KARPAGAM ACADEMY OF HIGHER EDUCATION

(*Deemed to be University Established Under Section 3 of UGC Act 1956)*

Coimbatore – 641 021

DEPARTMENT OF COMMERCE

Semester II

		L	T	P	C
17AEC201	**ENVIRONMENTAL STUDIES**	**4**	**-**	**-**	**4**

Scope

The study creates awareness among the people to know about various renewable and nonrenewable resources of the region, enables environmentally literate citizens (by knowing the environmental acts, rights, rules, legislation, etc.) to make appropriate judgments and decisions for the protection and improvement of the earth.

Objectives

- Creating the awareness about environmental problems among people.
- Developing an attitude of concern for the environment.
- Motivating public to participate in environment protection and improvement.

UNIT-I: Environment Definition, scope and importance, components, Ecosystem Definition, Concept, Scope, importance, Structure and functions of ecosystem. Energy flow, Ecological succession Food chains and food webs. Classification of ecosystem.

Unit II: Natural Resources - Renewable and Non-renewable Resources: Natural resources and associated problems. Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources : Use and over-utilization, exploitation. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. Ill-effects of fire works.

Unit III: Biodiversity and Its Conservation: Introduction, definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Unit IV: Environmental Pollution - Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution , Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: Foods, earthquake, cyclone and landslides.

Unit V: Social Issues and the Environment: From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and

possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Population growth, variation among nations. Population explosion—Family Welfare Programme. Environment and human health. Human rights. Value education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in environment and human health.

Suggested readings

T1: Tripathy.S.N. and Sunakar Panda. 2004. Fundamentals of Environmental Studies; 2nd Edition, Vrianda Publications Private Ltd., New Delhi.

T2: Arvind Kumar, 2004. A Textbook of Environmental Science; APH Publishing Corporation, New Delhi.

T3: P.S.Verma, V.K.Agarwal. 2001. Environmental Biology (Principles of Ecology); S.Chand and Company Ltd., New Delhi.

T4: Anubha Kaushik, C.P.Kaushik, 2004. Perspectives in Environmental Studies, New Age International Pvt. Ltd. Publications, New Delhi.

R1: Singh, M.P., B.S. Singh and Soma S. Dey, 2004. Conservation of Biodiversity and Natural Resources. Daya Publishing House, Delhi.

R2: Daniel B.Botkin and Edward A. Keller. 1995. Environmental Science, John Wiley and Sons, Inc., New York.

R3: Uberoi, N.K., 2005. Environmental Studies, Excel Books Publications, New Delhi, India.

KARPAGAM ACADEMY OF HIGHER EDUCATION

Coimbatore - 641021.

(For the candidates admitted from 2017 onwards)

LECTURE PLAN

DEPARTMENT OF COMMERCE

STAFF NAME: SUGANYA. J

SUBJECT NAME: ENVIRONMENTAL STUDIES SUB.CODE: 17AEC101

SEMESTER: I CLASS: I B.COMCA

S.No.	Lecture Duration (Period)	Topics to be Covered	Support Materials
Unit - I			
1.	1	Environment Definition, scope and importance	T4 : 1-4,T2:1,
2.	1	Components of environment	T1:1,2
3.	1	Ecosystem Definition, Concept, Scope, importance	T4 :65-66,T2:55,56, T4:52,53
4.	1	Structure of ecosystem	T4 :66-68
5.	1	Functions of ecosystem	T4 :68,76-78
6.	1	Energy flow through the ecosystem	T4 :76-78
7.	1	Ecological succession	T4 :84-87
8.	1	Food chains and food webs	T4 :69-72
9.	1	Classification of ecosystem.	T4 :76

10.	1	Recapitulation and Discussion of important questions	
		Total No. of Hours Planned for Unit-I	**10**
		Unit - II	
1.	1	Natural resources and associated problems.	T4:6-9
2.	1	Forest resources	T4: 9-12
3.	1	Water resources	T4 : 13-22,T2:37-40
4.	1	Mineral resources	T4 : 23-28, T2: 43-48
5.	1	Food resources	T4: 30-36
6.	1	Energy resources	T4: 38-52,T2:32-35
7.	1	Land resources : Use and over-utilization, exploitation	T4: 40-43
8.	1	Role of an individual in conservation of natural resources.	T4: 59-61
9.	1	Equitable use of resources for sustainable lifestyles.	T4: 62-63
10	1	Ill-effects of fire works	T4: 64-66, T2:47-49
11	1	Recapitulation and Discussion of important questions	
		Total No. of Hours Planned for Unit-II	**11**
		Unit - III	
1.	1	Introduction, definition: genetic, species and ecosystem diversity.	T4 : 98,99, T3: 75-78
2.	1	Biogeographical classification of India.	T4:100-101

3.	1	Value of biodiversity: consumptive use, productive use	T4: 101-102
4.	1	Value of biodiversity: social, ethical, aesthetic and option values.	T4 :102,103
5.	1	Biodiversity at global, National and local levels	T4 :104-107, R1: 23-29
6.	1	India as a mega-diversity nation. Hot-spots of biodiversity.	T4 :107-111
7.	1	Threats to biodiversity: habitat loss, poaching of wildlife,	T4:111-112
8.	1	Man-wildlife conflicts	T4: 112-114
9.	1	Endangered and endemic species of India	T4 :115-118, T3: 92-98
10	1	Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.	T4 :119-121
11.	1	Recapitulation and Discussion of important questions	
		Total No. of Hours Planned for Unit-III	**11**
		Unit - IV	
1.	1	Definition, Causes, effects and control measures of Air pollution	T4:123-127
2.	1	Water pollution	T4: 132-135
3.	1	Soil pollution	T4: 141-143
4.	1	Marine pollution	T4:140,141
5.	1	Noise pollution	T4: 127-132
6.	1	Thermal pollution	T4:136-139

7.	1	Nuclear hazards	T4: 143,144
8.	1	Solid waste management: Causes, effects and control measures of urban and industrial wastes	T4:145-148 R3: 163-169
9.	1	Role of an individual in prevention of pollution	T4:148-150
10	1	Pollution case studies	T4:150-153
11	1	Disaster management: Foods, earthquake, cyclone and landslides.	T4:154-158
12	1	Recapitulation and Discussion of important questions	
Total No. of Hours Planned for Unit-IV			**12**
Unit - V			
1.	1	From unsustainable to sustainable development. Urban problems related to energy.	T4:161-165
2.	1	Water conservation, rain water harvesting, watershed management.	T4: 165-171, R2:143-145
3.	1	Resettlement and rehabilitation of people; its problems and concerns.	T4:171-172
4.	1	Environmental ethics: Issues and possible solutions.	T4: 173-177
5.	1	Climate change, global warming, acid rain, ozone layer depletion	T4:178-180, R2: 157-163
6.	1	Nuclear accidents and holocaust. Case studies. Wasteland reclamation.	T4: 181-189
7.	1	Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act.	T4:192-195

8.	1	Water (Prevention and Control of Pollution) Act. Wildlife Protection Act	T4: 196-201
9.	1	Issues involved in enforcement of environmental legislation, Public awareness. Population growth, variation among nations.	T4:204-213
10.	1	Population explosion—Family Welfare Programme. Environment and human health. Human rights	T4:216-223
11.	1	Value education. HIV/AIDS. Women and Child Welfare.	T4:225-229
12.		Role of Information Technology in environment and human health.	T4: 230-233
13.	1	Recapitulation and Discussion of important questions	
14.	1	Recapitulation and Discussion of previous semester question papers	
15.	1	Recapitulation and Discussion of previous semester question papers	
16.	1	Recapitulation and Discussion of previous semester question papers	
Total No. of Hours Planned for Unit-V			**16**
Total No. of Hours Planned			**60**

Textbook:

P.S.Verma, V.K.Agarwal. 2001. Environmental Biology (Principles of Ecology); S.Chand and Company Ltd., New Delhi.

Anubha Kaushik, C.P.Kaushik, 2004. Perspectives in Environmental Studies, New Age International Pvt. Ltd. Publications, New Delhi.

Reference book

Singh, M.P., B.S. Singh and Soma S. Dey, 2004. Conservation of Biodiversity and Natural Resources. Daya Publishing House, Delhi.

UNIT I

Environment Definition, scope and importance, components, Ecosystem Definition, Concept, Scope, importance, Structure and functions of ecosystem. Energy flow, Ecological succession Food chains and food webs. Classification of ecosystem.

ENVIRONMENT

DEFINITION

- Environment is derived from the French word Environner which means to encircle or surround.
- All the biological and non-biological things surrounding an organism are thus included in environment.
- Thus environment is sum total of water, air and land, inter-relationships among themselves and also with the human beings, other living organisms and property.
- The above definition given on Environment (Protection) Act, 1986 clearly indicates that environment includes all the physical and biological surroundings and their interactions.

COMPONENTS

- The natural environment of a living organism can be divided into three components.
  - Biotic components
  - Abiotic components
  - Energy components

Biotic Components

- It consists of all the living organisms present within the environment.

Abiotic components

- All other substances except living organisms are known as abiotic components.
- The abiotic components broadly consist of atmosphere (air), Hydrosphere (water) and Lithosphere (soil).

Energy components

- The energy component may be solar energy, geo-chemical energy, thermo-electrical energy, hydro-electrical energy, atomic energy and energy due to radiation.

ECOSYSTEM

Definition

Tansley (1935) – self regulating group of biotic communities of species interacting with one another and with their non-living environment exchanging energy and matter

CONCEPT OF ECOSYSTEM

- Living organisms cannot be isolated from their non-living environment because the later provides materials and energy for the survival of the farmer.
- An ecosystem is therefore defined as a natural functional ecological unit comprising of living organisms and their non-living environment that interact to form a stable self supporting system.

  Eg. Pond, lake, desert, grassland, forest, etc.

Ecosystem characteristics

- Structural features - composition and organization of biological communities and abiotic components constitute- structure of Ecosystem.
- Biotic structure – Plants, animals, microorganisms – form biotic components – nutritional behavior and status in the ecosystem – producers or consumers – how do they get their food.

SCOPE OF ECOSYSTEM

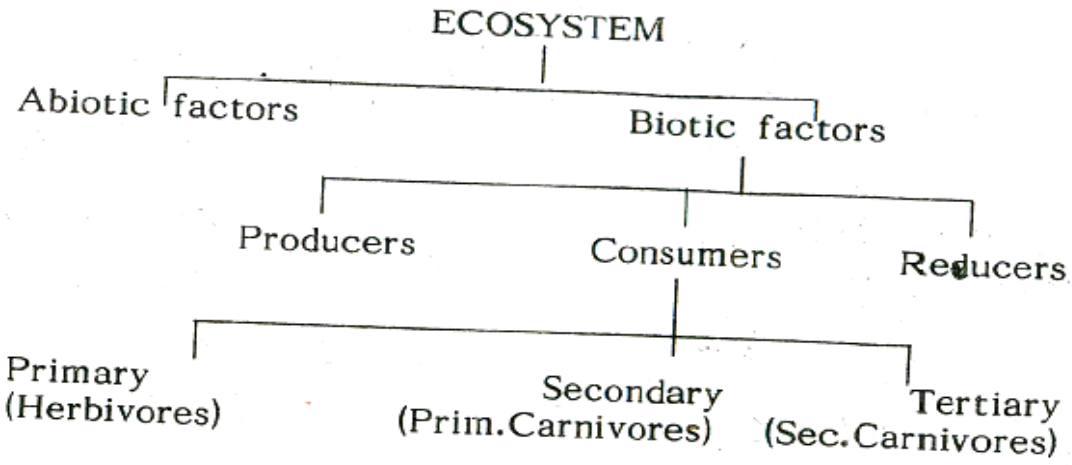
- Modern ecology focuses on the basic functional ecological unit the ecosystem.
- An ecosystem is any spatial or organizational unit which includes a community of living organisms and non-living substances of environment interacting to produce an exchange of materials between the living and non-living parts.
- It may be as small as a puddle or as large as the entire earth (biosphere or ecosphere).
- Further, an ecosystem may be natural as a pond, a lake, a river, an estuary, an ocean, a forest, etc., or it may be man-made or artificial like an aquarium, a dam, a cropland, a garden, an orchard, a city and so on.
- The term ecosystem was coined by A.G. Tansely (1935) – its ‘eco’ part means environment and the ‘system’ part implies, a complex of coordinated units.

IMPORTANCE OF ECOSYSTEM

- Ecosystem study indicates the available solar energy and the efficiency of an ecosystem to trap the same.
- It gives information about the available essential minerals and their recycling periods.
- Gross and net productivity of an ecosystem are known.
- It provides knowledge about the web of interactions and interrelations amongst the various populations as well as between populations and the abiotic environment.
- It helps human beings to know about conservation of resources, protection from pollution and inputs required for maximizing productivity.

STRUCTURE OF ECOSYSTEM

- The structure of any ecosystem is formed of two components, namely
  - Abiotic factors
  - Biotic factors.



Structure of an ecosystem.

Abiotic Factors

- The abiotic factors of an ecosystem include the non-living substances of the environment.

Example

- Water, soil, air, light, temperature, minerals, climate, pressure etc.
- The biotic factors of the ecosystem depend on the abiotic factors for their survival.

Biotic Factors

- The biotic factors include the living organisms of the environment.

Example

- Plants, animals, bacteria, viruses etc.
- The biotic factors of an ecosystem are classified into three main groups
  - Producers

- Consumers
- Reducers or decomposers.

Producers

- The organisms which carryout photosynthesis constitutes the producers of an ecosystem.
  - **Eg.** Plants algae and bacteria.
- The producers depend on the abiotic factors of the ecosystem for producing energy.
- They are provided with chlorophyll.
- Chlorophyll is used in the synthesis of energy rich compounds with the utilization of abiotic factors like light, CO2, water and minerals
- A portion of the energy synthesized, is used by the producers for their growth and survival and the remaining energy is stored for future use.

Consumers

- Consumers are organisms which eat or devour other organisms.
- The consumers are further divided into three or more types.
- They are primary consumers, secondary consumers and tertiary consumers.

(i) Primary Consumers

- They eat the producers like plants, algae and bacteria.
- The primary consumers are also called herbivores.
- Elton referred the herbivores as key industry animals.
- Rabbit, deer, etc., are primary consumers in a terrestrial ecosystem.

(ii) Secondary Consumers

- They kill and eat the-herbivores.
- They are also called carnivores.
- As these carnivores directly depend on herbivores, they are specifically called primary carnivores.
- Fox, wolf, etc. are the secondary consumers in a terrestrial ecosystem.

(iii) Tertiary Consumers

- They kill and eat the secondary consumers.
- They are also called secondary carnivores.
  - **Eg**. Lion, tiger, etc.

Reducers or Decomposers

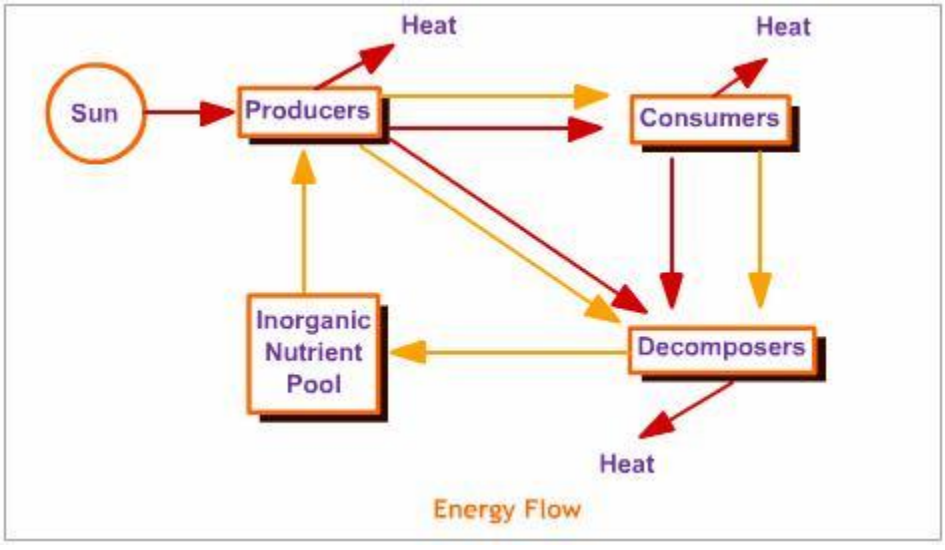
- The decomposers are organisms that break up the dead bodies of plants and their waste products.

- They include fungi and certain bacteria.
- They secrete enzymes.
- The enzymes digest the dead organisms and the debris into smaller bits or molecules.
- These molecules are absorbed by the reducers.
- After taking energy, the reducers release molecules to the environment as chemicals to be used again by the producers.

FUNCTIONS OF ECOSYSTEMS

- Ecosystems have some functional attributes which keep the component parts running together.
- For example – green leaves prepare food and roots absorb nutrients from the soil.
- Herbivores feed on part of the plant production, and in turn serve as food for carnivores.
- Decomposers carry out the function of breaking down complex organic materials into simple inorganic product which can be used by the producers.
- All these functions in an ecosystem occur through delicately balanced and controlled processes.
- Thus, this cycle goes on and on, leading to efficient continuous functioning of the ecosystem.
- Food chain, food web and trophic structure.
- Energy flow
- Cycling of nutrients (biogeochemical cycles)
- Primary and secondary production
- Ecosystem development and regulation.

ENERGY FLOW IN ECOSYSTEM



- The diagram above shows how both energy and inorganic nutrients flow through the ecosystem.
- We need to define some terminology first.
- Energy "flows" through the ecosystem in the form of carbon-carbon bonds.
- When respiration occurs, the carbon-carbon bonds are broken and the carbon is combined with oxygen to form carbon dioxide.
- This process releases the energy, which is either used by the organism (to move its muscles, digest food, excrete wastes, think, etc.) or the energy may be lost as heat.
- The dark arrows represent the movement of this energy.
- Note that all energy comes from the sun, and that the ultimate fate of all energy in ecosystems is to be lost as heat. Energy does not recycle!!
- The other component shown in the diagram is the inorganic nutrients.
- They are inorganic because they do not contain carbon-carbon bonds.
- These inorganic nutrients include the phosphorous in your teeth, bones, and cellular membranes; the nitrogen in your amino acids (the building blocks of protein); and the iron in your blood (to name just a few of the inorganic nutrients).
- The movement of the inorganic nutrients is represented by the open arrows.
- Note that the autotrophs obtain these inorganic nutrients from the inorganic nutrient pool, which is usually the soil or water surrounding the plants or algae.
- These inorganic nutrients are passed from organism to organism as one organism is consumed by another.
- Ultimately, all organisms die and become detritus, food for the decomposers.
- At this stage, the last of the energy is extracted (and lost as heat) and the inorganic nutrients are returned to the soil or water to be taken up again.
- The inorganic nutrients are recycled, the energy is not.
- Many of us, when we hear the word "nutrient" immediately think of calories and the carbon-carbon bonds that hold the caloric energy.
- IT IS VERY IMPORTANT that you be careful in your use of the word nutrient in this sense.
- When writing about energy flow and inorganic nutrient flow in an ecosystem, you must be clear as to what you are referring.
- Unmodified by "inorganic" or "organic", the word "nutrient" can leave your reader unsure of what you mean.
- This is one case in which the scientific meaning of a word is very dependent on its context. Another example would be the word "respiration", which to the layperson usually refers to "breathing", but which means "the extraction of energy from carbon-carbon bonds at the cellular level" to most scientists (except those scientists studying breathing, who use respiration in the lay sense).

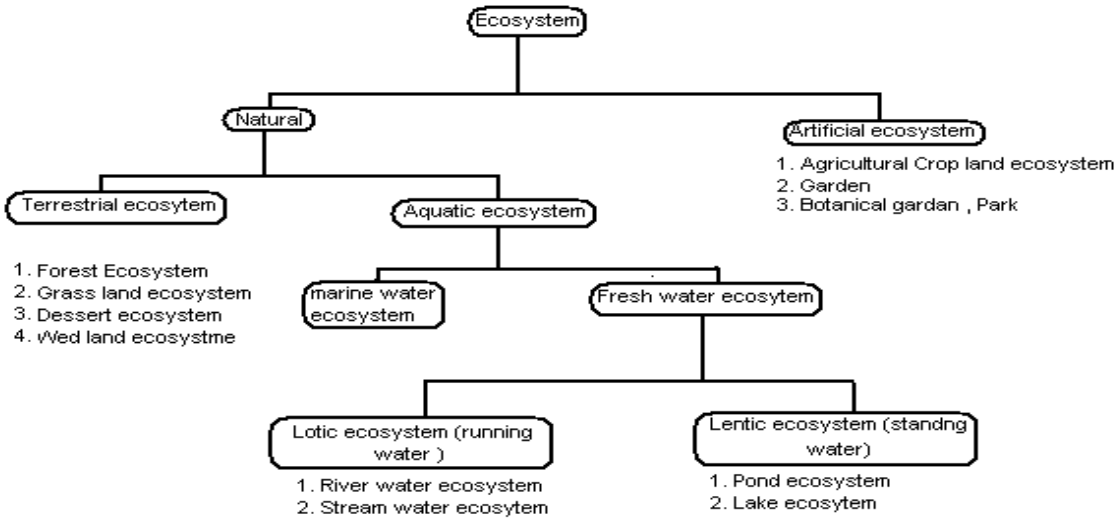
To summarize: In the flow of energy and inorganic nutrients through the ecosystem, a few generalizations can be made:

1. The ultimate source of energy (for most ecosystems) is the sun
2. The ultimate fate of energy in ecosystems is for it to be lost as heat.
3. Energy and nutrients are passed from organism to organism through the food chain as one organism eats another.
4. Decomposers remove the last energy from the remains of organisms.
5. Inorganic nutrients are cycled, energy is not.

ECOLOGICAL SUCCESSION

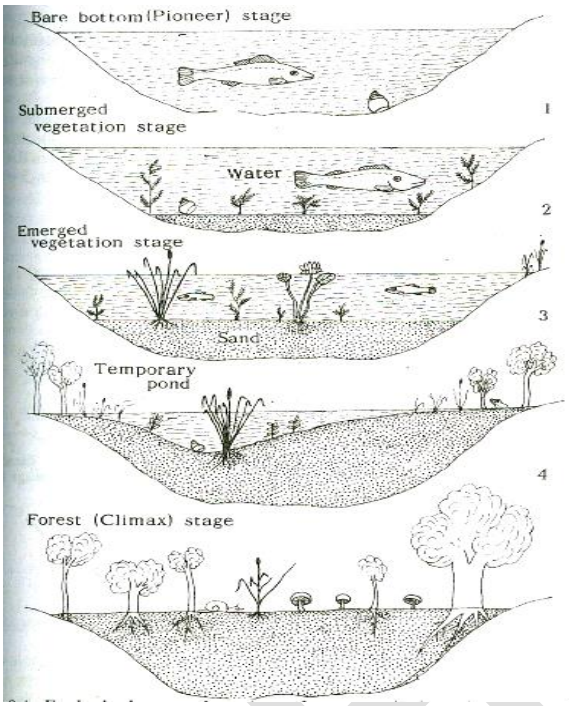
- The communities in any area are not stable.
- They are changing into other forms of communities from time to time.
- Thus in a particular area one community may be replaced by another community or by a series of communities.

Types of ecosystem



For example

- A pond community can be transformed into a marshy land community, if he pond is gradually filled with sand and mud.
- The marshy land in the course of time may give rise to a grassland community or a forest community according to the environmental factors prevailing there.
- This process of development of new communities is called ecological succession.
- It can be defined as an orderly and progressive replacement of one community by another till the development of a stable community in that area (Smith, 1965).



Ecological succession. A pond community is replaced by a forest community through ecological succession

Significance of Succession

- Ecological succession creates a stable community in the fluctuating physical environment. The stable or climax community has the ability to buffer and control the physical forces like water, temperature etc.
- It plays an important role in the slow dispersal of animals.

FOOD CHAINS

- The biotic factors of the ecosystem are linked together by food.

For example

- The producers form the food for the herbivores.
- The herbivores the food for the carnivores.
- The sequence of the eaters being eaten is called food chain.

  Producers ----------> Herbivores ----------> Carnivores
- The various steps in a food chain are called trophic levels.
- Owing to repeated eating being eaten the energy is transferred from to another trophic level.
- This transfer of energy from one trophic level to another is called energy flow.

- A typical food chain can be seen in a pond ecosystem.
- The algae and phytoplankton are eaten by the zooplankton.
- The zooplankton are eaten by fishes which are eaten by snakes.

Pond Ecosystem

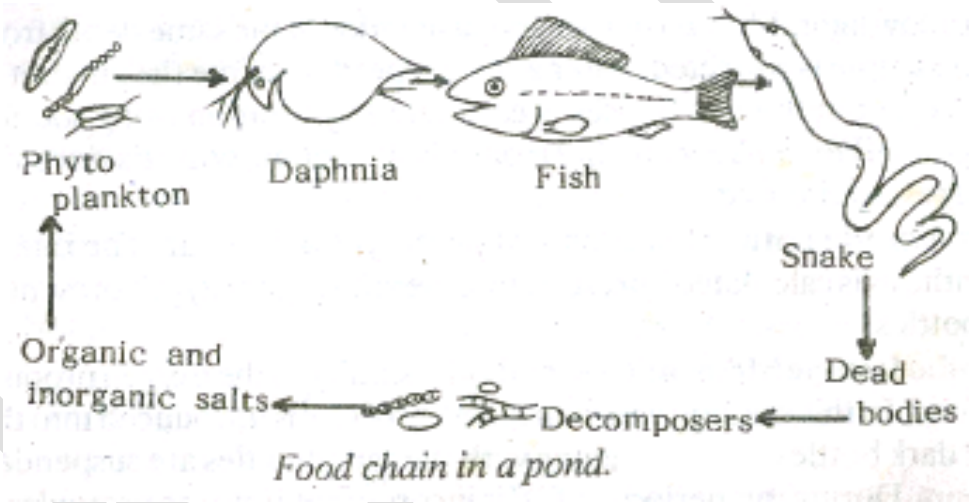
Phytoplankton ----------> Zooplankton ----------> Fishes ---------> Snakes

Grassland Ecosystem

Plants ----------> Mouse ----------> Snake ----------> Hawk

Forest Ecosystems

Plants ----------> Goat ----------> Man ----------> Lion



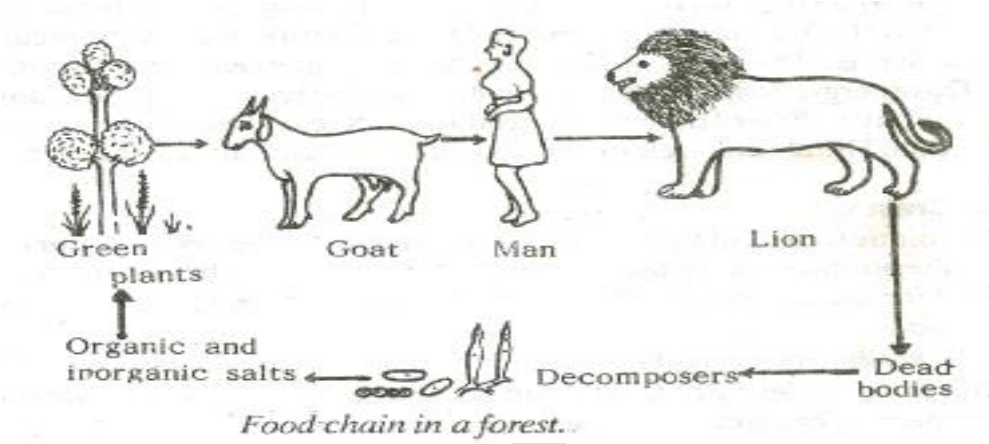
Food chain in a pond.

Types of food chains

- The food chains are of two types, namely
  - Grazing food chain
  - Detritus food chain

Grazing food chain

- This food chain starts from plants, goes through herbivores and ends in carnivores.
  Plants-----> Herbivores ------> Primary carnivores-----> secondary carnivores
- This type of food chain depends on the autotrophs which capture the energy from solar radiation.



Food chain in a forest.

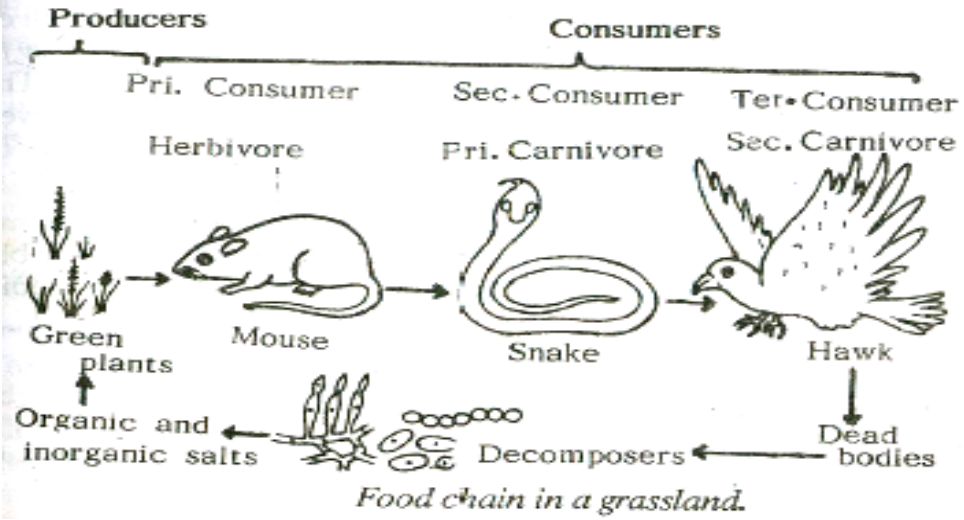
A few chains are given below

Grass --------> Grasshopper --------> Lizard --------> Hawk
Grass --------> Mouse ----------> Snake ---------> Hawk
Phytoplankton ----------> Zooplankton ----------> Fishes ---------> Snakes

- The grazing food chain is further divided into two types, namely
  - Predator chains
  - Parasitic chains

Predator chains

- In predator food chains one animal capture and devours another animal.
- The animal which is called prey and the animal which eats other animals is called predator.
- The predator food chain is formed of plants, herbivores, primary carnivores, secondary carnivores and so on.



Food chain in a grassland.

Parasitic chain

- The plants and animals of the grazing food chain are infected by parasites.
- The parasitic chain within the grazing food chain is formed.

Detritus food chain

- It starts with dead organic matter and ends in inorganic compounds.
- There are certain groups of organisms which feed exclusively on the dead bodies of animals and plants.
- These organisms are called Detritivores.
- The Detritivores include algae, bacteria, fungi, protozoans, insects, millipeds, centripeds, crustaceans, mussels, clams, annelid worms, nematodes, ducks, etc.
- These organisms ingest and digest the dead organic materials.
- Some amount of energy is trapped and the remainder is excreted in the form of simple organic compounds.
- These are again used by another set of Detritivores until the organic compounds are converted into CO2 and water.

Dead organic materials ----------> Detritivores ----------> CO2 + H2O

Linking of Grazing and Detritus Food Chains

- The two main food chains cannot operate independently.
- They are interconnected at various levels.
- According to Wilson and Bossert (1971) the stability of the ecosystem directly proportional to the number of such links.
- The detritus feeders obtain energy form the dead bodies of animals and plants which are components of the grazing food chain.
- Again some of the detritus feeders are eaten by the consumers of the grazing food chain.
- For example, in a pond ecosystem earthworms belonging to the detritus food chain are eaten by fishes belonging to the grazing food chain.

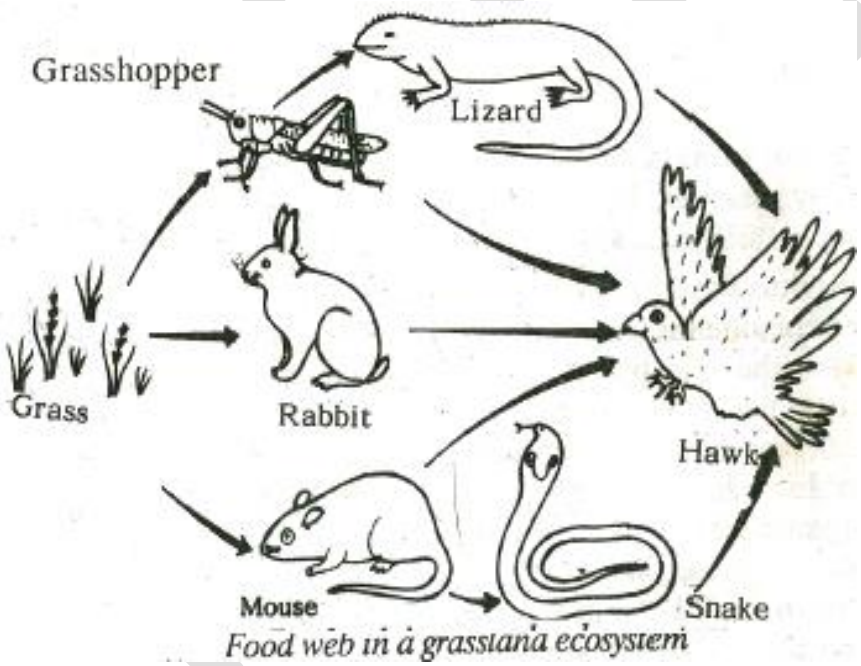
FOOD WEB

- In an ecosystem the various food chains are interconnected with each other to form a net work called food web.
- The interlocking of many food chains is called food web.
- Simple food chains are very rare in nature.
- This is because each other organisms may obtain food from more than one trophic level.

- In other words, one organism forms food for more than one organisms of the higher trophic level.

Examples

- In a grassland ecosystem, grass is eaten by grasshopper, rabbit and mouse.
- Grasshopper is eaten by lizard which is eaten by hawk.
- Rabbit is eaten by hawk.
- Mouse is eaten by snake which is eaten by hawk.
- In addition hawk also directly eats grasshopper and mouse.
- Thus there are five linear food chains which are inter interconnected to form a food web.
- This is a very simple food web.
- But in any ecosystem the food web is more complex.
- For example, in the grassland itself, in addition to hawk, there are many other carnivores such as vulture, crow, wolf, fox, man, etc.



Food web in a grassland ecosystem

Significance of Food Web

- Food webs are very important in maintaining the stability of an ecosystem.
- For example, the deleterious growth of grasses is controlled by the herbivores.
- When one type of herbivores becomes extinct, the other types of herbivores increase in number and control the vegetation.
- Similarly, when one type of herbivores animal becomes extinct, the carnivores predating on this type may eat another type of herbivore.

CLASSIFICATION OF ECOSYSTEMS

- The ecosystem may be large, as large as the world or small, as small as a cow dung ecosystem.
- The biosphere (the total life content of the world) is the major ecosystem.
- It comprises all other ecosystems.

Mega Ecosystem

- The biosphere is formed of four mega ecosystems.

(i) Marine Ecosystem

- It includes saline-water ecosystems like oceans, seas, estuaries, brackish waters, etc.

(ii) Limnic Ecosystem

- It includes all fresh water ecosystems like pond, pools, lakes, rivers, streams, etc.

(iii) Terrestrial Ecosystems

- It includes the ecosystems of air, forests, grasslands, deserts, etc.

(iv) Industrial Ecosystems

- These are man-made ecosystems. Eg. Cropland, city town, etc.

Macro Ecosystems

- The mega ecosystem is further divided into sub units called macro ecosystems.

Examples

- Forests.
- The terrestrial macro ecosystem is formed of many forest ecosystem.

Meso Ecosystems

- The macro ecosystem is further divided into meso ecosystems.

Examples

- The forest ecosystem is formed of many meso ecosystems like deciduous forest, coniferous forest, etc.

Micro Ecosystems

- The meso ecosystem is further divided into micro ecosystems.

Examples

- A low land in a forest, a mountain in a forest, etc.
- All ecosystems in the world are further divided into natural and artificial ecosystems.

Natural Ecosystems

- These are self-regulating systems without much direct human interference and manipulations.

Examples

- Ponds, lakes, rivers, seas, oceans, grasslands, deserts, etc.

Artificial Ecosystems

- These are man-made ecosystems.

Examples

- Crop lands, cities, towns, villages, etc.

POSSIBLE QUESTIONS

Unit- I

Part- A

1. Define environment.
2. What is meant by ecosystem? Write its types.
3. Define pollution.
4. Write a note on energy flow.
5. Define air pollution.
6. Add a note on ecological succession.
7. What is thermal pollution?
8. Define soil pollution.
9. Write s note on food chains.
10. Define ecology.
11. List out any four causes of water pollution.
12. Mention any four effects of noise pollution.

Part - B

1. What are the adverse effects and control measures of water pollution? Explain.
2. Explain in detail the components of ecosystems.
3. Discuss various effects and control measures of air pollution.
4. What are the major sources of soil pollution? How does soil pollution affect soil productivity?
5. Explain in detail about the structure and functions of ecosystem.
6. What is the need for studying environmental studies?
7. What are food chains and food webs? Give examples and discuss their significance.
8. Explain in detail about causes, effects and control measures of air pollution.

Syllabus:

Natural Resources - Renewable and Non-renewable Resources: Natural resources and associated problems. Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources : Use and over-utilization, exploitation. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. Ill-effects of fire works.

NATURAL RESOURCES

- Any component of the environment which can be transferred in a way such that it becomes more valuable and useful is termed as resource.
- Life on this planet earth depends upon the large number of things and services provided by the nature which are known as natural resources.

Resources

- There are two types of resources (i) renewable and (ii) non renewable resources

Renewable resources

- They have the capacity to renew. Example. Clean air, clean water.

Non renewable resources

- Available in minute quantities
- They cannot be regenerated
- Example. Ground water, minerals.

The major resources are (i) Forest (ii) water (iii) mineral (iv) food (v) energy and (vi) Land resources

FOREST RESOURCES:

- Forests are one of the most important resources of the world.
- They act as a blanket on the surface of the earth.
- Around 1/3rd of world land area was found to be forests.

USES OF FOREST:

Commercial uses

- Forests provide timber
- fire wood
- food material
- resin
- gum
- non edible oils,
- drugs
- medicine
- rubber
- fibers
- Bamboo and many other important items.

Ecological uses:

- Production of Oxygen: Photosynthesis – earth's lungs
- Reducing global warming – sink for carbon di oxide
- Wild life habitat – 7 million species in tropical forests alone
- Regulation of hydrological cycle – prevent surface run off – giant sponges – 50-80% moisture.
- Soil conservation – hold solid particles tightly and prevent soil erosion – wind breaks.
- Pollution moderators: absorb toxic gases and purify air reduce noise pollution.

ASSOCIATED PROBLEMS OF FOREST RESOURCES

DEFORESTATION

Deforestation is mainly done for the following reasons:

- For shifting of Cultivation
- For fuel requirement

- To get raw materials for industrial use
- For the developmental projects of the Government
- To meet the growing food needs
- By overgrazing

CONSEQUENCES OF DEFORESTATION

1. Threatens many wild life species due to destruction of natural habitat
2. Biodiversity is lost along with that genetic diversity
3. Hilly regions are made prone to landslides
4. Soil erosion and loss of soil fertility
5. Hydrological cycle is affected

(loss of rainfall, flood, drought etc)

TIMBER EXTRACTION AND MINING

The important effects of timber extraction are

- thinning of forests
- loss of biodiversity, particularly tr ee breading species
- soil erosion and loss of soil fertility
- migration of tribal people from one place to another in search of new forest
- extinction of tribal people and their culture

CONSTRUCTION OF DAMS

Uses of dams are

- Dams are regarded as symbol of national development.
- provides large scale employment of tribal people and increase the std. of living of
- them
- contribute for economic uplift and growth

- help in checking flood
- generate electricity
- reduce power and water shortage
- provide irrigation water
- provide drinking water to remote areas
- promote navigation and fishery.

Associated Environmental problems:

1. Displacement of tribal people
2. Loss of flora and fauna
3. Siltation and sedimentation near reservoir
4. Stagnation and water logging near reservoir
5. Growth of aquatic weeds
6. Micro climatic changes
7. causes earthquakes
8. Breeding of disease vectors

WATER RESOURCES

- Water is an indispensible resource. Around 97% of world surface is covered with water. Most of the animals and plants have 60-65% of water in their body.

USES OF WATER RESOURCES

Water is used for

- Domestic
- irrigation and
- industrial purposes

ASSOCIATED PROBLEMS OF WATER RESOURCES

- Due to economic development, rapid industrial growth and population explosion over utilization of ground water leads to rapid depletion of water resources, ground subsidence, lowering of water table and water logging.
- The use of ground water and surface water rate which are higher than that of recharge ultimately leads to Water scarcity, Water logging, Salination, alkalization.
- creates declining of water levels
- crops failure and reduction in agricultural production
- over pumping of ground water create drought and food shortage
- over pumping of ground water sea water intrusion in coastal aquifers
- land subsidence may due to over pumping of ground water
- river pollution due to industrial activities and dumping of waste into rivers, which in turn force to utilize the ground water, ultimately leads to over pumping

Flood: over flow of water, whenever the water in flow is greater than the carrying capacity of the channels flood occurs.

Causes:

- heavy rainfall, snow melt, sudden release of water from dams.
- Prolonged down pour leading to overflowing of rivers and lakes
- Reduction in carrying capacity due to obstructions or sediments etc.
- Deforestation, overgrazing, mining increases water run off
- Removal of dense forests from hilly regions

Effects:

- Submerges the flooded area
- Loss of soil fertility due to soil erosion
- Extinction of civilization at costal area

Flood management:

- Dams and reservoirs can be constructed
- Embankments and proper channel management
- Flood way should not be encroached
- Forecasting or flood warning
- Decrease of run off by infiltration through afforestation or rain water harvesting etc.

Drought : Unpredictable delay in climatic condition occurring due to monsoon rain failure.

Types:

- **Meterological** : in order of month or year, actual moisture supply at a given place consistently falls below critical level.
- **Hydrological:** deficiency in surface and subsurface water supplies
- **Agricultural:** inadequate soil moisture to meet the need of a particular crop at particular time or susceptibility of crops during different stages in its development
- **Socioeconomic:** reduction in the availability of food and social securing of people

Causes:

- Deforestation and lesser rainfalls coupled with cutting of trees for timber leads to desertifictation.
- Over drafting of ground water, subsidence of soil, drying of wetlands
- Pollution of soil with solid waste, industrial effluents etc makes land useless and dry

- Population explosion in man and livestock leads to enhanced requirement of timber, fuel wood, grazing
- Shifting cultivation

Effects:

- Increase of water in stream pond
- Ground water table get declined
- Loss of agricultural crops
- Loss of biodiversity
- Government spent a lot of money as drought relief fund

Control measures

- Rain water harvesting
- Watershed management
- Prevent deforestation
- Encourage afforestation

MINERAL RESOURCES

Environmental impacts of over extraction of mineral resources:

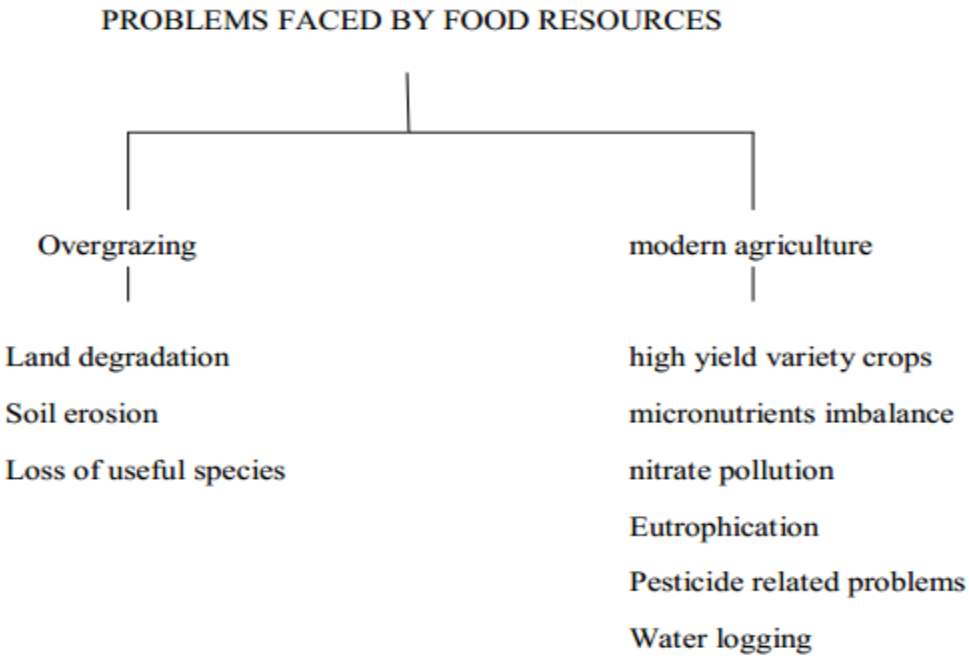
- Depending on the conditions of terrain and depth of ore deposits 2 types of mining operations are carried out. 1. open cast mining and 2. underground mining.

Both types of mining processes in each step produce several environmental effects such as,

- Deforestation takes place due to removal of vegetal covers.

- Great volume of debris has been generated which disrupt the surface and ground water circulation. It also reduces the water carrying capacity of streams very close to mining area
- The stacking of over burden and building of soil banks creates problems of landslides
- Under ground fire in coalmines is a hazard that is difficult to control
- Mining and ore processing normally causes air pollution and water pollution
- The acid water generated in coalmines can pose a serious problem of water pollution, which adversely affects the flora and fauna.
- Deeper excavation of ground causes lowering of water table, which leads to drying of wells or sea water intrusion
- In stone quarries, blasting of rocks not only annoying the people nearby, but also cause hazard from fly rocks and dusts and damage to buildings due to vibrations
- The disposal of waste material produced after concentrations of ore create increase concentration of heavy metals and toxic elements in the environment.

FOOD RESOURCES:



CHANGES CAUSED BY OVERGRAZING AND AGRICULTURE:

Overgrazing:

Process of eating away the vegetation along with its roots without giving a chance to regenerate

- Land degradation-leads to organically poor, dry, compacted soil cannot be used for further cultivation
- Soil erosion-cover of vegetation gets removed from soil
- Loss of useful species-good quality grasses and herbs with high nutritive value, when grazed lose even the root stocks which carry the reserve food for regeneration get destroyed which gives raise to secondary species like parthenium, Lantane, Xanthium etc
- To prevent –match the forage supplement to the herd¨s requirement.eg.Switch grass

Modern agriculture:

- The practice through which specific plant species are cared and managed so as to obtain maximum yield of consumable parts of plants –agriculture
- Makes use of hybrid seeds and selected and single crop variety, high tech equipment and lots of energy subsides in the form of fertilizers, pesticides and irrigation water e.g. green revolution

Due to modern agriculture

- Damage to soil occurs
- Water contamination takes place
- Water scarcity occurs
- Global climate change takes place
- Water logging-results when soil is over irrigated
- Soil salinity-increase plant productivity, interferes with water uptake by plants
- Fossil fuels and pesticides produce air pollution

Impacts related to high yielding varieties:

- Monoculture ie the same genotype is grown over vast areas. Disease spread easily
- Micronutrient imbalance e.g Zinc deficiency-affect soil productivity
- Nitrate pollution-nitrogenous fertilizers applied deep soil contaminates ground water. cause blue baby syndrome methaemoglobinemia- affects infants
- Eutrophication: Over nourishment of lakes due to agriculture field wash out -leads to algal bloom-dead organic matters increases due to decomposition-leads to oxygen demand

Problems associated with pesticide use:

- Evolution of genetic resistance
- Imbalance in ecosystem
- Creation of new pest
- Persistence, Bioaccumulation and Biomagnification
- Mobility through soil, water, air, washed away into rivers, streams, when it rains can harm fishes
- Creating super pest
- Death of non starget organisms
- Salinity
- Water logging

ENERGY RESOURCES

Growing energy needs:

- Population explosion, Luxurious life, Industries, Agriculture, mining, transportation, lighting, cooling, heating, building all need energy. Fossil fuels like coal, oil, natural gas produce 95% of energy

Sources of energy

Primary- Renewable energy-resources which can be generated continuously in nature and are in exhaustible and can be used again endlessly. wood, Tidal, Solar, wind, hydropower, biomass, biofuel, geothermal, hydrogen.

Non – renewable energy- Resources which have accumulated in nature over a long span of time and cannot be quickly replenished when exhausted.coal, petroleum, natural gas

Secondary-petrol, electrical energy, coal burning

Energy renewable	Advantage	Disadvantage
	1. Wide availability 2. Low cost 3. Decentralized power production 4. Low pollution 5. Available for the future	1. Unreliable supply 2. Produced in small quantity 3. Difficult to store 4. Cost more
Energy non renewable	1. Available in high concentrated form 2. Easy to store 3. Reliable supply 4. Lower cost	1.highly pollution Available only in few places High running cost Limited supply and will one day get exhausted

Use of alternate energy sources:

- Refers to energy sources which are not based on the burning of fossil fuels or the splitting of atoms. Such as solar energy, wind energy, hydro power, tidal energy, ocean thermal energy, geothermal energy, biomass energy.

LAND RESOURCE

- Land is critically important national resource which supports all living organisms including plants and animals. The soil profile of land determines its ability to serve socio-economic needs.

ASSOCIATED PROBLEMS

- Land Degradation: Land degradation is defined as the reduction in soil capacity to produce in terms of quality, quantity goods and services.
- Land slides- The hill slopes are prone to land slides, landslips, rockslides etc. These hazardous features have reduced the overall progress of the region as they obstruct the roads, communication media and water flow.
- Soil erosion:

ROLE OF INDIVIDUAL IN CONSERVATION OF NATURAL RESOURCES:

Natural resources are forest, water, soil, food, mineral and energy resources. Overuse of these resources cause problems

Conserve water:

- Don‟t keep water taps running
- Install water saving toilets
- Check for water leaks
- Reuse soapy water
- Use drip and sprinkling irrigation

Conserve energy

- Turn off lights, fan when not in use
- Use solar cooker for cooking
- Try riding bicycle

Protect soil:

- Don‟t uproot plants
- Grow grass which binds soil and prevent erosion
- Make compost
- Use green manure
- Don‟t over irrigate
- Use mixed cropping

EQUITABLE USEOF RESOURCES FOR SUSTAINABLE IFE STYLE:

- Most developed countries like USA, Canada, Japan, Australia have 22% of natural resources, use 88%.73%of its energy and command 85%of its income
- Less developed countries has 78% of population, 12% Usage of natural resources, 27% of energy, 15% of income
- Gap arises due to increase in population distribution of resources and wealth
- Problem solved by equitable distribution of resources and wealth
- Global consensus has to be reached for more balanced distribution of basic resources like safe drinking water, food, fuel etc. So poor low developed countries able to sustain their life
- Two basic cause of unsustainability are over population in poor countries and over consumption of resources by rich countries generate wastes
- Rich countries lower down their consumption level
- Poor countries fulfilled by providing them resources

POSSIBLE QUESTIONS

PART A (ONE MARKS – ONLINE EXAMINATIONS)

PART B (2 MARKS)

1. Define Natural resources
2. Write a short note on renewable resources.
3. Explain Land Resources
4. Differentiate renewable and non-renewable resources.
5. What are endangered species?
6. Mention any two functions of the ecosystem
7. Mention any two ill-effects of fireworks
8. Explain water conservation
9. Write a short note on energy resources
10. Write any 6 mineral resources.

PART (6 MARKS)

1 What is deforestation? What are its effects?

2 Describe the uses of various mineral resources available to man.

3 List any eight mineral resources stating their uses to mankind

4 Bring out the ill-effects of fireworks.

5 Explain the importance of land resources.

6 Discuss the effects of over-utilization of water resources.

7 What are the roles of individual on conservation of Natural resources?

8 Explain the different types of forest resources.

Unit III
SYLLABUS

Biodiversity and Its Conservation: Introduction, definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Biodiversity and its conservation

- Introduction
- Definition
- Genetic Biodiversity
- Species Biodiversity
- Ecosystem Diversity

Bio-geographical classification of India

Value of biodiversity

- Consumptive
- Productive uses
- Social
- Ethical
- Aesthetic and option values.

Threats to biodiversity

- Habitat loss
- Poaching of wildlife
- Man-wildlife conflicts.

Biodiversity and its conservation

- If we divide the whole earth's mass into 10 billion parts, it is only in one part where life exists and the astounding variety of living organ-isms numbering somewhere around 50 million species are all restricted to just about a kilometer- thick layer of soil, water and air. Isn't it wonderful to see that so much diversity has been created by nature on this earth from so little physical matter!

- Biodiversity refers to the variety and variability among all groups of living organisms and the ecosystem complexes in which they occur.
- From the driest deserts to the dense tropical rainforests and from the high snow-clad mountain peaks to the deepest of ocean trenches, life occurs in a marvellous spectrum of forms, size, colour and shape, each with unique ecological inter-relationships.
- Just imagine how monotonous and dull the world would have been had there been only a few species of living organisms that could be counted on fingertips!
- In the Convention of Biological diversity (1992) biodiversity y has been defined as the variability among living organisms from all sources including *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they arc a part.

Biodiversity

- Biodiversity is the abbreviated word for "biological diversity" (bio-life or living organisms, diversity-variety).
- Thus biodiversity is the total variety of life on our planet, the total number of races, varieties and species.
- The sum of total of various types of microbes, plants and animals (producers, consumers and decomposers) in a system.

Levels of Biodiversity

- Units of biodiversity may range from the genetic level within a species to the biota in a specific region and may extend up to the great diversity found in different biomes.

GENETIC DIVERSITY

- It is the basic source of biodiversity.
- The genes found in organisms can form enormous number of combinations each of which gives rise to some variability.
- Genes are the basic units of hereditary information transmitted from one generation to other.
- When the genes within the same species show different versions due to new combinations, it is called genetic variability.
- For example, all varieties belong to the species *Oryza*, but there are thousands of wild and cultivated varieties of rice which show variations at the genetic level and differ in their color, size, shape, aroma and nutrient content of the grain.
- This is the genetic diversity of rice.

SPECIES DIVERSITY

- This is the variability found within the population of a species or between different species of a community.
- It represents broadly the species richness and their abundance in a community.

- There are two popular indices of measuring species diversity known as *Shannon -Wiener index* and *Simpon index*.

What is the number of species on this biosphere?

- The estimates of actual number vary widely due to incomplete and indirect data.
- The current estimates given by Wilson in 1992 put the total number of living species in a range of 10 million to 50 million.
- Till now only about 1.5 million living and 300.000 fossil species have been actually described and given scientific names.
- It is quite likely that a large fraction of these species may become extinct even before they are discovered and en-listed.

ECOSYSTEM DIVERSITY

- This is the diversity of ecological complexity showing variations in ecological niches, strophic structure, food-webs, nutrient cycling etc.
- The ecosystems also show variations with respect to physical parameters like moisture, temperature, altitude, precipitation etc.
- Thus, there occurs tremendous diversity within the ecosystems, along these gradients.
- We may consider diversity in forest ecosystem, which is supposed to have mainly a dominance of trees.
- But, while considering a tropical rainforest, a tropical deciduous forest, a temperate deciduous forest and a boreal forest, the variations observed are just too many and they are mainly due to variations in the above mentioned physical factors.
- The ecosystem diversity is of great value that must be kept intact.
- This diversity has developed over millions of years of evolution.
- If we destroy this diversity, it would disrupt the ecological balance.
- We cannot even replace the diversity of one ecosystem by that of another.
- Coniferous trees of boreal forests cannot take up the function of the trees of tropical deciduous forest lands and vice versa, because ecosystem diversity has evolved with respect to the prevailing environmental conditions with well regulated ecological balance.

BIOGEOGRAPGHICAL CLASSIFICATION OF INDIA

- India has different types of climate and topography in different parts of the country and these variations have induced enormous variability in flora and fauna.
- India as a rich heritage of biological diversity and occupies the tenth position among the plant rich nations of the world.
- It is very important to study the distribution, evolution, dispersal and environmental relationship of plants and animals in time and space.
- Biogeography comprising of Phytogeography and zoogeography deals with these aspects of plants and animals.

- In order to gain insight about the distribution and environmental interactions of flora and fauna of our country, it has been classified into ten biogeographic zones.
- Each of these zones has its own characteristic climate, soil, topography and biodiversity.

India's major bio-geographic habitats

S. No.	Biogeographic Zone	Biotic Province	Total area (Sq.Km.)
1	Trans-Himalayan	Upper Regions	186200
2	Himalayan	North-West Himalayas West-Himalayas Central Himalayas East Himalayas	6900 720000 123000 83000
3	Desert	Kutch Thar Ladakh	45000 180000 NA
4	Semi-Arid	Central India Gujarat-Rajwara	107600 400400
5	Western Ghats	Malabar Coast Western Ghat Mountains	59700 99300
6	Deccan Peninsula	Deccan Plateau South Central Plateau Eastern Plateau Chhota Nagpur Central Highlands	378000 341000 198000 217000 287000
7	Gangetic Plain	Upper Gangetic Plain Lower Gangetic Plain	206400 153000
8	North-East India	Brahmaputra Valley North-Eastern Hills	65200 106200
9	Islands	Andaman Islands Nicobar Islands Lakshadweep Islands	6397 1930 180
10	Coasts	West Coast East Coast	6500 6500

Value of Biodiversity

- The value of biodiversity in terms of its commercial utility, ecological services, social and aesthetic value is enormous.
- We get benefits from other organisms in innumerable ways.
- Sometimes we realize and appreciate the value of the organism only after it is lost from his earth.

- Very small, insignificant, useless looking organisms may play a crucial role in the ecological balance of the ecosystem or may be a potential source of some invaluable drug for dreaded diseases like cancer or AIDS.
- The multiple uses of biodiversity or biodiversity value has been classified by McNeely *et al* in 1990.

i) Consumptive use value

- These are direct use values where the biodiversity product can be harvested and consumed directly.
    - E.g. fuel, food, drugs, fibre, etc.

Food

- A large number of wild plants are consumed by human beings as food.
- About 80,000 edible plant species have been reported from wild.
- About 90% of present day food crops have been domesticated from wild tropical plants.
- Even now our agricultural scientists make use of the existing wild species of plants that are closely related to our crop plants for developing new hardy strains.
- Wild relatives usually possess better tolerance and hardiness.
- A large number of wild animals are also our sources of food.

Drugs and medicines

- About 75% of the world's population depends upon plants or plant extracts for medicines.
- The wonder drug *Penicillin* used as an antibiotic is derived from a fungus called *penicillium.*
- Likewise, we get *Tetracyclin* from a bacterium.
- Quinine, the cure for malaria is obtained from the bark of Cinchona tree, while *Digitalin* is obtained from foxglove (Digitalis) which is an effective cure for heart aliments.
- Recently *vinblastin* and *vincristine,* two anticancer drugs, have been obtained from Periwinkle (*Catharanthus*) plant, which possesses anticancer alkaloids.
- A large number of marine animals are supposed to possess anti-cancer properties which are yet to be explored systematically.

Fuel

- Our forests have been used since ages for fuel wood.
- The fossil fuels coal, petroleum and natural gas arc also products of fossilized biodiversity.
- Firewood collected by individuals are not normally marketed, but are directly consumed by tribals and local villagers, hence falls under consumptive value.

ii) Productive use values

- These are the commercially usable values where the product is marketed and sold.
- It may include lumber or wild gene resources that can be traded for use by scientists for introducing desirable traits in the crops and domesticated animals.
- These may include the animal products like tusks of elephants, musk from musk deer, silk from silk-worm, wool from sheep, fir of many animals, lac from lac insects etc, all of which are traded in the market.
- Many industries are dependent upon the productive use values of biodiversity.
    - **E.g.** the paper and pulp industry, Plywood industry, Railway sleeper industry, Silk industry, textile industry, ivory-works, leather industry, pearl industry etc.
- Despite international ban on trade in products from endangered species, smuggling of fur, hide, horns, tusks, live specimen etc. worth millions of dollars are being sold every year.
- Developing countries in Asia, Africa and Latin America are the richest biodiversity centers and wild life products are smuggled and marketed in large quantities to some rich western countries and also to China and Hong Kong where export of cat skins and snake skins fetches a booming business.

iii) Social Value

- These are the values associated with the social life, customs, religion and psycho-spiritual aspects of the people.
- Many of the plants are considered holy and sacred in our country like Tulsi (holy basil), Peepal, Mango, Lotus, Bael etc.
- The leaves, fruits of flowers of these plants are used in worship or the plant itself is worshipped.
- The tribal people are very closely linked with the wild life in the forests.
- Their social life, songs, dances and customs are closely woven around the wildlife.
- Many animals like Cow, Snake, Bull, Peacock, Owl etc. also have significant place in our psycho-spiritual arena and thus hold special social importance.
- Thus biodiversity has distinct social value, attached with different societies.

iv) Ethical value

- It is also sometimes known as existence value.
- It involves ethical issues like "all life must be preserved".
- It is based on the concept of "Live and Let Live".
- If we want our human race to survive, then we must protect all biodiversity, because biodiversity is valuable.
- The ethical value means that we may or may not use a species, but knowing the very fact that this species exists in nature gives us pleasure.
- We all feel sorry when we learn that "passenger pegion" or "dodo" is no more on this earth.
- We are not deriving anything direct from Kangaroo, Zebra or Giraffe, but we all strongly that these species should exist in nature.
- This means, there is an ethical value or existence value attached to each species.

v) Aesthetic value

- Great aesthetic value is attached to biodiversity.
- No one of us would like to visit vast stretches of barren lands with no signs of visible life.
- People from far and wide spend a lot of time and money to visit wilderness areas where they can enjoy the aesthetic value of biodiversity and this type of tourism is now known as eco-tourism.
- The "Willingness to pay" concept on such eco-tourism gives us even a monetary estimate for aesthetic value of biodiversity.
- Ecotourism is estimated to generate about 12 billion dollars of revenue annually that roughly gives the aesthetic value of biodiversity.

vi) Option values

- These values include the potentials of biodiversity that are presently unknown and need to be explored.
- There is a possibility that we may have some potential cure for AIDS or cancer existing within the depths of a marine ecosystem, or a tropical rain-forest.
- Thus option value is the value of knowing that there are biological resources existing on this biosphere that may one day prove to be an effective option for something important in the future.
- Thus, the option value of biodiversity suggests that any species may prove to be a miracle species someday.
- The biodiversity is like precious gills of nature presented to us.
- We should not commit the folly of losing these gills even before unwrapping them.
- The option value also includes the values, in terms of the option to visit areas where a variety of flora and fauna, or specifically some endemic, rare or endangered species exist.

vii) Ecosystem service value

- Recently, a non-consumptive use value related to self maintenance of the ecosystem and various important ecosystem services has been recognized.
- It refers to the services provided by ecosystems like prevention of soil erosion, prevention of floods, maintenance of soil fertility, cycling of nutrients, fixation of nitrogen, cycling of water, their role as carbon sinks, pollutant absorption and reduction of the threat of global warming etc.
- Different categories of biodiversity value clearly indicate that ecosystem, species and genetic diversity all have enormous potential and a decline in biodiversity will lead to huge economic, ecological and socio-cultural loss.

THREATS TO BIODIVERSITY

- Extinction or elimination of a species is a natural process of evolution.
- In the geologic period the earth has experienced mass extinctions.

- During evolution, species have died out and have been replaced by others.
- However, the rate of loss of species in geological past has been a slow process, keeping in view the vast span of time going back to 444 million years.
- The process of extinction has become particularly fast in the recent years of human civilization.
- In this century, the human impact has been so serve that thousands of species and varieties are becoming extinct annually.
- One of the estimates by the noted ecologist, E.O. Wilson puts the figure of extinction at 10, 000 species per year or 27 per day.
- This startling figure raises an alarm regarding the serious threat to biodiversity.
- Over the last 150 years the rate of extinction has escalated more dramatically.
- If the present trend continues we would lose $1/3^{rd}$ to $2/3^{rd}$ of our current biodiversity by the middle of twenty first century.
- Let us consider some of the major causes and issues related to threats to biodiversity.

LOSS OF HABITAT

- Destruction and loss of natural habitat is the single largest cause of biodiversity loss.
- Billions of hectares of forests and grasslands have been cleared over the past 10,000 years for conversion into agricultural lands, pastures, settlement areas or development projects.
- These natural forests and grasslands were the natural homes of thousands of species which perished due to loss of their natural habitat.
- Severe damage has been caused to wetlands thinking them to be useless ecosystems.
- The unique rich biodiversity of the wetlands, estuaries and mangroves are under the most serious threat today.
- The wetlands are destroyed due to draining, filling and pollution thereby causing huge biodiversity loss.
- Sometimes the loss of habitat is in installments so that the habitat is divided into small and scattered patches, a phenomenon known as habitat fragmentation.
- There are many wild life species such as bears and large cats that require large territories to subsist.
- They get badly threatened as they breed only in the interiors of the forests.
- Due to habitat fragmentation many song birds are vanishing.
- There has been a rapid disappearance of tropical forests in our country also, at a rate of about 0.6% per year.
- With the current rate of loss of forest habitat, it is estimated that 20-25% of the global flora would be lost within a few years.
- Marine biodiversity is also under serious threat due to large scale destruction of the fragile breeding and feeding grounds of our oceanic fish and other species, as a result of human intervention.

POACHING

- Illegal trade of wildlife products by killing prohibited endangered animals i.e., poaching is another threat to wildlife.
- Despite international ban on trade in products from endangered species, smuggling of wildlife items like furs, hides, horns, tusks, live specimens and herbal products worth millions of dollars per year continuous.
- The developing nations in Asia, Latin America and Africa are the richest source of biodiversity and have enormous wealth of wildlife.
- The rich countries in Europe and North America and some affluent countries in Asia like Japan, Taiwan and Hong Kong are the major importers of the wild life products or wild life itself.
- The trading of such wild life products is highly profit making for the products who just hunt these prohibited wild life and smuggle it to other countries mediated through a mafia.
- The cost of elephant tusks can go upto $100 per kg; the leopard fur coat is sold at $100,000 in Japan while bird catchers can fetch upto $10,000 for a rare hyacinth macaw, a beautiful coloured bird, from Brazil.
- The worse part of the story is that for every live animal that actually gets into the market, about 50 additional animals are caught and killed.
- If you are fond of rare plants, fish or birds, please make sure that you are not going for the endangered species or the wild-caught species.
- Doing so will help in checking further decline of these species.
- Also do not purchase furcoat, purse or bag, or items made of crocodile skin or python skin.
- You will certainly help in preserving biodiversity by doing so.

MAN-WILDLIFE CONFLICTS

- We have discussed about the need to preserve and protect our wildlife.
- However, sometimes we come across conflicting situations when wildlife starts causing immense damage and danger to man and under such conditions it becomes very difficult for the forest department to pacify the affected villagers and gain local support for wild-life conservation.
- Instances of man animal conflicts keep on coming to lime light from several states in our country.
- In Sambalpur, Orissa 195 humans were killed in the last 5 years by elephants.
- In retaliation the villagers killed 98 elephants and badly injured 30 elephants.
- Several instances of killing of elephants in the border regions of Kote-Chamarajanagar belt in Mysore have been reported recently.
- The man-elephant conflict in this region has arisen because of the massive damage done by the elephants to the farmer’s cotton and sugarcane crops.
- The agonized villagers electrocute the elephants and sometimes hide explosives in the sugarcane fields, which explode as the elephants intrude into their fields.

- In fact, more killings are done by locals than by poachers.
- Recently, in early 2004, a man-eating tiger was reported to kill 16 Nepalese people and one 4-year old child inside the Royal Chitwan National Park, 240Km South west of Kathmandu.
- The Park renowned for its wildlife conservation effort has become a zone of terror for the locals.
- At times, such conflicting situations have been reported from the border regions of Corbett, Dudhwa, Palamau and Ranthambore National Parks in our country as well.
- Very recently in June, 2004 two men were killed by leopards in Powai, Mumbai.
- A total of 14 persons were killed during 19 attacks since January by the leopards from the Sanjay Gandhi National Park, Mumbai which has created a panic among the local residents.

Causes of Man-animal conflicts

- Dwindling habitats of tigers, elephants, rhinos and bears due to shrinking forest cover compels them to move outside the forest and attack the field or sometimes even humans.
- Human encroachment into the forest areas raises a conflict between man and the wildlife, perhaps because it is an issue of survival of both.
- Usually the ill, weak and injured animals have a tendency to attack man.
- Also, the female tigress attacks the human if she feels that her newborn cubs are in danger.
- But the biggest problem is that if human-flesh is tasted once then the tiger does not eat any other animal.
- At the same time, it is very difficult to trace and cull the man-eating tiger and in the process many innocent tigers are also killed.
- Earlier, forest departments used to cultivate paddy, sugarcane etc. within the sanctuaries when the favorite staple food of elephants i.e. bamboo leaves were not available.
- Now due to lack of such practices the animals move out of the forest in search of food.
- It may be noted that, one adult elephant needs 2 quintals of green fodder and 150 kg of clean water daily and if it is not available, the animal strays out.
- Very often the villagers put electric wiring around their ripe crop fields.
- The elephants get injured, suffer in pain and turn violent.
- Earlier there used to be wild-life corridors through which the wild animals used to migrate seasonally in groups to other areas.
- Due to development of human settlements in these corridors, the path of wildlife has been disrupted and the animals attack the settlements.
- The cash compensation paid by the government in lieu of the damage caused to the farmers crop is not enough.
- In Mysore, a farmer gets a compensation of Rs. 400//- per quintal of expected yield while the market price is Rs. 2400/- per quintal.
- The agonized farmer therefore gets revengeful and kills the wild animals.

Remedial Measures to Curb the Conflict

- Tiger conservation project (TCP) has made provisions for making available, vehicles, tranquillizer guns, binoculars and radio sets etc. to tactfully deal with any imminent danger.
- Adequate crop compensation and cattle compensation scheme must be started, along with substantial cash compensation for loss of human life.
- Solar powered fencing should be provided along with electric current proof trenches to prevent the animals from straying into fields.
- Cropping pattern should be changed near the forest borders and adequate fodder, fruit and water should be made available for the elephants within forest zones.
- Wild life corridors should be provided for mass migration of big animals during unfavorable periods.
- About 300 km^2 area is required for elephant corridors for their seasonal migration.
- In similipal Sanctuary, Orissa there is a ritual of wild animal hunting during the months of April-May for which forest is burnt to flush out the animals. Due to massive hunting by people, there is a decline in prey of tigers and they start coming out of the forest in search of prey.
- Now there is WWF-TCP initiative to curb this ritual of "Akhand Shikar" in Orissa.

Unit IV
Environmental Pollution

Environmental Pollution - Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution , Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: Foods, earthquake, cyclone and landslides.

ENVIRONMENTAL POLLUTION

Definition

Pollution may be defined as an undesirable change in the physical, chemical or biological characteristics of our air, water and land that may or will harmfully affect human life, the lives of the desirable species, our industrial processes, living conditions and cultured assets, or that may or will waste or deteriorate our raw material resources.

Types of environmental pollution

- Air pollution
- Water pollution
- Soil pollution
- Marine pollution
- Noise pollution
- Thermal pollution
- Nuclear hazards

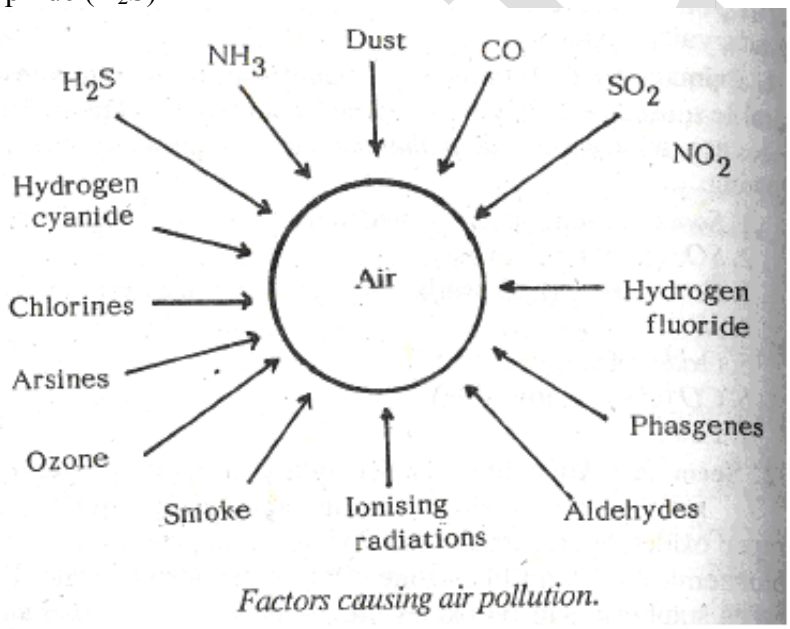
AIR POLLUTION

- Air pollution refers to the undesirable change occurring in air causing harmful effects on man and domesticated species.

UNIT IV- ENVIRONMENTAL POLLUTION

Air pollutants

- Dust
- Smoke
- Sulphur oxides (CO)
- Nitrogen oxides (SO_2)
- Ammonia (NH_3)
- Nitrogen dioxide(NO_2)
- Hydrogen cyanide
- Hydrogen fluorides
- Hydrogen sulphide (H_2S)
- Chlorines
- Phosgenes
- Arsines
- Aldehydes
- Ozone
- Ionizing radiations
- CO_2



Factors causing air pollution.

Air pollutants are two types

- Primary air pollutants
- Secondary air pollutants

Primary Air Pollutants

- Air is polluted by poisonous gases and undesirable substances.
- They are released by burning fossil fuels.
- These substances are called primary air pollutants.
- The tissues present in the tip of dusheri mango turns black when they are exposed to sulphur dioxide (SO_2) fumes.

The primary pollutants are following

- Soot released from unburned fuel
- SO_2
- Benzopyrene (hydrocarbon) released from cigarette smoke.
- NH_3
- Oxides of nitrogen
- CO (carbon monoxide)
- Lead

Secondary Air Pollutants

- Secondary air pollutants are poisonous nitrogen oxides, hydrocarbons and O_2 interact to produce more powerful photochemical oxidants like ozone (O_3), peroxyacetyl nitrate (PAN), Aldehydes, sulphuric acid, peroxides, etc.
- All these constitute photochemical smog.

CAUSES OF AIR POLLUTION

Agriculture

- Hydrocarbons released by plants, pollen grains, insecticides etc. cause air pollution.

Dust

- Dust in the air is increased by dust storms, wind, volcanoes, automobiles, etc.

Industries

- The Combustion of fossil fuels like coal, petroleum, etc. in industries is the main source of pollution.

Automobiles

- The combustion of petrol and diesel in automobiles releases harmful gases into the air.
- They also produce dust.

Ionising Radiations

- Ionizing radiations include alpha particle, beta particles and gamma rays.
- They are released into the air from testing atomic weapons and atomic explosions.

Freons

- Use of freons and other chlorine-flourine-carbons as refrigerants, coolants and as filling agents in aerosol pachages cause pollution.

Aerosols

- Aerosols are small particles of all sorts of solid or liquid substances suspended in the air.
- They block the stomata of plants and prevent he gaseous exchanges between plants and atmosphere.
- They may also change the climate of an area.

UNIT IV- ENVIRONMENTAL POLLUTION

Biological indicators

- Some plants are sensitive to certain air pollutants.
- These plants are used to indicate the presence of these substances.
- These plants are called biological indicators

Example

- Pinto beans and petunias are used to indicate the presence of peroxy acetyl nitrate (PAN).
- Tobacco and annual blue-grass plants are used to show the presence of ozone (O_3).

ECOLOGICAL EFFECTS OF AIR POLLUTION

Death

When air is polluted with poisonous gases, death comes as a result immediately. Bopha episode is a good example.

Bhopal episode

- On 2nd December 1984about 3000 human beings died about 5000 paralysed and thousands of cattle, bird, dogs and cats died in one night at Bhopal.
- This mass death is due to the leakage of methyl isocyanate (toxic gas) into the air from art insecticide plant managed by Union Carbide.

Chlorosis

- The disappearance of chlorophyll is called Chlorosis.
- It is caused by SO_2 and fluorides present in the air.

Necrosis

- The breakdown of cells is called necrosis.
- It is caused by SO_2, nitrogen dioxide, ozone and fluorides.

Green house effect

- CO_2 is released into the air by the combustion of fuels.
- It is estimated that CO_2 content of the is increasing at the rated 0.4% per annum.
- This will result in an appreciable warming up of the ear.
- This is called green house effect.
- It is very likely that this will cause the melting of polar ice caps resulting in a rise of nearly 60 feet on the sea level.
- Coastal regions and low lying areas allover the world will be go under water.

UNIT IV- ENVIRONMENTAL POLLUTION

Crop losses

- Heavy loss of crop plants is caused by smog.
- Smog denotes a combination of smoke and fog.
- The important components of s ozone and PAN (Peroxyacetyl nitrate).
- They damage leafy vegetables, cereals, textile crops, ornamental plants, fruits and forest trees.

Respiratory disorders

- Excessive ethylene accelerates respiration causing premature senescence (old age) and abscission (accumulation of yellow fluid (pus) in the body).
- Aldehydes irritate nasal and respiratory tracts.
- Chlorine and phosgenes (carbonyl chloride) cause pulmonary oedema.

Nausea

- H_2S smells like rotten eggs and nausea.

Vomiting

- SO_2 causes vomiting.

Jaundice

- Arsines induce RBC breakdown and jaundice.

Oxygen carrying capacity

- CO reduces O_2 carrying capacity of RBC by its permanent combination with haemoglobin.

Coughing

- Coughing is induced by phosgenes (carbonyl chloride).

Headache

- SO_2 causes headache.

Cancer

- Cancer is caused by air pollutants like ash, soot, smoke. chromium, nickel and radioactive elements.

Mutation

- Radioactive elements produce mutation.

- Ozone produces chromosomal aberrations.

Cardiac diseases

- Cadmium causes high blood pressure and heart diseases.

Pneumonia

- Pneumonia is caused by breathing in too much of manganese particles.

Depletion of Ozone Umbrella

- Intheatmosphere, about 30km above the surface of the earth, the ozone molecules (O_3) form an umbrella.
- It prevents the penetration of harmful ultra violet radiation from the sun and thus protects the life of the earth.
- It is now feared that there is danger of appearing holes on the ozone umbrella.
- This is caused by the use of freons and other chlorine-fluorine-carbons as refrigerents, coolants in domestic refrigerators and otter cold storage facilities, and as filling agents in foam plastics and in aerosol packages.
- Reaching ozone umbrella, they destroy ozone molecules as a result of photochemical reactions.
- Over the past 16 years, the density of the ozone layer has been diminishing at an average rate of 3%.
- It is calculated that the depletion of ozone layer by I% results in an increase in the incidence of skin cancer by 5% to 7%.

Acid Rains

- One of the major environmental issues facing human society at the National and International level is the problem of acid.
- The rainwater is always slightly acidic as CO_2 in the atmosphere gets dissolved in it.
- However during recent years, it has been noted a further lowering of pH of rainwater often as 2.4.
- This lowering of pH is due to the dissolution of acids in the rain water.
- Precipitation of oxides of sulphur and nitrogen with rain is termed acid rain.
- Acid rain is caused by air pollution.
- When atmospheric air contains sulphur dioxide (SO_2) and oxides of nitrogen such as nitrous oxide (N_2O) and nitric oxide (NO), they dissolve in rainwater forming sulphuric acid and nitric acid.
- The rain water falls as acid rain.
- The main source of oxides of sulphur and nitrogen is the burning of fossil fuels in power plants based on coal and oil contribute more than 60% of all sulphur oxides and 25 to 20% of nitrogen oxides in the atmosphere.
- Automobiles make a sustainable contribution in large cities.
- Ozone is now recognized as a major factor in the formation of acid rain.

- Acid rain affects both materials and organisms.
- It attacks building materials principally sandstone, limestone, marble, steel and nickel.
- In plants, it leads to Chlorosis (gradual yellowing in which the chlorophyll making mechanism is impeded) or depigmentation of leaves.
- Acid rain increases the acidity of lakes and rivers.
- Vast tracts of forests and lakes in Europe and North America have been destroyed by acid.

- Acidity kills fish, bacteria and algae and the aquatic ecosystem collapses into sterility leaving a crystal clear but ultimately a dead lake

CONTROL OF AIR POLLUTION

- The emission of exhaust from automobiles can be reduced by devices, such as positive crankcase ventilation valve and catalytic converter.
- Electrostatic precipitators can reduce smoke and dust from industries.
- Later birds, cats and dogs which me the marine animals died.
- Finally many men who ate fish, crabs and shell fish died.
- Their initial symptoms of Minamata disease include the numbness of limbs, lips and tongue, impairment of motor control, deafness and blurring of vision.
- Finally it affects and destroys the brain.
- As a result of the attack of Minamata disease about 17 persons died and 23 became permanently disabled in the year 1953, in Japan.

Diarrhoea

- It is caused by mercury, cadmium and cobalt.

Mortality of Plankton and Fish

- Chlorine which is added to water control the growth of algae and bacteria in the cooling system of power stations may persist in streams to cause the mortality of plankton and fish.

Reduction in Productivity

- Intensive agriculture increases the amount of silt in lakes and rivers.
- Silt prevents the penetration of light to depths and thus reduces primary production.

Siltation

- Siltation is a phenomenon by which the gills of fish deposited with silt.
- This causes heavy mortality among fishes.

Poor Oxygenation

- Oil present on the surface of water prevents water oxygenation.
- This reduces respiration and metabolism in aquatic organisms.

Poor Photosynthesis

- Oil-pollution prevents photosynthesis in phytoplankton.

Red Tide

- When coastal waters are enriched with nutrients of sewage dinoflagellates multiply rapidly and form bloom.
- This blooming lat. liberate into the water toxic metabolic by-products which can result in a large scale death of marine fishes.
- This is called red tide.

Biochemical Oxygen Demand

- Sewage enriches the water with nutrients.
- This causes rapid growth of plankton and algae.
- This leads to oxygen depletion in water.
- The oxygen depletion causes the death of algae.
- They decay and decomposition of algae consumes more oxygen from water.
- Biochemical Oxygen Demand or biological oxygen demand (BOD) is the amount of oxygen required by the microorganisms in water.
- BOD is higher in polluted water (sewage) and lesser in drinking water.
- Increased BOD lowers the contents of dissolved O_2 in water causing the suffocation and death of aquatic flora and fauna.

Water-borne diseases

- Disease like jaundice, cholera, typhoid, diarrhoea, etc. are transmitted through water contaminated with sewage.

Methaemoglobinema

- The nitrate used in fertilizers enters the intestine of man through drinking water.
- In the intestine it is converted into nitrite.
- Nitrite is absorbed into the blood where it combines with haemoglobin to form methaemoglobin: Methaemoglobin cannot transport oxygen.
- This leads to suffocation and breathing troubles, especially in infants.
- This disease is called methaemoglobinema.
- Gaseous pollutants arising from industries can be removed by differential solubility of gases in water.
- A finepray of water in the device called scrubber can separate many gases like NH_3, SO_2, etc. from the emitted exhaust.
- Certain gases can be removed by filtration or absorption through activated carbon.

- Certain gases can be made chemically inert by chemical conversion.
- At the Government level pollution can be controlled by framing legislations.

WATER POLLUTION

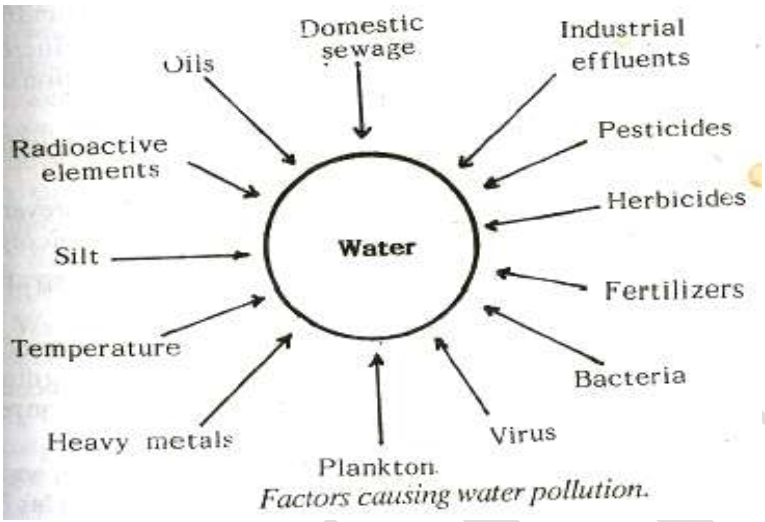
- Water is the soul of nature; its pollution will perish the world.
- Water pollution refers to the undesirable change occurring in water which may harmfully affect the life activities of man and domesticated species.

Water pollutants

The common water pollutants are as follows

- Domestic sewage
- Industrial effluents
- Pesticides
- Herbicides
- Fertilizers
- Bacteria and viruses
- Plankton blooms
- Heavy metals like mercury
- Temperature
- Silt
- Radioactivity
- Oils, etc.

UNIT IV- ENVIRONMENTAL POLLUTION



Factors causing water pollution.

CAUSES OF WATER POLLUTION

Domestic sewage

- Domestic sewage consists of human faeces, urine, and the dirty used-up water in houses.
- It contains a large number of pathogenic bacteria and virus.
- The sewage is released into the rivers on the banks of which most of the cities are situated.

Industrial effluents

- All industrial plants produce some organic and inorganic chemical wastes.
- Those nonusable chemicals are dumped in water as a means of getting rid of them.
- The industrial wastes include heavy metals (Hg, Cu, lead zinc etc), detergents, petroleum, acids, alkalies, phenols, carbonate, alcohol cyanides, arsenic, chlorine, etc.

Thermal Pollution

- Many industries use water for cooling.
- The resultant warm water is discharged into rivers.
- This brings about thermal pollution.

Agricultural pollution

- The fertilizers used for crops are washed into ponds and rivers.

Pesticides

- Pesticides are used to control pests in fields and houses.
- They include DDT, BHC, endrin etc.

UNIT IV- ENVIRONMENTAL POLLUTION

Radioactive wastes

- Liquid radioactive wastes are released into the sea around nuclear installations.
- The oceanic currents carry the radioactive contaminants everywhere.
- Oil pollution
- Oil is a source of pollution in sea-water.
- Oil pollution is due to ship accidents, loading and discharging of oil at the harbour, oil refineries and off-shore oil production.

Retting

- The process of decaying coconut husk to get fibre for making coir is called retting.
- Retting releases H_2S.
- It makes water polluted.

ECOLOGICAL EFFECTS OF WATER POLLUTION

Minamata disease

- This disease is caused by mercury poisoning.
- It is characterized by crippling and death.
- This disease appeared in a coastal town, Minamata, in Japan.
- The primary cause for this disease was a p industry which was started on the san coast of Japan in 1905.
- From this factory a by-product called mercury was disposed into the sea.
- This mercury cumulated in marine animals.

Eutrophication

- Domestic sewage and fertilizers add large quantities of nutrients such as nitrates and phosphates to the fresh water ecosystems.
- The rich supply of these nutrients makes blue green algae, green algae and other phytoplankton to grow abundantly.
- This increased productivity of lakes and ponds brought about by nutrient enrichment is known as eutrophication.
- As the algae use O_2 of the water for respiration, the O_2 is depleted from the water.
- The rapid growth also consumes all the nutrients of the water.
- The depletion of O_2 and nutrients lead to the death of algae and other phytoplankton.
- As other organisms, such as zooplankton and fishes of the water, depend on the blue green algae and phytoplankton for their food, they also die.
- This eutrophication leads to the complete depletion of the fauna from the ecosystem.

CONTROL OF WATER POLLUTION

Sewage Treatment

UNIT IV- ENVIRONMENTAL POLLUTION

Pollution control by sewage treatment includes the following steps

- Sedimentation
- Dilution
- Storage

(i) Sedimentation

- When sewage is allowed to stand, the suspended particles settle to the bottom.
- So by sedimentation the suspended particles are removed from sewage.

(ii) Dilution

- The sewage can be diluted with water.
- This increases the O_2 contents and reduces BOD and CO_2.

(iii) Storage

- The diluted sewage is stored in a pond.
- This facilities the growth of microorganisms.
- This renders further oxidation of sewage.

Waste stabilization pond or oxidation pond

- The national Environmental Engineering Research Institute (NEERI) at Nagpur has devised a very economical method for the treatment of industrial and domestic effluents.
- Domestic and industrial wastes are stored in a dilute condition in shallow ponds called oxidation or stabilization ponds.
- After a few days micro-organisms and algae flourish.
- The micro-organisms decompose the organic wastes by oxidation, and the water is purified.
- This water is rich in nitrogen, phosphorus, potassium and other nutrients.
- This water can be used for fish agriculture etc.

Recycling

- Pollution can be prevented to a certain extent by reutilizing the wastes.
- This is called recycling.

Example

- The dung of cows and buffaloes can be used for the production of gobargas.
- Sewage can be used for irrigation fish culture after treatment in oxidation pond.
- Certain pollutants from industrial effluents can be removed by filtration and selective absorption.

- Excessive use of pesticides and herbicides should be avoided.
- At the Government level, legislations should be framed to control water pollution.

SOIL POLLUTION

- The contamination of soil by human and natural activities which may cause harmful effects on living beings.

Causes

- Industrial waste
- Urban waste
- Agricultural practices
- Radioactive pollutants
- Biological agent

Effects

- Affect human health
- Affect soil fertility
- Reduce soil productivity
- Cause abnormalities

Control measures

- Properly collect solid waste
- Microbial degradation
- Recovery of products from waste
- For methane generation, use cattle dung
- For biogas generation, use biodegradable organic waste

NOISE POLLUTION

- The word noise has a Latin origin nausea meaning a feeling of sickness at the stomach with an urge to vomit.
- Noise is defined as unwanted sound or sound without value.
- Noise pollution is the unwanted sound dumped into the environment.
- Noise is measured by the unit decibel (dB).
- One decibel is equal to the faintest sound that can be heard by the human ears.
- Some people feel discomfort with the sound of 85dB.
- But more people do not feel discomfort with the sound of 115 dB.
- Pain is usually felt at 145dB.

Causes of Noise Pollution

- Scooters

- Motor bikes
- Cars
- Tempos
- Vans
- Buses
- Trucks
- Tractors
- Aircrafts
- Supersonic aircrafts
- Motor boats
- Ships
- Loud speakers
- Loud pop-music
- Social gatherings
- Machines of factories
- Mills
- Industries
- Kitchen appliances
- Fire crackers and generators are some of the chief sources of pollutions.

ECOLOGICAL EFFECTS OF NOISE POLLUTION

- Noise diminishes the power of hearing.
- It gives pain to the ear.
- It interferes with communication-systems.
- It causes stress.
- It causes fright.
- It increases the rate of heart beat.
- It causes the constriction of blood vessels.
- It increases blood pressure.
- It causes head-ache.
- It causes the dilation of pupil of the eye.
- It causes emotional upsets and
- It causes deafness.
- Noise causes physical or mental fatigue and lack of concentration.
- In industrial situations this effect results in lowered efficiency, reduced work rate and higher chances for accident.
- Noise disturbs sleep.
- High frequency or ultrasonic sound can affect the semicircular canals of the internal ear and cause nausea and dizziness.

CONTROL OF NOISE POLLUTION

Noise pollution can be controlled in the following ways

- Legislations should be framed.
- The sources that generate unwanted sound should be reduced.
- Noisy automobiles should be condemned.
- Wheels of automobiles should be oiled properly.
- Industrialists must take up necessary steps to control noise.
- Loudspeakers should be set at a low sound.
- Trees absorb noise and thus reduce noise pollution. So thick vegetation must be grown around industries, cities and on the sides of roads.
- Noise-producing machines should be placed in closed rooms.
- Residential houses should be constructed far away from in factories and airports.

THERMAL POLLUTION

- Increase or decrease in the temperature of water, air and land by human activity is called thermal pollution.

Sources of thermal pollution

CO_2

- CO_2 is produced during the combustion of fuel in houses, factories, power stations, etc.
- It is also released by plants and animals in the process of respiration.
- The CO_2 contents of the atmosphere has gone up by 15% in the past 100 years.
- It is estimated that by the year 2000 AD the increase in the CO_2 contents of the air will be nearly 25%.
- This will result in an appreciable warming up of the earth.
- This is called green house effect.
- It is very likely that this will cause the melting of polar ice caps.
- This will result in an ice caps will lead to rise of nearly 60 feet in sea level.
- As a result coastal areas and low-lying areas all over the world will be flooded and will go under water.

Hot water

- Power stations, industries and nuclear reactors use large quantities of water for cooling purposes.
- The resulting hot waters are released into the rivers.

UNIT IV- ENVIRONMENTAL POLLUTION

ECOLOGICAL EFFECTS OF THERMAL POLLUTION

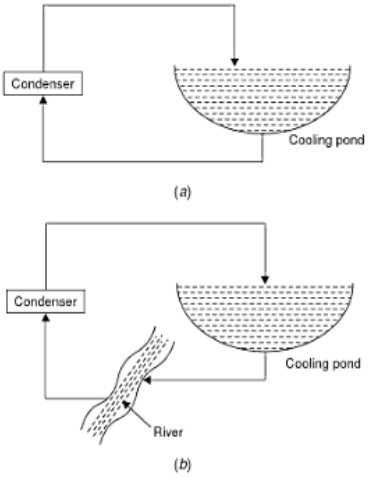
- When the temperature of the earth increases, ice caps melt. This will flood the coastal and low lying areas of land.
- A rise of 10°C in temperature increases the rate of exchange of salts between the organisms and the environment. This will accelerate the entry of toxins into the body from the external medium.

CONTROL OF THERMAL POLLUTION

- Cooling ponds
- Spray Ponds
- Cooling towers

Cooling Ponds

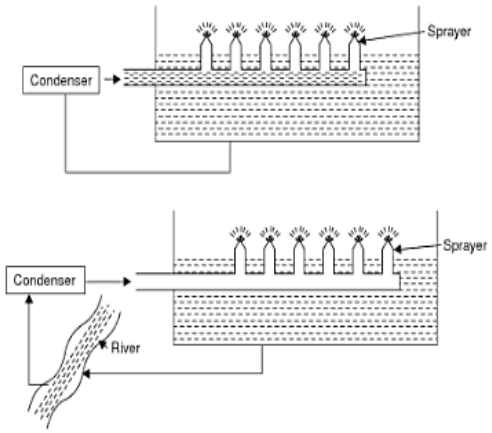
- Water from condensers is stored in ponds where natural evaporation cools the water which can then be recirculated or discharged in nearby water body.



Dissipation of heat by cooling ponds

Spray Ponds

- The water from condensers is received in spray ponds.
- Here the water is sprayed through nozzles where fine droplets are formed.
- Heat from these fine droplets is dissipated to the atmosphere.

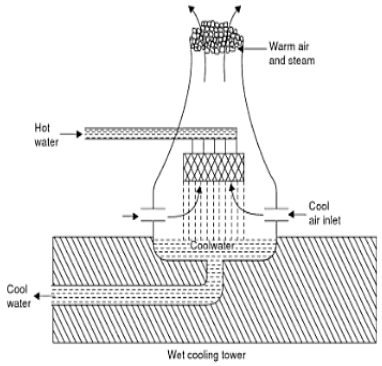


Dissipation of heat by spray ponds.

Cooling Towers

(i) Wet cooling tower

- Hot water is sprayed over baffles.
- Cool air entering from sides takes away the heat and cools the water.
- This cool water can be recycled or discharged.
- Large amount of water is lost through evaporation and in the vicinity of wet cooling tower extensive fog is formed which is not good for environment and causes damage to vegetation.

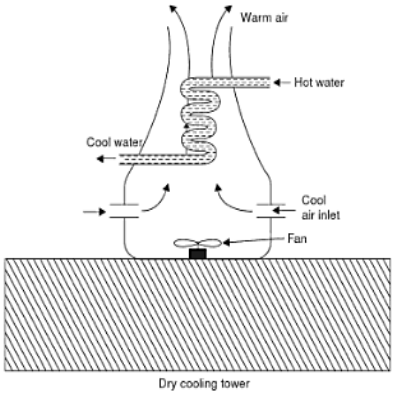


Wet cooling tower

(ii) Dry cooling tower

- The heated water flows in a system of pipes.
- Air is passed over these hot pipes with fans.
- There is no water loss in this method but installation and operation cost of dry cooling tower is many times higher than wet cooling tower.

UNIT IV- ENVIRONMENTAL POLLUTION



POSSIBLE QUESTIONS
PART A
ONE MARK
ONLINE EXAMINATION

PART B (2 MARKS)

1. Write short notes on human health.
2. Write a note on EP Act.
3. Define global warming.
4. Write briefly different phases of value of education.
5. Write short notes on RIO-summit.
6. What is green house effect?
7. Write short notes on deforestation.
8. Brief out energy policy act.
9. Write short notes on disposal of solid wastes.
10. What are the causes of earthquake?
11. Write short notes on preventive measures of disease.
12. List out any two causes of solid waste management.

UNIT IV- ENVIRONMENTAL POLLUTION

PART- C(6 MARKS)

1. Explain in detail about environment and human health
2. Give a detailed account on landslides and its disaster and rehabilitation management.
3. Discuss the causes, effects and control measures of solid waste management.
4. Explain in detail cyclone and its disaster management
5. Explain in detail about the value of education.
6. Write in detail the causes of earthquake and its disaster and rehabilitation management.
7. Give an detailed account on global warming and its causes
8. Discuss in detail about disaster and rehabilitation management for floods.
9. Give a detailed account on global warming and its causes.
10. Explain in detail about the disaster management.
11. Discuss in detail any two natural disasters and its consequence.

Unit V

SYLLABUS

Social Issues and the Environment: From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act.

Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Population growth, variation among nations. Population explosion—Family Welfare Programme. Environment and human health. Human rights. Value education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in environment and human health.

Social issues and the environment

- Urban problems related to energy
- Water conservation and management
- Rain water harvesting
- Water shed management
- Resettlement and Rehabitilisaion
- Natural resources and associated problems and sustainable utilization
- Environmental Education

SOCIAL ISSUES AND THE ENVIRONMENT

- Human beings live in both natural and social world. Our technological development has strong impacts on the natural as well as the social components.
- When we talk of development, it cannot be perceived as development only for a privileged few who would have a high standard of living and would derive all the benefits.
- Development has to be visualized in a holistic manner, where it brings benefits to all, not only for the present generation, but also for the future generations.

- There is an urgent need to inter-link the social aspects with development and environment.
- In this unit we shall discuss various social issues in relation to environment.

URBAN PROBLEMS RELATED TO ENERGY

- Cities are the main centers of economic growth, trade, education, innovations and employments.
- Until recently, a big majority of human population lived in rural areas and their economic activities centered around agriculture, cattle rearing, fishing, hunting or some cottage industry.
- It was some 200 years ago, with the dawn of industrial era, the cities showed a rapid development.
- Now about 50 percent of the world population lives in urban areas and there is increasing movement of rural folk to cities in search of development.
- The urban growth is so fast that is becoming difficult to accommodate all the industrial, commercial and residential facilities within a limited municipal boundary.
- As a result there is spreading of the cities into the sub-urban or rural areas too, a phenomenon known as urban sprawl.
- In developing countries too urban growth is very fast and in most of the cases it is uncontrollable and in planned growth.
- In contrast to the rural set-up the urban set-up is densely populated, consumes a lot of energy and materials and generates a lot of waste.
- The energy requirements of urban population are much higher than that of rural ones.
- This is because urban people have a higher standard of life and their life style demands more energy inputs in every sphere of life.

The energy demanding activities include

- Residential and commercial lighting.
- Transportation means including automobiles and public transport for moving from residence to workplace.
- Modern life-style using a large number of electrical gadgets in everyday life.
- Industrial plants using a big proportion of energy.
- A large amount of waste generation which has to be disposed off properly using energy based techniques.
- Control and prevention of air and water pollution which need energy dependent technologies.
- Due to high population density and high energy demanding activities, the urban problems related to energy are much more magnified as compared to the rural population.

WATER CONSERVATION AND MANAGEMENT

- Water being one of the most precious and indispensable resources needs to be conserved.
- The following strategies can be adopted for conservation of water.

Decreasing run-off losses

- Huge water-loss occurs due to run-off on most of the soils, which can be reduced by allowing most of the water to infiltrate into the soil.
- This can be achieved by using contour cultivation, terrace farming, water spreading, chemical treatment or improved water-storage system.

(i) Contour cultivation

- On small furrows and ridges across the slopes trap rainwater and allow more time for infiltration.
- Terracing constructed on deep soils have large water-storage capacity.
- On gentle slopes trapped run off is spread over a large area for better infiltration.

(ii) Conservation-bench terracing

- Conservation-bench terracing involves construction of a series of benches for catching the run off water.

(iii) Water spreading

- Water spreading is done by channeling or lagoon-leveling.
- In channeling, the water-flow is controlled by a series of diversions with vertical intervals.
- In lagoon leveling, small depressions are dug in the area so that there is temporary storage of water.

(iv) Chemical wetting agents (Surfactants)

- Chemical wetting agents (Surfactants) increase the water intake rates when added to normal irrigated soils.

(v) Surface crop residues

- Surface crop residues, Tillage, mulch, animal residues etc. help in reducing run-off by allowing more time for water to penetrate into the land.

(vi) Chemical conditioners

- Chemical conditioners like gypsum ($CaSO_4.2H_2O$) when applied to sodic soils improve soil permeability and reduce run off.
- Another useful conditioner is HPAN (hydrolysed polyacrylonitrile).

(vii) Water-storage structures

- Water storage structure like farm ponds, dug-outs etc. built by individual farmers can be useful measures for conserving water through reduction of runoff.

Reducing evaporation losses

- This is more relevant in humid regions.

- Horizontal barriers of asphalt placed below the soil surface increase water availability and increase crop yield by 33-40%.
- This is more effective on sandy soil but less effective on loamy sand soils.
- A co-polymer of starch and acrylonitrile called 'super slurper' has been reported to absorb water upto 1400 times its weight.
- The chemical has been found to be useful for sandy soils.

Storing water in soil

- Storage of water takes place in the soil root zone in humid regions when the soil is wetted to field capacity.
- By leaving the soil fallow for one season water can be made available for the crop grown in text season.

Reducing irrigation losses

- Use of lined or covered canals to reduce seepage.
- Irrigation in early morning or late evening to reduce evaporation losses.
- Sprinkling irrigation and drip irrigation to conserve water by 30-50%.
- Growing hybrid crop varieties with less water requirements and tolerance to saline water help conserve water.

Re-use of water

- Treated wastewater can be used for ferti-irrigation.
- Using grey water from washings, bath-tubs etc. for watering gardens, washings cars or paths help in saving fresh water.

Preventing wastage of water

- This can be done in house-holds, commercial buildings and public places.
    - Closing taps when not in use
    - Repairing any leakage from pipes
    - Using small capacity flush in toilets

Increasing block pricing

- The consumer has to pay a proportionately higher bill with higher use of water.
- This helps in economic use of water by the consumers

RAINWATER HARVESTING

- Rainwater harvesting is a technique of increasing the recharge of groundwater by capturing and storing rainwater.
- This is done by constructing special water-harvesting structures like dug wells, percolation pits, lagoons, check dams etc.
- Rainwater, wherever it falls, is captured and pollution of this water is prevented.

- Rainwater harvesting is not only proving useful for poor and scanty rainfall regions but also for the rich ones.
- The annual average rainfall in India is 1200 mm, However, in most places it is concentrated over the rainy season, from June to September.
- It is an astonishing fact that Cherapunji, the place receiving the second highest annual rainfall as 11000 mm suffers from water scarcity.
- The water flows with run off and there is little vegetation to check the run off and allow infiltration.
- Till now there is hardly any rain-water harvesting being done in this region, thereby losing all the water that comes through rainfall.

Rainwater harvesting has the following objectives

- To reduce run off loss
- To avoid flooding of roads
- To meet the increasing demands of water
- To raise the water table by recharging ground water
- To reduce groundwater contamination
- To supplement groundwater supplies during lean season.

Rainwater can be mainly harvested by any one of the following methods

- By storing in tanks or reservoirs above or below ground.
- By constructing pits, dug-we., lagoons, trench or check-dams on small rivulets
- By recharging the groundwater.

- Before adopting a rain-water harvesting system, the soil characteristics, topography, rainfall pattern and climatic conditions should be understood.

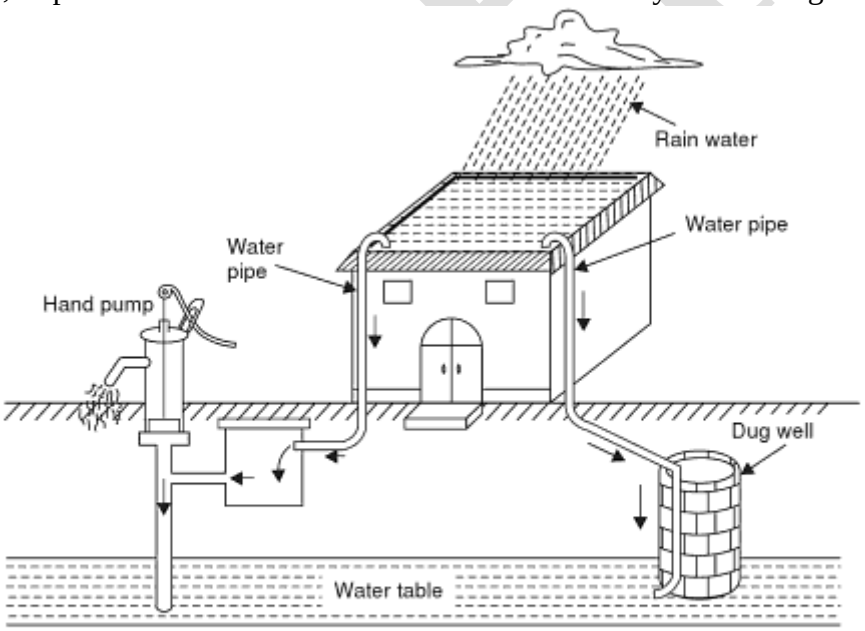
Traditional Rain Water Harvesting

- In India, it is an old practice in high rainfall areas to collect rainwater from roof-tops into storage tanks.
- In foot hills, water flowing from springs are collected by embankment type water storage.
- In Himalayan foot-hills people use the hollow bamboos as pipelines to transport the water of natural springs.
- Rajasthan is known for its `tankas' (under-ground tanks) and khadins (embankments) for harvesting rainwater.
- In our ancient times we had adequate Talaabs, Baawaris, Johars, Hata etc. in every city, village and capital cities of our kings and lords, which were used to collect rain-water and ensured adequate water supply in dry periods.

Modern Techniques of Rain Water Harvesting

- In arid and semi-arid regions artificial ground water recharging is done by constructing shallow percolation tanks.

- Check-dams made of any suitable native material (brush, poles, rocks, plants, loose rocks, wire-nets, stones, slabs, sacks etc.) are constructed for harvesting runoff from large catchment areas.
- Rajendra Singh of Rajasthan popularly known as "water man" has been doing a commendable job for harvesting rain-water by building check dams in Rajasthan and he was honoured with the prestigious Magsaysay Award for his work.
- Groundwater flow can be intercepted by building groundwater dams for storing water underground.
- As compared to surface dams, groundwater dams have several advantages like minimum evaporation loss, reduced chances of contamination etc.
- In roof top rainwater harvesting, which is a low cost and effective technique for urban houses and buildings, the rain-water from the top of the roofs is diverted to some surface tank or pit through a delivery system which can be later used for several purposes.
- Also, it can be used to recharge underground aquifers by diverting the stored water to some abandoned dug-well or by using a hand pump.
- All the above techniques of rainwater harvesting are low-cost methods with little maintenance expenses.
- Rainwater harvesting helps in recharging the aquifers, improves groundwater quality by dilution, improves soil moisture and reduces soil erosion by minimizing run-off water.



Roof-top rainwater harvesting by recharging
(*i*) through hand pump or (*ii*) through abondoned dugwell.

WATERSHED MANAGEMENT

- The watershed is defined as the land area from which water drains under gravity to a common drainage channel.

- Thus, watershed is a delineated area with a well-defined topographic boundary and one water outlet.
- The watershed can range from a few square kilometers to few thousand square kilometers in size.
- In the watershed the hydrological conditions are such that water becomes concentrated within a particular location like a river or a reservoir, by which the watershed is drained.
- The watershed comprises complex interactions of soil, landform, vegetation, land use activities and water.
- People and animals are an integral part of a watershed having mutual impacts on each other.
- We may live anywhere; we would be living in some watershed.
- A watershed affects us as it is directly involved in sustained food production, water supply for irrigation, power generation, and transportation as well as for influencing sedimentation and erosion, vegetation growth, floods and droughts.
- Thus, management of watersheds, treating them as a basic functional unit, is extremely important and the first such Integrated Watershed Management was adopted in 1949 by the Damodar Valley Corporation.

Watershed degradation

- The watersheds are very often found to be degraded due to uncontrolled, unplanned and unscientific land use activities.
- Overgrazing, deforestation, mining, construction activities, industrialization, shifting cultivation, natural and artificial fires, soil erosion and ignorance of local people have been responsible for degradation of various watersheds.

The objectives of watershed management are as follows:

- Rational utilization of land and water resources for optimum production causing minimum damage to the natural resources is known as watershed management.
- To rehabilitate the watershed through proper land use adopting conservation strategies for minimizing soil erosion and moisture retention so as to ensure good productivity of the land for the farmers.
- To manage the watershed for beneficial developmental activities like domestic water supply, irrigation, hydropower generation etc.
- To minimize the risks of floods, droughts and landslides.
- To develop rural areas in the region with clear plans for improving the economy of the region.

Watershed Management Practices

- In the Fifth Five Year Plan, watershed management approach was included with a number of programmes for it and a national policy was developed.
- In watershed management, the aspects of development are considered with regard to the availability of resources.

- The practices of conservation and development of land and water are taken up with respect to their suitability for peoples' benefit as well as sustainability.

Various measures taken up for management include the following:

(i) Water harvesting

- Proper storage of water is done with pro-vision for use in dry seasons in low rainfall areas.
- It also helps in moderation of floods.

(ii) Afforestation and Agroforestry

- In watershed development, afforestation and crop plantation play a very important role.
- They help to prevent soil erosion and retention of moisture.
- In high rainfall areas woody trees are grown in between crops to substantially reduce the runoff and loss of fertile soil.
- In Dehradun trees like Eucalyptus and Leucaena and grasses like Chysopogon are grown along with maize or wheat to achieve the above objectives.
- Woody trees grown successfully in such agroforestry programmes include Dalbergia sissoo (Sheesham), Tectona panda (Teak) and Acacia nilotica (Keekar) which have been used in watershed areas of river Yamuna.

(iii) Mechanical measures for reducing soil erosion and runoff losses

- Several mechanical measures like terracing, bunding, bench terracing, no-till farming, contour cropping, strip cropping etc. are used to minimize runoff and soil erosion particularly on the slopes of water-sheds.
- Bunding has proved to be a very useful method in reducing run-off, peak discharge and soil loss in Dehradun and Siwaliks.

(iv) Scientific mining and quarrying

- Due to improper mining, the hills lose stability and get disturbed resulting in landslides, rapid erosion etc.
- Contour trenching at an interval of 1 meter on overburden dump, planting some soil binding plants like Ipomoea and Vitex and draining of water courses in the mined area are recommended for minimizing the destructive effects of mining in watershed areas.

(v) Public participation

- People's involvement including the farmers and tribals is the key to the success of any watershed management programme, particularly the soil and water conservation.
- People's cooperation as well as participation has to be ensured for the same.
- The communities are to be motivated for protecting a freshly planted area and maintaining a water harvesting structure implemented by the government or some external agency (NGO) independently or by involving the local people.
- Properly educating the people about the campaign and its benefits or sometimes paying certain incentives to them can help in effective people's participation.

- Successful watershed management has been done at Sukhomajri Panchkula, Haryana through active participation of the local people.
- Watershed management in Himalayan region is of vital importance since most of the watersheds of our country lie here.
- Several anthropogenic activities accelerate its slope instability which needs to be prevented and efforts should be made to protect the watershed by preventing overgrazing, terracing and contour farming to check runoff and erosion etc.
- On steeper slopes with sliding faces, straw mulching tied with thin wires and ropes helps in establishing the vegetation and stabilizing the slopes.

RESETTLEMENT AND REHABITILISAION

Problems and Concerns

- Economic development raises the quality and standard of living of the people of a country.
- Developmental projects are planned to bring benefits to the society.
- However, in the process of development, very often there is over-exploitation of natural resources and degradation of the environment.
- Besides this, quite often, the native people of the project site are directly affected.
- These native people are generally the poorest of the poor, underprivileged tribal people.
- Various types of projects result in the displacement of the native people who undergo tremendous economic and psychological distress, as the socio-economic and ecological base of the local community is disturbed.

(a) Displacement problems due to dams

- The big river valley projects have one of the most serious socio-economic impacts due to large scale displacement of local people from their ancestral home and loss of their traditional profession or occupation.
- India is one of countries in the world leading in big dam construction and in the last 50 years more than 20 million people are estimated to have been directly or indirectly affected by these dams.
- The Hirakund Dam has displaced more than 20,000 people residing in about 250 villages.
- The Bhakra Nangal Dam was constructed during 1950.s and till now it has not been possible to rehabiltate even half of the displaced persons.
- Same is the case with Tehri Dam on the river Bhagirathi, construction of which was green signalled after three decades of long campaign against the project by the noted activist Sunderlal Bahuguna the propagator of Chipko Movement .
- The immediate impact of the Tehri Dam would be on the 10,000 residents of the Tehri town. While displacement is looming large over the people, rehabilitation has become a more burning issue.

(b) Displacement due to Mining

- Mining is another developmental activity, which causes displacement of the native people.
- Several thousands of hectares of land area is covered in mining operation and the native people are displaced.
- Sometimes displacement of local people is due to accidents occurring in mined areas like subsidence of land that often leads to shifting of people.

(c) Displacement due to Creation of National Parks

- When some forest area is covered under a National Park, it is a welcome step for conservation of the natural resources.
- However, it also has a social aspect associated with it which is often neglected.
- A major portion of the forest is declared as core-area, where the entry of local dwellers or tribals is prohibited. When these villagers are deprived of their ancestral right or access to the forests, they usually retaliate by starting destructive activities.
- There is a need to look into their problems and provide them some employment.

REHABILITATION ISSUES

- The United Nations Universal Declaration on Human Rights [Article 25(1)] has declared that right to housing is a basic human right.
- In India, most of the displacements have resulted due to land acquisition by the government for various reasons.
- For this purpose, the government has the Land Acquisition Act, 1894 which empowers it to serve notice to the people to vacate their lands if there is a need as per government planning.
- Provision of cash compensation in lieu of the land vacated exists in section 16 of the Act.

The major issues related to displacement and rehabilitation are as follows:

- Tribals are usually the most affected amongst the displaced who are already poor. Displacement further increases their poverty due to loss of land, home, jobs, food insecurity, loss of access to common property assets, increased morbidity and mortality and social isolation.
- Break up of families is an important social issue arising due to displacement in which the women are the worst affected and they are not even given cash/land compensation.
- The tribals are not familiar with the market policies and trends. Even if they get cash compensation, they get alienated in the modern economic set-up.
- The land acquisition laws ignore the communal ownership of property, which is an inbuilt system amongst the tribals. Thus the tribals lose their communitarian basis of economic and cultural existence. They feel like fish out of water.
- Kinship systems, marriages, social and cultural functions, their folk-songs, dances and activities vanish with their displacement. Even when they are resettled, it is individual-based resettlement, which totally ignores communal settlement.

- Loss of identity and loss of the intimate link between the people and the environment is one of the biggest loss. The age-long indigenous knowledge, which has been inherited and experienced by them about the flora, fauna, their uses etc. gets lost.

Rehabilitation Policy

- There is a need for a comprehensive National Rehabilitation Policy.
- Different states are following different practices in this regard.
- There is a need to raise public awareness on these issues to bring the resettlement and rehabilitation plans on a humane footing and to honour the human rights of the oustees.