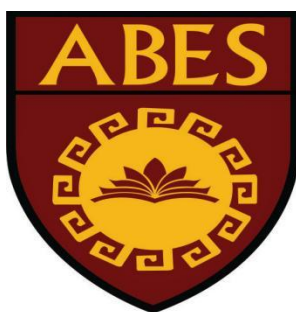


ABES ENGINEERING COLLEGE, GHAZIABAD

DEPARTMENT OF APPLIED SCIENCES & HUMANITIES



Estd.2000

**ENVIRONMENT and ECOLOGY
BAS104/204**

UNITWISE QUESTION BANK/HANDOUTS/NOTES

SYALLABUS

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

Unit-1

8

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 such as Food, Shelter, Housing, Agriculture, Industry, Mining, Transportation, Economic and Social security on Environment, Environmental Impact Assessment, Sustainable Development.

Unit-2

8

Natural Resources: Introduction, Classification. Water Resources; Availability, sources and Quality Aspects, Water Borne and Water Induced Diseases, Fluoride and Arsenic Problems in Drinking Water. Mineral Resources; Material Cycles; Carbon, Nitrogen and Sulfur cycles. Energy Resources; Conventional and Non conventional Sources of Energy. Forest Resources; Availability, Depletion of Forests, Environment impact of forest depletion on society.

Unit-3

8

Pollution and their Effects; Public Health Aspects of Environmental; Water Pollution, Air Pollution, Soil Pollution, Noise Pollution, Solid waste management.

Unit-4

8

Current Environmental Issues of Importance; 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
CO1: Gain in-depth knowledge on natural processes that sustain life, and govern economy.	K2
CO2: Estimate and Predict the consequences of human actions on the web of life, global economy and quality of human life.	K3
CO3: Develop critical thinking for shaping strategies (scientific, social, economic and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.	K4
CO4: Acquire values and attitudes towards understanding complex environmentaleconomic social challenges, and participate actively in solving current environmental problems and preventing the future ones.	K3
CO5: Adopt sustainability as a practice in life, society and industry.	K3

Reference Books:

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

UNIT-1: Environment & Ecosystem

- 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 such as Food, Shelter, Housing, Agriculture, Industry, Mining, Transportation, Economic and Social security on Environment
- Environmental Impact Assessment
- Sustainable Development.

Handout

- Environment is the sum total of the surroundings and conditions within which a living organism exists.
- There are two types of Environment: Natural / Global Environment & Anthropogenic / Manmade.
- The components of Environment are classified as Biotic Components & Abiotic Components.
- Segments of Environment:
 1. Atmosphere :blanket of gases surrounding the earth
 2. Hydrosphere: composed of various water bodies on the earth. It includes the oceans,lakes, rivers, etc.
 3. Lithosphere : contains various types of soils and rocks on earth
 4. Biosphere: composed of all living organisms and their interactions with rest of the environment, viz. atmosphere, lithosphere, and hydrosphere.
- Structure of the Atmosphere (Miller's Profile)
 1. Troposphere: The upper boundary known as the tropopause 70 % of the atmosphere's mass height from 10 -17 km above the equator & the temp is 15 to -54.5°C.
 2. Stratosphere: The upper boundary known as the stratopause extends from the tropopause to about 50 km. The average temperature ranges from -54.5 to -2°C.
 3. Mesosphere: The upper boundary known as the mesopause the height reaches upto 80 to 85 km the mesopause and the average temperature ranges from -2 to -92 °C
 4. Thermosphere: The layer is also called ionosphere extends upto 500- 700 km the temperature is maximum, about 1200°.
 5. Exosphere: The uppermost layer of the atmosphere extends up to a height of about 1600 km
- Multidisciplinary nature of environmental studies states that the science of Environment studies comprises various branches of studies like chemistry, physics, life science, medical science, agriculture, public health, sanitary engineering, geography, geology, atmospheric science, etc.
- The objectives of environmental studies (According to UNESCO (1971),are-
 1. Creating the awareness about environmental problems among people.
 2. Imparting basic knowledge about the environment and its allied problems.
 3. Developing an attitude of concern for the environment.
 4. Motivating public to participate in environment protection and environmental improvements.
 5. Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
 6. Striving to attain harmony with Nature.
- PESTEL Analysis of environment includes six segments of the general environment which are Political, Economic, Social, Technological, Environmental and Legal.
- Ecology is the study of the relationships between living organisms including humans, and their physical environment. There are two types of Ecology: Autecology & Synecology.
- An ecosystem is a community of living organisms (plants, animals and microbes) in conjunction with the nonliving components of their environment (things like air, water and mineral soil), interacting as a system.
- The abiotic components include physical, chemical, edaphic factors etc. The biotic component

- Aquatic ecosystem and terrestrial ecosystem could be further categorized
- A food chain refers to the order of events in an ecosystem, where one living organism eats another organism, and later that organism is consumed by another larger organism.
- The important types of food chains are grazing food chain & detritus food chain.
- In the predator food chain, one animal captures and devours another animal. The parasitic chain is formed within the grazing food chain as the parasites derive the energy of plants and animals.
- A network of food chains which are interconnected at various trophic levels, so as to form a number of feeding connections amongst different organisms of a biotic community is called food web.
- The energy flow in the ecosystem is important to maintain an ecological balance. A part of the energy is stored within the plants. This stored energy is transferred to the primary consumers when they feed on the producers. This energy is further passed on to the secondary consumers when they feed on the primary consumers, and so on.
- Ecological Pyramids is a graphical representation showing the relationship between different organisms in an ecosystem. The ecological pyramid is of three types: the pyramid of the number, pyramid of biomass, pyramid of energy.
- A balanced ecosystem is the community of living (biotic) organisms interacting with non-living (abiotic) features in the environment. Ecological balance ensures the stability of the organisms and environment. It enhances a stable environment that is free from ecological imbalances such as flood, hunger caused by drought, windstorms that may wipe out everything, and over hunting of the predators.
- The human activities leading to adverse impacts on the environment are Housing, Agriculture, Industry, Mining, Transportation
- Mining can cause erosion, sinkholes, loss of biodiversity, or the contamination of soil, groundwater, and surface water by chemicals emitted from mining processes. These processes also affect the atmosphere through carbon emissions which contribute to climate change.
- The growth of speedy transportation is man's greatest achievement in minimizing distances but at the same time it has also become a cause of environmental degradation like Air Pollution, Noise Pollution, Land Consumption and Landscape Damage, Ecological Degradation
- Poor housing is associated with a wide range of health conditions such as respiratory diseases including asthma, cardiovascular diseases, injuries, mental health and infectious diseases including tuberculosis, influenza and diarrhea.
- Industrialization contributes major part for the economic development and prosperity of a country. On one hand it provides employment opportunities and wealth generation while on the other hand it leads to following environmental deterioration.
- Agriculture has positive as well as negative impacts on environment. Positive impacts are that it provides food security, enhances rainfall and greenery, employment opportunities & supports ecology. Negative impacts of agriculture lead to pollution, deforestation, contamination of food, destruction of natural flora and fauna, decrease in groundwater, destruction of natural species, eutrophication, bio-magnification etc.
- EIA is designed to identify the potential risks of a project (e.g., infrastructure development such as a dam) to environment and human well-being and identify measures to eliminate and/or mitigate these risks.

- The steps are screening, scoping, Impact assessment & Mitigation, Impact Management, The EIA Report, review & Management & Monitoring.
- Sustainable development can be defined as an approach to the economic development of a country without compromising with the quality of the environment for future generations.
- The pillars of sustainable development are :
 1. Environmental Pillar: The environmental pillar emphasizes the need to protect and preserve the natural environment, including ecosystems, biodiversity, air, water, and land resources.
 2. Economic Pillar: The economic pillar focuses on fostering economic growth and development that is both inclusive and environmentally sustainable.
 3. Social Pillar: The social pillar addresses the need for social equity, justice, and inclusivity in development.
 4. Institutional Pillar: It is related to good governance e.g., policies etc.
- “Social security is the protection which society provides for its members through a series of public measures, against the economic and social distress that otherwise would be caused by the substantial stoppage of earning resulting from :- sickness, maternity injury, unemployment, old age and death.
- Economic security is the ability of individuals, households or communities to cover their essential needs sustainably and with dignity.
- Food security has the following dimensions:
 1. availability of food means food production within the country, food imports and the previous year's stock stored in government granaries.
 2. accessibility means food is within reach of every person.
 3. affordability implies that an individual has enough money to buy sufficient, safe and nutritious food to meet one's dietary needs.
- A balanced diet is one that contains all of the essential elements that the human body needs. Carbohydrates, lipids, vitamins, minerals, proteins, fiber and water are all essential components in a well-balanced diet.
- Shelter is a basic need of life not only for humans but also for animals. Shelter provides security from harsh environment conditions and also from dangerous animals.
- Bio-magnification stands for Biological Magnification, which refers to the growth of harmful compounds in food chains.
- Bio-magnification affects human health, reproduction and development of marine creatures and it destroys the coral reefs.

UNIT -01

ENVIRONMENT

The French word 'ENVIRON' means encircle/surround. Environment is the sum total of the surroundings and conditions within which a living organism exists. Land, water, air, plants and other living organisms constitute the environment.

Types of Environment

1. Natural / Global Environment without interference of human beings / widely distributed. The natural environment consists of land-based ecosystems such as grasslands and forests, aquatic ecosystems such as rivers and wetlands, and coastal and marine ecosystems such as mangroves and sea-grassy meadows.

2. Anthropogenic / Manmade: The term "anthropogenic environment" suggests, in its etymology, an environment that is created by humans.

Components & Segments of Environment: The components are

Biotic Component: are living things within an ecosystem; such as plants, animals, and micro-organisms.

Abiotic Component: are non-living components; such as water, soil and atmosphere.

Segments of Environment- It includes

- (i) **Atmosphere :** blanket of gases surrounding the earth
- (ii) **Hydrosphere:** composed of various water bodies on the earth. It includes the oceans, lakes, rivers, etc.
- (iii) **Lithosphere :** contains various types of soils and rocks on earth
- (iv) **Biosphere:** composed of all living organisms and their interactions with rest of the environment, viz. atmosphere, lithosphere, and hydrosphere

Atmosphere

Atmosphere is the protective thick gaseous mantle, surrounding the earth which sustains life on earth and saves it from unfriendly environment of outer space.

Characteristic Features

1. Atmos meaning, an envelope of gases include nitrogen, oxygen, argon, carbon dioxide, traces of carbon monoxide, oxides of nitrogen, sulphur and hydrocarbon, and very little amount of water vapour.
2. It is mobile, elastic, compressible and expandable as made up of gases.
3. The atmosphere protects the earth's biosphere by absorbing a major portion of the electromagnetic radiation and most of the cosmic rays. The atmosphere also absorbs infra-red radiation and thereby maintains the temperature of the earth at life sustaining levels.

Structure of the Atmosphere (Miller's Profile)

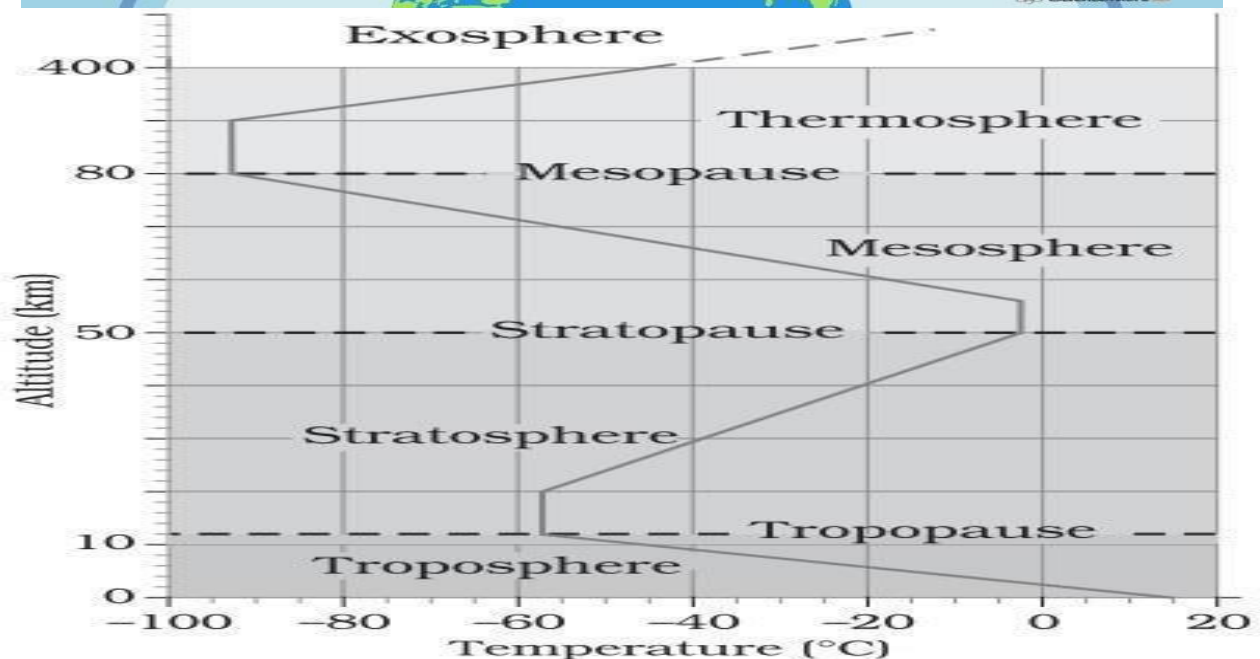
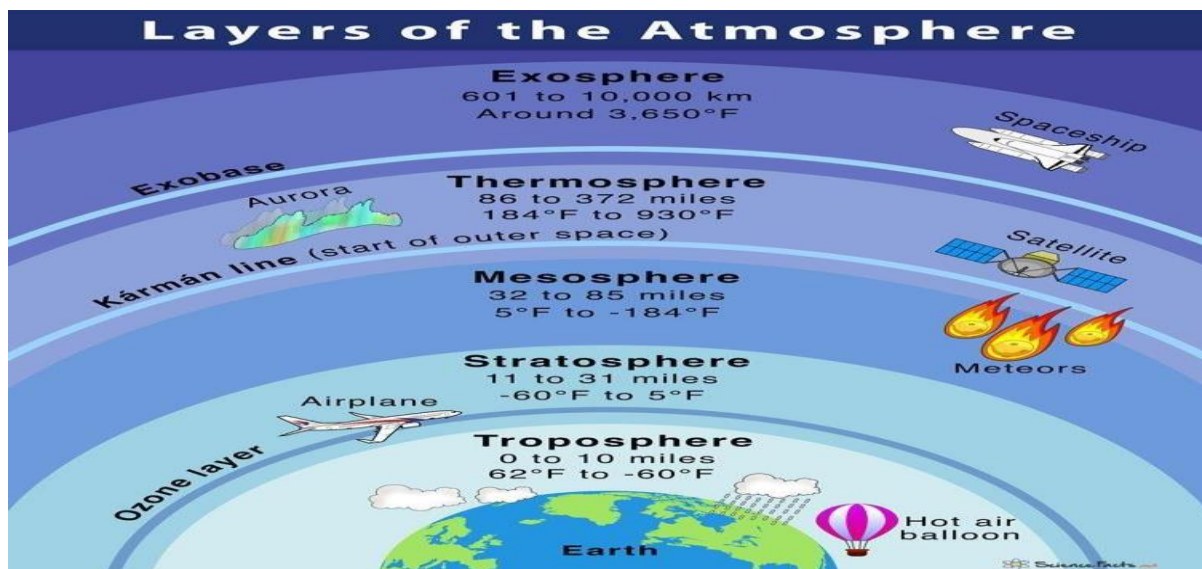
Troposphere: The upper boundary known as the tropopause 70 % of the atmosphere's mass height from 10 -17 km above the equator at the tropopause the temp is 15 to -54.5°C.

Stratosphere: The upper boundary known as the stratopause extends from the tropopause to about 50 km the top of the stratosphere may be near freezing the O₃ molecule, present here, absorbs UV rays shields life on earth from the effects of UV rays. The average temperature ranges from -54.5 to -2°C.

Mesosphere: The upper boundary known as the mesopause the height reaches upto 80 to 85 km the mesopause is the coldest place and the average temperature ranges from -2 to -92 °C

Thermosphere: The layer is also called ionosphere extends upto 500- 700 km the temperature is maximum, about 1200°C atmospheric gases such as O₂ and nitric oxide split into atoms and then undergo ionization

Exosphere: The uppermost layer of the atmosphere extends up to a height of about 1600 km gives way to interplanetary space



Hydrosphere- The hydrosphere is the combined mass of water found on, under, and above the surface of the earth. Water moves through the hydrosphere in a cycle. Water collects in clouds, then falls to Earth in the form of rain or snow. This water collects in rivers, lakes and oceans. Then it evaporates into the atmosphere to start the cycle all over again. This is called the water cycle or hydrological cycle.

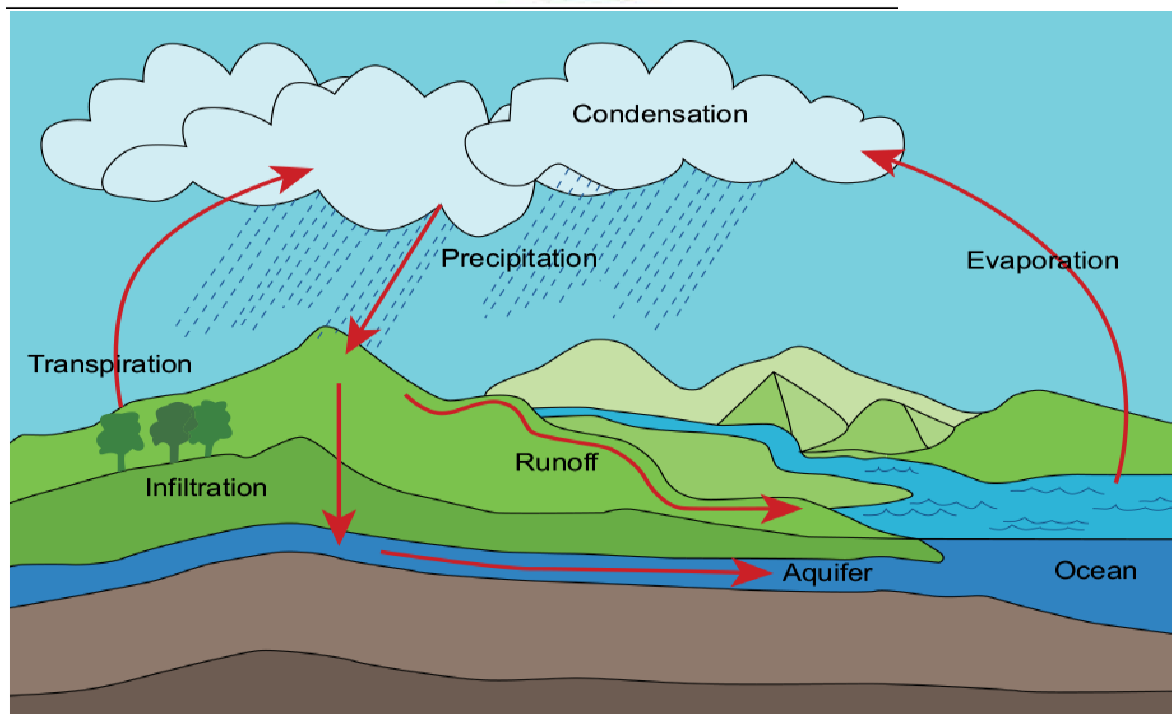
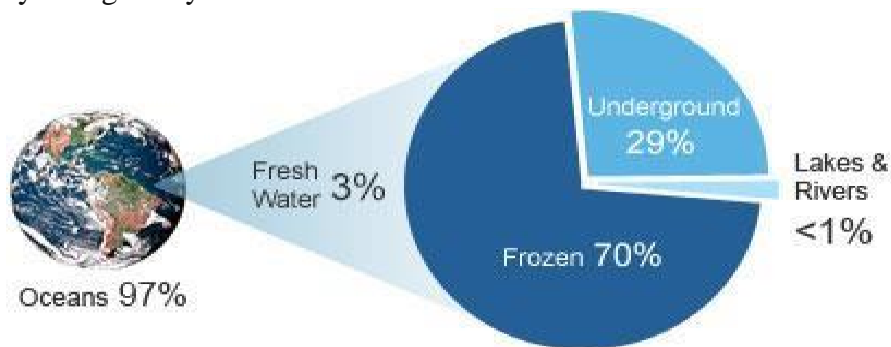
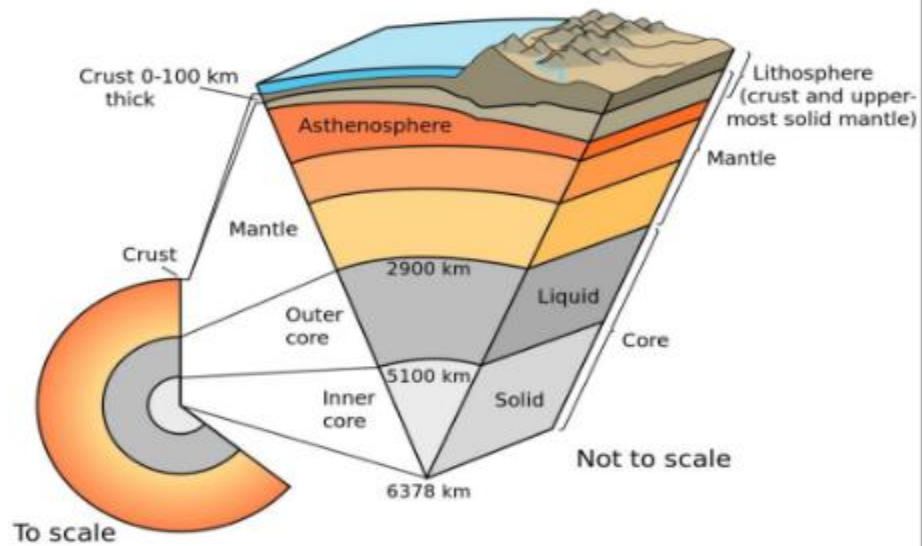
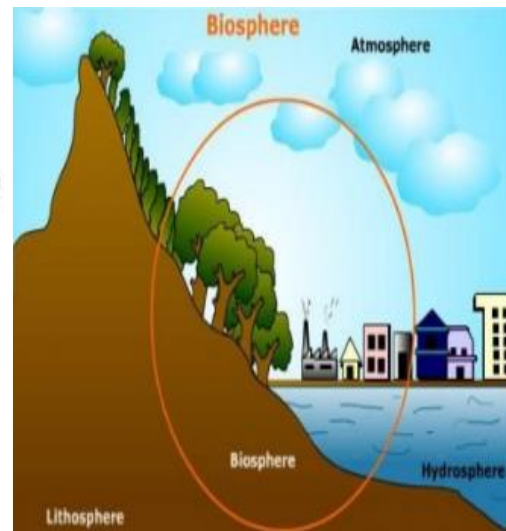
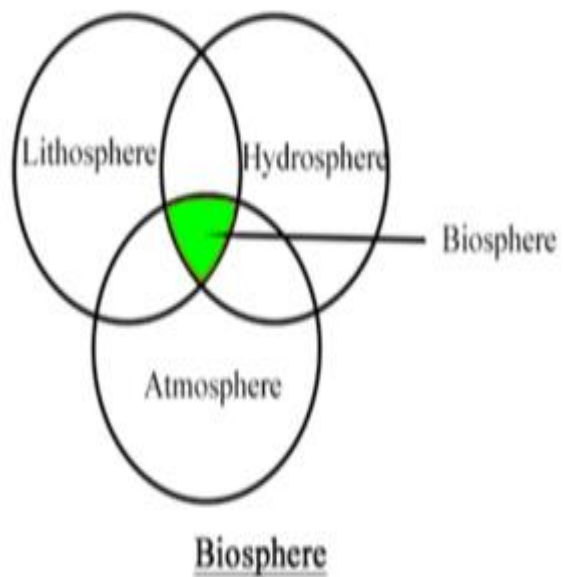


Fig. Water Cycle

Lithosphere: The lithosphere is the solid, outer part of Earth. The lithosphere includes the brittle upper portion of the mantle and the crust, the outermost layers of Earth's structure. It is bounded by the atmosphere above and the asthenosphere (another part of the upper mantle) below. There are two types of lithosphere: **oceanic lithosphere** and **continental lithosphere**. Oceanic lithosphere is associated with oceanic crust, and is slightly denser than continental lithosphere. The most well-known feature associated with Earth's lithosphere is tectonic activity. Tectonic activity describes the interaction of the huge slabs of lithosphere called **tectonic plates**.

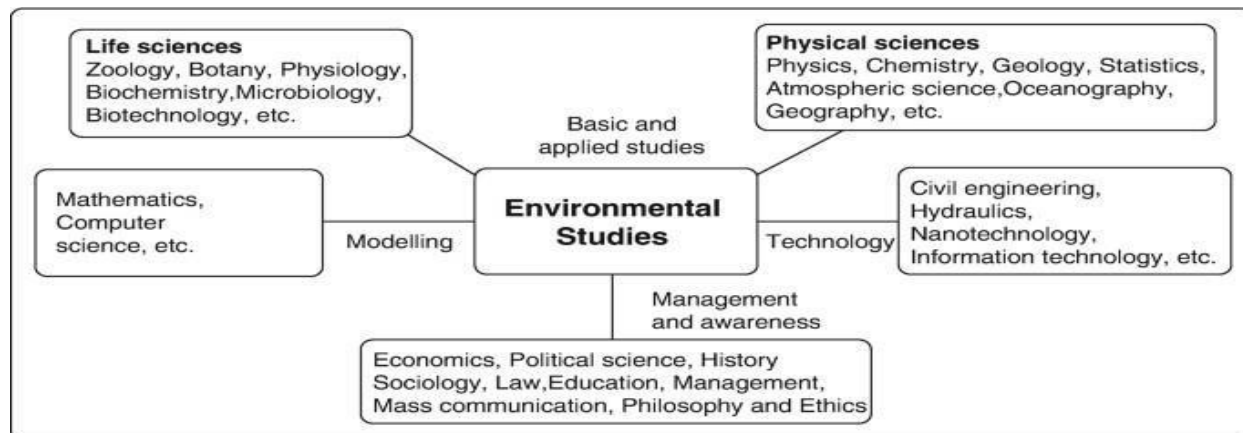


Biosphere: The biosphere is a narrow zone on the surface of the earth where soil, water, and air combine to sustain life.



MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

An environment study is a multidisciplinary subject where different aspects are dealt with in a holistic approach. The science of Environment studies comprises various branches of studies like chemistry, physics, life science, medical science, agriculture, public health, sanitary engineering, geography, geology, atmospheric science, etc. We need inputs from diverse disciplines such as biology, botany, zoology, soil science, technology oceanography, atmospheric science, economics, sociology, anthropology and ethics. Environmental studies involve educating the people for preserving the quality of environment



Objectives and Guiding Principles of Environmental Studies

According to UNESCO (1971), the objectives of environmental studies are-

- (a) Creating the awareness about environmental problems among people.
- (b) Imparting basic knowledge about the environment and its allied problems.
- (c) Developing an attitude of concern for the environment.
- (d) Motivating public to participate in environment protection and environmental improvements.
- (e) Acquiring skills to help the concerned individuals in identifying and solving environmental problems.
- (f) Striving to attain harmony with Nature.

PESTEL Analysis- Environment: It includes six segments of the general environment which are Political, Economic, Social, Technological, Environmental and Legal

Scope of Environmental Studies

- (i) Conservation of natural resources
- (ii) Ecological aspects
- (iii) Pollution of the surrounding natural resources
- (iv) Controlling the pollution
- (v) Social issues connected to it
- (vi) Impacts of human population/activities on the environment

Importance of Environment: It can be understood as

Atmosphere- Contains Lifesaving gases- Oxygen, Carbon Dioxide, Nitrogen.

Hydrosphere- Provides water for Domestic, Industrial and Agricultural uses.

Lithosphere- Helps in establishment of organisms. Provides mechanical support to grow.

Biosphere- Our entire life support system is dependent on the well-being of all of the species living on earth. This association is visible in food chains, food web and ecological pyramids.

Ecology and Ecosystem

‘**Ecology**’ first proposed by the German biologist Ernst Haeckel. Ecology is the study of the relationships between living organisms including humans, and their physical environment.

There are two types of Ecology: Autecology & Synecology.

Autecology is the study of the interaction between individual species with their environment while Synecology is the study of interactions among two or more species or a population with their environment.

Ecosystem term is coined by A.G. Tansley in 1935.

An ecosystem is a community of living organisms (plants, animals and microbes) in conjunction with the nonliving components of their environment (things like air, water and mineral soil), interacting as a system. The abiotic components include physical, chemical, edaphic factors etc. The biotic component comprise of

1. Producers

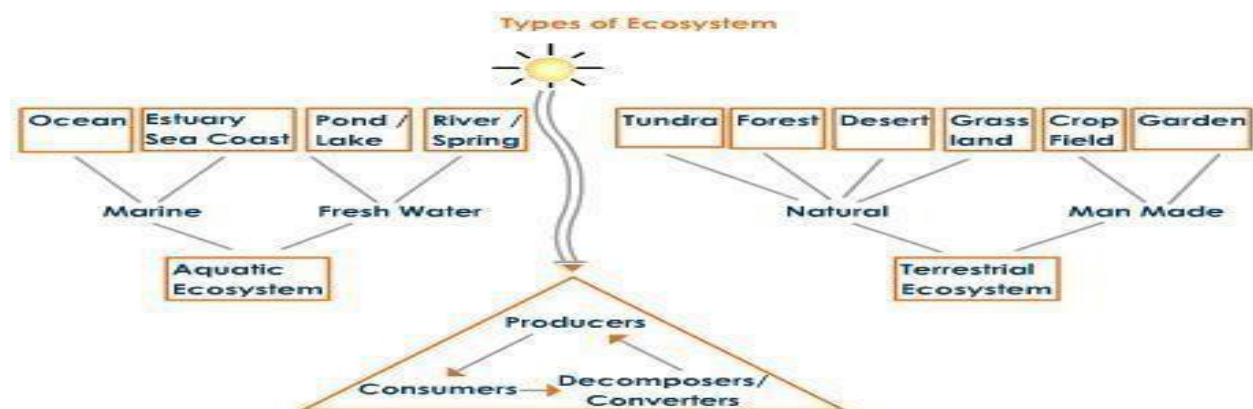
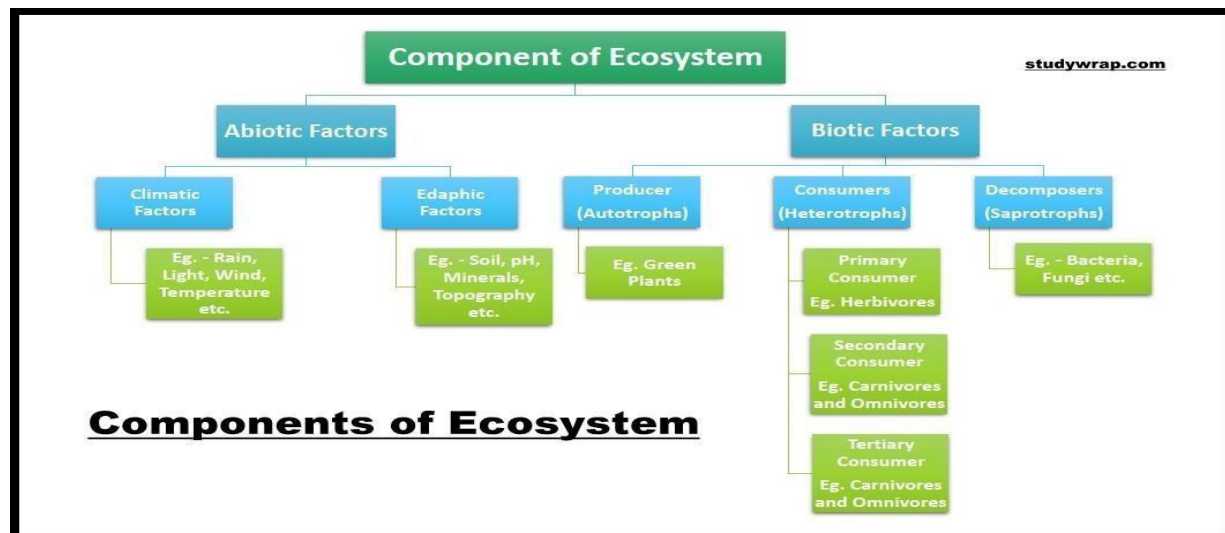
1. These are autotrophic organisms that can synthesize their food by using inorganic molecules like water and carbon dioxide.
2. Thus, they do not depend on other organisms for their food.
3. Green plants and blue-green algae are major producers in an ecosystem that perform photosynthesis to form their food.
4. Producers are the **suppliers of energy** in an ecosystem. They act as food for primary consumers.

2. Consumers

1. These are the heterotrophic organisms that cannot synthesize their food.
2. They depend on other organisms to fulfilling their food needs.
3. These are categorized into primary consumers, secondary consumers, tertiary consumers etc or herbivores, carnivores, and omnivores based on their position in the food chain.
4. Consumers help in the **circulation of energy** in an ecosystem.

3. Decomposers

These are the small microscopic organisms (saprotrophic organisms) like fungi and bacteria that perform the function of decomposition.



Types of Ecosystem

Forest Ecosystem: The Earth's Giant Ecosystem

Forest Ecosystem 30% of area should be covered with forest. At present it is only 8-10%. Abiotic Components- Light conditions may vary due to complex stratification in plants. Minerals are abundant. Organic matter adds to the soil from debris and litter accumulation. Biotic Components- Producers- Much species diversity mainly trees or shrubs. *Shorea robusta*, *Tectona grandis*, *Thuja*, *Juniperous* Consumers- Primary- Ants, Flies, Bugs, Spiders (on leaves): Elephant, Deer, Squirrel (leaves, Fruits) Secondary- Snakes, Birds, Lizards, Wolf Tertiary- Lion, Tiger Decomposer- Fungi- *Aspergillus*, *Ganoderma*, *Fusrium* Bacteria- *Bacillus*, *Clostridium* Actinomycetes- *Streptomyces*

Desert Ecosystem

17% of total land area is desert. Extremely low rainfall, dry condition so vegetation is scarce.

Abiotic Components- Temperature very high, low rainfall. Nutrient recycling is poor due to scanty biota.

Biotic Components-

Producers- Grassy shrubs and few thorny trees. *Cactus*, Lichen, Mosses.

Consumers- Insects, Reptiles, Birds, Camel. **Decomposer-** very few Fungi, Bacteria.

Lentic (Pond/Lake Ecosystem)

Abiotic Components- Chemicals especially in dissolved state. Climate is suitable.

Biotic Components- Producers- Phytoplanktons- Ulothrix, Spirogyra, Volvox, Anabaena
Macrophytes- Hydrilla, Utricularis, Azolla, Lemna.

Consumers- Primary- Zooplanktons, Annelids, Molluscs. Secondary- Insects, Fishes
Tertiary- Large Fishes

Decomposers- Fungi, Bacteria, Actinomycetes

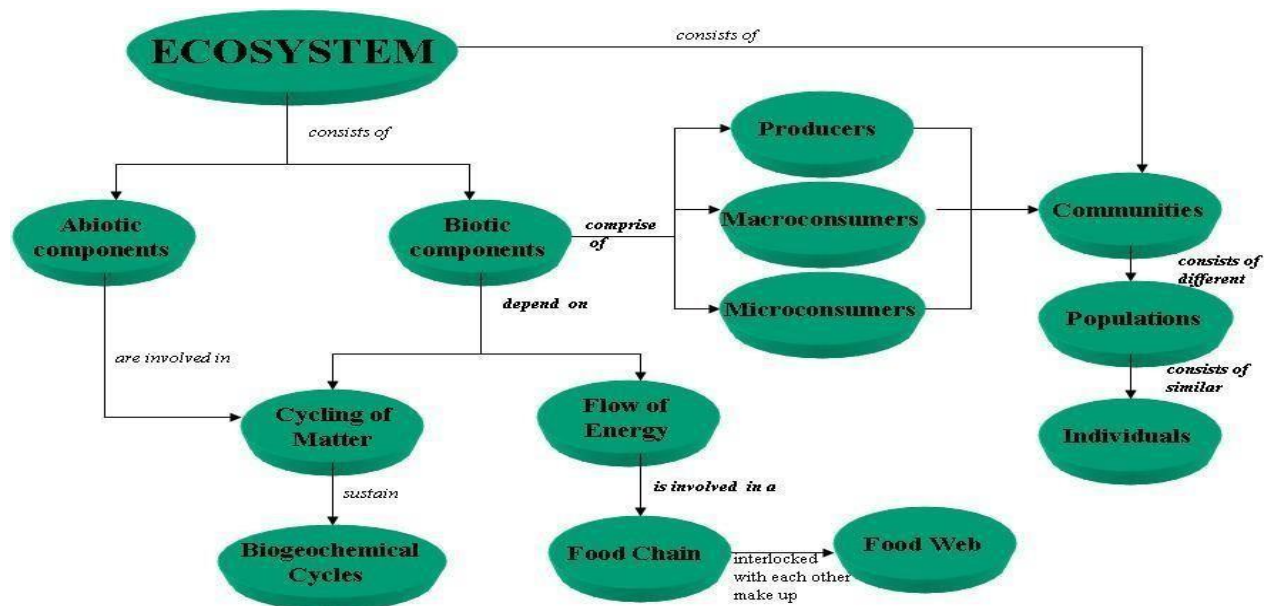
Estuary Ecosystem-

Abiotic Components- Combination of fresh and marine ecosystem (brackish water ecosystem). Most productive ecosystem.

Biotic Components- **Producers-** Sea grasses, Sea Weeds, Phytoplanktons, Algae

Consumers- Oysters, Crabs, Fishes. **Decomposer-** Fungi, Bacteria, Actinomycetes

Structure of an Ecosystem



Food Chains: A food chain refers to the order of events in an ecosystem, where one living organism eats another organism, and later that organism is consumed by another larger organism. The flow of nutrients and energy from one organism to another at different trophic levels forms a food chain.

The food chain also explains the feeding pattern or relationship between living organisms. Trophic level refers to the sequential stages in a food chain, starting with producers at the bottom, followed by primary, secondary and tertiary consumers. Every level in a food chain is known as a trophic level.

The important types of Food chains-

1. **Grazing food chain:** The grazing food chain is a type of food chain that starts with green plants, passes through herbivores and then to carnivores. In a grazing food chain, energy in the lowest trophic level is acquired from photosynthesis.

Terrestrial: Grasses → Grasshopper → Frog → Snake → Hawk

Aquatic : Phytoplanktons → Zooplanktons → Fish → Crane → Hawk

2. **Detritus food chain:** The detritus food chain includes different species of organisms and plants like algae, bacteria, fungi, protozoa, mites, insects, worms and so on. The detritus food chain begins with dead organic material. The food energy passes into decomposers and detritivores, which are further eaten by smaller organisms like carnivores. Carnivores, like maggots, become a meal for bigger carnivores like frogs, snakes and so on. Primary consumers like fungi, bacteria, protozoans, and so on are detritivores which feed on detritus.

Detritus → Microorganisms → Crabs and Shrimps → Small Fishes → Large Fishes

Types of grazing food chain

- Predator food chain
- Parasitic food chain

Predator food chain

In the predator food chain, one animal captures and devours another animal. In this food chain one animal kills and eat the other animal. The animal which kills other animals for food is called a predator. This act of hunting is called predation. Animals that are caught and eaten by a predator are called prey. Predators that only eat the meat of prey are carnivores.

Parasitic food chain

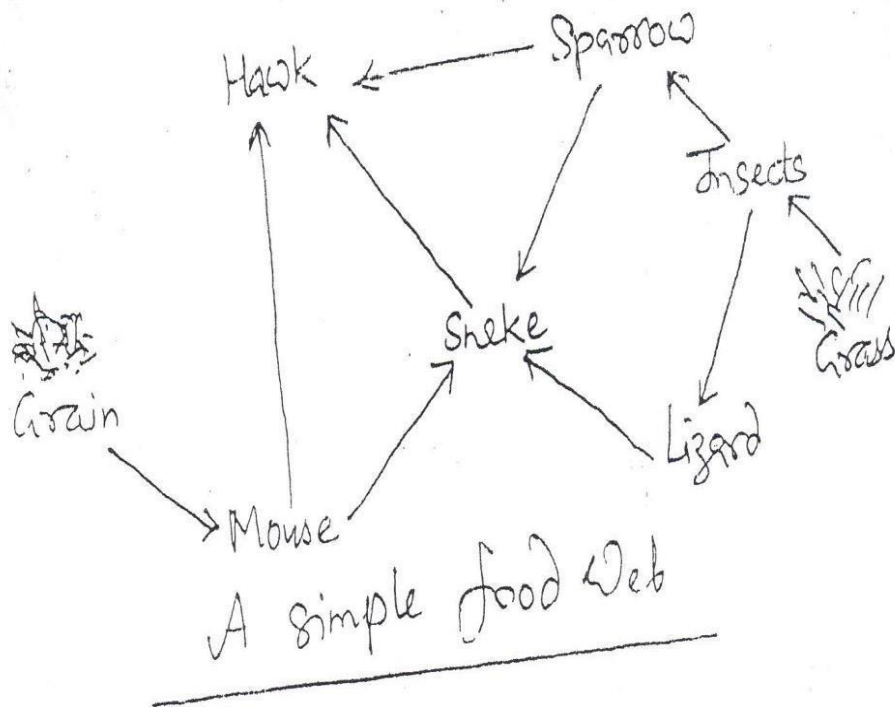
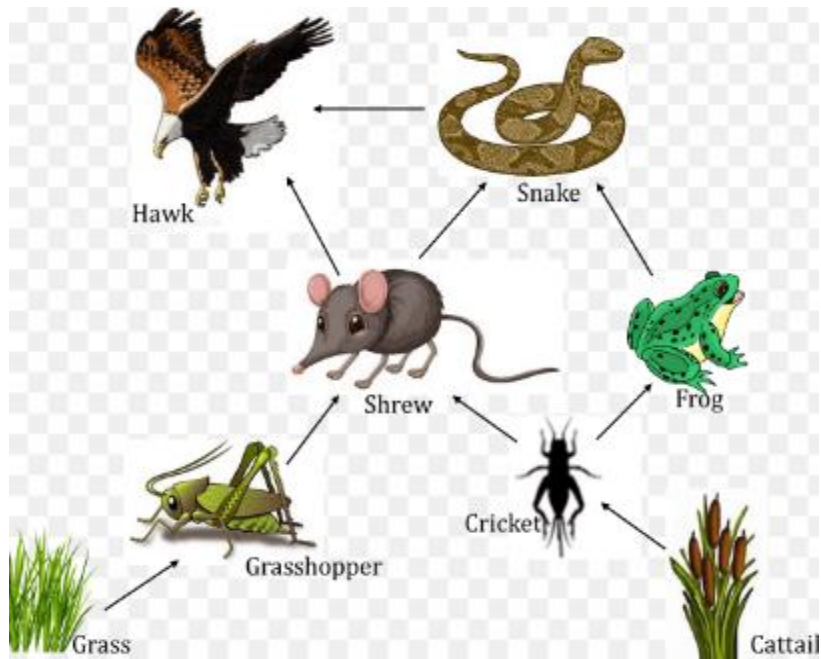
The plants and animals of the grazing food chain are affected by parasites. Parasites derive their energy from their hosts. Thus, the parasitic chain is formed with in the grazing food chain.

Tree → Birds → Insects/Mites → Microorganisms

Food Web:

A network of food chains which are interconnected at various trophic levels, so as to form a number of feeding connections amongst different organisms of a biotic community is called food web. Food webs are very important in maintaining the stability of an ecosystem. When one type of herbivores animal becomes extinct, the carnivore predating on this type may eat another type of herbivore.

The combination of all food chain in a given community or ecosystem is called food web. The interlocking of many food chains is called food web. Food web is non linear flow of energy. Food web is a set of interconnected food chains by which energy and materials circulate within an ecosystem. The food web is divided into two broad categories viz., the grazing web, which typically begins with green plants, algae, or photosynthesizing plankton and the detritus web, which begins with organic debris. These webs are made up of individual food chains. In a grazing web, materials typically pass from plants to plant eaters (herbivores) to flesh eaters (carnivores). In a detritus web, materials pass from plant and animal matter to bacteria and fungi (decomposers), then to detritus feeders (deprivers) and then to their predators (carnivores).



Energy Flow in an Ecosystem

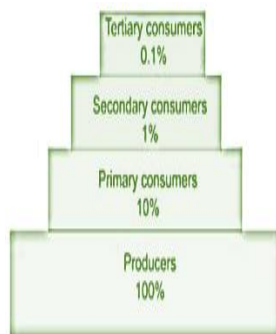
The energy flow in the ecosystem is important to maintain an ecological balance. The producers synthesize food by the process of photosynthesis. A part of the energy is stored within the plants. The remaining energy is utilized by the plants in their growth and development. This stored energy is transferred to the primary consumers when they feed on the producers. This energy is further passed on to the secondary consumers when they feed on the primary consumers, and so on.

The 10 percent law of energy flow states that when the energy is passed on from one trophic level to another, only 10 percent of the energy is passed on to the next trophic level.

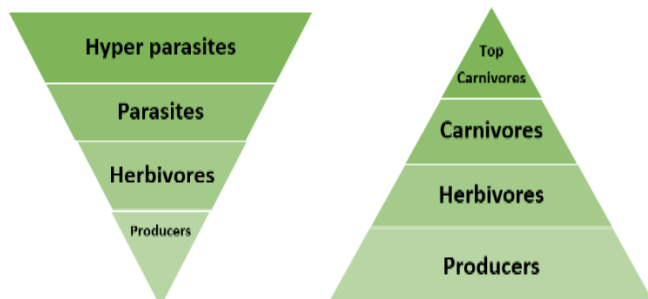
Ecological Pyramids: It is a graphical representation showing the relationship between different organisms in an ecosystem. It shows the flow of energy at different trophic levels in an ecosystem. An ecological pyramid is a graphical representation of the relationship between the different living organisms at different trophic levels. Charles Elton developed the concept of the pyramid of numbers. Mainly the ecological pyramid is of three types:

1. the pyramid of the number,
2. pyramid of biomass,
3. pyramid of energy

Pyramid of energy is always upright as the energy flow in food is always unidirectional. In the ecological pyramid of energy, 10% law is followed in which only 10% of energy from the organic matter is passed on the upper level of the ecosystem. The 10% law is given by Raymond Lineman.

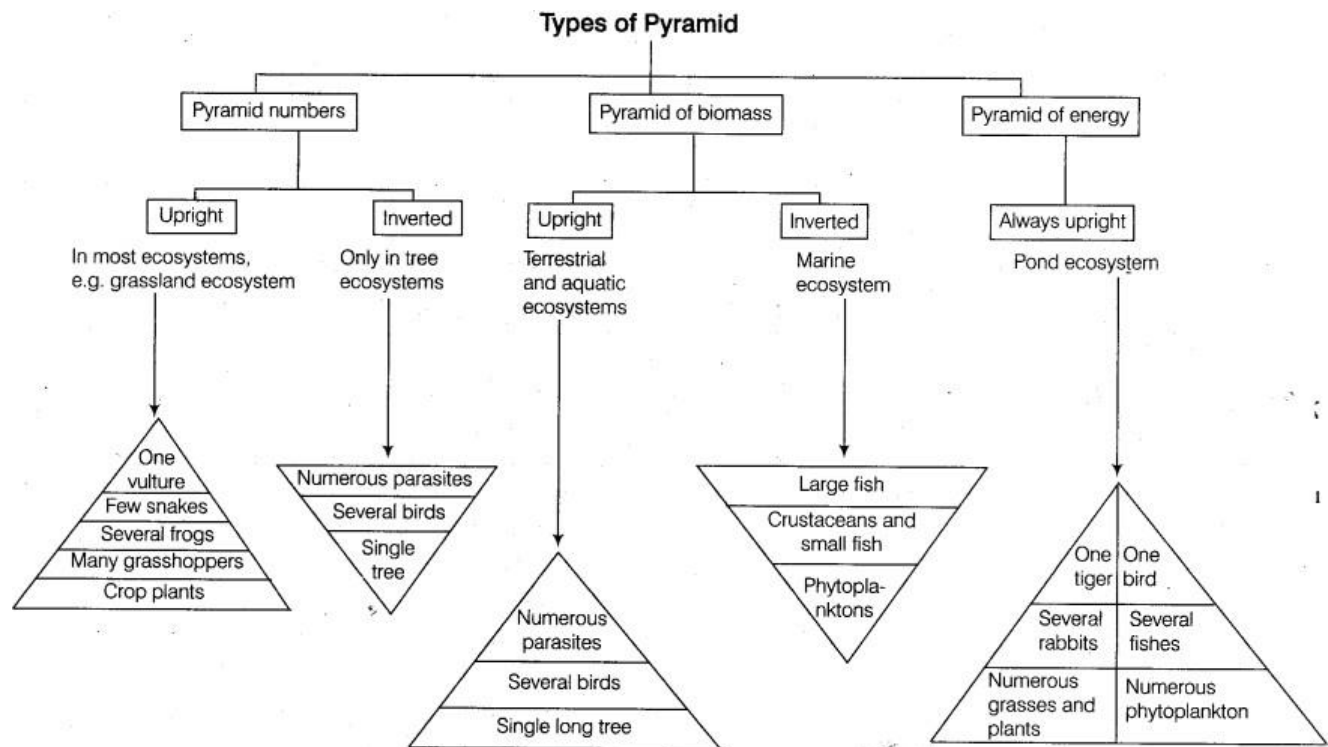
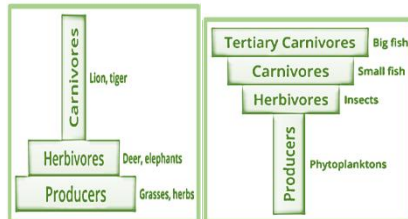


The pyramid of numbers can be both upstanding and inverted. The upright pyramid has the largest number of producers at the base level and the quantity/number of other organisms' step by step diminishes at a higher level. The pyramid of numbers in the parasitic food chain is constantly transformed and we get an inverted pyramid.



Pyramid of Biomass

The pyramid that demonstrates the total weight of every food layer in a specific food chain in an ecosystem is the **biomass pyramid**. This pyramid can be both upright/upstanding and inverted. In the forest ecosystem, the biomass of the producer is most elevated and the biomass of tertiary consumers is low. The pyramid of biomass might be reversed in the aquatic ecosystem.



Balanced or Ideal Ecosystem

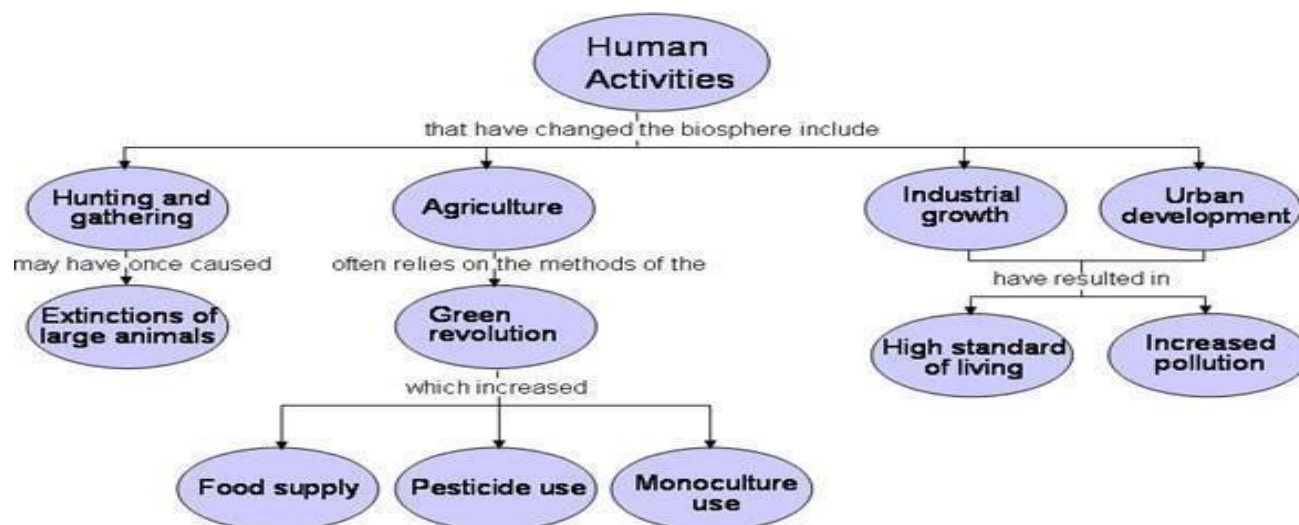
- In a balanced ecosystem, the community of living (biotic) organisms interacts with non-living (abiotic) features in the environment.
- Abiotic features of ecosystems include precipitation, temperature, landscape, sunlight, soil, water chemistry, and moisture.
- The types of biotic factors in a balanced ecosystem include primary producers such as plants, primary consumers such as herbivores, secondary consumers such as carnivores, consumers such as omnivores that consume both plants and animals, and detritivores that eat decaying organic matter.
- Biotic factors rely upon abiotic factors to survive.

- Plants require a certain temperature, moisture, and soil chemistry to thrive. Animals rely on those plants for their food.
- Anything affecting any factor of an ecosystem can throw it off balance and force organisms to adapt or die off.

Importance of Ecological Balance

- Ecological balance ensures the stability of the organisms and environment.
- It creates a conducive environment for organism multiplication and thriving.
- It enhances a stable environment that is free from ecological imbalances such as flood, hunger caused by drought, windstorms that may wipe out everything, and over hunting of the predators.

Effects of Human Activities on Environment



Effects of Human Activities such as Food, Shelter, Housing, Agriculture, Industry, Mining, Transportation, Economic and Social security.

SNo.	IMPACT	DETAILS
1.	Overpopulation and overconsumption	-Decrease in finite resources. -Increase in waste -Decrease Earth sustainable productivity
2.	Pollution	-Health problems -Death (humans/wildlife/plants) -Dead zones in oceans -Acid rain: ruin infrastructure and monuments, decrease crop yields, increase health problems, changes pH of water -Ocean acidification: creates carbonic acid. Prevents formation of shells

3.	Global warming and climate change	-Increase greenhouse effect, warms oceans, Melts glaciers and ice sheets. Glacial retreat. Decreased snow cover, Increased frequency of extreme events. Sea level rise.
4.	Agriculture and gene modification	-Point source pollution. Excessive use of water. stream modification, use of pesticides , clearance of forests, grazing, release of greenhouse gases -Unexpected outcomes of gene modification, Choke crops
5.	Deforestation and land degradation	-Loss in biodiversity -Wildlife damage human settlement -increased greenhouse effect -Decreased air filtering

Effects of Mining

Environmental effects of mining can occur at local, regional, and global scales through direct and indirect mining practices.

- Mining can cause erosion, sinkholes, loss of biodiversity, or the contamination of soil, groundwater, and surface water by chemicals emitted from mining processes. These processes also affect the atmosphere through carbon emissions which contributes to climate change.
- Some mining methods (lithium mining, phosphate mining, coal mining, mountaintop removal mining, and sand mining) may have such significant environmental and public health effects that mining companies in some countries are required to follow strict environmental and rehabilitation codes to ensure that the mined area returns to its original state.

Effects of Transportation

- The growth of speedy transportation is man's greatest achievement in minimizing distances but at the same time it has also become a cause of environmental degradation. Its direct impacts are:
 - Energy Consumption in Transport and Environmental Pollution
 - Air Pollution
 - Noise Pollution
 - Land Consumption and Landscape Damage
 - Ecological Degradation

Effects of Housing

The quality of housing has major implications for people's health. Poor housing is associated with a wide range of health conditions such as respiratory diseases including asthma, cardiovascular diseases, injuries, mental health and infectious diseases including tuberculosis, influenza and diarrhoea.

Housing is becoming increasingly important to public health due to demographic and climate changes, according to the latest WHO Housing and health guidelines.

Improved housing conditions can save lives, reduce disease, increase quality of life, reduce poverty, help mitigate climate change and contribute to the achievement of a number of Sustainable Development Goals, in particular those addressing Health (SDG 3) and Sustainable Cities (SDG 11). Housing is therefore a major entry point for inter-sectoral public health programmes and primary prevention.

Effect of Industries

Industrialization contributes major part for the economic development and prosperity of a country. On one hand it provides employment opportunities and wealth generation while on other hand it leads to following environmental deterioration:

1. It leads to the depletion of natural resources.
2. It leads to air pollution, water pollution and soil pollution.
3. Global warming, climatic changes are the major consequences of industrialization.
4. It causes acid rain.
5. It leads to the degradation of land quality.
6. It leads to the generation of hazardous waste whose safe disposal becomes a big problem.
7. These industries are responsible for the following adverse diseases and ill effect like silicosis and pneumoconiosis, tuberculosis, skin diseases and deafness.

Effect of Agriculture: Positive impacts are as

- ❖ Provides food security
- ❖ Enhances rainfall and greenery
- ❖ Employment opportunities
- ❖ Supports ecology

Negative impacts are as

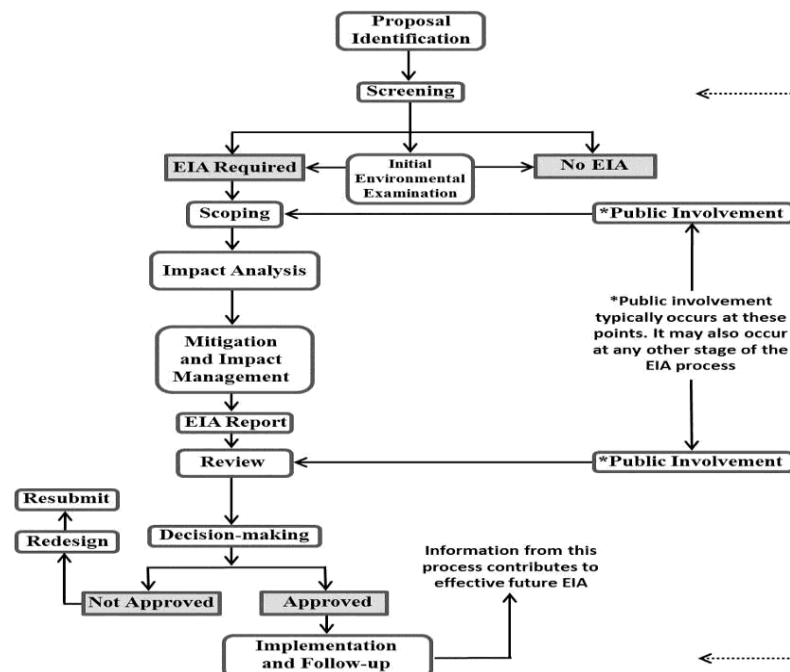
1. Pollution
2. Deforestation
3. Contamination of food
4. Destruction of natural flora and fauna.
5. Decrease in groundwater
6. Destruction of natural species
7. Eutrophication
8. Biomagnification

Environmental Impact Assessment (EIA)

EIA is designed to identify the potential risks of a project (e.g., infrastructure development such as a dam) to environment and human well-being and identify measures to eliminate and/or mitigate these risks. The steps are as

1. Screening: Determines whether the environmental and social impacts of a proposed development project would be significant enough to develop an EIA.
2. Scoping: Establish the boundaries of the EIA, set the basis of the analyses that will be conducted at each stage, describe the project alternatives and consult the affected public.

3. Impact assessment & Mitigation: Evaluate the socioeconomic and environmental impacts of the planned project and its alternatives, and then identify the mitigation measures to reduce those impacts
4. Impact Management: Prepare the plans required for addressing mitigation measures and other project risks, such as technological failures and natural disasters.
5. The EIA Report: Pull together all the research and work done during the previous steps into a comprehensive, structured document, ensuring that the EIA report contains all the key components.
6. Review :Designated authorities review the EIA report to determine if the planned project will get a license or if it requires amendments.
7. Management & Monitoring: Ensure that the mitigation measures, priorities listed in the Environmental Management Plan, and contingency plans are properly implemented and effectively address the project's impacts.



Advantages of EIA

- Reduced cost and time of project implementation and design
- Avoided treatment costs and impacts of laws and regulations
- Lays base for environmentally sound projects
- Greater awareness of environmental legislation
- Protection of Environment & Optimum utilization of resources
- It acts as a detailed study of the potential impacts of proposed projects
- It helps in predicting environmental impacts at an early stage in project planning and design
- EIA-based approvals for most projects also involve the process of conducting public hearings, so that who are likely to be affected can be taken on board before approving the project
- EIA links environment with development
- The goal is to ensure environmentally safe and sustainable development.

Limitations of EIA

- Time-consuming
- Little public participation in actual implementation
- Sometimes too focused on the scientific analysis
- Compliance monitoring after EIA is seldom carried out
- Impact assessment processes are in place and applied in many countries, yet biodiversity is often inadequately addressed

Sustainable Development

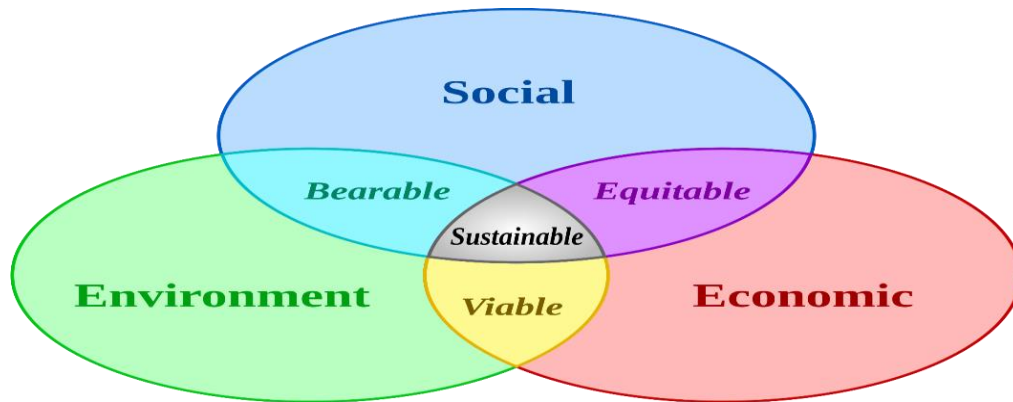
Sustainable development can be defined as an approach to the economic development of a country without compromising with the quality of the environment for future generations.

Sustainable Development Goals

- To promote the kind of development that minimizes environmental problems.
- To meet the needs of the existing generation without compromising with the quality of the environment for future generations.

Pillars of Sustainable Development

- 1) **Environmental Pillar:** The environmental pillar emphasizes the need to protect and preserve the natural environment, including ecosystems, biodiversity, air, water, and land resources. Sustainable development seeks to promote responsible resource use, reduce pollution and waste, conserve natural habitats, and mitigate the impact of human activities on the environment. By safeguarding the environment, we can ensure the long-term availability of resources and maintain the Earth's ability to support life.
- 2) **Economic Pillar:** The economic pillar focuses on fostering economic growth and development that is both inclusive and environmentally sustainable. It recognizes the importance of economic prosperity in improving living standards and reducing poverty. However, it emphasizes that economic growth should not come at the expense of environmental degradation or social inequality. Sustainable development encourages the adoption of green technologies, resource efficiency, fair trade practices, and investment in renewable energy to create a more resilient and stable economy.
- 3) **Social Pillar:** The social pillar addresses the need for social equity, justice, and inclusivity in development. It emphasizes that all members of society should have access to basic services such as education, healthcare, clean water, and sanitation. Sustainable development seeks to reduce disparities in income, gender, and access to resources, empowering marginalized communities and promoting social cohesion and harmony.
- 4) **Institutional Pillar:** It is related to good governance e.g., policies etc.



Obstacles in the Path of Sustainable Development:

- 1) **Short-Term Economic Interests:** One of the significant obstacles to sustainable development is the focus on short-term economic gains over long-term benefits. Some industries and practices prioritize immediate profits, disregarding the potential negative impacts on the environment and society.
- 2) **Population Growth and Consumption Patterns:** Rapid population growth and unsustainable consumption patterns put immense pressure on natural resources. Meeting the demands of a growing population while minimizing the ecological footprint is a critical challenge.
- 3) **Lack of Political Will:** Sustainable development often requires bold policy decisions and regulations. The lack of political will and commitment to implement necessary changes can hinder progress towards sustainability.

Achieving Sustainable Development

- It can be achieved by restricting human activities.
- Technological development should be input effective and not input utilising.
- The rate of consumption should not surpass the rate of salvation.
- For renewable resources, the rate of consumption should not surpass the rate of production of renewable substitutes.
- All types of pollution should be minimized.
- It can be achieved by sensible use of natural resources.
- Few examples of sustainable development
- Wind Energy , Solar Energy, Crop Rotation, Sustainable Construction, Efficient water fixtures , green space, sustainable forestry.

Social Security

“Social security is the protection which society provides for its members through a series of public measure, against the economic and social distress that otherwise would be caused by the substantial stoppage of earning resulting from :- sickness , maternity ,injury , unemployment, old age and death.

Need for Social Security

- Protects not just the subscriber but also his/her entire family by giving benefit packages in financial security and health care.
- Acts as a facilitator - helps people to plan their own future through insurance and assistance.
- For a worker/employee- a source of Social Security protection for himself and his family.
- An employer- responsible for providing adequate social security coverage to all your workers

Methods

- **Social insurance** scheme protects an individual from falling to the depths of poverty and nursery
- **Social assistance** is one of the device according to which benefits are given as a legal right to workers who are eligible for such assistance.

Schemes in India

1. Preventive Schemes

- ❖ Preventive Schemes are aimed at risk prevention.
- ❖ In the strategy of social management of risks, preventive approach tries to prevent poverty
- ❖ helps people under below poverty line to come above poverty line.
- ❖ Preventive health care, vaccinations against diseases forms part of the preventive strategies. Majority of the schemes are of social assistance in nature.

2. Promotional Schemes

- ❖ Promotional social security schemes are mainly means of tested Social Assistance type to guarantee minimum standards of living to vulnerable groups of population
- ❖ The Governments at the State and Centre draft schemes financed from the general revenues of the Government.

- ❖ These are the strategies of risk mitigation.
- ❖ These guarantee: Food and Nutritional Security ,Employment security ,Health Security ,Education Security Women Security .
- ❖ The Examples of schemes in the Promotional aspect are
- ❖ Jawahar Rojgar Yojana
- ❖ Rural Landless Laborers Employment Guarantee Schemes Programmes of Integrated Rural Development Project Drought prone area Programmes
- ❖ Sakshara
- ❖ Integrated Child Development Scheme (ICDS)
- ❖ Public Distribution System
- ❖ Reservations for the disabled in services
- ❖ Special educational institutions for the disabled persons etc.

Protective Social Security Programmes

The protective social security programmes help the poor in removing/reducing contingent poverty. In India, the protective social security programmes have been designed to address the contingent poverty or the contingencies defined by the ILO.

These programmes take care of , Old-age income needs (Old age pension) Survival benefits (Provident Funds) Medical need of insured families (Medical Insurance) Widow and children/dependant economic needs (Widow/Children/orphan, and dependent pension) Maternity benefits Compensation for loss of employment and Work injury benefits.

- ❖ The benefits are extended only to working population majority of whom are in the organized sector through legislations like:
- ❖ Workmen's Compensation Act, 1923
- ❖ Employees State Insurance Act, 1948
- ❖ Employees Provident Fund and
- ❖ Miscellaneous Provisions Act, 1952
- ❖ Maternity Benefits Act, 1961
- ❖ Payment of Gratuity Act, 1972

Economic security

It is the ability of individuals, households or communities to cover their essential needs sustainably and with dignity. This can vary according to an individual's physical needs, the environment and prevailing cultural standards. Food, basic shelter, clothing and hygiene qualify as essential needs, as does the related expenditure; the essential assets needed to earn a living, and the costs associated with health care and education also qualify. It aims at:

Food consumption, Food production, Income, Living conditions & Capacity. It addresses through:

- ❑ **Relief activities:** These are implemented quickly and efficiently with a view to saving lives and protecting livelihoods at immediate risk. Examples include distributing food and essential household items.
- ❑ **Livelihood-support activities:** These are designed to bolster livelihoods sustainably. Examples include microeconomic initiatives, cash transfers and distributing farming tools or seed – along with training.
- ❑ **Capacity-building activities:** These aim to build up the capacities of important local institutions so that people affected by crisis or conflict can benefit from improved services. Such activities are often combined with livelihood-support programmes for maximum impact. For instance, Economic Security works with veterinarians to organize campaigns to vaccinate people's livestock in conflict- affected areas.

Food security

Food security has the following dimensions

- (a) availability of food means food production within the country, food imports and the previous year's stock stored in government granaries.
- (b) accessibility means food is within reach of every person.
- (c) affordability implies that an individual has enough money to buy sufficient, safe and nutritious food to meet one's dietary needs.

Food security is ensured in a country only if

- (1) enough food is available for all the persons
- (2) all persons have the capacity to buy food of acceptable quality
- (3) there is no barrier on access to food.

Need for food security

During natural calamity such as drought, production of food grains get decreased, creating a shortage of food in the affected areas. The prices get increased due to shortage of food. People cannot afford to buy food and if such a calamity happens in a very wide spread area or is stretched over a longer time period, it might cause a situation of starvation.

Massive starvation might take a turn into a famine. A Famine is characterised by widespread deaths due to starvation and epidemics caused by forced use of contaminated water or decaying food and loss of body resistance due to weakening from starvation.

Food-insecurity in India

In India, a large section of people suffers from food and nutrition insecurity. People having little or no land, traditional artisans, petty self-employed workers and destitute including beggars are the worst affected groups.

In the urban areas, the food-insecure families are those who are generally employed in ill-paid occupations and the casual labour market. These workers are largely engaged in seasonal activities and are paid very low wages. The social composition along with the inability to buy food also plays a role in food insecurity.

People affected by natural disasters, which migrate to other areas in search of work, are among the most food-insecure people. A large proportion of pregnant and nursing mothers and children under the age of 5 years constitute an important segment of the food insecure population.

Another aspect of food insecurity is hunger, which is not just an expression of poverty, it brings about poverty. Hunger has chronic and seasonal dimensions. Chronic hunger is a consequence of diets persistently inadequate in terms of quantity and/or quality. Seasonal hunger is related to cycles of food growing and harvesting. In the field of agriculture, India adopted a new strategy, which resulted in the 'Green Revolution'.

Food Security in India

Since the Green Revolution, the country has avoided famine even during adverse weather conditions. India has become self-sufficient in food grains during the last 30 years because of a variety of crops grown all over the country. The availability of food grains has been ensured with a carefully designed food security system by the government.

This system has two components:

- (a) buffer stock,
- (b) public distribution system.

Buffer stock

Buffer Stock is the stock of food grains, namely wheat and rice, procured by the government through the Food Corporation of India (FCI). The stock of wheat and rice are purchased by the FCI from the farmers where there is surplus production. The farmers are paid a pre announced price for their crops, called Minimum Support Price (MSP).

Every year, the MSP is declared by the government before the sowing season to provide incentives to farmers for raising the production of these crops.

Buffer Stock is created to distribute foodgrains in the deficit areas and among the poorer section of the society at a price lower than the market price also known as Issue Price.

Public Distribution System

FCI distributes the food procured from the farmer through government-regulated ration shops. It is called the Public Distribution System (PDS). Ration shops also, known as Fair Price Shops, keep stock of food grains, sugar, and kerosene for cooking. Rationing in India was introduced during the 1940s against the backdrop of the Bengal famine. In the mid- 1970s, three important food intervention programmes were introduced:

1. Public Distribution System (PDS) for food grains
2. Integrated Child Development Services (ICDS) a
3. Food-for-Work (FFW).

At present, there are several Poverty Alleviation Programmes (PAPs), mostly in rural areas, which have an explicit food component also. Employment programmes greatly contribute to food security by increasing the income of the poor.

Current Status of Public the Distribution System

Public Distribution System (PDS) is the most important step taken by the Government of India towards ensuring food security.

In 1992, Revamped Public Distribution System (RPDS) was introduced in the country.

From June 1997, Targeted Public Distribution System (TPDS) was introduced to adopt the principle of targeting the 'poor in all areas'.

In 2000, two special schemes were launched Antyodaya Anna Yojana (AAY) and Annapurna Scheme (APS).

Over the year, the PDS proved to be the most effective instrument of government policy in stabilising prices and making food available to consumers at affordable prices.

Role of cooperatives in food security

In India, the cooperatives are also playing an important role in food security especially in the southern and western parts of the country. The cooperative societies set up shops to sell low priced goods to poor people. Some of the examples of cooperative societies are Mother Dairy in Delhi, Amul from Gujarat, Academy of Development Science (ADS) in Maharashtra.

Balanced Diet

A balanced diet is one that contains all of the essential elements that the human body needs. Carbohydrates, lipids, vitamins, minerals, proteins, fiber and water are all essential components in a well-balanced diet. A nutritious, well-balanced diet lowers the risk of disease and enhances general health.

Malnutrition

Malnutrition can mean undernutrition or overnutrition. It can also mean an imbalance of macronutrients (proteins, carbohydrates, fats) or micronutrients (vitamins and minerals). Undernutrition is characterized by a lack of nutrients and insufficient energy supply, whereas overnutrition is characterized by excessive nutrient and energy intake.

Shelter Security

Shelter is basic need of life not only for humans but also for animals. Shelter provides security from harsh environment conditions and also from dangerous animals.

Shelter: Primary Need of Life

Shelter is one of the key elements of survival along with food and water. Birds, animals, insects, humans, and all other organisms need shelter to survive. Shelter provides protection from weather and any other kind of danger. Shelter can be terrestrial, grassland, temperate, tropical, aquatic etc. **Shelter can be classified into:**

1. **Permanent Shelter:** These are the places where human or animal lives for very longer duration e.g. houses, caves, nest of birds etc. Permanent place are made up of cement and bricks and they are strong in structure.
2. **Temporary Shelter:** These are the place where animals and humans live only for short duration and for any specific purpose. e.g. bus shelters, house boats, migratory birds' nest at different place, tent houses, caravan, shelter home etc.

Despite the absence of a specific legislation on the human right to adequate housing in India, the courts have interpreted Article 21 in the Constitution of India to include the right to housing as an integral part of the right to life.

Need of Shelter Security:

1. Shelter security is an issue of great concern, since the number of homeless people worldwide has grown considerably in recent years.
2. With increasing population, there is also increasing pressure on finite land resources for housing.
3. 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.

Bio-magnification

- Bio-magnification stands for Biological Magnification, which refers to the growth of harmful compounds in food chains.
- Heavy metals such as mercury and arsenic, pesticides such as DDT and polychlorinated biphenyls (PCBs) are among the contaminants that are taken up by organisms as a result of the food they eat.
- These toxic compounds then accumulate within the cells of the organism. The build-up of toxic substances in the tissue of a certain organism is known as **bio- accumulation**.
- As these compounds are slowly eliminated or metabolized/broken down, their concentration in organisms increases as they go up the food chain.
- This usually happens throughout a food chain and affects all creatures, but animals higher up the food chain are more affected.

Example of Bio-magnification

1. Entry of Toxins In Phytoplanktons

Small plants that float in the sea and absorb pollutants are known as phytoplankton. Toxins are absorbed and remain in their body's tissues without being eliminated or broken down. Toxins accumulate in high quantities of up to 200 parts per trillion over time, representing a fourfold increase in toxin accumulation.

2. Entry of Toxins In Zooplanktons

Small marine invertebrates that float in the seas are referred to as zooplankton. They eat the phytoplankton and absorb the poison as a result. Toxins are trapped in the tissue of the organism and are not eliminated or broken down. The toxin concentration rises to two parts per billion over time, which is a ten-fold increase over the prior concentration.

3. Consumption of Zooplanktons by Small Fish

When little fish consume zooplanktons, they absorb the poisons. They are then absorbed into their fatty tissues. As a result, buildup develops, resulting in concentrations of around 20 parts per billion, a ten-fold increase.

4. Consumption of Small Fish by Larger Ones

When giant fish graze on smaller fish for nourishment, the poisons that build in their fatty tissues are consumed. The concentrations increase until they reach 80 to 100 parts per billion. The hazardous levels have increased by four to five times.

5. Organisms on Top of the Food Chain

When enormous fish are consumed, the species at the top of the food chain, such as dolphins, sea birds, and humans, gradually accumulate poisons in their tissues, such as their liver. The concentrations reach the highest ranges of 10,000 to 15,000 parts per billion in this area. Since the effects interfere with the normal functioning of essential organs, the animals' fertility is affected, and they are more susceptible to effects.

Effects of Bio-magnification

1. Impact on Human Health

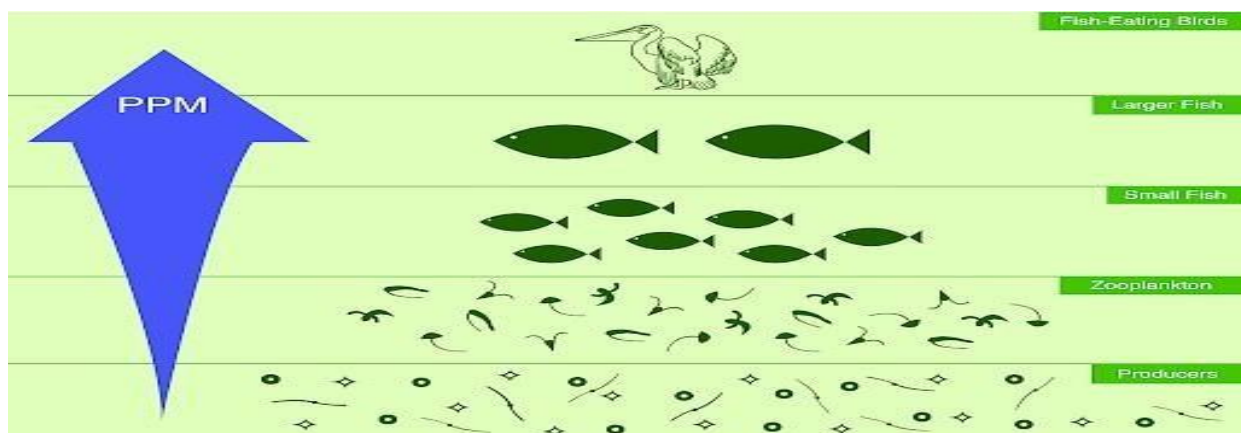
- Mercury, cadmium, lead, cobalt, chromium, and other chemicals make people more susceptible to cancer, liver and kidney failure, respiratory illnesses, birth defects in pregnant women, brain damage, and heart disease and even death.
- Consumption of mercury and polycyclic aromatic hydrocarbon-tainted seafood, for example, has been linked to ailments like hepatitis and cancer (PAHs).

2. Effects on Reproduction and Development of Marine Creatures

- The accumulation of hazardous substances and elements in the critical organs of aquatic species has an impact on their reproduction and growth.
- Seabird eggs, for example, have thinner shells than typical, which can lead to the birds breaking their eggs rather than incubating them.
- Selenium and other heavy metals, such as mercury, have a negative impact on fish reproduction by destroying their reproductive organs.

3. Destruction of the Coral Reefs

- Cyanide, which is used in gold leaching and fishing, destroys coral reefs. Various seacreatures use the reefs as spawning, feeding, and living grounds and thus get damaged.



UNIT 1

Short Answer Questions (2 Marks)

1. What is bio-accumulation?
2. Elaborate the terms "ecosystem" and "environment"
3. Cite the major segments of the environment.
4. Differentiate between a food chain and a food web.
5. Enumerate the objectives of UNESCO for environmental awareness
6. Define PESTEL segments of environment
7. Define the terms bio-magnification.
8. What do you understand by terms biotic and abiotic components?
9. What is food web? Give examples
10. Write the positive and negative effects of urbanization
11. Define the term ecology and ecosystem.
12. How does energy flow in an ecosystem?
13. Write in detail about functions of ecosystem.
14. Name the ecological pyramid, which cannot be inverted.
15. Describe the role of buffer stock.

Long Answer Questions (5/7/9 Marks)

1. What are effects of transportation and agricultural activities on environment?
2. Discuss the need of food security. Explain the pillars of food security.
3. Describe an ecological pyramid. Depict the types with the help of suitable diagrams
4. Describe Environmental Impact Assessment in detail. Prepare a flow diagram of steps involved in the process of EIA.
5. Define urban sprawling. Write the positive and negative effects of Urbanization.
6. Explain the role of the pillars of sustainable development. Write about the obstacles in the path of sustainable development.
7. Enlist the objectives of Environmental Education. Explain the scope and significance of Environmental studies in our daily life
8. Explain the biotic and abiotic components of an ecosystem. What role do biotic components play in functioning of an ecosystem?
9. Discuss the process of eutrophication as a form of water pollution. Explain its consequences on aquatic ecosystems.
10. How would you broadly divide major layer of regions of the atmosphere? State respective altitude and temperature ranges
11. Describe the components of an ecosystem. Explain the role of producers, consumers & decomposers in an ecosystem
12. Discuss importance of EIA in planning and implementation of engineering projects.
13. Discuss the need for public awareness for the conservation and protection of the environment.
14. Comment on the statement "Environmental Studies has multi-disciplinary nature."