SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY :: PUTTUR
(AUTONOMOUS)

Subject with Code : Environmental Science(20HS0801) **Year &Sem : III-B.Tech & IISEM**
Branch : B.Tech – CSE,CAD,CSM,CCC,CAI,CIC,CE,AGE **Regulation : R20**

QUESTION BANK WITH ANSWERS

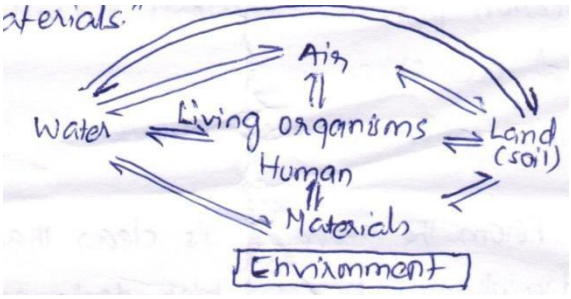
UNIT-I

NATURAL RESOURCES

1. Define Environment. Explain the need of public awareness towards environment. [CO1][L2][10M]

Ans: 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.



Need for public awareness:

Conferences:

Environmental issues led to many problems. So, to draw attention from the globe conference held on 5thJune, 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 ispopularly known as earth summit (1992).
- Another summit on sustainable development held at Johannesburg (2002). In this, issues of the environmentwere discussed.

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

Awards: For the first time an environmentalist got the Nobel Prize, this made the land m

and also shows that interest in global environment concern. Wangari Maathai awarded Nobel prize in 2004 for her contribution to sustainable development, democracy and peace. Wangari Maathai is Kenya"s deputy environment minister and also founder of Kenya based green belt movement. In this movement woman has planted about 30 million trees across Africa. This helped in conservation of wild life. Maathai gave a beautiful slogan "when we plant new trees we plant the seeds of peace".

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 tress 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.

Concept of Ecomark: To get awareness, the concept of eco mark was introduced, i.e., product to be marketed in such a way that it is eco-friendly product & has no harm in the disposal, etc. In this relation Eco-clubs & Eco task force was launched by the government. Now a days it is fashion that everybody talk about the environment, but only a few have clear cut idea and still fewer people have actual experience and interest about it. But this awareness is becoming a political issue.

"Environment is very wrongly taken as a fashion by all walks of life, ha realizing that is our real life- situation and our sustenance and security are at state

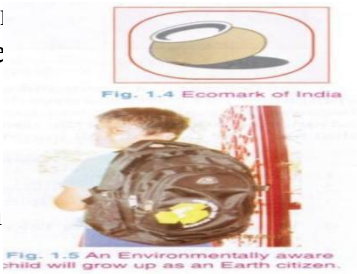


Fig. 1.4 Ecomark of India

Fig. 1.5 An Environmentally aware child will grow up as an Earth citizen.

The awareness about the environment is compulsory because

1. Environment belongs to all, such that everyone should participate inimplementation of environment protection plans.
2. To change the mindset of the modern society, environmental awareness is needed.
3. There is need to create awareness regarding health issues i.e., to live in a clean & healthy environment.
4. Keeping in the mind of future generations, there is no other option that we have to educate aboutenvironment awareness.

2. Discuss Scope and Importance of Environmental studies. [CO1][L2][10M]

Ans: Scope: As it is a multidisciplinary subject, it has wide scope. The environmental studies comprises 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 the 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 are listed as follows:

3. 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 ligitation (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.

4. 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.

5. 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.

6. Green media:

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

7. 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**

World wet land day	-February 2
World forest day	- March 21
World day for water	-March 22
World metrological day	-March 23
Earth day	-April 22
International biodiversity day	-May 22
Anti tobacco day	-May31
World environment day	-June 5
World ocean day	-June 8
World population day	-June 11
Ozone week	-September 16-23
World care free day	- September 22
Green consumer day	- September 28

World farm animal day	- October 2
World habitat day	-October 3
World animal welfare day	-October 4
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

Global verses local nature of environment:

Activities of environment can be socialized or globalised. Global issues are global warning, depletion of ozone layer, dwindling forests and energy resources, loss of global biodiversity etc. local issues are mining of hydro electric project, disposal of waste, lake (or) river pollution, Soil erosion, water logging, salinization of soil, flourosis, etc. So in order to know and rectify problems, people should be environmentally educated.

Individualistic nature of environment:

As the issues of the environment becoming more serious, are has to understand and have the solution of problems raised due to those issues. If we want to live in a clean, healthy and hygienic conditions means we should be aware of the environment. If we want to live in authentically beautiful, safe & secure environment (or) if we want to hand over clean & safe earth to our future generations, it is most essential to understand the basics of environment.

3 (a) Differentiate Renewable and non-renewable resources with examples [CO1][L4][5M]

Ans: 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:

1) **Renewable resources:** These resources are in-exhaustive and can be regenerated within a span of time.
Eg: Forest, Wild Life, Wind energy, Hydropower Solar energy.
2) **Non-renewable resources:** This resources are exhaustive and cannot regenerated
Eg: fossil fuels like coal, petroleum, etc.

Even our renewable resources become non-renewable if the rate of regeneration is less than the rate of consumption. If any species is exploited too much than it fall below the threshold level, followed by endangered and extinct. So, we have to be careful in consuming the natural resources such that it should be available for future generations (we should not exhaust them). We shall discuss a

1) Forest resources
2) Water resources
3) Mineral resources
4) Food resources
5) Energy resources

Fig. 2.1 Forests give us a variety of valuable gits as materials and services.

3 (b) What are the uses of forest? **[CO1][L1][5M]**

ANS: 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:

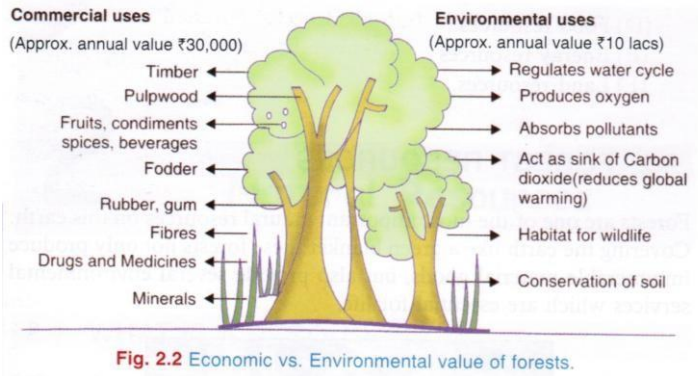


Fig. 2.2 Economic vs. Environmental value of forests.

1) **Production of O_2**: The trees generate O_2 by photosynthesis, which is very important to the life and so called earth lungs.
2) **Reduces global warming:** The main green house gas is CO_2, which is responsible for global warming. This CO_2 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 absorbs 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 CO_2. They also absorbs noise and their by reduces sound pollution.

4 (a) What are the major causes of deforestation? **[CO1][L1][5M]**

Ans: 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 forest 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 are used for packing of tea leafs 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 are subjected to fires (or) man may induce it, which causes major loss to forests.

Major consequences - Deforestation (problems)

a. Many wildlife species are affected because their habitat (home), forests are subjected to destruction.
b. Due to loss in forest, biodiversity is also lost.
c. Hydrological cycle is affected such that it influences rainfall
d. Soil erosion
e. Landslides in hill stations
f. Global warming- due to increase in CO_2.

4 (b) What are the effects of deforestation on Environment? [CO1][L1][5M]

ANS: Some of the effects of deforestation are listed below:

a) Effect on climate

Global warming

Less rainfall

Hot climate.

b) Effect on biodiversity

Loss of medicinal plants.

Loss of timber, fuel wood.

c) Effect on resources

Loss of land resource

Loss of soil fertility

Soil erosion

Drastic changes in biogeochemical cycles

d) Effect on economy

Increase in medicinal values

Demand of industrial products.

e) Effect on food

Loss of fruit production

Loss of root based foods.

5(a) Discuss briefly droughts and floods. [CO1][L2][5M]

ANS: 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.

5(b) Discuss the use and over exploitation of water resources. [CO1][L2][5M]

ANS: 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 depends 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 m^3 water per year (which is many time compared to most of the developing countries).

Water - Precious:

Earth is covered by water $1/3^{rd}$. But 97% of water is salty and not fit for drinking, only 3% of water is available and that too large amount is locked as polar ice caps and just 0.003% is readily available for use (ground and surface water). Ground water is extensively used for drinking, irrigation & domestic purposes, which led to decrease (rapidly). Due to pollution many of the water bodies becomes unfit for usage. Industries releases effluents into the water bodies without cleaning it.

As per United Nations estimation 2002, 101 billion people do not have safe water to drink, 2.2 billion do not have good sanitation. With increasing in demands water would become shortage by 2024, 2/3rd of population would suffer from this.

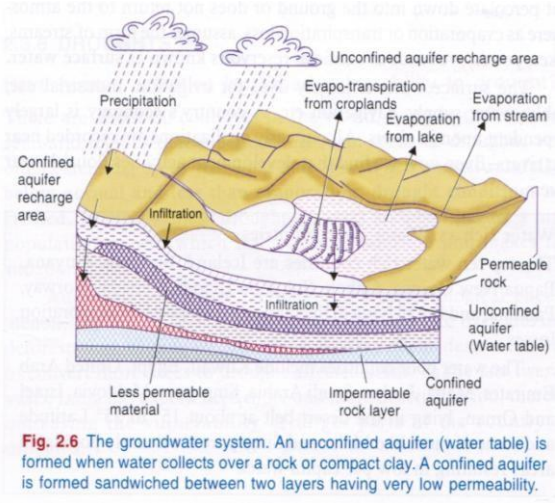


Fig. 2.6 The groundwater system. An unconfined aquifer (water table) is formed when water collects over a rock or compact clay. A confined aquifer is formed sandwiched between two layers having very low permeability.

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. Sediment of rock which holds water is called aquifer. Aquifers are of two types:

1) *Unconfined aquifers*: These are permeable and present in deeper areas and can be recharged by rain water.

2) *Confined aquifers* : 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.

6. Define Aquifer. Discuss its types with the diagram. **[CO1][L2][10M]**

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7.What are major causes for conflicts over water? Discuss one international and One inter-state water conflict. **[CO1][L2][10M]**

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

The Indus water treaty

After the partition of India and Pakistan in 1947, an understanding on the sharing of water of Indus river between two countries became necessary to facilitate the development of water resources of this basin. After prolonged talks between two countries, it was signed for an agreement. According to this, three western rivers (The Jhelum, Chenab and Indus) were allocated to Pakistan and three eastern rivers (The Ravi, Beas and Sutlej) were allocated to India. In addition to these certain restrictions were made:

- India has not been allotted to build storages (reservoirs) on the rivers allocated to Pakistan.
- More restrictions are imposed to India and less for Pakistan, as it is in lower riparian (part).

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 Tamilnadu for Cauvery. Karnataka claims that the agreements were made heavily in favour of Tamilnadu. Both states have increasing demands for agriculture and industries. Tamilnadu occupy downstream region and Karnataka is in upstream region and refuses to give water. An agreement was made on 2nd june 1990, such that 205 TMCF of water should be maintained in the Mettur dam of Tamilnadu. Based on this agreement made, farmers of delta region of Cauvery belonging to Tamilnadu 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 Tamilnadu as agreement made but releasing only the excess water that they have.

The Sutlej Yamuna dispute

The issue of sharing Ravi-Beas water and Sutlej Yamuna Link (SYL) issue between Punjab and Haryana is being discussed again & again and the case is in Supreme Court. The Supreme Court ordered to Punjab government to complete construction of SYL canal, as case filed by Haryana state. If Punjab constructs the canal of remaining 10 % (90 % of canal was already constructed by Haryana), this would enable to two states to share water from the river as per the award.

Water Conflict in the Middle East

Three major rivers are shared in the Middle East. They are Tigiris-Euphrates, The Jordan and The Nile. Ethiopia controls 80 % of the water flow and Sudan too is diverting water of Niles 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 Tigiris-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.

8. **Discuss the major environmental impacts of mineral extraction.** **[CO1][L1][10M]**

ANS: 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

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

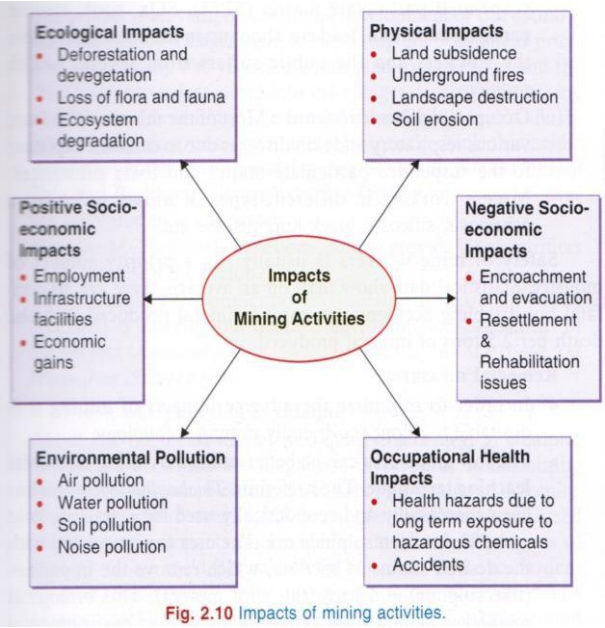


Fig. 2.10 Impacts of mining activities.

Impacts:

The impacts due to mining activities are

i) Devegetation & defacing of landscape:

Vegetation, bio diversity is lost for the mining activity. Sometimes large scale of deforestation is done which leads to several ecological losses. In addition to this top soil is also removed, which affects the landscape also. Due to this aesthetic value is affected & also it is prone to soil erosion.

ii) Subsidence of land:

This is mainly due to underground mining. It results in fitting of building, cracks in houses, building of roads, bending of rail tracks & leaking of gas from cracked pipe line leading to serious disasters.

iii) Ground water contamination:

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 pollutes the surface water streams, leading to health hazards.

v) Air pollution:

Due smelting of minerals/ores, the pollutants enters 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 works in mines suffers from various respiratory diseases, skin diseases, asbestosis, silicosis, etc, due to continuous exposure to particular matter.

9. (a) What are the uses of minerals and it's Exploitation? [CO1][L1][5M]

ANS: 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 equipments (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, diamomd, quartz, feldspar etc
2) Metallic: eg: bauxite, laterite, haematite, etc.

Human beings has 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'

MAJOR RESOURCES OF METALS AND THEIR USES

S. No.	*Metal*	*Major World reserves*	*Major uses*
1.	Al	Australia, Gvinea, Jamaica	packing food items ,transportation, utensil, electronics
2.	Cr	CIS, South Africa	for making high strength steel alloys, textile/tanning
3.	Cu	USA, Canada, CIS, Chile, Zambia	electric and electronic goods, buildings, constructions
4.	Fe	South Africa ,Canada, US, CIS	heavy machinery, steel products for transportation
5.	Pb	North America, USA, CIS	leaded gasoline, paints, communication
6.	Mn	South Africa, CIS, Brazil, Gabon	making high strength & heat resistant steel alloys
7.	Pt	South Africa, CIS	auto mobiles, catalysts, electronics, medicines
8.	Au	South Africa, CIS, Canada	ornaments, medicines, electronics, aero space
9.	Ag	South Africa, Canada, Mexico	photography, jewelry, electronics
10.	Ni	CIS, Canada, New Caledonia	catalyst

NON-METALS AND THEIR USES:

Non-Metalic Minerals	*Major Uses*
Silicate minerals	sand & gravel for construction, bricks, painting etc
Limestone	used for concrete, building stones, used in agriculture for neutralizing acid soils
Gypsum	used in plaster wall board, in agriculture
Potash, phosphorite	fertilizers
Sulphur pyrites	used in medicine, car battery, industry.

From the above data it is clear that CIS (common wealth of independent states i.e., 12 republics of former USSR), USA, Canada, South Africa & Australia are major sources of most of metallic minerals. Due to this USA become richest & most powerful nation (<200 years). Japan without any reserves, developed technologically, & sustained with its economy.

Classification of minerals: Based on the requirement minerals are classified into two.

a) **Critical minerals:** Required for the economy of a nation. eg: Fe, Al, Au, Cu, etc.
b) **Strategic minerals:** Required for defence of a country. eg: Mn, Co, Pt, Cr, etc.

Some major minerals of India:

A. ***Energy generating minerals*****:**
   i. *Coal & lignite***:** West Bengal, Jharkhand, Orissa, Madhya Pradesh, Andhra Pradesh.
   ii. *Uranium (pitch blend (or) ore)***:** Jharkhand, Andhra Pradesh, (Nellore, Nagaland), Rajasthan (Ajmer).

B. Commercial minerals:
   i) *Al (bauxite ore)*: Jharkhand, West Bengal, Maharastra, Madhya Pradesh, Tamil Nadu.
   ii) *Fe (haematite & magnetite)***:** Jharkhand, Orissa, Madhya Pradesh, A.P, T.N, Karnataka, Maharastra.

iii) *Cu (copper pyrites)*: Rajasthan (khetri), Bihar, Jharkhand, Karnataka, M.P, W.B, A.P, Uttarakhand.

(b) Write a brief note on Nuclear Energy. **[CO1][L1][5M]**

ANS: 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.

$$\underset{92}{^{235}U} + \underset{0}{^{1}n} \longrightarrow \underset{36}{^{92}Kr} + \underset{56}{^{141}Ba} + 3\,\underset{0}{^{1}n} + \text{energy}$$

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

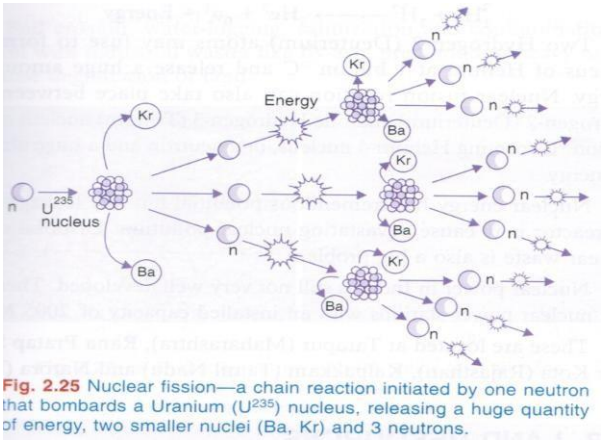


Fig. 2.25 Nuclear fission—a chain reaction initiated by one neutron that bombards a Uranium (U^{235}) nucleus, releasing a huge quantity of energy, two smaller nuclei (Ba, Kr) and 3 neutrons.

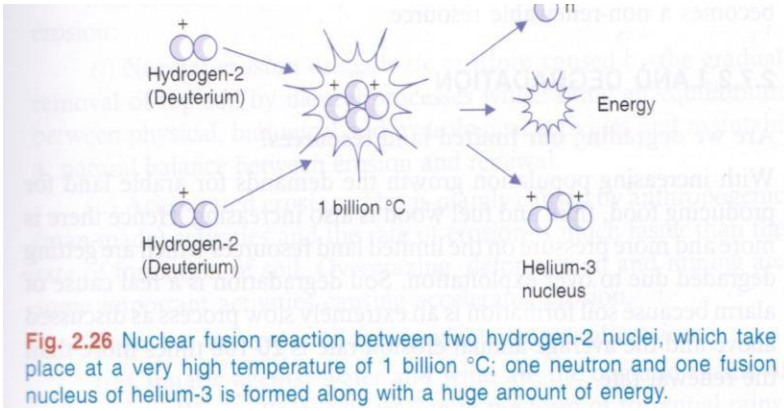


Fig. 2.26 Nuclear fusion reaction between two hydrogen-2 nuclei, which take place at a very high temperature of 1 billion °C; one neutron and one fusion nucleus of helium-3 is formed along with a huge amount of energy.

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

$$\underset{1}{^{2}H} + \underset{1}{^{3}H} \longrightarrow \underset{2}{^{4}He} + \underset{0}{^{1}n} + \text{energy.}$$

One Deuterium ($_1H^2$) & tritium ($_1H^3$) combines to form $_2He^4$ at 100 million ^{o}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. Summarise on solar energy, wind energy and Hydropower Energy resources. [CO1][L2][10M]

a) ANS: 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. Eg: Stoves, bricks, glass, etc. Active solar heat collectors are pumped through medium like water (or) air, normally placed on building top.

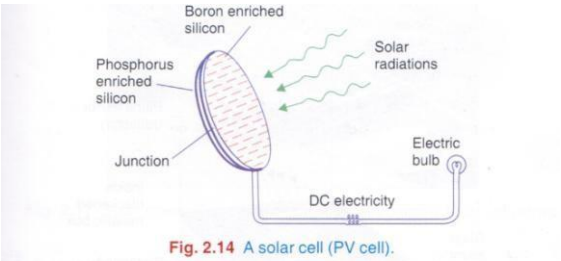


Fig. 2.14 A solar cell (PV cell).

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 gets 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.

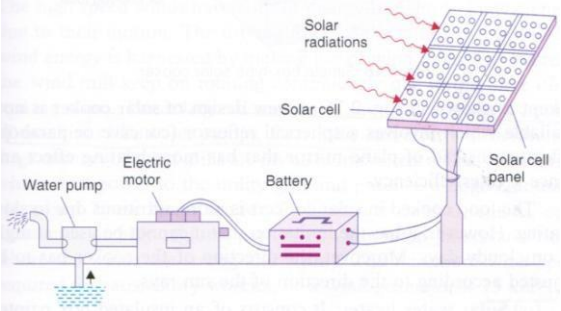
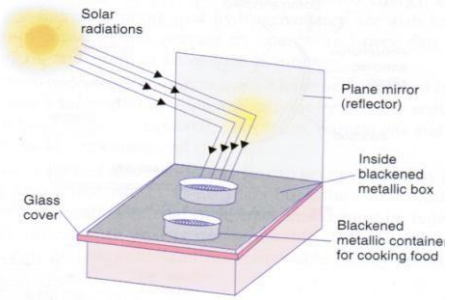


Fig. 2.15 A solar pump run by electricity produced by solar cells.

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


Fig. 2.17 Solar power plant with thousands of concave solar reflectors.

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 utilised 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) Hydropower:

In dams water is stored from rivers. The stored water in dams are made to fall from height into the turbines situated (or) fixed at the bottom. The turbines are rotated by which mechanical energy is converted into electrical energy. We can also construct mini hydal project in the hilly areas, but the minimum height required is 10 meters. India has power to generate $4x10^{11}$ KWH (estimated) but only 11% is utilized. It does not cause any pollution and also renewable, check floods, used for irrigation, navigation etc., but the problems are deforestation, land clearance etc.,

Fig. 2.19 Hydroelectric power (Dam)

UNIT-II

ECOSYSTEMS

1. Describe the structure and functions of an Ecosystem. **[CO2][L3][10M]**

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

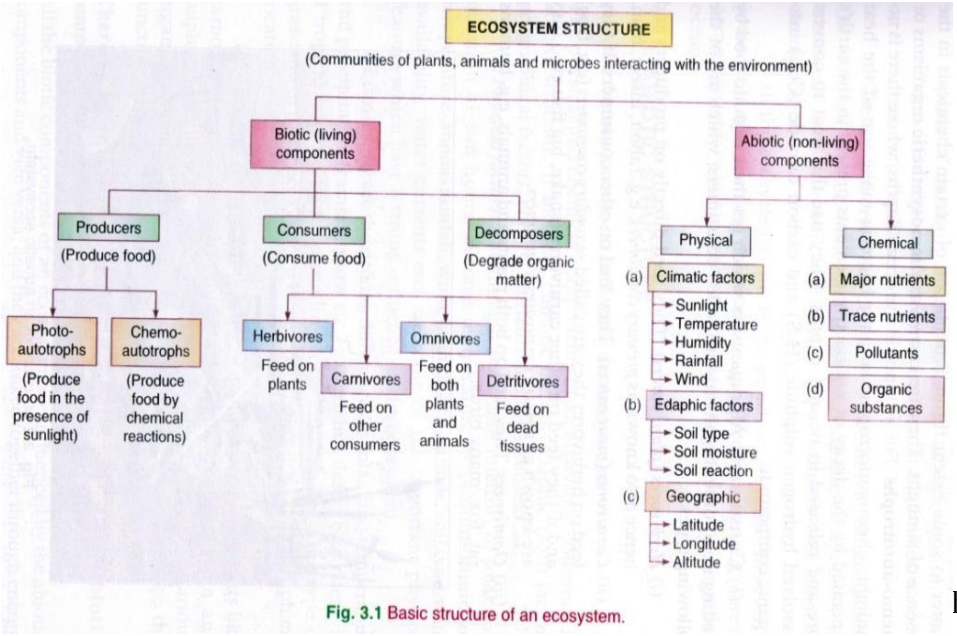


Fig. 3.1 Basic structure of an ecosystem.

Structural features of ecosystem:

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

I. Biotic component:

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

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

hlorophyll) in the presence of sunlight.

Sunlight

$$6\,CO_2 + 12\,H_2O \xrightarrow{\text{Cholorophyll}} C_6H_{12}O_6 + 6\,H_2O + 6O_2$$

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 oxidise H_2S & CO_2 in the absence of sunlight with the help of heat into organic compounds.

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

8. Herbivores (plant eaters)**:**

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

Eg: rabbit, insect, man etc.

9. 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.

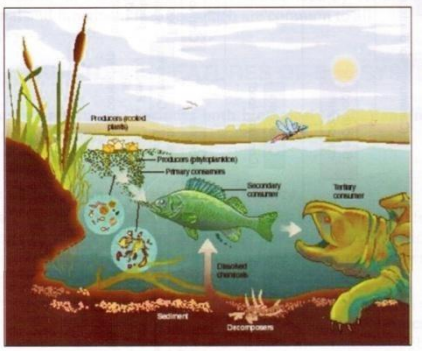


Fig. 3.2 Structure of an aquatic ecosystem.

10. Omnivores:

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

11. Detritivores:

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

- **Decomposers:**

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

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

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.

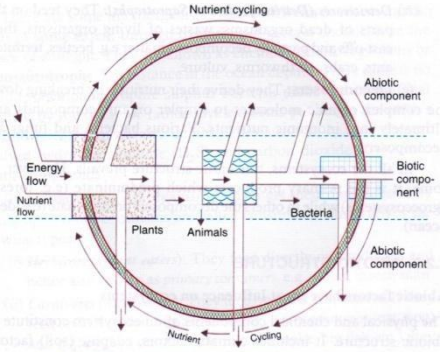


Fig. 3.3 Nutrient cycling and energy flow mediated through food-chain. The flow of energy is unidirectional while the nutrients move in a cyclic manner from the abiotic to biotic (food chain) to abiotic and so on.

- **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.

- **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.

Functioning of ecosystems:

Under natural conditions, ecosystem performs in a systematic way. Flow of energy is undisturbed until on external force acts on it. Apart from energy, nutrients and water also required for life process in biotic components. The functional attributes are:

- Trophical structure (food chain & food webs)
- Flow of energy.
- Nutrient‟s cycle.
- Primary & secondary production.
- Regulation & development of ecosystem.

2. What are biogeochemical cycles? Describe the carbon cycle and nitrogen cycle. [CO2][L3][10M]

Nutrient's cycles:

Apart from energy flow, the nutrients also flows in the ecosystem, but their flow is in a cyclic way.

Eg: C, N, S, O, P, etc. (in hydrological cycle, the water moves in a cyclic path)

The nutrients flow from producers to carnivores and ultimately reach the detritus food chain and again they are converted into nutrients and continue the cycle. The different cycles are:

Carbon cycle:

Nature has a well balanced carbon cycle until they are interrupted by human activities.

- CO_2 present in the atmosphere is utilised by plants in the process of photosynthesis, by this it produces food materials (carbohydrates)

- These food materials are utilised by consumers and followed by detritivores. Decomposition of all death organisms by micro organisms leads to the formation of CO_2 which is released into atmosphere.
- In between these process, all the organisms releases CO_2 by respiration into atmosphere, which is utilised by plants.
- Now a days due to anthropogenic activities (man made activities) carbon cycle is disturbed. i.e., the levels of CO_2 are increased enormously in the atmosphere creating imbalance. Due to this world is facing serious problem (global warning)

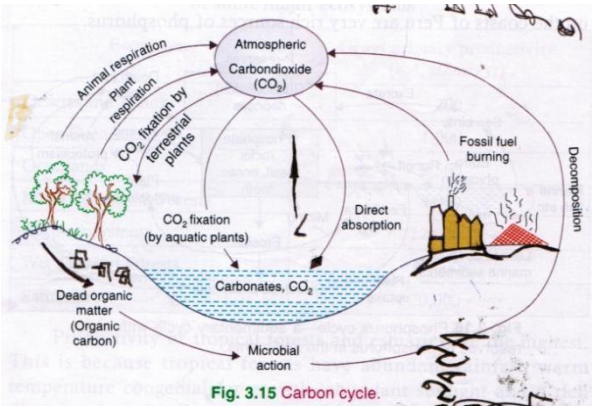


Fig. 3.15 Carbon cycle.

Nitrogen cycle:

- Atmospheric air comprises of 78% N_2, but it is not utilised directly by the plants. The N_2 is fixed by physical (lightening) or biologically (some bacteria Eg:- cyanobacteria, rhizhobium etc)
- The N_2 utilised by the plants with the help of bacteria is used to synthesize amino acids, proteins, vitamins etc.
- This N_2 is passed into the successive trophic levels. Finally death of all organisms (plants and animals) takes place followed by the decomposition by ammonifying, nitrifying bacteria which convert them into NH_3, NO_3^-, NO_2^- etc which is again used by plants.
- Some bacteria converts NO_3^- into atmospheric N_2 & released back into the atmosphere, but a little amount of N_2 is lost into deep sediments of oceans.

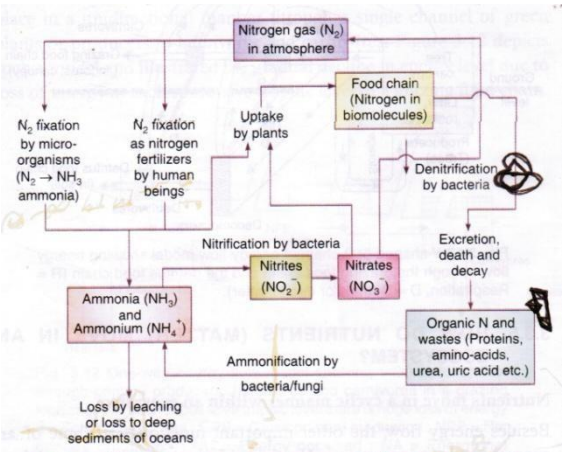


Fig. 3.14 Nitrogen cycle—a gaseous cycle with major reserve in atmosphere (N_2 : 78%). The boxes represent pools of Nitrogen in atmosphere/soil/water. Circulation occurs due to conversion of nitrogen from one form to another by microorganisms.

3. Define Ecological pyramids. Explain different types of ecological pyramids with neat Sketch. [CO2][L2][10M]

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.

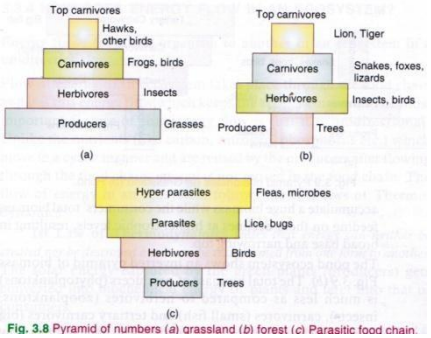


Fig. 3.8 Pyramid of numbers (a) grassland (b) forest (c) Parasitic food chain.

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.

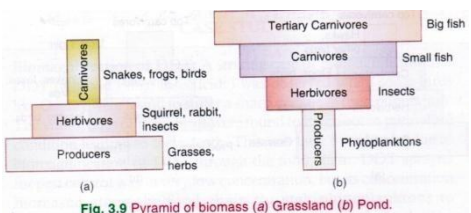


Fig. 3.9 Pyramid of biomass (a) Grassland (b) Pond.

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.

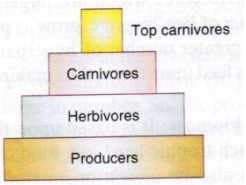


Fig. 3.10 Pyramid of energy.

4. Discuss the models of Energy flow in an Ecosystem. **[CO2][L2][10M]**

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

5) **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

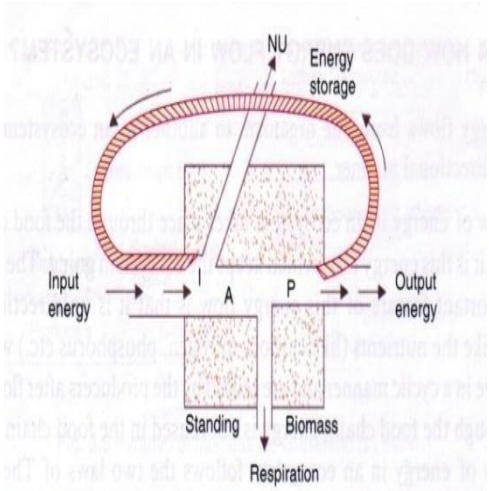


Fig. 3.11 Universal energy flow model applicable to all living components (I = Energy input; A = Assimilated energy ; P = Production ; NU = Energy not used.)

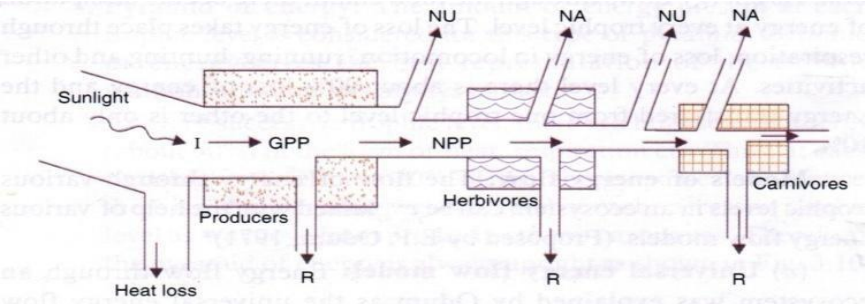


Fig. 3.12 One-way energy flow model showing unidirectional flow through primary producers, herbivores and carnivores in a grazing food chain. At each successive trophic level there is huge loss of energy (I = Solar energy input ; GPP = Gross primary production ; NPP = Net primary production ; NU = Energy not used ; NA = Energy not assimilated e.g. excretion ; R = Respiratory loss).

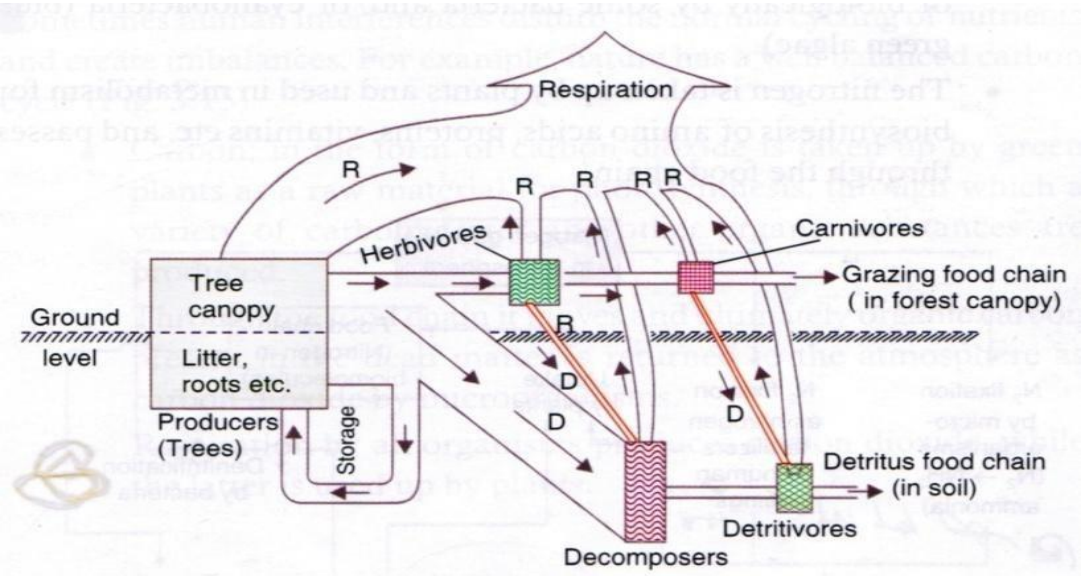


Fig. 3.13 Y-shaped or 2-channel energy flow model showing energy flow through the grazing food chain and the detritus food chain (R = Respiration, D = Detritus or dead matter).

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.

6) 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 produces to carnivores.

7) 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.

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

5. Explain the following

(a) Food chains **[CO2][L2][3M]**

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)

2) Grass -----□ Grass hopper -------□ Frog ----□ Snake ---□Hawk (grassland ecosystem)

3) Phytoplankton ----□ Water fleas ---□ Small fish -----□ Tuna fish (pond ecosystem)

4) Liches ---□ Reinder-------□Man (artic tundra)

From the above fig. It is clear that each level of organisms depends on other for food material.

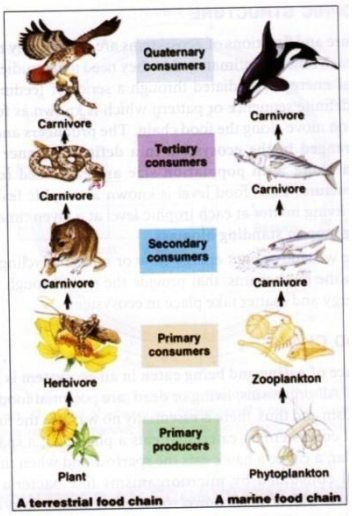


Fig. 3.4 Food chain in a terrestrial and marine ecosyster

Types of food chains: a) grazing food chain.

B)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-----□Rabbi…..□Fox.

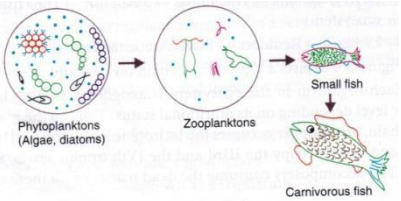


Fig. 3.5 A grazing food chain in a pond ecosystem.

B) Detritus food chain: It starts with death & decay matter, followed bydetritivores ar

Eg: Phytoplankton ---□Detritus feede…..□Carnivores.

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.

(b) Food web **[CO2][L2][3M]**

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 trophical 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: Cladoria-----□Reindeer □Man.

Grass-------□Caribou □Wolf.

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

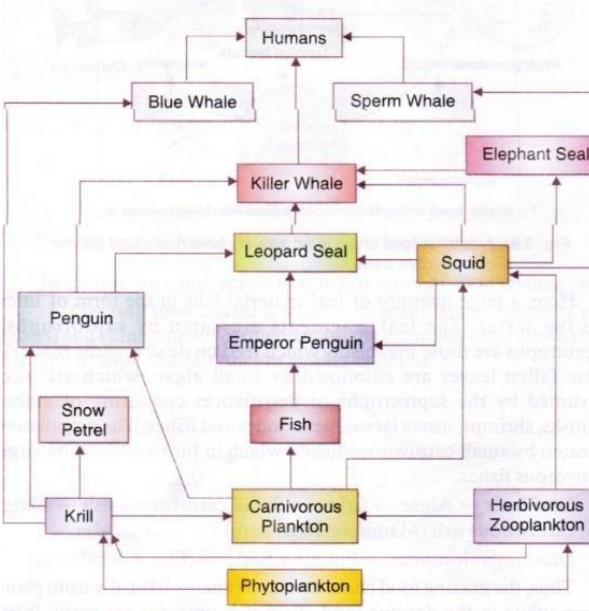


Fig. 3.7 A simplified food web in Antarctic ecosystem.

(c) 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:

4) 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.
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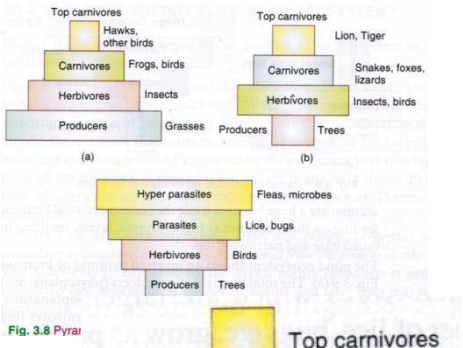

Fig. 3.8 Pyra

5) Pyramid of biomass:

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

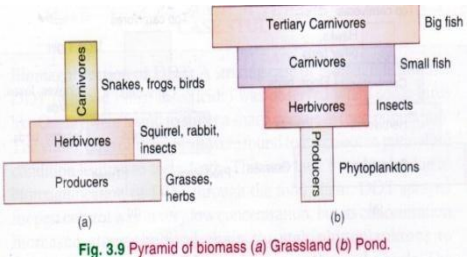

Fig. 3.9 Pyramid of biomass (*a*) Grassland (*b*) Pond.

This also may be upright (or) inverted.

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

6) Pyramid of energy:

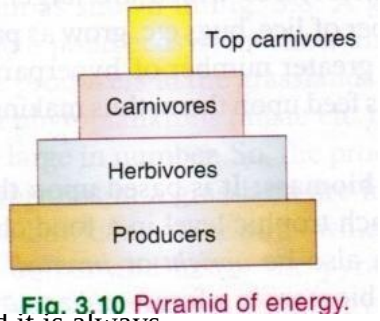

Fig. 3.10 Pyramid of energy.

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

6. Explain various processes involved in Ecological succession. [CO2][L2][10M]

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) serves 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 completion 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 gets modified and this is known as reaction. The reaction may be favourable for new species and unfavourable for old species and which tends to replace it by which it deeds to seral communities.

5)Stabilisation:

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 benfit among the organism.

7. What is the nature of grassland ecosystem? Explain its types. [CO2][L1][10M]

In this ecosystem grass species is predominated over the remaining species and at times it allows growing few trees & shrubs. It receives average rainfall, overgrazing is the phenomenon that affects the grassland ecosystem. Controlling of overgrazing yields more NPP or otherwise it is subjected to desertification. Three types of grasslands are discussed here.

vii) Tropical grasslands: They occur near the borders of tropical rain forests which receives moderate to low rainfall and high average temperature.

Fig. 3.24 A tropical grassland supporting black bucks (Pic. Velavadar, Gujarat)

In Africa, the tropical grasslands are known as savannas. This savanna consists of tall grasses with scattered shrubs and stunted trees, wide diversity of animals including zebra, giraffes, gazelle, antelopes etc. Fires are caught by these savannas during dry season. Termites gather the death matter known as mounds, on which the fungi are grown which releases CH_4 (green house gas). By fires of these groups also releases another major green house gas CO_2. In these grasslands most of the captured carbon is transformed in the form of carbohydrates in bulbs, rhizomes and runners etc. These are fed upon by black, bulks, deer etc.

c) Temperature grasslands:

They are found on flat, gentle sloped hills. Here winters are very cold and summer is hot and dry dueto which fires occurs and not allows shrubs (or) trees to grow.

In different areas they called by different names as follows:USA & Canada - prairies.

South America - pampas.

Africa - velds.

Central Europe & Africa - steppes.

Here wind keeps blowing due to which evaporation rate is high followed by fires in summer. This is used for agriculture as soilsare fertile.

d) Polar grassland (Arctic Tundra):

They are found in Arctic polar region. Here there is severe cold, frigid winds with ice and snow which does not allow trees to grow. The animals seen in these grass lands are arctic wolf, weasel, arctic fox, reindeer etc. Through the year a layer of ice present beneath soil known as permafrost, (in summer small annual plants grow) and also shallow lakes, bogs etc, and organisms like mosquitoes, migratory birds appear.

8. Explain the structural components of desert and lake ecosystem.

[CO2][L2][10M]

Stuructural components of Desert Ecosystms:

I. Biotic components

1) Producer Organisms

- In a desert, producers are mainly shrubs/bushes; some grasses & a few trees.
- Dominant plant species include: Succulents (water - retaining plants adapted to arid climate or soil conditions) & hardy grasses.
- Besides some lower plants such as lichens & xerophytic mosses are also present.

2) Consumer Organisms

These include animals such as insects, reptiles which are capable of living in xeric conditions

- Besides some nocturnal rodents, birds & some mammalians like camel etc are also found.

3) Decomposers

Due to poor vegetation with very low amount of dead organic matter, decomposers are poor in desert ecosystem.

- The common decomposers are some bacteria & fungi, most of which are thermophillic.

II. Abiotic components

Due to high temperature & very low rainfall, the organic substances are poorly present in the soil.

Stuructural components of Lakes ecosystem:

- A pond is a place where living organisms not only live but interact with biotic & abiotic components.
- Ponds are often exposed to tremendous anthropogenic pressure which significantly affects the system.
- Lakes are usually big standing freshwater bodies.
- They have a shallow water zone called Littoral zone; an open water zone where effective penetration of solar light takes place, called limnetic zone and a deep water zone where light penetration is negligible, called Profoundal zone.

I. Biotic components

1) Producer Organisms

- It includes submerged, free floating and amphibious macrophytes (like; Hydrilla, Utricularia, Wolfia, Azolla, Typha etc.) and minute floating and suspended lower phytoplanktons (like; Ulothrix, Spirogyra, Oedogonium etc.)

2) Consumer Organisms

a) Primary consumers:These are zooplanktons (ciliates, flagellates, other protozoan, small crustaceans) and benthos.

b) Secondary consumers: These are carnivores like insects and fishes feeding on herbivores

c) Tertiary consumers: These are the large fishes feeding on small fishes.

3) Decomposers Micro – organisms like bacteria, fungi and actinomyctes.

II. Abiotic component

❖ These are the inorganic as well as organic substances present in the bottom soil or dissolved in water. In addition, to the minerals, some dead organic matter is also present.

9 (a) Define food chain. Write its types. [CO2][L1][5M]

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)

5) Grass -----□ Grass hopper -------□ Frog ----□ Snake ---□Hawk (grasslandecosystem)
6) Phytoplankton ----□ Water fleas ---□ Small fish -----□ Tuna fish (pondecosystem)
7) Liches ---□ Reinder -------□Man (artic tundra)

From the above fig. It is clear that each level of organisms depends onother for food material.

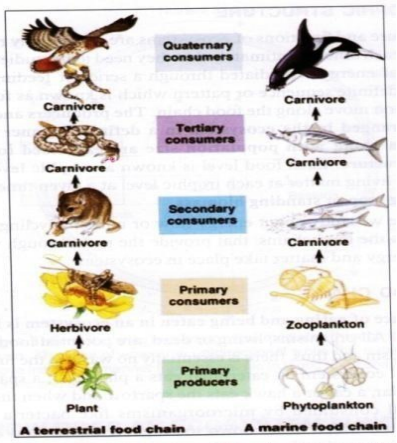

Fig. 3.4 Food chain in a terrestrial and marine ecosyster

Types of food chains: a) grazing food chain.

7)Detritus food chains.

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

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

Grass-----□Rabbit ----- □Fox.

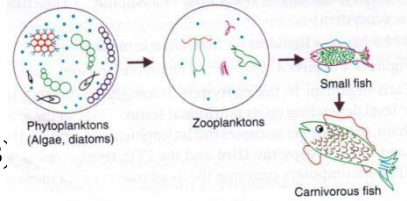

Fig. 3.5 A grazing food chain in a pond ecosystem.

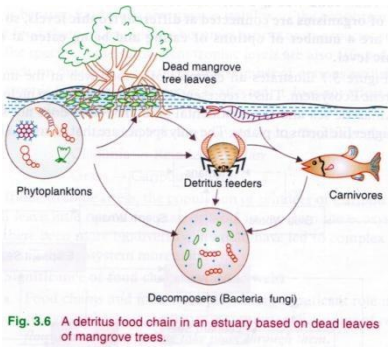

Fig. 3.6 A detritus food chain in an estuary based on dead leaves of mangrove trees.

b) Detritus food chain: It starts with death & decay matter, followed bydetritivores 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.

9(b) Explain the structure and functional components of forest ecosystem. [CO2][L2][5M]

Structure and Function of Forest Ecosystem

❖ A forest is an area with a high density of trees.

❖ World's total land area is 13,076 million hectares - (Source: FAO; 1989)

❖ Of which total forests account for about 31% of the world's land area.

❖ In India, the forest cover is roughly 19% of the total land area.

- ❖ The forest ecosystems are of great concern from the environmental point of view.
- ❖ It provides numerous environmental services like;
- ➢ Nutrient cycling,
- ➢ Maintaining biodiversity
- ➢ Providing wildlife habitat
- ➢ Affecting rainfall patterns
- ➢ Regulating stream flow
- ➢ Storing water
- ➢ Reducing flooding
- ➢ Preventing soil erosion
- ➢ Reclaiming degraded land & many more…

I. Biotic components

 The various biotic components, representatives from the three functional groups, of a forest ecosystem are:

1) Producer Organisms

- ● In a forest, the producers are mainly trees.
- ● Trees are of different kinds depending upon the type of forest developed in that climate.
- ● Apart from trees, climbers, epiphytes, shrubs and ground vegetation.
- ● Dominant species of trees in major types of forest ecosystems are:
- ● Tectona grandis, Acer, Betula, Picea, Pine, Cedrus.

2) Consumers

 In a forest, consumers are of three main types;

a) Primary Consumers

- ● These are Herbivores which feed directly on producers.
- ● Eg:
- ● Ants, Beetles, Bugs, spiders etc. feeding on tree leaves.
- ● Larger animals such as Elephants, Deer, giraffe etc. grazing on shoots
- ● and/or fruits of trees.

b) Secondary Consumers

 These are carnivores and feed on primary consumers.

Eg: Birds, Lizards, Frogs, Snakes and Foxes.

c) Tertiary Consumers

 These are secondary carnivores and feed on secondary consumers

 These include top carnivores like Lion, Tiger.

3) Decomposers

- These include wide variety of saprotrophic micro- organism like;
- Bacteria (Bacillus Sp., Clostridium sp., pseudomonas.
- Fungi (Aspergillus sp., Ganoderma sp., Fusarium.
- Actinomycetes (Streptomyces).
- They attract the dead or decayed bodies of organisms & thus decomposition takes place.
- Therefore, nutrients are released for reuse.

II. Abiotic components

 These include basic inorganic & organic compounds present in the soil & atmosphere.

 In addition dead organic debris is also found littered in forests

10. Explain the different types in aquatic ecosystem. [CO2][L2][10M]

Aquatic ecosystem includes water bodies and species present in

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

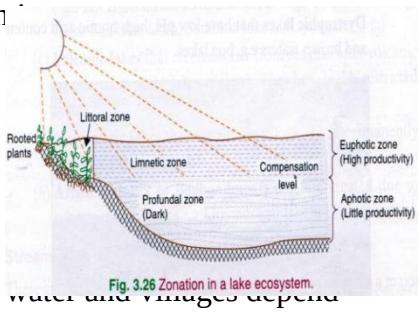

Fig. 3.26 Zonation in a lake ecosystem.

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 this anthropogenic activities like washing, bathing, swimming, etc, the systemgets 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.

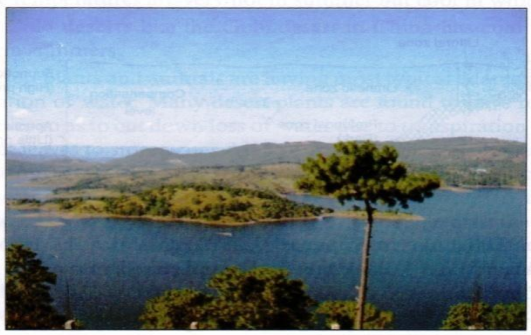
Fig. 3.27 An oligotrophic lake in the hillocks of Shillong.

3) Prefunded zone: Deep bottom zone with low penetration oflight.

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

Due to variation in the temperature of the lakes different strata (layers) are formed and thephenomenon is known as stratification.

The stratification is due to temperature difference i.e., top player warm up, on the other side bottom layerbecomes colder. The layers are:

1. ***EPILIMNION*:** Warm, lighted and surface layer.
2. ***HYPOLIMNION*:** Cold, viscous and bottom layer.
3. ***THERMOCLINE*:** Middle layer connecting the above two layers.

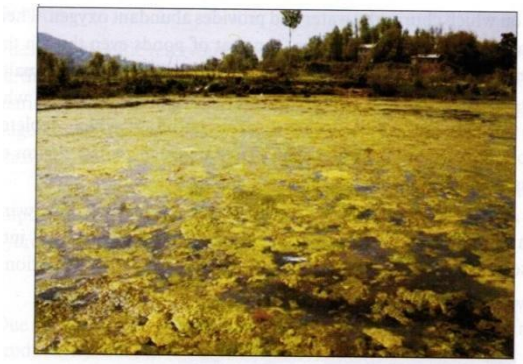

Fig. 3.28 Dal lake in Srinagar showing algal blooms due to entrophication

Types of lakes:

They are based on nutrients and different factors and they are:

1. **OLIGOTROPHIC LAKES:** These poses low nutrients.
2. **EUTROPHIC LAKES:** This poses high nutrients (N & P) andsource is runoff water.
   Eg: Dal lake.
3. **DYSTROPHIC LAKES:** These poses low P^H & high humicacid content. **Eg:** Bog lake
4. **ENDEMIC LAKES:** These are ancient, deep and posses onlyendemic fauna. **Eg:** Lake Baikal (Russia,
   deepest lake & threatened due to pollution)

UNIT-III

BIODIVERSITY AND ITS CONSERVATION

1. Define Biodiversity. Explain Genetic diversity, Species diversity & Ecosystem diversity. [CO3][L2][10M]

"Biodiversity refers to variety and variability of all living organisms in a ecosystem".

1/10 billionth part of earth is occupied by living organisms of 50 million species which is restricted to

1 km thickness of soil. It is pleasure to see much diversity on this earth with little physical matter. The diversity

is from tropical rain forests to deserts, high snow clad mountain peaks to deepest of ocean. They diverse in the

form of size, colour, shape, forms, unique ecological relationship etc. If there would be little species, then the

world looks dull.

Levels of biodiversity: It may range from genus to species and they are categorised 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 with in a species leads to variety.

Eg: Oryza sativa is a rice species having thousands of varieties (which has different size, shape, colour, 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.

c) 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, eco system 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.

Eg: Coniferous trees of boreal forests cannot do the function of trophical deciduous forest and vice versa.

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

2. Discuss the values of bio diversity. [CO3][L2][10M]

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, fibre, 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 develops 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	Cinchonatree (bark)	Malaria
Digitalin	Digitalis(foxglove)	Cure for heart
Vinblastin & 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 fossilised 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 dollar 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. Ecosystems and

 Many plants & its products are used for holy & sacred in our country. **Eg:** Tulsi, peepal, mango, lotus, bael, etc.

 Similarly many animals has significant role in our psycho – spiritual aspects. **Eg:** 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. 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.

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 proved that it posses 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.

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

These include services provided by eco systems. Recently various eco system services has been

recognised which includes soil erosion, prevention of floods, soil fertility maintenance, nutrients cycle, nitrogen

fixation, hydrological cycle etc. ocean acts as sink for CO_2 (green house – 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.

Some important values of biodiversity of some selected species:

Animals/Plants Species in Lifetime	**Amount Gained Through Ecotourism / Year**
Male lion (7 years)	$ 515,000
Skin (if killed)	$ 1000
Kenyon elephant	$ 1 million
Mountain gorillas	$ 4 million
Whale watching on herney bay	$ 12 million
Great barrier keef (Australia)	$ 2 billion
Typical tree	$ 19, 62, 150 worth by.

3. Explain Bio-geographical classification of India. [CO3][L2][10M]

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.

Bio geographical classification of India:

It is very important to study the evolution, distribution and dispersal of plants & animals. The distribution of flora & fauna of our country has been grouped into 10 bio geographic zones. They are listed as follows:

Table 4.1. India's major biogeographic habitats

Sr. No.	Biogeographic zone	Biotic province	Total area (Sq. Km.)	Important flora and fauna
1.	Trans-Himalayan	Upper Regions	186200	• Pine, Deodar • Wild sheep, Yak, Tibetan ass, Snow Leopard, Marmot, Wolf, Black necked crane.
2.	Himalayan	North-West Himalayas West Himalayas Central Himalayas East Himalayas	6900 720000 123000 83000	• Pine, Cork tree, Sal, Dhaak (Butea), Castor • Wild bear, Sambar, Leopard, Sikkim Stag, Musk Deer
3.	Desert	Kutch Thar Ladakh	45000 180000 NA	• Acacia, Zizyphus, Khejri, Date palm. • Camel, Bastard, Wild ass, Desert cat, Fox, Rat
4.	Semi-arid	Central India Gujarat-Rajwara	107600 400400	• Acacia, Date palm, Peepal • Gir Lion, Tiger Sariska and Ranthambore (Tiger Reserves)
5.	Western Ghats	Malabar Coast Western Ghat Mountains	59700 99300	• Sheesham, Peepal, Tuna, Bahera • Tortoise, Frog, Lizards, Snakes
6.	Deccan Peninsula	Deccan Plateau South- Central Plateau Eastern Plateau Chhota Nagpur Central Highlands	378000 341000 198000 217000 287000	• Acacia, Palaash, Tuna, Pine, Castor • Sambar, Sloth bear, Tiger, Cheetal, Four-horned stag, Wild elephant, Wild buffalo
7.	Gangetic Plain	Upper Gangetic Plain Lower Gangetic Plain	206400 153000	• Sal, Acacia, Jamun, Mango, Bael • Black chinkara, Stag, Rhinoceros, Gazzel, Alligator, Turtle.
8.	North-East India	Brahmaputra Valley North-Eastern Hills	65200 106200	• Bamboo, Sal, Jack fruit, Tuna Chestnut, Castor • Elephant, Rhinoceros, Yak, Deer, Porcupine
9.	Islands	Andaman Islands Nicobar Islands Lakshadweep Islands	6397 1930 180	• Bahera, Harar, Jack fruit, Cardamom, Coconut, Cloves • Dolphin, Alligator, Molluscs
10.	Coasts	West Coast East Coast	6500 6500	• Coconut, Banana, Cashew nut • Dugong, Dolphin, Turtle, Alligator, Molluscs

Source: "Conserving our Biological Wealth", WWF for Nature-India and Zoological Survey of India.

4.Write a brief note on Indian diversity with special reference as a mega diversity nation. [CO3][L1][10M]

Indian biodiversity:

Every country has its own biodiversity based on the climate conditions of which India is rich in bio diversity of flora and fauna.

 6% of global species are found in India & total number of species is 1,50,000.

World rank of India	**Category**
10th	Among plant rich countries.
11th	Endemic of higher vertebrates.
6 th	Centres of diversity & origin of agricultural crops.

 India has 3 hot spots out of 34 in the world. India is one of 12- mega diversity countries in the world.

India – mega diversity nation:

As per ministry of environment and forests, government of India records (2000) possess.

Plants species (flora) – 47,000

Animal species (fauna)- 81,000

Endemism:

Species restricted to particular area are known as endemic species & India shows good number of endemic species. About 62% of amphibians & 50% of lizards are endemic to India of which Western Ghats posses‟ maximum.

Centre of origin: More number of species is originated from India. Nearly 5000 species of flowering plants of which 166 of crop varieties & 320 species of wild varieties. India is quite rich in terms of agricultural diversity. Ecosystems and Biodiversity

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Marine diversity:

Along 7500 km coastline of our country, there exists more species of mangroves, estuaries, coral reefs. More than 340 species of corals are found here. This marine diversity is rich in molluscs, crustaceans (crabs), poly cheats etc. A large number of species in India is to be explored still, in connection with many wet lands coral reefs, mangroves have to be studied in detail.

Indian forests cover 64.01 million hectares & rich in biodiversity due diverse climate across trans Himalayan, North West, West, Central and Eastern Himalayas, Western Ghats, Coasts, Deserts, Gangetic Plains, Deccan Plateau, Andaman Nicobar, Lakshadweep island etc.

Table 4.3. Distribution of species in some major groups of flora and fauna in India

Group-wise species distribution			
Plants	**Number**	**Animals**	**Number**
Bacteria	850	Lower groups	9979
Fungi	23,000	Mollusca	5042
Algae	2500	Arthropoda	57,525
Bryophytes	2564	Pisces (Fishes)	2546
Pteridophytes	1022	Amphibia	428
Gymnosperms	64	Reptiles	1228
Angiosperms	15,000	Birds	204
		Mammals	372

Source: MoEF (GoI), 2000

5. Discuss the following

(a) **Social value.** **[CO3][L2][2M]**

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. **Eg:** Tulsi, peepal, mango, lotus, bael, etc.

 Similarly many animals has significant role in our psycho – spiritual aspects. **Eg:** 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.

(b) **Ethical Value.** **[CO3][L2][2M]**

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. 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.

(c) **Aesthetic value.** **[CO3][L2][2M]**

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.

(d) **Optional value.** **[CO3][L2][2M]**

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 proved that it posses 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.

(e) **Ecosystem service value.** **[CO3][L2][2M]**

Based on values of various ecosystem services. These include services provided by eco systems. Recently various eco system services has been recognised which includes soil erosion, prevention of floods, soil fertility maintenance, nutrients cycle, nitrogen fixation, hydrological cycle etc. ocean acts as sink for CO2 (green house – 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.

6. (a) Define hotspot of bio diversity. **[CO3][L1][2M]**

They areas which posses endemic species and more rich species are termed as hot spots of biodiversity

& introduced by Myers (1988). Earlier 25 hot spots were identified of which two belongs to India and at present 34 are there and in India 3.

(b)What are the hotspots found in India? Discuss their salient Features. **[CO3][L1][8M]**

In India there are three hot spots but extending into the neighbouring countries namely Indo- Burma

Region, Eastern Himalaya and Western Ghats-Srilanka region. The Indian hot spots are rich

in floral endemics and also reptiles, amphibians, swadow, 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 Easter

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 grass

lands.

 Fauna includes 6 large mammal species, Antlered muntjac, the Annamite muntjac, grey – Shanked 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.

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.

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

3.Eastern Himalayas hot spot:

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 centre 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 hot spots in India. The common flora includes Ternstroemia japonica, Rhododendron, Hypercium and fauna includes laughing Thrush, fairy Blue bird, Lizard, Hawk etc.

7.What are the major threats to Biodiversity? [CO3][L1][10M]

Threats to biodiversity:

During course of evolution, some species get vanished i.e., extinction and may be replaced by others.

This evolution is a slow process, but the process of extinction become fast due to human impact. An estimate by a famous ecologist E. O. Wilson states that 10,000 species/year and 27/day are subjected to extinction, which is a serious threat to biodiversity. Earlier the rate of extinction is slow but for the last 150 years, the rate is dramatically increased and if this continues we would lose 1/3rd to 2/3rd of current bio diversity by the middle of 21st century.

Major causes and issue for the threats to biodiversity:

1) Loss of habitat: (place in which they live)

This is the major cause in which billions of hectares of forests and grasslands have been cleared over the past 10,000 years for different human activities like agriculture, pastures, settlements, projects etc. Due to

this, thousands of species homes were lost and gets perished. Wetlands are damaged which rich in biodiversity are including mangroves and estuaries and the reason for this are draining, filling and pollution.

This habitat loss takes place in step wise such that it is divided into small patches known as habitat fragmentation. Some of the species like bears & cats survive only in the interior of the forests but due to fragmentation they are relocated or vanishing. Some of the singing birds are also subjected to this phenomenon.

With current late of disappearance of forests (0.6% per year), 20-25% of global flora would be lost within a few years. Marine diversity is also under serious threat due to fragile breeding and feeding ground by human.

2) Poaching:

It is defined as killing of prohibited endangered species for the purpose of trading, which is an illegal activity. Inspite of ban at international level for the endangered species like furs, hides, horns, tusks, live specimen, herbal products, etc, the smuggling are done which in approximately million dollars per year. The developing counties like in Asia, Latin America and Africa are rich source of biodiversity. But rich countries in & North America, some part of Asia (Japan, Taiwan, Hong Kong) shows interest in importing wild life & its products. This wild life trade is high profit making which is accompanied by mafia.

Product	Rate
Elephant‟s tusks	$100/kg
Leopard fur coat	$1,00,000 (in Japan)
Hyacinth macaw (from Brazil)	$10,000

Note: For the purpose of particular animal, near the 50 animals were killed.

Remedied measures:

- We should not show interest in case of endangered species.
- Do not purchase fur coat, purse (or) bag made of crocodile (or) python skin.

Human wild life conflicts:

From the earlier discussion it is clear that we have to preserve and protect the wild life but at times wildlife is danger to man, in relation to this forest officers also in critical situation to help affected people & preserve wild life. Some of the importance‟s are –(India)

- 195 human were killed by elephants and in turn 98 elephants were killed and 30 severely injured in last five years in Sambalpur, Odisha.
- In the border of kote-Chamaraja Nagar belt (Mysore) many elephants were killed in relation to the damage done by it to the farmers of cotton & sugarcane.
- In Royal Chitwan National Park (240 km from Kathmandu), a man–earlier tiger killed 16 Nepalese and a

4 year child (2004).

 Some people were killed by leopard, viz., 2 men in Powai (Mumbai) & 14 persons (leopards from Sanjay Gandhi National Park) in Mumbai (2004).

 Some more conflicts are reported from border of Corbett, Dhudwa, Palamar & Ranthambole National Parks.

8. Summarise the following

(a) Endangered species. [CO3][L2][5M]

"If species number is reduced below critical level i.e., drastically reduced and if not protected then it is subjected to extinction, the species is known as endangered species". **Eg:** Great Indian Bustard (less than 500 species) "A species which is abundant but faces continuous decline due to over exploitation, then it is said to be vulnerable". If the factors are not checked, they will become endangered. Eg: Andaman Hor Shoe Bat (endemic to India). "The species which does not belongs to either endangered (or) vulnerable but it is at a risk known as rare species". **Eg:** Ganges shark (its oil is valuable)

"A species is said to be extinct when it is not seen in the wild life for 50 years of period". **Eg:** Dodo (Passenger Pigeon), in India (cheetah, pink headed dusk & mountain avail) 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. It is difficult to give complete endangered flora and fauna of our country. Nearly 150 mammals, 150 birds and 450 plants species are identified as endangered in India of which 132 species of flora and fauna are identified as critically endangered (source: Red list of 2012, earth summit) Some of the endangered reptiles, birds, mammals and plants are listed below:

NAME OF THE CLASS/CATEGORY NAME OF THE SPECIES

Reptiles Gharial, green sea turtle, tortoise, python. Aves (birds) great Indian bustard, peacock, pelican, great Indian horn bill, Siberian white crane. Mammals" Indian wolf, red fox, sloth bear, red panda, tiger, leopard, striped hyena, Indian lion, golden cat, desert cat, dugong. Primates" Hoolock, gibbion, lion-tailed macague, nilgiri langur, capped monkey, golden monkey. Plants Orchids, rhododendrons, rauvolfia serpentina santalum, cycas beddonei, pitcher plant

(b)Endemic species. [CO3][L2][5M]

In India there is 62% of endemic flora. The three hot spots of India consist of 7000 endemics out of 47000 species of endemic. The endemic are seen in Eastern Himalayas, khasi hills, Ganges- Brahmaputra low lands, Western Ghats etc.

Eg: Sapria himalayana, Uraria lurida, Nephenthes khasiana, Pedicularis perroter etc.

Out of 81,000 endemics of fauna, major portion are endemic to India of which Western Ghats cover 62% of amphibians and 50% lizards (reptiles)

Eg: Varanus (monitor lizards), python, Indian salamander, nectophhryne etc.

9. What is Red Data Book? What do you mean by Extinct, Endangered, Vulnerable and Rare Species? Name some Extinct Species of plant & animals of our country. [CO3][L1][10M]

10. What is meant by In-situ and Ex-situ conservation of Biodiversity? Give examples. [CO3][L1][10M]

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 realised 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 7 major bio reserves, 80 national parks, 420 wild life sanctuaries and 120 botanical gardens in our country covering 4% of the geographic area.

The biosphere reserves conserve some representation eco system for long time period. In India there are

many biosphere reserves, they are Nanda Devi (UP), Nokrek (Meghalaya), Manas (Assam), Sunderbans (West Bengal), Gulf of Mannar (Tamil Nadu), Nilgiri (Tamil Nadu, Karnataka, Kerala), Great Nicobars and Similipal (Odisha) Within the biosphere reserves there may be some National parks.

Eg: Nilgiri biosphere reserves has two national parks (Bandipur and Nagarhole)

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
Abohar 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

UNIT-IV

ENVIRONMENTAL POLLUTION AND GLOBAL ENVIRONMENTAL ISSUES, NATURAL DISASTERS

1. Define Air pollution. Explain its causes, effects and control measures of Air pollution.
[CO4][L1][10M]

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 , I 131, Sr90, Pt 239, 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, radioactivity materials 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.

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 μm) can be trapped by hair and sticky mucous lining in the nose. Smaller particles will be trapped by mucous present in the trancheo-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. SO2 severely affects the respiratory system

that to when they combine with suspended particles forms sulphate particles, which goes deep into lung and effects severely. NO2 also irritate lung and causes chronic bronchitis & emphysema.

Normally Haemoglobin (Hb) present in blood carry O2 form lungs to different parts of the body.

Hb + O2 ----□ HbO2 (oxy haemoglobin) 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 O2 to all parts of the body. This causes suffocation and long exposure leads to dizziness, unconsciousness and finally death.

Hb + CO --------□ CO-Hb (carboxy haemoglobin)

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 CO2, 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)

Epinasty : Curling of leaves

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

SO2 : causes bleaching of leaves, chlorosis and injury of leaves

NO2 : abscission and suppressed growth

O3 : 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 minimised 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) Minimisation of activities such as transportation etc.

4) Modernisation of equipments 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 check up - 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.

14) Pollution should reduce at level of source.

2. Elaborate on
(a)Water pollution. **[CO4][L2][5M]**

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 sceptic tanks, industries (textiles, chemicals), deep well injection, mining etc. Ground water is also polluted by As, F-, NO3- (which causes serious health hazards)

Surface water pollution: The major sources are

a) Sewage: Due to sewage, surface water is polluted and this is severe in cities.

b) 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.

c) Synthetic detergents: Detergents and soaps used for cleaning which pollutes water.

d) Agro chemicals: Fertilizers (NO3-, PO32-), pesticides (insecticides, fungicides, herbicides) washed by rain water and surface runoff and thereby pollutes water.

e) Oils: Oils can be spilled during drilling and shipping which pollutes water.

Effects of water pollution: The main effects are

i) Oxygen demanding wastes

ii) N & P compounds

iii) Pathogens

Iv) Toxic compounds

(c) Land pollution. **[CO4][L2][5M]**

(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)

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 reaches 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)

3. (a) What is an earthquake? Write its effects. [CO4][L1][5M]

Earth quakes: Sudden movements of earth‟s crust leads 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 epicentre.

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)

(b)Write short notes Landslides. [CO4][L1][5M]

Landslides:

This occurs due to gravitational pull of coherent rock of soil masses. Slow land slips don‟t cause damage but sudden rock slides & mud slides are dangerous. Landslides are governed by the forces which

tend to pull the earth down slope and resisting forces which tend to resist such movement.

Factors & reasons:

1. Chemical action of water causing weathering of rocks.

2. Earth quakes & vibrations etc.

3. Disturbances in resistant rock overlying rock of low pressure.

4. Saturation of unconsolidated sediments with water.

5. Unconsolidated sediments exposed due to logging, road (or) house building.

Landslides are minimised by:

1. Draining the surface & sub-surface water.

2. Providing slope support like gabions (wired stone blocks).

3. Concretes support at the base of slope.

4. Discuss the natural formation and occurrence of ozone in the Stratosphere. [CO4][L2][10M]

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 (O2) & atomic oxygen in the presence of UV radiation (242 nm).

$$O_2 + (O) \text{ ----------} \square\ O_3 \text{ (ozone)}$$

But this ozone is again converted to O2 & O by harmful UV radiation (200 to nm).

$$O_3 + h\nu \text{ ----------} \square\ O_2 + O$$

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	450 DU **(Stratosphere** winds transport O3 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, sterilants 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:-

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.

5. Explain the following

(a)Acid rains. [CO4][L2][5M]

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.

SO3 + H2O ----------□ H2SO4 /

NO2 + H2O ----------□HNO3

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

takes place. The PH of rain water is 5.6 due to dissolution of CO2 in water. When the acid mixes with rain water the PH 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 PH 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 Ca 2+, Mg 2+, 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 oxidses into acids & falls as rain from clouds and thereby still increasing the acidic PH . A unit decrease in PH increases 10 times acidity. Average PH in rain fall over Easter United States from 1979 to 1980 was less than 5.0. Acid rain recorded in India

NAME OFPLACE	**PH**
i) Kodiakanal	5.18
ii) Minicoy	5.52
iii) Mohan Bari	5.50

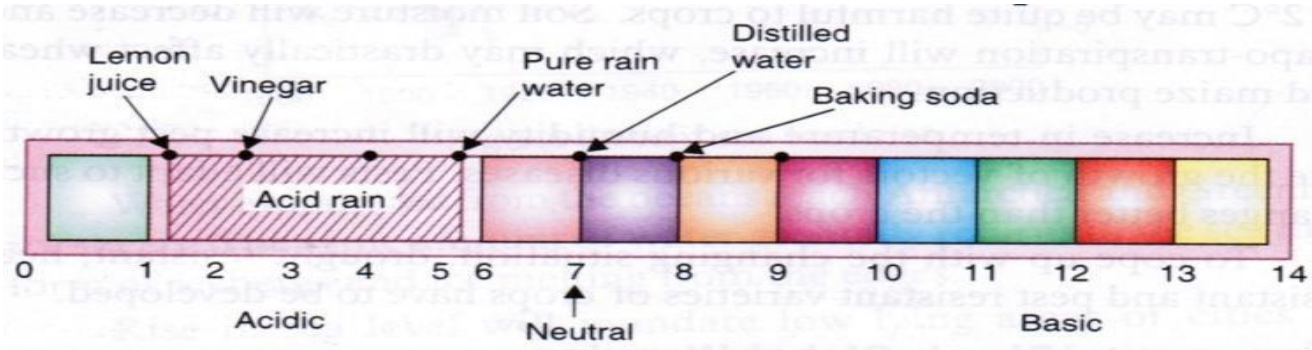

Fig. 6.7 The pH scale of common substances.

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 fisheless 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 SO2 & NO2 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.

(b) Global warming **[CO4][L2][5M]**

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

Green house gases:-

The solar radiations reach the earth surface and will be reemitted to the atmosphere normally. But the green

house gases trap the radiations by which the earth‟s surface temperature increases and the phenomena is known as green house effect. The major green house gases are: 1) CO_2 2) CFC‟s 3) CH_4 4) N_2O

IMPACTS OF GREEN HOUSE EFFECT:-

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

i) **Global temperature increase:-**

Due to increase in the concentration of green house gases the earth‟s temperature is also increased. By 2050 the average increase would be 1.5 to 5.5 oC.

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 oC. 1metre 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 mainly affected in Ethiopia,

Kenya & Indonesia. These micro organisms are born & multiplied on stagnate water. Sometimes skin diseases are also caused.

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) Optimise population growth.

ix) Remove CO2 by photosynthetic algae & plant more trees.

6. Define noise pollution. Explain its causes, effects and control measures of noise Pollution. [CO4][L1][10M]

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". 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 X 10-5 pa. dB is the measure of loudness and frequency. The central pollution control board (CPCB) recommended permissible levels For different locations as follows:

Area	Category	Noise level in dB	
		day	night
A	Industry	75	70
B	Commercial	65	55
C	Residential	55	45
D	Silent zone	50	40

Note: Threshold of pain (140) / Threshold of hearing(0)

Source of noise pollution:

The main sources are transportation (automobiles, rails), industries, celebrations (social

/religious), electric home appliances etc. The high level of noise have been recorded in some of the cities of the world

Nanjing (china) - 150 dB

Rome - 90 dB

New York - 88 dB

Mumbai - 82 dB

Delhi - 80 dB

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.

Noise Pollution during Diwali:

Diwali is one of the major festivals in India. Fire crackers are burnt for fun and traditional. The noises generated by burning of crackers are beyond 125dB (but as per rules of Environmental (protection) rules, 1999 should not exceed 125dB) After the sound measurements made in various place during Diwali, it is recommended that fireworks should maintain the noise levels of crackers in dB. According to recent test report on fire crackers produced by the national physical laboratory. New Delhi stated that most of the crackers produce noise beyond 125dB. Some of them are even near the threshold of Pain.

Control of Noise Pollution:

1) *Reduction In Source of Noise*:Heavy hold vehicles should not be permitted in densely populated areas.

2) Noise producing machines is placed in such a room that, it should absorb the noise.

3) Necessary caution should be taken to reduce friction (oiling, grease)

4) *Use of Silencers*: Silencers reduces the sound pollution

5) Plantation

6) *Through Law*: Various legal actions should be taken over the noise pollution. Unnecessary horn should not be blown.

7. Write short notes on

(a) Droughts and floods [CO4][L1][6M]

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.

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 resultedin 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.

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.

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

7(b) Cyclones [CO4][L1][4M]

Cyclones:

These are recurring phenomenon in the tropical coastal regions. Tropical cyclones move like a spinning top at the sped of 10-30 KMPH & may lasts 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 oC 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.

8. How can you, as an individual, prevent environmental pollution? Why such an effort at Individual level is important? [CO4][L2][10M]

Role of on individual in prevention of pollution: Everyone has to contribute their own dedication for the control of pollution, because every individual is responsible for the pollution. If each one takes part in the prevention of pollution will have great result in the global level. "Think globally act locally" Everyone has to take following measures for reducing environmental pollution.

1. Prevention is better than control; we should be in a position to prevent.
2. Use eco friendly products.
3. Reduction in use of CFC"s (Chloro Fluoro Carbons)
4. Should ban polystyrene cups having CFC"s which destroys the ozone layer.

5. Use refrigeration with no CFC‟s.
6. Chemicals from peaches & plums are used to clean chips & circuit of systems instead of CFC‟s.
7. The devices which do not pollute environment should be used instead of polluting devices inspite of cost.
8. Reduce dependency on fossil fuels, use H2 fuels.
9. Save power, save nation (electricity).
10. Use of renewable resources.
11. Should increase energy efficiency.
12. Reduce, Reuse and Recycle of wastes.
13. Mass transport systems (one bus instead 10 cars)
14. Optimum level of pesticides should be used.
15. Use of rechargeable batteries.
16. Use of less hazards chemicals (vinegar, baking soda, borax)
17. Do not litter polythene bags, which affect different animals like cows, etc.
18. Use of phosphate free – detergents, shampoos, etc (eutrophication)
19. Use of organic manure of fertilizers.
20. Optimum level of wastes should be used.
21. Reduce deforestation instead plant trees which reduces CO2 etc.
22. Over population should be controlled

9 (a) What is solid waste management? Explain its causes and effects. [CO4][L1][6M]

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/causes 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 categorised into two:

i) Biodegradable:- This wastes can be degraded by micro organisms

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 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 dioxans, polychlorinated biphenyls, etc, which causes cancer.

(b) Write a short note on control measures of solid waste management. [CO4][L1][4M]

Management of solid waste:

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

I. **Reduction involve of raw materials:** Use of Raw materials depends 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.

10. Write a note on Population growth? What are the factors influencing population size?
[CO4][L1][10M]

In 1800, the human population is 1billion 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.

Reasons for population growth:

During stone-age population was stable and environment conditions are also stable till artificial condition had entered. There are more no. of deaths due to diseases and drought conditions. In AD 14th century 50% of people died in Asia and Europe due to bubonic plague. But with improvement in technology human expectation‟s also increased i.e., they lead life with better sanitation, food and medical facilities. So due to this there is rapid increase in the population growth. In developing countries children are consider as economic assets and so it lead to rapid growth in population. 90-95% of population growth is seen in last 50 years with increase in 3-4% per year.

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, 102, 103, 104 .....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:

$$Td=70/r$$

Where Td = 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.

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 ¼, Botswana 2/3rd 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 are 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.

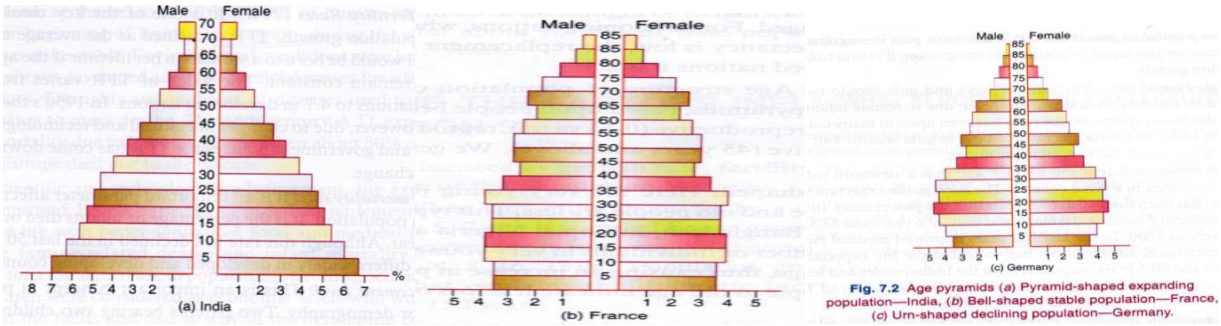

Fig. 7.2 Age pyramids (*a*) Pyramid-shaped expanding population—India, (*b*) Bell-shaped stable population—France, (*c*) Urn-shaped declining population—Germany.

UNIT-V

ENVIRONMENTAL LEGISLATION, LAWS, POLICES FOR SUSTAINABLE DEVELOPMENT

1.Discuss the salient features of forest conservation Act and Wild life (protection) Act. [CO5][L2][10M]

Forest Act, 1980:-

This act deals with the conversation 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 consume 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 forests** activities like cleaning 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 hydro electric 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 trees, medicinal plants also central 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 warm 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, bourder 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 & consume the forest.

2. Describe Air (Prevention and control of pollution) Act and Environment (Protection) Act. [CO5][L3][10M]

The Air Act, 1981 (Prevention & Control of Pollution):- ***The features are:-***

i) This act prevents & controls the pollution.

ii) Air pollution is defined as "any impurities in the form of solid, liquid (or) gaseous in a given concentration which cause harmful to human & other creatures"

iii) Noise pollution also included under this act in 1987.

iv) State & central pollution boards have to check the standard levels of the air pollutants released in to the atmosphere by the industries.

v) The powers are given to the state & central boards to punish the offenders, funds are also provided to them.

vi) Under section 20, there is a provision for the standard levels of emission from automobiles (motor vehicles)

vii)State board can declare any area as "air pollution control area" and can take necessary measures.

Under section 28 of water act & section 31 of air act had given provision for appeal with authority consisting of three persons to hear the appeals filed by the party (industry).

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 means 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 permeable 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 eg:- BOD (Biological Oxygen Demand) are given for different medium as follows:-

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

Amendents (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 exceed 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.

3.What you mean by sustainable development? What are the major measures to attain sustainability? [CO5][L1][10M]

We human beings live in both natural and social world. So, our developmental activities will be strongly inter-related with natural and social components. Development does not only mean benefits, high standard of living, increase in GNP (gross national product), but it also affect the people and environment. So we have to link development with social aspects and environment.

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.

Keys to Success of Sustainable Developement

a) **Inter generational equity:-** We should not over exploit and damage the natural resources and have to hand over safe & healthy resources for future generations.

b) **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.

Eg:- 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 Sustinable Developement

- **Using appropriate technology:-**

For the development we should use eco-friendly, resource efficient and culturally suitable technology, for this local resources & local labours are utilised. 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 minimise the usage of resource (Reduce) and should use them again & again instead of passing it to the waste (Reuse) and also 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.

- **Resource utilisation as per carrying capacity :-**

Any system can with stand 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 additional to food. When it crosses the limit environment starts degrading, due to over exploitation.

4(a) What is the role of Information Technology in Environment and human health? [CO5][L1][5M]

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 centre‟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 system 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 centres 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 centres are in process in which 81 are established which includes government department, NGO‟s, etc.

The centres (ENVIS) create websites on specific environment related subjects & also establish linkages with all information sources. They create data bank selected parameters in the subject, identity information

gaps, publish newsletters and bulletins. The ENVIS centre also maintains the data bases of (pollution control, clean technologies, remote sensing, costal 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.

(b) Discuss the impact of increase of pollution on environment. [CO5][L2][5M]

- Air pollution affects all things. It is harmful to our health, and it impacts the environment by reducing visibility and blocking sunlight, causing acid rain, and harming forests, wildlife, and agriculture. Greenhouse gas pollution, the cause of climate change, affects the entire planet.
- Humans impact the physical environment in many ways: overpopulation, pollution, burning fossil fuels, and deforestation. Changes like these have triggered climate change, soil erosion, poor air quality, and undrinkable water.
- Exposure to air pollution can affect everyone's health. When we breathe in air pollutants, they can enter our bloodstream and contribute to coughing or itchy eyes and cause or worsen many breathing and lung diseases, leading to hospitalizations, cancer, or even premature death.
- Increased risk of respiratory illness and cardiovascular problems.
- Increased risk of skin diseases.
- May increase the risk of cancer.
- Global warming.
- Acid rain.
- Ozone depletion.
- Hazards to wildlife.

5. Discuss briefly about sustainable development. [CO5][L2][10M]

Sustainable development

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

True sustainable development

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

Dimensions of sustainable development

Multi dimensional concept – derived from interactions between society, economy and environment.

Aspects of sustainable development

a) **Inter generational equity:-** We should not over exploit and damage the natural resources and have to hand over safe & healthy resources for future generations.

b) **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.

Eg:- 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.

Approaches for sustainable development

- Developing appropriate technology - locally adaptable, eco-friendly, resource efficient and culturally suitable
- Reduce, reuse, recycle [3R] approach – reduces waste generation and pollution
- Providing environmental education and awareness – changing attitude of the people
- Consumption of renewable resources – attain sustainability
- Conservation of non renewable resources – conserved by recycling and reusing
- Population control.

6. Discuss the salient features of Water Act. [CO5][L2][10M]

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. Organises training programmes for prevention & control of pollution.

4. Organises programme 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 disposals.

7.Write a note on

(a) Kyoto protocol [CO5][L1][5M]

- The Kyoto Protocol was an international treaty which extended the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that (part one) global warming is occurring and (part two) that human-made CO_2 emissions are driving it. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. There were 192 parties (Canada withdrew from the protocol, effective December 2012)[5] to the Protocol in 2020.
- The Kyoto Protocol implemented the objective of the UNFCCC to reduce the onset of global warming by reducing greenhouse gas concentrations in the atmosphere to "a level that would prevent dangerous anthropogenic interference with the climate system" (Article 2). The Kyoto Protocol applied to the seven greenhouse gases listed in Annex A: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulfur hexafluoride (SF_6), nitrogen trifluoride (NF_3).[8] Nitrogen trifluoride was added for the second compliance period during the Doha Round.[9]
- The Protocol was based on the principle of common but differentiated responsibilities: it acknowledged that individual countries have different capabilities in combating climate change, owing to economic development, and therefore placed the obligation to reduce current emissions on developed countries on the basis that they are historically responsible for the current levels of greenhouse gases in the atmosphere.
- The Protocol's first commitment period started in 2008 and ended in 2012. All 36 countries that fully participated in the first commitment period complied with the Protocol. However, nine countries had to resort to the flexibility mechanisms by funding emission reductions in other countries because their national emissions were slightly greater than their targets. The financial crisis of 2007–08 helped reduce the emissions. The greatest emission reductions were seen in the former Eastern Bloc countries because the dissolution of the Soviet Union reduced their emissions in the early 1990s.[10] Even though the 36 developed countries reduced their emissions, the global emissions increased by 32% from 1990 to 2010.
- Negotiations were held in the framework of the yearly UNFCCC Climate Change Conferences on measures to be taken after the second commitment period ended in 2020. This resulted in the 2015

adoption of the Paris Agreement, which is a separate instrument under the UNFCCC rather than an amendment of the Kyoto Protocol.

- **1992** – The UN Conference on the Environment and Development is held in Rio de Janeiro. It results in the Framework Convention on Climate Change ("FCCC" or "UNFCCC") among other agreements.
- **1995** – Parties to the UNFCCC meet in Berlin (the 1st Conference of Parties (COP) to the UNFCCC) to outline specific targets on emissions.
- **1997** – In December the parties conclude the Kyoto Protocol in Kyoto, Japan, in which they agree to the broad outlines of emissions targets.
- **2004** – Russia and Canada ratify the Kyoto Protocol to the UNFCCC bringing the treaty into effect on 16 February 2005.
- **2011** – Canada became the first signatory to announce its withdrawal from the Kyoto Protocol.
- **2012** – On 31 December 2012, the first commitment period under the Protocol expired.

(b) Montreal protocol [CO5][L1][5M]

- The meeting called for international cooperation in research involving ozone-depleting chemicals (ODCs) and empowered the United Nations Environment Programme (UNEP) to lay the groundwork for the Montreal Protocol.
- The **Montreal Protocol** is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion.
- It was agreed on 16 September 1987, and entered into force on 1 January 1989. Since then, it has undergone nine revisions, in 1990 (London), 1991 (Nairobi), 1992 (Copenhagen), 1993 (Bangkok), 1995 (Vienna), 1997 (Montreal), 1998 (Australia), 1999 (Beijing) and 2016 (Kigali) As a result of the international agreement, the ozone hole in Antarctica is slowly recovering.
- Climate projections indicate that the ozone layer will return to 1980 levels between 2040 (across much of the world) and 2066 (over Antarctica). Due to its widespread adoption and implementation, it has been hailed as an example of successful international co-operation.
- Former UN Secretary-General Kofi Annan stated that "perhaps the single most successful international agreement to date has been the Montreal Protocol".
- In comparison, effective burden-sharing and solution proposals mitigating regional conflicts of interest have been among the success factors for the ozone depletion challenge, where global regulation based on the Kyoto Protocol has failed to do so. In this case of the ozone depletion challenge, there was global regulation already being installed before a scientific consensus was established. Also, overall public opinion was convinced of possible imminent risks.
- The two ozone treaties have been ratified by 198 parties (197 states and the European Union), making them the first universally ratified treaties in United Nations history.
- These truly universal treaties have also been remarkable in the expedience of the policy-making process at the global scale, where only 14 years lapsed between a basic scientific research discovery (1973) and the international agreement signed (1985 and 1987).

Phase out of HCFCs – the Montreal Amendment

- Hydro chlorofluorocarbons (HCFCs) are gases used worldwide in refrigeration, air-conditioning and foam applications, but they are being phased out under the Montreal Protocol since deplete the ozone layer.

- HCFCs are both ODS and powerful greenhouse gases: the most commonly used HCFC is nearly 2,000 times more potent than carbon dioxide in terms of its global warming potential (GWP).
- Recognizing the potential benefits to the Earth's climate, in September 2007 the Parties decided to accelerate their schedule to phase out HCFCs.
- Developed countries have been reducing their consumption of HCFCs and will completely phase them out by 2020.
- Developing countries agreed to start their phase-out process in 2013 and are now following a stepwise reduction until the complete phase-out of HCFCs by 2030.

8. Explain about Municipal solid waste management. CO5][L2][10M]

Management of solid waste is very important in order to minimize the adverse

effects of solid wastes.

Types of solid wastes

1. Urban wastes

Sources

- ✓ Domestic wastes – Food waste, Cloth, Waste paper.
- ✓ Commercial wastes – Packing material, cans, bottles, polythene.
- ✓ Construction Wastes – Wood, concrete debris.
- ✓ Bio medical wastes – Anatomical wastes, infectious wastes.

2. Industrial wastes

Sources

- ✓ Nuclear power plants – generates radioactive wastes
- ✓ Thermal power plants – produces fly ash in large quantities

3. Chemical industries

Produces large quantities of hazardous and toxic materials

Management of solid waste:

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

I. **Reduction involve of raw materials:** Use of Raw materials depends 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. How can we create public environmental awareness? [CO5][L2][10M]

Our environment is presently degrading due to many activities like pollution,

deforestation, overgrazing, rapid industrialization and urbanization.

Objectives of public awareness

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

Methods to create environmental awareness

- ✓ In schools and colleges
- ✓ Through mass – media
- ✓ Cinema
- ✓ Newspapers
- ✓ Audio - Visual media
- ✓ Voluntary organizations
- ✓ Traditional techniques
- ✓ Arranging competitions
- ✓ Leaders appeal
- ✓ Non – government organizations.

10.Describe your recent visit to any industrial site and explain the impact of pollutants emitted on Environment and discuss the various measures to control the pollution levels.

[CO5][L3][10M]