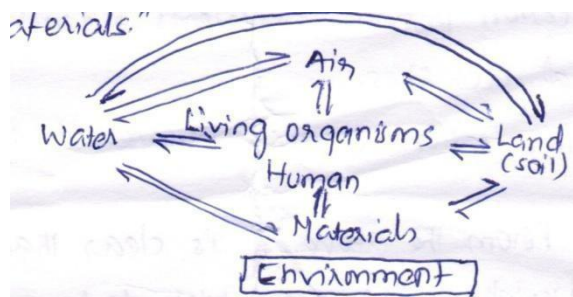


UNIT-I

Multidisciplinary Nature of environmental studies and natural resources**1. Define Environment. Explain Multidisciplinary nature of Environmental studies.**

Environment is derived from the word “French”- environner, which means to encircle (or) surround. Environment includes biological and non biological things. As per environment protection (act) 1986, environment includes physical and biological things & their interaction between them.

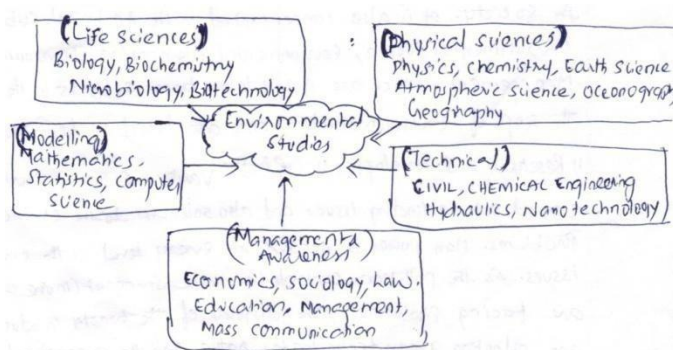
Anyhow environment is thus defined as “the total sum of water, air, land and their relationships, also with human, other living organisms & materials.



From the figure it is clear that each and every factor interdepends with one another. At the same time human have direct influence on the various factors i.e., the over exploitation of these influence heavily on the human beings. Hence human have direct (or) indirect relationship with surroundings (flora & fauna). The multi stored buildings, commercial complexes, factories, transportation networks, pollutants, animals, plants & population of urban environment is differed with the rural environment.

Environment is a complex subject in which it includes & interrelates with many subjects (disciplines).

- Life sciences includes botany, zoology, microbiology, genetics, biochemistry helps in understanding the biotic components and their interactions.
- Physical sciences includes physics, chemistry, geology, atmospheric science etc helps in understanding the abiotic components and their interactions.
- Mathematics, statistics, computer science, helps in model of the environment.
- Economics, management, sociology deals with the socio-economic aspects and their development activities.
- Technical like civil, chemical, nanotechnology gives control and treatment of the environmental pollution.
- Law & education provides guidelines & deals with legal issues regarding environmental activities.
- Mass communication creates awareness about environmental measures.



From the above it is clear that environmental studies is a multidisciplinary subject which deal & inter relates with the other subjects also.

2. (a) Discuss Scope and Importance of Environmental studies.**Scope:**

As it is a multidisciplinary subject, it has wide scope. The environmental studies comprise of the following:

- Natural resources-conservation and management.
- Ecology and biodiversity.
- Environmental pollution & control.
- Social issues related to development and environment.
- Human population and environment.

- Environmental studies have direct effect on every section of the society. It is also concentrated in the technical subjects like environmental science, environmental engineering, environmental management- which are going to be boom subjects in the future. The scope of environmental science is listed as follows:
Research and Development(R & D):

Various R&D activities can be carried out in finding issues and also solutions to the environmental problems. Man power is needed at every level of the environmental issues. As the pollution controls laws are stringent (more strict), industries are facing problems in the disposal of the wastes produced. Companies are adopting green technologies rather than the expensive litigation (fine).

So, companies are in a position to invest for the pollution control technologies with cost cutting effluent treatment. So they are investing in R&D activities, because cleaning and disposal is a big task. It is estimated that American business spends more than \$100 billion dollars per year for this purpose. Germany and Japan also have stringent (measure) laws. There is \$200 billion market for cleaning East Germany alone. In India also there strict laws for the disposal of effluents i.e., before they reaches the water bodies they have to be purified.

1. Green advocacy:

With increasing of various issues related to the environment, the demand for the environmental lawyer also being increased. They deals with the cases related to water, air pollution and also regarding wild life, forest preservation etc.

2. Green marketing:

As the people are being educated and got awareness about the environmental issues, interesting in buying and marketing about the eco-friendly products. So, in related to that issues and also stringent laws, companies are producing the eco friendly products with ISO certification (ecomark (or) ISO 14000). In future there are demands for environmental auditors and managers.

3. Green media:

For the environment awareness, among the people, mass media like TV, radio, newspaper, advertisement, etc are needed which ultimately provides scope for the people.

4. Environmental consultancy:

Many government and non government organizations are involved in the consultancies for studying and tackling the issues related to the environment.

Importance of the environment: Environment belongs to all. As the relation between environment and us is bidirectional, if we disturb environment, it disturbs us. Here is the some important days listed in the environment calendar

Environmental calendar

Earth day	-April 22
International biodiversity day	-May 22
World environment day	-June 5
World population day	-June 11
Ozone week	-September 16-23
Wild life week	- October 1-7
World conservation day	- October 24
International day for natural Disaster reduction	- October 13
International day for biological Diversity	-December 29

(b) Explain the need of public awareness towards environment.

Need for public awareness:

Conferences:

Environmental issues led to many problems. So, to draw attention from the globe conference held on 5th June, 1972 called Stockholm conference. From that day we celebrate every 5th June as world environment day.

- Another conference on environment & development held at Riode Janerio from the United Nations. This is popularly known as earth summit (1992).

- Another summit on sustainable development held at Johannesburg (2002). In this, issues of the environment were discussed.

The above awareness held was to draw attention of the public towards deteriorating environment.

Awareness of environment in public:

Stringent rules by the government (or) measures alone cannot be helpful in achieving development of the environment until public has the participatory role. But it is only achieved by awareness about ecology and environment issues. The awareness can be done by educating the public about the environment. We should educate the public such that we shouldn't reach the threshold level. **E.g:** Ban of polythene littering.

A Chinese proverb say "if you plan for one year, plant rice, if you plan for 10 years, plant trees and if you plan for 100 years, educate people". i.e., if we want to protect and manage our earth, the only way is people to be educated environmentally.

Contemporary Indian environmentalists: In our country, efforts are made to create awareness about the environment. In that relation many legends are there.

- Kuldeep singh, green judge & Sh. M. C. Mehta, the green advocate
- Sh. Sunderlal bahuguna- Chipko movement
- Tehri Bachao Andolan, Smt. Medha Patkar and Ms. Arundhati Roy- Narmada Bachao Andolan.
- Sh. Rajendra singh, Magsaysay awardee - water conservation.

3 (a) Differentiate Renewable and non-renewable resources with examples.

Living things on this earth depends on variety of goods and services gifted by nature known as natural resources e.g.: water, soil, air, minerals, forest, wildlife etc. This can be categorized into two:

(i) Renewable resources: These resources are in-exhaustive and can be regenerated within a span of time.

E.g. 1. Solar energy:

Solar energy is ultimate energy where all forms of energy depends on it. The reaction that takes place in sun is nuclear fusion which releases enormous amount of heat & light energy. The solar energy received by earth is 1.4 KJ/S/M^2 . We use this solar energy for different house hold purposes like drying , clothes, food grains, separation of salt from sea water etc., There are different devices used for harvesting solar energy.

(ii) Non-renewable resources: The resources which are exhaustive and cannot be regenerated with in a span of time.

1. Coal: Coal was formed before 255-350 million years ago. Plants are buried deeper into the earth, due to course of time with heat & pressure will be converted into coal. There are different forms of coal based on the formation of it. They are

- 1) Peat
- 2) Lignite
- 3) Bituminous (semi, sub & bituminous)
- 4) Anthracite

Of all the forms, anthracite is last stage of decomposition which is also good quality coal with high carbon content. The present coal reserves will be only for 200 years for the present rate of usage but if it increases by 2% then it would be lasts for 65 years only.

- Coal produces CO_2 when burnt. CO_2 is responsible for global warming (green house gas). "S" is present in coal as impurity and so combustion produces oxides of sulphur which is pollutant .
- India has 5% of world's coal reserves. Major coal fields in India are Raniganj, Jharia, Bokaro, Singrauli, Godavari valley, Jharkhand, Odissa, West Bengal, Madhya Pradesh, Andhra Pradesh & Maharashtra. In J&K (Anthracite).

(b) What are the uses of forest?

Uses of Forest:

Forests are potential value to us. They are useful for industries; nevertheless, they are very useful to the

environment. It also decides economic status of the country.

Let's compare the values of forest in terms of economics and commercial where the economic ultimately dominates commercial.

Commercial Uses:

The commercial uses of forest are: It can be used as goods like timber, pulp wood, rubber and gums, oils etc. Half of the timber cut every year used for the heating and cooking. 1-3rd of wood is used as building materials, 1/6th of pulp wood is used for making paper. These forest lands are used for mining, agriculture, dams' construction, grazing, etc.

Ecological Values:

A Typical tree produces a value of 30000 rupees in terms of goods but it provides a value of 1000000 rupees as ecologically. They are:

- 1) Production of O₂: The trees generate O₂ by photosynthesis, which is very important to the life and so-called earth lungs.
- 2) Reduces global warming: The main greenhouse gas is CO₂, which is responsible for global warming. This CO₂ is taken by the plant for photosynthesis and thereby acts as sink.
- 3) Wild life habitat: Forests are homes for millions of animals and plants (7 million species are found in forests).
- 4) Regulation of hydrological cycle: Trees in forest absorb water in the ground level and some part of the water is released into atmosphere by transpiration process. There by trees is main cause of clouds which ultimately reaches into earth by rain. So thereby this maintains hydrological cycle.
- 5) Soil conservation: Trees and plants hold the soil firmly, such that it prevents from soil erosion.
- 6) Reduces pollution: Trees and plants in forest absorb many toxic gases including CO₂. They also absorb noise and thereby reduces sound pollution.

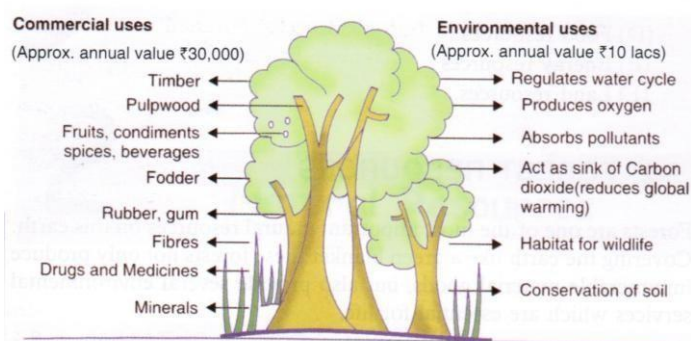


Fig. 2.2 Economic vs. Environmental value of forests.

4. (a) What are the major causes of deforestation? What are the effects of deforestation on Environment?

MAJOR CAUSES OF DEFORESTATION:

The following are the reasons of deforestation:

1. Shifting cultivation:

300 million people living on shift cultivators who follow slash and burn culture. So, due to this half of the forests are cleaned annually in Bihar, Madhya Pradesh and Andhra Pradesh.

2. Fuel Requirements:

Due to increasing the demands of the people many forests are subjected to deforestation. During independence 65 million tons were used but in 2001, 300-500 million tons are used.

3. Raw Materials-Industries:

Woods are used in preparation of furniture, railway sleepers, plywood, pulpwood are used in making papers etc. Plywood is used for packing of tea leaves in J & K, Assam etc.

4. Development Projects:

For different project works like dams (river valley project), hydro-electric project etc, forests are being removed.

5. Growing Food Needs:

Due to increase in population and to face the demands of people, forests are permanently cleared for agriculture.

6. Over Grazing:

Due to overgrazing by cattle, forests are cleared. Many of the forests are subjected to deforestation.

7. Forest Fires:

Sometimes naturally forest is subjected to fires (or) man may induce it, which causes major loss to forests.

(b) Discuss briefly droughts and floods.**Floods:**

In some countries like India and Bangladesh rain fall does not occur throughout the year rather than 90% of the rainfall fall will be in the few months (June, September). This leads to floods by over flowing of lakes and rivers.

Floods are regular in some parts of India and Bangladesh, which causes economic loss. If the floods are moderate then it can be utilized for cropping of paddy. Floods are severe in the years of 1970, 88, 91 resulted in massive damage and also deaths. In 1970 one million drowned, where as in 1991-140000 died. The reasons for the floods are deforestation, over grazing, mining and rapid industrialization etc. In earlier day's floods are natural disasters but now days this is manmade.

Droughts:

There are about 80 countries which experiences droughts frequently. Drought is due to decrease in rainfall and increase in evaporation. The densely populated areas are more affected to droughts.

Reasons :(Man-made Effects)

This is a metrological phenomenon and occurred due to over grazing, deforestation, mining etc. Now days, India is experiencing the drought condition in higher rates.

The cropping pattern is also another reason. Some crops consume more water in that case the same crop should not be cultivated every time instead we have to rotate it with another crop.

Precautions: Remedial measures

To avoid drought condition mixing of cropping pattern should be followed social forestry and waste land should be utilized based on natural processes.

CASE STUDY:

In Kolar district of Karnataka 11 talukas suffered from the drought condition. It is now known that the reason is due to the tree eucalyptus which is planted before. This tree releases much water in the process of transpiration into the atmosphere.

5. Define Aquifer. Discuss its types with the diagram.**Ground Water:**

About 9.86% of fresh water is in the form of ground water. Earlier days ground water is considered as pure water, but due to pollution it is be contaminated.

Aquifer: Sediment of rock which holds water is called aquifer.

Aquifers are of two types:

Unconfined aquifer: These are permeable and present in deeper areas and can be recharged by rain water.

Confined aquifer: These are not permeable as the sediment of rocks cover them and can only be recharged where the aquifers meet the surface but the problem is source for recharge is some kms away.

Effects of Ground Water Usage:

- 1) ***Subsidence:*** If the recharge rate is more when compared to usage rate, then more water is sedimented (ground subsidence) due to which large economic loss happens by submergence of land surface and finally leads to problems like structural damage in buildings etc.
- 2) ***Lowering of water table:*** Due to continuous usage of water for different purposes, sharp decrease in the water table takes place. If this continues there will be no sufficient water for future uses (agriculture, etc.)
- 3) ***Water logging:*** If excess irrigation is done with brackish water, it leads to water logging and salinity problems.

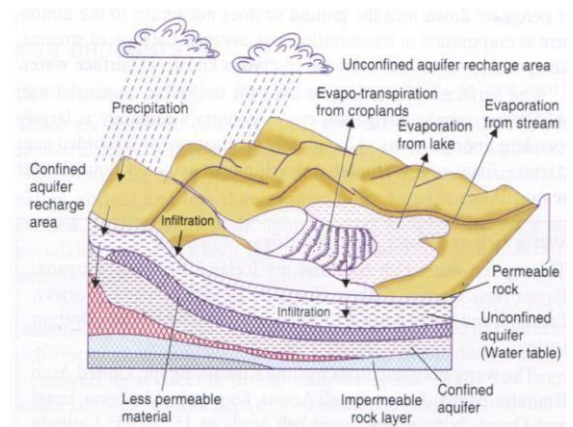


Fig. 2.6 The groundwater system. An unconfined aquifer (water table) is formed when water collects over a rock or compact clay. A confined aquifer is formed sandwiched between two layers having very low permeability.

6. What are major causes for conflicts over water? Discuss one international and One inter-state water conflict.

Conflicts over water: Indispensability of water and its unequal distribution led to problems among states and countries. Some of the major conflicts are:

The Cauvery water dispute

Out of 18 major rivers in India, 17 are shared between different states. On all these sharing different conflicts are raised. One of the severe conflicts is between states of Karnataka and Tamil Nadu for Cauvery. Karnataka claims that the agreements were made heavily in favor of Tamil Nadu. Both states have increasing demands for agriculture and industries. Tamil Nadu occupies downstream region and Karnataka is in upstream region and refuses to give water. An agreement was made on 2nd June 1990, such that 205 TMC of water should be maintained in the Mettur dam of Tamil Nadu. Based on this agreement made, farmers of delta region of Cauvery belonging to Tamil Nadu started cropping complex pattern which includes *SAMBA* and *KURVAI* which needs more water. But after that due to crisis of rain water, they did not release water to Tamil Nadu as agreement made but releasing only the excess water that they have.

Water Conflict in the Middle East

Three major rivers are shared in the Middle East. They are Tigris-Euphrates, The Jordan and The Nile. Ethiopia controls 80 % of the water flow and Sudan too is diverting water of Nile's flow. It affects low lying country Egypt, which is irrigating crops along the river Nile and its delta. The river Jordan is shared among Jordan, Syria and Israel. Turkey is planning to build 22 dams on Tigris-Euphrates for power generation. It affects Syria and Iraq, which is lying in downstream.

The next war in the middle would be fought over water and not for the oil.

7. What are the uses of minerals and discuss the major environmental impacts of mineral extraction?

Environment impacts of mineral extraction (or) impacts of mining:



Fig. 2.9 Large scale devegetation and ecological changes occur due to mining.



Fig. 2.8 Mining activities in hills disturb the ecology of the region (Picture : Garhwal hills, Uttarakhand)

The environmental damage caused by mining activities are as

Environmental concern arises from the impacts of extraction & processing of these minerals during mining, smelting, etc. Mining is done to extract minerals from their deposits by 1. sub-surface mining (or) 2. Surface mining. Sub surface mining is destructive, dangerous, expensive & includes risks of health hazards, accidents etc. But surface mining can be achieved by

- Open pit mining:** digging hole & removal of ores. Eg.: Cu, Fe, gravel limestone, sand stone, marble, granite.
- Dredging:** Buckets & draglines are used to scrap the minerals.
- Strip mining:** can be achieved bulldozers, power shovels, stripping wheels. Eg.: phosphate rocks

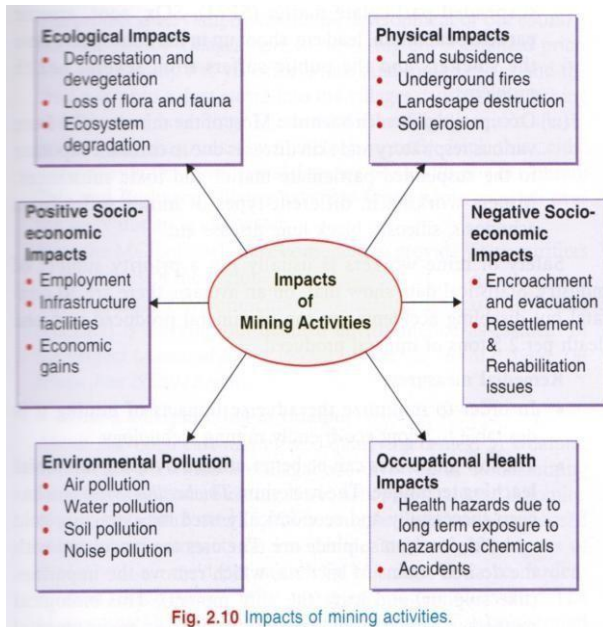


Fig. 2.10 Impacts of mining activities.

Ground water is polluted due to mining. „S“ is present in many minerals. During mining „S“ mixes with water & will be converted into H_2SO_4 by microbes. Due to this water becomes acidic & unfit. Some heavy metals also be mixed with ground water which affects health.

iv) Surface water pollution:

The acid mine drainage contaminates nearby surface stream like lakes, etc. Due to this aquatic life is affected. Sometimes uranium is also contaminated in the water bodies and kills aquatic life. Heavy metals also pollute the surface water streams, leading to health hazards.

v) Air pollution:

Due smelting of minerals/ores, the pollutants enter into atmosphere and causes serious environmental health impacts & several health problems. The suspended matter may be SO_2 , soot, As, Cd, Pb, etc.

vi) Occupational health hazards:

People who work in mines suffers from various respiratory diseases, skin diseases, asbestosis, silicosis, etc, due to continuous exposure to particular matter.

8. Explain impacts on Overgrazing and Agriculture.

Impacts of over grazing & agriculture: Increase in population ultimately led to increase in food production which have the following side effects:

Impacts due to overgrazing: Most of the animals are fed on the grazing land for their food. So grazing is a threat to biodiversity also. The impacts are:

i) Land degradation:

Vegetation is removed due to over grazing. Soil gets directly exposed due to which the roots cannot be penetrated into deeper layers, which is ultimately linked with moisture content. Organic recycling and humus content is affected. Thus over grazing leads to loss in soil structure, hydraulic conductivity, soil fertility etc.

ii) Soil erosion:

Soil is directly exposed after removing the surface vegetation. Then the soil is not binded well, because roots help in binding the soil. Finally this leads to soil erosion with effect of strong wind, rainfall etc.

iii) Loss of useful species:

Overgrazing affects composition and regeneration capacity of grass lands. It also affects the nutritional

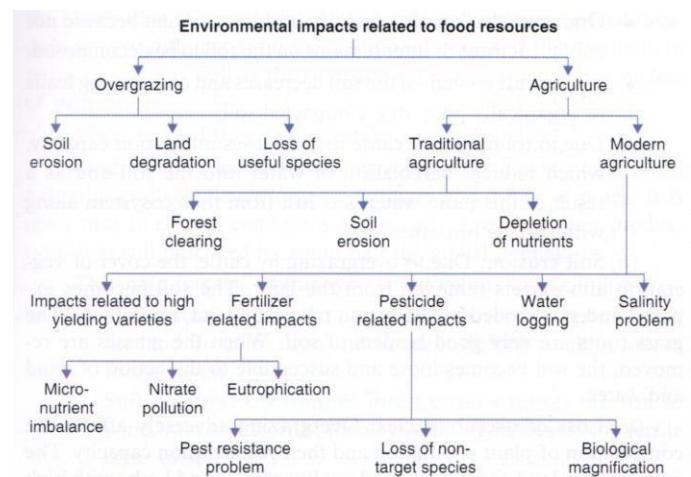


Fig. 2.11 Chain of side effects on environment due to intensive practices for increased food production.

value of grass lands. Due to overgrazing some species are removed in turn other species which has nonnutritional value may appear in that area. Eg.:- Cenchrus, Dichanthium, Panium, Heteropogan etc are replaced by Parthnium, Lanthana, Xanthium etc. In Arunachal Pradesh & Meghalaya thorny brushes, weeds are invaded due to overgrazing. So, total ecosystem will be affected.

Impacts due to agriculture:

10 to 20,000 years ago human used to cultivate plants of his own choice. He followed slash and burn culture (shifting cultivation) i.e., he will select the land or forest area for the cultivation and vacate that area and move to another area. In this method all the vegetation has been disturbed. But it is, still present in north east hills of India. The impacts are

1. Traditional agriculture system:

It involves of small plant, naturally available water, organic fertilizer and a mix of crops. It is natural but the yield is low. But still practiced by half of the global population. The impacts are.

Deforestation:-

Due to slash & burn agriculture system forests are cleared for the purpose of agriculture due to which it is subjected for deforestation.

i) Soil erosion: -

If the vegetation is removed, then the soil is not firmly binded together, because absence of trees. It finally leads to soil erosion with effect of rainfall etc.

ii) Depletion of nutrients: - Due to slash & burn type the crops absorb nutrients very rapidly from the soil which leads to the infertility of the soil.

2. Modern agricultural system: -

Hybrid, single crops, hi-tech equipments, fertilizers, pesticides, irrigation water are the contents of modern agricultural system. The impacts are:

High Yielding Varieties (HYV):

To compensate over population, high yielding varieties are grown. The problem with the high yielding varieties are easily attacked by pathogens, the total crops are affected i.e., the resistance power is less due to uniformity.

Fertilizers:

The following are the fertilizer related impacts:

Micronutrient imbalance:

The macro nutrients are C, H, O, P, K, N, S, Ca, Mg (CHOPKNS COFFEE MAY GO). So farmers use these macro nutrients for the best growth leaving behind micro nutrients. This leads to micro nutrient deficient, which affected soil fertility in Punjab & Haryana.

a) Nitrate pollution:

If the nitrogenous fertilizers are used in excess, they percolate into the soil and mix with the ground water and converts into nitrates (the permissible level is 25 mg/l). If it crosses the permissible level, causes blue baby syndrome (methaemoglobinemia). This disease affects infants mainly. In India, this problem is present in many areas. In countries like Denmark, England, France, Germany & Netherlands also this problem is prevalent.

b) Eutrophication (Eu-More / Trophic-Nutrition)

Excessive use of N & P fertilizers creates another problem in the nearby water bodies (lakes & ponds). The excess fertilizers run off to nearby lakes, ponds etc, thereby it causes over nutrients. Due to this over nutrition, the algae species present in water grows very fast and completes their life cycle also fast. After the death of these species, they are oxidized i.e., decomposed, which consumes O₂ present in the water as dissolved oxygen (DO). Due to decrease in the DO, the aquatic life is severely affected. The flora and fauna present in that eco system will be perished. This effect is due to eutrophication (rich in nutrients).

ii) Pesticides:

Many pesticides are used for the cultivation of crops. There are different levels of pesticides.

The first-generation pesticides are S, As, Pb, Hg, etc.

The second- generation pesticide is DDT (Dichloro Diphenyl Trichloroethane-discovered –Paul Mueller).In connection with the addition of pesticides for protection of crops, many damages also occurs, which are discussed below:

a) Resistance in pests:

Due to continuous usage of pesticides, the pests also develop immunity power against the pesticides. So they are able to survive even after the use of it. About 20 species are known to survive against the pesticides and named as super pests.

b) Death of non-target organisms:

These insecticides are broad, such that they kill all the organisms including the non target organisms. The non target organisms may be useful for the growth of the crops.

c) Biological magnification:

The pesticides which are used in the crop fields will be accumulated, through the series of the food chain (zooplanktons→small fish→large fish). The accumulated pesticides will be magnified (increased) known as biomagnifications.

iii) Water logging: - The excess water with-standard in the ground is called water logging.

Causes:

Due to over irrigation of croplands, excess water is accumulated which reaches into the underground and forms continuous column with the underground water table. If the soil is completely drenched with water, there will be no space (or) pores, due to which roots cannot get adequate air for respiration, loss of mechanical strength etc. Punjab and Haryana are more affected due to water logging.

9. (a) Give an account on Solar energy, Wind energy, and Tidal Energy.

a) Solar energy:

Solar energy is ultimate energy where all forms of energy depends on it. The reaction that takes place in sun is nuclear fusion which releases enormous amount of heat & light energy. The solar energy received by earth is 1.4 KJ/S/M^2 . We use this solar energy for different house hold purposes like drying , clothes, food grains, separation of salt from sea water etc., There are different devices used for harvesting solar energy.

i) Solar heat collections:

Passive solar heat collectors-receives energy in nature as such. E.g.: Stoves, bricks, glass, etc. Active solar heat collectors are pumped through medium like water (or) air, normally placed on building top.

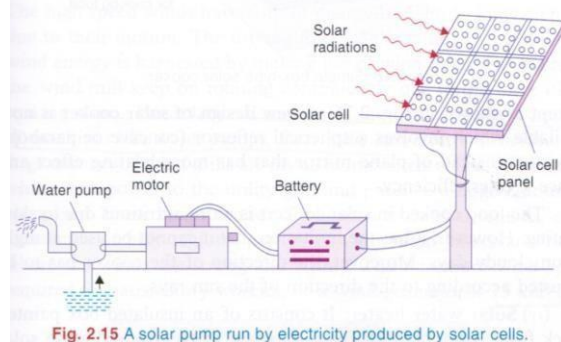
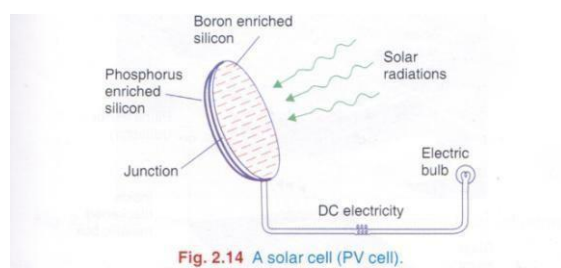
ii) Solar cells:

These are also known as photovoltaic cells (PV Cells). These are made up of semiconducting materials like Si, Ge etc. when solar radiations fall on them, the electrons get excited and conducts electrons. Si is obtained from silica (or) sand is abundantly available and inexpensive. The potential produced from a PV cell is 0.4 to 0.5 V (4 cm^2 size) & 60 mA current.

A group of solar cells joined in series which produces energy that is sufficient for running irrigation water pump, street lights, traffic signals, water pumps etc. They are also used in satellites for electricity generation. They can be used much in remote areas.

iii) Solar cooker:

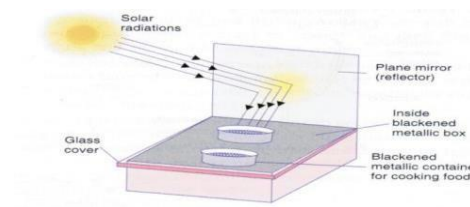
It consists of black insulated box fixed with reflective mirror perpendicularly. Concave (Or) parabolic reflects much instead of plane mirror. The solar energy falls on mirror and reflects to the food material placed in insulated box. The food cooked in these



cookers is nutritious & healthy. Only defect is during rainy season & at night times it is not effective.

iv) Solar water heater:

It consists of black insulated box covered with glass. Inside the black box copper wire is connected which gets heated and flows to storage tank fitted on roof top and then supplied.



v) Solar power plant:

On large scale, solar energy is utilized on many concave mirrors (thousands) to produce heat and converts water into steam, this steam rotates turbines which ultimately produces electricity. In Gurgaon 50 kW capacity power plant was installed.

b) Wind energy:

High speed winds have lot of kinetic energy with them. The driving force of wind is sun. A large wind mills are constructed very high, the wind energy rotates the blades. A cluster of wind mills are called wind farms. Due to rotation of the blades of the wind mills, electricity is produced. These are located in hilly areas, coastal regions, open grass lands etc. The speed required to rotate is 15 km/hr. The electricity produced is utilized for water pumps, flour mills, electric generators.



Fig. 2.18 A wind farm with large number of wind mills in Tamilnadu.

As it does cause any air pollution, it is effective. The only thing is initial installation is high but wind energy is cheap. 10% of world electricity is produced through this method. In our country we can generate 20000 MW, but at present we are generating 1020 MW only. The largest is situated near Kanyakumari, Tamil Nadu which generates 380 mw.

c) Tidal energy:

Ocean tides are produced due to gravitational forces of sun & moon. This causes high & low tides. Reservoirs are connected with barrages. When high tide comes, the water flows into the barrage of the reservoir due to which turbines are rotated. When the low tides happens, then the water flows from the reservoir of the barrage due to which turbines are rotated. Finally due to rotations, electricity is produced.

These are only few sites in the world where tidal energy is utilised. They are:

- 1) Bay of Fundy, Canada (17-18 m high tides) capacity to generate 5000 MW.
- 2) La Rance, France.
- 3) Gulf of Combay, Gulf of Kutch & the sunderban deltas in India.

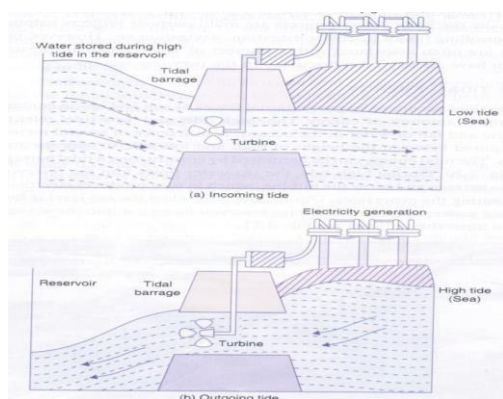


Fig. 2.21 Water flow out from the reservoir at low tide (a) and flow into the reservoir at high tide (b). Electricity is generated by the incoming and outgoing tides. Turbine is driven by the power of the sea in both directions.



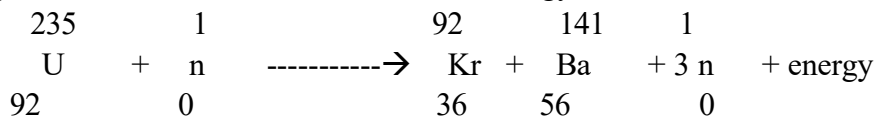
Fig. 2.20 A tidal barrage harnesses tidal energy.

(b) Write a brief note on Nuclear Energy.**Nuclear energy:**

It is a powerful energy which can destructs. (nuclear weapons) It is produced by two types of reactions.

i) Nuclear fission:

In this large nucleus namely U^{235} is bombarded with fast moving neutron, which splits the large nucleus into smaller ones (${}_{36}K^{92}$, ${}_{56}Ba^{141}$) with release of enormous amount of energy.



This is a chain reaction as the neutrons are formed in the above reaction again bombards three more nucleus and so on.

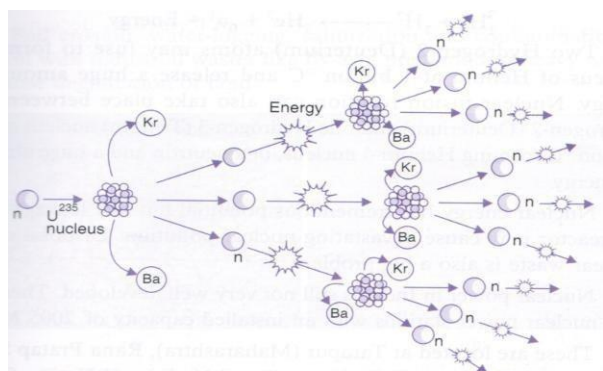


Fig. 2.25 Nuclear fission—a chain reaction initiated by one neutron that bombards a Uranium (U^{235}) nucleus, releasing a huge quantity of energy, two smaller nuclei (Ba, Kr) and 3 neutrons.

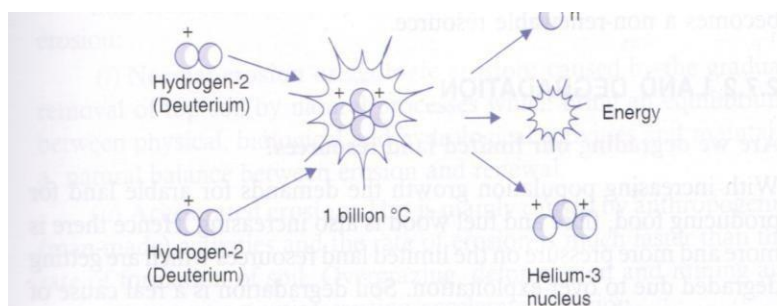
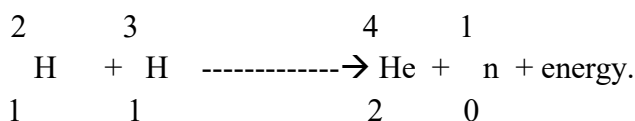


Fig. 2.26 Nuclear fusion reaction between two hydrogen-2 nuclei, which take place at a very high temperature of 1 billion $^{\circ}C$; one neutron and one fusion nucleus of helium-3 is formed along with a huge amount of energy.

Nuclear fusion: In this two small nucleus fuses together to form large nucleus, but it require extremely high temperature (1 billion $^{\circ}C$) to fuse. Once they combine they release enormous amount of energy. This reaction takes place in sun.



One Deuterium (${}_1H^2$) & tritium (${}_1H^3$) combines to form ${}_2He^4$ at 100 million $^{\circ}C$ with release of huge amount of energy.

Effects (problems) due to nuclear reaction:

1. Leakage from reactor causes severe pollution.
2. Disposal is a big problem.

Nuclear power in India is not still developed. There are only four nuclear power stations with 2005 MW capacity. They are located in –

Tarapur (Maharastra).
Ranapratap Sagar (Rajasthan).
Kalpakam (Tamilnadu).

Narora (U.P).

10. Discuss the use and over exploitation of water resources. Give an account on uses and exploitation of Minerals.**Uses of Minerals and its Exploitation:**

Minerals are used in different sectors like domestic, agricultural and, industrial etc. The main causes are

- 1) Development of industries with machinery
- 2) Production of energy
- 3) Constructions (houses, buildings etc.)
- 4) Defense equipment's (weapons)
- 5) Transportation (coal tar vehicles)
- 6) Communication (telephone wires, cables, devices)

- 7) Used in medicines (some metals in Ayurveda)
- 8) For preparation of alloys (Steel)
- 9) Agriculture (fertilizers), fungicides (zineb with Zn)
- 10) Jewelry (Au, Ag, Pt and Diamond)

Based on their properties, minerals are basically two types:

- 1) Non-metallic: eg: graphite, diamond, quartz, feldspar etc
- 2) Metallic: eg: bauxite, laterite, hematite, etc.

Human beings have been using metals extensively and so named bronze and iron age. Some elements determine the economy and political power. Iron and steel are used in maximum quantity, followed by Mn, Cu, Cr, Al & Ni

Water-Use and Over Exploitation:

Life doesn't exist without water. Water performs different functions like nutrient uptake, regulation of temperature, removal of wastes etc. So, human depends on it for every activity. Water is used for drinking, irrigation, transportation, washing, coolant, etc. The climatic conditions also depend on it, as this inter-related with it. Based on usage of water it can be divided into a) water withdrawal (water from the ground or any surface source) b) water consumption (water is taken up but not circulated for reuse). 60% of water withdrawn are evaporated. Due to increase in population the withdrawn water usage is also increased.

On a whole in earth 70 % of withdrawn water is consumed for agriculture. In India- 98 %, in Kuwait- 4

%. For industrial purpose as a whole 25 % of water is used, but in European countries- 70 %, 5 % in undeveloped countries. In USA an average family (4) consumes 1000 m³ water per year (which is many time compared to most of the developing countries).+

Remedy:

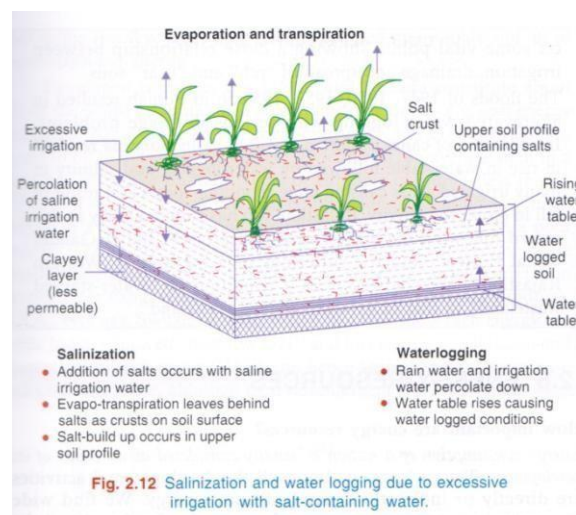
- 1) Prevention of excess irrigation.
- 2) Sub surface drainage technology.
- 3) Growth of trees like eucalyptus which consumes more water.

iv) Salinity:

One –third of total cultivated land is affected due to salinity. In India 7 million hectares re estimated to be salt affected. Salinity is characterized by accumulation of soluble salt like NaCl, Na₂SO₄, CaCl₂, MgCl₂ etc. in soil layers. Due to accumulation of salts, the electrical conductivity will be more than 4 ds/m and P^H is ~ 8.0. Some of the Na₂CO₃ & NaHCO₃ are also present.

Causes:

- Excessive irrigation (canal (or) ground water is used, which is not depended on rainfall). In canal & ground water excess salts are present. Salinity causes stunted growth & fewer yield.
- 1000"s of hectares of land are affected by salinity in Punjab & Haryana. Most of the crops cannottolerate salinity.



Remedies:

- 1) Usage of more quality water for irrigation.
- 2) Underground drainage for flushing of salts slowly.
- 3) Sub surface drainage is in experimental section in CSSRI, Sampla, Haryana (Central Soil Salinity Research Institute). Through this research institute barrier level is to be converted into productive level.

UNIT-II

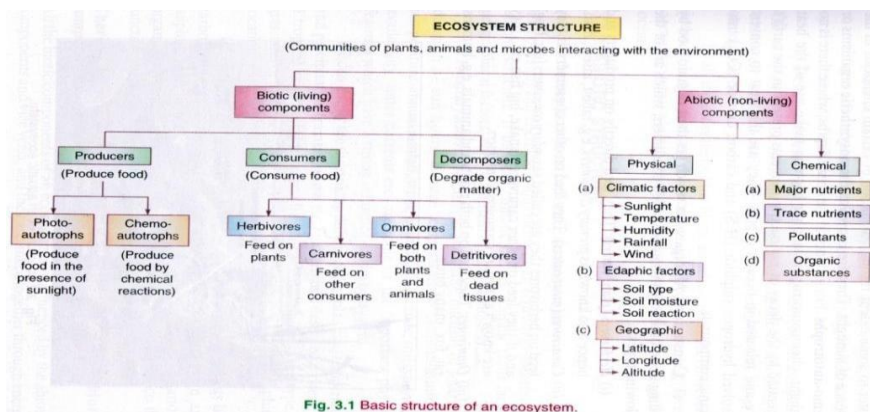
ECOSYSTEMS AND BIODIVERSITY

1. Describe the structure and functions of an Ecosystem.

“The study of organisms in their natural home (or) habitat interacting with their surroundings is known as ecology”.

Characteristics of ecosystem:

In spite of large variations in size, structure, composition of ecosystem but they have some common i) structural and ii) functional features.



Structural features of ecosystem:

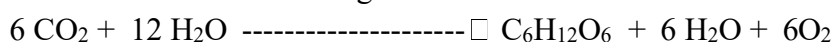
As stated, earlier ecosystem comprises of a) Biotic & b) Abiotic components.

This comprises of plants, animals, microorganisms etc. Based on nutrition criteria, they are classified as follows:

i) Producers: These can synthesize food materials by own. They are also known as „photo autotrophs“ (photo-light; auto-self; trophs-food)

Eg: Green plants synthesize food materials with the help of (O₂, H₂O, Chlorophyll) in the presence of sunlight.

Sunlight



Chlorophyll

Some microorganisms can also produce organic matter by the oxidation of some chemicals in the absence of sunlight and so known as chemosynthetic organisms (or) chemo-autotrophs.

Eg: Sulphur bacteria in deep oceans oxidize H₂S & CO₂ in the absence of sunlight with the help of heat into organic compounds.

ii) Consumers: These cannot synthesis food materials and depend on producers for food. They are of following types depending upon the level.

a) Herbivores (plant eaters):

They are known as primary consumers or they feed directly on producers.

Eg: rabbit, insect, man etc.

b) Carnivores (meat eaters):

These are known as secondary consumers as depend on herbivores for food materials. Eg: frog.

If they depend on other carnivores, they are known as tertiary consumers/secondary carnivores. Eg: snake, big fish, etc.

c) Omnivores:

They feed on all of them (primary, secondary and tertiary consumers) Eg: man, rat, fox, birds, etc.

d) Detritivores:

They feed on dead organisms, wastes of living organisms & their cast-offs and partially decomposed matter. Eg: beetles, crabs, earth worms, etc.

iii) Decomposers:

These convert complex organic molecules into simple ones, finally to inorganic matter and derive the energy from them. Eg: bacteria, fungi, etc.

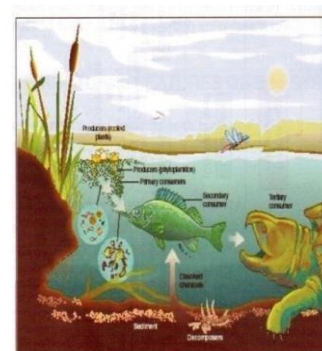


Fig. 3.2 Structure of an aquatic ecosystem.

NOTE: In all types of ecosystems biotic components dominate over abiotic but within biotic component sometimes producers (forests), predominate and sometimes decomposers (deep ocean) predominate.

II) Abiotic component:

Ecosystems are driven by abiotic factors and play a key role. It includes physical & chemical components. They are climatic condition, soil conditions, energy, nutrients, geographical factor and toxic substances.

i) Physical factors:

Sunlight & shade, intensity of solar flux, duration of sunlight, average temperature from maximum & minimum, annual rainfall, wind, latitude, soil type, water availability, water currents etc.

Note: We can observe the fluctuations of solar flux, temperature, precipitation etc in different ecosystems (desert, tropical rainforest, tundra eco systems). Similarly, there is a geographical difference in grassland and forest ecosystem.

ii) Chemical factors: They include major essential nutrients (C, H, O, P, K, N, S, Ca, Mg), salts, organic matter etc., influences eco system.

Both biotic and abiotic components are interlinked together with energy flow and shown below diagrammatically.

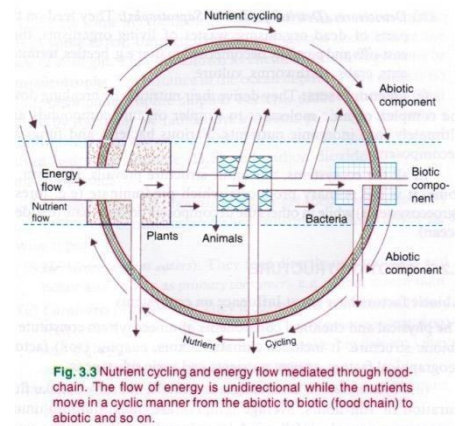


Fig. 3.3 Nutrient cycling and energy flow mediated through food-chain. The flow of energy is unidirectional while the nutrients move in a cyclic manner from the abiotic to biotic (food chain) to abiotic and so on.

2. (a) Discuss the models of Energy flow in an Ecosystem.

Energy flow in an ecosystem:

The energy flow is unidirectional as flows from one trophic level to the other in single direction. In contrast with these nutrient flows in cyclic path. The flow of energy obeys 1st & 2nd law of **thermodynamics**.

1st law of thermodynamics:

It states that “energy can neither be created nor be destroyed but can be transformed from one form to another”.

Eg: Plants capture solar energy and converts into biochemical energy and which are consumed by the successive levels.

2nd law of thermodynamics:

It states that “the energy is dissipated (on dispersed as it is used). In clear the energy is dispersed into less concentrated medium (from more concentrated ones).

Eg: At each trophic level 90% of the energy is wasted (for locomotion, respiration, etc) and the remaining only 10% of energy is transferred to successive trophic levels.

Energy flow – models:

To explain flow of energy, the following models are proposed.

a) Universal energy flow model: Normally, as energy flows from one form to other, some amount of energy is wasted. Similarly, as the energy flows from one level to the other, some amount of energy is wasted and there is availability of less energy for the next level. The loss of energy is due to excretion, locomotion, respiration, un-utilization, etc. The only remaining energy is used for production. So the energy flow in the form of pipes becomes narrow & narrow as they move from higher trophic level to the lower ones.

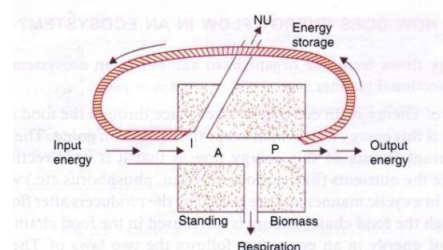
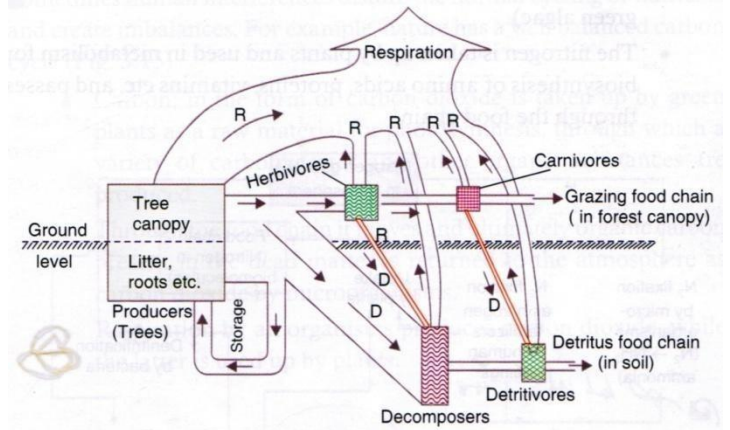
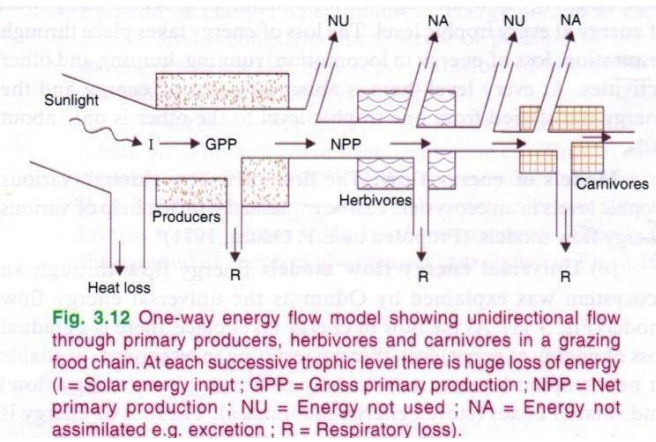


Fig. 3.11 Universal energy flow model applicable to all living components (I = Energy input; A = Assimilated energy; P = Production; NU = Energy not used.)

Single energy channel flow model: In this model energy flows in a unidirectional way similar to that of food chain and not food web. As usual the energy is wasted as it moves from one level to another level. Flow of energy is from producers to carnivores.



b) Double channel (or) y-shaped energy model:

In nature, both grazing and detritus food chains operate together leading to the y-shaped energy model.

Eg: 1. Marine ecosystem- In this ecosystem major portion of the energy is deviated to grazing food chain and some portion to detritus food chain.

3. Forest ecosystem- In this ecosystem major is passed to detritus and little amount to grazing food chain.

(b) Explain Food chain and its types.

Food chains:

The sequence of flow of energy (eating and being eaten) from producers to consumers in an ecosystem is called food chain.

Eg: 1) Plant leaf ----> Catter pillar -----> Sparrow -----> (decomposes all dead organisms by decomposers)

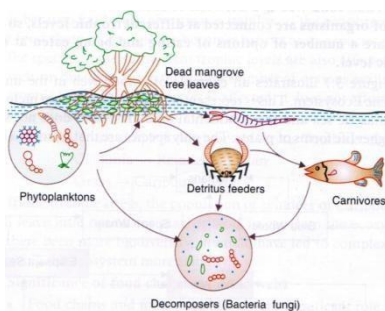
Types of food chains:

- grazing food chain
- Detritus food chains.

a) Grazing food chain: It starts with primary producers (green plants) and ends with secondary (or) tertiary consumers (carnivores)

Eg: Phytoplankton ----> Zooplankton -----> Small fish ----> Large fish
(algae, diatoms)

Grass-----> Rabbit -----> Fox.



b) Detritus food chain: It starts with death & decay matter, followed by detritivores and decomposers.

Eg: Phytoplankton ---> Detritus feeders -----> Carnivores.

Decomposers

Thus, for grazing food chain energy is obtained from plants but for detritus, it is obtained from biomass of plants. Grazing food chain dominates over detritus.

3. Explain various processes involved in Ecological succession.

Ecological succession: - change of ecosystem with time & environmental conditions

An ecosystem is not constant in nature and changes with time and other factors, and the change also can be predicted.

- During the course time one type of community is replaced by another community with several changes is known as ecological succession.
- Ecological succession is defined as “an orderly process of changes in the community structure and function with time and ultimately to higher point by modification in the physical environment resulting in stabilized ecosystem”.
- The whole sequence of communities is known as several stages (or) series and the first one is known as pioneer community.

Process of succession: The process of succession takes place in a systematic order.

1) Nudation: development of barren land.

Reasons: Landslides, volcanic eruption, drought conditions, glaciers, frost, over grazing, disease outbreak, agricultural, industrial activities, etc.

2) Invasion:

Successful establishment of one (or) more species in barren land through dispersal (or) migration.

Eg: dispersal of seeds, spores etc by wind, a water, insects, birds, etc. (seeds, germinates and becomes pioneer species)

3) Competition and coaction:

Due to increase in the population, there arises competition between the species and also within the species for different reasons like water, space, nutrition etc. This influence such other in many ways known as coactions.

4) Reaction: Due to influence of environmental factors such as water, nutrients etc, the organisms get modified and this is known as reaction. The reaction may be favourable for new species and unfavorable for old species and which tends to replace it by which it leads to seral communities.

5) Stabilization: The succession reaches to highest point of more (or) less stable community which is equilibrium with environment.

The climax community have maximum biomass and mutual benefit among the organism.

4. (a) Write a short note on Ecological pyramids.

Ecological pyramids:

“The graphical representation of trophic structure and function of an ecosystem starting with producers and followed by successive levels is known as ecological pyramids”. There are three types:

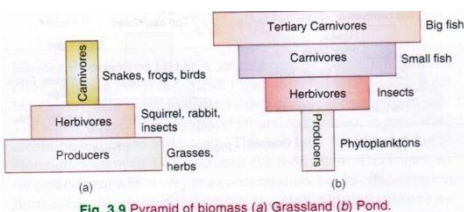
1) Pyramid of numbers:

In this type, it indicates the number of individuals present in that particular trophic level. This may be upright (or) inverted.

- a) Upright pyramid – grass land ecosystem.
- b) Inverted pyramid- parasitic food chain.
- c) Broader in middle and narrow on sides- forest ecosystem.

2) Pyramid of biomass:

In this type, it indicates the total biomass at each trophic level.



This also may be upright (or) inverted.

- a) Forest ecosystem- upright.
- b) Pond ecosystem – inverted.

3) Pyramid of energy:

In this type, it indicates the amount of energy associated in each trophic level and it is always upright because some amount of energy is wasted as it flows from one trophic level to the other. A) Pyramid of energy- upright.

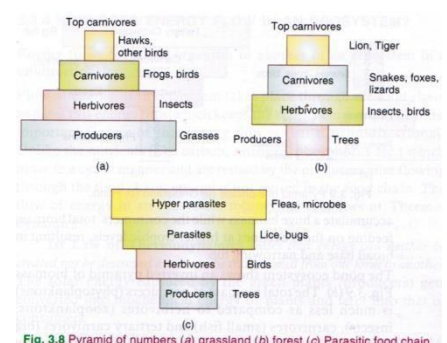


Fig. 3.8 Pyramid of numbers (a) grassland (b) forest (c) Parasitic food chain.

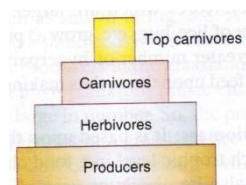


Fig. 3.10 Pyramid of energy.

(b) Write about Food web.

Food web: Food chain has linear structure, but this has network structure. “The different organisms of different trophic levels are connected through a network in which there are multi-options for eating and being eaten is called food web”.

In tropical ecosystems, the food webs are more complex due to rich in species diversity.

Reason for evolution of food web: In a linear food chain, if one species becomes extinct, then there will be no food for the preceding ones. So in search of food material, it diverted and which led to the evolution of food web. In a food web an organism has multiple options for consumption and also for being consumed.

Eg: Cladonia----□ Reindeer □ Man.

Grass-----□ Caribou □ Wolf.

If due to some reasons reindeer & caribou becomes endangered, the man (or) wolf finds food with other any trophic levels.

Significance of food chains & food web:

- 1) Both food chain & webs plays a key role in the flow of energy & nutrients in the ecosystem.
- 2) The ecological balance of population size of trophic level is maintained constantly by food chains.
- 3) Food chain shows a specific property known as “biomagnifications”.

5. Explain the different types in aquatic ecosystem and desert ecosystem.**Aquatic ecosystems:**

Aquatic ecosystem includes water bodies and species present in it.

Water bodies may be a) fresh water, b) Marine

a) Fresh water bodies: The fresh water bodies are of two types. They are:

i) Lentic- stagnant: *They are:*

a) Pond ecosystem:

It is stagnant fresh water body usually shallow. The source is rain water and villages depend upon it for different activities. But due to these anthropogenic activities like washing, bathing, swimming, etc, the system gets polluted. The species includes algae, aquatic plants, insects, fishes, birds etc.

b) Lake ecosystem:

It is a big fresh water body with stagnant. It is divided into different zones.

- 1) Littoral zone: Shallow zone with penetration of light.
- 2) Limnetic zone: Open zone with high penetration of light.
- 3) Profundal zone: Deep bottom zone with low penetration of light.

Eg: Dal lake (J & K), Naini lake (Uttarakhand), Loktak lake (Manipur)

ii) Lotic water bodies

Streams ecosystem : These are the fresh water aquatic ecosystem with continuous flowing of water. The physical factors (O₂) & nutrients are uniformly distributed due to streaming. The organisms face temperature and streaming problem severely compared to lotic systems. The species present in this have less tolerance towards O₂ deficiency as there is always abundant O₂ due to continuous streaming. If dissolved oxygen (DO) level is decreased due to pollution then these organization are affected.

River ecosystem: These flows across mountain highlands followed

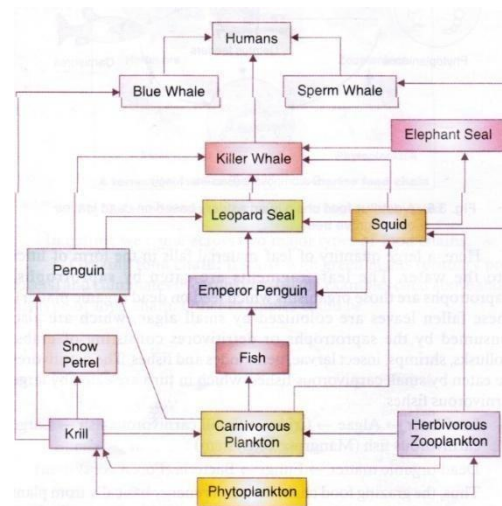


Fig. 3.7 A simplified food web in Antarctic ecosystem.

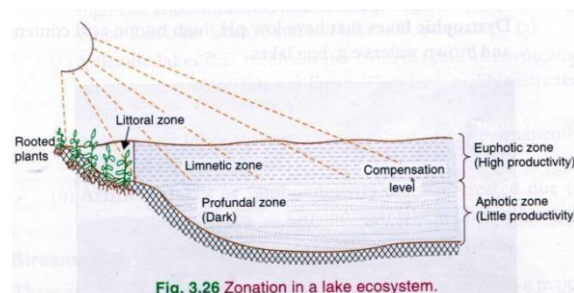


Fig. 3.26 Zonation in a lake ecosystem.

by plains & finally mix with sea. They show different conditions as follows:

1. **MOUNTAIN HIGH LAND:** Cold, clear water, high DO are characteristics. The species are periphytons (on rocks) fishes (consumes more DO Eg: Trout)
2. **SECOND PHASE:** This is gentle slope area with male plants & fishes (need less DO)
3. **THIRD PHASE:** This is the delta phase and rich in bio diversity, nutrients etc.

b) Marine ecosystem (oceans):

It comprises of 70% of globe surface and possess 2,50,000 species and supply food for human & other organisms. Oceans provide us drugs, Fe, P, Mg, Oil, natural gas, sand & gravel. Ocean plays key role in maintaining biogeochemical cycle, hydrological cycle etc., and also acts as sink for CO₂. Oceans have two major life zones.

1. **COASTAL ZONE:** This is relatively warm, rich in nutrients, shallow due to which shows high NPP. They are rich in biodiversity.
2. **OPEN SEA:** It is the deeper part and divided into three regions based on penetration of sunlight.
 - I) *Euphotic Zone:* It receives abundant sunlight with more photosynthesis activity.
 - II) *Bathyal Zone:* It receives dim sun light & geologically active.
 - III) *Abyssal Zone:* It does not receive sunlight in fact, it is dark zone due to which no primary production. It ranges from 2000 to 5000 meters. It is incomplete ecosystem.

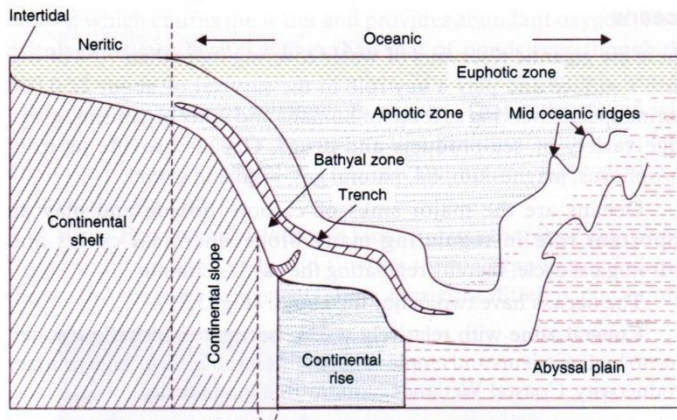


Fig. 3.31 Vertical and horizontal zonation of a marine ecosystem.

many of them are endemic. The migratory species like fishes (salmons) spends half life span in fresh & remaining half in marine, for them estuaries points provide resting place during migration. They are useful to human due to high productivity and reason for this is continuous streaming and tidal action. However, these should be protected from pollution & maintain naturally.

Desert ecosystems:

These types of ecosystems occur where evaporation exceeds rainfall, snow etc. The rainfall & snow fall is less than 25 cm Per year.

There are three major types of deserts based on climatic conditions.

1) Tropical deserts:

Deserts like Sahara & Namibia (Africa), Thar (Rajasthan, INDIA), come under this category. Here there is only few species and windblown, sand dunes are common.

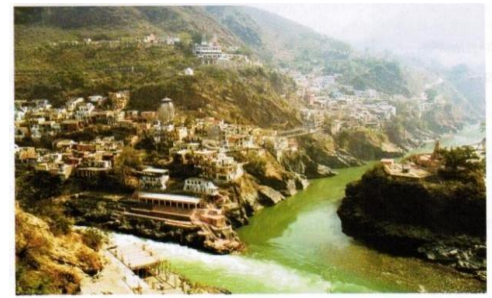


Fig. 3.29 Bhagirathi river at Devprayag with clear and clean water.



Fig. 3.30 Coastal wetland is a habitat for various species of water birds (Pic. Ahmedabad)

ESTUARIES:

It is a point where fresh water & salt water meet, i.e., connecting point between river & ocean. They are rich in nutrients and DO due to continuous streaming by which primary production is achieved greatly. These are affected by tidal current seasonally (diurnally, monthly). The species present in this area have wide range of tolerance towards temperature, salinity, streaming etc. The organisms are known as eurythermal and euryhaline. Eg: Coastal bays and tidal marshes.

Estuaries possess rich in species diversity and

2) Temperature deserts:

Deserts like Mojave (south California) comes under this category. Here day time, the temperature is hot in summer but cool in winter.

3) Cool deserts:

Gobi Desert comes under this category these are characterized by cold winters and warm summer.

6. Define Biodiversity. Explain Genetic diversity, Species diversity & Ecosystem diversity.

“Biodiversity refers to variety and variability of all living organisms in an ecosystem”.

Levels of biodiversity: It may range from genus to species and they are categorized as follows:

a) Genetic diversity:

The diversity within the same species is due to difference in the gene level and this is known as genetic diversity.

Genes are the basic units of hereditary information. They carry genetic information from one generation to other. Different genetic combination within a species leads to variety.

Eg: *Oryza sativa* is a rice species having thousands of varieties (which has different size, shape, color, etc)

b) Species diversity:

This is the diversity seen between different species (or) within the population of species. It represents number of species and the predominance in a community.

There are two Species Measuring indices. They are:

i) Shannon-wiener index and ii) Simpson index.

The total number of species in the world would be 10-50 million (rough estimation given by Wilson in 1992) But only 1.5 million living and 3 lakh fossil species have been determined and given scientific names. It is fact that some species become extinct before knowing their names and uses.

a) Ecosystem diversity:

This is the diversity that shows variations in physical characters, ecological niches, trophic structures, food webs, nutrient cycles, etc. The physical factors are moisture, temperature, altitude, precipitation (rainfall & snow fall) etc. Of all the diversity, ecosystem diversity has great value which ended over millions of years. We can't replace it & if we destroy it, it disturbs the ecological balance and function.

e.g.: Coniferous trees of boreal forests cannot do the function of tropical deciduous forest and vice versa.

Let us consider forest ecosystem to explain the ecosystem diversity. Due to variations in the physical factors etc. different types of forest are evolved; viz, tropical rainforest, tropical deciduous forest, temperate deciduous forest, etc.

7. Discuss the values of Biodiversity.

Values of biodiversity:

Due to biodiversity, there are different values. There will be benefits for a given organism in different ways whether it is small or large. Some species may produce invaluable drugs like medicines for cancer, AIDS, etc., the multiple values of biodiversity has been classified by Mc Neely et al in 1990. The different values are:

1) Consumptive use value:



This includes direct usage of products like fuel, food, drugs, fiber, pulp, wood, etc.

Food:

There are number of wild varieties of plants consumed by human & about 80,000 species have been reported as edible. About 90% of present food crops are cultivated from wild tropical plants. Eminent scientists develop hardy strains by using existing wild plants only, because they possess better tolerance & hardness.

Drugs and medicines:

About 75% of world's population depends on extracts of plants for medicines. There are number of medicinal plants which are reported as:

DRUG	SPECIES NAME	USES
Isabgol	Plantago (husk)	bowel disorder
Penicillin	penicillium (fungus)	antibiotic
Tetra cyclin	tetra cyclone (bacteria)	antibiotic
Quinine	cinchona tree (bark)	malaria
Digitalin	digitalis (foxglove)	cure for heart
Vinblastine & vincristine	Catharanthus	anticancer action

Fuels:

Since from olden ages, forest products are used for fuel. The fossil fuels like coal, petroleum, natural gas are the products of fossilized biodiversity. Fire wood comes under consumptive value because they are not marketed and used directly by local people.

2) Productive use value:

Based on product use these products are marketed & sold commercially.

- This includes animal products like elephant tusks, deer musk's, silk, sheep, wool, animals' fur, insect lac etc.
- Based on above products of biodiversity, industries are operated. Eg: paper, pulp, fly wood, silk, textile, leather, pear industries etc.
- Wild gene resources used for introducing desirable traits (character) in crops by scientists.

Some products of endangered species like fur, hide, horns, tusks, live specimen etc. are banned for trading and marketing but still smuggling is done with exchange of millions of dollars every year in developing countries like Asia, Africa, Latin America etc. Countries like China and Hong Kong export cat & snake skins which is a booming business.

3) Social value: Based on socio – cultural use

It includes social life, customs, religion beliefs, psycho- spiritual aspects etc, of people.

- Many plants & its products are used for holy & sacred in our country. e.g.: Tulsi, peepal, mango, lotus, bael, etc.
- Similarly, many animals have significant role in our psycho – spiritual aspects. e.g.: cow, snake, bull, peacock, owl etc. (vehicles of God & goddesses, which are vertebrates of chordate)
- The tribal people have their beliefs in social life, songs, dance and customs around wild life.

4) Ethical value: Based on ethics of existence

It involves issues like preservation of life based on the concept "live & let live".

We should protect the precious biodiversity for future. Some species may not be helpful yet we have to protect it. We should feel sorry for the extinct species like Passenger pigeon, Dodo etc.



Fig. 4.2 Zebra: The majestic animal has Existence or Ethical value.

There is no direct use from animals like kangaroo, zebra, giraffe, etc., yet

we need to protect them for the existence of these species in nature. This is known as ethical value.

5) Aesthetic value: Based on aesthetics

This is the value which gives pleasure, peace of mind, excitement and feeling of appreciation.

No one wishes to visit barren lands but shows interest for site seeing zoo's, parks, etc., and also spends money for that case. This is known as aesthetic value and a type of tourism, known as eco-tourism. The willingness to pay concept on such eco-tourism gives us even a monetary estimate for aesthetic value of biodiversity. 12 billion dollars of revenue are generated / year.

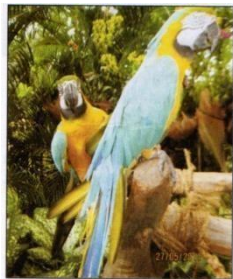


Fig. 4.3 The beautiful blue parrot possesses aesthetic value. (Pic. Aviary, Singapore)



Fig. 4.4 Jurong Park, Singapore with 600 bird species is an eco-tourism centre.

6) Option values: Based on unknown utility that is to be explored

the uses of these biodiversity is not known at present and may be known in the future i.e., one day it may prove that it possesses values. Thus, option values of biodiversity states that any species may prove to be a miracle species someday. These bio diverse species are precious, gifted by nature. We should not lose it.

Eg: Many marine animals are believed to possess anti-cancer properties which are to be known in future.

NOTE: This option value also includes visiting of variety of flora & fauna specifically endemic (or) endangered species.

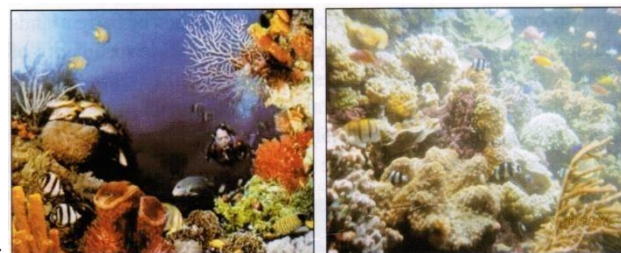


Fig. 4.5 Marine Biodiversity is enormous and marine species have great option value as future medicines and cures (Picture : Downtown Aquarium, Houston, Texas, USA)

7) Eco system service: Based on values of various ecosystem services.

These include services provided by eco systems. Recently various eco system services have been recognized which includes soil erosion, prevention of floods, soil fertility maintenance, nutrients cycle, nitrogen fixation, hydrological cycle etc. ocean acts as sink for CO₂ (greenhouse – global warming)

From the above categories it is clear that there is lot of values from biodiversity, its loss leads to huge economic, ecological and socio-cultural losses.

8. Explain Bio-geographical classification of India.

Major bio geographical regions of India: Biogeography consists of Phyto & zoogeography distribution of plants & animals respectively.

Due to variations in climate, topography, enormous varieties of flora and fauna are seen in India & which is rich in biodiversity and occupies 10th position among plant rich nation in the world.

SL.NO	BIOGEOGRAPHIC ZONE	IMPORTANT FLORA AND FAUNA
1.	Trans Himalayan zone	Pine, Deodar Wild Sheep, Yak
2.	Himalayan	Pine, Cork tree Wild bear, Leopard

3.	Desert	Acacia, Cactus Camel, Desert cat
4.	Semi-arid	Acacia, date palm Gir lion, Tiger
5.	Western Ghats	Sheesham, Peepal Frogs, Lizards
6.	Deccan Peninsula	Acacia, Tuna Tiger, Wild Elephant
7.	Gangetic Plain	Acacia, Jamun Rhinoceros, Turtle
8.	North East India	Bamboo, Castor Elephant, deer
9.	Islands	Jackfruit, Coconut Dolphins, Alligators
10.	Coasts	Coconut, Banana Dolphins, Alligators

9. (a) Define hotspot of Biodiversity.

They areas which possess endemic species and more rich species are termed as hot spots of biodiversity & introduced by Myers (1988).

(b) What are the hotspots found in India? Discuss their salient Features.

Hot spots in India:

In India there are three hot spots but extending into the neighboring countries namely Indo- Burma Region, Eastern Himalaya and Western Ghats-Sri Lanka region. The Indian hot spots are rich in floral endemics and also reptiles, amphibians, shadow, tailed butterflies, etc.

1. Indo- Burma hot spot:

It covers with an area of 2 million KM² of tropical East Asia of Ganges – Brahmaputra low lands. It covers Indo- Chinese sub region.

- This hot spot covers lower Mekong catchment, Eastern Bangladesh, North Eastern India, south of Brahmaputra River, Myanmar, part of southern & western China, Cambodia, Vietnam, Thailand, small part of peninsular Malaysia and several off shore islands.
- In this hot spot distinct weather conditions are seen with wide diversity of ecosystems (which includes wet green, dry green, deciduous, mundane forest, shrub lands, wood lands, swamps, mangroves and grasslands.
- Fauna includes 6 large mammal species, Antlered muntjac, the Annamite muntjac, grey – Shankled douc, the Annamite striped rabbit, the leaf deer and Saola.
- The endemic species includes turtles, which is likely to be extinct due to habitat loss.
- This hot spot also holds 1,300 birds which includes white-earned night-heron, the grey crowned crocias, orange-necked partridge, which are threatened for extinction.



Fig. 4.7 Grey shanked Langur from Indo-Burma Hot-spot.

2. Western Ghats hot spot:

It covers an area of 17,000 KM² along Maharashtra, Karnataka, Tamil Nadu and Kerala. In 2011, it is included.

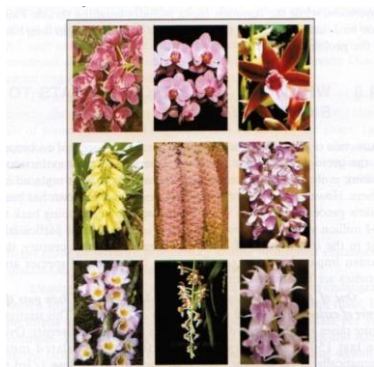
- It has 40% of endemics of flora and about 62% amphibian, 50% lizards are endemics to this region.
- 20% of forests are ever green with 500m elevation and some are semi-ever green with 500-1500 altitude.



Fig. 4.8 Western Ghats have a large number of endemic frog species. (Source: <http://www.frogindia.org>)

- Centers of this spot are Agastyamalai Hills and silent valley-the new Amambalam reserve basin.

3. Eastern Himalayas hotspot:



It covers an area of 7298 KM² of Sikkim, Eastern Himalayas and dwindled about 1/3rd of its original cover.

- In this hot spot, there numerous deep and semi- isolated valleys in which there are endemic species and rich in biodiversity.
- There are about 4250 plant species of 60% are endemic. Certain species like *Sapria himalayana*, a parasitic angiosperm sighted twice in last 70 years.
- This hot spot is considered as center for organic evolution and cradle of flowering plants. Out of global flora 30% are endemic to India and in Himalayas there are 35,000.

Inspite of endemism, some species are common to hotspots in India. The common flora includes *Ternstroemia japonica*, *Rhododendron*, *Hypericum* and fauna includes laughing Thrush, fairy blue bird, Lizard, Hawk etc.

10. What is Red Data Book? Give a brief account on In-situ and ex-situ conservation.

The International Union for Conservation of Nature and Natural resources (IUCN) published a “RED DATA book” which consists of the list of endangered and extinct species of flora and fauna. Red data signal is the warning symbol that if they are not protected, they will be extinct.

Conservation of bio diversity: It can be conserved by

1. Protection.
2. Creating awareness

Bio diversity has to be conserved for the different reasons like genetic value, commercial, medicinal, aesthetic, ecological and optional values.

Now a day's people realized hunting is not a game for enjoyment instead they think that diversity is gift of God and we need to enjoy the pleasure of it. Many measures are taken for its conservation.

There are two approaches:

1. In situ conservation (with in habitat)
2. Ex situ conservation (out-side habitat)

1. In situ conservation: This is achieved by the protection of wild flora & fauna in nature itself.

Eg: Biosphere reserves, National parks, Sanctuaries, Reserve forests etc.

At present we have 18 major bio reserves, 106 national parks, 573 wild life sanctuaries and 122 botanical gardens in our country covering 2.4% of the geographic area.

A national park is a dedicated area for conservation of wild life. In addition to this it gives aesthetic value (tourism). National Park conserves a particular species of wild life. Here domestic animal grazing & other forests activities are prohibited. Some natural parts of our country are listed below:

Table 4.5. Some important national parks in India

Name of National Park	State	Important Wildlife
Kaziranga	Assam	One-horned Rhino
Gir National Park	Gujarat	Indian Lion
Dachigam	J & K	Hangul
Bandipur	Karnataka	Elephant
Periyar	Kerala	Elephant, Tiger
Kanha	M.P.	Tiger
Corbett	Uttarakhand	Tiger
Dudwa	U.P.	Tiger
Ranthambore	Rajasthan	Tiger
Sariska	Rajasthan	Tiger

Table 4.6. Some important wildlife sanctuaries in India

Name of Sanctuary	State	Major Wildlife
Ghana Bird Sanctuary	Rajasthan	300 species of birds (including migratory)
Hazaribagh Sanctuary	Bihar	Tiger, Leopard
Sultanpur Bird Sanctuary	Haryana	Migratory birds
Nal Sarovar Bird Sanctuary	Gujarat	Water birds
Abobhar Wildlife Sanctuary	Punjab	Black buck
Mudamalai Wildlife Sanctuary	Tamil Nadu	Tiger, Elephant, Leopard
Vedanthangal Bird Sanctuary	Tamil Nadu	Water birds
Jaldapara Wildlife Sanctuary	W. Bengal	Rhinoceros, Elephant, Tiger
Wild Ass Sanctuary	Gujarat	Wild ass, wolf, nilgai, chinkara

Wild life sanctuaries are the protected areas where killing, hunting, shooting (or) capturing of wild life is prohibited. However private ownership rights are given such that it should not affect the wild life. Some of the wild life sanctuaries are listed above.

There are many botanical gardens in India of which one of the major botanical garden is situated in Ooty (Tamil Nadu). For plants there is one gene sanctuary for citrus species (lemon, orange, etc.) & one for pitcher plant (insect eating plant) in North East India.

For the protection of animals, there are different projects.

Eg: project tiger, Gir lion project, Crocodile breeding project, Project elephant, Snow leopard project etc.

2. Ex-situ conservation:

This is achieved by establishment of gene banks, seed banks, zoos, botanical gardens, culture collection etc.

The main objective is to maintain genetic information (genes) of crop varieties and wild life species for future improvement. In India, the following important gene bank/seed banks are listed:

a) National Bureau of Plant Genetic Resources (NBPGR):

This is in New Delhi, where agriculture and horticultural crops including wild varieties are preserved by cryo-preservation of seeds, pollen grains etc, by using liquid N₂ (at – 196 °C)

Eg: Rice, pulses, millets, brassica, turnip, radish, tomato, onion, carrot, chilli, tobacco, poppy, etc, gene pool can be maintained by using liquid N₂ successfully.

b) National Bureau of Animal Genetic Resources (NBAGR):

This is Karnal, Haryana & maintains the semen of domesticated bovine animals.

c) National Facility for Plant Tissue Culture Repository (NFPTCR):

In this bank tissue cultures of crops & plants are maintained for the development. Now this facility is within NBPGR.

The G-15 countries have also resolved to set up a network of gene banks to facilitate the conservation of various varieties of aromatic and medicinal plants for which India is the networking coordinator country.

UNIT-III**ENVIRONMENTAL POLLUTION****1. Define Air pollution. Explain its causes, effects and control measures of Air pollution.****AIR POLLUTION:**

Atmospheric air composes of 78% N₂, 21% O₂ & remaining 1 % of gases like CO₂, CO, NO, etc. when this concentration is disturbed; it leads to air pollution & also effects man & his environment. The substances which cause pollution are gases, particulate matter or radioactive substances etc.

Gases include oxides of S (SO₂, SO₃), N (NO, NO₂, NO₃), C (CO₂, CO), volatile organic compounds etc. particulate matter includes smoke, dust, soot, fumes, aerosols, liquid droplets, pollen grains etc. Radioactive substances include Rn²²², I¹³¹, Sr⁹⁰, Pt²³⁹, etc.

Classification of Air Pollutants:

Based on source & origin, pollutants are classified into: 1) primary 2) secondary

Primary Pollutants: These are directly emitted from any source. E.g.: CO, SO₂, SO₃, NO, NO₂, NO₃, radioactive substances etc.

Secondary Pollutants: These are formed by interaction of primary pollutants or with constituents of atmosphere. E.g.: PAN (Peroxy Acetyl Nitrate) Photo chemical SMOG (smoke + fog) etc.

Sources of Air Pollution (REASONS): The sources of air pollution may be

A) Natural or B) Man –made (Anthropogenic)

A) Natural Sources: The natural sources are volcanic eruption, fires in forests, sea salt sprays, biological decay marshes, extra terrestrial bodies, pollen grains, spores, radioactive substances etc.

B) Man-Made (Anthropogenic): Manmade sources include thermal power plant (major sources for generating electricity, nuclear power plant without proper installation-pollutants SO₂ & fly ash), vehicular (or) auto mobile emission (another major source of air pollution which releases CO (77%), NO, NO₂ (8%), hydro carbons (14%) Diesel vehicles produce more SPM than petrol vehicles SPM (Suspended Particular Matter), fossil fuel burning, agricultural activities, fertilizers, textile mills, tanneries, refineries, chemical industries, papers & pulp mills etc.

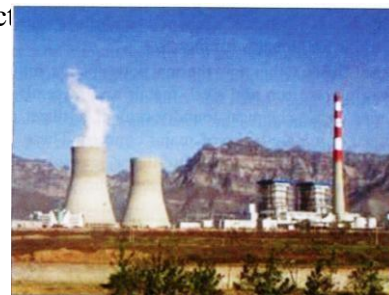


Fig. 5.1 Thermal Power Plants emit fly ash and SO₂.

Air Pollution inside the Home (Indoor)

The important indoor air pollutants is Rn. Rn gas & its radioactive daughters are responsible for lung cancer death every year. Rn is emitted from building materials like bricks, concrete, tiles etc & also present in ground water, natural gas & will be emitted while we use it.

Under developed and developing countries (INDIA) use fuels like coal, dung cakes, wood, kerosene for heating purpose. Complete combustion of these fuels produces CO₂, which doesn't make harm. But incomplete combustion of these substances produces toxic gases such as CO, SO₂, black soot. The other pollutants are HCHO, Benzo-(a)Pyrene (BAP) BAP is present in cigarette smoke which causes cancer. But a House wife using a wood fuel inhales BAP equivalent to 20 Packets of cigarette a day.

Effects of Air Pollution

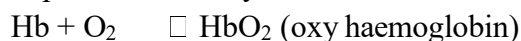
Air pollution shows adverse on human, plants, animals, aquatic life & also on other materials.

1. Effects on Human Health:

Human respiratory system is very specific and so it prevents & protects from air pollution. Bigger particles ($>10\ \mu\text{m}$) can be trapped by hair and sticky mucous lining in the nose. Smaller particles will be trapped by mucous present in the tracheo-bronchial system present in the lungs. These smaller particles are sent back into throat by which it can be removed by splitting (or) swallowing into mouth.

Continuous expose of air pollutants (including cigarette smoke), heavily effects these natural systems which causes cancer, asthma, chronic bronchitis, emphysema (air sacs damage). Suspended particles also cause severe damages to lung tissues and the effects are cancer, asthma, bronchitis etc. SO_2 severely affects the respiratory system that to when they combine with suspended particles forms sulphate particles, which goes deep into lung and effects severely. NO_2 also irritate lung and causes chronic bronchitis & emphysema.

Normally Haemoglobin (Hb) present in blood carry O_2 from lungs to different parts of the body.



But CO has 210 times affinity with Hb. When CO is inhaled by the body, it combines with Hb & form carboxy haemoglobin and such that stops the transport of O_2 to all parts of the body. This causes suffocation and long exposure leads to dizziness, unconsciousness and finally death.



Many other pollutants like benzene, (from unleaded petrol) formaldehyde, polychlorinated biphenyls, toxic metals, dioxanes causes mutations, reproductive problems & cancer. Asbestos, Be, Hg, As, radioactive substances causes lung diseases and also affects organs like kidney, liver, spleen, brain etc.

2. Effects on Plants:

As we have lungs & sweat pores for respiration and sweating (cooling), same like that plants have stomata (leaf pores) through gases diffuses in and out. For the sake of photosynthesis the stomata will open for intake of CO_2 , in addition air pollutants also enter into it and thereby affect photosynthesis.

Normally leaves have a protection layer (cuticle) made up of waxy substances which protects from dehydration, diseases, pests, frost. Some of the terms are discussed below:

Necrosis : Damage of leaf structure (cause dead areas in leaf)

Chlorosis: Yellowing of leaf due to decrease in chlorophyll content

Abscission: Falling of leaves (dropping)

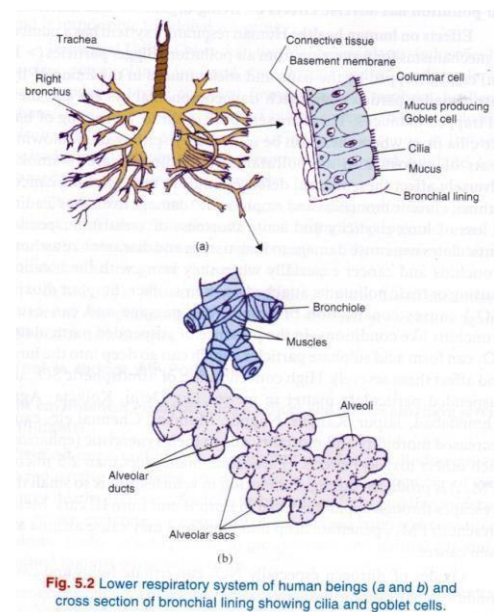


Fig. 5.2 Lower respiratory system of human beings (a and b) and cross section of bronchial lining showing cilia and goblet cells.

Epinasty : Curling of leaves

If the pollutant settles in the stomata, reduces the function of sunlight and finally results in the death of plants.

SO ₂	:	causes bleaching of leaves, chlorosis and injury of leaves
NO ₂	:	abscission and suppressed growth
O ₃	:	flecks on the leaf surface, primitive causing, necrosis, bleaching.
PAN	:	silvering of lower surface
Fluorides	:	epinasty, abscission and dropping of flowers

3. Effects on aquatic life: Air pollutants mix up with rain and cause acidic nature in water bodies due to which aquatic will be affected.

4. Effects on materials: SO₂ and moisture content causes corrosion (sulphuric acid) Due to this, buildings, vehicles, bridges, wires, metals, railway tracks are affected. H₂SO₄ damages metals and lime stone. It also affects papers and so it becomes brittle. Fabrics, leather, paints also been affected. O₃ present in atmosphere affects rubber. NO₂, NO, O₃ affects cotton and rayon fibres.

Control of Air Pollution : Air pollution can be minimized by

- 1) Siting of industries after proper environmental impact.
- 2) By diluting the pollutants (can be achieved by increasing the height of emission of pollutants)
- 3) Minimization of activities such as transportation etc.
- 4) Modernization of equipment's which reduces pollution.
- 5) Use of appropriate materials.
- 6) Use of low „S“ content coal. (or) „S“ should be removed.
- 7) Removal of oxides of nitrogen.
- 8) Vehicles pollution checkup - replacement of vehicles. Installation of catalytic converters by which it reduces CO and other pollutants.
- 9) Using mass transport system, bicycles etc.
- 10) Replacement of less polluting fuels (H₂ gas)
- 11) Using of nonconventional sources of energy.
- 12) Using of biological filters.
- 13) Plantation.

2. Explain in detail about Water pollution causes, effects and control measures of water pollution.

WATER POLLUTION:

The physical, chemical and biological changes of water are termed as water pollution, which makes unfit for use.

Sources of Water Pollution: Water is essential for survival of the life. It is used for different purposes like drinking, cooking, bathing, washing, irrigation, industries, etc, and sources are from rivers, lakes, ground water.

As water is a universal solvent, most of the substances dissolve in it and it is the reason for water pollution. Pollution of water may be point sources (or) non point sources. Point sources are a specific site which discharges effluents into them; they are industries, power plants, underground coalmines, offshore oil wells etc. The non point sources are run-off agricultural fields, small drains, rain water, sweeping roads and fields etc, these scatters the particles which pollute the water.

Ground Water Pollution:

6.2% of water is available as ground water (~30times of surface water) Ground water is less subjected to pollution because various contaminants are retained in soil itself. However ground water is polluted due to septic tanks, industries (textiles, chemicals), deep well injection, mining etc. Ground water is also polluted by As , F^- , NO_3^- (which causes serious health hazards)

Surface water pollution: The major sources are

- Sewage:** Due to sewage, surface water is polluted and this is severe in cities.
- Industrial Effluents:** Industrial wastes such as toxic chemicals, acids, bases, salts, phenols, cyanides, ammonia, and radioactive substances etc, causes water pollution. It also increases temperature of water bodies and affects the survivals of the species.
- Synthetic detergents:** Detergents and soaps used for cleaning which pollutes water.
- Argo chemicals:** Fertilizers (NO_3^- , PO_4^{2-}), pesticides (insecticides, fungicides, herbicides) washed by rain water and surface runoff and thereby pollutes water.
- Oils:** Oils can be spilled during drilling and shipping which pollutes water.

Effects of water pollution:

- Oxygen demanding wastes:** There will be a certain amount of oxygen dissolved in water called dissolved oxygen (DO) The amount DO depends on aeration, photosynthetic activity of plants in water, respiration of aquatic life, temperature, pressure etc. The optimum level of DO for survival of aquatic life is 8-15mg/l.

If the organic wastes reach the water bodies, it is oxidised by the microorganisms present in the water. For the oxidation process some amount of DO is utilised, which decreases the DO level of water and thereby affecting the aquatic life and it also releases PO_4^{2-} which causes eutrophication.

- N & P compounds:** If nutrients like N & P are added to the water bodies, plants and algae will grow fast and die soon. After that those are subjected to oxidation which consumes O_2 in addition some foul-smelling gases are produced and also changes the concentration of O_2 (which also affects P^{H} of water)
- Pathogens:** Many wastes water (sewages) contain many diseases causing micro-organisms such as bacteria, virus etc. Cholera dysentery, typhoid, jaundices are water born diseases.
- Toxic compounds:** Pollutants such as heavy metals, pesticides, cyanides, organic and inorganic compounds effects aquatic life. The pesticides, methyl mercury etc, gets into bodies of organisms present in water. The toxic substances polluting the water ultimately affect the human health. Substances like DDT are in soluble in water and so get accumulated in lipids of the body called “Bio accumulation”. We know the food chain i.e., successive levels of food chains. (zoo plankton → small fish → human) The toxic substances increase from lower to higher level of food chain known as “bio magnification”.

Eg: water → zoo plankton → minnows → needle fish → birds

DDT (ppm)	0.000001	0.01	0.1	1.0	10
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Some heavy metals like Pb, Hg, Cd cause various diseases. Hg in water is converted into CH_3Hg by bacteria this CH_3Hg accumulates in fish. In 1953 people of Japan suffered from



Fig. 5.4 Sewage discharged in Ganga is polluting the river.

numbness of body parts, vision, hearing problem, mental retardants (This disease is called Minamata disease occurred due to consumption of fish containing CH_3Hg), due to this disease 50 dead and 700 subjected to paralysis.

- Cd caused a disease called ITAI-ITAI in people of Japan; this is due to Cd contaminated rice. The rice fields are irrigated with effluents from mines. Due to this disease bones, liver, kidney, lungs, pancreas, thyroid are affected.
- „As“ pollution of ground water causes various abnormalities (mostly seen in Bangladesh and West Bengal)
- Increase in nitrate content of drinking water causes blue baby syndrome or methemoglobinemia. This disease is due to conversion of hemoglobin to non-functional. Nitrates in stomach converted into nitrites which produce cancer causing products.
- Excess of fluorides in drinking water affects teeth & bones (Ca), called Fluorosis.
- Pesticides in drinking water reach finally to humans & cause various problems. So DDT, aldrin, dieldrin, etc, are banned. Recently in AP many suffered from various problems caused due to consumption of cashew contaminated with endosulphan.

Biological oxygen demand (BOD): The amount of biodegradable organic matter is expressed In terms of BOD. The DO is utilised for the oxidation of organic matter present in water.

“The amount of DO require to decompose biodegradable organic matter of a given volume over a period of 5 days at 20 °C.”

More BOD values, less the quality of water. So, from BOD values quality of water can be estimated. Control of water pollution: Normally it is easy to reduce water pollution at a point source, but due to absence of proper legislation it becomes difficult. So water pollution can be prevented from non-point sources

- Agrochemicals like pesticides and fertilizers uses should be optimized and should not use on slope lands, which finally reaches run offs.
- Substitution of N_2 fixing bacteria instead of use of fertilizers.
- Adaptation of integrated pest management.
- Separate drainage system should be Provided.
- Plantation.

3. What are environmental effects due to soil pollution and explain its causes and remedial measures.

SOIL POLLUTION: (Soil is the upper layer of earth in which organic matter is made available for living matter). *The main sources of soil pollution are:* Dumping of various types of materials like Domestic and Industrial wastes.

Domestic wastes: Garbage, glass, plastics, metallic cones, paper fibres, cloth rags, containers, paints, varnishes etc. Leaches are harmful and toxic, which pollute the soil.

Industrial wastes: Effluents from chemical industries, paper, pulp mills, tanneries, textile mills, steel industries, refineries, pesticides and fertilizers industries, pharmaceuticals, cement industries, food industries, thermal and nuclear power plants, mining etc. (Thermal power plants produce fly ash in huge quantities, which are dumped into the soil)

Industrial wastes may contain same organic and inorganic compounds that are non-biodegradable. Industrial effluents may contain toxic substances like Hg, Pd, Pb, As etc.

Agro chemicals (pesticides and fertilizers) are used for crops. But they ultimately reach the soil and pertain for a long time, due to which the soil is affected. Eg: DDT, HCHO, Endrin,

Lindane, Heptachlor, Endosulphan, etc.

The excreta of animals and human are dumped into the soil. The sewage are also dumped into the soil consists of the disease causing organisms like bacteria, viruses, worms etc.

The explosion of radioactive (substances) devices, discharge of wastes from industries and labs pollutes the soil. The radioactive isotopes persist in soil for a long time. Eg : Isotopes of Ra, U, Th, Sr, I₂, Cs etc.

Effects of soil pollution

- 1) It affects the human (by accumulation in food chain)
- 2) Various chemicals (acids, pesticides, heavy metals etc.) affects (fertility) of soil by the changes in physical, chemical, biological properties.
- 3) Death of non-target organisms due to persistent toxic chemicals.
- 4) Diseases due to pathogens (bacteria, caused viruses etc)
- 5) Vegetation is also affected due to radio isotopes (ground water is also affected)
- 6) Sr⁹⁰ gets deposited in place of Ca & causes brittleness in bones & teeth.
- 7) N, P, K fertilizers reach water bodies and causes eutrophication.

Control of soil pollution

- 1) Treatment of effluents before disposal.
- 2) Solid wastes should be properly collected & disposed.
- 3) Recovery of wastes should be done.
- 4) Organic wastes & cattle dung are used for biogas production.
- 5) Microbial degradation technique is introduced (eco-friendly).

4. (a) Define Noise pollution.

We hear different types of sounds every day. Sound is a mechanical energy. Some sort of sound may be pleasant to someone but may not be pleasant to others so the unpleasant and unwanted sound is called “noise”.

(b) write its causes, effects and control measures.

Sound propagates through air, liquid, solid, etc. Sound is the waves that comprises of compression and rare fractions. The number of compressions and rare fractions per unit time is called frequency, and it is expressed in Hz (hertz) and also called number of cycles per second.

Human can hear wide range of sound pressure. High sound pressure cannot create linear response to human ear. Noise measurement are expressed as sound pressure level (SPL), it is expressed in dB (decibel) The average threshold for a healthy ear is 2×10^{-5} pa. dB is the measure of loudness and frequency.

The central pollution control board (CPCB) recommended permissible levels

The main sources are transportation (automobiles, rails), industries, celebrations (social /religious), electric home appliances etc.

Effects of Noise Pollution:

- i) Interferes with man's communication: In a noisy area communication is severely affected.
- ii) Hearing damage: Noise can cause temporary (or) permanent damage of hearing based on intensity & duration of sound level.
- iii) Physiological & psychological change: Continuous expose to noise affects the various functions & systems of the body. The effects are hypertension, insomnia (sleeplessness), gastro-intestinal & digestive disorder, ulcer, BP, emotional changes.

Control of Noise Pollution:

- 2) *Reduction In Source of Noise*: Heavy hold vehicles should not be permitted in densely populated areas.
- 3) Noise producing machines is placed in such a room that, it should absorb the noise.
- 4) Necessary caution should be taken to reduce friction (oiling, grease)
- 5) *Use of Silencers*: Silencers reduces the sound pollution
- 6) Plantation
- 7) *Through Law*: Various legal actions should be taken over the noise pollution. Unnecessary horn should not be blown.

5. How can you, as an individual, prevent environmental pollution? Why such an effort at Individual level is important?

- Reducing waste: Use two types of dustbins for waste segregation, and avoid throwing garbage near water bodies.
 - Using less plastic: Reduce the use of plastic and polythene bags, and promote the use of paper or cloth bags.
 - Avoiding toxic chemicals: Use products with low chemical content and organic properties, and use products that smell strongly less or outside the house.
 - Conserving energy: Turn off electrical appliances when not in use, and use energy-efficient devices such as CFLs.
 - Planting trees: Plant more trees.
 - Using renewable energy: Use renewable energy sources.
 - Reducing fossil fuel use: Reduce the use of fossil fuels.
- Other ways to reduce environmental pollution include:
- Marking areas used to store or deliver hazardous or polluting substances
 - Implementing effective waste management systems, including recycling programs, waste segregation, and controlled waste disposal facilities.

6. What do you understand by Thermal pollution? Discuss various effects and control measures of thermal pollution.

THERMAL POLLUTION

It is defined as waste heat which causes undesirable changes in the natural environment.

Causes of thermal pollution:

Industries, thermal power plants, nuclear power plants, refineries, steel mills etc, are the sources of thermal pollution. The efficiency of power plants is 33% i.e., 66% of energy is converted into waste heat energy. Coolers are maintained for the reduction of heat in which water are circulated. For this purpose, water is taken from the nearby water bodies and the heated water is returned to the same which increases temperature of the water bodies. This causes thermal pollution.

Effects of thermal pollution:

- Due to increase in temperature of water bodies, Dissolved Oxygen (DO) level is decreased.
- High temperature acts as barrier for the penetration of O₂ into deeper parts.
- The levels of toxicity, pesticides, fungicides, detergents increase with increase in temperature.
- With increase in temperature, metabolic activities also increase which finally decreases the DO levels.
- At high temperature flora and fauna gets disturbed and some species may die.
- Aquatic life like fishes is subjected to death due to discharge of heat (treated) water.

- Migration of fishes is affected.

Control of thermal pollution:

1. Cooling ponds: The hot water is stored in the ponds. The natural evaporation process cools the water after the recycling process i.e., through rains they come back into earth.
2. Spray ponds: The hot water is sent to spray ponds where water is sprayed into the atmosphere through nozzles. When small droplets are formed, the temperature is reduced.
3. Cooling towers:
 - Wet cooling water: The hot water is passed through an inlet of wet cooling tower and cool air is passed over it. Cool air removes the heat and also excessive water loss also takes place due to which fog is formed which is a pollutant to the atmosphere.
 - Dry cooling tower: The heated water is passed through an inlet of dry cooling tower and dry air passed over it with help of rotation of fans. This dry air removes heat without water loss but very costly when compared to the wet cooling tower method.

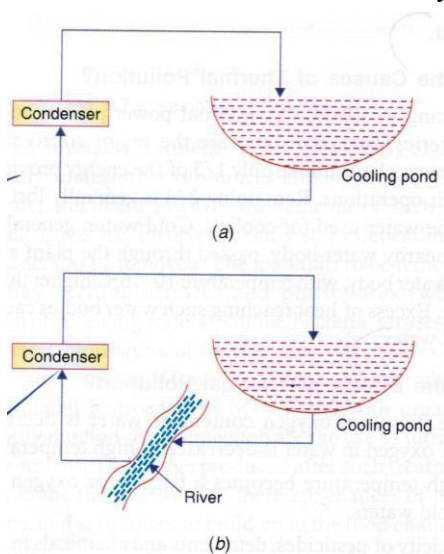


Fig. 5.8 Dissipation of heat by cooling ponds.

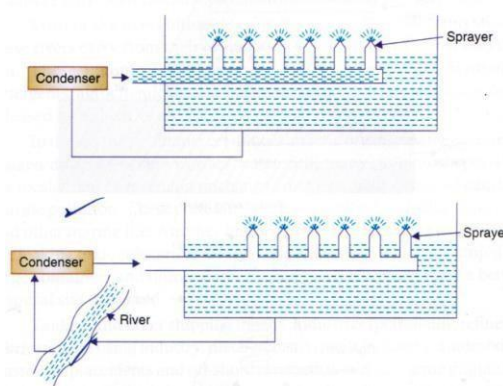


Fig. 5.9 Dissipation of heat by spray ponds.

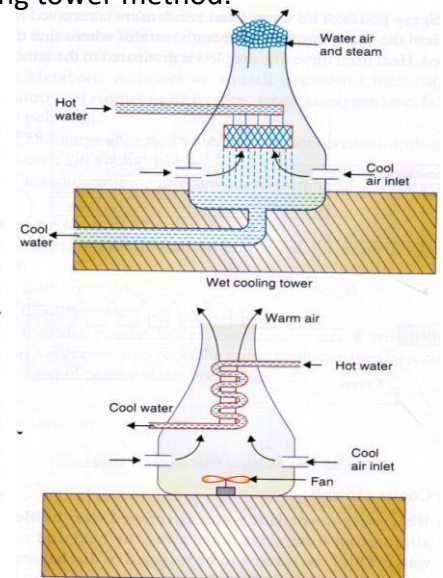


Fig. 5.10 Cooling towers: wet and dry.

7. Define radioactivity. Mention the sources and effects of radioactivity.

NUCLEAR HAZARDS:

Radioactive substances are Present in nature; they undergo natural decay when bombarded with fast moving particles. They release energy in the form of α , β , γ particles.

α : fast moving; positive –do not penetrate into paper

β : fast moving; negative-do not penetrate into wood („Al“ sheet) γ rays –do not penetrate concrete wall

Sources of radio activity: *The sources are:*

- 1) Natural sources: - This include cosmic rays (from outer space), Rn^{222} , soil, rocks, air, water, food etc, which contain radioactive substances.
- 2) Anthropogenic sources: - This includes nuclear power plants, nuclear accidents, x-rays, test laboratories etc, where radioactive substances are used.

Effects of Radiations: Radiations causes harmful changes in the body cells and also at gene level.

- 1) Genetic damage: Due to radiations, mutations take place in DNA, thereby causes damage to offspring and several generations are affected.

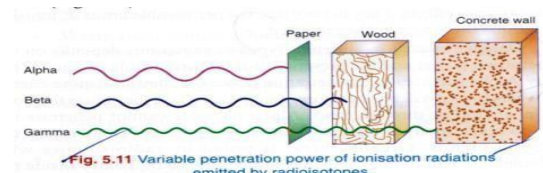


Fig. 5.11 Variable penetration power of ionisation radiations emitted by radioisotopes.

- 2) Somatic damages: This includes burns, miscarriages, eye cataract, bone cancer, thyroid, breasts, lungs and skin damages.

These adverse effects are observed when it crosses threshold level but for short duration radiations are not affected that much. The damages of different radiations depend on the penetration power. α -particles does not penetrate more than that of β , so α particles do not penetrate into skin but β penetrates and damages internal organs. During mining of „U“ radio isotope enters into crust of earth and affect the crops grown there, water bodies and ultimately humans. I^{131} accumulates in thyroid and causes cancer.

Control of nuclear pollution:

- 1) Check regularly the nuclear power plants.
- 2) Lab waste should be disposed properly where isotopes are used.

8. Explain about the solid waste management? What adverse effects can solid waste can cause? How can a solid waste be managed?

Solid waste

With increase in population, there is increase in amount of waste generated also. If the waste generate crosses the threshold limit level, it causes very harm to the life. So, we have to manage the waste that is produced.

The wastes are grouped into solid, liquid and gases.

Solid wastes are Domestic waste, municipal waste, Bio-medical wastes mining wastes, Agricultural wastes, sewage etc. The sources of above Urban and Industrial wastes are:

Urban wastes:-

- ✓ Wastes from homes and shops (Domestic and municipal wastes): It contains variety of discarded material like polythene bags, metal cans, glass bottles, waste paper, cloths, package materials, shells etc.
- ✓ Biomedical wastes: This includes anatomical wastes, pathological wastes, infectious wastes etc.

Construction & mining wastes:-This includes debris, rubbles, wood, concrete, heavy metals, „S“ etc.

- ✓ Agricultural- (wastes from horticulture & slaughter houses): This includes vegetable pants, remains of slaughter animals, pesticides, fertilizers etc.

The urban solid wastes are categorized into two:

- i) Biodegradable: - This wastes can be degraded by microorganisms eg: Vegetable wastes, stale, food, shells, tea leaves, etc.
- ii) Non-Biodegradable: - These wastes cannot be degraded by micro-organisms eg: Polythene bags, scrap metals, glass bottles, etc

Industrial wastes:

This includes large number of materials like packing materials, organic wastes, acids, etc. Sometimes toxic & hazardous substances are released. The wastes from different industries like chemical, metal & mineral processing industries are harmful. Nuclear power plants release

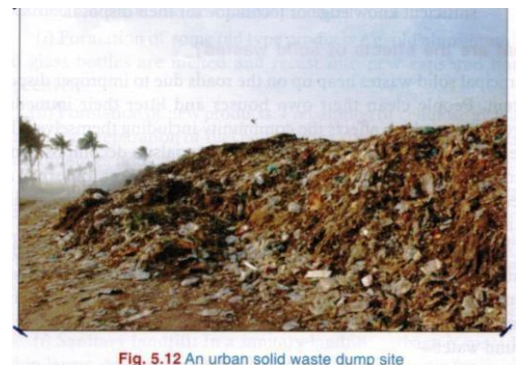


Fig. 5.12 An urban solid waste dump site

radioactive materials (wastes), thermal power plants produce fly ash in large quantities.

Solid wastes from different industries like rubber, plastics, paper, glass, wood, oils, paints, tars, dyes, scrap leather, abrasives, asbestos, batteries etc, are produced. In Europe and North America, the laws are stringent against the disposal of wastes. So, they export the wastes to other developing countries which do not even have sufficient knowledge instead of treatment.

Effects of solid wastes:

Municipal solid wastes & home wastes after cleaning is dumped into the surrounding environment, which heaps the roads due to the improper disposal. If wastes consist of biodegradable in the surrounding environment, it is degraded by the microorganisms which produce the foul smell, infectious diseases, etc.

The industrial wastes of toxic metals, hazards substances spread on land and causes physio-chemical changes, which decreases the fertility of the soil. Finally, they pollute the ground water also. Sometimes hazardous materials are mixed with garbage, combustible wastes which causes difficult in the disposal. Pesticides, solvents, radioactive materials mixed with papers and other non-toxic materials. Burning of these materials produce dioxins, polychlorinated biphenyls, etc, which causes cancer.

Management of solid waste:

Control measure for reduce wastes, solid waste management includes, Reduce, Reuse, Recycle (3R's) before disposal.

- I. Reduction involves of raw materials: Use of Raw materials depend on waste production. If the amount of raw materials is decreased, the waste production is also decreased.
- II. Reuse of waste materials: The refillable containers can be reused. Villagers make casseroles and silos from waste paper, etc. Rubbers are made from discarded cycle tubes. These are done due to financial constraints.
- III. Recycling of materials: The discharged materials are recycled to form new products.
 - a) Formation of some old type products: Old „Al“ cans & glass bottles are melted and recast into new cans & bottles.
 - b) Formation of new products: This includes preparation of cellulose from paper, preparation of fuel pellets from kitchen waste. From steel cans, automobile & construction materials are prepared.

The process of Reducing, Reusing, Recycling save money, energy, raw materials & and also reduces pollution. eg: recycling of papers –reduces cutting of trees. And reuse of metals – reduce mining activities.

9. (a) Write a short note on Bhopal gas tragedy.

Bhopal Gas Tragedy: This is the world's worst accident that occurred on early hours of 3rd December 1984 in Bhopal. Union Carbide Factory synthesizes a pesticide namely **Methyl Iso-Cyanate (MIC)**. Accidently reaction mixture got over heated by the entry of water, so it exploded and eventually no safety devices are in working condition, due to which 40 tons of MIC leaked into atmosphere (contains 40 Kg Phosgene). MIC even at low concentration affects skin, lungs and eyes. But high concentration removes O₂ from lungs and causes death. About 5100 persons were killed, of which 2600 due to direct exposure and 2500 due to effects of exposure. About 65000 people were affected by different disorders & 1000 became blind. Totally (\$ 570 million) spent to clean up and settle.

Note: This tragedy can be prevented by safety measures, which costs \$ 1 million.

(b) Give an account on Chernobyl nuclear disaster.

Chernobyl nuclear disaster: This worst nuclear disaster in human life took place at Chernobyl, Ukraine (USSR) This nuclear plant produces 1000 MW electrical energy. On 25th April 1986, it is shut down for repairs. All top executives were busy for May Day. Anyhow plant was switched-on at 1:23hr on April 26, 1986, due to faulty operation it is exploded. After explosion the temperature suit up to 2000-degree centigrade, volcanic cloud of molten mass is formed. The gases spread over most of northern atmosphere, Poland, Denmark, Sweden, Norway, (which were affected).

On the first day of accident 31 persons died and 239 people were hospitalized. Since the plume was rich in I^{131} , Cs^{134} , Cs^{137} , people were feared that they would be affected from cancer (thyroid, leukemia). I^{131} is contaminated in milk products by which children are affected. Totally 2000 people died and many suffered from skin lashes, loss of hair, nausea, anemia, (blood abnormalities, hemorrhage), eye diseases, reproductive failure etc.

This disaster caused damage to agriculture, several fields, trees, shrubs, plants etc, are damaged.

However nuclear energy is cheap and non-polluting but improper management causes disasters.

10. Give an account on Earthquake, Floods and Cyclones.Earth quakes:

Sudden movements of earth's crust lead to earth quakes. The earth's crust has several tectonic plates of solid rock which normally moves along their boundaries, when some external force (or) friction is acted on it & it stops moving. As a result, stress is developed due to which fractures are occurred causing earth quakes. The point of the fault is known as epicenter.

Earth quakes are measured in Richter scale:

Value (Richter scale)	level of earth quake
4	Insignificant
4-4.9	Minors
5-5.9	Damaging
6-6.9	Destructive
7-7.9	Major
7-8	Great

- The largest earth quake recorded in Chile (9.5 on Richter scale) on May 22 1960, which affected 90000 sq. km & killed 6000 people.
- In India, the massive earth quake took place at Bhuj town, Gujarat, which killed 20-30,000 people. (Severity of earth quake is equal to 5.3 mega ton hydrogen bomb)
- In China 8,30,000 people killed in 1556 due to tsunami. The earth quakes are due to anthropogenic activities.

Some of the manmade activities causing earth quakes are:

- i) Confined to a lake behind a dam.
- ii) Underground nuclear testing.
- iii) Disposal of liquid water in deep water bodies.

Preventive measures for earth quakes:

- 1) By constructing earth quake resistant building in earth quake prone zones.
- 2) Some sort of structures is placed in the building such that it can absorb the vibrations.
- 3) Construction of wooden houses (Japan).

Case study: 2004 Asian tsunami (Indian Ocean earth quake)

This occurred on December 26, 2004 & it is one of the deadliest disasters in modern history known as Asian tsunami (also known as Boxing Day tsunami as it occurred on Boxing Day). The measure on

Richter scale is 9.1 to 9.3 & the epicenter is on west coast of Sumatra, Indonesia. A series of waves up to 30m were raised in the Indian ocean which killed more than 1.86 lakh people of south, south-east Asia, Indonesia, Sri Lanka, India, Thailand with covering on area of 1200 km.

It is the second largest earth quake with duration of 500 to 600 seconds which resulted in vibration of entire planet about 1 cm. The total energy released by the earth quake has been estimated is $3.35 \times 10^{10} \text{ J}$ ($=0.8 \text{ GT of TNT}$). If the damage is far away from the source, then it is known as „tele-tsunami“. In deep of oceans, tsunami waves are harmless but at the coastal areas it becomes largely destructive (thus origin place of tsunami is safe). Due to this coastline of Kerala, Sri Lanka (west coast), Somalia (although greater distance), Bangladesh (comparatively less) are affected less.

No tsunami warning systems are placed in Indian Ocean. It is difficult to detect as it originates from the deep of ocean and so costly network of sensors are required. Pacific Ocean has warning system as it experiences more tsunamis (Ring of fire). Now United Nations started working on Indian Ocean warning system.

Environmental aspects: (man-made reasons for tsunamis):

1. Destruction of coral reefs (Indonesia, Sri Lanka & Bangladesh destroyed them)
2. Many reef areas are exploded around Indian Ocean with explosives.
3. Removal of coastal mangroves & coastal dunes.

Note: Surin Island saved from tsunami waves due to struck of the waves in coral reefs.

Effects:

1. The effects of the tsunami will continue for many years.
2. Damages to eco system (coastal wetlands, mangroves, forests etc).
3. Huge loss to animal & plant biodiversity.
4. Mixing of salt & sewage water with fresh water.

Note: The United Nation Environment Programme (UNEP) is helping the local government to restore the ecology of the region.

Floods:

The overflow of water due to heavy rains (or) sudden snow melt which causes inundation of surrounding land is called floods. Floods don't cause damage to property as remaining natural disasters does. However they cause economic loss (wipe off agricultural lands), health problems (water borne diseases), etc. In India, Uttar Pradesh has 20% of 40 million hectares of flood prone zone. On average every year one major disaster hits India causing huge economic loss also loss to human life.

Reasons:

1. Due to anthropogenic activities like constructive of roads, parking space, buildings etc., which are covered with hard surface and doesn't allow water to percolate.
2. Deforestation.



Fig. 5.14 A building washed away in flash floods of 2012 in Uttarakhand.

Preventive measures:

1. Have to restore wet lands.
2. Replace ground cover on water courses.
3. Building check dams on small streams.
4. Instead of buildings on flood plains, it should be used for wild life habitat, tanks, etc.

Cyclones:

These are recurring phenomenon in the tropical coastal regions. Tropical cyclones move like a spinning top at the speed of 10-30 KMPH & may last for a week with diameter of 100 to 1500 KM.

Different names of cyclones in different areas:

Places	Names
Atlantic, Caribbean, North Eastern Pacific	Hurricanes Western
Pacific	Typhoons
Indian Ocean	Cyclones
Sea around Australia	Willy Willies.

Reasons:

1. Heat & moisture.
 2. Temperature above 26 °C on sea surface.
- More storms occur in the Bay of Bengal (5-6 per year) than in the Arabian Sea.
 - The following cause severe damage to land.
 - a) Hurricane winds (74 Miles/hr)
 - b) Rains.
 - c) Storm surge (500-100 Miles wide dome of water)
 - Sea water with combined force rushes in lands & inundates the low-lying areas.

Remedies:

- i) It is difficult to stop it.
- ii) Some long-term measure can prevent it, they are
 - a) Plantation-coastal belt.
 - b) Construction of dams, dykes, embankments, storm shelter and wind breaks.
 - c) Providing proper drainage & wide roads for quick evacuation.

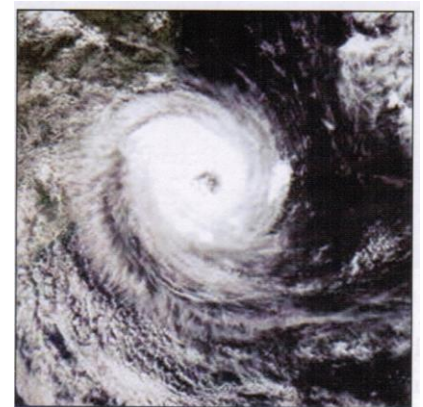


Fig. 5.16 The cyclone Katrina

UNIT-IV**SOCIAL ISSUES AND THE ENVIRONMENT****1. What do you mean by Sustainable development? What are major measures to attain sustainability?****FROM UNSUSTAINABLE TO SUSTAINABLE DEVELOPEMENT**

According to Brundtland G.H, Director, WHO, Sustainable development is defined as “meeting the needs of present without compromising the ability of future generations to meet their own needs” but now days due to increase in the issues, a number of programs (or) questions are raised (or) initiated. For eg:- Does it protect our biodiversity? Does it prevent soil erosion? Does it slow down population growth? Does it increase forest cover? Does it cut the emissions of CFC, SO₂, NO₂ & CO₂? Does it reduce waste generation and does it bring benefits to all?

For the sake of human development, that to very few rich nations polluted the air we breathe, water we drink, food we eat etc. Due to over exploitation our natural sources are also badly affected. If this continues, we will face dooms day & there should be limit for growth -stated by meadows et-al.

Although fears started due to unsustainable development in 1970 but got a clear discussion on sustainable development in 1992, world summit. This earth summit mainly aims at “a new and equitable global partnership through the creation of new levels of co-operation among states”. The main agenda (agenda-21) is Sustainable development in social, economic & political context for 21st century.

Keys to Success of Sustainable Development

- Inter-generational equity:** - We should not over exploit and damage the natural resources and have to hand over safe & healthy resources for future generations.
- Intra generational equity:** - The development activities should be in such a way that it should minimise wealth gaps with in the nation. The benefits should achieve intra generational equity. To overcome the problems of developing countries, the technology should be improved.

E.g.: - Drought tolerant varieties, vaccines for infectious diseases, clean fuels for domestic & industrial uses.

The developed countries should hold the developmental activities of the developing countries and should decrease the wealth gap.

Measures for Sustainable Development

- Using appropriate technology: -
For the development we should use eco-friendly, resource efficient and culturally suitable technology, for these local resources & local labors are utilized. It should produce minimum waste with less resource. Always nature is taken as model ad so called design with nature.
- Reduce, Reuse & Recycle approach (3R): -
We should minimize the usage of resource (Reduce) and should use them again & again instead of passing it to the waste (Reuse) andalso should Recycle it properly.
- Creating awareness & educate environmentally: -
To create awareness among the people we should educate the people regarding environment. Then people use to think about the environment. The subject should be introduced at the school level itself then only it will be taken into action in the future. If we educate in the childhood about the environment then it becomes as a habit.

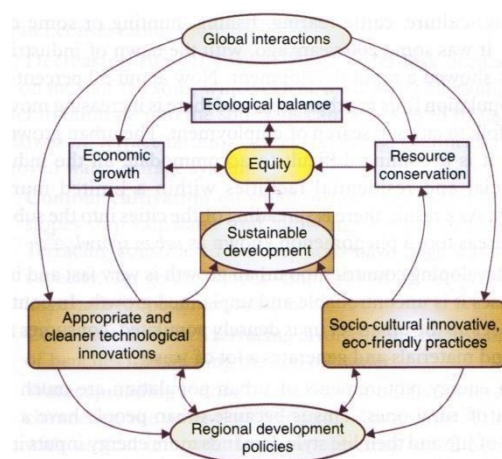


Fig. 6.1 Multidimensional model for sustainable development

- Resource utilization as per carrying capacity: -

Any system can withstand to a certain limit known as carrying capacity. This carrying capacity is complex in terms of human beings because they need so many things in addition to food.

When it crosses the limit environment starts degrading, due to over exploitation.

Carrying capacity has two basic components

- Supporting capacity: - capacity to regenerate
- Assimilative capacity: - capacity to tolerate stress.

So, in order to attain sustainable development consumption should not go beyond regeneration & tolerance capacity.

2. (a) What is rainwater harvesting? Write the objectives of rainwater harvesting.

RAIN WATER HARVESTING: -

This is a technique to increase ground water and can be achieved by constructing dug wells, percolation pits, lagoons, check dams etc. But this harvesting had done where the rain falls and also prevents pollution.

The average rain fall in India is 1200mm/year, but it falls mostly in the month of June, September. The second highest annual rain fall in India is Chera punji (11000mm/year) but it suffers from water due to run off and little vegetation. So rain water should be stored for future use.

Rain water harvesting has the following objectives:

- 1) Reducing run off
- 2) To avoid floods
- 3) To meet increasing demands of water
- 4) Increase water table in ground water
- 5) Reducing water contamination
- 6) Stored ground water supplied in the demands

Methods to harvest rain water

- By storing in tanks (or) reservoirs
- By constructing pits, dug wells, lagoons etc.

We should study the soil characteristics, rainfall pattern, and climatic conditions before harvesting rain water.

(b) Discuss on Traditional and Modern rainwater harvesting techniques.

Two methods of rain water harvesting is discussed.

Traditional rain water harvesting: -



Fig. 6.3 An ancient Joharh at Sanchi, M.P. a traditional method of rainwater harvesting

In India it is old practice. The rain water is collected on roof top storage tanks. The foot hill people of Himalayas use bamboo sticks (hollow) as pipelines to transport water. In Rajasthan they used to harvest rainwater underground

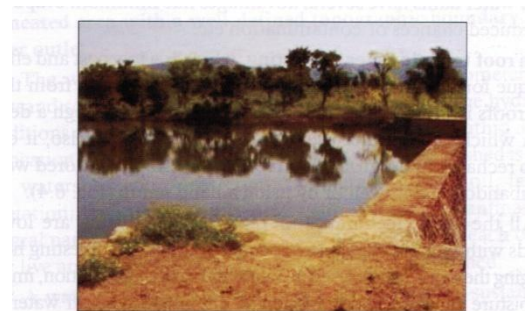


Fig. 6.2 A check dam in Rajasthan built for rainwater harvesting.

tanks known as tankas & khadins. But this rain water harvesting method is prominent in ancient period i.e., every city, village, capital city of kings, use to collect rain water which is used in future in scarcity. They are named as talab's, baawaris, jhowars, Hariz etc..

Modern technique of rain water harvesting: -

In arid and semi-arid regions ground water is recharged artificially by constructing shallow percolation tanks. Check dams are constructed in the catchment areas to harvest water. Rajendra Singh known as '**water man**' build many check dams in Rajasthan for which he was awarded '**Magsaysay award**'. Ground water dams is efficient to harvest rain water and have advantages like reduce evaporation loss, contamination etc.

Roof top rain water harvesting technique is effective and low investment which is used in urban houses & buildings. The rain water from top of the roof is diverted to surface tank (or) pit can be used for future use. It is also used to recharge ground water aquifers by diverting stored water to dug well (or) by hand pump.

All the above techniques of rain water harvesting is low-cost methods & helps in recharging aquifers, soil moisture, reduce soil erosion and there by minimizes run off.

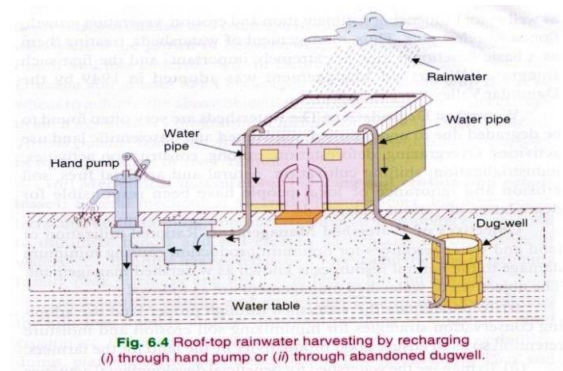


Fig. 6.4 Roof-top rainwater harvesting by recharging (i) through hand pump or (ii) through abandoned dugwell.

3. What is watershed? Critically discuss the objectives and practices of Watershed management.

WATER SHED MANAGEMENT: -

River basin is a land area present near the river in which river water is present.

"The land area with topographic boundary, water outlet and water drainage channel is called watershed". This water shed ranges from few sq km to few 1000 sq km. So, in the water shed water are collected from the nearby river (or) reservoirs.

Human & animals are integral part of watershed and so they dependent with each other. The impacts of water shed are food production, water supply for the irrigation, power generation, transportation, sedimentation, erosion, vegetation growth, floods, droughts, etc. So, water shed is basic functional unit for life & first integrated watershed management was adopted in 1949 by Damodar Valley Corporation.

Water degradation: - Water sheds are degraded due to uncontrolled & unplanned activities like deforestation, mining, construction, industrialization, shifting cultivation, fires, soil erosion, ignorance of local people etc.

Objectives of watershed management: -

Optimizing the water resources for production with minimum damage to natural resources is known as watershed management. The objectives are:

- 1) 1. Good productivity for the farmers & minimizing soil erosion.
- 2) For domestic water supply, irrigation, hydropower generation.
- 3) To minimize floods, droughts, landslides.
- 4) To develop economically.

WATERSHED MANAGEMENT PRACTICES ARE:

For the benefits of the people the practices of conservation & development of land & water are done. The various measures are:

- i) Water harvesting: Water is to be stored for future use and also used for drought conditions, low rainfall areas, to check floods etc.
- ii) Afforestation & Agro-forestry: - In watershed management plantation play important role in preventing soil erosion, retention of moisture, reduce run off, reduce loss of fertile etc. So in relation to these case trees like Eucalyptus, Leucaena, Grasses like Chrysopogon are grown in Dehradun. In the watershed areas of Yamuna river- Dalbergia, Tectona (teak), Acacia are grown
- iii) Mechanical measures for reducing soil erosion & run off: - To minimize runoff & soil erosion, terracing bunding, bench terracing, contour cropping, strip cropping etc are done.
- iv) Scientific mining and quarrying: - Due to improper mining, landslides, soil erosion takes place and can be compensated by planting some soil binding plants like Ipomoea, vertex & contour trenching at an interval of 1 meter on over burden dump.
- v) Public participation: - For any program to get success people should involve. So people should co-operate as well as to participate in the watershed management. We should motivate & educate people to maintain water harvesting bodies implemented by GO's (or) NGO's. For Such people incentives should be provided. Successful watershed management has done at Sukhomajri, Panchkula, Haryana.

Most of the watersheds are located in Himalayan region. Several human activities cause instability in the slopes, which has to be prevented. On steeper slopes straw munching tied with thin wires & ropes helps in stabilizing the slopes.

4. Explain about the global warming?

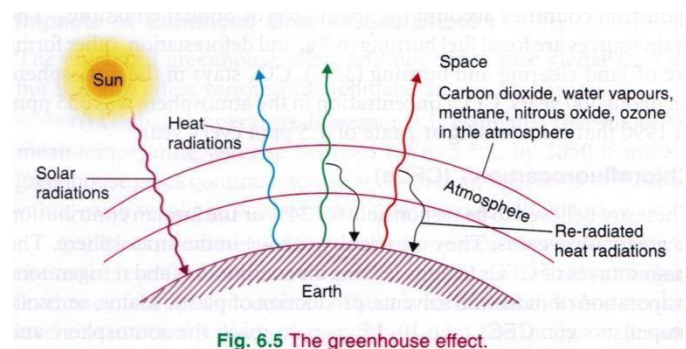
(a) Global warming

GLOBAL WARMING: -

The trapping of heat by certain gases in the troposphere is called greenhouse effect. The heat trapped depends on the concentration of gases. The gases are known as greenhouse gases. In absence of greenhouse gases, the temperature would have been -18°C but on average it is 15°C , i.e., due to greenhouse gases the raise in temperature is 33°C by which species exists at this optimum temperature during recent years the concentration of greenhouse gases level increased enormously due to human activities like deforestation, industrialization, etc, by which global temperature also raised. This finally resulted in change in the climatic conditions eg: Droughts & Floods.

Greenhouse gases: -

The solar radiations reach the earth surface and will be reemitted to the atmosphere normally. But the greenhouse gases trap the radiations by which the earth's surface temperature increases and



the phenomena is known as greenhouse effect. The major greenhouse gases are:

- 1) CO₂ 2) CFC's 3) CH₄ 4) N₂O

1) Carbon dioxide(CO₂): It constitutes 55% to the global warming greenhouse gases. The main source of CO₂ is fossil burnings (67%), industries and deforestation (33%). The life span of CO₂ is 500 years. In 1990 it was 355 ppm and increasing at rate of 1.5 ppm per year.

2) Chloro Fluro Carbons (CFC's):-

It constitutes 24% of the greenhouse gases effect. This also depletes ozone layer. The main sources are: leaking air conditioners, refrigerators, solvents, aerosols, propellants, etc. They trap 1500-1700 times than per molecules of CO₂ in troposphere. The average concentration of CFC is 0.00225ppm and increasing by 0.5% per year. CFC's takes 10-15 years to reach stratosphere and life span in it is 65 to 110years.

3) Methane (CH₄):-

It constitutes 18% of the greenhouse gases, the main source is anaerobic degradation of organic matter by microorganisms in wet lands, paddy fields, etc. The other source is partial burning of fuels (eg:- natural gas). They trap 25 times than a CO₂ molecule and the life span is 7-10 years. The concentration is 1.675 ppm and increases by 1% annually.

4) Nitrous oxide (N₂O): -

It constitutes 6% of greenhouse gases. It also depletes ozone layer. The main source are from nylon products, burnings of biomass & nitrogen rich fuels (coal), breakdown of nitrogen fertilizers, etc. It traps 230 times than a CO₂ molecules & life span is 140-190 years. The concentration is 0.3 ppm & increases at a rate of 0.2 % per year.

IMPACTS OF GREEN HOUSE EFFECT: -

The increase in greenhouse effect not only causes global warming but also affects other natural process:

i) Global temperature increase: -

Due to increase in the concentration of greenhouse gases the earth's temperature is also increased.

By 2050 the average increase would be 1.5 to 5.5 °C.

ii) Raise in sea level: -

Due to increase in the global temperature, the sea level is also increased due to melting of polar ice caps & glaciers, in addition to expansion of water. By next 50-100 years the sea level raise would be 0.2 to 1.5 meters with increase in 3 °C.

1 metre increase in sea level drenches the cities like Shanghai, Cairo, Bangkok, Sydney, Hamburg & deltas in Egypt, Bangladesh, India, china, by which rice productivity is affected. Millions of people will be affected who built homes in the coastal areas of Ganges, the Nile, the Mekong, Yangtze & Mississippi Rivers due to rise in sea level.

In India, the Lakshadweep islands are affected with 4 m raise and Mumbai can be saved by embankment to prevent inundation.

iii) Effects on human health: -

Due to global warming rainfall pattern will be changed, due to which water born diseases like malaria, filariasis and elephantiasis are affected to the people. These diseases are

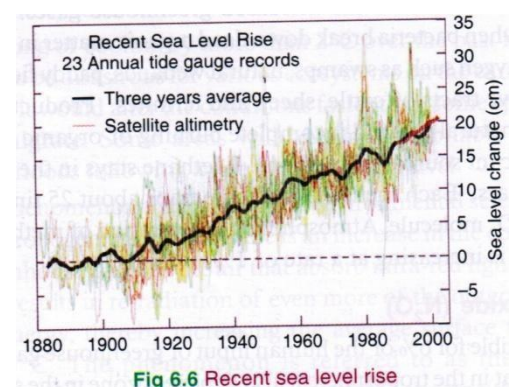


Fig 6.6 Recent sea level rise

mainly affected in Ethiopia, Kenya & Indonesia. These microorganisms are born & multiplied on stagnate water. Sometimes skin diseases are also caused.

iv) Effects on agriculture: -

It may be positive (or) negative effects, with increase in temperature & soil moisture will decrease. Evaporation-transpiration will increase due to which wheat, maize production is affected. Increase in temperature & humidity, growth, & resistance of pests will increase. To overcome this drought resistance, heat resistant & pest resistant crops have to be developed.

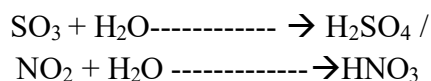
Measures to check global warming (prevention): -

- i) Reduce the sources of the CFC's.
- ii) Increase in efficiency.
- iii) Use of renewable resources.
- iv) Use of nuclear power plants.
- v) Change from coal to natural gas.
- vi) Trap methane & use as fuel.
- vii) Practice sustainable agriculture.
- viii) Optimize population growth.
- ix) Remove CO₂ by photosynthetic algae & plant more trees.

(b) Acid rains:

Acid Rain: -

The major sources of acid forming gases are oxides of sulphur & nitrogen coming from fossil fuels & industries. In atmosphere these oxides (SO₂, SO₃, NO₂) form acids by the reaction with water molecules.



These acids fall as acid rain and due to this acidic deposition takes place. Sometimes dry deposition also takes place.

The P^H of rain water is 5.6 due to dissolution of CO₂ in water. When the acid mixes with rain water the P^H falls below 5.6. The Adirondack lakes located in New York is known to receive acid rains. The strong acid HNO₃, H₂SO₄ releases H⁺ ions in the rain drop and thereby increases acidity. The overall P^H of rain drop due to net effect of H₂CO₃, H₂SO₄, HNO₃, other acids & neutralizers like NH₃. But in urban areas acidic effect is neutralised by Ca²⁺, Mg²⁺, NH₄⁺ ions.

In the absence of rain, dry acid deposition takes place. SO₂, SO₃, NO₂, acid aerosols gets deposited on surface of water bodies, vegetation, soil & other materials in which they form acids similarly formed in acid rains. Sometimes these SO₂, SO₃, NO₂, gets deposited in the clouds and oxidises into acids & falls as rain from clouds and thereby still increasing the acidic P^H. A unit decrease in P^H increases 10 times acidity. Average P^H in rain fall over Easter United States from 1979 to 1980 was less than 5.0.

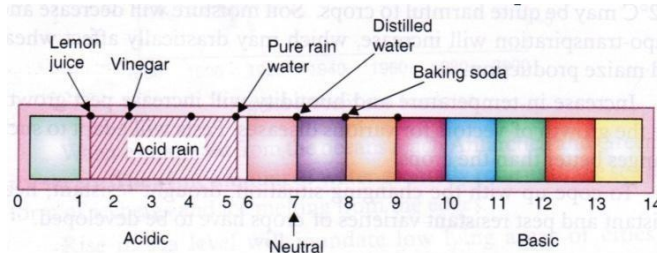


Fig. 6.7 The pH scale of common substances.

Effects of acid rain: - It causes number of harmful effects mostly to aquatic system.

- 1) It causes deterioration in the monuments like Taj Mahal, stone statues (in Greece & Italy priceless stone statues were dissolved by acid rain.
- 2) It damages metals & cars finishes.
- 3) It damages foliage & weakens trees, which is susceptible to insects & fungi which are tolerant to acids.
- 4) The reproduction of fishes is affected & also kills it. In lakes of Sweden, Norway, Canada becomes fishless due to acid rains. The aquatic animals suffers from toxic metals like Al, Hg, Mn, Zn, Pb leaked from acid rain.

Control of acid rain: - Acid rain can be controlled by:

- 1) Reducing emission of SO_2 & NO_2 from industries & power plants.
- 2) Lakes and soil to be limited to correct acid rain.
- 3) For drinking water pipes, coating of inner layers should be done with inert polymers.

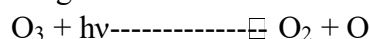
5. Discuss the natural formation and occurrence of ozone in the Stratosphere.

Ozone layer depletion: -

For the last 450 million years earth has natural sun creep called ozone layer in the stratosphere which filters harmful UV radiations from sunlight & protects various lives.

The ozone is obtained from the molecular oxygen (O_2) & atomic oxygen in the presence of UV radiation (242nm). $\text{O}_2 + (\text{O}) \longrightarrow \text{O}_3$ (ozone)

But this ozone is again converted to O_2 & O by harmful UV radiation (200 to nm).



The net result of above two reaction forms ozone concentration in the stratosphere of 24 km length, i.e., 16 to 40 km away from earth. This above equilibrium is disturbed by reactive atoms like Cl, Br, etc, & there by destroying ozone molecule which leads to thinning of ozone layer.

The unit to express ozone concentration is Dobson units (DV). 1 DV=0.01mm thickness of ozone at 1 atm. The concentrations of ozone at different region are as follows:

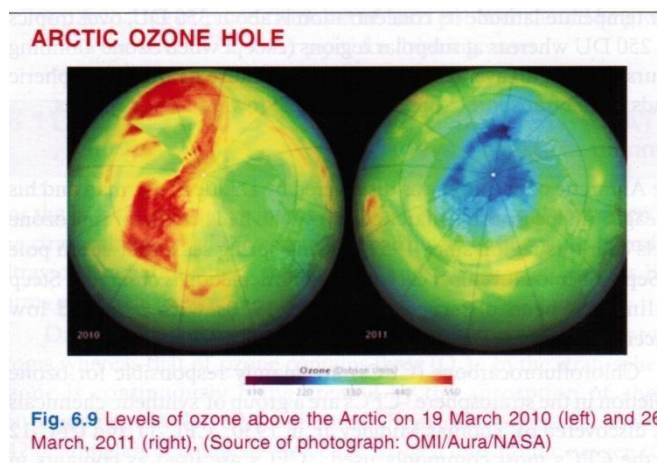
Region	Concentration
i) Temperate	350 DU
ii) Tropical	250 DU
iii) Sub-polar sub polar)	450 DU (Stratosphere winds transport O_3 from tropical to sub polar)

Thinning of ozone layer:-

The first ozone hole was discovered in the Antarctic region by Dr. Foe C. Farman et-al. They conducted a survey since 1957 & observed that during spring season i.e., from September to November ozone depletion is observed. Very low concentration is observed during 1970 to 1993 i.e., 90 DV.

Reasons:-

Mostly CFC's are responsible for the depletion of ozone. The most commonly used CFC's are CFC-11 & CFC-12. CFC's are used as coolants in AC's, refrigerators, propellants, solvents, sterilant etc. CFC's released in the troposphere reaches



stratosphere and affects the ozone in it. Life span of CFC's is 65-110 years.

50% of the ozone layer was destroyed in the Antarctic region during spring and early summer during winter ice crystals are formed, CFC's gets deposited in the crystals and destroy ozone much faster similarly same effect seen in north poles but the depletion is 10-25%.

Another reason for depletion of ozone is N_2O emitted from aircrafts, nitrogenous fertilizers etc. The NO_2 & Cl_2 combines together and destructs ozone further.

Effects of ozone depletion: -

- 1) Ozone filters harmful UV radiations & when it depletes, the UV falls directly into the earth, due to which mutation (change in DNA sequence) & cancer occurs (skin).
- 2) Cornea of eye is also affected as it absorbs UV rays.
- 3) Decreases the melanin production and thereby decreases the immunity.
- 4) Phytoplankton, zooplankton and aquatic animals are affected.
- 5) Crop yield will be decreased such as rice, soybean, cotton, sorghum, bean, wheat etc.
- 6) Paints, plastic, other polymers are degraded, which causes economic loss.

6. Discuss various measures for wasteland reclamation.

Waste land reclamation: -

Economically unproductive lands suffering from environmental deterioration are known as wastelands. They are salt affected lands, sandy areas, gullied areas, barren hills-ridges, snow covered areas, glaciers, barren after Jhum cultivation, etc. More than half of our country geographical areas are wastelands in spite of $1/6^{th}$ of world population.

Maximum waste lands areas in our country in Rajasthan (36 m ha) followed by M.P, A.P, Haryana (8.4% of total area). Waste lands are formed due to natural process & also by human activities. The natural process is swelling uplands, snow covered lands, coastal saline areas, sandy areas, etc. The human activities are deforestation, mining, slash & burn agriculture, etc. Desserts are wastelands but human activities spread the area of deserts to large.

Wasteland reclamation practices: -

Wasteland reclamation was under the control of "wasteland development board" with following objectives:

- i) To improve the physical structure and quality of marginal soils.
- ii) To increase availability of good quality water for irrigating these lands.
- iii) To prevent soil erosion, floods, landslides.
- iv) To conserve biological resources of land for sustainable use.

Reclamation practices are

- i) Land development and leaching:- Salts are removed from root zone by leaching. After that we have to check for salinity, texture, depth of permeable layer, water table, land levelling, etc. 0.5 to 1.0 cm of water is required to remove 90% soluble salts from each cm of soil. After levelling and ploughing leaching is done.
- ii) Drainage:- Water logged soil subjected to removal of excess water by artificial drainage system in two ways.
 - a) Surface drainage:- This method is used to remove water from the field after heavy rains by providing ditches to runoffs. Usually 5cm water removed in 24hrs (30-45cm deep & 20-60m length).
 - b) Sub surface drainage:- Horizontal sub-surface drainage is provided in the form of PVC pipes below 2-3 m of land surface to remove excess water. World Bank has funded for sub surface drainage at sampla, Rohtak (Haryana).

- iii) Irrigation practice:- Surface irrigation with precise land levelling helps to reduce water logging & salinity. Frequent irrigation helps to maintain water in the upper root zone which increases yield also.
- iv) Selection of tolerant crop & crop rotations:- Barley, sugar beet, date palm etc are highly tolerant to salinity with electrical conductivity of 10 d s/m and so yield is not affected.
Wheat, Sorghum, Pearl, Millet, Maize, Pulses, Sunflower, Sugarcane, Bringial, bottle guard are moderately tolerant.
- v) Gypsum amendment:- Gypsum is added to sodaic soils to replace Na with Ca and thereby reduces soda content.
- vi) Green fertilizers & Bio-fertilizers:- Farm yard manure or nitrogen fertilisers improve the saline soil quality. Green manuring with dhaincha improve the quality of salt affected soils and blue green algae is also used as bio-fertilizers.
- vii) Afforestation programme: - The national commission on agriculture launched several afforestation schemes in 6th plan to overcome the problem of wasteland. Ministry of environment has target of 5 million ha of wastelands to plant fodder, etc. In addition to this plantation on roads, rail, canal slides are done for wasteland reclamation.

Note: Vivek (Comedy actor) is in a programme of planting 1 crore plants (as insisted by Dr. A.P.J Abdul Kalam).

7. Write a critical note on nuclear holocaust and ozone layer depletion.

Nuclear accidents and Holocaust: -

A nuclear accident is more drastic and occurs at any time without expectations. Failure in reactor leads to effect human population in a particular area.

The modern nuclear bomb has explosive force of 500 kilotons & 10 megatons. Due to nuclear explosive large soot is carried to stratosphere by the combustion of wood, plastic, petroleum, forests, etc. This black soot traps solar radiations not to enter into the earth by which cooling takes place, finally leads to disturbance in greenhouse effect. Due to this cooling effect, evaporation also reduces. So, due to nuclear explosion phenomena opposite to global warming occur known as nuclear winter which affects crop productivity.

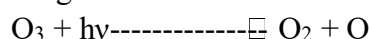
- Chernobyl nuclear accident, 1986 resulted in wide spread of radioactive substances. During IInd world-war bomb-attack on Dresden, Germany caused huge fire storms.
- Two powerful nuclear bombs were dropped on Hiroshima & Nagasaki cities of Japan killed nearly 1 lakh people & destroyed the cities. Neutron & Gamma rays are emitted from explosives of 12 kilotons of tri nitrotoluene. Sr^{90} was liberated which replaced Ca in bones caused brittle of bones. Even after 50 years also, the impact was seen.

Ozone layer depletion: -

For the last 450 million years earth has natural sun creep called ozone layer in the stratosphere which filters harmful UV radiations from sunlight & protects various lives.

The ozone is obtained from the molecular oxygen (O_2) & atomic oxygen in the presence of UV radiation (242nm). $\text{O}_2 + (\text{O}) \longrightarrow \text{O}_3$ (ozone)

But this ozone is again converted to O_2 & O by harmful UV radiation (200 to nm).



The net result of above two reaction forms ozone concentration in the stratosphere of 24 km length, i.e., 16 to 40 km away from earth. This above equilibrium is disturbed by reactive atoms like Cl, Br, etc, & there by destroying ozone molecule which leads to thinning of ozone layer.

The unit to express ozone concentration is Dobson units (DV). 1 DV=0.01mm thickness of ozone at 1 atm. The concentrations of ozone at different region are as follows:

Region	Concentration
iv) Temperate	350 DU
v) Tropical	250 DU
vi) Sub-polar	450 DU (Stratosphere winds transport O ₃ from tropical to sub polar)

Thinning of ozone layer: -

The first ozone hole was discovered in the Antarctic region by Dr. Foe C. Farman et-al. They conducted a survey since 1957 & observed that during spring season i.e., from September to November ozone depletion is observed. Very low concentration is observed during 1970 to 1993 i.e., 90 DV.

Reasons: -

Mostly CFC"s are responsible for the depletion of ozone. The most commonly used CFC"s are CFC-11 & CFC-12. CFC"s are used as coolants in AC"s, refrigerators, propellants, solvents, sterilant etc. CFC"s released in the troposphere reaches stratosphere and affects the ozone in it. Life span of CFC"s is 65-110 years.

50% of the ozone layer was destroyed in the Antarctic region during spring and early summer during winter ice crystals are formed, CFC"s gets deposited in the crystals and destroy ozone much faster similarly same effect seen in north poles but the depletion is 10-25%.

Another reason for depletion of ozone is N₂O emitted from aircrafts, nitrogenous fertilizers etc. The NO₂ & Cl₂ combines together and destructs ozone further.

Effects of ozone depletion: -

- 7) Ozone filters harmful UV radiations & when it depletes, the UV falls directly into the earth, due to which mutation (change in DNA sequence) & cancer occurs (skin).
- 8) Cornea of eye is also affected as it absorbs UV rays.
- 9) Decreases the melanin production and thereby decreases the immunity.
- 10) Phytoplankton, zooplankton and aquatic animals are affected.
- 11) Crop yield will be decreased such as rice, soybean, cotton, sorghum, bean, wheat etc.
- 12) Paints, plastic, other polymers are degraded, which causes economic loss.

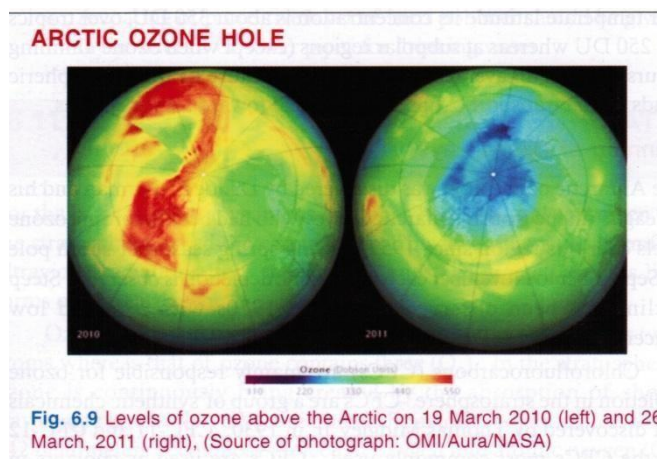
8. Give a brief note on consumerism and waste products.

Consumerism and waste products: -

Consumerism refers to consumption of resources by the people. In early days the people use to consume less but now-days with increase in population consumerism also increased. This difference in consumerism is due change in lifestyle, population growth, etc. Earlier less than 1 million population for thousands of years. Now it had crossed 6 billion and by 2045 reaches 11 billion.

Based on population and consumerism two categories are listed:

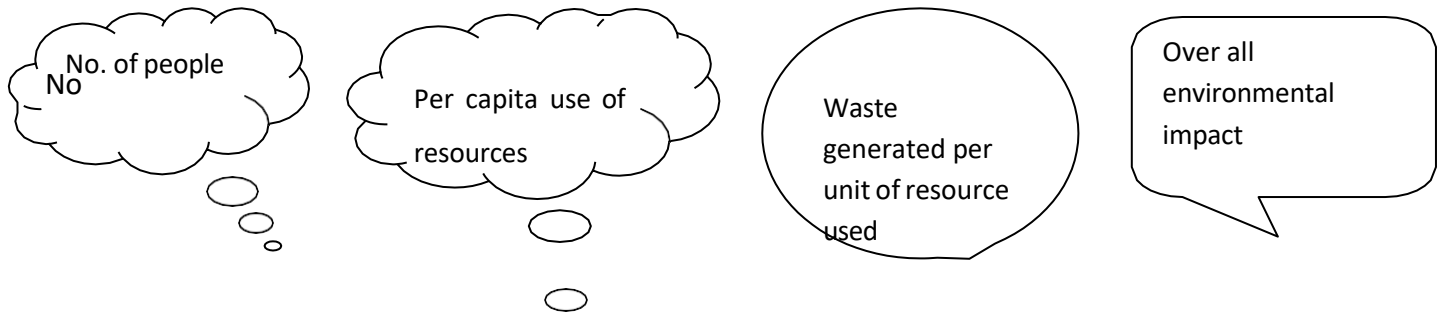
- i) Over population: - Due to over population, inadequate in food, water & other sources take place.



This leads to poverty, under nourishment and premature death, etc. This occurs in less developed countries (LDC's), where there is less per capita consumption with high overall consumption & less wastes.

- ii) Over consumption: - Although the population is low or moderate, the usage of resources is high due to luxurious life style leading to more waste generation. This occurs in more developed countries (MDC's), where per capital consumption is high.

This concept can be well explained by Paul Ehrlich and John Holdren Model:



In both the cases overall impact may be same (or) greater in case of over consumption (more developed countries) & consumerism varies with country. USA is known for maximum consumerism for way of life style they lead. They generate waste by utilizing resources.

Comparison of consumerism and waste generation: -

Parameter	USA	INDIA
i) Population	4.7%	16%
ii) Production of goods	21%	1%
iii) Energy use	25%	3%
iv) Pollutants & waste	25%	3%
v) CFC's production	22%	0.7%

From the above comparison it is clear that population of India is 34 times but less in energy consumption & waste generation by 1/8th part.

Consumerism highlights: -

- On average an US citizen consumes resources 50 times as much as Indian.
- Due to high consumerism, an US born baby destroy earth 20-150 times than a baby born in LDC's
- Although Japanese has similar life style than that of American causes half the impact than American does due to usage of better technology like eco-friendly, energy efficient, 3R principle. (Reduce, Reuse, Recycle).

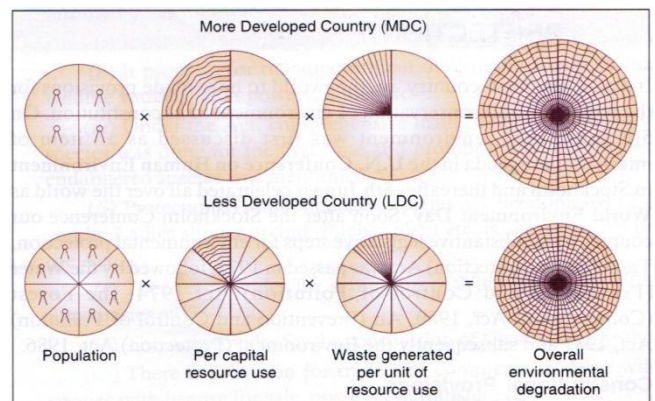


Fig. 6.10 Relationship of population, consumerism waste production and environmental impacts.

9. (a) Discuss the salient features of Wildlife (Protection) Act, 1972.

Wild life protection act, 1972: -

Initially this act is under state government and transferred to central in the year 1976, but the Indian board of wild life (IBWL) was started in the year 1952. After the wild life protection act many national parks & sanctuaries has setup.

Major activities in this act: -

- i) It gives definition for wildlife.
- ii) It gives provision for wildlife advisory board, wild life warden - power duties.

- iii) List & Prohibition of hunting endangered species is done.
- iv) Endangered plants like Beddome, Cycad, Blue vanda, Ladies slipper, Orchid, Pitcher plants, etc. are protected.
- v) Provides setups of national parks, wild life sanctuaries, etc.
- vi) Provides constitution of central zoo authority.
- vii) Provision for Trade & Commerce of some wild life with license and ban of scheduled animals.
- viii) Legal powers are given to the officers to punish offenders.
- ix) Breeding of endangered species are done.

Several individual projects for endangered species were stated under this act lion act (1972), tiger act (1973), crocodile act (1974) etc.

The major drawback of this act is that adopted all over India except in Jammu and Kashmir in which mild penalty is given to offenders & also ownership certificates is given for tiger, leopard skins, etc.

(b) Discuss various provisions for Forest (Conservation) Act, 1980.

Forest Act, 1980: -

This act deals with the conservation of forests & adopted all over India except Jammu & Kashmir. *The features are: -*

- i) The forests are used for forestry purpose only. If it is to be used for any other purpose like mining, replacement with economically important trees then prior permission should be taken with central government.
- ii) It makes provision to conserve all types of forests & there is committee to recommend funds from central government.
- iii) It gives stringent warning to stop the illegal activities.
- iv) Non-forest activities like clearing of land for cultivation are not entertained. But some construction work like fencing, water holes, pipelines, wireless communication can be done.

Amendment (changes) in the forest Act, 1992: -

- i) In 1992 some changes are made in the act which gives provision for some non-forest activities with cutting trees for transmission lines, drilling and hydroelectric project with central government approval.
- ii) Without prior intimation from the government wild life sanctuaries, national parks survey, etc. are not entertained.
- iii) Cultivation of tea, coffee, spices and rubber are included under non-forestry activity and prohibited in the reserve forests.
- iv) For the cultivation of fruit trees, oil government approval has to be taken because they may cause ecological imbalance.
- v) Tusser cultivation for silk yielding insect is a lively hood for forest people and so it is a good practice as it does not cause any harm & so considered as forests activity. But the mulberry plantation for silk worm is non-forestry activity.
- vi) As mining is a non-forestry activity prior approval from central government should be taken.
- vii) Non-forestry activity also includes removal of stones, bajri, boulder etc.
- viii) If any non-forestry activity is proposed to the central government, it should benefit & should not cause impact to the environment thus forest act had given provision to protect & conserve the forest.

10. (a) Discuss the Major Environmental Protection Rules, 1986.**The Environment (Protection) Act, 1986:**

This act came into existence on November 19, 1986, the birth anniversary of late Indira Gandhi, who was pioneer of environmental protection issues. This act is generalised throughout India.

- i) Environment includes water, air, land and their inter relationships between them and human beings, all other living organisms.
- ii) Environmental pollution means the presence of any solid, liquid and gaseous substances in certain amount which effect the environment.
- iii) Hazardous substances mean any substance (or) its preparation method which is difficult in handling & causes harm to human & other living organisms.

The act has given full power to the central government to take necessary action for protection & improvement of environment and state government also has to co-ordinate.

The main function of this act to set up:

- a) The standard of quality of air, water & soil for various purposes.
 - b) The maximum permissible level of various pollutants (including noise) for different areas.
 - c) The procedure and safe guards for handling hazardous substances in different areas.
 - d) Prohibition and restriction for handling hazardous substances in different areas.
 - e) Prohibition and restriction of industrial locations.
 - f) The procedure and safeguards for prevention of accidents and also to take remedial measures against such accidents.
- The central government has right to inspect & take sample, etc.
 - Environment (protection) rules, 1986-schedule I-IV specified the standards of prevention & pollution to improve the quality of environment especially discharge of effluents and gases from industries. But the standard may vary with medium into which it is discharged.
 - For e.g.: - BOD (Biological Oxygen Demand) are given for different medium as follows: -

BOD values (ppm)	medium
30	Inland waters
350	Public seven
100	Land (or) Coastal region

NOTE: - In sensitive areas like hospitals the standards are more stringent & it is the duty of pollution control board to check often whether the industries are following the norms (or) not.

Guidelines to state pollution control board: - Environment (protection) rules, 1986.

- a) They have to advise industries to treat waste water with best technology.
- b) They have to encourage for 3R (Reduce, Reuse & Recycle) for industries.
- c) They have to encourage the industries for biogas recovery.
- d) They have to check the permissible levels of effluents.
- e) Both state & central have to come forward to implement clean technologies in order to increase fuel efficiency & decrease pollutant level.

Amendments (changes) in Environment (Protection) rules Act, 1986-1994: Environment impact assessment (EIA) was made on various projects of which 29 should get clearance from central and remaining state pollution control board. The proposed project should be in such a way that they shouldn't exceeds the level.

The proposed project should provide

- i) EIA report.
- ii) Risk analysis report.
- iii) NOC from state pollution control board.
- iv) Availability of water & electricity.
- v) Summary of project report.
- vi) Any issues regarding rehabilitation (if more than 1000 people) displaced.

Central governments hazardous wastes (management & handling) rules, 1989: -

- i) The occupier is full & full responsible for the handling & disposal of wastes without effects.
- ii) These are 18 hazardous waste categories.
- iii) The guidelines for handling, storage, treatment, transport & disposal are also given and should be followed by the management stringently.

(b) What are the salient features of Water (Prevention and Control of Pollution) Act, 1974.

Water Act, 1974- (prevention and control):-

The preciousness of water is maintained & conserved by preventing and control of pollution. Water pollution is defined as change in the properties of physical, chemical & biological (or) discharge of wastes which causes nuisance, injurious to health, damage aquatic or other animals. So water pollution can cause any harm to any living thing.

Activities and feature are: -

- i) It provides for maintenance and restoration of quality of water.
- ii) It provides establishment of state & central boards for pollution control with powers & functions, funds, budgets etc.
- iii) It punishes with penalty for offenders.

Central pollution control board: -

1. It suggests central government to concern about prevention and control of water pollution.
2. It also coordinates with state boards & guides them.
3. Organizes training programs for prevention & control of pollution.
4. Organizes program through mass media also.
5. Statistical data is collected related pollution.
6. Suggestion and rules are formed for disposal of sewage effluents.
7. Maintenance of water quality standard measurements are followed & labs are established for analysis.

State pollution control board: - Have similar functions that of central board

- i) This board advises state government to concern about individual location to prevent pollution.
- ii) It maintains quality standard measurements for disposal of effluents from industries.
- iii) The state board takes the samples of effluents legally & sent to the labs for analysis. If the maximum limit is crossed then the unit is not supported to process.
- iv) Every industry has to obtain grant for fixed duration along with the fees for analysis of sample.
- v) It suggests efficient method for treatment & disposal of effluents.

With the development, prevention & control of pollution is also necessary for healthy life. Often, they will check the effluent treatment plans for efficiency in treating the disposal

UNIT-V

HUMAN POPULATION AND THE ENVIRONMENT

1. Write a note on Population growth? What are the factors influencing population size?

Population Growth:

In 1800, the human population is 1 billion i.e., up to 39,000 years. By 1930 it is 2 billion and by 1975 it is 4 billion. Now it reached 6 billion and by 2045 it may reach 11 billion. If we observe, the growth within few decades the population is being doubled.

Population characteristics and variations among nations:

Exponential Growth:

When a quantity increases by constant amount then it is called linear growth. e.g: 1,3,5,7, etc. But when it increases with percentage i.e., 10 , 10^2 , 10^3 , 10^4 then it is known as exponential growth. Population growth takes place exponentially and drastic change occurred in last 150 years.

Doubling time:

The time need for the population to double at constant rate is known as doubling time. It is calculated as follows:

$$T_d = 70/r$$

Where T_d = Doubling in time.

r = annual growth rate.

If a nation has 2% increase annually, then the population will be doubled in 35 years.

Total fertility rate (TFR):

It is defined as average number of children that would be born to a woman in her life time if the age specific birth rate remains constant. TFR varies from 1.9 to 4.7 in developing countries, but in 1950's it is 6.1 and however due to cultural changes and government policies it has come down.

Infant mortality rate:

It is a parameter which affects future population growth. It is percentage of infants died out of those born in a year. Any how this rate has declined in last 50 years.

Replacement level:

This is also an important concept in which two parents are replaced by two children. But this replacement may affect due to infant mortality rate. The replacement level in developing countries is 2.72 that of developed countries is 2.1.

Age structure:

Age factor can be represented in the form of pyramids based on different categories

Pre-reproductive	- 0-14
Reproductive	- 15-44
Post reproductive	- 45 & above

Based on age groups three structures obtained.

a) Pyramid shaped:

This type of pyramid shaped is seen in India, Bangladesh, Ethiopia & Nigeria. Here very young age groups are high and old age groups are less due to death

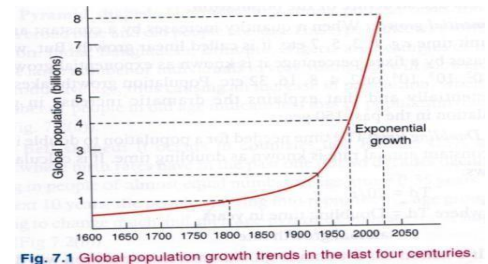
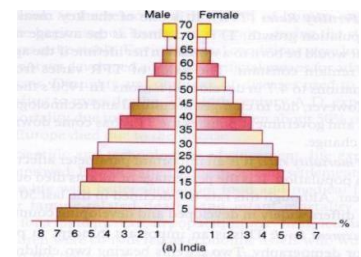


Fig. 7.1 Global population growth trends in the last four centuries.



b) Bell shaped:

This shape is seen in countries like France, USA, Canada, where birth rates are declined due to which 0-35 age people are almost equal and such age pyramids are quite stable in population growth.

c) Urn-shaped:

This shape age pyramids are seen in countries like Germany, Italy, Hungary in which very young class is smaller than middle reproductive groups.

However, population growth is affected by TFR, age structure, infant mortality, replacement level. Growth of the population occurs even when two parents have two children.

1. Developing countries like Ethiopia show pyramid shaped age structure in which TFR is 6.9. Presently it has 57 million populations which may reach to 225 million by 2050 when TFR becomes 2.1.
2. In countries like Africa, Mali, Rwanda, Uganda, Zambia, Zimbabwe the growth is affected due to AIDS. In Zimbabwe $\frac{1}{4}$, Botswana $\frac{2}{3}$ rd are died due to AIDS before reaching 50.

Zero population growth:

When birth & death rate are equal, then it is said to be zero population growth.

Male-female ratio:

The ratio of boys & girls should be balanced in the society for health environment but due to abortions the female gender has drastically decreased in many countries. In China ratio of boys to girls is 140:100.

Life expectancy:

It an average age that a new born is expected to live in a given country. Earlier the life expectancy is 40 and now it has risen to 65.5. In 1900 the life expectancy of Indians is 22.6 Y & 23.3 Y for male & female respectively, but now it had increased to 60.3 & 60.5 Y respectively. These difference in the life expectancy is due to improved medical facilities and technological advancement but in countries like Japan and Sweden the life expectancy is quite higher i.e., 82.1-84.2 & 77-77.4 Y for male and female respectively.

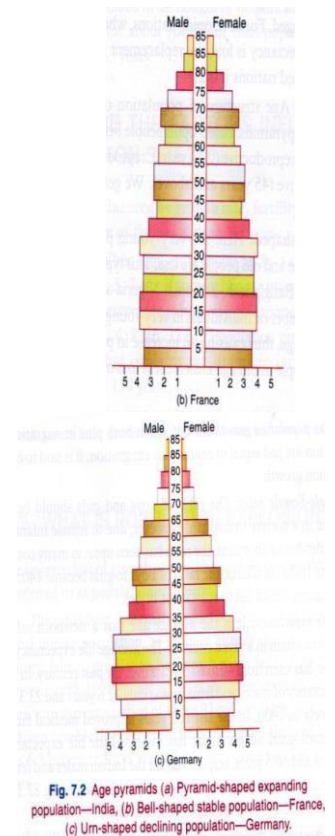
Demographic transition:

Population growth and economic development are interrelated to each other. Due to improved living condition death rates are decreased and birth rates are controlled due to which population growth is lowered and this phenomenon is called demographic transition.

2. What do you mean by (a) Doubling time (b) Total Fertility Rate (c) Zero Population Growth (d) Life Expectancy (e) Replacement level.

(a) Doubling time:

The time need for the population to double at constant rate is known as doubling time. It is calculated as follows:



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(e) Replacement level:

This is also an important concept in which two parents are replaced by two children. But this replacement may affect due to infant mortality rate. The replacement level in developing countries is 2.72 that of developed countries is 2.1.

3. (a) What is meant by 'Population Explosion'?

Population explosion:

In the past 100 years, the population growth has drastic change from 1950 to 1990 (40 years) the population has crossed 5 billion and every year 92 million increase takes place. So every year New Mexico is added (Mexico population-92 million) In the year 2000 the population is 6.3 billion and in the next hundred years they may increase by 4 times. This unpredicted growth of human population at an alarming rate is called population explosion.

The Indian scenario:

India is the second most populated country in the world with 1 billion and if it continues may reach up to 1.63 billion by 2050 & will become most populous country in the world surpassing China. So, we are facing serious population explosion problem. We should realize ourselves that do we have resource, provision for housing, education, employment for drastic population growth. If we see the population statistics of our country, it had added another India after 35 years of independence. India has 1 billion of 6 billion world population which means every 6th person is an Indian.

Every second 4.5 children are born & 2 people die due to which net gain of 2.5 person, resulting in growing 9000/hour & 2,14,000/day.

Due to population explosion, there is severe depletion in the natural resources and also environment is subjected to degradation. The non-renewable sources like land, water, fossil fuels get exhausted & even renewable sources will also be depleted. Qualities of life can be raised by industrialization & economic growth but toxic pollutants are introduced into atmosphere. There

discussion going on throughout the world that we should stabilize or even shrink the population by decreasing the fertility rates (or) we should find the alternate for the resource.

On the population growth two important views (or) ideas are discussed.

i) Malthusian theory:

According to Malthus, human population growth is exponential but the food production rate is low and so it leads to starvation, poverty, diseases, crime, etc. He believes in positive checks & preventive checks to stabilize population growth. Positive checks - famines, diseases, outbreak and violence. Preventive checks - birth control.

ii) Marxian theory:

According to Karl Marx, population growth is a symptom rather than cause of poverty, resource depletion, pollution, etc. He believed that social exploitation & oppression of less privileged people leads to poverty, overcrowding, unemployment, environmental degradation, etc.

We have to compromise with two views as all factors are interdependent & inter related to each other.

(b) Discuss the Family welfare and Family planning program.

Family welfare programs:

Population explosion is like a time bomb that could be exploded at any time, so in order to avoid that we must keep the population level below the carrying capacity. We cannot know how long we continue our exponential growth but the warning. Signals are given to control the population in terms of depletion of resources. A catastrophic doomsday model warns that earth cannot sustain more than two doublings i.e. 25 billion.

Stabilization ratio:

This is the ratio of birth rate to death rate. In developed countries this is 1 in the year 2000 & in developing nations it is around „3“. Stabilization in developing countries is only possible through various family welfare programs.

- Kerala is the only state in India with lowest birth rate. The factors that decide the model are age of marriage for woman at 21 (Indian average 18), female literacy is 53% (Indian average 13%), budget, provision for primary education 60% (Indian average 50%), better public distribution of food among 97% of population, better medical facilities in rural areas, great success of family planning programmes, etc.

Family planning:

Family planning includes restriction in number of children and the time gap between them. In earlier days also they used some tradition, taboos, folk medicine as a family planning activity.

Now modern science has provided with several birth control techniques like mechanical barrier, surgical methods, chemical pills & physical barrier to implantation. Still more hundred contraceptive methods are in trials.

In regarding family planning, the United Nations family planning agency provides funds to 135 countries. In so many countries abortion is a part of family planning in which female infant killing also takes place due to which male female ratio is affected. World Health Organization (WHO) estimated that 50% of present married couples adopt some planning to restrict the family, which is far better by 10% about 30 years back.

The Indian scenario:

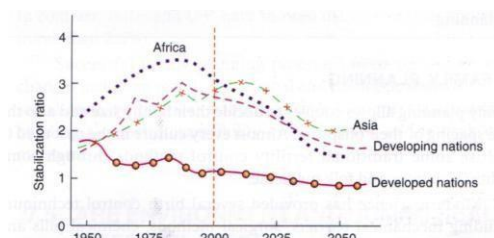


Fig. 7.3 Stabilization ratio of developing & developed nations, Africa and Asia. A ratio of 1 achieved in developed nations around 2000 indicates zero population growth in developed nations while Africa is presently having the highest ratio.

India had started family planning program in 1952 when the population was nearly 40 crores. In 1970's government forced to do family planning. In 1978 government passed legally for minimum age for marriage for men & woman is 21 & 18 (earlier 18 & 15 respectively) In 1981 census also there is no decrease in the population growth & since then funds for family planning programs has been increased.

In 2000 state government has also adopted their own approach. In regarding this Kerala had been stabilized population growth and now comparable with USA & also proving that wealth is not related to zero population growth. In 2001 A.P. also achieved zero population growth with a different approach (passing cash, better land, housing, subsidized loan, etc. are provided in regarding family planning programs) In contrast to this U.P. & Bihar showed 2.5% growth in population.

Successful family planning program includes:

Education & economic status of women, social security, political stability, proper awareness, confidence building along with accessibility, effectiveness in birth control etc.

4. Discuss the influence of environmental parameters and pollution on human health.

Environment and human health:

A physically fit person and who is free from diseases is called a healthy person. According to "WHO" health is a "state of complete physical, mental & social well-being & not complete absence of disease (or) infirmity". However human health is influenced by many factors like nutritional, biological, chemical (or) psychological, etc.

The factors are:

Infectious organisms:

Micro-organisms which cause diseases, threatens human health especially in developing countries of tropical region due to moisture & high temperature in addition to malnutrition. Microbes contaminate the food & causes food poisoning.

Some microorganisms cause respiratory diseases like pneumonia, tuberculosis, influenza, etc. & gastro intestinal diseases like diarrhea, dysentery, cholera etc. Some parasites cause malaria, schistosomiasis, filariasis, etc. These are all due to unclean & unhygienic.

Chemicals:

As a result of human activities, many chemicals are introduced into the environment mostly in the form of effluents in industries. Chemicals can be divided into two categories.

- 1) Hazardous
- 2) Toxic

Explosives, inflammables, are hazardous & a chemical that kills cells & causes death is called toxic. Some chemicals are

- | | | |
|-----------------|---|-------------------------|
| 1) Carcinogenic | - | causes cancer. |
| 2) Mutagenic | - | causes mutations. |
| 3) Teratogenic | - | affects embryo. |
| 4) Neurotoxins | - | affects nervous system. |

The pesticides & some industrial pollutants affect reproduction, development & may cause various tumors. Many chemicals like DDT, chlorinated pesticides accumulate in the food chain & affect the organism by biomagnifications. Sometimes heavy metals like Hg, Cd, Pb, etc. affect the human health. Food will be contaminated while cooking and also container of the food (e.g:-steel, etc.) various alcoholic beverages contain Pb, while tobacco contains Cd.

Noise:

Ear is capable of hearing (or) have tolerance up to certain levels of sound only if they go beyond

permissible level then it affects & damages the ear. Sound is related to various physiological & psychological changes.

Radiations:

Radiations may cause short term (or) long term changes in various organs. Cosmic rays & UV rays affect human health which may cause cancer.

Diet:

In maintenance of human health diet plays an important role. Deficient in nutrition (mal nutrition) causes many diseases (attack will be easy). Salt & fat levels are important factors in cardiovascular diseases. Due to contamination of poisonous seeds of *Argemone mexicana* cases seen in India. Some chemicals are added to polish & process some food materials like pulses, oils etc.

Settlement:

People living environment without basic needs of life like water, sanitation, etc may cause various psychological and also physiological (process) problems.

5. Discuss the salient features of draft Declaration of Human Rights and Environment.

Human rights:

The right that is given to human to enjoy this earth & its surroundings is called human rights. The foundation of human right was laid in 13th century. Due to the liberal thoughts of philosophers, scientific dogmas, socio-economic restrains are resulted. For the state of all people happy, universal declaration of human rights (UNDHR) by UNO started on December 10, 1948. This declaration protects any individuals from injustice & human rights violation. UNDHR includes specific rights, civil, political & economic, social & cultural. It also gives right to live, liberty, security, fair trial by law, freedom of thought, expression, conscience, association, freedom of movement & also stresses on equal pay for equal work, trade union, health care, education, etc.

To say, the human rights are universal. But there is a wide gap between the developing & developed countries. The reason for the violation of human rights in developing countries is population & poverty, i.e., human right are valid until a life settles for the particular individuals.

Statistical data by WHO

No. of people

Malnourished, no clean drinking water, conditions	1 of 5 health facilities, proper hygienic
No fuel to cook	1 of 3
Struggle for existence	1 of 5
Death due to drinking contaminated water	40 million

Unemployment of poor thinks that financial assistance will given by the child for sustainability against child labor & universal education. For the developed countries social & economic rights are less important than the civil & political. But in developing countries this is reverse due to poverty, ignorance, illiteracy, malnutrition & diseases.

In June 1993, at Vienna world conference on human rights, social & economical rights are equalized to civil & political. If any country follows the human rights, developing assistance will be given so due to those human rights is considered to be an important factor. Due to poor human rights in India & other developing countries affected in this regard. (nearly 24 million dollars are slashed by USA in BURTAN BILL)

In India, human rights issues have centered around slavery, bonded labor, women subordination, custodial deaths, violation against women & minorities, child abuse, dowry deaths, man killings of Dalits, torture, arbitrary detentions etc. In Indian constitution we have list of social,

economic, civil, political rights but those are violated often. (Due to money factor). For overall development & peace, we have to respect the human rights of all people.

After the human rights were confined, another issue is emerged after the earth summit 1992, i.e., sustainable development regarding environment. Declaration of human rights & environment confines a healthy secure & ecological good environment for every human being. In relation to that equity, security, basic needs should be in justified way to all.

But there are in-equities between the developed & developing countries in the depletion of natural resources. The developed countries are enjoying only the fruits of natural resources and throwing the wastes to the developing countries by export. Due to the wastes, worker class & the poor are the victims to unsafe & unclean environment (air, water, etc.) On the way of unsustainable development, the tribal people lose their habitat for projects & dams.

Draft declaration of human rights & environment: -

The draft declaration concern about rights & duties of individuals, governments, international organizations & national corporations.

The environment degradation is caused by poverty, debt programmes & international trade, once it is degraded it cannot be reversed. In addition to these violation to human rights further degraded.

The principles of the draft declaration are divided into five parts.

Part-1:

It deals with human rights with sustainable development & peace for all. It also deals with needs to lead a dignified and good quality life. It concerns about the future generation needs also.

Part -2:

It deals with human rights related with free from degrading environment & pollution. It stresses on the enjoyment of eco system with rich biodiversity. It gives rights to own native land /home & need not to be vacated unless emergency (any beneficial programme of the society). Anyone in the earth can help the other in natural/technological disaster.

Part-3:

It deals with human rights related environmental information, education, awareness & public participation.

Part-4:

It deals with human rights related duties to protect & preserve environment. It includes remedies & measures for environmental degradation & sustainable development. It also stresses that states should not quarrel regarding the resources and should respect the international law for protection of environment.

Part-5:

It deals with human rights with social justice and equity in related to natural resources & sustainable development.

Right to development has to be linked to right to safe & clean environment not only in personal but at global level. Threshold level of human rights is not defined till now.

6. Briefly discuss Value Education.

Value education:

Education is the one of the most important tools for progress of a country in economical & cultural way. Anyhow objective of education is not only giving information to meet exams & get good job but also to use at the right place within the frame work of a spectrum of ethical values.

The scientific & technological achievements brought drastic & revolutionary changes and no doubt about it. The informational technology also imparts their role i.e., anyone can sit in the internet

and get information worldwide. But due to this man had become materialistic, self-centered, over ambitious and ideals of real life have been pushed to background. So, value-based education has a very significant role in providing proper direction for youth & to get positive attitude due to which we can move towards enjoyable & sustainable future.

Value education helps in value-based judgements related to natural principle. It constitutes human values, religious values, national values, aesthetic values & environment values. Value education increases awareness about our national history, heritage, national pride, constitutional rights and duties, national integration, community & environment development.

Value education is divided into different phases i.e., value awareness, value orientation, value appraisal, value selection, value commitment & value action. But the basic aim is to create awareness about the values & as a result of this student mindset orient towards values & analyses them. So, he will take the commitment towards the values.

Value based environmental education:

Every person should have idea about environmental education. The fundamentals of environment and principles of ecology helps to manage the resources in a sustainable way and it creates that it is a duty of every citizen, such that a clean & safe environment could be hand-hovered to future generation.

From supreme court (filled M C Mehta, 1988), environmental education has been included in the curriculum right from the school/college/ university level. The main objective is to educate all environmentally, in which environment belongs to all & if we affect the environment, it re affects us.

Values of environmental education:

The values help in attaining sustainable development & also change our mindset attitude & our life styles. They are:

1) Human values:

The basic human values “man in nature” (rather than nature for man) etc. are mediated through text books because it plays an important role in building positive attitudes in the environment.

2) Social values:

In environmental education love, compassion, tolerance, justice, etc. to be included such that all forms of life & the biodiversity will be protected.

3) Cultural & religious values:

These are the values in Vedas like “*Dehi me dadami te*” i.e., you give me & I give you (Yajurveda) The cultural & religious values teach us to perform functions such as protect & nurture nature in every aspect like rivers, earth, mountains, forests, etc.

4) Ethical values:

Ethical values of environmental education should care about earth rather than human i.e., should promote earth citizen ship (welfare of earth) instead of human being supreme power.

5) Global values:

The human civilization is a part of earth planet & similarly nature & various factors over the earth are interlinked with each other by harmony. If we disturb, it causes ecological imbalance.

6) Spiritual values:

Principles of self-restraint, self-discipline, contentment, reduction of desires, freedom from greed & austerity are some of the elements added into traditional & religious part of country. All these values promote conservation.

“What is use of building beautiful house, if you don’t have a decent planet to place it on”. This can answer

“What is real development & progress”. i.e., shouldn’t develop with environmental disasters, health

hazards, destroying nature's beauty. Loss of mental peace, etc. The value elements can succeed the goals of environmental education.

7. Briefly discuss HIV/AIDS, mode of its spread and its effects on environment.

HIV/AIDS:

Acquired Immuno Deficiency Syndrome is only caused due to Human Immuno deficiency Virus (HIV)

Mode of transmission:

Blood transfusion, unprotected sex with infected person, sharing needles (or) syringes used for the infected person, mother to baby through pregnancy, breast feeding after delivery.

Note:

It is not transmitted by tears, sweat, urine, feces, saliva (during kissing) & also by sharing towel, utensils, clothing, toilet seats, insect bite, etc.

About 40 million are affected with HIV/AIDS world wide and 70% of them in sub-Saharan Africa. AIDS is fourth killing disease. In 2003 3 million people died due to HIV/AIDS. It is rapidly spreading in Europe & Asia & there will sharp increase in Russia, China & India.

Discovery:

It is discovered in 1983. Definite source of the virus could not be identified.

AIDS is a man-made epidemic produced by genetically engineered laboratory produced virus. This AIDS virus cannot kill human directly but weakens the immune power & subjectable to diseases. i.e., infectious organisms invade into human body easily when immune system is affected. Alcoholic consumption increases the invasion of AIDS. Most of the evidence states that AIDS has spread from Africa & that too transferred from African monkey (white sooty mangabeys) or chimpanzees to human.

HIV-India Context: In India about 6 million people are affected with HIV & it is serious in A.P, Karnataka, T.N, M.H, Nagaland, and Manipuri where it has crossed 1% mark among pregnant women. In Manipur & Chennai HIV are found to be transmitted through injecting drug & more in sex-workers.

Some of the people believe that HIV has spread through vaccine programs & it is as follows:

- HIV has spread in Africa through HIV contaminated polio vaccine prepared by using monkey's kidney.
- It has spread through Hepatitis-B viral vaccine in New York, Los angles, San Francisco.
- It has spread through small pox vaccine programme of Africa.

Effects of HIV / AIDS in Environment:

Due to AIDS, large no. of deaths occurs by which local environment & natural resources are affected, they are loss of labour, etc. With decrease in the no. of population and lack of experience results in difficult to look after the perennial crops & due to which production is affected. If the deaths are of forest workers, then forestation, soil conservation, etc are affected & demands for fuel wood will be increased. Excess of water is required for maintaining the sanitation in AIDS affected region. HIV affected person cannot perform work efficiently.

AIDS Vaccine: Monkey trails.

The AIDS affected monkey lives long & so got idea to make vaccine. As a part of research, it is discovered how HIV destroys the immune system. Norman Letvin of Harvard Medical school, Boston believed that the vaccine helps to live longer without ill & doesn't prevents.

Prevention & highlights was released by US center for disease control and prevention. In 1980's researchers believed that there is a chance to make vaccine but in 1981, 25 million was died due to this.

Norman Letvin team vaccinated Simian Immune deficiency Virus (SIV) against monkey which similar to that of HIV.

Most of the vaccines stimulate to produce antibodies which develop immune response against a particular virus/ bacterium but not for HIV. Second type of immune response called cell mediated immune response which fights against AIDS virus by T-cells.

NOTE:

Monkeys who get the SIV vaccine live much longer when they are later infected with HIV living up to 900 days while the unvaccinated one die on average of 300 days.

8. Discuss various issues and measures for women and child welfare at international and national level.

Women & Child welfare:

Women & child are ultimately sufferers as they are weak and economically dependent.

Women welfare:

A woman usually suffers from different issues like gender discrimination & devaluation at home, workplace, marriages, power, public life particularly in developing countries. Women are subjected to gender violence, victimization & harassment, etc. From the data of ministry of women & child development, states that immediate attention should be drawn towards abduction, dowry deaths, rape, domestic violence, criminal offenses, mental torture of women in the interest of them. The human rights of women are violated often. So, stringent legislation should be formed. Now there are many women groups also known as women cells, who cares for different welfare & legal issues. The ministry for women & child development works for welfare & upliftment of women such as family planning, health care, education, awareness etc.

The exploitation of nature not only affects the environment but also family life of women, such as rehabilitation from native place of forests for project, mining, etc, activities. men will be given compensation or work but the women will be confined to household purposes only as they did not get any compensation & will be dependent on men. If at all they had given work, it is highly unorganized & often humiliating socially, so the *National Network for Women & Mining* (NWWM) with about 20 groups fighting for a gender audit of India's mining companies, resettlement & compensation issues.

Apart from government bodies, the non-government organization (NGO'S) mostly mahila mandalas creates awareness amongst women of remote villages to empower, train, educate them & to live self-dependent.

At intentional level the United Nations decade for women (1975-85) included several women welfare related issues. The land mark outcome of the decade is elimination of a form of discrimination against women has been accepted as international standard for the protection & promotion of women's human rights. The most important thing is women to be educated about these issues.

Child welfare:

Children are the assets of a society. From a statistical data –1 million in 21 million infants are abandoned & in India due to different socio-economic reasons. Around 20 million children are working a child labor, some in hazardous industries like matches, fireworks, brassware's, potteries, etc & reasons to work is poverty. They work hours together in unhealthy condition without nutritive food, etc.

The UN general assembly in 1959 adopted the declaration of the rights of a child & after that in 1990 it become international law with 54 articles to promote & protect the well-being of children in a society.

The law defines right of the child

- i) to survival
- ii) Protection
- iii) Development
- iv) Participation

1. Right to survival includes good standard of living, good nutrition & good health.
2. The right to protection means freedom from exploitation, abuse human treatment & neglect
3. Right to development includes education, social security, early childhood care & support, etc
4. Right to participation means freedom of thought, conscience & religion and appropriate information to the child.

The world summit on children held on September 30, 1990, in which well-being of the children targets are discussed, India also agrees with world declaration on survival, protection & development of children. A national plan of action for children has been formulated by the *Ministry of Human Resource Development (MHRD)*.

Government of India in a strategic plan has formulated for children's welfare regarding health, education, nutrition, clean & safe drinking water, sanitation & environment. Some more important activities also involved, they are up gradation of home-base skill, mid –day meals scheme, etc.

Children are also victims of environment pollution as they consume more amount of water, food, air than adults. Reports of Centre for Science and Environment (CSE), New Delhi says that biggest threat to children is water borne diseases & 6 million children are affected by this way. Children are also affected by cancer in which 6% is increasing per year. Even foetus is also affected due to environmental toxins. So, we have gathered and work to handle safe, secure environment to our children.

9. Discuss the role of Information Technology in Environment and human health.

Role of information technology in environment and human health:

It has tremendous potential use in the field of environment education when compared to business, economics, politics etc.

Development of internet facilities, WWW (World Wide Web), GIS (Geographical Information System), etc, created a platform of update information on various aspects of environment & health, in addition to many software has been developed.

Database on environment & health:

Collection of inter- related data on various subject is known as database. It is stored in the computer & can be taken whenever required as it is arranged in a systematic way which is easy to manageable. These are several distribution information center's (DICs) in our country which are linked with each other and also with central information network having access to international database.

The ministry of forest & environment, government of India are maintaining a database of biotic communication in which wild life conservation, forest cover, etc, are maintained, in addition to this disease like HIV/AIDS, malaria, fluorosis, etc, are also maintained.

Some of the information systems are:

- a) Environment information system (ENVIS): The ministry of environment and forests came to know the importance of environmental information & in 1982 December ENVIS has established and agenda of this is to provide information to decision makers, policy makers, scientists, engineers, research workers all over the world.

ENVIS has number of centers which is collaborated with ministry of environment & forests. Due to wide network of ENVIS, it is considered as National Focal Point (NFP) for INFOTERRA, global information network of United Nations Environment Programme (UNEP). To strengthen

ENVIS in-terms of sustainable development in India, 85 centers are in process in which 81 are established which includes government department, NGO's, etc.

The centers (ENVIS) create websites on specific environment related subjects & also establish linkages with all information sources. They create data bank selected parameters in the subject, identify information gaps, publish newsletters and bulletins.

The ENVIS center also maintains the data bases of (pollution control, clean technologies, remote sensing, coastal ecology, biodiversity, western Ghats and eastern Ghats, environmental management, media related to environment, renewable energy, desertification, mangroves, wildlife, Himalayan ecology, mining etc. The National institute of occupational health maintains the database of health aspects of people in hazardous and non-hazardous industries, safety measures, etc.

The Major objectives of ENVIS are

- 1) To build a repository and dissemination center in Environmental Science and Engineering.
- 2) To change to modern technologies of acquiring, processing, storage etc.
- 3) To support and develop R & D with innovation in environmental information technology.
- 4) To provide national environmental services in-order to meet the future needs.
- b) National Management Information System (NMIS): Department of Science and Technology (DST) maintains the database of R&D projects with concerned scientists also.
- c) Geographical Information System (GIS): - The Photographs of satellites provides us actual information about various physical and biological resources and to some extent about degradation of environment. We can also get the information like water logging, desertification, deforestation, mineral and energy reserves, etc. So, it is proved to very effective tool in environmental management.

A large number of inter-related (or) inter dependent aspects of thematic maps are superimposed by GIS technique, in relation to this several software's are developed. The thematic map containing digital information of water resources, industrial growth, human settlements, road network, soil type, forest land, cropland etc.

Applications of GIS:

- 1) It is useful in future land use planning.
- 2) Polluted zones, degraded (or) diseased croplands, etc can be interpreted by GIS.
- 3) Suited areas for industrialization can be planned.
- 4) It can check unplanned growth and related environmental problems.
- 5) Forest cover and its conservation can be known by satellite data.
- 6) GIS also gives information regarding monsoon, ozone layer depletion, inversion. etc.
- 7) New resources of oil, minerals, etc, can be determined using remote sensing satellites.
- 8) It also helps in identifying disease infected areas especially malaria, schistosomiasis, etc.

Thus, remote sensing and GIS play a key role in resources mapping, environmental conservation, management, planning and environmental impact assessment.

10. Prepare a field report of the visit of a hill site.

Study of hilly area:

- i) Background data: Note down the name of the mountain ranges or the hills. Note down the altitude of the region. Find out the average annual rainfall and temperature in the area.
- ii) Observations on natural vegetation: Make your observations on the forests on the present hill slopes. Do you find dense forests on the hills or deforestation is observed in some areas?

<u>Sl.no</u>	<u>Environmental characters</u>	<u>Observation</u>
1	Topography	
2	Climate	
3	Soil conditions	
4	Plants	
5	Animals	
6	Degradation (if any)	
7	Impact of Degradation (if any)	

Photography

With the advent of smart phones, an almost unlimited number of high-quality photographs can be taken of the objects, events, and people observed during a field study. Photographs can help capture an important moment in time as well as document details about the space where your observation takes place. Taking a photograph can save you time in documenting the details of a space that would otherwise require extensive note taking. However, be aware that flash photography could undermine your ability to observe unobtrusively so assess the lighting in your observation space; if it's too dark, you may need to rely on taking notes. Also, you should reject the idea that photographs represent some sort of "window into the world" because this assumption creates the risk of over-interpreting what they show. As with any product of data gathering, you are the sole instrument of interpretation and meaning-making, not the object itself.

Video and audio recording:

Video or audio recording your observations has the positive effect of giving you an unfiltered record of the observation event. It also facilitates repeated analysis of your observations. This can be particularly helpful as you gather additional information or insights during your research. However, these techniques have the negative effect of increasing how intrusive you are as an observer and will often not be practical or even allowed under certain circumstances [e.g., interaction between a doctor and a patient] and in certain organizational settings [e.g., a courtroom].

Illustrations/Drawings

This does not refer to an artistic endeavour but, rather, refers to the possible need, for example, to draw a map of the observation setting or illustrating objects in relation to people's behaviour. This can also take the form of rough tables, charts, or graphs documenting the frequency and type of activities observed. These can be subsequently placed in a more readable format when you write your field report. To save time, draft a table [i.e., columns and rows] on a separate piece of paper before an observation if you know you will be entering data in that way.

Unit-3 Assignment questions

ENVIRONMENTAL POLLUTION AND SOLID WASTE MANAGEMENT

- 1. Define Air pollution. Explain its causes, effects and control measures of Air pollution.**
- 2. Explain in detail about Water pollution causes, effects and control measures of water pollution.**
- 3. Explain about the solid waste management? What adverse effects can solid waste can cause? How can a solid waste be managed?**

Unit-4 Assignment questions

UNIT 4: SOCIAL ISSUES AND THE ENVIRONMENT

1. Define pollution? Explain about the Urban problems related to energy?
2. Explain about the water conservation? What is rainwater harvesting? Write the methods of rainwater harvesting?
3. Explain about the global warming?

Unit-5 Assignment questions

UNIT 5: Human Population and the Environment

1. Write a note on Population growth? What are the factors influencing population size?
2. Discuss the salient features of draft Declaration of Human Rights and Environment
3. Briefly discuss HIV/AIDS, mode of its spread and its effects on environment.