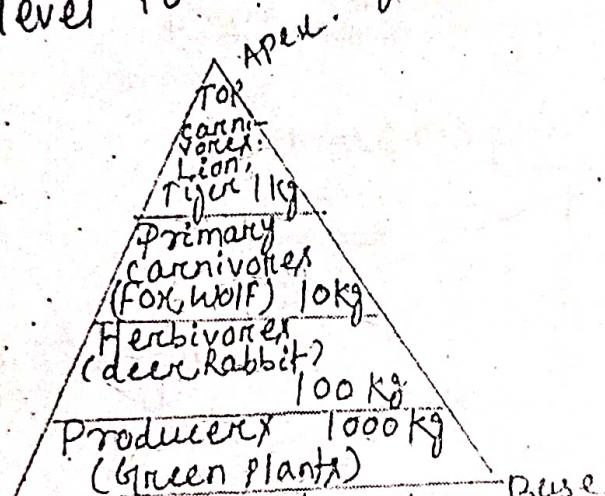
- It represents the number of producers and consumers at each successive trophic level.
- Its base shows producers, the next level shows primary and secondary consumers and the apex higher or tertiary consumers.
- Grassland ecosystem is the example.



### → Pyramid of Biomass

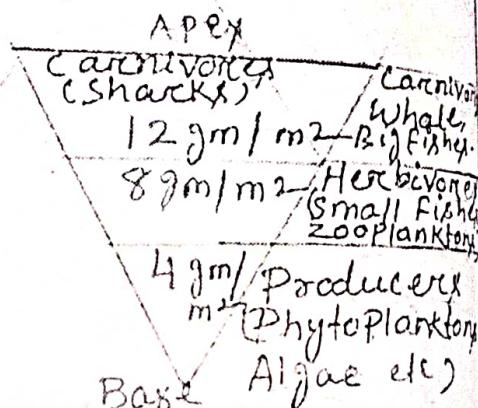
- It is based on the weight or biomass of the organisms in each trophic level at a time.

- The biomass decreases from the lower trophic level to the higher one. Example Forest ecosystem.



Upright Pyramid of biomass in a Terrestrial ecosystem.

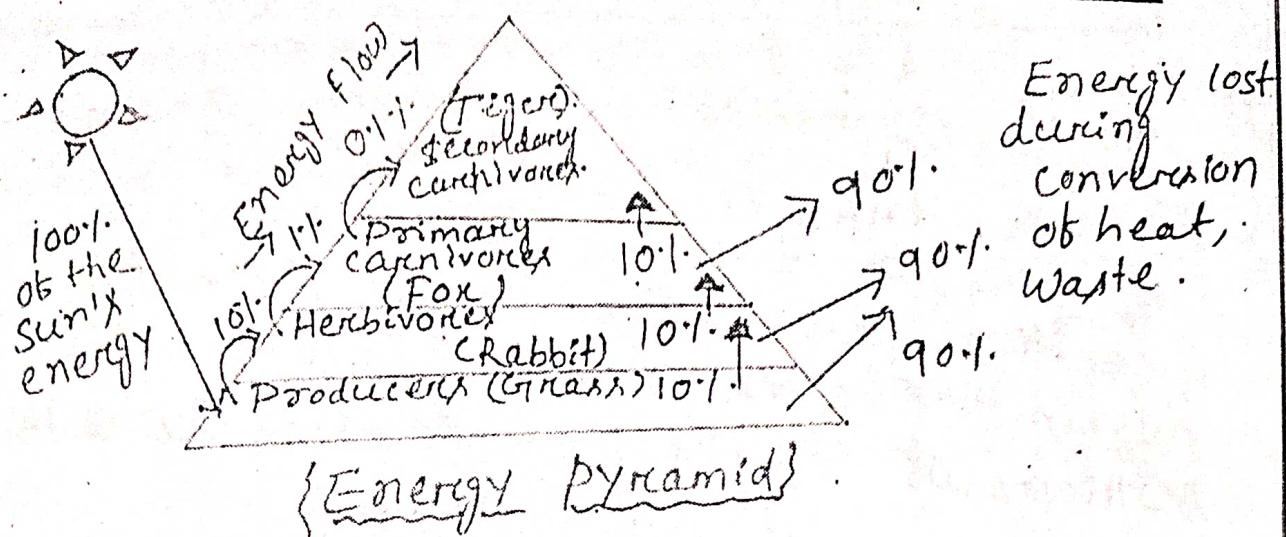
Inverted Pyramid in an aquatic ecosystem



(<sup>imp</sup> Ecological pyramid always producers should occupy the base of the pyramid)

### → Pyramid of Energy

- It is based on the total energy present in each trophic level of the pyramid.
- The energy should always transfer from base towards the apex of the pyramid (upright).
- It is always upright as energy decreases at successive trophic level from base (producer to apex (consumer))



⇒ Effects of human Activities such as Food, shelter and housing on environment.

- There are thousands of edible plants and animals over the world, from which only few may constitute the major food of human beings.
- With increasing population, the demand for crops has increased at a rate that has created a lot of stress on land resources. As a result, forests have been cleared to create agricultural lands.
- According to Food and Agriculture Organisation (FAO) of the United States Nations, the minimum caloric intake on a global scale is 2500 calories/day. But people receiving 2000-2200 calories/day, hence it is said to be undernourished. which may result into various deficiencies and health related problems.
- About 15-20 million deaths occur annually due to malnutrition (deficiency of proteins).
- During the last 50 years, world grain production has increased almost three times, thereby increasing per capita production by about 50%, but at the same time population growth increased such a rate in less developed countries that reduced the food production.

⇒ EFFECT OF SHELTER ON ENVIRONMENT:-

- With increasing population, there is also increasing pressure on finite land resources for housing.
- Both overcrowded unplanned urban settlements and unhygiene, underdeveloped rural settlement pose big challenges for the present and future generations.
- Fast depletion of natural resources, shrinking land, rising pollution levels and associated health problems have forced us to re-look at the structure and design of buildings by introducing environmental approach to buildings.

⇒ EFFECT OF ECONOMIC GROWTH ON ENVIRONMENT

- Economic growth required for raising the quality of life of human beings.
- Technological advancement leading to rapid industrialisation and urbanisation but these things will lead to depletion of natural resources, energy crisis and pollution of the air, water and soil.
- Economic growth led to wide disparity between the developed and developing nations.
- For example U.S.A. with just 4.7% of global population consumes 25% of the total energy and produces 25% of total pollution.

or wastes and 22% of total chlorofluorocarbons (CFCs) responsible for ozone depletion.

- Whereas, the developing nations, still struggling to not even able to provide basic amenities like food, safe drinking water, hygienic shelter and a livable life to millions of its people. (so much wealth gap)

#### ⇒ Effects of Social Security on environment

- The ultimate goal of development is to improve the quality of life, so that all people throughout the world enjoy long, healthy, purposeful and fulfilling lives.
- But the developed nations with only 20% of global population control about 80% of global economy.
- At present around 1.4 billion people (1/4th of global population) live on less than \$1 (1 dollar) per day.
- About 12% of global population living in poor countries is suffering from under-nutrition or malnutrition, these people suffer from acute social insecurity because they are struggling for survival by not getting drinking water, fire wood and food for survival.
- Intra-generational equity has emerged.

a new concept in sustainable development to ensure equitable share of resources for economic growth of the poor and their social security.

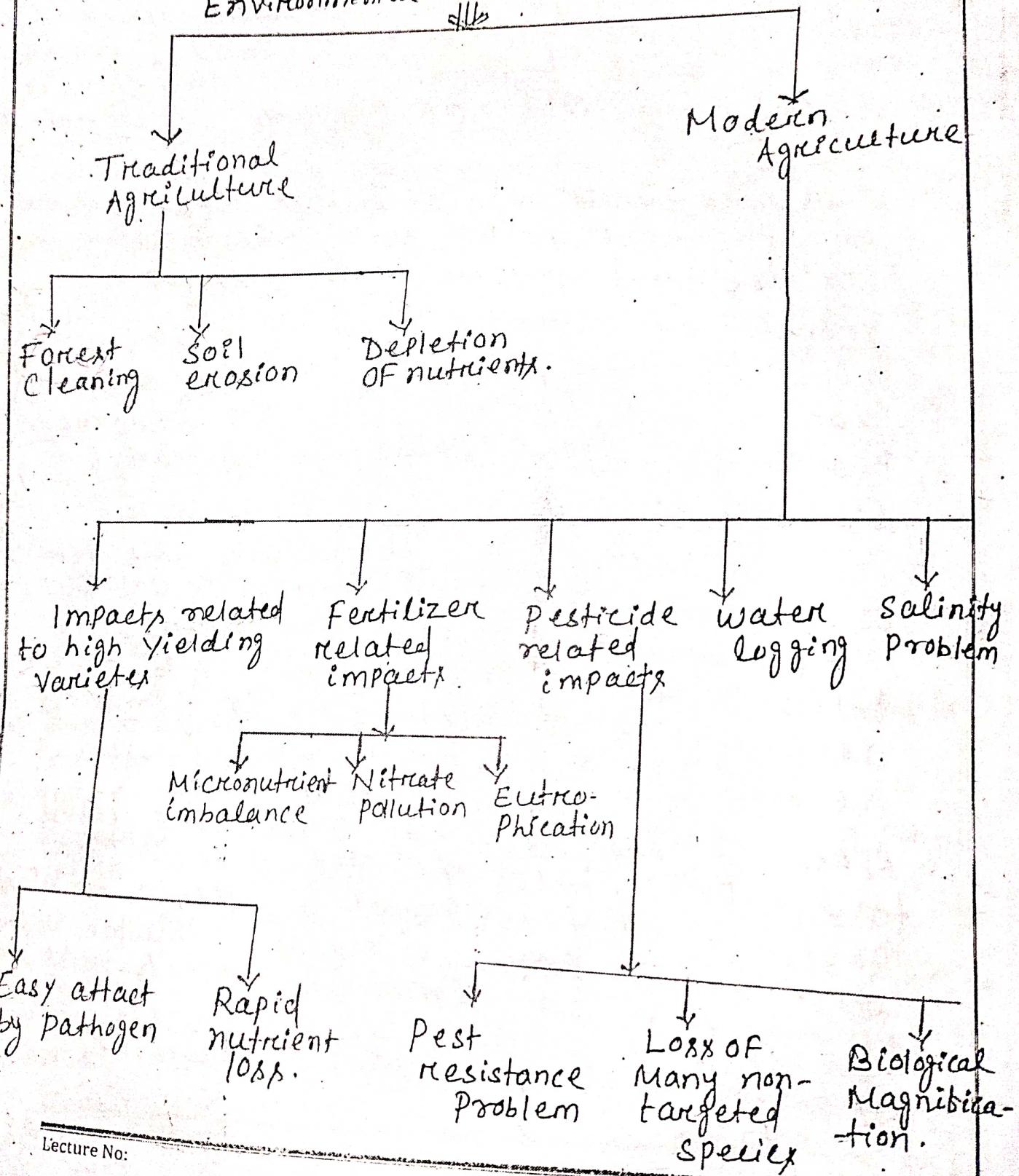
### EFFECT OF agriculture on environment:-

- Agriculture is the oldest and widespread occupation of the people in rural areas, but over the years, there have been notable changes in the pattern of Farming.
- Manual Farming has been replaced by Mechanical Farming due to advancement of different technologies.
- The changes in earlier form of agriculture have been brought by the following ways
  - i) Mechanical factors:- Tractors, tubewells and agricultural equipments.
  - ii) Chemical Factors:- Fertilizers and pesticides.
- Chemical factors have brought a revolution in the agriculture, as they express growth in a very short span of time but their effects in the long run are harmful or detrimental.
- Affects of Tractors:- It is a mechanical means of cultivation which are used for ploughing, leveling, weed controlling and sowing. Tractors cause mechanical stress/harm to the detritivores such as earthworms, so that the mineral

cycle or biogeochemical cycle is hampered.

- Fertilizers such as artificial fertilizers are used to provide nutrients to plants. They are easy to handle, transport, store and helps in better crop yield as compared to organic composts.
- Increased artificial fertilizer use is polluting the environment and contaminating the surface and ground water resources.
- Synthetic or artificial Fertilizers are derived from by-product of the petroleum industry Examples are Ammonium Nitrate, Ammonium Phosphate, Superphosphate and Potassium Sulphate etc.
- In long term run, it reduces the fertility of land and also lead to loss of organic matter from the soil. It also affects the lakes, ponds and underground water due to accumulation of fertilizers in them and the soil.
- EFFECT OF PESTICIDES: - Pesticides are used to kill pests, helps in reduction of crop loss, controls the probable disease in plants which would cause diseases to human beings also helpful for controlling weeds.
- But it has some disadvantages like

## Environmental impacts of Agriculture



- Non targeted species also killed.
- Some pests are beneficial to the crops; they are also killed.
- Soil fertility is reduced.
- Food chain and food webs are disturbed.
- It results into many incurable diseases.

### On environment:-

- Effects of Industries on environment:-
- Industrial activities generates a large amount of waste products, which are usually discharged into water bodies. This causes air pollution, noise pollution, etc.
- The smoke from industries causes air pollution.
- It's noise causes noise pollution.
- Industrialization is considered as development but it is necessary to review the impact of industrialization on society and environment.
- Otherwise it can bring the following problems such as

- ① Ecosystem imbalance:- Industrial plants discharge a large amount of chemical contaminants to the air and water and pollute them. Industrialization and urbanization contaminating the atmosphere and leading the biosphere to undesirable changes that will result in ecosystem imbalance.
- ② Biodiversity loss:- To set up new industries the biologically rich habitats are being

destroyed and fragmented

### ③ Toxic Metal and non metal discharge:-

The organic impurities cause harmful effects on water bodies and the region which connected them. Discharge of industrial wastes in water decrease the DO (dissolved oxygen) level of water and causes deficiency of pure drinking water.

### ④ Food chain imbalance:- Industrial discharges containing various organic and inorganic contaminants that enter into the food chain and imbalance it, also it disturbs the energy flow of the ecosystem.

### ⑤ Disturbances of Self Purification Mechanism

- The organic matter gets oxidized by bacteria and produce ammonia, nitrate, sulphate etc.
- These substances are utilized by protozoa, fish, insects etc.
- Discharge of organic matter into the water stream, results into growth of bacteria and reduces the dissolved oxygen, which is then recovered by atmosphere. This process is called Self purification.
- When industrial wastes enter into the water bodies, self purification process gets disturbed.

## ⑥ Gasous Emissions:-

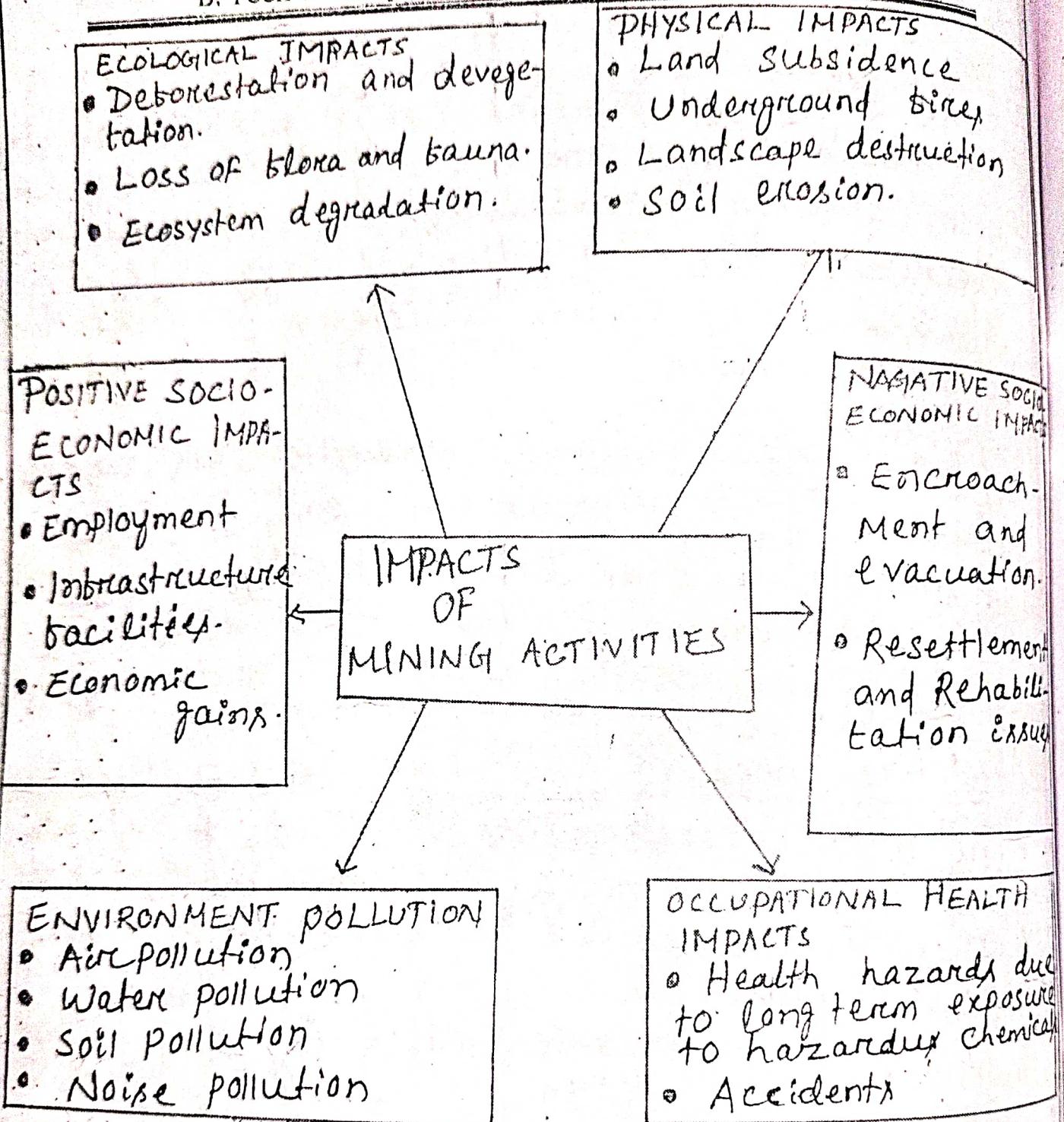
- Due to large amount of industrial coal burning, toxic gases like  $\text{CO}_2$ ,  $\text{CH}_4$ ,  $\text{N}_2\text{O}$ , CFCs are increasing in the lower atmosphere.
- The emission of these green house gases results into global warming, whereas  $\text{SO}_2$  and  $\text{NO}_2$  emitted from industries cause acid rain and formation of smog.

## Control Measures of Industrial Waste:-

- Scientific techniques should be adopted for the reprocessing of the industrial wastes.
- Recycling practices should be made a must in the industrial plants.
- Reasonable funds should be provided for the construction of treatment plants for industrial effluents/wastes.
- Eco-friendly industrial plants should be taken into consideration.

## → EFFECTS OF MINING ON ENVIRONMENT:-

- Mining is done to extract minerals (fossil fuel) from deep deposits in soil by using sub-surface mining or from shallow deposits by surface mining.
- The sub-surface mining is more destructive, dangerous and expensive including risks of occupational hazards and accidents.
- Surface mining is of three types:
  - \* Open pit mining  
In which machines dig holes and remove the ore (Cu, Fe, Limestone, Marble, granite etc)
  - \* Dredging  
It is the process in which the ~~ore~~ & chained buckets and draglines are used which scrap up the minerals from under water mineral deposits.
  - \* Strip mining  
In which the ore is stripped off by using bulldozers, power shovels and stripping wheels (Phosphate rocks).



The major effects of mining operations on human being and plants are as follows:-

- i) Mining produce a large quantity of waste. Water dissolves these wastes to produce contaminated liquid that pollute soil, river and ground water.
- ii) Mining also leads to air pollution due to release of green house gases and other toxic gases. For example ( $\text{CH}_4$ ,  $\text{CO}_2$  etc.)
- iii) It leads deforestation including loss of flora and fauna.
- iv) Mining operation produce a lot of noise. The deafening sound of machinery and blasting creates lots of noise pollution, which are unbearable to local people and forest wild life.
- v) It leads to migration of tribal people from mining areas to other areas in search of land and food.
- vi) Mining results in lowering of ground water level.

## → EFFECTS OF TRANSPORTATION ON ENVIRONMENT:-

- In Modern era, private transport, commuting and relatively short distance travel is mainly by automobiles.

- The widespread use of automobiles has affected our environment in a substantial manner.

- Effects of Road transport on environment:-

- Emission of Carbon dioxide:-(CO<sub>2</sub>/CO)
  - i) Emission of Carbon dioxide (CO<sub>2</sub>) emit from automobiles. It reacts with haemoglobin of the blood and produce carboxy haemoglobin. This carboxy haemoglobin minimizes the O<sub>2</sub> carrying capacity of blood and produce headache, fatigue, unconsciousness and cardiovascular damage.

- ii) Nitrogen Oxides (NO<sub>2</sub>)

- At higher concentration it attacks the lungs and due reduce the O<sub>2</sub> carrying capacity of lungs (causes lung cancer and Asthma). It breaks down the air sacs in lungs.

- It also harms the plant lives by reducing plant growth, its productivity and its yield at a high rate.

- iii) Hydrocarbons:

If causes lung and skin cancer (carcinogenic)

• Effects of Sea transport :-

- It consists of ships and submarines etc.
- Sometimes due to storms and icebergs, accident takes place due to which oil spills into the oceans.
- This floating oil is absorbed and consumed by billions of tiny phytoplankton and other organisms and causes biological magnification.

• Effects of Air transport :-

- It is one of the fastest modes of transportation and pollution too.
- Airplanes, jet planes travel in troposphere release various pollutants such as  $\text{CO}$ ,  $\text{CO}_2$ , oxides of Nitrogen and oxides of Sulphur.
- Oxides of Nitrogen and oxides of Sulphur and disrupt the ozone layer by  $\text{SO}_2$  and  $\text{Cl}_2$ .
- Airplanes create supersonic booms which harm people physiologically and psychologically.

Control Measures

- a) Reduction of lead content in motor fuel.
- b) Improvement in processes of automobile technology.
- c) Improvement in traffic system and conditions of roads.

- d) restriction in the growth of Urban centers, industries and commercial centers.
- e) implementation of emission norms for new and in use vehicles.
- f) use of unadulterated fuel.
- g) improvement in fuel quality and usage of cleaner fuel etc.

### → Effect of Housing on environment:-

- With increasing population growth, there has been a global shift of population from rural to urban centres.
- Housing and infrastructure facilities is a major challenge in Urban areas, where space is limited.
- Production and usage of practically all types of building materials during construction and demolition produce some impact on environment.
- Extraction and processing of building material is associated with energy consumption and waste generation.
- Production and use of building materials have the following environmental impacts:

- i) Energy consumption and related impacts.
- ii) Physical degradation of environment and loss of top fertile soil.
- iii) Depletion of natural resources and biodiversity due to deforestation.
- iv) Gaseous emissions causing global warming and acid rains.
- v) Toxic emissions and health effects.
- vi) Occupational health hazards.

#### Energy consumption during building and construction:

- Energy is required for extraction of minerals such as iron ore, bauxite etc.
- Energy is also required for transportation, fabrication and installation during construction, refurbishment and demolition of buildings.
- The choice of ecofriendly materials are necessary which are as close to nature as possible and also nearer to the construction site, so that energy consumption for transportation, processing and framing is minimal.

#### Resource depletion and loss of biodiversity.

Timber is an ecofriendly building material but excess cutting of forests bore timber

Production should be based on a sustainable strategy of forest management.

- Timber production based on "selective cutting practice" ensuring replacement of cut trees by fresh plantations, can take care of Forest sustainability.

### Pollution aspects of building:-

- Several building materials continue to affect the indoor air quality. These used as solvents, finishes and cleansers for maintenance and protection of building materials can cause "sick building syndrome".
- Production of plastics is also associated with generation of the green house gas such as  $\text{CO}_2$ , volatile organic compounds (VOCs) and polyvinyl chloride (PVC) which are harmful because of creating health related problems.
- Manufacturing of metals from their ores has several environmental impacts. In recycling of metals harmful chemicals dioxins are produced which are carcinogenic in nature.

⇒ Environmental Impact Assessment :- (EIA)

- It is a formal study process, used to predict the environmental consequences of proposed major developmental projects.
- Such assessment may include those projects which can significantly alter the landscape and consequently disrupt and disturb the services and inhabitant of the place.
- It also involves manufacturing, handling and use of hazardous materials and those projects which are to be settled down nearby urban centers, near ecologically sensitive areas, hill resorts and nearby scientific and cultural heritage area.

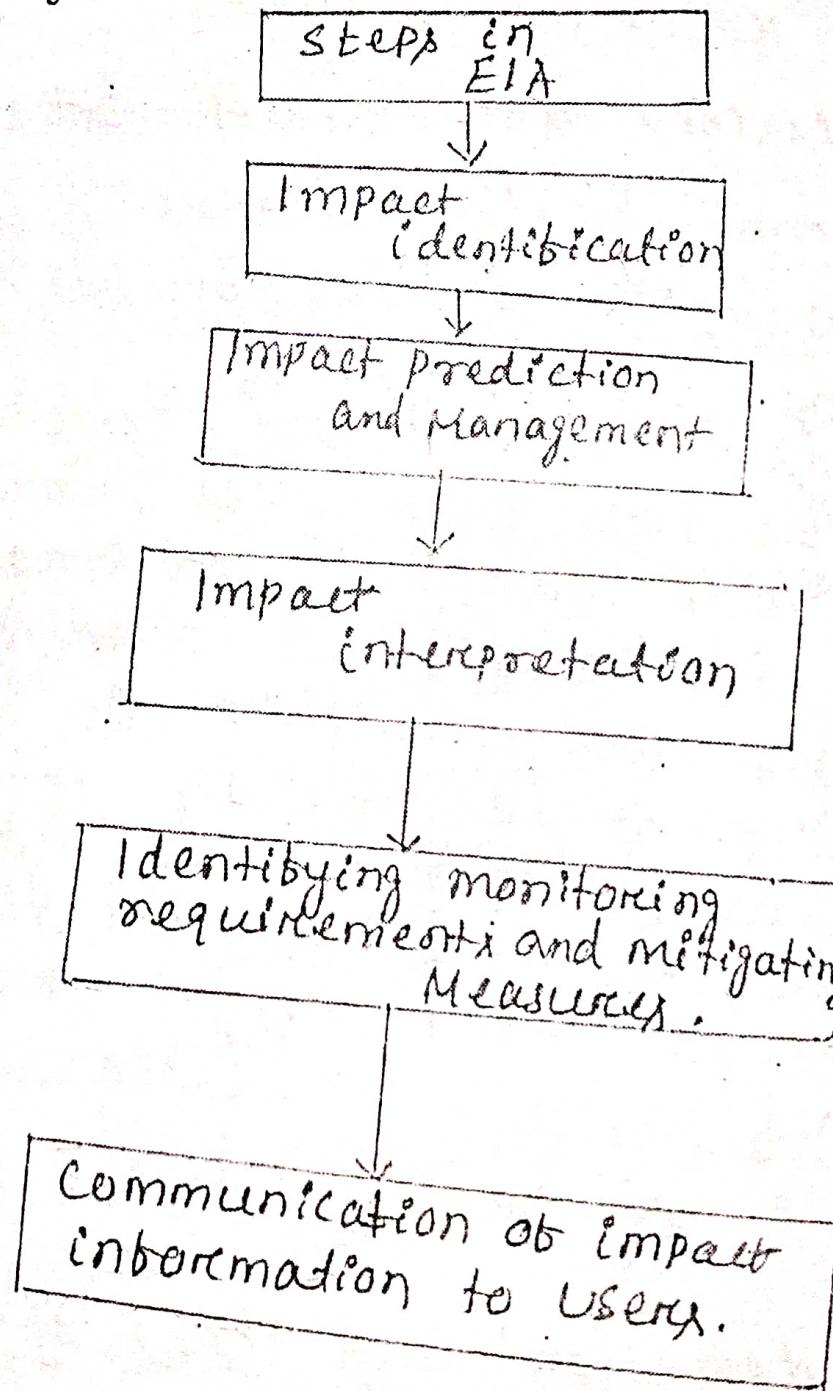
Some of the projects are as follows:-

- i) Establishment of cement industry
- ii) Petroleum industry
- iii) Hazardous waste treatment Plant.
- iv) Nuclear power plant.
- v) Distilleries
- vi) Heavy water projects

- EIA analyses the project thoroughly so that the project may not be harmful to the people, their homeland and their nearby surrounding areas.
- EIA tries to face the problems and tries to mini-

mize it by making a pre design.

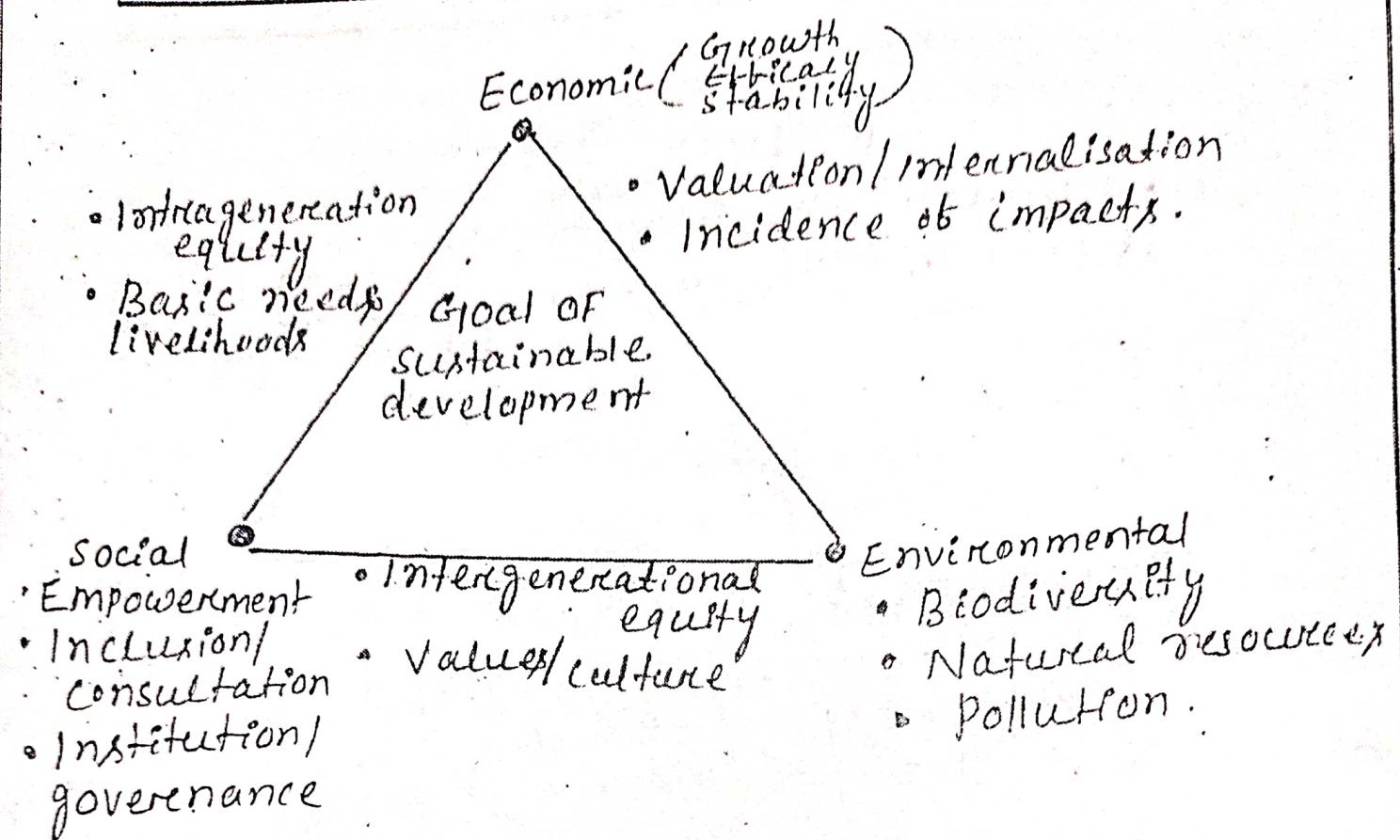
- To achieve the aim of EIA, the statements sent and being communicated to all the groups of:
  - i) The project developer and their investors,
  - ii) The regulators, planners and politicians.



- The project planners and engineer first of all used to read the conclusion of an EIA and then make decision about the project by taking in consideration about the benefits of the project and avoiding the problems.
- The project gets its credit and recognition, without causing serious problem to environment and is likely to be completed on time and within the budget decided to it.
- The project developers, their management planners and politicians make a decision after taking the conclusion by the members of EIA team. The project should not harm the existing ecology and should be beneficial to local people) and gave permission to the owners after having undertaking.

### ⇒ Sustainable development:-

- Sustainable development is the development that meets the needs of the present without compromising the ability of the future generations to meet their own needs.
- It is the extending progress without exhausting resources.
- Important aspects of sustainable development
  - i) Environment
  - ii) Society
  - iii) Economy.

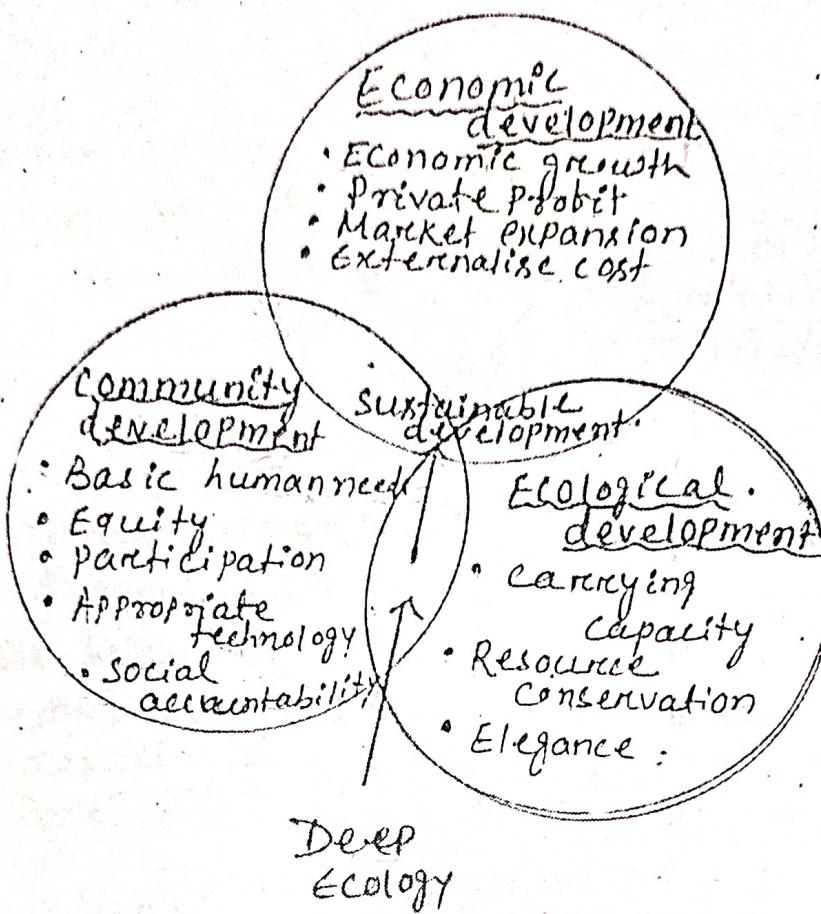


### Objectives of sustainable development:-

- To promote equity.
- To improve the quality of life.
- Sustainable use of natural resources
- Protecting the ecosystem
- To fulfill international standard.
- Long term planning and implementation
- Zero pollutant emissions from the industrial process.

### Factors affecting Sustainable development.

- Excessive exploitation/use of non renewable resources.
- Increasing population growth and population density.



- ④ Pollution
- ④ Deterioration of land.
- ④ Uncontrolled consumption of energy and environmental resources etc. are the major factors affecting sustainable development.