KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University Established Under Section 3 of UGC Act 1956)
Coimbatore – 641 021.

LECTURE PLAN
DEPARTMENT OF BIOCHEMISTRY

STAFF NAME: Dr.A.MANIMARAN
SUBJECT NAME: ENVIRONMENTAL STUDIES SUB.CODE: 18AEC201
SEMESTER: II CLASS: I B.Sc

Sl. No	Duration of Period	Topics to be Covered	Books Referred	Page No	Web Page referred
		UNIT – I			
1.	1 1 1	Environment – Definition – components Ecosystem-Definition, Concept, Importance, scope	T1 T2	1-2 55-56; 74-75	
2.	1	Structure and functions of ecosystem	R1	100-106	
3.	1	Energy flow	T2	69-70	
4.	1	Ecological succession	R1	292-309	
5.	2	Food chains Food webs.	R1	107	
6.	2	Classification of ecosystem.	R1	107-108	
7.	1	Revision			
Total number of hours planned for Unit I: 7					
		UNIT – II			
1.	1	Natural resources and associated problems Forest resources, Water resources Mineral resources Food resources	T4 T3	5-22 35-39; 57-64	
2.	1	Energy resources, Land resources	T4	38-58	
3.	1	Natural resources: uses and over-utilization	T3	41-42	
4.	1	Role of individual in conservation of natural resources	T4	59-61	
5.	1	Equitable use of resources for sustainable lifestyles	T4	62	
6.	1	Ill-effects of fireworks			W1
7.	1	Revision			
Total number of hours planned for Unit II: 7					
		UNIT – III			
1.	1	Biodiversity and its conservation: Introduction- Definition, Genetic, species and ecosystem diversity.	T5 R2	95-96 17-21	

2.	1	Biogeographical classification of India	T4	100-101	
3.	1	Value of biodiversity: Consumptive, productive uses; social, ethical, aesthetic and option values.	T4	101-104	
4.	1	Biodiversity at global national and local levels	T4	106-107	
5.	1	India as a biodiversity of nation, Hots-pots of biodiversity.	T4	107-111	
6.	1	Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.	T4	111-115	
7.	1	Endangered and endemic species of India	T4	118	
8.	1	Conservation of biodiversity: In-situ and ex-situ conservation of biodiversity	T4	119-121	
Total number of hours planned for Unit III: 8					
UNIT – IV					
1.	1	Environmental pollution – Definition, Causes, effects and control measures of air pollution and water pollution	T5	121-132	
2.	1	Definition, Causes, effects and control measures of Soil pollution and marine pollution	T5	135-157	
3.	1	Definition, Causes, effects and control measures of noise pollution, thermal pollution and nuclear hazards.	T5 T4	165-168 188-189	
4.	1	Solid waste Management: Causes, effects and Control measures of urban and industrial wastes.	R4 T5	384-387 169-171; 178-184	
5.	1	Role of individual in prevention of pollution, Pollution case studies	T3	136-137	
6.	1	Disaster and rehabilitation management: Floods, Earthquake, Cyclone, landslides	T5 R3	201-203 151-156	
7.	1	Revision			
Total number of hours planned for Unit IV: 7					
UNIT V					
1.	1	Social issues and the environment- From unsustainable to sustainable development. Urban problems related to energy	T5	220-226	
2.	1	Water conservation, Rain water harvesting, watershed. Resettlement and Rehabilitation of people; its problems and concerns.	T5	227-228	
3.	1	Environmental ethics: issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion,	R3 T4	139-144 176-189	

		nuclear accidents and its holocaust.			
4.	1	Case studies. Wasteland reclamation. Consumerism and waste products.	T4	189-194	
5.	1	Environment protection Act. Air (prevention and control of pollution) Act. Water (prevention and control of pollution) Act.	T3	194-197	
6.	1	Wildlife protection Act. Forest conservation Act. Issues involved in enforcement of environment legislation.	T4	195-204	
7.	1	Public awareness. Population growth variation among nations.	T3	201-208	
8.	1	Population explosion – family welfare. – programme. Environment and human health.	T3	209-216	
9.	1	Human rights. Value education. HIV/AIDS. Women and child welfare. Role of Information technology in environment and human health.	T3	217-229	
Total number of hours planned for Unit V: 9					
Previous year ESE Question Paper Discussion					
1.	1	Previous year ESE question paper discussion			
2.	1	Previous year ESE question paper discussion			
Total Hours Planned: 40					

TEXT BOOK

T1: Tripathy. S. N and Sunakar Panda, 2004. Fundamentals of Environmental Studies, Second Edition, Vrinda Publication Pvt. Ltd., Orissa.

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

T3: Manoj Tiwari and Archana Tiwari, 2010. I. K. International Publishing House Pvt. Ltd. New Delhi.

T4: Anubha kaushik, C. P kaushik, 2004. Perspectives in environmental Studies, New Delhi

T5: Benny Joseph, 2009. Environmental Studies, Second Edition, Tata McGraw Hill Publishing Co.Ltd., New Delhi.

REFERENCES

R1: Verma. P.S and Agarwal V.K, 2001. Environmental Biology (Principles of Ecology) S.Chand and Company Ltd., New Delhi.

R2: Singh, M.P., B.S. Singh and Soma S. Dey, 2004. Conservation of Biodiversity and Natural Resources. Daya Publishing House, Delhi.

R3: Erach Bharucha, 2005. Environmental Studies. UGC, Universities Press Pvt. Ltd., Hyderabad.

WEBSITES

W_1: http://www.agelfire.com/co3/NCFS/science/environmentalimpact.html

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Coimbatore - 641021.

(For the candidates admitted from 2018 onwards)

DEPARTMENT OF BIOCHEMISTRY

SUBJECT : ENVIRONMENTAL STUDIES
SEMESTER : II
SUBJECT CODE : 18AEC201 CLASS : I B.Sc. Biochemistry

Course objective

- To develop an attitude of concern for the environment.
- To know the social issues of the environment.
- To understand the core concepts and methods from ecological and physical sciences and their application in environmental problem solving.
- To know about the various renewable and nonrenewable resources of the region.

Course outcomes (CO's)

1. Make appropriate judgments and decisions for the protection and improvement of the earth.
2. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
3. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.

UNIT I: Introduction- Environment

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 fireworks.

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 READING

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

2. Botkin, D.B., and Keller, E.A., (1995). Environmental Science, John Wiley and Sons, Inc., New York.

3. Uberoi, N.K., (2005). Environmental Studies, Excel Books Publications, New Delhi, India.

4. Tripathy, S.N., and Panda, S., (2004). Fundamentals of Environmental Studies; 2nd Edition, Vrianda Publications Private Ltd., New Delhi.

5. Kumar, A., (2004). A Textbook of Environmental Science; APH Publishing Corporation, New Delhi.

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

7. Kaushik, A., Kaushik, C.P., (2004). Perspectives in Environmental Studies, New Age International Pvt. Ltd. Publications, New Delhi.

S.No	Question	Option a	Option b	Option c	Option d	Answer
1.	The term ecology was introduced by	Haeckel	Odum	Tansely	Ramdeo Mishra	Haeckel
2.	The study of interactions between living and non-living organisms and environment is called	Ecosystem	Ecology	Phyto-geography	Phytosociology	Ecology
3.	An ecosystem consist of	Green plants and animals	Green plants and decomposers	Producers and consumers	Green plants, animals, decomposers and abiotic environment	Green plants, animals, decomposers and abiotic environment
4.	The environment which has been modified by human activities is called	Natural environment	Anthropogenic environment	Modem environment	Urban environment	Anthropogenic environment
5.	Driving force in an ecosystem is	Plants	Producers	Solar energy	Biomass energy	Solar energy
6.	Which one of the following is an abiotic component of the ecosystem?	Bacteria	Plants	Humus	Fungi	Humus
7.	Which of the following is a possible producer in an ecosystem?	Plants	Animals	Human beings	Fish	Plants
8.	The organisms which feed on dead organisms and excreta of living organisms are known	Decomposers	Consumers	Producers	Carnivores	Decomposers
9.	The food chain in which microorganisms breakdown dead producers is called:	Consumer food chain	Predator food chain	Parasitic food chain	Detritus food chain	Detritus food chain
10.	In a food chain animals constitute the	First trophic level	Second trophic level	Intermediate trophic level	Ultimate trophic level	Intermediate trophic level
11.	The food chain in which microorganisms breakdown dead producers is called:	Consumer food chain	Predator food chain	Parasitic food chain	Detritus food chain	Detritus food chain
12.	Food chain starts with	Producer	Herbivores	Carnivores	Omnivores	Producer
13.	In a food chain, humans are	Secondary consumers	Primary consumer	Producers	Primary and secondary consumers	Primary and secondary consumers
14.	Which one is the correct food chain?	Phytoplankton —» Zooplankton —» Fish	Zooplankton —» Phytoplankton —» Fish	Zooplankton —» Protozoans —» Fish	Grass —» Fish —» Zooplankton	Phytoplankton —» Zooplankton —» Fish
15.	A food web consists of	Interlocking food chains	Producers, consumers and decomposers	A portion of a food chain	A set of similar consumers	Interlocking food chains
16.	Food webs are	One kind of food	Not related to food chains at all	Inter-connected arrangement of food chains	Linear arrangement of food chains	Inter-connected arrangement of food chains
17.	An ecosystem may not undergo changes because	It is in a state of homeostasis	It has plants and animals both	It gets solar energy continuously	The decomposers are present in it	It is in a state of homeostasis
18.	Energy flow in ecosystem is given by	Haeckel	Odum	Tansely	Ramdeo Mishra	Odum
19.	Energy flow in an ecosystem is always	Unidirectional	Cyclic	Reversible	Multi-directional	Unidirectional
20.	Eutrophication is	An improved water quality status of lakes	The result of accumulation of plant nutrients in water bodies	A process in the carbon cycle	A water purification technique	The result of accumulation of plant nutrients in water bodies

21.	The primary producers in a forest ecosystem are	Chlorophyll containing trees and plants	Herbivores	Carnivores	Bacteria and other micro·organism	Chlorophyll containing trees and plants
22.	The desert among the following which is not a cold desert is	Golbi desert	Patagonian desert	Atacama desert	Majava desert	Majava desert
23.	Increase in fauna and decrease in flora would be harmful due to increase in	Diseases	CO	O_2	Radioactive pollution	CO
24.	The largest reservoir of nitrogen an our planet is	Ocean	Atmosphere	Biosphere	Fossil fuels	Atmosphere
25.	Overgrazing results in	Soil erosion	Retention of useful species	Productive soils	Flood	Soil erosion
26.	On earth, energy enters ecosystems as	Sunlight	heat	Glucose	ATP	Sunlight
27.	The group of organisms which convert light into food are called	Autotrophs	Heterotrophs	Decomposers	Omnivores	Autotrophs
28.	Chief source of energy in environment is	Fire	Moon	Sun	Stars	Sun
29.	Renewable source of energy is	Coal	Petroleum	Plants	Uranium	Plants
30.	A renewable exhaustible natural resource is	Petroleum	Coal	Forest	Minerals	Forest
31.	Decomposers include	Herbivores	Carnivores	Bacteria	Plants	Bacteria
32.	In a food chain of grassland ecosystem the top consumers are	Herbivores	Carnivores	Omnivores	Bacteria	Carnivores
33.	Which is the most stable ecosystem?	Mountain	Desert	Forest	Ocean	Ocean
34.	A snake feed on frog, the hawk feed on this snake. What is the place of snake in food chain?	Producer	Primary consumer	Secondary consumer	Tertiary consumer	Secondary consumer
35.	Which of the following uses maximum energy?	Primary consumer	Secondary consumer	Decomposer	Primary producer	Primary producer
36.	Through which of the following energy enters in an ecosystem	Herbivores	Producer	Decomposer	Carnivores	Producers
37.	Who is the primary consumer of biotic community?	Herbivores	Omnivores	Scavengers	Carnivores	Herbivores
38.	From which the following detritus food chain will start?	Algae	Bacteria	Protozoa	Virus	Bacteria
39.	At each tropic level, in which form energy is lost?	Heat	Light	Chemical	No lose	Heat
40.	In in an ecosystem which of the following is unidirectional?	Sulphur	Organic nutrient	Carbon	Free energy	Free energy
41.	What is obtained by the activity of decomposer for the producer?	Nutrient	Food	Carbohydrate	Energy	Nutrient
42.	Humans are	Herbivore	Carnivore	Autotrophs	Omnivores	Omnivores
43.	An Eco-System comprises of	Living organisms	Non-living organisms	Both living and non-living organisms	Only plants	Both living and non-living organisms
44.	Region where fresh water meets salt water is called	Sea	Estuarine	Lake	River	Estuarine
45.	Green plants of an ecosystem are called	Producers	Decomposers	Consumers	Predator	Producers
46.	The green plants are also called	Producers	Consumers	Reducers	Detritivores	Producers
47.	The pioneers in xerach succession is the	crustose lichen	mosses	shrubs	forest	crustose lichen
48.	The final stable community in an ecological succession is called the	final community	ultimate community	climax community	seral community	climax community
49.	The process of successful establishment of the species in a new area is called	sere	climax	invasion	ecesis	ecesis
50.	Succession initiated on bare rock is called	hydrosere	psammosere	xerosere	oxylosere	xerosere
51.	The formation of a climax community from an abandoned farm land is a an example of	Autogenic succession	allogenic succession	primary succession	secondary succession	secondary succession
52.	The development of a bare area without any life form is called	nudation	Ecesis	sere	reaction	nudation
53.	The final stable community in ecological succession is	Climax	Sere	Pioneers	Carnivores	Climax

54.	The intermediate developmental stages in the ecological succession is called	sere	Ecesis	climax	nudation	sere
55.	The conversion of a pond to a climax forest community is an example of	xerarch succession	mesarch succession	hydrarch succession	psammosere	hydrarch succession
56.	A gradual change in an ecosystem after a disturbance is known as...	climax community	ecological succession	evolution	pioneer species	ecological succession
57.	Which of the following statement best describe a seral community in an ecological succession?	Less stable	More aggresive	More diversity but less stability	More adapdability but less stability	More adapdability but less stability
58.	Upper part of sea/aquatic ecosystem contains	plankton	nekton	plankton and nekton	benthos	plankton
59.	A mutually beneficial association necessary for survival of both partners is	mutualism	commensalism	amensalism	colony	mutualism
60.	Which one of the following gases contributes maximum to the green house effect’ on the earth?	carbon dioxide	Chlorofluoro carbon	Freon	methane	carbon dioxide

UNIT-I

SYLLABUS

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.

Definition

Environment literally means Surrounding in which we are living. Environment includes all those things on which we are directly or indirectly dependent for our survival, whether it is living component like animals, plants or non living component like soil, air water. Environmental Protection Act (1986) defined "Environment as the sum total of water, air and land, their interrelationship among themselves and with the human beings, other living beings and property."

Scope of Environmental Studies

The disciplines included in environmental education are environmental sciences, environmental engineering and environmental management.

(a) Environmental Science

It deals with the scientific study of environmental system (air, water, soil and land), the inherent or induced changes on organisms and the environmental damages incurred as a result of human interaction with the environment.

(b) Environmental Engineering

It deals with the study of technical processes involved in the protection of environment from the potentially deleterious effects of human activity and improving the environmental quality for the health and well beings of humans.

(c) Environmental Management

It promotes due regard for physical, social and economic environment of the enterprise or projects. It encourages planned investment at the start of the production chain rather than forced investment in cleaning up at the end.

It generally covers the areas as environment and enterprise objectives, scope, and structure of the

environment, interaction of nature, society and the enterprise, environment impact assessment, economics of pollution, prevention, environmental management standards etc.

Importances of environmental studies

- To clarify modern environmental concept like how to conserve biodiversity.
- To know the more sustainable way of living.
- To use natural resources more efficiently.
- To know the behaviour of organism under natural conditions.
- To know the interrelationship between organisms in populations and communities.
- To aware and educate people regarding environmental issues and problems at local, national and international levels.

Components of environment

Abiotic component

It includes medium and climate. Medium may be defined as the substance or surroundings in which an organism lives and grows. There are four types of media in which plants, animals and microbes live. These are soil, water, air and bodies of other organisms, in case of parasite. There is difference between climate and weather. Climate is the total experience of weather and atmospheric behaviour over a number of years. Weather is the day-to-day meteorological conditions, especially temperature, humidity, wind, rainfall, cloudiness, etc., affecting place.

Biotic components

It consists of flora and fauna. The term flora refers to the plants present in an area. The term fauna refers to the animals present in an area.

Energy component

The energy component includes solar energy, geothermal energy, thermoelectrical energy, hydroelectrical energy and nuclear or atomic energy. Energy due to radiation and other sources also play an important role to maintain the life of organisms.

ECOSYSTEMS

Definition

The term ecosystem was first proposed by A.G. Tansley, 1935. An ecosystem is a group

of biotic communities of species interacting with one another and with their non-living environment exchanging energy and matter.

Concept of ecosystem

In biology, an ecosystem is a community of organisms and their physical environment. The notion of an ecosystem recognizes the many ways that an organism interacts with and depends on various parts of its environment. The ecosystem idea generalizes the "food chain" and "food web" concepts, allowing for more relationships than just consumption. For example, plants provide not just food for animals but also shelter, shade, moisture, etc.

While organisms in an ecosystem may be engaged in competition or predation, the concept focuses on interdependence — one organism's reliance on another or on the ecosystem as a whole.

The idea of an ecosystem means viewing an organism, corporation, or other entity as part of a larger system whose parts are interacting and interdependent.

Scope and Importance:

Taylor (1936), in an attempt to define ecology, has very rightly pointed out that scope of ecology by stating that ecology is the science of all the relations of ecosystems, all organisms to all their environments.

Ecology plays an important role in agriculture crop rotation, weed control, management of grasslands, range management forestry, biological surveys, pest control, fishery biology, and in the conservation of soil, wildlife, forest, water supplies, water bodies like rivers, lakes and ponds, Ecosystem is defined as a dynamic entity composed of a biological community and its associated abiotic environment. Often the dynamic interactions that occur within an ecosystem are numerous and complex.

Ecosystems are also always undergoing alterations to their biotic and abiotic components. Some of these alterations begin first with a change in the state of one component of the ecosystem, which then cascades and sometimes amplifies into other components because of relationships.

Structure and Function of an Ecosystem:

Each ecosystem has two main components:

(1) Abiotic

(2) Biotic

(1) Abiotic Components:

The non living factors or the physical environment prevailing in an ecosystem form the abiotic components. They have a strong influence on the structure, distribution, behaviour and inter-relationship of organisms.

Abiotic components are mainly of two types:

(a) Climatic Factors:

Which include rain, temperature, light, wind, humidity etc.

(b) Edaphic Factors:

Which include soil, pH, topography minerals etc.?

2) Biotic Components:

The living organisms including plants, animals and micro-organisms (Bacteria and Fungi) that are present in an ecosystem form the biotic components.

On the basis of their role in the ecosystem the biotic components can be classified into three main groups:

(A) Producers

(B) Consumers

(C) Decomposers or Reducers.

(A) Producers:

The green plants have chlorophyll with the help of which they trap solar energy and change it into chemical energy of carbohydrates using simple inorganic compounds namely water and carbon dioxide. This process is known as photosynthesis. As the green plants manufacture their own food they are known as Autotrophs (i.e. auto = self, trophos = feeder)

The chemical energy stored by the producers is utilised partly by the producers for their own growth and survival and the remaining is stored in the plant parts for their future use.

(B) Consumers:

The animals lack chlorophyll and are unable to synthesise their own food. Therefore, they depend on the producers for their food. They are known as heterotrophs (i.e. heteros = other, trophos = feeder)

The consumers are of four types, namely:

(a) Primary Consumers or First Order Consumers or Herbivores:

These are the animals which feed on plants or the producers. They are called herbivores. Examples are rabbit, deer, goat, cattle etc.

(b) Secondary Consumers or Second Order Consumers or Primary Carnivores:

The animals which feed on the herbivores are called the primary carnivores. Examples are cats, foxes, snakes etc.

(c) Tertiary Consumers or Third Order Consumers:

These are the large carnivores which feed on the secondary consumers. Example are Wolves.

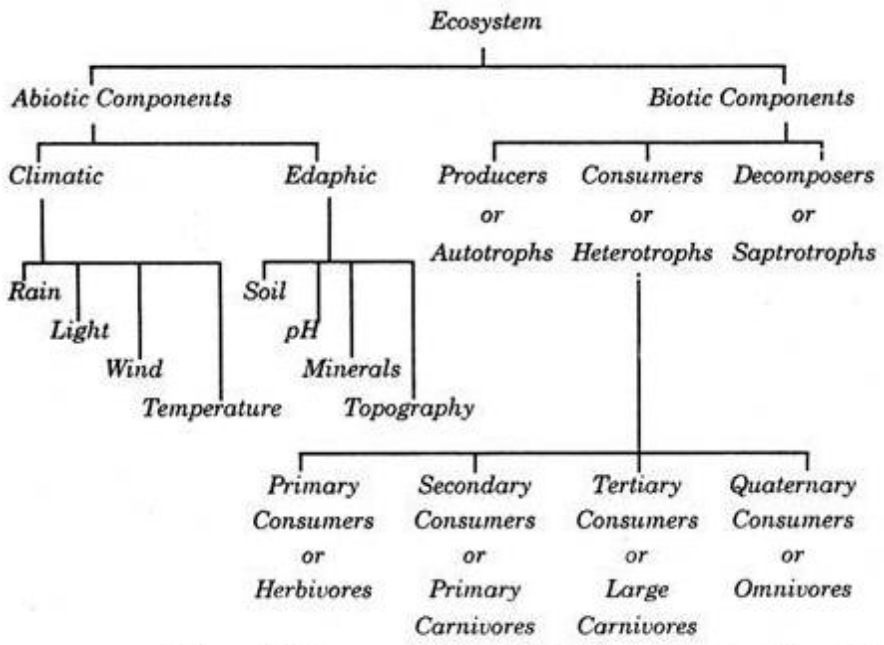
(d) Quaternary Consumers or Fourth Order Consumers or Omnivores:

These are the largest carnivores which feed on the tertiary consumers and are not eaten up by any other animal. Examples are lions and tigers.

(C) Decomposers or Reducers:

Bacteria and fungi belong to this category. They breakdown the dead organic materials of producers (plants) and consumers (animals) for their food and release to the environment the simple inorganic and organic substances produced as by-products of their metabolisms.

These simple substances are reused by the producers resulting in a cyclic exchange of materials between the biotic community and the abiotic environment of the ecosystem. The decomposers are known as Saprotrophs (i.e., sapros = rotten, trophos = feeder)



Schematic Representation of the Structure of an Ecosystem.

Functions of Ecosystem

In an ecosystem there are two processes proceeding simultaneously:

1) Energy flow and

2) Biogeochemical cycle

This energy flow is based on two important Laws of Thermodynamics which are as follows:

(1) The first law of Thermodynamics:

It states that the amount of energy in the universe is constant. It may change from one form to another, but it can neither be created nor destroyed. Light energy can be neither created nor destroyed as it passes through the atmosphere. It may, however, be transformed into another type of energy, such as chemical energy or heat energy. These forms of energy cannot be transformed into electromagnetic radiation.

(2) The second law of Thermodynamics:

It states that non-random energy (mechanical, chemical, radiant energy) cannot be changed without some degradation into heat energy. The change of energy from one form to another takes

place in such a way that a part of energy assumes waste form (heat energy). In this way, after transformation the capacity of energy to perform work is decreased. Thus, energy flows from higher to lower level.

Main source of energy is sun. Approximately 57% of sun energy is absorbed in the atmosphere and scattered in the space. Some 35% is spent to heat water and land areas and to evaporate water. Of the approximately 8% of light energy striking plant surface, 10% to 15% is reflected, 5% is transmitted and 80 to 85% is absorbed; and an average of only 2% (0.5 to 3.5%) of the total light energy striking on a leaf is used in photosynthesis and rest is transformed into heat energy.

Energy flow in Ecosystems

Living organisms can use energy in two forms radiant and fixed energy. Radiant energy is in the form of electromagnetic waves, such as light. Fixed energy is potential chemical energy bound in various organic substances which can be broken down in order to release their energy content.

Organisms that can fix radiant energy utilizing inorganic substances to produce organic molecules are called autotrophs. Organisms that cannot obtain energy from abiotic source but depend on energy-rich organic molecules synthesized by autotrophs are called heterotrophs. Those which obtain energy from living organisms are called consumers and those which obtain energy from dead organisms are called decomposers (Fig. 3.7).

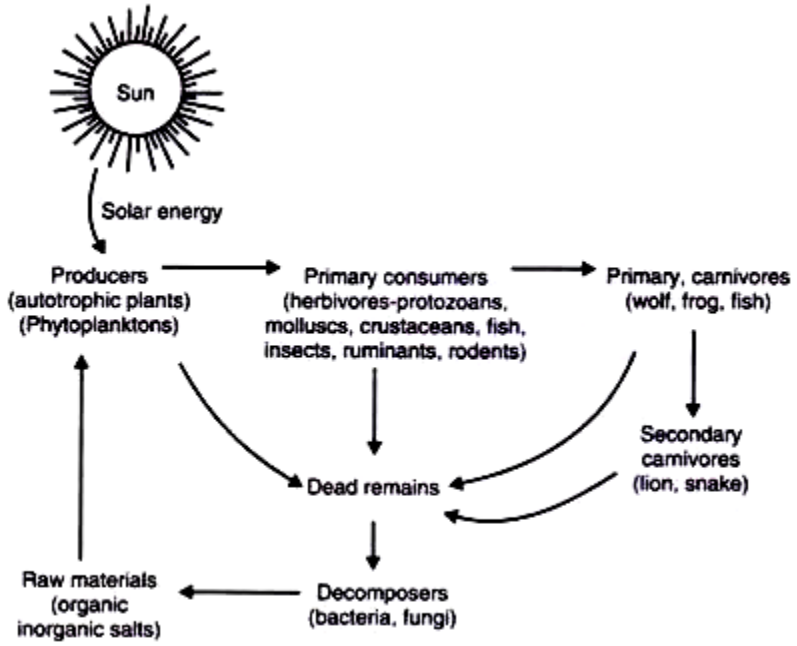


Fig. 3.7. Flow of energy at different levels of ecosystem.

When the light energy falls on the green surfaces of plants, a part of it is transformed into chemical energy which is stored in various organic products in the plants. When the herbivores consume plants as food and convert chemical energy accumulated in plant products into kinetic energy, degradation of energy will occur through its conversion into heat. When herbivores are consumed by carnivores of the first order (secondary consumers) further degradation will occur. Similarly, when primary carnivores are consumed by top carnivores, again energy will be degraded.

Trophic level:

The producers and consumers in ecosystem can be arranged into several feeding groups, each known as trophic level (feeding level). In any ecosystem, producers represent the first trophic level, herbivores present the second trophic level, primary carnivores represent the third trophic level and top carnivores represent the last level.

Food Chain:

In the ecosystem, green plants alone are able to trap in solar energy and convert it into chemical energy. The chemical energy is locked up in the various organic compounds, such as carbohydrates, fats and proteins, present in the green plants. Since virtually all other living

organisms depend upon green plants for their energy, the efficiency of plants in any given area in capturing solar energy sets the upper limit to long-term energy flow and biological activity in the community.

The food manufactured by the green plants is utilized by themselves and also by herbivores. Animals feed repeatedly. Herbivores fall prey to some carnivorous animals. In this way one form of life supports the other form. Thus, food from one trophic level reaches to the other trophic level and in this way a chain is established. This is known as food chain.

A food chain may be defined as the transfer of energy and nutrients through a succession of organisms through repeated process of eating and being eaten. In food chain initial link is a green plant or producer which produces chemical energy available to consumers. For example, marsh grass is consumed by grasshopper, the grasshopper is consumed by a bird and that bird is consumed by hawk.

Thus, a food chain is formed which can be written as follows:

Marsh grass → grasshopper → bird → hawk

Food chain in any ecosystem runs directly in which green plants are eaten by herbivores, herbivores are eaten by carnivores and carnivores are eaten by top carnivores. Man forms the terrestrial links of many food chains.

Food chains are of three types:

1. Grazing food chain
2. Parasitic food chain
3. Saprophytic or detritus food chain

1. Grazing food chain:

The grazing food chain starts from green plants and from autotrophs it goes to herbivores (primary consumers) to primary carnivores (secondary consumers) and then to secondary carnivores (tertiary consumers) and so on. The gross production of a green plant in an ecosystem may meet three fates—it may be oxidized in respiration, it may be eaten by herbivorous animals and after the death and decay of producers it may be utilized by decomposers and converters and finally released into the environment. In herbivores the assimilated food can be stored as carbohydrates, proteins and fats, and transformed into much more complex organic molecules.

The energy for these transformations is supplied through respiration. As in autotrophs, the energy in herbivores also meets three routes respiration, decay of organic matter by microbes and consumption by the carnivores. Likewise, when the secondary carnivores or tertiary consumers eat primary carnivores, the total energy assimilated by primary carnivores or gross tertiary production follows the same course and its disposition into respiration, decay and further consumption by other carnivores is entirely similar to that of herbivores.

Thus, it is obvious that much of the energy flow in the grazing food chain can be described in terms of trophic levels as outlined below:

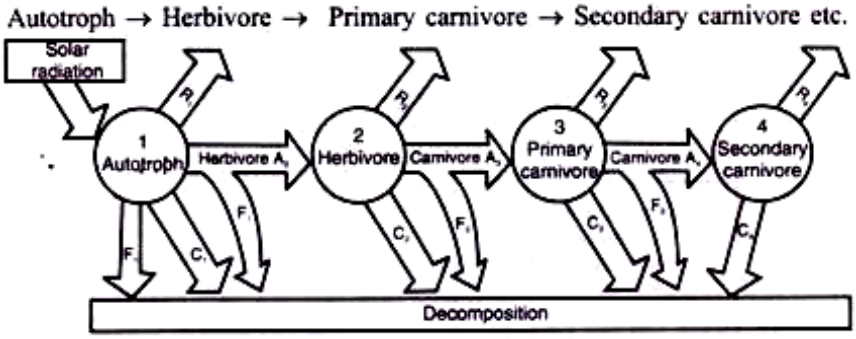


Fig. 3.8. Diagrammatic representation of a grazing food chain showing input and losses of energy at each trophic level. Trophic levels are numbered and used as subscripts to letters indicating energy transfer. A—assimilation of food by the organisms at the trophic level; F—energy lost in the form of faeces and other excretory products; C—energy lost through decay; and R—energy lost to respiration.

A schematic representation of grazing food chain showing input and losses of energy has been presented in Fig. 3.8.

2. Parasitic food chain:

It goes from large organisms to smaller ones without outright killing as in the case of predator.

3. Detritus food chain:

The dead organic remains including metabolic wastes and exudates derived from grazing food chain are generally termed detritus. The energy contained in detritus is not lost in ecosystem as a whole, rather it serves as a source of energy for a group of organisms called detritivores that are separate from the grazing food chain. The food chain so formed is called detritus food chain (Fig. 3.9).

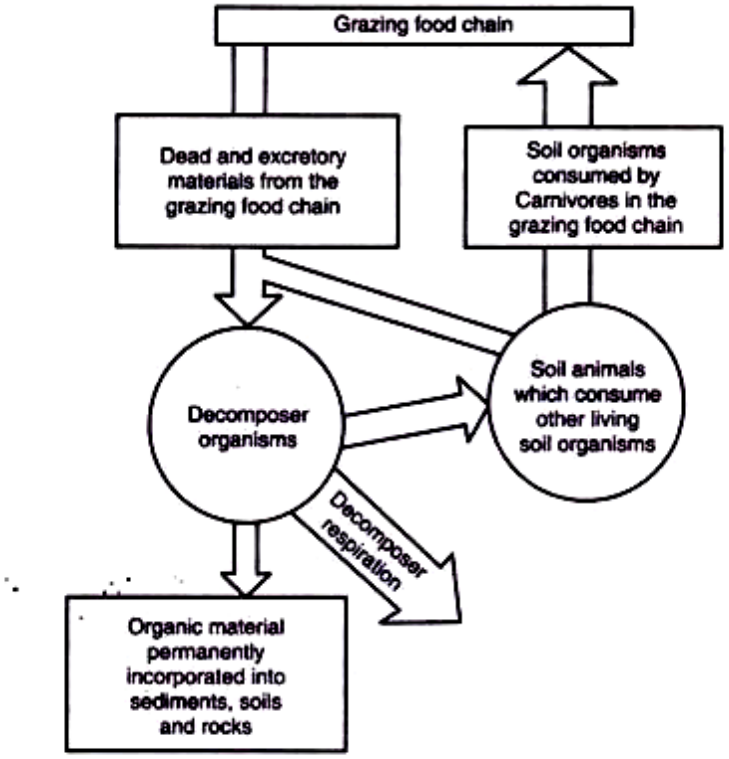


Fig. 3.9. Diagrammatic representation of the detritus food chain showing energy transfers between it and the grazing food chain, as well as energy losses to the detritus food chain.

In some ecosystems more energy flows through the detritus food chain than through grazing food chain. In detritus food chain the energy flow remains as a continuous passage rather than as a stepwise flow between discrete entities. The organisms in the detritus food chain are many and include algae, fungi, bacteria, slime moulds, actinomycetes, protozoa, etc. Detritus organisms ingest pieces of partially decomposed organic matter, digest them partially and after extracting some of the chemical energy in the food to run their metabolism, excrete the remainder in the form of simpler organic molecules.

The waste from one organism can be immediately utilized by a second one which repeats the process. Gradually, the complex organic molecules present in the organic wastes or dead tissues are broken down to much simpler compounds, sometimes to carbon dioxide and water and all that are left are humus. In a normal environment the humus is quite stable and forms an essential part of the soil. Schematic representation of detritus food chain is given in Fig. 3.9.

Food web:

Many food chains exist in an ecosystem, but as a matter of fact these food chains are not independent. In ecosystem, one organism does not depend wholly on another. The resources are shared specially at the beginning of the chain. The marsh plants are eaten by variety of insects, birds, mammals and fishes and some of the animals are eaten by several predators.

Similarly, in the food chain grass → mouse → snakes → owls, sometimes mice are not eaten by snakes but directly by owls. This type of interrelationship interlinks the individuals of the whole community. In this way, food chains become interlinked. A complex of interrelated food chains makes up a food web. Food web maintains the stability of the ecosystem. The greater the number of alternative pathways the more stable is the community of living things. Fig. 3.10. illustrates a food web in ecosystem.

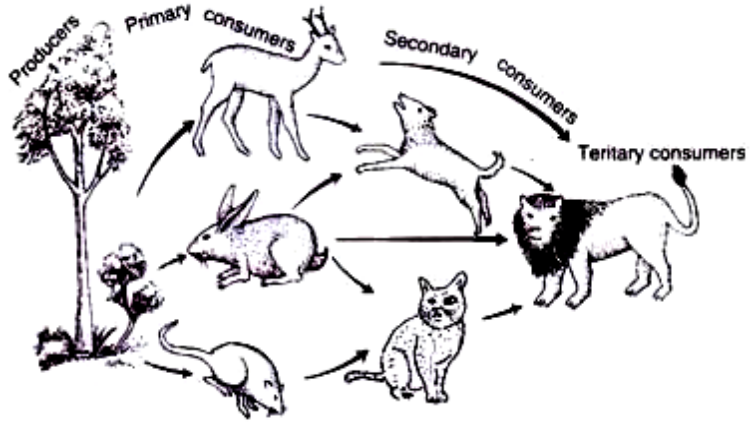


Fig. 3.10. Food web in an ecosystem.

Biogeochemical cycles

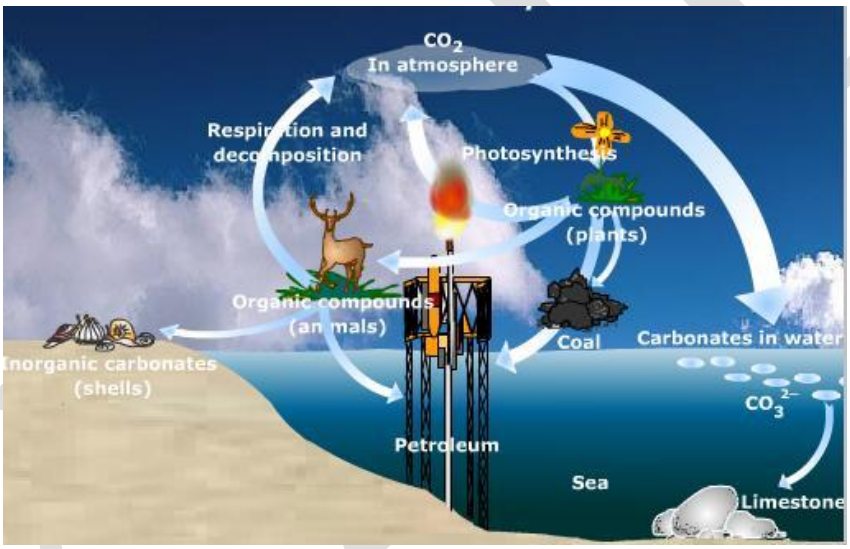
Organic materials synthesised by the producers are eaten and assimilated by the consumers. With the help of decomposers, all the organic materials in the bodies of the consumers are eventually broken down into inorganic materials. These are then rebuilt into organic compounds by the synthetic activities of the consumers. Thus, matter circulates in nature. Though it may constantly change it's form, there is no overall loss or gain.

The cyclic flow of nutrients between non-living environment (soil, rocks, air, water) and living

organisms is known as biogeochemical cycle. The major nutrient element i.e. carbon, hydrogen, oxygen and nitrogen, which form about 95% mass of the living organism, are circulated again and again between living and non-living components of the ecosystem.

Carbon cycle

The atmosphere contains a pool of CO_2. CO_2 is removed from the pool by the photosynthetic activities of plants. It is released back into the environment by respiration which is carried out by all organisms including those micro-organisms (decomposing bacteria) responsible for the decay of dead plants and animals. Not all dead material decays. Sometimes dead plants and animals form fossil fuels such as peat, coal, petroleum and petroleum-based gases. Man uses these materials as sources of energy and when they are burned CO_2 is returned to the CO_2 pool.

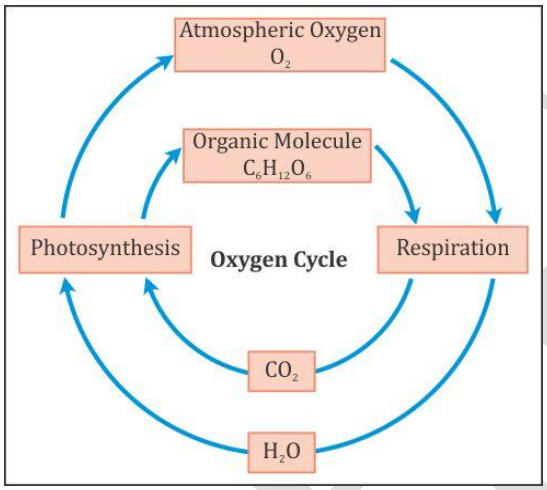


The amount of carbon dioxide in the atmosphere is maintained by a balance between the processes that withdraw carbon dioxide from it (photosynthesis) and those, which add carbon dioxide to it (respiration and combustion). The red arrows represent the flow of carbon dioxide.

Oxygen cycle

Circulation of oxygen in various forms through nature. Free in the air and dissolved in water, oxygen is second only to nitrogen in abundance among uncombined elements in the atmosphere. Plants and animals use oxygen to respire and return it to the air and water as carbon dioxide (CO_2). CO_2 is then taken up by algae and terrestrial green plants and converted into carbohydrates during the process of photosynthesis, oxygen being a by-product. The waters of

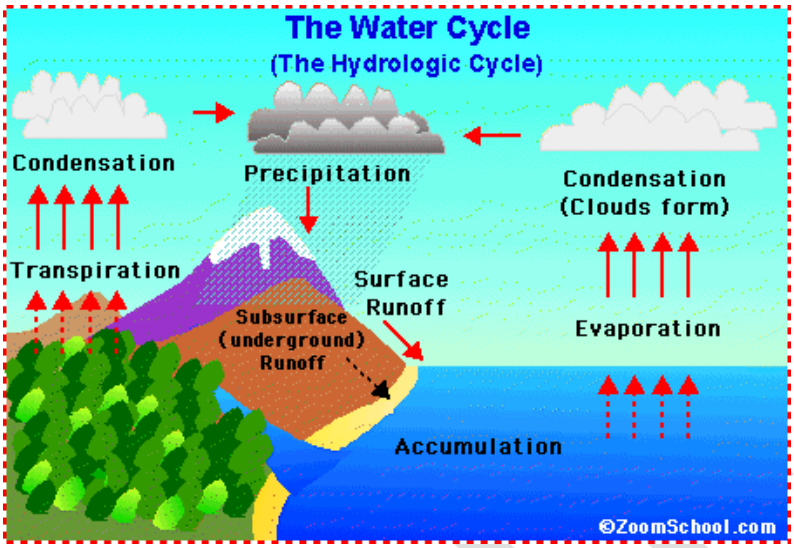
the world are the main oxygen generators of the biosphere; their algae are estimated to replace about 90 percent of all oxygen used. Oxygen is involved to some degree in all the other biogeochemical cycles. For example, over time, detritus from living organisms transfers oxygen-containing compounds such as calcium carbonates into the lithosphere



Despite the burning of fossil fuel and the reduction of natural vegetation (on land and in the sea), the level of atmospheric oxygen appears to be relatively stable because of the increase in plant productivity resulting from agricultural advances worldwide.

The Water Cycle

Water on Earth is always changing. Its repeating changes make a cycle. As water goes through its cycle, it can be a solid (ice), a liquid (water), or a gas (water vapor). Ice can change to become water or water vapor. Water can change to become ice or water vapor. Water vapor can change to become ice or water.



Adding or subtracting heat makes the cycle work. If heat is added to ice, it melts. If heat is added to water, it evaporates. Evaporation turns liquid water into a gas called water vapor.

If heat is taken away from water vapor, it condenses. Condensation turns water vapor into a liquid. If heat is taken away from liquid water, it freezes to become ice.

The water cycle is called the hydrologic cycle. In the hydrologic cycle, water from oceans, lakes, swamps, rivers, plants, and even you, can turn into water vapor. Water vapor condenses into millions of tiny droplets that form clouds. Clouds lose their water as rain or snow, which is called precipitation. Precipitation is either absorbed into the ground or runs off into rivers. Water that was absorbed into the ground is taken up by plants. Plants lose water from their surfaces as vapor back into the atmosphere. Water that runs off into rivers flows into ponds, lakes, or oceans where it evaporates back into the atmosphere.

The cycle continues.

Nitrogen Cycle

- All life requires nitrogen-compounds, e.g., proteins and nucleic acids.
- Air, which is 79% nitrogen gas (N_2), is the major reservoir of nitrogen.
- But most organisms cannot use nitrogen in this form.
- Plants must secure their nitrogen in "fixed" form, i.e., incorporated in compounds such as:
    - nitrate ions (NO_3^-)

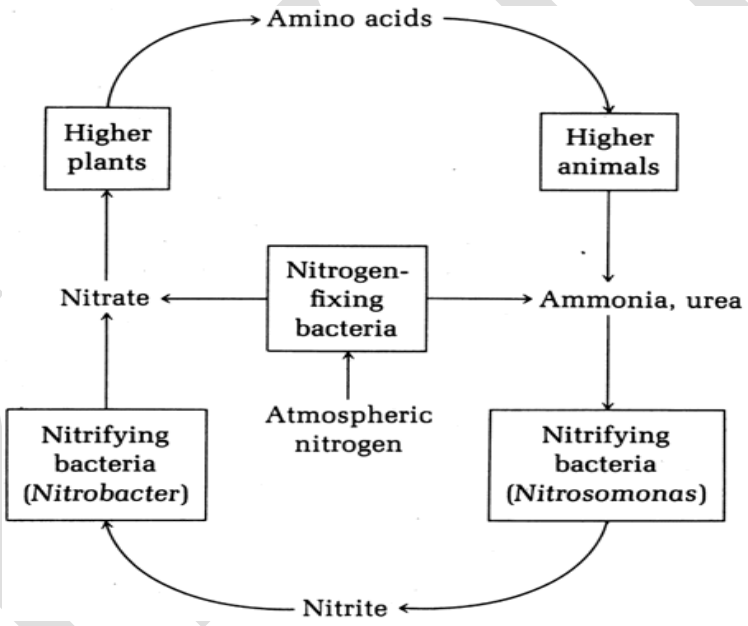
- ammonium ions (NH_4^+)
- urea $(NH_2)_2CO$

- Animals secure their nitrogen (and all other) compounds from plants (or animals that have fed on plants).

Four processes participate in the cycling of nitrogen through the biosphere:

- nitrogen fixation
- decay
- nitrification
- denitrification

Microorganisms play major roles in all four of these.



Nitrogen Fixation

The nitrogen molecule (N_2) is quite inert. To break it apart so that its atoms can combine with other atoms requires the input of substantial amounts of energy.

Three processes are responsible for most of the nitrogen fixation in the biosphere:

- **atmospheric fixation** by lightning
- **industrial fixation**
- **biological fixation** by certain microbes — alone or in a symbiotic relationship with some

plants and animals

Atmospheric Fixation

The enormous energy of lightning breaks nitrogen molecules and enables their atoms to combine with oxygen in the air forming nitrogen oxides. These dissolve in rain, forming nitrates, that are carried to the earth.

Atmospheric nitrogen fixation probably contributes some 5– 8% of the total nitrogen fixed.

Industrial Fixation

Under great pressure, at a temperature of 600°C, and with the use of a catalyst, atmospheric nitrogen and hydrogen (usually derived from natural gas or petroleum) can be combined to form ammonia (NH_3). Ammonia can be used directly as fertilizer, but most of its further processed to urea and ammonium nitrate (NH_4NO_3).

Biological Fixation

The ability to fix nitrogen is found only in certain bacteria and archaea.

- Some live in a symbiotic relationship with plants of the legume family (e.g., soybeans, alfalfa).
- Some establish symbiotic relationships with plants other than legumes (e.g., alders).
- Some establish symbiotic relationships with animals, e.g., termites and "shipworms" (wood-eating bivalves).
- Some nitrogen-fixing bacteria live free in the soil.
- Nitrogen-fixing cyanobacteria are essential to maintaining the fertility of semi-aquatic environments like rice paddies.

Biological nitrogen fixation requires a complex set of enzymes and a huge expenditure of ATP.

Although the first stable product of the process is ammonia, this is quickly incorporated into protein and other organic nitrogen compounds.

Decay

The proteins made by plants enter and pass through food webs just as carbohydrates do. At each trophic level, their metabolism produces organic nitrogen compounds that return to the environment, chiefly in excretions. The final beneficiaries of these materials are microorganisms of decay. They break down the molecules in excretions and dead organisms into **ammonia**.

Nitrification

Ammonia can be taken up directly by plants — usually through their roots. However, most of the ammonia produced by decay is converted into **nitrates**. Until recently this was thought always to be accomplished in two steps:

- Bacteria of the genus **Nitrosomonas** oxidize NH_3 to **nitrites** (NO_2^-).
- Bacteria of the genus **Nitrobacter** oxidize the nitrites to **nitrates** (NO_3^-).

These two groups of autotrophic bacteria are called **nitrifying bacteria**. Through their activities (which supply them with all their energy needs), nitrogen is made available to the roots of plants. However, in 2015, two groups reported finding that bacteria in the genus *Nitrospira* were able to carry out both steps: ammonia to nitrite and nitrite to nitrate. This ability is called "comammox" (for complete ammonia oxidation).

In addition, both soil and the ocean contain **archaeal** microbes, assigned to the Crenarchaeota, that convert ammonia to nitrites. They are more abundant than the nitrifying bacteria and may turn out to play an important role in the nitrogen cycle.

Many legumes, in addition to fixing atmospheric nitrogen, also perform nitrification — converting some of their organic nitrogen to nitrites and nitrates. These reach the soil when they shed their leaves.

Denitrification

The three processes above remove nitrogen from the atmosphere and pass it through ecosystems. Denitrification reduces nitrates and nitrites to nitrogen gas, thus replenishing the atmosphere. In the process several intermediates are formed:

- nitric oxide (NO)
- nitrous oxide (N_2O)(a greenhouse gas 300 times as potent as CO_2)
- nitrous acid (HONO)

Once again, bacteria are the agents. They live deep in soil and in aquatic sediments where conditions are anaerobic. They use nitrates as an alternative to oxygen for the final electron acceptor in their respiration.

Phosphorus cycle

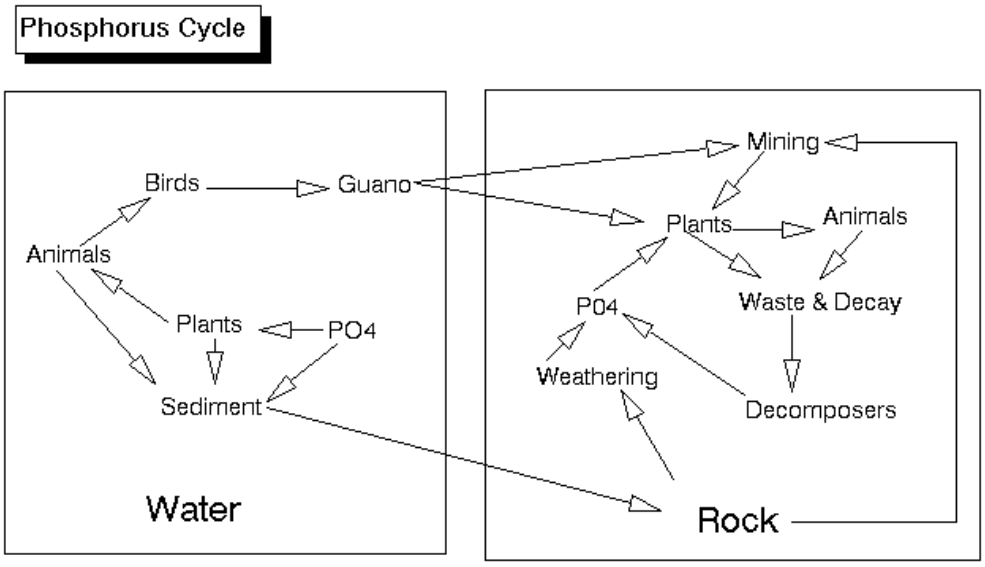
Phosphorus is an essential nutrient for plants and animals in the form of ions PO_4^{3-} and HPO_4^{2-}. It

is a part of DNA-molecules, of molecules that store energy (ATP and ADP) and of fats of cell membranes. Phosphorus is also a building block of certain parts of the human and animal body, such as the bones and teeth.

Phosphorus can be found on earth in water, soil and sediments. Unlike the compounds of other matter cycles phosphorus cannot be found in air in the gaseous state. This is because phosphorus is usually liquid at normal temperatures and pressures. It is mainly cycling through water, soil and sediments. In the atmosphere phosphorus can mainly be found as very small dust particles. Phosphorus moves slowly from deposits on land and in sediments, to living organisms, and than much more slowly back into the soil and water sediment. The phosphorus cycle is the slowest one of the matter cycles that are described here.

Phosphorus is most commonly found in rock formations and ocean sediments as phosphate salts. Phosphate salts that are released from rocks through weathering usually dissolve in soil water and will be absorbed by plants. Because the quantities of phosphorus in soil are generally small, it is often the limiting factor for plant growth. That is why humans often apply phosphate fertilizers on farmland. Phosphates are also limiting factors for plant-growth in marine ecosystems, because they are not very water-soluble. Animals absorb phosphates by eating plants or plant-eating animals.

Phosphorus cycles through plants and animals much faster than it does through rocks and sediments. When animals and plants die, phosphates will return to the soils or oceans again during decay. After that, phosphorus will end up in sediments or rock formations again, remaining there for millions of years. Eventually, phosphorus is released again through weathering and the cycle starts over.



Ecological succession

Ecological succession is the gradual process by which ecosystems change and develop over time. Nothing remains the same and habitats are constantly changing.

3 Types of Ecological Succession

Succession may be initiated either by formation of new habitat (landslide or lava flow) or disturbance of already existing habitat (fires, land clearance). There are three recognized stages to ecological succession. Each covers a gradual process of change and development. They do not have hard and defined boundaries, and it is possibly for an ecological system to be in both stages at once during the transition period from one to another. The 3 stages of ecological succession are:

1. Primary – This is when an ecological community first enters into a new form of habitat that it has not been present in before. A good example of this would be the habitat created when granite is removed in a quarry. The rock face that is left behind is altered and becomes a new habitat. The environment that then grows within that habitat is considered to be in its primary stage.

2. Secondary – The secondary succession stage occurs after a habitat has been established, but it is then disturbed or changed in some fashion and a new community moves in. To use the example from before – let us say that a primary stage develops on the face of a newly quarried granite cliff. That habitat grows undisturbed, until there is a forest fire that then burns and

changes a portion of the habitat that has been growing on the rock face. That ecological habitat has now entered its secondary stage.

3. Climax – the climax stage is the last stage of an ecosystem. It is when the ecosystem has become balanced and there is little risk of an interfering event or change to mutate the environment. Several rainforests and deserts qualify as being in the climax stage. What is tricky about a climax stage is that given human development, any ecosystem that is in the climax stage now holds the risk of being destroyed and going backward in the stages.

Stages of succession

The process begins with establishment of a few pioneer species which are replaced or reduced in abundance by species of increasing complexity. The diversity increases until the ecosystem as a whole gets stabilized with the establishment of climax community. The establishment of pioneer species at a bare site causes changes in soil structure and nutrient content. Changes in physical environment soon follow the first step.

New species of plants replace the existing plants due to the change of physical factors and soil structure. These in turn alter the existing conditions paving way for newer species to get established. These changes are often accompanied by the introduction of animal species into the area.

The cyclic process ends after reaching a stabilized community called as climax community. The ecosystem is fully balanced at this stage until they get disturbed by any other external factors. Disturbances eventually destroy the existing climax community and the process of succession starts anew.

The process

The processes of ecological succession are

1. Nudation.

It is the development of a bare site uninhabited by any organisms. The process is usually caused by disturbances. These factors can be either topographic (soil erosion, wind action etc); climatic (hails, storm, glaciations, fire etc.); or biotic (human activities). The area thus formed can sustain only autotrophic organisms which can utilize inorganic substrates. The environmental conditions are set up for the inhabitation of new species. For example, secretion of acidic substances by

lichen species helps in break down of rocks into soil.

2. Invasion or migration.

The process of invasion or migration helps the arrival of seeds, spores or other reproductive propagules for establishment of species. Invasive species are non native organisms which can spread widely in a community. These are usually threatening the normal ecosystem and causative agents for community disturbance. However, in succession process, they help to alter the soil texture and function. R-selected species are often the first colonizers due to their high reproductive rates and better dispersal mechanisms.

3. Ecesis.

This is the initial establishment of plant community. This is dependent on the soil structure. The stage is also called as 'colonization'. In this stage, the early colonizing species proliferate abundantly through germination, growth, and reproduction. Ecesis is due to allogenic mechanisms alone. This is the stage at which the pioneer species survive the dispersal mechanisms. The different pioneer species can have different maturation rates which allow this process to be longer and gradually allowing replacement of some species by others. The process also makes the soil structure suitable for those species whose seeds were present in the existing ecosystem but were unable to germinate for lack of suitable community support.

4. Aggregation

Aggregation is the increase in population of the species which has become established in the area. The shrubs replace the small herbs in most successions. This also proves as a source of food for future inhabitants.

5. Competition.

Once the few initial species have become established the intra as well as interspecific competition among the species starts. This stage is called competition. The competition is usually for resources such as food, water etc. Competition is found in both plants as well as animal species. The process leads to sharing of resources (resource partitioning) or competitive exclusion.

6. Reaction.

The environmental conditions get modified by the action of species occupying the habitat. These

changes subsequently trigger the displacement and replacement of one species by another. The existing community will be unable to support itself due to the harsh conditions. The major underlying mechanism is autogenic succession in which the plants themselves alter the environmental conditions. Early colonizers usually facilitate the way for establishment of mature species.

7. Stabilization

Stabilization is the process by which the climax community gets established. A climax community is mature, self sustaining, stable and is the final stage of succession. The physical and chemical conditions are altered and stabilized to such levels that it supports the entire community. The climax communities are best adapted to the regions of succession and the community structure is likely to continue until another disturbance steps in. This represents a steady state of ecological equilibrium with specific composition, structure and energy flow.

The process of secondary succession is much faster due to the availability of enriched soil and other factors. The only limiting factor in such succession is the disturbance. The process is essentially the same as primary except for the absence of some of the typical stages. Eventually both will result in the establishment of stable communities which are made up mostly of K-selected species.

Hydrosere

It is succession occurring in the aquatic environment. Such a type of succession does not necessarily lead the aquatic communities toward the development of land communities.

If the body of water is large and very deep or very strong wave action and other powerful physical forces are at work, the succession results in a stable aquatic community in which any considerable further change is hardly recognizable.

Succession is recognizable only if the colonization of plant communities takes place in artificial small and shallow ponds, lakes, etc. where wave action speeds up the process by allowing the erosion of soil towards edge regions. In this way, the filling process also speeds up quickly and consequently the body of water disappears within few years time.

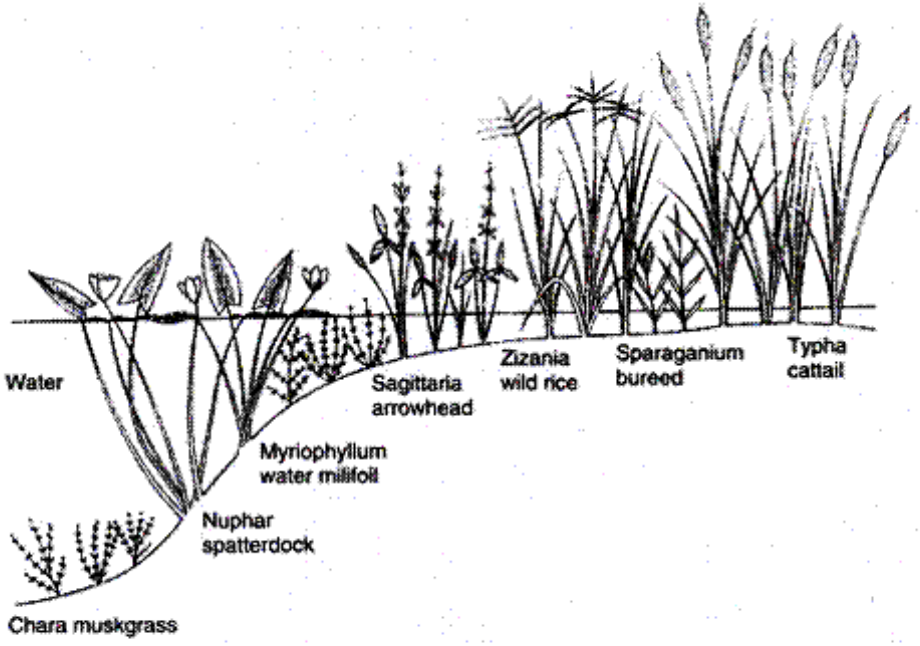


Fig. 7.1. Zonation of aquatic vegetation (hydrophytes) along a pond and along river banks. Note the changes in vegetation with water depth.

In a new and virgin pond hydrosere starts with the colonisation of phytoplankton and finally terminates into a forest (the climax community).

1. Phytoplankton stage:

In the initial stage of succession algal spores are brought in the body of water. The simple forms of life like bacteria, algae and many other aquatic plants (phytoplankton) and animals (zooplankton) floating in water are the pioneer colonizers. All these organisms add large amount of organic matter and nutrients due to their various life activities and after their death, they settle at the bottom of pond to form a layer of muck.

2. Submerged stage:

The phytoplankton stage is followed by submerged plant stage. When a loose layer of mud is formed on the bottom of the pond, some rooted submerged hydrophytes begin to appear on the new substratum. The submerged aquatic vegetation develops in the regions of ponds or lakes where water depth is about 10 feet or more. The pioneers are Elodia, Potamogeton, Myriophyllum, Ranunculus, Utricularia, Ceratophyllum, Vallisnena, Chara, etc.

These plants form tangled mass and have marked effects upon the habitat. When these plants die

their remains are deposited at the bottom of the ponds or lakes. The eroded soil particles and other transported materials are also deposited at the bottom. This gradually raises the ho t the ponds and lakes up. As this process of stratification progresses the body of water becomes more and more shallow, consequently the habitat becomes less suited for the submerged vegetation but more favourable for other plants.

3. Floating stage:

When the depth of water reaches about 4 to 8 feet, the submerged vegetation starts disappearing from its original place and then the floating plants make their appearance gradually in that area. In the beginning the submerged and floating plants grow intermingled but in the course of time the submerged plants are replaced completely. The most tolerant species in the area are able to reproduce and perpetuate. Their broad leaves floating on the water surface check the penetration of light to deeper layer of water.

This may be one of the main causes responsible for the death of submerged plants. Due to continuous interaction between plant communities and aquatic environment, the habitat becomes changed chemically as well as physically. More water and air borne soil and dead remains of plants are deposited at the bottom. Thus, the substratum rises up in vertical direction. Important floating plants that replace the submerged vegetation are Nelumbmm, Trapa, Pistia, Nymphaea, and Limnanthemum etc.

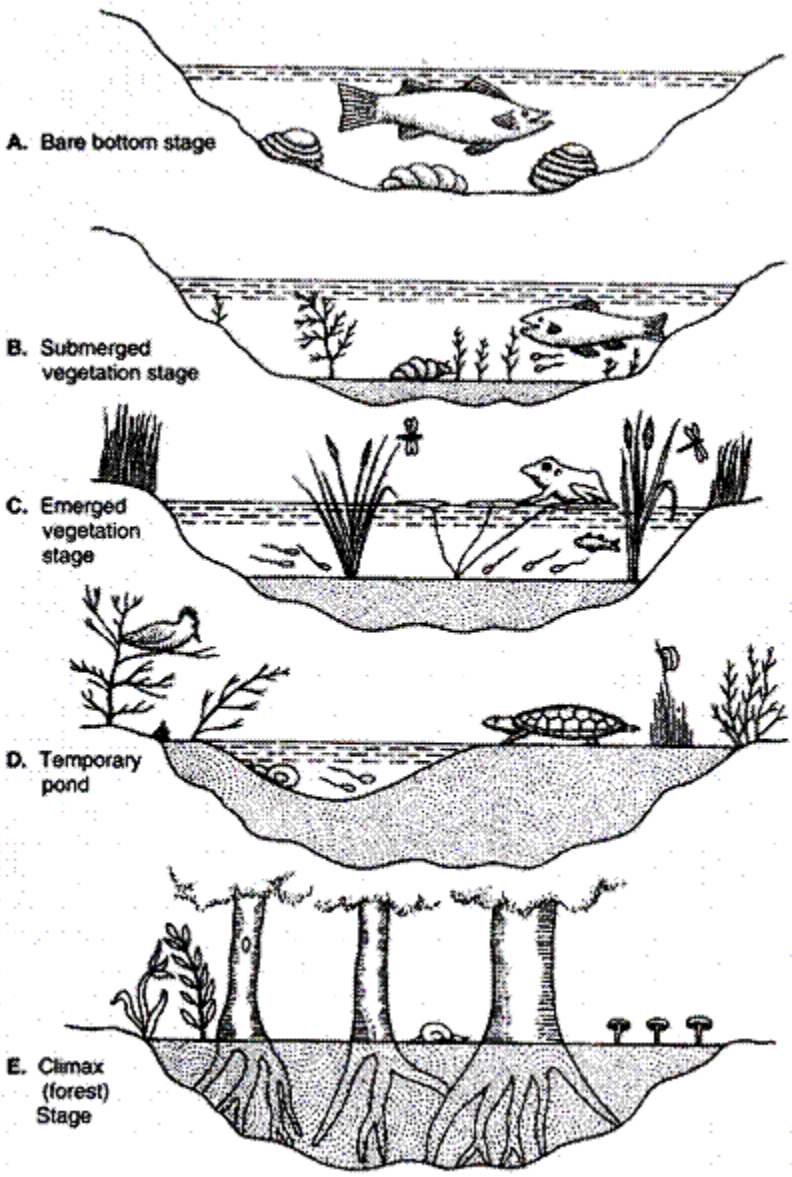


Fig. 7.2. Community succession in an open pond.

4. Reed-swamp stages:

When the ponds and lakes become too shallow (water depth one to three feet) and the habitat is changed so much that it becomes less suited to the floating plants some other plants which are well adapted to new environment will then come in .Under these conditions, the floating plants start disappearing gradually and their places are occupied by amphibious plants which can live successfully in aquatic as well as aerial environment Important examples are Bothrioclova,

Typha, Phragmites (Reed), etc.

The foliage leaves of such plants are exposed much above the surface of water and roots are generally found either in mud or submerged in water. The foliage leaves form a cover over submerged and floating plants and thus they cut off light from the plants underneath them. Under such conditions neither submerged nor floating plants can survive. Further deposition of soil and plant debris at the bottom reduces the depth of water and makes the habitat less suitable for the pre-existing plants.

When the bottom reaches very close to the water surface many secondary species, such as those of Polygonum, Sagittaria, etc. make their appearance. Later, they also bring about such reactions by which the habitat becomes less suitable for most of the existing species, and consequently new successional step follows.

5. Sedge Marsh or Meadow stage:

The filling process finally results in a marshy soil which may be too dry for the plants of pre-existing community. Now the plants well adapted to new habitat begin to appear in the pre-existing community in mixed state. Important plants that are well suited to marshy habitat are the members of cyperaceae and grammeae. The species of sedge (Carex) and rushes (Juncus), species of Themeda, Iris, Dichanthium, Eriophorum, Cymbopogon, Campanula, Mentha, Caltha, Gallium, Teucrium, Cicuta, etc. are the first invaders of marshy area.

As these plants grow most luxuriantly in the marshes, they modify the habitats in several ways. They absorb and transpire a large quantity of water and also catch and accumulate plant debris and wind and water borne soil particles. Consequently a dry habitat results which may be totally unfit for the growth of normal hydrophytes. Gradually the mesophytes start appearing and after some time the sedge vegetation is totally replaced by them.

6. Woodland stage:

In the beginning some shrubs and later medium sized trees form open vegetation or woodland. These plants produce more shade and absorb and transpire large quantity of water. Thus, they render the habitat more dry. Shade loving herbs may also grow under t e trees and shrubs. The prominent plants of woodland community are species of Buteazon, Acacia, Cassia, Terminalia, Salix, Cephalanthus, etc.

7. Climax forest:

After a very long time the hydrosere may lead to the development of climax vegetation. As the level of soil is raised much above the water level by progressive accumulation of humus and soil particles, the habitat becomes more dry and certainly well aerated. In such a habitat, well adapted self-maintaining and self-reproducing, nearly stable and uniform plant community consisting mostly of woody trees develops in the form of mesophytic forest.

In the climax forest, all types of plants are met with. Herbs, shrubs, mosses and shade loving plants represent their own communities. Trees are dominant and they have control over the entire vegetation. Bacteria, fungi, and other micro-organisms are more frequently found in the climax vegetation. They react upon the habitat and make the soil rich in the organic materials. At the climax stage, a complete harmony develops between plant community and habitat.

It is now clear that whole sere is a continuously but gradually changing complex in which the changes are forced by biotic, topographic or climatic factors. It is very slow process that cannot be observed in nature. It may require thousands of years to reach the climax stage. One can however, observe the sequence of hydrosere as he moves in the lake or pond from the deepest region towards the shallower margin.

Xerosere (Succession in dry conditions)

The succession occur in dry condition is called Xerosere. It undergoes following stages.

1. Crustose lichen stage

Crustose are land lifeless structure. The crustose may have an external protective layer surface on the rock. Special types of lichens can grow on ,these rocks. The lichens are called crustose lichens. Its most common species are *Rhizocorpon. Rthodina and Lea117 (1M.* These lichens can live in extreme conditions. Sometime, their surface becomes wet due to rain and dew-drops. They absorb water during dry season. They cause weathering of the rock. They prepare the land for next stage.

2. Foliage lichen stage

Now habitat is suitable for foliage lichens. Foliage lichens are leaf like. They are attached at one point.. Their examples are *Parmelia* and *Dermaticarpo.* They produce shade on the crustose

lichens. As a result the growth of crustose lichen is reduced or decreased. They make the soil acidic. Humus is added to it. It makes the rock rough.

3. Moss stage

The soil becomes more porous. Litter of the lichens is collect in it. Thus at this stage moss plants in ade the area. The examples of mosses are *Polyerichum and Tornda.* The mosses compete with lichens for water. They penetrate much deeper in the soil as compared to the lichens. The lichens become dead. Thus more humus is added to the soil. Minerals combine widi this humu. This environment is now suitable of herbaceous plants:

4. Herbaceous (plant) stage

The soil has a large amount of humus and litter. Thus its water holding capacity is increased. Thus -there is wire availability of moistures, humus and soil for anchorage. The herbaceous plants are now established there. These plants increase the process of weathering. Evaporation or transpiration takes place. It reduces the temperature. Now bacteria, fungi and other animals establish there. Some xerophytes grasses also establish there.

5. Shrub stage

Soil conditions are now becomes favourable for shrubs. Shrubby plants now start growing. They become dense. They cast shadow on herbs so the herbs die. Thus ***the*** herbaceous plants add more humus to the soil. The roots of shrubs penetrate into soil. They develop wide cracks in rock. The process of soil formation continues.

6. Climax stage

The soil is much improved now. So it now allows the growth and establishment of woody plants. These plants are densely rooted. The shade of these plants inhibits the growth of most plants. Woody plants dominate in this stage. This stage essentially remains the same if nothing changes in the environment to upset the balance. It is a stable stage in succession. Thus the woody forest is the climax stage for this region.

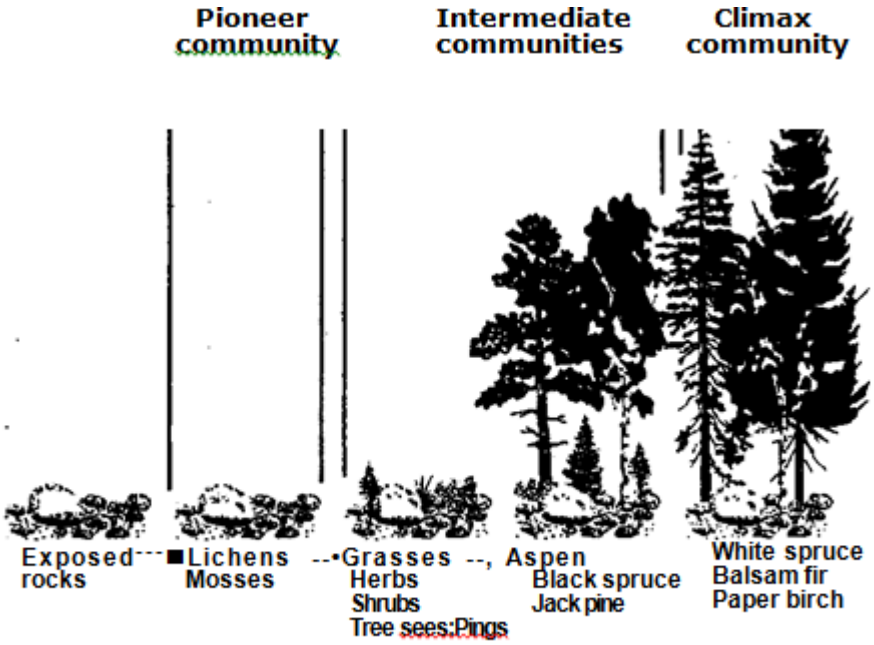


Fig: Different stage of Xerosere

Classification of ecosystem

The ecosystems are of many different types and are classified based on a number of factors. Here in this article, we are going to discuss all the major types of ecosystems and will try and understand on what basis these classifications are done. We will study all the different factors which differentiate the ecosystems from one another and will try and develop an understanding of these factors at an advanced level.

Basically there are two types of ecosystems, the aquatic ecosystems and the terrestrial ecosystems. All the other types which are generally used to describe ecosystems fall under one of these two categories.

Aquatic Ecosystems

An ecosystem is an entity formed by the interaction between living organisms and the physical environment. It is classified into two main categories: Terrestrial ecosystems and Aquatic ecosystems. Terrestrial ecosystems contain organisms that depend on physical environment on land masses of continents. Aquatic ecosystems are systems composed of living organisms and non-living elements interacting in a watery environment. In simple terms, an aquatic ecosystem is a community of plants and animals that primarily depend on water. There are two major types

of aquatic ecosystems:

- Marine Ecosystems
- Freshwater Ecosystems

- **Marine Ecosystems**

While terrestrial ecosystems cover only about 28 percent, marine ecosystems cover approximately 71 percent of the earth's surface. Different habitats ranging from coral reefs to estuaries make up this largest aquatic ecosystem in the planet. Prime examples of marine ecosystems include:

- Ocean: Main body of salty water that is further divided into important oceans and smaller seas. Major oceans include the Pacific Ocean, Indian Ocean, Arctic Ocean, Atlantic Ocean and Southern Ocean.
- Intertidal zone: Area which remains underwater at high tide and remains terrestrial at low tide. Different types of habitats including wetlands, rocky cliffs and sandy beaches fall under intertidal zones.
- Estuaries: Areas between river and ocean environments that are prone to tides and inflow of both freshwater and saline water. Due to this inflow, estuaries have high levels of nutrients. There are different names of estuaries such as inlets, lagoons, harbors etc.
- Coral Reefs : Often referred as the "rainforests of the sea", coral reefs are mounds found in marine waters as a result of accumulation of calcium carbonate deposited by marine organisms like corals and shellfish. Coral reefs form the most varied marine ecosystems in the planet, but cover less then one percent of the world's ocean. Nevertheless, around 25 percent of marine animals including different types of fishes, sponges and mollusks are found in coral reefs.

Common species found in marine ecosystems include:

- Marine mammals such as seals, whales and manatees
- Different species of fish including mackerel, flounder, dogfish, sea bass, etc.
- Organisms such as the tiny planktonic, brown algae corals, echinoderms, etc.

Marine ecosystems are important for the well-being of both terrestrial and aquatic environments.

However, they are vulnerable to environmental problems such as climate change, pollution and overfishing, which can be a serious harm to marine biodiversity.

- **Freshwater Ecosystems**

Although freshwater ecosystems are one of the main types of aquatic ecosystems, only 0.8 percent of the earth's surface is covered by them. The water in freshwater ecosystems is non-saline (which means water has no salt content). Approximately 41 percent of the earth's fishes are found in freshwater ecosystems.

Examples of freshwater ecosystems are:

- Streams and rivers (Lotic): Lotic ecosystems refer to systems with rapid flowing waters that move in a unidirectional way. Best examples are rivers and streams, which harbor several species of insects and fishes. Crustaceans like crayfish and crabs; and mollusks such as clams and limpets are commonly found in streams and rivers. Various mammals such as beavers, otters and river dolphins also inhabit lotic ecosystems.
- Lakes, ponds and pools (Lentic): Lentic ecosystems are still waters such as lakes and ponds that have a community of biotic (living organisms) and abiotic (physical objects) interactions. Ponds and lakes have a diverse variety of organisms including algae, rooted and floating-leaved plants, invertebrates such as crabs, shrimps, crayfish, clams etc, amphibians such as frogs and salamanders; and reptiles like alligators and water snakes.
- Wetlands: The best examples of wetlands include swamps and marshes, where the water is completely or partially shallow. Biologically, wetlands are known to be too diverse as it harbors numerous animals and plant species. Plants such as black spruce, water lilies, mangrove, tamarack and sedges are commonly found in wetlands. Various species of reptiles and amphibians are also found in wetlands.

Freshwater ecosystems, which are one of the major types of aquatic ecosystems, are in danger because of the rapid extinction rates of several invertebrates and vertebrates, mainly because of overfishing and other activities that harm the ecosystem.

Terrestrial ecosystem

Terrestrial ecosystem refers to the interaction between living organisms and non-living objects occurring on land masses of islands and continents. They differ from aquatic ecosystems because of lower importance to water, which is a major part in aquatic ecosystems. The Earth's surface comprises of 28 percent (approximately 55,000,000 square miles) of terrestrial ecosystems.

In terrestrial ecosystems, major categories of life forms include birds (Aves) with over 8,000 species, mammals (Mammalia) with approximately 4,000 species and insects with approximately 900,000 species. Plant categories include flowering plants (Magnoliophyta) with around 275,000 species, mosses with around 24,000 species and conifers with around 500 species.

Grassland as an Ecosystem:

One of the simplest and self-sufficient terrestrial eco-system is the grassland which occupies approximately 19 per cent of the earth's surface.

Just like other eco-systems, a grassland ecosystem is composed of different components:

(A)Abiotic Component:

It consists of various nutrients present in soil or in aerial environment. Abiotic substances like carbon dioxide, water, nitrates, phosphates, sulphates, etc. supply the elements like C, H, O, N, S, P, etc. from air and soil. Besides, some trace elements are also present in the soil.

(B) Biotic Component:

The various organisms constituting biotic components can be divided into the following headings:

(a) Producers:

The grasses and few forbs and shrubs are the autotrophs or producers of a grass-land eco-system. These prepare carbohydrate by the process of photo-synthesis in the presence of light, light trapping pigments (chlorophylls), carbon dioxide of the atmosphere and water from the soil. Some producers, species are Dicahanthiun, Cynodon, Desmodium, Digitaria, etc.

(b) Consumers:

There are mainly three types of consumers:

(i) Primary Consumers:

The primary consumers are herbivorous mainly grazing animals like cows, buffalos, deer's, goats, sheep's, etc. In addition to the grazing animals some insects, termites and millipedes feed

on the grasses.

(ii) Secondary Consumers:

These are the carnivores feeding on herbivores. Some common examples of secondary consumers are foxes, snakes, frogs, lizards, etc.

(iii) Tertiary Consumers:

These are the carnivore feeding on secondary consumers. Some common examples are snakes, hawks, etc. (c) Decomposers or Transformers: These are the microbes which decompose and transform the organic substances of dead organisms (plants or animals) into inorganic components. The inorganic components are subsequently absorbed by the producers for the preparation of food. The microbes are mainly fungi, some bacteria and actinomycetes.

Forest Ecosystem:

A forest is a complete functioning ecosystem that supports in numerable plant and animal species as well as land, water and air subsystem. It is a heterogeneous complex of living and nonliving elements which are interrelated. It may be small like a backyard or large like the planet earth which depends on the range of individual species or group of species, geology and other issues.

Different types of forest ecosystems and their characteristics are as follows:

(A) Temperate Forests:

Temperate forests are the regions which have seasonal variation in climate i.e., the climate changes a lot from summer to winter. The annual rain fall is about 750- 2000 mm and soil is rich. Such types of forests are found in western and central Europe, Eastern Asia and eastern North America.

These forests have deciduous trees (oaks, maples etc.) and coniferous trees (pines). These forests contain abundant micro-organ- isms, mammals (hares, deer, fares, coyotesetc). Birds (warblers, wood peckers, owls etc.) snakes, frogs, salamanders etc.

(B) Tropical Rain forests:

Tropical rain forests are special ecosystems which accommodate thousands of species of animals and plants. These untain usually densely packed tall trees those form a ceiling from the sun above. The filing prevents the growth of smaller plants. However, the areas where the sunlight can reach the surface become the place of growth of a number of interesting plants.

The annual rainfall in these regions is about 80 inches. The temperature remains almost same throughout the year. Such types of forests are found in Brazil of South America (Neotropic) and Central and West Africa. The area is always warm and muggy.

Structure of forest ecosystem:

The living organisms existing within the ecosystem interact with each other and with the surroundings. Each organism has a definite role in sustaining the ecosystem. The abiotic components of such ecosystem include physical components (light, heat, etc.), inorganic components (carbon dioxide, water, oxygen, nitrogen, phosphorous, calcium etc.) and organic components (amino acids, humic acid, fatty acids, carbohydrates etc.).

The various organisms constituting the biotic components are:

(i) Producer,

(ii) Consumer,

(iii) Decomposes or transformer.

(i) Producers:

The trees and other plants produce the basic food stuff (carbohydrate) and energy by the process of photosynthesis which are subsequently un-assumed by other organisms within the food chains and food webs.

(ii) Consumers:

All animals including mammals, insects and birds are called consumers. The primary consumers eating only plants are termed as herbivores. Secondary consumers feed on herbivores, are termed as carnivores. Tertiary consumers feed on small carnivores, are also carnivores. Omnivores consume both plant and animals matters.

(iii) Decomposers:

The materials like leaves, needles, old branches, dead plants and dead animals are decomposed by worms, microbes, fungi, ants and other bugs. The decomposers break these items down in to their smallest primary elements to be used again i.e., the decomposers sustain the nutrient cycle of ecosystem.

Desert Ecosystem:

A desert is an area where evaporation exceeds precipitation. The annual precipitation in these regions is in between 25 mm and 50 mm, spread unevenly over the year. The desert gets heated during day time and temperature becomes high. The night can be quite cold since the lack of vegetation allows the heat from the ground to radiate away into atmosphere very quickly. The desert soil has very little organic matter but it is rich in minerals.

The desert plants have wax coated leaves, deep and widely spread shallow roots. These try to conserve water by having few or no leaves. The desert animals are usually small in size. They remain under cover during the day time and come out to feed at night. Many animals have thick external shell which reduces moisture loss due to evaporation.

The deserts differ from one another by their soil composition. Some deserts are made of very fine red sands and others consist of sand mixed with pebbles and rocks. The sands are mostly minerals and sometimes oils are found hidden deep within the rocks.

The different components of desert ecosystems are:

(i) Abiotic Component:

The abiotic component includes various nutrients present in the soil and arid environment. Interestingly, the abiotic component is having very little organic matter and water.

(ii) Biotic component:

The various organisms constituting the biotic components are:

(i) Producers:

The producers capable of producing food by photosynthesis are mainly shrubs or bushes, some grasses and a few trees. Most of the desert plants are succulents and others have seeds that remain dormant until rain awakens them. The desert plants include many species of cacti, desert rose, living rock, welwitchia etc.

(ii) Consumers:

The animals consuming the producers are insects, reptiles etc. There are also some rhodents, birds, some mammalian vertebrates.

The desert insects include locust, a special type of destructive grasshopper, Yucca moth, darkling beethe etc. The desert reptiles may be snakes and lizards. The desert birds are sand grouse, gila

wood pecker, road runner ostrich etc. The mammals residing in the desert are camels, horses, foxes, jackals etc.

(iii) Decomposes:

The number of decomposes in the desert are very few because of poor vegetation leading to less organic matter. The usual decomposes are some bacteria and fungi which are thermophillic.

S.No	Question	Option a	Option b	Option c	Option d	Answer
1.	Which one of the following is an example of non-renewable resources?	Wind	Water	Vegetation	Coal and minerals	Coal and minerals
2.	Which of the following is a renewable resource	coal	fuel	minerals	water	water
3.	_____ of stratosphere provides protection to our life.	Nitrogen	Hydrogen	Ozone	Argon	Ozone
4.	Which of the following soil is the best for plant growth?	Sandy soil	Clay	Gravel	Loamy soil	Loamy soil
5.	_____ is the major raw material for biogas.	Plant leaves	Cow dung	Mud	Grass	Cow dung
6.	Forests can be not be conserved if	timber trees are cut down worldwide.	timber trees are cut down selectively.	if rate of plantation exceeds rate of cutting trees.	new seedlings are planted and grown trees are cut.	timber trees are cut down worldwide.
7.	The resources which are found everywhere are known as	Ubiquitous	Non-renewable resources	Human made resources	Renewable resources	Ubiquitous
8.	Balancing the need to use resources and also conserve them for the future is called	sustainable development resource	conservation	resource development	human resource development	sustainable development resource
9.	Land covers only about ____ percent of the total area of the earth's surface	25	30	35	20	30
10.	The thin layer of grainy substance covering the surface of the earth is called	soil	sand	mineral	organic matter	soil
11.	The process in which bare ground between plants is covered with a layer of organic matter like straw, is called	Mulching	Contour carriers	Shelter belts	Intercropping	Mulching
12.	The process in which different crops are grown in alternate rows and are sown at different times to protect the soil from rain wash, is known as	Crop rotation	Intercropping	Terrace farming	Contour cropping	Intercropping
13.	Fresh water accounts for only ____ percent.	1.7	2.7	3.7	4.7	2.7
14.	Deciduous forests shed their leaves in a particular season to conserve loss of moisture through	transpiration	evaporation	condensation	respiration	transpiration
15.	A natural area designated to protect the ecological integrity of one or more ecosystems for present and future generations, is called	Bird sanctuaries	Biosphere reserve	Wildlife sanctuaries	National park	National park
16.	A naturally occurring substance that has a definite chemical composition is a	compound	mineral	metal	rock	mineral
17.	Minerals that lie at shallow depths are taken out by removing the surface layer; this is known as	Drilling	open-cast mining	Shaft mining	Quarrying	open-cast mining
18.	Kolar in _____ has deposits of gold in India.	Tamil Nadu	Kerala	Karnataka	Andhra Pradesh	Karnataka
19.	The following is called 'Black gold'.	Petroleum	Coal	Bauxite	Metal	Petroleum
20.	Petroleum means	Land oil	Shell oil	Black oil	Rock oil	Rock oil
21.	Bio-gas is primarily a mixture of	Methane and carbon dioxide	Methane and Oxygen	Propane and carbon dioxide	Propane and oxygen	Methane and carbon dioxide

22.	Shifting cultivation is a type of	Commercial farming	Primitive subsistence agriculture	Intensive subsistence agriculture	Growing vegetables	Primitive subsistence agriculture
23.	Cotton requires	high temperature, light rainfall	low temperature, light rainfall	high temperature, high rainfall	low temperature, high rainfall	high temperature, light rainfall
24.	Water contains	one hydrogen atom and one oxygen atom	two hydrogen atoms and one oxygen atom	one hydrogen atom and two oxygen atoms	three hydrogen atoms and two oxygen atoms	two hydrogen atoms and one oxygen atom
25.	Primary source of water is	Rivers	Ground water	Lakes	Rain water	Rain water
26.	When combustion of coal takes place in insufficient air (oxygen) which gas is formed . Instead of carbon dioxide	Sulphur dioxide	Carbon monoxide	Nitrogen peroxide	Nitrous oxide	Carbon monoxide
27.	An aquifer, which is underlying by impermeable layer at the bottom and not confined at the top is known as	Confined aquifer	Un confine aquifer	Semi confined aquifer	Perched aquifer	Un confine aquifer
28.	The percentage of earth covered by ocean is	31%	51%	71%	97%	97%
29.	Energy we use to heat our homes, drive our cars and run our computers comes from	Artificial Resources	Natural Resources	Renewable Resources	Nonrenewable Resources	Natural Resources
30.	For travelling short distances, best way to conserve natural resources is	by driving	by flying	by taking lift	by cycling	by cycling
31.	**Which of the following is a non-renewable resource?**	Petroleum	Forests	Water	Wildlife	Petroleum
32.	**Which among the following is not a renewable source of energy?**	Solar energy	Biomass energy	Hydro-power	Geothermal energy	Biomass energy
33.	Identify the non-renewable energy resource from the following:	Coal	Fuel cells	Wind power	Wave power	Coal
34.	Which of the following is a disadvantage of most of the renewable energy sources?	Highly polluting	High waste disposal cost	Unreliable supply	High running cost	Unreliable supply
35.	Photovoltaic energy is the conversion of sunlight into:	Chemical energy	Biogas	Electricity	Geothermal energy	Chemical energy
36.	Horizontal axis and vertical axis are the types of:	Nuclear reactor	Wind mills	Biogas reactor	Solar cell	Wind mills
37.	Steam reforming is currently the least expensive method of producing:	Coal	Biogas	Hydrogen	Natural gas	Hydrogen
38.	A fuel cell, in order to produce electricity, burns:	Helium	Nitrogen	Hydrogen	Oxygen	Hydrogen
39.	Fuel cells are:	Carbon cell	Hydrogen battery	Nuclear cell	Chromium cell	Hydrogen battery
40.	Both power and manure is provided by:	Nuclear plants	Thermal plants	Biogas plants	Hydroelectric plant	Biogas plants
41.	The outermost layer of the earth is:	Magma	Mantle	Crust	Solid iron core	Crust
42.	Common energy source in Indian villages is:	Electricity	Coal	Sun	Wood and animal dung	Wood and animal dung
43.	The one thing that is common to all fossil fuels is that they:	Were originally formed in marine environment	Contain carbon	Have undergone the same set of geological processes during their formation	Represent the remains of one living organisms	Contain carbon
44.	The process that converts solid coal into liquid hydrocarbon fuel is called:	Liquefaction	Carbonation	Catalytic conversion	Cracking	Liquefaction
45.	Lignite, bituminous and anthracite are different ranks of:	Nuclear fuel	Coal	Natural gas	Biogas	Coal
46.	Cruid oil is:	Colourless	Odourless	Smelly yellow to black liquid	Odourless yellow to black liquid	Smelly yellow to black liquid
47.	BTU is measurement of:	Volume	Area	Heat content	Temperature	Heat content
48.	The first controlled fission of an atom was carried out in Germany in:	1920	1928	1925	1938	1938

49.	Boiling water reactor and pressurised water reactors are:	Nuclear reactor	Solar reactor	OTEC	Biogas reactor	Nuclear reactor
50.	The natural resources available in limited quantity at global level is	Non renewable	Renewable	Exhaustible	Inexhaustible	Exhaustible
51.	The recent technique used for study of vegetation is	Remote sensing	Field work	Ground photography	Observation	Remote sensing
52.	Serious threat to wild life is	Habitat destruction	International trade	Introduction of exotic species	Over exploitation	Habitat destruction
53.	Solar energy is which type of natural resources	Renewable	Non-renewable	Exhaustible	Inexhaustible	Inexhaustible
54.	Reforestation is	Plantation of forests	Plantation forests in deforested areas	Cutting down of forests	Management of forests	Plantation forests in deforested areas
55.	More than 70% of world's fresh water is contained in	Ponds	Glaciers and polar ice caps	Green land	Oceans	Glaciers and polar ice caps
56.	The main reserve of fresh water on earth surface is	Ground water	Rivers	Lakes	Polar ice caps and glaciers	Polar ice caps and glaciers
57.	There is decrease in _____ because of deforestation	Soil erosion	Global warming	Rainfall	Drought	Rainfall
58.	Which of the following acts as a main source of ground water?	Rain	River	Ocean	Canals	Rain
59.	Which one is not an exhaustible resource	Solar energy	Coal	Rainfall	Wind power	Coal
60.	Maximum use of fresh water is in	Agriculture	Domestic use	Industry	Pisciculture	Agriculture

UNIT-II

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 fireworks.

Natural resources and associated problems

Human population is growing day-by-day. Continuous increase in population caused an increasing demand for natural resources. Due to urban expansion, electricity need and industrialization, man started utilizing natural resources at a much larger scale. Non-renewable resources are limited.

They cannot be replaced easily. After some time, these resources may come to an end. It is a matter of much concern and ensures a balance between population growth and utilization of resources.

This over utilization creates many problems. In some regions there are problems of water logging due to over irrigation. In some areas, there is no sufficient water for industry and agriculture. Thus, there is need for conservation of natural resources.

There are many problems associated with natural resources

Forest resources

In India, forests form 23 percent of the total land area. The word 'forest' is derived from the Latin word 'foris' means 'outside' (may be the reference was to a village boundary or fence separating the village and the forest land).

A forest is a natural, self-sustaining community characterized by vertical structure created by presence of trees. Trees are large, generally single-stemmed, woody plants. Forest can exist in many different regions under a wide range of conditions, but all true forests share these physical characteristics.

Because a forest is a natural community, no forest is static in time. That is, because forest communities respond to outside influences, most forests are in a state of constant flux. Depending upon the systems within which forest communities exist, such factors might include rainfall, fire, wind, glaciation, seismic activity, flooding, animal activity, insulation, and so on.

At any time, a forest is a collection of past responses to outside influences and internal competitive interactions. Therefore, the present status of any forest, indeed of any natural community, reflects what has gone on before.

Uses of Forests:

1. Commercial uses:

The forests of a country make a natural asset of immense value. They produce a large number of products of commercial as well as industrial importance. Some of such valued products are structural timber, charcoal, raw materials for the manufacture of paper, newsprint, panel products, bidi leaves, resins, gums, essential oils and a number of useful medicinal shrubs.

2. Ecological uses:

Most of the ecologically useful plants are in the form of herbs, shrubs, climbers and grasses. Tropical forests are considered as the lungs of the earth and have aptly been called as the life support system. They are the treasure house of food, medicines and commerce.

These forests harbour some very primitive species of plants and animals and provide the most stable environment for life and land. Between 1999 and 2009, about 350 million hectares of tropical forests (equivalent to 4 times the size of France) have been converted to other uses.

3. Regulation of climate:

Rain forests, the most primitive ecosystem, are universally recognised for regulating the global climate, rainfall and the consequent productivity of land and water.

4. Reducing global warming:

The forest canopy absorbs CO2 during photosynthesis and acts as a sink for green-house gases.

5. Soil conservation:

A properly stocked forest guards against soil erosion, damage of water sheds, floods and sedimentation.

6. Regulation of hydrological cycle:

Forested watersheds act like giant sponges, absorb rain water, increase humidity by transpiration and regulate hydrological cycle.

7. Medicinal value:

Most of the medicinal plants are found in the under-brush strata of the forest. They contain chemicals such as alkaloids, glycosides, terpenoids, lignans, fatty acids, resins, tannins, gums and many other substances which have specific effects on the human body For example, Tinospora cordifolia, Vitex trifolia, Serpentina, Eucalyptus, rusa grass, khus, camphor and sandal wood are used in medicines. Quinine, a malaria drug, is obtained from the bark of Cinchona.

8. Oils:

Essential oils, obtained from a variety of forest plants, are used in the manufacture of soaps, cosmetics, pharmaceuticals, confectionery and tobacco flavouring etc.

9. Food products:

Vegetative shrubs, herbs, climbers, ferns, mosses are derived from trees and consist of flowers, fruits, leaves, bark, stem or root. Several forest fruits, flowers and even leaves and roots are eaten. Examples are bel, ber, phalsa, jamun, khirni and tendu.

The parts of some plants are used as vegetables and for making pickles. Examples are amla, anar, imli, karaunda, kokam, kachnar etc. Kalazira is the seed of carum carvi and is used as a spice. Shahtoot fruit is eaten or made into a sharbat. Tendu leaves are used as wrappers of tabacco to make bidis.

10. Desert vegetation:

India is gifted with cold desert vegetation of Tibet Plateau. It has been estimated that more than 15000 known floral species are found in India. The North-East region, comprising of Assam, Tripura, Meghalaya etc. is the richest zone. There are more than 6700 endemic species largely found in Himalayas and Western Ghats of Peninsular India.

11. Shelter for tribal people:

The forests play an important role in the life of tribal people living in close proximity of forests because they provide them food, shelter, timber, wood fuel, fruits, meat, medicines, hides, skins and other products of their daily and commercial use. Forests also give shelter to diverse species of plants, wildlife and micro-organisms.

12. Pollution moderators:

Forests absorb many toxic gases and can help in keeping the air pure. They also absorb noise and thus help in preventing air and noise pollution.

13. Aesthetic value:

Forests also have a great aesthetic value. All people appreciate the natural beauty and tranquility of forests.

Over Exploitation of Forest Resources:

Exploitation of vast potential of forests may be due to the following causes:

1. Commercial Demand:

Forests contribute substantially to the national economy. The international timber trade alone is worth over US $ 40 billion per year. But the commercial demand for pines, teak, sal and conifers has turned the productive forest wealth into near desert.

2. Raw Materials for Industrial Use:

Wood, timber, wooden crates for manufacture of furniture, railway sleepers and pulp for paper industry have exerted tremendous pressure on forests. Plywood is in great demand for packing tea in tea industry while fir tree wood (ten times more) is exploited for packing apples alone.

3. Development Projects:

Mega Projects of the World Bank, construction of dams, hydroelectric projects, power stations, roads, highways, railways, open cast coal and lime stone mines have been instrumental for the massive destruction of forest cover. The tidal mangrove forests called Sunderbans have been stripped and the Southern Peninsula has turned to acacia scrub semidesert. The tropical deciduous forests of Vindhyan range of Mirzapur were replaced with a savannah ecobiome and near barren wasteland due to excessive exploitation.

4. Growing Food Demands:

Forest wealth has been recklessly exploited for agricultural land and settlements.

5. Fuel Requirement:

Increasing demand for fuel wood by over growing population in India had shot up to 600 million tonnes in 2010. If the trend continues, time will come soon when the cost of fuel would be much higher than the cost of food.

Problems Associated with Forests:

1. Overexploitation of forests is responsible for soil erosion, loss of wildlife and biodiversity, change in landscape, wind direction, floods, droughts and global warming.

2. Deforestation upsets the delicate balance of nutrients, gases and symbiotic relationship between man and plants.

3. Tropical forests, considered as the lungs of the earth, are under a virtual death sentence owing to burgeoning population density. Merciless clearing of plant species (genetic erosion) at the rate of 8 million hectares per year has resulted in tremendous loss of vast reservoir of genetic diversity.

4. Hydrological cycle gets affected thereby influencing rainfall.

5. Horticulture has contributed to social destabilisation, eco-destruction and massive deforestation. The snow line of Himalayas is continuously receding, an extremely serious phenomenon with far reaching consequences.

Hot Beds of Extincting Forests:

Some extincting tropical forests are: Madagascar, Western Eucador, Colombian, Choco, Western Amazonia, Northern Borneo, Eastern Himalayas, Peninsular Malaysia, Philippines and New Caledonia.

Probleme of Deforestation:

Destruction of biotic potential of land leads to deforestation, i.e., forest destruction. The total forest area of the world was estimated to be 7000 million hectare in 1900 which fell down to 2100 million hectare by 2010. This process of deforestation is a serious threat to economy, quality of life and future of the environment in our country.

a. Note that we are still far behind the target of achieving 33% forest area as per National Forest Policy. Despite increasing awareness, deforestation rate continues to increase.

b. Each day about 32300 hectare of forests disappear and another 32300 hectare of forest suffers degradation.

c. During the period 2005-2010, the tropical deforestation rate had increased by 9.5% as compared to 1995's deforestation rates.

d. Primary forests have suffered a loss of 25%.

e. Further, forests are being replaced by plantations with much less biodiversity.

Major Causes of Deforestation:

1. Rapid explosion of human and livestock population.

2. Overgrazing by cattle, indiscriminate felling of trees and over exploitation of land resources.

3. Construction of dams destroy thousands of square kilometres of tropical forests. The process of filling the reservoirs may drown large tracks of forests, displace people and kill wild life.

4. Although dams are intended to provide inexpensive electricity, many of them are economic failures because of lack of environmental planning. Erosion of water shed fills reservoirs with silt and reduces the ultimate output and usefulness of dams.

5. Proliferation of industries, quarrying, irrigation and expansion of agricultural land for farming to meet the growing food demand.

Forest Conservation:

The National Forest Policy of India (1988) recommended that one-third (33%) of our land should be under forest cover. But today, the forest cover has reduced to merely 12%. Per capita forest area available in India is 0.06 hectare as against 0.64 hectare of the world's per capita forest area. We have almost reached a critical state which must be remedied before it is too late for our own survival.

Some conservation strategies have been listed as follows.

1. Conservation of Reserve Forests:

Reserve forests include National Parks, Sanctuaries, Biosphere Reserves and the areas where major water resources are located, viz., the Himalayas, Western and Eastern Ghats. These must be protected and no commercial exploitation should be allowed in these areas.

2. Production Forestry:

These are forests on the plains and their productivity can be enhanced by proper management. Generally, fast growing trees (Eucalyptus, Acacia) are grown using modern techniques.

Production of commercial forestry is intended entirely for commercial purposes to meet the needs of the forest based industries. Grazing lands and fallow lands not used for agriculture can be used for raising such plantations.

3. Social Forestry:

Social forestry is based on public and common land to produce firewood, fodder, fruits and small timber for rural community. The aim is to reduce pressure on natural forests for these requirements.

4. Agro Forestry:

Same land is used for farming and forestry by taungya (growing crops between rows of trees) and jhum (shifting crop and forest cultivation) techniques.

5. Urban Forestry:

It aims at growing ornamental and fruit trees along roads, parks or vacant lands.

WATER RESOURCES:

Water, a vital natural resource and precious commodity, is essential for multiplicity of purposes, viz., drinking, agriculture, power generation, transportation and waste disposal.

In chemical processes industrial water is used as a reaction medium, a solvent, a scrubbing medium and a heat transfer agent.

As a source of life for man, plants and animals, it is indispensable and cannot be replaced by any other solvent.

Availability of Water:

The chief sources of water are rain water, sea water, ground and surface water. The World's total quantum of water is 140×10^{16} m^3.

Sea Water:

About 97% of earth's water supply is in the oceans which is unfit for human consumption or other uses due to high salt contents. Of the remaining 3%, 2.3% is locked in the polar ice caps and hence inaccessible. The remaining 0.7% is available as fresh water. If all the sea beds could

be raised up and brought at the level of the earth surface, then the entire water in oceans would cover the whole earth's surface and make it 2.5 km deep water mass.

Ground Water:

Ground water, a gift of nature, is about 210×10^9 m^3 (0.66%) including recharge through infiltration, seepage and evapotranspiration. Out of this nearly one-third is extracted for irrigation, industrial and domestic use, while most of the water is recycled into rivers. Of the fresh water below the surface about 90% satisfies the description of ground water that is, water which rests below the water table. About 2% water occurs as soil moisture in the unsaturated zone above the water table and is essential for plant growth.

The major portion of water (about 165 $x10^{10}$ m^3) which goes to earth crust is retained as soil moisture. Only 500 $x10^9$ m^3 percolates down to the ground water deposits. About 120 $x10^9$ m^3 of water applied to agricultural fields moves down to ground water table and 50 x 10^9 $m^3$of surface flow also end up as ground water. Thus a total of 670 $x10^9m^3$ fresh water enters the ground annually.

Surface Water:

We have a very limited stock of usable water that is, 0 03% of the mass balance. The 115×10^{10} m^3 of surface water is increased by the addition of about 450 $x10^9$ m^3 of fresh water from ground water flow, 200 $x10^9$ m^3 from surface flow and 50 x 10^9 m^3 as run-off from irrigated areas. The surface loses almost 50×10^9 m^3 m of its water which percolates down to ground water deposits. The total surface flow per year is 185×10^9 m^3 which is distributed among river basins.

Rain Water:

In India, the annual rainfall is about 400 $x10^{10}$ m^2. Out of this, 70 $x10^{10}m^2$ of water evaporates immediately, 115 $x10^{10}$ m^2 runs off into surface water bodies and the remaining percolates into the soil. The hydrological cycle in nature is, more or less, balanced in terms of charge (cloud formation) and discharge (rainfall). By 2010, the total water requirement was expected to thrice as much as we had in 1974. The waste water from these is extremely polluted and on mixing with rivers it is polluting the rivers also.

Water Quality:

It is essential to enforce water quality standards to specify suitability of water for drinking, irrigation, industry, public health and environmental safety purposes. All developed countries strictly conform to water quality standards. The United States Public Health (USPH) has laid down following standards for drinking water.

Table 1. Water quality parameters (Domestic water supplies) and USPH Standards.

Parameter	USPH Standards	Parameter	USPH Standards
pH	6.0–8.5	Chloride	250.0
Dissolved oxygen	4.0–6.0	Sulphate	250.0
Total dissolved solids	500.0	Cyanide	0.05
Suspended solids	5.0	Nitrate + nitrite	10.0
Calcium	100.0	Iron	0.3
Magnesium	30.0	Lead	0.05
Mercury	0.002	Arsenic	0.05
Chromium VI	0.05	Phenol	0.001
COD	4.0	Detergents	0.1

Note. All parameters except pH are in ppm or mg/L.

The quality parameters for surface water (rivers, lakes, ponds) are 4 to 5 times higher than the above values for drinking water. The delicate balance existing between the ratio of available and exploitable water resources and sustaining their quality should be maintained to support the life systems on earth.

Water for domestic purposes should be free from:

1. Materials which impart colour, taste or turbidity, e.g., oils, grease, phenols etc.

2. Substances which may settle to form objectionable deposits or float on the surface as debris, oils and scum.

3. Toxic substances including radionuclides, physiologically harmful to man or other aquatic life.

Over Exploitation of Water Resources:

Water, a vital natural resource and precious commodity, is essential for multiple purposes. Human beings depend on water for almost every developmental activity. Out of 30% stream flow, water consumed by man is 8% for irrigation, 2% for domestic use, 4% for industrial consumption, 12% for electrical utilities, 4% for transportation and waste disposal. Water shapes the earth's surface and regulates our climate.

Water use by man is of two types:

(i) Water withdrawal, that is, using ground water or surface water. With the rapid growth of population, many countries are now using desalinated sea water as a potential source of supply of potable water in scarcity hit regions. Desalination may be accomplished by processes such as distillation, freezing, electro-dialysis and reverse osmosis.

(ii) Water consumption that is, water which is taken up but not returned for reuse. Globally, only 60% of the water withdrawn is consumed due to loss through evaporation.

Water consumption in major sectors:

Irrigation:

Agriculture sector is the major consumer (93%) of water in India (Table 2). While in a country like Kuwait, which is water poor, only 4% is used for watering the crops. On a global average, 70% of water withdrawn is used for irrigation.

Table 2. Estimates of water requirements (in cubic kilometres) in India.

Water needed for	1974	2000	2025
Irrigation	350.0	630.0	770.0
Thermal power generation	11.0	60.0	160.0
Industries	5.5	30.0	120.0
Domestic needs	8.8	26.6	39.0
Livestock management	4.7	7.4	11.0
Total	380.0	754.0	1100.0

Industries:

About 25% of water on global average is used in industry which again varies from 70% in European countries to 5% in less developed countries.

Power generation:

In India, power generation sector requires about 15 times more water by 2012 than it was in 1974.

Domestic water needs:

Per capita consumption of water shows wide variations. In USA, an average family of 4 consumes more than 1000 m^3 of water per year which is many times more than that in most developing countries. With growing population, the demand for good quality fresh water is steadily increasing but its availability is dwindling because of misuse, wastage and pollution.

World Health Organisation:

Current estimates show that water consumption will have to be cut by 50% by 2025 if nations fail to address imbalances in global water supply and demand.

Problems of Excessive use of Ground Water:

1. Lowering of water table:

Excessive use of ground water for drinking, irrigation and domestic purposes has resulted in rapid depletion of ground water table leading to drying of wells and sharp decline in future agricultural production.

2. Ground subsidence:

When ground water withdrawal is more than its recharge rate, the sediments in the aquifers become compact causing ground subsidence. It results in sinking of overlying land surface which may damage buildings, cause fractures in pipes, reverse the flow of sewers and canals and tidal flooding.

3. Water logging:

Excessive irrigation with brackish water raises the water table leading to water logging and salinity problems.

MINERAL RESOURCES

Definition:

Minerals provide the material used to make most of the things of industrial- based society; roads, cars, computers, fertilizers, etc. Demand for minerals is increasing world wide as the population increases and the consumption demands of individual people increase. The mining of earth's natural resources is, therefore accelerating, and it has accompanying environmental consequences.

A mineral is a pure inorganic substance that occurs naturally in the earth's crust. All of the Earth's crust, except the rather small proportion of the crust that contains organic material, is made up of minerals. Some minerals consist of a single element such as gold, silver, diamond (carbon), and sulphur.

More than two-thousand minerals have been identified and most of these contain inorganic compounds formed by various combinations of the eight elements (O, Si, Al, Fe, Ca, Na, K, and Mg) that make up 98.5% of the Earth's crust. Industry depends on about 80 of the known minerals.

A mineral deposit is a concentration of naturally occurring solid, liquid, or gaseous material, in or on the Earth's crust in such form and amount that its extraction and its conversion into useful materials or items are profitable now or may be so in the future. Mineral resources are non-renewable and include metals (e.g. iron, copper, and aluminum), and non-metals (e.g. salt, gypsum, clay, sand, phosphates).

Minerals are valuable natural resources being finite and non-renewable. They constitute the vital raw materials for many basic industries and are a major resource for development. Management of mineral resources has, therefore, to be closely integrated with the overall strategy of

development; and exploitation of minerals is to be guided by long-term national goals and perspectives.

Types of Mineral Resources:

Minerals in general have been categorized into three classes' fuel, metallic and non-metallic. Fuel minerals like coal, oil and natural gas have been given prime importance as they account for nearly 87% of the value of mineral production whereas metallic and non-metallic constitutes 6 to 7%.

(A) Fuel Minerals:

Coal, oil and natural gas are the basic fossil fuel. We have good reserves for coal but are very poor in more essential fuel — oils and natural gas.

(i) Coal:

Proven coal reserves of the country as on January 1994 (estimated by GSI) is about 68 billion tonnes. We are mining about 250 tonnes annually and this rate is expected to go by 400 – 450 tonnes by 2010 A.D. If we could maintain our mining rate of 400 tonnes per year then the coal reserves might last for about 200 years taking proven reserves as 80 billion tonnes.

The calorific value of coal varies with percentage of carbon present in it. Coal depending upon variation in percentage carbon, can be divided into three categories as follows (bituminous / anthracite type is the most abundant form present in Indian coal):

Table: Categories of Coal

Type	% Carbon	% Volatile Matter	% Moisture
Lignite	**38**	**19**	**43**
Bituminous	**65**	**10**	**25**
Anthracite	**96**	**1**	**3**

(ii) Crude Oil (Petroleum):

It is believed that petroleum has been formed over a period of millions of years, through conversion of remains of micro organisms living in sea, into hydrocarbon by heat, pressure and catalytic action. The petroleum on fractional distillation and further processing provides us numerous products and by-products.

Some of the common products obtained on fractional distillation are given in Table 2.4, along with the temperature (just below the boiling point) at which they tend to liquefy after crude oil

feed at the base is heated to about 400°C. One million tonne of crude oil on fractional distillation provides about 0.8 million tonnes of petroleum products.

The percentage composition varies with the quality of crude oil or it could be varied up to a certain limit depending upon the requirement or demand. On an average the percentage composition of the common product with their number of carbon atoms is given in table

Table: Average % Composition of Petroleum products (with no. of C atoms) obtained through fractional distillation.

S. No.	% Composition	Name of products	No. of carbon atoms with average value
1.	25	Petrol	C_6-C_{12} (C_8)
2.	45-60	Diesel & Kerosene	C_6– C_{22} (C_{14})
3.	15-20	Naphtha	
4.	8- 10	Fuel oil	C_{30} – C_{80} (C_{40})
5.	2-5	Asphalt	C_{50} -C_{100}(C_{100})

We have very poor reserves for petroleum just limited to 700 million tonnes. About 40% of the total consumption of the overall petroleum products of the country is used in road transport sector (in case of diesel, consumption of road transport sector is to the extent of 70% of the total diesel consumption of the country).

Rest 60% of the petroleum products are used in industries including power generation, domestic and for miscellaneous purposes. In view of rapid growth of these vital sectors, the consumption of petroleum products has been increasing consistently over a period of last few years and is bound to increase at rapid pace in near future.

(iii) Natural Gas:

The proven reserve for natural gas on April 1993 works out to be approx. 700 billion cubic meter (BCM). As regard to production vis a vis utilization aspect in earlier years, more than half of gas coming out of the wells remained unutilized. However, in recent years, we have achieved a utilization rate of 80 – 90%. Keeping in view the future demands and proven gas reserves, it is unlikely that our gas reserves might last for more than 20 years.

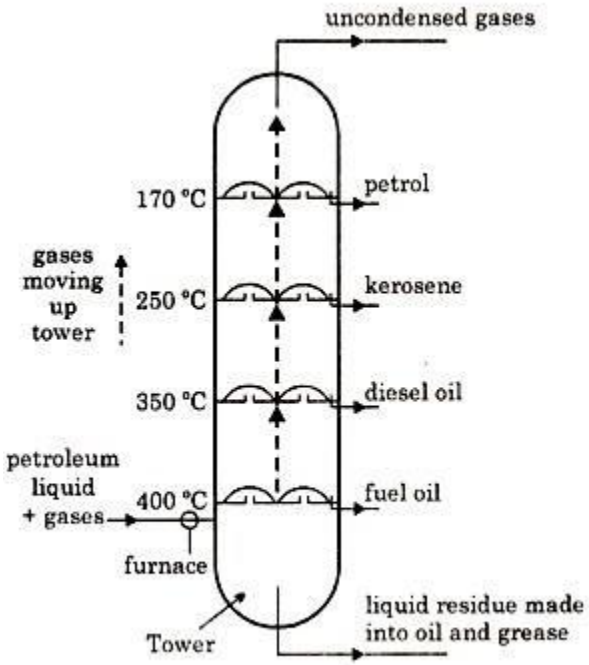
(B) Metallic and Non-metallic Minerals:

India is poorly endowed with mineral wealth. Except for iron ore and bauxite our share of world reserves of every other mineral is one percent or less. However, there has been a phenomenal

growth in production since independence. As per estimates if the present trend of production continues, we will exhaust our reserves of all the important minerals and fuels, except coal, iron ore, limestone and bauxite, in 25 to 30 years.

Use and Exploitation:

The use of minerals varies greatly between countries. The greatest use of minerals occurs in developed countries. Like other natural resources, mineral deposits are unevenly distributed around on the earth. Some countries are rich in mineral deposits and other countries have no deposits. The use of the mineral depends on its properties. For example aluminum is light but strong and durable so it is used for aircraft, shipping and car industries.



Fractional Distillation Tower.

Recovery of mineral resources has been with us for a long time. Early Paleolithic man found flint for arrowheads and clay for pottery before developing codes for warfare. And this was done without geologists for exploration, mining engineers for recovery or chemists for extraction techniques. Tin and copper mines were necessary for a Bronze Age; gold, silver, and gemstones adorned the wealthy of early civilizations; and iron mining introduced a new age of man.

Human wealth basically comes from agriculture, manufacturing, and mineral resources. Our complex modern society is built around the exploitation and use of mineral resources. Since the future of humanity depends on mineral resources, we must understand that these resources have

limits; our known supply of minerals will be used up early in the third millennium of our calendar.

Furthermore, modern agriculture and the ability to feed an overpopulated world is dependent on mineral resources to construct the machines that till the soil, enrich it with mineral fertilizers, and to transport the products.

We are now reaching limits of reserves for many minerals. Human population growth and increased modern industry are depleting our available resources at increasing rates. The pressure of human growth upon the planet's resources is a very real problem.

The consumption of natural resources proceeded at a phenomenal rate during the past hundred years and population and production increases cannot continue without increasing pollution and depletion of mineral resources.

Environmental impacts of mineral extraction

Major mines which are known for causing severe problems are given below:

- Jaduguda Uranium Mine, Jharkhand- exposing local people to radioactive hazards.
- Jharia coal mines, Jharkhand- underground fire leading to land subsidence and forced displacement of people.
- Sukinda chromite mines, Orissa- Seeping of hexavalent chromium into river posing serious health hazard, Cr6+ being highly toxic and carcinogenic.
- Kudremukh iron ore mine, Karnataka- causing river pollution and threat to biodiversity.
- East coast Bauxite mine, Orissa-Land encroachment and issue of rehabilitation unsettled.
- North-Eastern Coal Fields, Assam-Very high sulphur contamination of groundwater.

Impacts of mining: Mining is done to extract minerals from deep deposits in soil.

Environmental damages caused by mining activities are as follows:

- Devegetation and defacing of lands: Mining requires removal of vegetation along with underlying soil mantle and overlying rock masses. This results in destruction of landscape in the area.
- Subsidence of land: Subsidence of mining areas results in tilting of buildings, cracks in houses, buckling of roads, bending of rail tracks and leaking of gas from cracked pipe lines leading to serious disasters.

- Groundwater contamination: Mining pollutes the groundwater. Sulphur, usually present as an impurity in many ores is known to get converted into sulphuric acid through microbial action, thereby making the water acidic.
- Surface water pollution: The acid mine drainage often contaminates the nearby streams and lakes. The acidic water, radioactive substances like uranium, heavy metals also contaminate the water bodies and kill aquatic animals.
- Air pollution: In order to separate and purify the metal from other impurities in the ore, smelting is done which emits enormous quantities of air pollutants. Oxides of sulphur, arsenic, cadmium and lead etc. shoot up in the atmosphere near the smelters and the public suffers from several health problems.
- Occupational Health Hazards: Miners working in different type of mines suffer from asbestosis, silicosis, black lung disease.

Remedial measures

- Adopting eco-friendly mining technology
- Utilization of low grade ores by using microbial –leaching technique. In this method, the ores are inoculated with the desired strains of bacteria like Thiobacillus ferroxidans, which remove the impurities and leave the pure mineral.
- Re-vegetating mined areas with appropriate plants
- Gradual restoration of flora
- Prevention of toxic drainage discharge.

FOOD RESOURCES

World Food Problems

- During the last 50 years world grain production has increased almost three times.
- The per capita production is increased by about 50%.
- At the same time population growth increased at such a rate in less developed countries.
- Every 40 million people die of undernourishment and malnutrition.
- This means that every year our food problem is killing as many people as were killed by the atomic bomb dropped on Hiroshima during World War II.
- This statistics emphasize the need to increase our food production, and also to control population growth.

- It is estimated that 300 millions are still undernourished.

Impacts of overgrazing and agriculture

Overgrazing

Overgrazing can limit livestock production. Over grazing occurs when too many animals graze for too long and exceed the carrying capacity of a grass land area.

Impact of overgrazing

- Land degradation: Overgrazing removes the grass cover. The humus content of the soil is decreased and it leads to poor, dry, compacted soil.
- Soil erosion: The soil roots are very good binders of soil. When the grasses are removed, the soil becomes loose and susceptible to the action of wind and water.
- Loss of useful species: Due to overgrazing the nutritious species like cenchrus, panicum etc. are replaced by thorny plants like Parthenium, Xanthium etc. These species do not have a good capacity of binding the soil particles and, therefore, the soil becomes more prone to soil erosion.

Agriculture

Traditional Agriculture and its impacts

- Usually involves a small plot
- Simple tools
- Naturally available water
- Organic fertilizer and a mix of crops

Main impacts

- Deforestation
- Soil erosion
- Depletion of nutrients

Modern Agriculture and its impacts

- It makes use of hybrid seeds of selected and single crop variety.
- High-tech equipments, lots of energy subsidies in the form of fertilizers and, pesticides
- Irrigation water

Main impacts

- Impacts related to high yielding verities (HYV): The uses of HYVs encourage monoculture i.e. the same genotype is grown over vast areas. In case of an attack by some pathogen, there is total devastation of the crop by the disease due to exactly uniform conditions, which help in rapid spread of the disease.

Remedy

i. The most common method for getting rid of salts is to flush them out by applying more good quality water to such soils.

ii. Another method is laying underground network of perforated drainage pipes for flushing out the salts slowly.

Energy Resource Types

Energy resource types are different from types of energy. Energy resource types refer to the origin of the energy source itself, while types of energy refer to different types of potential (chemical, electrical, etc.) and kinetic (heat, sound, etc.) energy.

Generally, we can break energy into two broad categories of resources - non-renewable and renewable.

Non-renewable energy resources

These resources have formed over millions of years of geological processes, and we're using them faster than they can be naturally replenished. Examples include fossil fuels like coal, petroleum, and natural gas. We currently depend on non-renewables to meet most of our energy demands, extracting and combusting them primarily to generate electricity or develop fuels for transportation.

While we often consider nuclear power as an alternative energy option, it is important to remember that while its carbon output is very low compared to fossil fuels, nuclear fission is still a non-renewable resource.

Coal

A combustible sedimentary rock made up mostly of carbon and hydrocarbon, coal is the most abundantly used fossil fuel worldwide for the generation of electricity. In the United States, approximately 93% of the coal consumed is used to generate electricity (EIA website). The steel, concrete, and paper industries also rely heavily on coal for both heat and byproducts. The combustion of coal results in almost 3 times as many CO2 emissions as the amount of coal combusted

Natural Gas

A gas that is made up mostly of methane and found near other fossil fuels, like coal. Methanogenic processes occurring in landfills and marshes also produce natural gas. Like petroleum, natural gas must first be processed before we can use it as a fuel. It is important to remove most of the other components of natural gas until it is almost purely methane. When combusted, natural gas produces only about half the greenhouse gas emissions as coal does, making it a popular fossil fuel in our increasingly carbon-conscious society.

Petroleum

A toxic, flammable liquid occurring in geologic formations beneath the earth's surface (also known as crude oil). We use oil for a wide variety of things - the largest use of petroleum is for fuel oil and gasoline. But, you'll find petroleum in places you might not expect it as well - pharmaceuticals, plastics, asphalt, kerosene, and synthetic rubber, to name a few. Like natural gas, petroleum must be processed before we can utilize it. Crude oil naturally contains many different types of hydrocarbons, all with different boiling points. So, to process the oil for a specific application, the crude must be heated to a specific temperature range.

Uranium

A very heavy, fissile metal (U-235) that can be caused to split in a fission chain reaction, producing tremendous quantities of heat which can then be used to generate electricity. Because the reaction of one nucleus capturing another neutron sets off another 2-3 reactions, the resulting chain reaction is exponential and allows us to generate a substantial amount of heat with a relatively small amount of uranium. After extraction, uranium must be processed before we can start the fission process. Most reactors utilize uranium that has been finely ground and then gasified to uranium hexafluoride which is then converted to pellets of uranium dioxide. While nuclear power offers us a greenhouse gas emission-free source of energy, the concerns associated with reactor failure and long term storage of spent fuel present significant barriers to widespread adoption.

Renewable energy resources

Renewable energy resources are those sources of energy which can be replenished and are not depleted because of our consumption. Renewable resources include wind, solar, geothermal, hydropower, tidal, and biomass energy. Nuclear fusion also falls into this category. Typically, renewable energy resources have much lower greenhouse gas and other emissions associated with use.

But if renewable energy resources are cleaner and offer a sustainable supply of energy, why have we traditionally relied so heavily on non-renewable energy resources like fossil fuels?

- inexpensive

- in abundant supply
- storable

Wind

We can put wind to work by utilizing it to power turbines that generate electricity. The blades of the turbines turn a shaft which then powers a series of gears that feed into a generator and produce electricity. Wind turbines can be situated on agricultural or forested land, so there's little or no need to clear new areas of land to site wind fields. Some people take issue with the noise and visual pollution of the wind turbines. There are also concerns about bird and bat mortality. Watch the video to the left to learn more about how wind energy works.

Solar

Harnessing energy from the sun epitomizes the idea of a renewable energy source. We can use solar energy to heat water or homes and it can be converted into electricity. Currently, converting solar energy to electricity either occurs with the use of photovoltaic cells or solar power plants. The PV cells are able to convert sunlight directly into electricity. Solar power plants use the solar energy to produce steam to operate a generator. Like wind energy, however, solar energy is limited in availability based on localized weather conditions, and it can be challenging to store the energy generated.

Geothermal

The core of the Earth generates a tremendous amount of heat, and in many places around the world (particularly near tectonically active areas), we can harness that heat in wells and bring it to the surface to heat and cool homes and buildings. Like solar and wind, geothermal power can be captured at an individual level - you install a geothermal heat pump to cool and heat your home - or at a more centralized scale by using dry steam or hot water to generate electricity. Since no fuel is combusted, the plants release no greenhouse gas emissions like a traditional fossil fuel plant would. There are minor emissions of compounds responsible for acid rain.

Biomass

Biomass energy encompasses a broad range of fuels including wood and other plant material, food waste, garbage, and manure. In the case of wood and plant material, it can be processed and combusted for a beneficial end use such as generating electricity or firing a boiler. With food waste and manure, the gases resulting from the processes of decomposition of these materials can be harnessed and combusted for a beneficial end use. Utilizing biomass for energy not only provides us with a renewable energy source, but often allows us to put a material that would otherwise be considered waste to a good use. It's important to remember that while a renewable energy source, biomass fuels each have their own set of environmental impacts to consider.

Hydropower

Water is stored in a reservoir, generating a lot of potential energy. Then it is forced through a dam, turning a turbine, which then turns a generator to produce electricity. Used water is then returned to the river. While much work has been done to ensure that hydroelectric power has minimal negative impact on the environment (including the ability of hydropower facilities to earn a low-impact rating), it is important to recognize the ecosystem disruptions this energy resource can cause. Damming a river and utilizing the water to generate electricity alters the aquatic and riparian ecosystems, can limit the ability of fish to navigate across their natural habitat extent, and can change the temperature and composition of the river itself.

LAND RESOURCES

- It provides food, fibre, wood, medicine and other biological materials
- Soil is the mixture of inorganic materials (rocks and minerals) and organic materials (dead animals and plants).
- Top soil is classified as renewable resources.

Uses of land resources

- Land provide, food, wood, minerals, etc., for us
- Land nurtures the plants and animals that provide our food and shelter.
- Land is used as watershed or reservoir
- Land acts as a dust bin for most of the wastes, created by the modern society.
- Land is used for construction of buildings, industries.

LAND DEGRADATION

Process of degradation of soil or loss of fertility of the soil.

Harmful effects of land degradation

- The soil texture and soil structure are deteriorated
- Loss of soil fertility, due to loss of invaluable nutrients
- Increase in water logging, salinity, and alkalinity and acidity problems.
- Loss of economic social and biodiversity.

Causes of land degradation

1. Population

- Land resources degraded by over population &over exploitation.

2. Urbanization
   - Urbanization leads to deforestation, reduces the land
3. Fertilizers and pesticides
   - Increased applications of fertilizers and pesticides leads to pollution of land and water and soil degradation.
4. Damage of top soil
   - Increase in food production generally leads to damage to top soil through nutrient depletion.
5. Water-logging
   - Soil erosion, salination and contamination of the soil with industrial wastes all cause land degradation.
6. Soil erosion
   - Soil erosion is the process of removal of superficial layer of the soil from one place to another.

CONSERVATION OF NATURAL RESOURCES - ROLE OF AN INDIVIDUAL

Different natural resources like forests, water, soil, food, mineral and energy resources play a vital role in the development of a nation. While conservation efforts are underway at National as well as International level, the individual efforts for conservation of natural resources can go a long way.

I. Conserve Water

- Don't keep water taps running while brushing, shaving, washing or bathing.
- Check for water leaks in pipes and toilets and repair them promptly. A small pin-hole sized leak will lead to the wastage of 640 liters of water in a month.
- Use drip irrigation and sprinkling irrigation to improve irrigation efficiency and reduce evaporation.
- Install a small system to capture rain water and collect normally wasted used water from sinks, cloth-washers, bathtubs etc. which can be used for watering the plants
- Build rain water harvesting system in your house. Even the President of India is doing this.

II. Conserve energy

- Turn off lights, fans and other appliances when not in use.
- Obtain as much heat as possible from natural sources. Dry the clothes in sun instead of drier if it is a sunny day.
- Use solar cooker for cooking your food on sunny days which will be more nutritious and will cut down on your LPG expenses.
- Grow deciduous trees and climbers at proper places outside your home to cut off intense heat of summers and get a cool breeze and shade. This will cut off your electricity charges on coolers and air-conditioners.
- Try riding bicycle or just walk down small distances instead of using your car or scooter.

III. Protect the soil

- While constructing your house, don't uproot the trees as far as possible. Plant the disturbed areas with a fast growing native ground cover.
- Make compost from your kitchen waste and use it for your kitchen-garden or flower-pots.
- Do not irrigate the plants using a strong flow of water, as it would wash off the soil.
- If you own agricultural fields, do not over-irrigate your fields without proper drainage to prevent water logging and salinisation.
- Use mixed cropping so that some specific soil nutrients do not get depleted.

IV. Promote Sustainable Agriculture

- Do not waste food. Take as much as you can eat
- Reduce the use of pesticides.
- Fertilize your crop primarily with organic fertilizers.
- Eat local and seasonal vegetables. This saves lot of energy on transport, storage and preservation.
- Control pests by a combination of cultivation and biological control methods.

EQUITABLE USE OF RESOURCES FOR SUSTAINABLE LIFE STYLE

- There is a big divide in the world as North and South, the more developed countries (MDC'S) and less developed countries (LDC'S), the haves and the have nots.

- The MDC's have only 22% of world's population, but they use 88% of its natural resources, 73% of its energy and command 85% of its income.
- As the rich nations continue to grow, they will reach a limit.
- If they have a growth rat of 10% every year, they will show 1024 times increase in the next 70 years.
- Will this much of growth be sustainable? The answer is 'No' because many of our earth's resources are limited and even the renewable resources will become unsustainable if their use exceeds their regeneration.
- Thus, the solution to this problem is to have more equitable distribution of resources and wealth.
- We cannot expect the poor countries to stop growth in order to check pollution because development brings employment and the main problem of these countries is to tackle poverty.
- The poor in the LDC'S are at least able to sustain their life.
- Unless they are provided with such basic resources, we cannot think of rooting out the problems related to dirty, unhygienic, polluted, disease infested settlements of these people-which contribute to unsustainability.
- Thus, the two basic causes of unsustainability are over population in poor countries who have under consumption of resources and over consumption of resources by the rich countries, which generate wastes.
- In order to achieve sustainable life styles it is desirable to achieve a more balanced and equitable distribution of global resources and income to meet everyone's basic needs.
- The rich countries will have to lower down their consumption levels while the bare minimum needs of the poor have to be fulfilled by providing them resources.
- A fairer sharing of resources will narrow down the gap between the rich and the poor and will lead to sustainable development for all and not just for a privileged group.

Ill-effects of fireworks

i) The SPM (suspended particulate matter) levels rise to a large extent during Diwali.

- It can cause throat, nose & eye related problems which can later develop into adverse health hazards.
- It can lead to headaches & reduced mental acuity when it reaches the level of 100 ppm.

- It has much more severe effects in people with heart, respiratory or nervous system disorders.
- It can aggravate problem for people suffering from cold, allergies or coughs and can also cause congestion of throat & chest.

ii) Increase amount of noise has harmful effects on animals as well as humans. Standard decibel level for humans is 60 dB.

- Increase in the decibel level can lead to:
- Restlessness
- Temporary or Permanent Hearing Loss
- Fidgetiness
- High Blood Pressure
- Anger
- Heart Attack
- Sleep Disturbance
- Impulsiveness
- Can lead to withdrawal behaviour or hyperactivity in pregnant women, children & those suffering from respiratory problems.

iii) Fireworks can also cause health problems like:

- Chronic bronchitis
- Common Cold
- Allergic Bronchitis
- Bronchial Asthma
- Sinusitis
- Chronic Obstructive Pulmonary Diseases (COPD)
- Ephysema
- Rhinitis
- Pneumonia
- Laryngitis

iv) It results in smog which can reduce visibility thereby leading to accidents as well as is toxic if inhaled.

- It is said that one big firecracker like "1000 walas" and "hydrogen bombs" can produce up to 250 cc of smoke.
- It can also cause water contamination and acid rains.
- It results in air pollution that creates carcinogenic sulphur compounds and airborne arsenic effect.

v) Use of "rockets" near houses gives rise to many injuries each year. There is no law pertaining to the same.

vi) Harmful effects of fireworks displays:

- Green light produced in fireworks displays comes from Barium that is radioactive and poisonous.
- Blue colour produced from copper compounds comes from dioxins linked to cancer.
- Different effects are produced by using different chemicals that are linked to a host of health and respiratory problems.

S.No	Question	Option a	Option b	Option c	Option d	Answer
1.	Grasslands in India includes	12% total land area	14% total land area	18% total land area	20% total land area	18% total land area
2.	Biogas is a mixture of	40% methane and 60% CO_2	40% methane and 60% ethane	40% CO_2 and 60% methane	60% methane and 40% CO_2	60% methane and 40% CO_2
3.	One of the endangered species of Indian medicinal plants is that of	Ocimum	Nependenthes	Garlic	Podophyllum	Podophyllum
4.	MBA stands for	Man and biotechnology	Material and biology	Man and biology	Man and biosphere	Man and biosphere
5.	Red data book contains data of	all plant species	All animal species	Economically important species	Threatened species	Threatened species
6.	which of the following region has maximum diversity.	Mangrooves	Temperate forest	Tagia	Coral reefs	Coral reefs
7.	Endemic species are	rare species	Species localized in a specific region	cosmopolitan in distribution	Critically endangered species	Species localized in a specific region
8.	Approximately, 50% of total world species are present on	**tropical rain forest**	temperate rain forest	temperate deciduous forest	coral reefs	tropical rain forest
9.	The most important reason for decrease in biodiversity is	Habitat pollution	introduction of exotic species	over-exploitation	habitat destruction	habitat destruction
10.	Conservation within the habitat is	insitu conservation	exsitu conservation	invivo conservatio	exvivo conservation	insitu conservation
11.	Ex situ conservation includes	Zoo	Botanic garden	Germplasm bank	National park	Zoo
12.	Hot spots are regions of high	rarity	endemism	critically endangered population	diversity	endemism
13.	How many biosphere reserves are present in India	41	34	14	43	14
14.	Which micro organism is responsible for synthesis of antibiotics	Bacteria	Virus	Fungus	Algae	Fungus
15.	In which region of South America maximum species of birds can be found	Equador	Brazil	Colombia	Peru	Colombia
16.	Which scientist has classified species diversity?	Thoeprestus	Lineus	Whittaker	Treshaw	Whittaker
17.	How many Indian plant species are used to extract essential oils and scents?	50	500	50000	5000	500
18.	Which can be used for cryopreservation at 196^{o}C temperature?	Liquid N_2	Free N_2	Liquid CO_2	Solid N_2	Liquid N_2
19.	Which is the right option for national animal and bird of India?	Peacock & Lion	Flamingo & Tiger	Peacock & Tiger	Flamingo & Lion	Peacock & Tiger

20.	What is ecosystem diversity?	Similarity of species diversity in Ecosystem	Variation in species diversity in Ecosystem	Mutation in species diversity in Ecosystem	Homozygosity in species diversity in Ecosystem	Variation in species diversity in Ecosystem
21.	Which regions are included in Biodiversity Hot-spot?	Sanctuary	National park	Only Hotspot	Botanical garden	Sanctuary
22.	For which animal sunderbans is declared as a National Park?	Lion	Rhino	Tiger	Wild ass	Tiger
23.	Which one is odd for Amzon rain forest	Africa	Russia	Mauritius	Java	Java
24.	Which reason is responsible for extinction of host fish and parasites	Co-extinctions	Alien species invasions	Over exploitation	Loss of habitat	Co-extinctions
25.	Which organization is active for conservation of biodiversity at world level?	WWF	WHO	EE	UNO	WWF
26.	Which is the example of ex-situ conservation?	National park	Sanctuary	Biosphere reserve	Zoo	Zoo
27.	Which type of information is obtained from Red-List?	Red coloured fishes	Red eyed birds	Endangered plants and animals	Red coloured insects	Endangered plants and animals
28.	Which is true for wild life conservation?	Hunting of prey	Ex-situ conservation	National park	Botanical garden	Ex-situ conservation
29.	Which is the main cause of extinction of wild life?	Destruction of habitat	Hunting for flesh	Pollution of medicine and water	Air pollution	Destruction of habitat
30.	At which place animals and plants are most protected?	Botanical gardens	National park	Zoos	Sanctuary	National park
31.	For which animal Gir national park is famous	Tiger	Asiatic Lion	Leopard	Deer	Asiatic Lion
32.	Which is not applicable for in-situ conservation?	National park	Sanctuary	Botanical garden	Biosphere reserve	Botanical garden
33.	How many bio-geographical regions are present in India?	3	4	7	10	10
34.	Which one of the following areas in India, is a hotspot of biodiversity?	Sunderbans	Western Ghats	Eastern Ghats	Gangetic Plain	Western Ghats
35.	Darwin’s finches are a good example of	Convergent evolution	Industrial melanism	Connecting link	Adaptive radiatio	Adaptive radiatio
36.	The least porous soil among the following is a	Loamy soil	Silty soil	Clayey soil	Peaty soil	Clayey soil
37.	Which one of the following is not a renewable, exhaustible natural resource?	Aquatic animals	Wild life	Soil fertility	Minerals	Minerals
38.	Which one of the following is an example ex-situ conservation?	Wildlife	sanctuary	Seed bank	Sacred groves	Seed bank
39.	Which one of the following is not observed in biodiversity hotspots?	Species richness	Endemism	Accelerated species loss	Lesser inter-specific competition	Lesser inter-specific competition
40.	Sacred groves are specially useful in	Generating environmental awareness	Preventing soil erosion	Year-round flow of water in rivers	Conserving rare and threatened species	Conserving rare and threatened species
41.	The term Alpha diversity refers to	Genetic diversity	Community and ecosystem diversity	Species diversity	Diversity among the plants	Community and ecosystem diversity

42.	Biodiversity of a geographical region represents	Genetic diversity present in the dominant species of the region	Species endemic to the region	Endangered species found in the region	The diversity in the organisms living in the region	The diversity in the organisms living in the region
43.	Global warming can be controlled by	Reducing deforestation, cutting down use of fossil fuel	Reducing reforestation, increasing the use of fossil fuel	Increasing deforestation slowing down the growth of human population	Increasing deforestation, reducing efficiency of energy usage	Reducing deforestation, cutting down use of fossil fuel
44.	Species diversity is responsible for which phenomena ?	process of Evolution	speciation	For alternative types (allele) of gene.	For stability and normal function of Ecosystem	For stability and normal function of Ecosystem
45.	Which statement is correct for buffer zone of biosphere reserve ?	It is legally protected	Authority takes cooperation with local people.	Environmental Education is facilitated by this zone.	Hunting and felling of trees occur in this zone.	Environmental Education is facilitated by this zone.
46.	Which reason is responsible for extinction of host fish and parasites.	co-extinctions	Alien species invasions	over exploitation	loss of habitat	co-extinctions
47.	Which one is correct for individual of the same species ?	Population	Biotic Community	Ecosystem	Environment	Population
48.	Animals and plants are used as a food that means.....	Destruction value of biodiversity	Utility value of biodiversity	Ecosystem services	Deforestation	Destruction value of biodiversity
49.	What is called the biodiversity of different ecosystem of geographical area ?	α diversity	δ - diversity	β diversity	γ diversity	γ diversity
50.	What is called the area which is remain around the core zone of biosphere region ?	Buffer	Transition zone	Developed zone	Peripherial zone	Buffer
51.	Which is the most appropriate method for conservation of wild life ?	Vaccination	Hybridization	conservation in natural habitat	Killing of predator	conservation in natural habitat
52.	In India different types of mangoes species are example of …..	species diversity	Genetic diversity	Induced mutation	Breeding	Genetic diversity
53.	In India, which example has maximum varieties ?	Wheat	Rice	Mango	Tea	Mango
54.	What is important of gene diversity ?	Maintenance of species	speciation	Research of genetic code	Maintenance and research of spices	speciation
55.	How many plant species are there in India ?	40,000	80,000	58,000	45,500	45,500
56.	Which is the modern concept of conservation ?	Biosphere reserve	sanctuary	National park	Protected forest	Biosphere reserve
57.	Which is the correct one regarding to bird sanctuaries in Gujarat ?	Thol, Nalsarovar, Narayan sarovar	Nalsarovar, Shoolpaneshwar, Vansda	Thol, Narayan sarovar, Velavadar	Ratanmahal, Nalsarovar, Vansda	Thol, Nalsarovar, Narayan sarovar
58.	Which animal is remnant gene pool in the world ?	Flamingo	Painted Frog	Wild ass	Spring tailed Lizard	Wild ass
59.	Biodiversity of which organism is more in Eastern Ghat in comparison to Western Ghat ?	Reptilia	Amphibian	Aves	Mammals	Amphibian
60.	Find odd one out :	Nanda devi	Great Nicobar	Mannar	Thar	Thar

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

The term biodiversity was coined as a contraction of biological diversity by E.O. Wilson in 1985. Biodiversity may be defined as the variety and variability of living organisms and the ecological complexes in which they exist. In other words, biodiversity is the occurrence of different types of ecosystems, different species of organisms with the whole range of their variants and genes adapted to different climates, environments along with their interactions and processes.

Biodiversity includes the genetic variability (for which different varieties of spices have appeared in the course of evolution) and diversity of life forms such as plants, animal microbes, etc. living in a wide range of ecosystems.

The diversity may be interspecific (within species) and interspecific (in between the species) but these are well supported by ecosystem. It is seen that the diverse living forms of the ecosystem are modulated with the global environmental changes.

1. Types of Biodiversity:

There are three interrelated hierarchical levels of biodiversity namely, genetic diversity, species diversity and community or ecosystem diversity.

1. Genetic diversity:

It describes the variation in the number and types of genes as well as chromosomes present in different species. The magnitude of variation in genes of a species increases with increase in size and environmental parameters of the habitat.

The genetic variation arises by gene and chromosome mutation in individuals and in sexually reproducing organisms and it is spread in the population by recombination of genetic materials during cell division after sexual reproduction.

Genetic diversity has the following importance:

(i) It helps in speciation or evolution of new species;

(ii) It is useful in adaptation to changes in environmental conditions;

(iii) It is important for agricultural productivity and development.

2. Species diversity:

It describes the variety in the number and richness of the spices with in a region. The species richness may be defined as the number of species per unit area. The richness of a species tells about the extent of biodiversity of a site and provides a means for comparing different sites.

The species richness depends largely on climatic conditions. The number of individuals of different species with in a region represents species evenness or species equitability. The product species richness and species evenness give species diversity of a region. When a species is confined entirely to a particular area, it is termed as endemic species.

3. Ecosystem diversity:

It describes the assemblage and Interaction of spices living together and the physical environment a given area. It relates varieties of habitats, biotic communities ecological processes in biosphere. It also tells about the diversity within the ecosystem. It is referred as Land escape diversity because it includes placement and size of various ecosystems.

For example, the landscapes like grass lands, deserts, mountains etc. show ecosystem diversity. The ecosystem diversity is due to diversity of niches, trophic levels and ecological processes like nutrient cycling, food webs, energy flow, role of dominant species and various related biotic interactions. Such type of diversity can generate more productive and stable ecosystems or communities capable of tolerating various types of stresses e.g. drought, flood etc.

According to Whittaker (1965), the community diversities are of three types:

(i) α-Diversity:

It tells the species diversity in a given community.

It depends upon species richness and evenness.

(ii) β-Diversity:

It describes a range of communities due to replacement of species which arises due to the presence of different microhabitats, niches and environmental conditions.

(iii) γ -Diversity:

It describes diversity of habitat over a total land escape or geographical area.

2. Biodiversity of India:

As per available data, the varieties of species living on the earth are 1753739. Out of the above species, 134781 are residing in India although surface area of India is 2% of the earth's surface. Wild life Institute of India has divided it into ten biogeographical regions and twenty five biotic provinces.

Biogeographical regions are:

- Trans Himalayas,
- Gangetic plain,
- Desert,
- Semiarid zone;
- Western Ghats;
- Deccan peninsula,
- North eastern zone,
- Coastal lands
- Himalayas,
- Islands.

India is one of the twelve mega diversity nations of the world due to the following reasons:

- It has 7.3% of the global fauna and 10.88% of global flora as per the data collected by Ministry of Environment and forest.
- It has 350 different mammals, 1200 species of birds- 453 different reptiles, 182 amphibians and 45,000 plants spices.
- It has 50,000 known species of insects which include 13,000 butterflies and moths.

- It has 10 different biogeographical regions and 25 biotic provinces having varieties of lands and species.
- In addition to geographical distribution, geological events in the land mass provide high level of biological diversity.
- Several crops arose in the country and spread throughout the world.
- There is wide variety of domestic animals like cows, buffaloes, goats, sheep, pigs, horses etc.
- The marine biota includes sea weeds, fishes, crustaceans, molluses, corals, reptiles etc.
- There are a number of hot spots (namely Eastern Ghats, Western Ghats, North Eastern hills etc.).

3. Importance of Biodiversity:

The living organisms on earth are of great diversity, living in diverse habitats and possessing diverse qualities and are vital to human existence providing food, shelter, clothing's, medicines etc.

The biodiversity has the following importances:

1. Productive values:

Biodiversity produces a number of products harvested from nature and sold in commercial markets. Indirectly it provides economic benefits to people which include water quality soil protection, equalisation of climate, environmental monitoring, scientific research, recreation etc.

2. Consumptive value:

The consumptive value can be assigned to goods such as fuel woods, leaves, forest products etc. which may be consumed locally and do not figure in national and international market.

3. Social value:

The loss of biodiversity directly influences the social life of the country possibly through influencing ecosystem functions (energy flow and biogeochemical cycle). This be easily understood by observing detrimental effects of global warming and acid rain which cause an unfavorable alteration in logical processes.

4. Aesthetic value:

Aesthetic values such as refreshing fragrance of the flowers, taste of berries, softness of mossed, melodious songs of birds, etc. compel the human beings to preserve them. The earth's natural beauty with its colour and hues, thick forest, and graceful beasts has inspired the human beings from their date of birth to take necessary steps for its maintenance. Similarly botanical and zoological gardens are the means of biodiversity conservation and are of aesthetic values.

5. Legal values:

Since earth is homeland of all living organisms, all have equal right to coexist on the surface of earth with all benefits. Unless some legal value is attached to biodiversity, it will not be possible to protect the rapid extinction of species.

6. Ethical value:

Biodiversity must be seen in the light of holding ethical value. Since man is the most intelligent amongst the living organisms, it should be prime responsibility and moral obligation of man to preserve and conserve other organisms which will directly or indirectly favour the existence of the man.

7. Ecological value:

Biodiversity holds great ecological value because it is indispensable to maintain the ecological balance. Any disturbance in the delicately fabricated ecological balance maintained by different organisms, will lead to severe problems, which may threaten the survival of human beings.

8. Economic value:

Biodiversity has great economic value because economic development depends upon efficient and economic management of biotic resources.

In the day to day life, human beings are maintaining their lifestyle at the sacrifice of surrounding species which come from diversity of plants and animals struggling for their existence.

So, it is highly essential for the human beings to take care of their surrounding species and make optimum use of their service, for better economic development. Thus, it is rightly told, survival of the man depends upon the survival of the biosphere.

4. Uses of Biodiversity:

Biodiversity has the following uses for the development humanity:

- It provides food of all types.
- It provides fibers, sources for the preparation of clothes.
- It provides different types of oil seeds for the preparation of oils.
- It provides new varieties of rice, potato etc. through the process of hybridization.
- It provides different drugs and medicines which are based on different plant products.
- It is very essential for natural pest control, maintenance of population of various species, pollination by insects and birds, nutrient cycling, conservation and purification of water, formation of soil etc. All these services together are valued 16.54 trillion dollars per year.

5. Threats to Biodiversity:

Biodiversity is considered as a reservoir of resources to be used for the manufacture of food, medicine, industrial products, etc. But with an increased demand of rapid population growth, biodiversity is gradually depleting. A number of plants" and animal species have already become extinct and many are endangered.

The different factors responsible for causing threat to biodiversity are as follows:

1. Habitat destruction:

The primary cause of loss of biodiversity is habitat loss or destruction which is resulted due to the large industrial and commercial activities associated with agriculture, irrigation, construction of dams, mining, fishing etc.

2. Habitat fragmentation:

With increased population, the habitats are fragmented into pieces by roads, fields, canals, power lines, towns etc. The isolated fragment of habitats restricts the potential of species for dispersal and colonization. In addition, the habitat fragmentation also brings about microclimatic changes in light, temperature, wind etc.

3. Pollution:

The most dreaded factor inducing loss of biodiversity is environmental pollution which include air pollution, Water pollution, industrial pollution, pollution due to chemical Pastes, pesticides radioactive materials etc.

4. Over exploitation:

The natural resources are over exploited to meet growing rural poverty, intensive technological growth and globalization of economy. All these factors together may be responsible for the extinction of a number of species.

5. Introduction of exotic species:

The introduction of exotic species are due to:

- horticulture
- Agriculture
- European colonisation
- Accidental transport.

It is seen that some exotic species may kill or eat the native species thereby causing its extinction.

6. Diseases:

Since the animals are more vulnerable to infection, the anthropological activities may increase the incidence of diseases in wild species, leading to their extinction.

7. Shifting or Jhum cultivation:

The shifting or Jhum cultivation by poor tribal people greatly affects the forest structure which is a store house of biodiversity.

8. Poaching of wild life:

A number of wildlife species are becoming extinct due to poaching and hunting.

Table : Endangered and Endemic Species of India

Category Enlisted species Highly endangered Species.

1. Higher plants	15,000	135
2. Mammals	372	69
3. Reptiles and amphibians	580	22
4. Birds	1175	40
5. Fishes	1693	—

6. Conservation of Biodiversity:

Biodiversity is being depleted by the loss of habitat, fragmentation of habitat, over exploitation of resources, human sponsored ecosystems, climatic changes, pollution invasive exotic spices, diseases, shifting cultivation, poaching of wild life etc.

Since the human beings are enjoying all the benefits from biodiversity, they should take proper care for the preservation of biodiversity in all its form and good health for the future generation i.e., the human being should prevent the degradation and destruction of the habitats thereby maintaining the biodiversity at its optimum level.

Conservation of biodiversity is protection, upliftment and scientific management of biodiversity so as to maintain it at its threshold level and derive sustainable benefits for the present and future generation. In other words, conservation of bio-diversity is the proper management of the biosphere by human beings in such a way that it gives maximum benefits for the present generation and also develops its potential so as to meet the needs of the future generations.

Mainly the conservation of biodiversity has three basic objectives:

(a) To maintain essential ecological processes and life supporting systems.

(b) To preserve the diversity of species.

(c) To make sustainable utilisation of species and ecosystems.

Strategies for Conservation of Biodiversity:

The following strategies should be undertaken in order to conserve biodiversity:

1. All the possible varieties (old or new) of food, forage and timber plants, live stock, agriculture animals and microbes should be conserved.
2. All the economically important organisms in protected areas should be identified and conserved.
3. Critical habitats for each species should be identified and safeguarded.
4. Priority should be given to preserve unique ecosystems.
5. There should be sustainable utilisation of resources.
6. International trade in wild life should be highly regulated.
7. The poaching and hunting of wildlife should be prevented as far as practicable.
8. Care should be taken for the development of reserves and protected areas.
9. Efforts should be made to reduce the level of pollutants in the environment.
10. Public awareness should be created regarding biodiversity and its importance for the living organisms.
11. Priority should be given in wildlife conservation programme to endangered species over vulnerable species and to vulnerable species over rare species.
12. The habitats of migratory birds should be protected by bilateral and multilateral agreement.
13. The over exploitation of useful products of wild life should be prevented.
14. The useful animals, plants and their wild relatives should be protected both in their natural habitat (in-situ) and in zoological botanical gardens (ex-situ)
15. Efforts should be made for setting up of National parks and wild life sanctuaries to safeguard the genetic diversity and their continuing evolution.
16. Environmental laws should be strictly followed.

Conservation Methods:

There are two types of conservation methods namely in-situ and ex-situ conservations. Let us discuss the different conservation methods along with their importance.

(a) In situ conservation:

The conservation of species in their natural habitat or natural ecosystem is known as in situ conservation. In the process, the natural surrounding or ecosystem is protected and maintained so that all the constituent species (known or unknown) are conserved and benefited. The factors which are detrimental to the existence of species concerned are eliminated by suitable mechanism.

The different advantages of in situ conservation are as follows:

a) If is a cheap and convenient way of conserving biological diversity.

b) It offers a way to preserve a large number of organisms simultaneously, known or unknown to us.

c) The existence in natural ecosystem provides opportunity to the living organisms to adjust to differed' environmental conditions and to evolve in to a better life form.

The only disadvantage of in situ conservation is that it requires large space of earth which is often difficult because of growing demand for space. The protection and management of biodiversity through in situ conservation involve certain specific areas known as protected areas which include national parks, Sanctuaries and Biosphere reserves.

1. Protected areas:

The protected areas are biogeographical areas where biological diversity along with natural and cultural resources are protected, maintained and managed through legal and administrative measures. The demarcation of biodiversity in each area is determined on the basis of climatic and physiological conditions.

In these areas, hunting, firewood collection, timber harvesting etc. are prohibited so that the wild plants and animals can grow and multiply freely without any hindrance. Some protected areas are: Cold desert (Ladakh and Spiti), Hot desert (Thar), Saline Swampy area (Sunderban and Rann of Kutch), Tropical moist deciduous forest (Western Ghats and north East) etc. Protected areas include national parks, sanctuaries and biosphere reserves. There are 37,000 protected

areas throughout the world. As per World Conservation Monitoring Centre, India has 581 protected areas, national parks and sanctuaries.

2. National parks:

These are the small reserves meant for the protection of wild life and their natural habitats. These are maintained by government. The area of national parks ranges between 0.04 to 3162 km. The boundaries are well demarcated and circumscribed. The activities like grazing forestry, cultivation and habitat manipulation are not permitted in these areas. There are about 89 national parks in India.

Some important national Parks of India are:

(i). Biological Park, Nandankanan, Orissa,

(ii). Corbett national Park Nainital, U.P. (First national Park)

(iii). Koziranga national Park, Jorhat, Assam

(iv). Tudula national Park, Maharashtra

(v). Hazaribagh national Park, Hazaribagh, Bihar

(vi). Band havgarh national park, M.P.

(vii). Bandipur national park, Karnataka.

(viii). Kanha National Park, M.P.

(ix). Reibul Lamjao National Park, Manipur

(x). Nawgaon National Park, Maharashtra

3. Sanctuaries:

These are the areas where only wild animals (fauna) are present. The activities like harvesting of timbers, collection of forest products, cultivation of lands etc. are permitted as long as these do not interfere with the project. That is, controlled biotic interference is permitted in sanctuaries, which allows visiting of tourists for recreation. The area under a sanctuary remains in between 0.61 to 7818 km.

Some important sanctuaries of Orissa are as follows:

(i). Nandankanan Zoological Park

(ii). Chandaka Elephant reserve

(iii). Simlipal Tiger Reserve

(iv). Bhitarkanika Wild life Sanctuary

(v). Gharial project at Tikarpada

(vi). Chilika (Nalaban) Sanctuary

4. Biosphere reserves:

Biosphere reserves or natural reserves are multipurpose protected areas with boundaries circumscribed by legislation. The main aim of biosphere reserve is to preserve genetic diversity in representative ecosystems by protecting wild animals, traditional life style of inhabitant and domesticated plant/ animal genetic resources. These are scientifically managed allowing only the tourists to visit.

Some importance of biosphere reserves are as follows:

- These help in the restoration of degraded ecosystem.
- The main role of these reserves is to preserve genetic resources, species, ecosystems, and habitats without disturbing the habitants.
- These maintain cultural, social and ecologically sustainable economic developments.
- These support education and research in various ecological aspects,

Some important biosphere reserves are:

Simlipal, (Orissa), Sunderban (West Bengal), Kanha (M.P Kaziranga (Assam) etc. The biosphere reserve net work was introduced by UNESCO 1971.

TABLE 5.2 : BIOSPHERE RESERVES OF INDIA

S. No.	Date notified	Name of the site	Area in sq.km.	Location (state)
1.	0.1.08.86	Nilgiri	5,520	Parts of Wynad, Nagarhole, bandipur and Mudumalai, Nilambur, Silent Valeey, and the Siruvani Hills (Tamil Nadu, Kerala and Karnataka)
2.	18.01.88	Nanda Devi	5,860.69	Parts o the Chamoli, Pithoragarh, and Almorae dis tricts Uttaranchal)
3.	01.09.88	Nokrerk	820	Part of Gora Hills (Meghalaya)
4.	14.03.89	Manas	2,837	Parts of the Kokrajhar, Bongaigaon, Parpeta, Nalbari, Kamprup, and Daarang districts (Assam)
5.	29.03.89	Sunderbans	9,630	Parts of the Brahamaputra and Ganga deltas (West Bengal)
6.	18.02.89	Gulf of Mannar	10,500	Indian part of Gulf of Mannar between India and Sri Lanka (Tamil Nadu)
7.	06.01.89	Great Nicobar	885	Southernmost islands of the Andaman and Nicobar islands.
8.	21.06.94	Similpal	4,374	Partof Mayurbhanj district (Orissa)
9.	29.07.97	Dibru-Saikhowa	765	Parts of the Dibrugarh and Tinsukia districts (Assam)
10.	02.09.98	Dehang Debang	5,112	Parts of Siang and Debang Valley (Arunachal Pradesh).
11.	03.03.99	Pachmarhi	4,926.28	Part of the Betul, Hoshangabad, and Chindwara dis tricts (Madhya Pradesh)
12.	07.02.00	Kanchanjanga	2,619.92	Part of Kanchanjanga Hills (Sikkim)

(b) Ex-situ conservation:

Ex-situ conservation involves maintenance and breeding of endangered plants and animals under partially or wholly controlled conditions in specific areas like zoo, gardens, nurseries etc. That is, the conservation of selected plants and animals in selected areas outside their natural habitat is known as ex-situ conservation.

The stresses on living organisms due to competition for food, water, space etc. can be avoided by ex-situ conservation there by providing conditions necessary for a secure life and breeding.

Some important areas under these conservation are:

(i) Seed gene bank,

(ii) Field gene bank;

(iii) Botanical gardens;

(iv) Zoos.

The strategies for ex-situ conservations are:

(i) Identification of species to be conserved.

(ii) Adoption of Different ex-situ methods of conservation.

(i) Long-term captive breeding and propagation for the species which have lost their habitats permanently.

(ii) Short-term propagation and release of the animals in their natural habitat

(iii) Animal translocation

(iv) Animal reintroduction

(v) Advanced technology in the service of endangered species.

The different advantages of ex-situ conservation are:

(a) It gives longer life time and breeding activity to animals.

(b) Genetic techniques can be utilised in the process.

(c) Captivity breed species can again be reintroduced in the wild.

Some disadvantages of this method are:

(a) The favourable conditions may not be maintained always.

(b) Mew life forms cannot evolve.

(c) This technique involves only few species.

Hot Spots:

Hot spots are the areas with high density of biodiversity or mega diversity which are most threatened at present. There are 16 hot spots in world, out of which two are located in India namely North-East Himalayas and Western Ghats.

The hot spots are determined considering four factors:

i. Degrees of endemism;

ii. Degree of expectation

iii. Degrees of threat to habitat due to its degradation and fragmentation and

iv. Number of Species diversity.

The global hot spot and endemic species present within them are:

(i). North East Himalayas (3,500);

(ii). Western Ghats (1,600);

(iii). Cape region of South Africa (6,000);

(iv). Upland Western Amazonia (5,000);

(v). Madagascar (4,900);

(vi). Philippines (3,700)

(vii). Boreo (3, 500);

(viii). South West Australia (2,830);

(ix). Western Ecuador (2,500);

(x). Colombian Choco (2,500);

(xi). Peninsular Malaysia) (2, 400);

(xii). Californian Floristic Province (2,140);

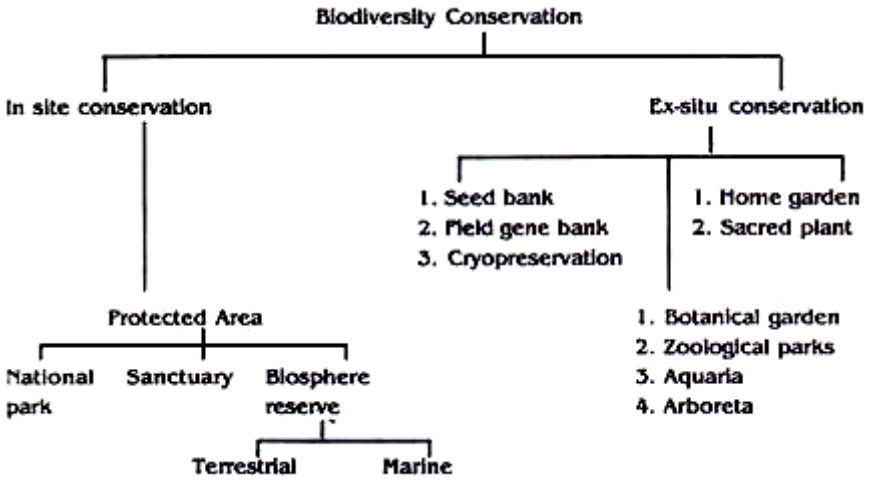
(xiii). Central Chile (1,450);

(xiv). Eastern Arc. Mts (Tanzania) (535);

(xv). South West Srilanka (500);

(xvi). South west Tvorie (200).

Different mechanisms involved in the conservation of biodiversity is shown in below figure.



S.No	Question	Option a	Option b	Option c	Option d	Answer
1.	Which of the following is the major cause of pollution	plants	man	fungi	hydrocarbon gases	hydrocarbon gases
2.	The unfavourable alteration of environment due to human activities is termed as	ecological disturbance	catastrophe	ecological degradation	pollution	pollution
3.	Heavy dust can cause	leaf blights	opening of stomata	closure of stomata	browning of leaves	closure of stomata
4.	5th June is observed as	world forest day	world environment day	world population day	world wildlife day	world environment day
5.	Cement factory labourers are prone to	leukemia	bone marrow disease	asbestosis	cytosilicosis	cytosilicosis
6.	Noise is measured using sound meter and the unit is	hertz	joule	decibel	sound	decibel
7.	Which of the following is an organic gas?	Hydrocarbons	Aldehydes	Ketones	Ammonia	Ammonia
8.	The major contributor of Carbon monoxide is	Motor vehicle	Industrial processes	Stationary fuel combustion	Plants	Motor vehicle
9.	Ozone found in	Mesosphere	Ionosphere	Stratosphere	Exosphere	Stratosphere
10.	Amount of energy released by an earthquake is also known as	unit	magnitude	direction	scale	magnitude
11.	Fine organic or inorganic particles suspended in air is called	particulate pollutant	gaseous pollutant	aerosol	smoke	aerosol
12.	The principal source of volatile organics (Hydrocarbons) is	Transportation	Industrial processes	Stationary fuel combustion	Volcanoes	Industrial processes
13.	According to EPA of USA, the following is not one of the six major pollutants?	Ozone	Carbon monoxide	Nitrogen oxides	Carbon di-oxide	Carbon di-oxide
14.	The Pollution Standard Index (PSI) scale has span from	0-200	0-300	0-400	0-500	0-500
15.	Which of the following is an organic gas?	Aldehydes	Ammonia	Hydrocarbons	Ketones	Ammonia
16.	Ozone is formed in the upper atmosphere by a photochemical reaction with	Ultra violet solar radiation	Without light	Infra red radiation	Visible light	Ultra violet solar radiation
17.	The function of automobile catalytic converter is to control emissions of	carbon dioxide and hydrogen	carbon monoxide and hydrogen	carbon monoxide and carbon dioxide	carbon monoxide and nitrogen dioxide	carbon monoxide and hydrogen
18.	The threshold concentration of sulphur dioxide in any industrial activity should not be permitted beyond	2ppm	3ppm	4ppm	5ppm	5ppm
19.	The threshold limit of benzene is	15ppm	20ppm	25ppm	30ppm	25ppm
20.	Which of the following is used as antiknock compound in gasoline?	tetramethyl lead	tetraethyl lead	trimethyl lead	triethyl lead	tetraethyl lead
21.	Which of the following is a fermentation product of molasses?	Methanol	Formaldeyde	Ammonia	Acetone	Acetone
22.	The boiler flue gas is source of	HCl	NO	HF	Volatile organic compounds	NO
23.	Which of the following is a secondary air pollutant?	Ozone	Carbon dioxide	Carbon monooxide	Sulphur dioxide	Ozone
24.	The environmental lapse rate is found to be:	– 6.5°C/km	8.6°C/km	6.5°C/km	5.6°C/km	– 6.5°C/km

25.	During Inversion:	Temperature increases with altitude	Temperature decreases with altitude	Temperature first increases then decreases	Temperature remains constant	Temperature increases with altitude
26.	Among the following, the only secondary pollutant is:	Sulphur tetraoxide	Sulphur dioxide	Ozone	Sulphur tetraoxide	Ozone
27.	Which of the following groups of plants can be used as indicators of SO pollution of air?	Epiphytic lichens	Ferns	Liver worts	Horn worts	Epiphytic lichens
28.	Which of the following on inhalation dissolved in the blood hemoglobin more rapidly than oxygen?	Sulphur dioxide	Carbon mono-oxide	Ozone	Nitrous oxide	Carbon mono-oxide
29.	Smog is:	A natural phenomenon	A combination of smoke and fog	Is colourless	Smoke	A combination of smoke and fog
30.	The following unit is not used to measure turbidity of water?	NTU	ATU	JTU	FTU	ATU
31.	The water temperature should preferably be less than __ degree Celsius.	10	15	25	30	25
32.	A technique used to determine the concentration of odour compounds in a sample is known as	Stripping	Settling	Flushing	Chlorination	Stripping
33.	In filtration, the amount of dissolved solids passing through the filters is	Difference between total solids and suspended solids	Sum of total solids and suspended solids	Independent of suspended solids	Dependent of suspended solids	Difference between total solids and suspended solids
34.	According to The United States Geological Survey, water having less than 1000 ml/litre of total dissolved solids is	Fresh water	Slightly saline	Moderately saline	Brine water	Fresh water
35.	Temporary hardness is caused due to	Magnesium carbonate	Calcium sulphate	Magnesium sulphate	Magnesium chloride	Magnesium carbonate
36.	Permanent hardness is caused due to	Magnesium carbonate	Magnesium bicarbonate	Magnesium sulphate	Calcium carbonate	Magnesium sulphate
37.	According to WHO, the soft water has 0 to _____ milligram per litre as CaCO3.	30	60	90	120	60
38.	The excess presence of which of the following cause the teeth of children mottled and discoloured?	Fluorides	Chlorides	Hardness	Sodium chloride	Fluorides
39.	Freshwater lakes are most often limited by	Nitrogen	Phosphorus	Carbon	Chloride	Phosphorus
40.	Which of the following is not a water borne disease?	Typhoid	Scabies	Cholera	Hepatitis	Scabies
41.	Disasters can be categorised into various types on the basis of?	Its speed	Its previous history	Loss of property they result	Loss of human life they result	Loss of human life they result
42.	Which of the following is a disaster mitigation stretegy?	Constructing cyclone shelters	Givingloans from banks	Providing cheap electricity	Providing school uniforms to children	Constructing cyclone shelters
43.	The term Tsunami is coined from?	Chinese term	Indian term	German term	Japanase term	Japanase term
44.	A series of earthquakes shook the Central American Nation Of Nicaragua and killed many people in the year?	1974	1972	1973	1975	1972
45.	Tsunami can occur any during?	Morning	Noon	Evening	Any time of day or nights	Any time of day or nights
46.	The National Civil Defence college was founded in 1957 at?	Bombay	Nagpur	Cochin	Hyderabad	Nagpur
47.	National Institute of Disaster management is located at?	Poona	Midnapur	New Delhi	Calcutta	New Delhi
48.	For coordinating disaster management activities for all natural hazards, the Nodal Agency at the Central Govt is the?	Ministry of Home Affairs	Ministry of Rural Development	Ministry of Communication	Ministry of Urban Mfair	Ministry of Home Affairs
49.	International Tsunami Information Centre is in?	Honolalu	Goa	J akartha	Pondicherry	Honolalu

50.	Report on Training on Search and Rescue for the members of the village Disaster Management Team is prepared by?	Govt. of Manipur	Govt. of Indonesia	Govt. of Uttaranchal	Indian Red Cross	Govt. of Uttaranchal
51.	Tsunamis are waves generated by ?	Rain fall	cyclone	Underwater landslides	deforestation	Underwater landslides
52.	Area of Indian coastline which is vulnerable tostorm surges, cyclones and tsunamis is?	5700 Km	3700km	2700km	4700km	5700 Km
53.	The Disaster management Act was enacted in India in the year?	2006	2006	2006	2006	2006
54.	National Disaster Reserve Fund is the result of?	12th Finance Commission	11thFinance Commission	13th Finance Commission	10thFinance Commission	11thFinance Commission
55.	The term " Cyclone " is derived from?	Greek Word	French Word	Latin Word	Chinese Word	Greek Word
56.	What percent of earthquakes and tsunamis account for world disasters?	8%	3%	9%	7%	8%
57.	According to World Bank Estimate, direct losses from natural disasters ar upto percent of GDP?	4%	2%	1%	3%	2%
58.	SAARC Disaster Management Centre is at?	Dhaka	Coloumbo	New Delhi	Khatmandu	New Delhi
59.	United Nations Disaster Management Team(UNDMT) is responsible for solving problem resulting from disasters in?	Africa	Asia	Australia	In all continents	In all continents
60.	Earthquake under the sea is called?	Tsunami	Hurrican	Cyclone	Thunder	Tsunami

UNIT-IV

SYLLABUS

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

Introduction:

Environmental pollution can be defined as "the unfavorable alteration of our surroundings"

Different Types of Pollution

Environment refers to the natural world. Environment refers surrounding (such as air, water, land) and their inter-relationship with human beings and other living species.

The flora anywhere on the earth, the soil and the stones, the rivers and water bodies, the sky and the air, the seas and the oceans, the fauna everywhere in the world, the climate and the interior of the earth – all combine together to form the **environment**.

Pollution comes from the Latin 'polluere' which means to contaminate. So, pollution is something that contaminates the environment.

Pollution means the presence of substance in the air, water, and land, which has adverse effects on living organs and on environment. Our environment is in danger due to pollution.

The atmosphere is being polluted by discharge of emissions from industrial plants, domestic sources, running vehicles, which burns fossil fuel and from thermal power etc. Public health and hygiene are seriously effected in the cities of developed and developing countries by presence of Sulphur dioxide, Carbon dioxide, Nitrogen oxide, Carbon monoxide, Hydro carbon substance, etc.

Types

The various types of environmental pollution includes air pollution, water pollution, soil pollution, radioactive pollution, noise pollution, light pollution, marine pollution,

1. Air pollution

Air pollution means the presence of pollutants in the atmosphere is such concentration that causes injury to human being and plants.

Air pollution is the name for anything that makes the air dirty. Thus, air pollution is anything that contaminates the air and makes it harmful to breathe for humans, animals and birds.

Of course, air pollution will depend on the context: some things may be counted as air pollution in some contexts, but not in others. But, in sum, air pollution can be defined as:

- Anything that contaminates the air.
- Something that makes the air dangerous to breathe.
- Potentially dependent on the context.

Air pollution can be both indoor and outdoor as follows:

- **Indoor air pollution:** Indoor air pollution is the pollution of the air in enclosed spaces such as our homes, shops, schools and other businesses. It can be caused by numerous things, like smoke from a domestic fireplace or the emission of gases inside a factory. It can be controlled by using detectors to detect pollution within the home or business and then controlling emissions. Chimneys may be used but these can simply cause outdoor air pollution instead.
- **Outdoor air pollution:** Outdoor air pollution is the pollution of the air outdoors. It is usually caused by the emission of polluting gases from the burning of fossil fuels in industry, car exhausts and air travel. It can be limited by reducing the emissions that we create in both homes and businesses, by reducing our reliance on fossil fuels and by traveling less by car and by plane.

Causes: Air mainly polluted by Carbon dioxide, Nitrogen oxide, Sulphur dioxide, etc. Example of air pollutants.

- Smoke: this can fill the air with particles of soot that make it physically dirty.
- Gases: poisonous gases are particularly dangerous.

Effects: The problems of air pollution.

1. Damaging to respiratory health.
2. Makes buildings grimy.
3. Aggravates allergies.
4. Causes diseases.
5. Reduces biodiversity.

Solution: Air pollution can be checked by increasing forest and protecting forests. Industry should be placed long distance from residential areas.

We should be careful and alert that our surrounding on our houses, streets, drains are cleaned. Smoke free furnaces should be used. Electric engines should be used more and not steam or diesel engines. Lastly air pollution can be better controlled by way of combined effort of Government and by private efforts.

2. Water pollution

Water pollution means contamination of water with physical, chemical or biological properties of water due to discharge of industrial effluent or any other liquid, gases or solid substance into water which is harmful for public health of commercial activities or in agriculture.

Sources: Domestic waste water and dirty municipal waste or sewage are the chief source of water pollution. Also read, major sources of water pollution.

Effects: Water pollution has had effects on human life. Water are polluted in different sources such as by gases, dirty soil, minerals, humans' materials, dead body of animals and other living organisms.

Solution: Water pollution can largely be controlled by proper treatment of domestic and municipal effluents. Domestic water and sewage can rightly be mixed with soil which will increase fertility. The industries must not discharge toxic water in the land. Also read, different ways to prevent water pollution.

3. Soil pollution

Soil pollution mainly occurs through agricultural chemicals. These are pesticides and fertilizers. These pesticides directly or indirectly injure other animals and human being.

Reasons: Land-ship, volcanic eruption, very strong wind current, torrential downpour, etc. are the natural phenomena which may partly contribute to creating soil pollution. The chief reason of soil pollution lies in the multifarious activities of man.

The contaminated sweepings and all sorts of refuses and garbage of the industrial establishment and of homes and homesteads, various types of chemicals and radio-active left-over etc., mainly cause soil pollution.

Control: The very harmful garbage and the unwholesome sweepings can be used to produce Bio-gas and manure. Use of pro-environment fertilizers and insecticides in agriculture are to be restored to. Proper precautionary measures are to be adopted while using the radio-active ingredients or implements.

Propagation of consciousness regarding soil pollution and other such means may materially help top control land or soil pollution.

4. Radioactive Pollution

Radioactive pollution refers to the presence of unwanted and undesired radioactive substances that radiates ionizing radiation in the environment and its surroundings. Such radiation is very harmful for the environment.

Sources of Radioactive Pollution: Various types of atomic refuses are the main sources of radioactive radiation. The cosmic rays coming down from the outer space are the sources of radioactivity. Again, the radioactive elements lying inside the earth are the sources of the radioactivity on earth.

Effects of radioactivity: The influence of radio-activities on human beings has become very harmful in the present century. The effects of radioactivity are generally divided into three classes, such as, instantaneous reaction, long-term reaction and a very retarded reaction.

Preventive measures: Various preventive measures are being resorted to today through the world for getting rid of this terrible danger of radiation of radioactive rays. These measures include:

- Adoption of special anti-radiation measures.
- The atomic refuses must be shifted scientifically to any safe area of the environment for proper interpolation.
- All people connected with radioactive production or program must be made aware of the direct or indirect adverse reaction of radioactivity.
- Properly trained people should only be allowed to work the nuclear research centers and treatment centers as well.
- All people professionally connected with any such project must put on their special type of radioactive preventive costume.
- The well-defined rules and regulation related to Nuclear energy ought to be abided by all.

5. Noise Pollution

One of the greatest problems of modern times is the sound or **noise pollution**. It refers to the presence of excessive sound or noise in the environment. It is often harmful for human and animal health.

Noise pollution is caused by large industries, vehicles such as cars, buses and lorries, etc. Besides these, the periodic sounds of hammering connected with some construction or repair work can be quite maddening.

Loud speakers blaring film music during festive occasions and speeches at political rallies or some other obscure cause add to the cacophony. The silence we so desperately long for seem unattainable.

6. Light pollution

Light pollution is caused by excess light contaminating the dark sky and making it artificially light.

Causes of light pollution: Lights that are left on – in both commercial premises and private residences – throughout the night are key causes of light pollution.

Effects of light pollution: Light pollution can disrupt the habitats of animals who rely on natural cycles of light and darkness to tell them when to wake up and when to rest. It can cause stress and disrupted sleep to humans. It can also make stargazing and astronomy difficult due to blocking out starlight.

Control measures: Turning lights off at night time and installing street lamps that do not scatter light up towards the sky will help to control light pollution.

7. Marine pollution

Marine pollution is presence of substances that contaminates the sea.

Causes of marine pollution: Sewage, oil spills, chemical runoff from industry and plastics and other waste from human lives are major pollutants in the sea. Polluting gases such as CO2 or sulfur dioxide can also dissolve in the sea and pollute it.

Effects of marine pollution: The acidification of the oceans and the destruction of marine habitats (thus in its turn leading to the death of marine organisms and the extinction of several species) are some of the main effects of marine pollution.

Control measures: Reducing waste and fossil fuel use and preventing chemical runoff and oil spills will help to protect the sea from pollution.

Disaster management aims to reduce, or avoid, the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery.

- **Mitigation** - Minimizing the effects of disaster.

  Examples: building codes and zoning; vulnerability analyses; public education.

- **Preparedness** - Planning how to respond.

Examples: preparedness plans; emergency exercises/training; warning systems.

- **Response** - Efforts to minimize the hazards created by a disaster.

  Examples: search and rescue; emergency relief.

- **Recovery** - Returning the community to normal.

  Examples: temporary housing; grants; medical care.

Types of Disasters:

There are two types of disasters:

(i) Natural Disasters:

The disasters that are caused by nature are termed as natural disasters e.g., earthquake, cyclone etc.

(ii) Man-made Disaster:

The disasters which are caused as a result of human activities are termed as Man-Made Disasters e.g., Road accident, terrorist attack.

Natural Disasters:

1. Earthquake:

Earthquake is a sudden and violent shaking of ground causing great destruction as a result of movement of earth's crust. An earthquake has the potential to tsunami or volcanic eruption.

Earthquake of magnitude 9.2 on the Richter's scale in 2004 in Indonesia is the second largest earthquake ever recorded. The deadliest earthquake happened in Central China, killing over 800,000 in 1556. People during that time and region lived in caves and died from the caves collapsing.

Earthquake mitigation strategies:

a. Existing critical facilities built on reclaimed land should be inspected and retrofitted if necessary to ensure earthquake resistance.

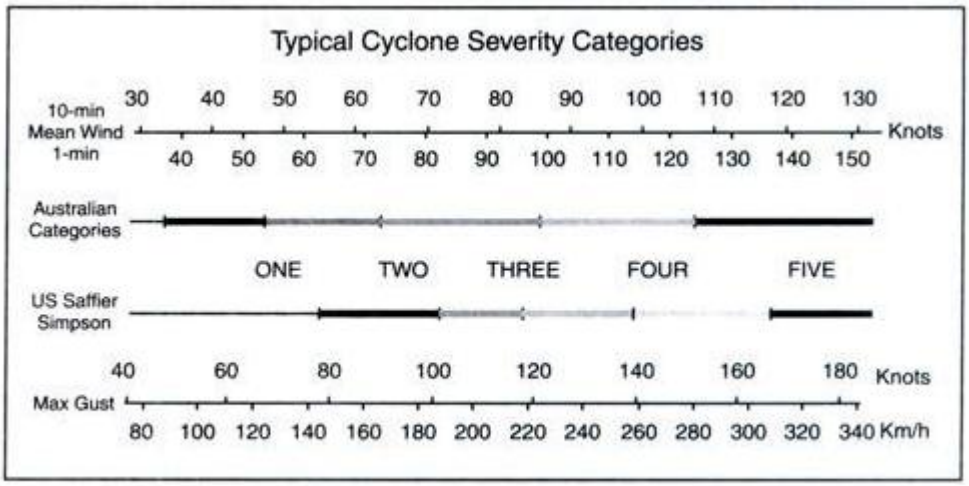
b. Future critical facilities should not be located on reclaimed land because of the high potential for liquefaction.

c. Older unreinforced masonry buildings should be inspected and retrofitted if necessary to increase earthquake resistance.

d. Older unreinforced masonry buildings should not be used for critical functions.

2. Cyclone:

Cyclones (or more properly called Tropical Cyclones) are a type of severe spinning storm that occurs over the ocean near the tropics.



Saffir-Simpson scale

The most famous Australian historic cyclone was Cyclone Tracy, December 1974, where around 11 people died in Darwin, Northern Territory. The direction they spin depends on which hemisphere they are in. In the Southern hemisphere they spin in a clockwise direction and Northern hemisphere they spin in an anti-clockwise direction.

Cyclone mitigation strategies:

a. Future critical facilities should not be located in areas of accelerated winds.

b. The most significant aspect of structural damage to buildings by high velocity wind results from roof damage. The roofs of existing buildings should be inspected and if necessary retrofitted to adequate standards.

c. The roofs of existing critical facilities should be retrofitted to a higher standard to ensure wind resistance.

d. Building openings such as windows and doors also suffer damage from high velocity winds. These openings if not constructed of wood or metal should be protected with shutters or temporary covers of adequate design.

3. Tsunami:

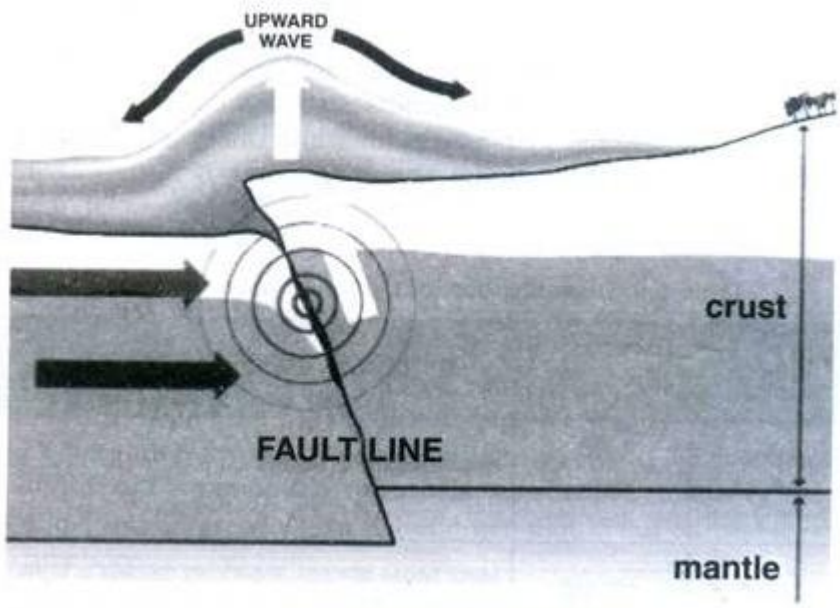
Tsunamis are giant waves, initiated by a sudden change, usually in relative position of underwater tectonic plates. The sudden jerk is enough to propagate the wave; however, its power can be enhanced and fed by lunar positioning and boundaries that focus its energy.

Tsunami mitigation strategies:

a. In some tsunami-prone countries earthquake engineering measures have been taken to reduce the damage caused onshore.

b. Japan, where tsunami science and response measures first began following a disaster in 1896, has produced ever-more elaborate countermeasures and response plans. That country has built many tsunami walls of up to 4.5 metres (15 ft) to protect populated coastal areas.

c. Other localities have built floodgates and channels to redirect the water from incoming tsunami.



Formation of Tsunami

4. Volcanic eruptions:

Volcanic disasters are caused by lava flows, volcanic mudflows and pyroclastic flows triggered by volcanic activities such as eruptions. It covers extensive areas; volcanic disasters can cause a large-scale damages and serious personal injury. Secondary disasters such as debris flows are often triggered by rainfall after a volcanic eruption.

In the 1815, the Indonesian eruption threw rocks more than 100 cubic km of ash killing 92,000 people. The greatest volcanic explosion occurred in Indonesia in 1883, which resulting in rocks hurling 55 km up into the air. The explosion was heard in Australia and generated a 40 m high tsunami, killing 36,000 people.

Volcanic disasters mitigation strategies:

a. Learn about community warning systems and of disasters that can come from volcanoes (earthquakes, flooding, landslides, mudflows, thunderstorms, tsunamis)

b. Make evacuation plans to higher ground with a backup route.

c. Have disaster supplies on hand (flashlight, extra batteries, portable battery-operated radio, first aid kit, emergency food and water, nonelectric can opener, cash and credit cards, and sturdy shoes)

5. Floods:

Flooding is the unusual presence of water on land to a depth which affects normal activities. Flooding can arise from: overflowing rivers (river flooding), heavy rainfall over a short duration (flash floods), or an unusual inflow of sea water onto land (ocean flooding). Ocean flooding can be caused by storms such as hurricanes (storm surge), high tides (tidal flooding), seismic events (tsunami) or large landslides.

Flood mitigation strategies:

a. Watercourses which pass through significant settlement areas should be properly configured and lined with concrete.

b. Existing bridges should be inspected to determine which ones are too low or which have support pillars within the watercourse channel. Where possible these should be replaced as these features restrict water flow and cause the channels to be easily blocked with debris.

c. Future bridges should not be built with these undesirable features.

d. Buildings constructed adjacent to watercourses should be elevated by at least one meter to prevent potential flood inundation.

e. Critical facilities should not be located adjacent to watercourses.

Man-made Disasters:

1. Road Accidents:

Road accidents are common in India due to reckless driving, untrained drivers and poor maintenance of roads and vehicles. According to Lifeline Foundation, the Ahmedabad based organization working for road safety, India accounts for 13 per cent of road accident fatalities worldwide.

With 130,000 deaths in 2007, India tops in the number of people killed in road accidents, surpassing China's 90,000. Most of these deaths occurred due to bad road designs and lack of proper traffic management systems to separate different streams of traffic.

2. Building and Bridge Collapse:

Building collapses are frequent in India where construction is often hastily done, with little regard for safety regulations, particularly in the western part of the country.

3. Terrorist Attack:

Devastating acts such as the terrorist attacks on the World Trade Centre and the Pentagon have left many concerned about the possibility of future incidents in the United States and their potential impact. Terrorism may involve devastating acts using weapons of mass destruction ranging from chemical agents, biological hazards, a radiological or nuclear device, and other explosives.

Mitigation strategies for man-made disasters:

a. For road accidents, traffic rules and regulations need to be followed strictly.

b. For building and bridge collapse, standard building materials should be used.

c. Moreover, more and more public awareness should be made to minimize the effects of man-made disasters.

If a Terrorism-Related Event Happens:

a. Stay calm and be patient.

b. Listen to a local radio or television station for news and follow the instructions of emergency service personnel.

c. Be vigilant. If the incident occurs near you, look out for secondary hazards such as falling debris or additional attacks.

d. Check for injuries and summon help for seriously injured people.

Awareness through Mass Media:

a. Media plays a significant role in educating the population about] disaster and its management.

b. Without media we could not aware people about disaster in remote areas of the country.

S.No	Question	Option a	Option b	Option c	Option d	Answer
1.	Today, the world's number one problem is:	Pollution	Population explosion	Nuclear proliferation	Natural calamities	Population explosion
2.	Population explosion has occurred in the last:	500 years	300 years	700 years	150 years	150 years
3.	Which rays strike on earth due to depletion of ozone layer ?	Ultraviolet	Infrared	Visible light	Microwaves	Ultraviolet
4.	Ozonospere is mainly depleted by	excess CO_2	excess CO	CFCs	ozone	CFCs
5.	Excess atmospheric carbon dioxide increase greenhouse effect as carbondioxide	Precipitates dust in the atmosphere	is opaque to infrared rays	reduce atmospheric pressure	is not opaque to infrared rays	is opaque to infrared rays
6.	The most abundant greenhouse gas in the earth's atmosphere	Carbon dioxide	methane	Nitrous oxide	Water vapour	Water vapour
7.	Which of the following is nor a greenhouse gas	Water vapour	Carbon dioxide	Ozone	methane	Ozone
8.	Which of the following is not a potential adverse effect of global warming	More extreme weather patterns	Retreat of glaciers	An increase of UVB radiation	Sea level	An increase of UVB radiation
9.	Which of the following processes acts to remove carbon dioxide from the atmosphere?	Burning fossil fuels	Photosynthesis	Deforestation	Lightning	Photosynthesis
10.	Excess acidity caused by acid rain can be neutralized by adding	more fertilizers.	by removing acidified soil	by adding P_2O_5.	by adding lime.	by adding lime.
11.	Acid rain has a pH	well below 3	3	4	well above 4.	4
12.	Considering climate change, melting of ice sheets and glaciers causes the	destruction of infrastructure	endangering of species	desertification	destruction of human settlements	endangering of species
13.	Long period of time without water is classified as	flood	drought	desertification	endangering	desertification
14.	The Wildlife (Protection) Act contains:	66 Sections	6 Sections	7 Sections	46 Sections	66 Sections
15.	The Water (Prevention and Control of Pollution) Act was enacted in the year	1986	1974	1994	1975	1974
16.	NGOs stands for	Non-Governmental Organization	Nine-Governmental Organization	Non-Gained Organizations	National-Grade Organization	Non-Governmental Organization
17.	The term disaster is derived from which of the following language?	Greek	Latin	French	Arabic	French
18.	Earthquake and Tsunami constitute diseaster percentage --------	8%	4%	6%	17%	8%
19.	Which of the following human activities does NOT release carbon dioxide into the atmosphere?	burning fossil	fishing	deforestation	driving	fishing
20.	As global warming continues, the intensity of what type of storm that hits coastlines is predicted to increase?	tornadoes	hurricanes	tsunamis	earthquakes	hurricanes
21.	Rising water temperatures is a result of global warming and may eventually increase sea levels due to the dissolving of what?	mountains	wetlands	river beds	glaciers	Glaciers
22.	What country emits the most carbon dioxide?	China	United States	Russia	India	China
23.	Name of extremely effective firs extinguishing agent is	helium	halons	halogens	argon	halons
24.	Chemical substance used in industry for cold cleaning, adhesives and vapor degreasing is	methyl chloroform	carbon tetrachloride	halons	hydrocarbons	methyl chloroform
25.	Layer of atmosphere in which Ozone layer lies is	exosphere	mesosphere	troposphere	stratosphere	Stratosphere

26.	Number of atoms in ozone molecules are	2	3	4	1	3
27.	Reformation of ozone in stratosphere is powered by	UV radiation	atmospheric oxygen	sunlight	heat	UV radiation
28.	Ozone (O?) comprises of	one oxygen atom	2 oxygen atoms	3 oxygen atoms	4 oxygen atoms	3 oxygen atoms
29.	Which of the following fuel material occurred naturally?	U^{235}	Pu^{239}	Pu^{241}	U^{-233}	U^{235}
30.	The function of a moderator is to	absorb the part of the Kinetic energy of the neutrons	extract the heat	reflect back some of the neutrons	start the reactor	absorb the part of the Kinetic energy of the neutrons
31.	Which of the following is not used as moderator?	water	heavy water	graphite	boron	boron
32.	Heat is generated in a nuclear reactor (thermal) by	fusion of atoms of uranium.	combustion of a nuclear fuel e.g. uranium.	absorption of neutrons in uranium atoms.	fission of U^{-235} by neutrons.	fission of U^{-235} by neutrons.
33.	In which of the following reactors, heat exchanger is not used?	Pressurized water reactor	Boiling water reactor	CANDU reactor	Gas cooled reactor	Boiling water reactor
34.	In Canadium Deuterium Uranium reactor (CANDU), the control rods are made of	Cadmium	Boron steel	Graphite	Beryllium	Cadmium
35.	Gas cooled reactors are _____ moderated.	Light water	Heavy water	Graphite	Beryllium	Graphite
36.	Article 5 includes exceptions to the right to liberty and security of the person. Which of the following instances would not be covered?	A young person held in secure accommodation.	An adult with a learning disability locked in his room in residential accommodation for 12 hours.	A person detained for treatment under s.3 Mental Health Act 1983.	Detention of an adult in a police cell after arrest for drunken behaviour	An adult with a learning disability locked in his room in residential accommodation for 12 hours.
37.	What is the meaning of lesson plan?	To read the lesson before teaching it	To prepare all that the teacher wants to teach in a limited period	To prepare detailed answers of all the questions to be asked in the class	To prepare the list of questions to be asked.	To read the lesson before teaching it
38.	Which is the first school for a child’s education?	Society	Friends	Family	School.	Family
39.	What is the place of principal in an edu-cational institute?	Overall head of the school	Manager of the school	Owner of the school	Founder of the school.	Manager of the school
40.	Preparing the child for future life as an aim of education is preparing child for	Some suitable vocation	Some particular course of study.	Facing all kinds of emergencies and situations of future life.	A happy married life.	Facing all kinds of emergencies and situations of future life.
41.	Which of the following appears to contribute to global cooling rather than global warming?	nitrous oxide	aerosols	methane	CFCs	aerosols
42.	Environmental Impact Assessment (EIA) is mandatory under which one of the following India legislations:	Indian Forest Act	Air (Prevention and Control of Pollution) Act	Wildlife Protection Act	Environment (Protection) Act	Environment (Protection) Act
43.	Mercury is considered hazardous to human health because:	Mercury is a pure metal and hard to digest.	Mercury accumulates and concentration increases high up the food chain.	Mercury is light and easily dispersed by wind.	Mercury is very soluble in water and easily absorbed by human body.	Mercury accumulates and concentration increases high up the food chain.
44.	What is Eutrophication?	thermal change in water	filling up of water body with aquatic plants due to excessive nutrients	pollution of water due to solid waste	Evaporation	filling up of water body with aquatic plants due to excessive nutrients
45.	The world as World Environmental day is celebrated on:	1-Dec	5-Jun	14-Nov	15-Aug	5-Jun
46.	The provisions of environmental protection in the constitution were made under:	Article 5-A	Article 21-B	Article 27-B (h)	Article 48-A and Article 51-A (g)	Article 48-A and Article 51-A (g)
47.	The first of the major environmental protection act to be promulgated in India was:	Water Act	Air Act	Environmental Act	Noise Pollution Rule	Water Act
48.	The Forest (Conservation) Act extends to the whole of India except:	Uttar Pardesh	Karnataka	Jammu and Kashmir	Haryana	Jammu and Kashmir

49.	Penalty for conservation of the provisions of the Forest Act is under:	Section 3A	Section 4A	Section 12A	Section 8A	Section 3A
50.	The Air (Prevention & control of pollution) Act was enacted in the year	1981	1996	2000	1974	1981
51.	The first major environmental protection act to be promulgated in India was:	The Wild life protection act	The air act	The noise pollution act	The water act	The Wild life protection act
52.	The central pollution control board was established under the provision of:	Environmental (Protection) Act 1986	Air (Prevention & control) Act 1981	Water (Prevention & control of pollution) Act 1974	Noise Pollution Rule	Water (Prevention & control of pollution) Act 1974
53.	Earth day' is observed on	1st December	5th June	22nd April	1st January	22nd April
54.	Noise pollution has been inserted as pollution in the Air Act in:	1981	1987	1982	2000	1987
55.	The Environmental (Protection) Act was enacted in the year:	1986	1992	1984	1974	1986
56.	The EPA consists:	2 Chapters	4 Chapters	8 Chapters	7 Chapters	4 Chapters
57.	The EPA contains:	25 Sections	12 Sections	26 Sections	14 Sections	26 Sections
58.	The Women's Population in the world is almost:	Half	One-forth	One-third	One fifth	Half
59.	AIDS day is	1-May	1-Dec	20-Dec	1-Jun	1-Dec
60.	HIV virus has a protein coat and a genetic material which is	Double stranded DNA	Single stranded RNA	Double stranded RNA	Single stranded DNA	Single stranded RNA

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

Developing and modernizing the technologies without losing our soundtraditional values and practices is essential.

Sustainable development

Meeting the needs of the present, without compromising the ability of futuregenerations, to meet their own needs.

True sustainable development

Optimum use of natural resources with high degree of reusability, minimumwastage, least generation of toxic byproducts and maximum productivity.

Dimensions of sustainable development

Multi-dimensional concept – derived from interactions between society, economyand environment.

Aspects of sustainable development

I.Inter-generational equity

II.Intra-generational equity

Approaches for sustainable development

1. Developing appropriate technology - locally adaptable, eco-friendly, resourceefficient and culturally suitable.

2. Reduce, reuse, recycle [3R] approach – reduces waste generation and pollution
3. Providing environmental education and awareness – changing attitude of the people
4. Consumption of renewable resources – attain sustainability
5. Conservation of nonrenewable resources – conserved by recycling and reusing
6. Population control

Urban problems related to energy

1. Causes for urbanization
2. Energy demanding activities
3. Solution for urban energy problem

Water conservation

The process of saving water for future utilization Need for water conservation

1. Changes in environmental factors
2. Better lifestyles
3. Increase in population
4. Deforestation
5. over exploitation of ground water
6. Agricultural and industrial activities

Strategies of water conservation

1. Reducing evaporation losses
2. Reducing irrigation losses
3. Re use of water
4. Preventing of wastage of water
5. Decreasing run-off losses
6. Avoid discharge of sewage

Methods of water conservation

I. Rain water harvesting- A technique of capturing and storing of rain water for further utilization.

Objectives

1. Increasing demands
2. Recharging the ground water
3. Reducing the ground water
4. Increase in hydro static pressure

II. Water shed management – The management of rainfall and resultant run-off Factors affecting watershed

1. Unplanned land use
2. Deforestation
3. Droughtly climates

Objectives

1. To minimize of risk of floods
2. For improving the economy
3. For developmental activities
4. To generate huge employment opportunities
5. To promote forestry6.To protect soil from erosion

Resettlement and Rehabilitation of people

Causes

1. Due to Developmental activities
2. Due to Disaster
3. Due to conservation initiatives

Rehabilitation issues

1. Displacement of tribals increases poverty
2. Breakup of families
3. Communal ownership of property
4. Vanishing social and cultural activities
5. Loss of identity between the people

Case Studies – Sardar Sarovar Dam, The Theri dam Project , Pong Dam

Environmental ethics

Refers to the issues, principles and guidelines relating to human interactions with their environment. Environmental problems

1. Deforestation
2. Population growth
3. Pollution due to effluent and smoke
4. Water scarcity
5. Land degradation

Solutions

1. Reducing the energy sources
2. Recycle and reuse of waste products
3. Soil degradation
4. Sustainable development
5. Protection of Bio – diversity
6. Reducing the population

Climate

The average weather of an areaCauses of climate change:

1. Presence of green house gases
2. Depletion of ozone gases

Effect of climate change

1. Migration of animals
2. Upsetting the hydrological cycles results in floods and droughts
3. Changes in global pattern of winds.

Green house effect:

The progressive warming of earth surface due to blanketing effect of man made CO_2 in the atmosphere. Green house gases- causing global warming CO_2, Ch_4, N_2O, CFCs

Effect on global warming- effects on

1. Sea level

2. Agriculture and forestry
3. Water resources
4. Terrestrial ecosystems
5. Human health

Measures

1. Reducing CO_2 emission
2. Utilizing renewable resources
3. Plant more trees
4. Adopt sustainable agriculture

ACID RAIN:

The precipitation of CO_2, SO_2, and NO_2 gases as pollutants in water.

Effects of acid rain

1. Human beings Destroy life – nervous, respiratory and digestive system causes premature death from heart and lung disorders
2. On Buildings Corrosion - Taj Mahal , houses, statues, bridges, metals
3. On terrestrial and Lake Ecosystem Reduces rate of photosynthesis, growth of crops, Fish population and bio mass production

Control measures

1. Clean combustion technologies
2. Using pollution control equipments
3. Replacement of coal by natural gas
4. Liming of lakes and soils

Ozone layer depletion:

Ozone is formed in the stratosphere by photo - chemical reaction

Ozone depleting chemicals

Chloro Fluro carbon, Hydro chloro fluoro carbon, Bromo fluoro Carbon.

Effects

1. On human health – Skin cancer, cataracts, allergies etc.

2. On aquatic systems- phyto plankton, fish

3. On materials- paints, plastics

4. On climate – increasing the average temperature of the earth surface.

Control Measures

1. Replacing CFCs2.Use of methyl bromide – crop fumigant

Nuclear accidents and Holocaust

The release of large amounts of nuclear energy and radioactive products into the atmosphere.

Waste land reclamation

Waste land:- The land which is not in use – unproductive , unfit for cultivationanother economic uses.

Types of waste land

Uncultivable waste land – Barren rocky areas, hilly slopes, sandy desserts.

Cultivable waste land- degraded forest lands, gullied lands. Marsh lands, saline land etc.,

Causes for waste land formation:

1. Soil Erosion, Deforestation, Water logging, Salinity

2. Excessive use of pesticides

3. Construction of dams

4. Over-exploitation of natural resources

5. Sewage and industrial wastes

6. Mining

7. Growing demands for fuel, fodder wood and food causes degradation and loss of soil productivity.

Objectives of waste land reclamation

1. To improve the physical structure and quality of the soil

2. To prevent soil erosion

3. To avoid over – exploitation of natural resources

4. To conserve the biological resources

Methods of waste land reclamation

1. Drainage
2. Leaching
3. Irrigation practices
4. Green manures and bio fertilizers
5. Application of Gypsum
6. Afforestation programmes
7. Social forestry programmes

Consumerisation of Waste products

Consumerisation – Consumption of resources

Traditionally favorable rights of sellers- Right to introduce product, price, Incentives.

Traditionally buyer rights-Right to buy, right to expect the product to perform as claimed

Important informations to be known by buyers: - ingredients, manufacturing dates, expiry etc.

Objectives of consumerisation:

1. Improves rights and power of the buyers
2. Making the manufacturer liable
3. Reuse and recycle the product
4. Reclaiming useful parts
5. Reusable packing materials
6. health and happiness

Sources of wastes:

Glass, papers, garbage's, food waste, automobile waste, dead animals, etc..

E – Waste

Computers, printers, mobile phones, Xerox machines, calculators, etc.

Effects of wastes:

1. Dangerous to human life
2. Degrade soil
3. Cadmium in chips, Cathode ray tube, PVC cause cancer and other respiratory problems.

4. Non-biodegradable plastics reduce toxic gases.

Factors affecting consumerisation and generation of wastes:

1. People over – Population
2. Consumption over - Population

Environmental legislation and laws – Important protection acts

1. Water Act 1974, 1978
2. Water amendment Act, 1987
3. Air Act, 1981
4. Wild life Act 1972
5. Forest Act 1980
6. Environment Act 1972.

Issues involved in Enforcement of Environmental legislation:

1. Drawbacks of wildlife protection Act
2. Drawbacks of Forest Act 1980
3. Drawbacks of Environment Act 1972.

Public Awareness:

Our environment is presently degrading due to many activities like pollution, deforestation, overgrazing, rapid industrialization and urbanization.

Objectives of public awareness

1. Create awareness among people of rural and city about ecological imbalances, local environment, technological development and various development plants.
2. To organize meetings, group discussion on development, tree plantation programmes exhibitions.
3. To learn to live simple and eco-friendlily manner.

Methods to create environmental awareness

1. In schools and colleges
2. Through mass – media
3. Cinema

4. Newspapers
5. Audio - Visual media
6. Voluntary organizations
7. Traditional techniques
8. Arranging competitions
9. Leaders appeal
10. Non – government organizations.

HUMAN POPULATION AND ENVIRONMENT

Population: density

Number of individuals of the population per Parameters affecting population size:

1. Birth rate or Natality
2. Death rate or Mortality
3. Immigration
4. Emigration

Population Growth

The rapid growth population of the global's for the past 100 year between the rate of birth and death.

Causes of rapid population growth:

- The rapid population growth is due to de birth rate
- Availability of antibiotics,increased foodimmunizatioproduct water and air - dr**e**creaseslateddeathsthefamine
- In agricultural based countries, childre field that is why population increases i

Characteristics of population growth.

- Exponential growth
- Doubling time
- Infant mortality rate
- total fertility rate
- Replacement level

- Male/female ratio
- Demographic transition

Variation of population based on age structure

1. Pyramid–Indiashaped, Bangladesh, Ethiopia,
2. Bell d–shapeFrance, USA, UK
3. Urn shaped-Germany, Italy,and.Japan

Population Explosion

The enormous increase in population due to low death rate and high birth rate.

Causes:

Modern medical facilities, life expectancy, illiteracy,

Effects:

Poverty, Environmental degradation,– Over exploitation of natural resources, Treat, Communal war

Remedy:-Through birth control programmes.

Family welfare programme: Objectives:

- Slowing down the population explosion
- Over exploitation of natural resources
- Reduce infant mortality rate
- Encourage late marriages
- Improve women's health
- Control of communal diseases

Environment and: human health

1. Physical–RadioactiveHazards and UV radiations, Chlorofluroisecarbons,etc. No
2. Chemical–CombustionHazards of Fossil fuels, indu pesticides, heavy metals,
3. Biological-Bacteria,Hazards Viruses, Parasites

Human rights:

1. Human right to freedom

2. Human right to property
3. Human right to freedom of religion
4. Humanright to culture and education
5. Human right to constitutional remedies
6. Human right to equality
7. Human right against exploitation
8. Human right to food and environment
9. Human right to good health.

Value education:

Types:

1. Formal education
2. Value education
3. Value-based environmental education

Objectives

1. To improve the integral growth of human
2. To create attitudes and improvement towa
3. To increase awareness about our national constitutionalationalrighin**t**egration,s, community environment.
4. To create and develop awareness about th role
5. To know about var-l**i**vingous livingorganismsand andnon thei with environment.

Types of values:

1. Universal values
2. Cultural values
3. Individual values
4. global values
5. Spiritual values

HIV/AIDS

AIDS is the abbreviated form for Acquired by a virus called HIV.

Effects;

1. Death
2. Loss of labor
3. Inability to work
4. Lack of energy

Woman and child welfare:

Objectives:

1. To provide education
2. To impart vocational training
3. To generate awareness
4. To improve employment opportunities
5. To restore dignity, equality and resp Role of information technology in environment

Remote sensing:

Component-Aplatform, aircraft, A balloon, rock Functions:

1. Origin of electro magnetic energy
2. Transmission of energy
3. Interaction of energy
4. Detection of energy
5. Preprocessing of data
6. Data analysis and interpretation
7. Integration and other applications

Applications:

In agriculture, forestry, land cover, waste

Data –Collection Base of inter related data on various subjects

1. Ministry of environment and forest
2. National management information system
3. Environmental information system

Geographical information system:

Application:

1. Thematic maps are super imposed using soft
2. Interpretation of polluted zones
3. To check unplanned growth and related envi

Satellite data:

1. Helps in providing reliable information and data about forest cover

2. Provide information about forecasting weather

3. Reserves of oil, minerals can be discovered

Role of information technology in human health

The health service technology involves three systems

1. Finance and accounting
2. Pathology
3. Patient Administration–clinical system.

Applications

1. Data regarding birth and death rates
2. To monitor the health of the people effectively
3. The information regarding the outbreak of epidemic diseases
4. Online Consultation
5. Drugs and its replacement.