ENVIRONMENTAL SCIENCE

Def?

- The word 'environment' is derived from the french word 'environnen' means to encircle or surround. It is a composite word for the condition / surrounding in which organism or group of organism live.

- It includes both physical and biotic world, in which biological beeng live, grow, get nourished and develop their natural characteristic.

- The environment consist of both biotic and abiotic substance i.e. consist of water, food, sunlight, temperature etc. Thus environment can be defined as in a no. of ways but common defination is

"Environment is the sum of all social, economical, physical or chemical factor which constitute the surrounding of men / living organism who is both creator and moulder of this environment.

Scope :-

- To understand all the aspect of our environment, we need to understand biology, chemistry, physics, geography, resource management, economics and population issue. Thus the scope of environmental studies is extremely wide and covers some aspect of nearly every major discipline.

- If we study natural history of the area in which we live, we would see that our surrounding were originally a natural landscape, such as forest, a river, a mountain, a desert or a combination of these element.

→ most of these landscape were modified by human ~~c~~ into villages, towns or cities. and these in turn are dependent on natural landscape such as forest, grassland, rivers, seashores for resources such as water for agriculture, fuelwood, fodder & fish.

→ We use water to drink, and for other day to day activities we breathe air, we use resources from which food is made and we depend upon community of living plants and animals which form a web of life, of which we are also part.

→ Over the past 200 years, however modern societies began to believe that easy answer to the question of producing more resource could be provided by the endless chemical application of technological innovation. Some example are:- growing food by using fertilizers & pesticides, developing better strain of domestic animals and crops, irrigating from land through mega-dams and developing industries. All this rapid economic growth and this type of ill-considered development has inevitably lead to environmental degradation beside several harmful effect as well.

→ Industrial development and intensive agriculture that provide the goods for our increasingly consumer-oriented society also use up large amount of natural resources like water, minerals, petroleum product, wood and so on. Non-renewable resources, such as mineral and oil, will be ~~extracted~~ exhausted in the near future if we will continue to extract these @ thought for subsequent generation.

Renewable resources such as timber, and water can be regenerated by natural processes such as regrowth and rainfall. However these too will be depleted if we continue to use them than nature can replace them. Also deforestation leads to floods in the monsoon season and dry rivers once the rain is over.

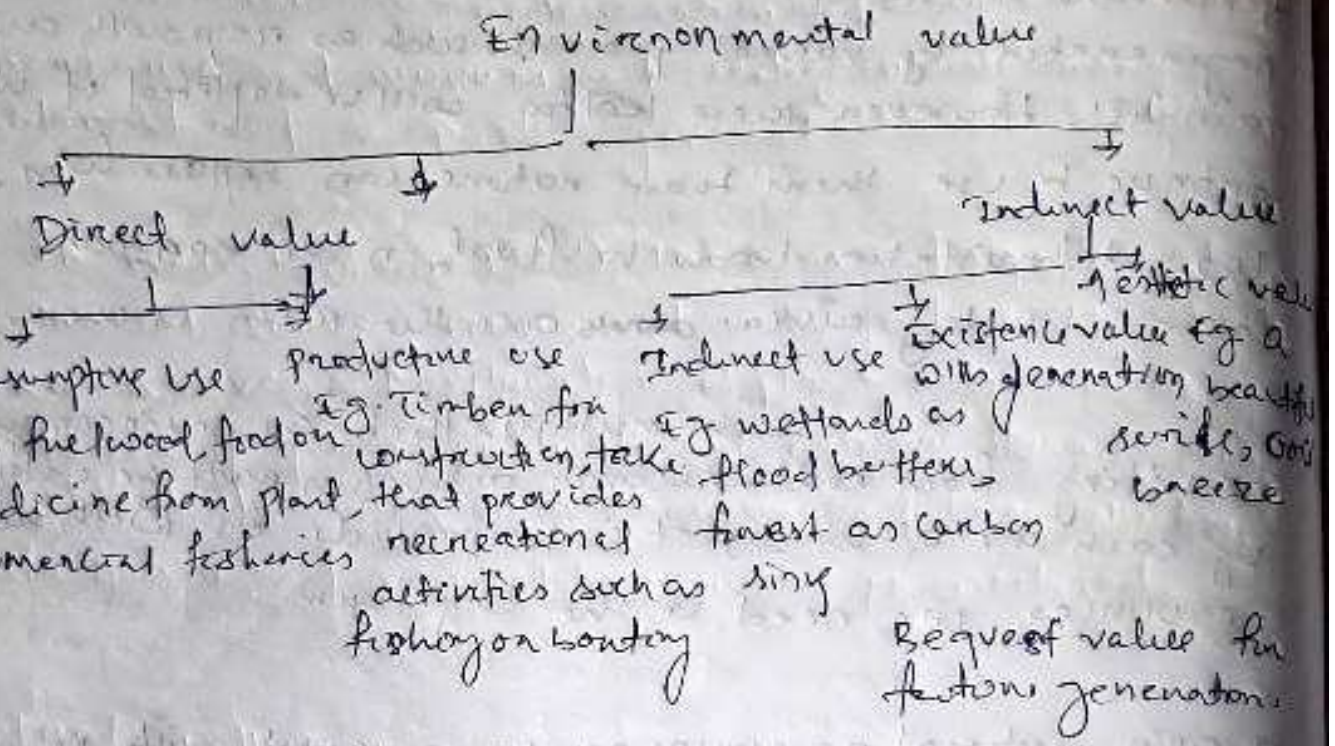
Such multiple effects on environment resulting from continuous human activities must be understood by each one of us. If it is to provide us with the resources we need in the long term

- Our natural resources can be compared with the money in a bank If we use rapidly, the capital will be reduced to zero. on the other hand, if we use only interest, it can sustain us even the longer term. This is called sustainable development

Importance :-

- we know water, soil, minerals, oils, ~~the product that we get from forest~~, are limited and are all part of ours ~~earth~~ life support system without them life itself would be impossible. As we keep increasing in number and the quantity resource of each of us also increases, the earth resource base quickly shrank.

- Increased amount of waste and pollution contaminating our water supply is the threat to the quality of life for all.



Need for public awareness

→ As the earth natural resources are rapidly dwindling and our environment is being increasingly degraded by human activities, it is evident that something need to be done.

→ We often feel that managing all this is something that the government should do. But if we to endanger our environment there is no way by which government can perform all these clean up function.

→ Just for any disease, prevention is better than cure protecting our environment is economically more viable than cleaning it up once it is damaged. → Individually, we can play a major role in environment management.

→ We can reduce wastage ~~material~~ of natural resources and we can act as watch dogs that inform the government about sources that lead to pollution and degradation of the

this can be made possible through public awareness. mass media such as news papers, radio and television strongly influence public opinion

→ politicians in a democracy always respond positively to a strong public supported movement. Thus if you join an NGO that support conservation, you might be able to influence politician to make green policies.

→ we are living on 'spaceship earth' with limited supply of resource. Each of us is responsible for spreading this message to as many people as possible. There are several Govt and non-govt (NGO) are working towards environment protection in our country

Initiation in Environment

Botanical survey of India

→ The BSI was established in 1890 at the royal botanic garden, Calcutta, however it closed down for several years after 1939.

→ The aims and objective of the survey were redefined by the programme implementation and evaluation committee in 1976 with a view to encourage taxonomic research and to accelerate scientific ~~expert~~ expertise for the preparation of a comprehensive list of flora of the country "endemic flora of India" project.

ethnobotanical study, modernisation and maintenance of herbarium and museum and creating interest among botanist and in public general

→ In recent view (1987) the aims and objective of botanical survey remained unchanged except activities like survey and exploration of plant resources, listing of endangered species, publication of national flora, preparation of national data bank on herbarium and live collection, distribution, and nomenclature were prioritised.

Central pollution Control Board (CPCB)

- It is a statutory organisation which was constituted in 1974 under the water (prevention and control of pollution) Act, 1974 and under the Air (prevention and control of pollution) Act, 1981 to prevent and control pollution to improve the quality of India's environment

→ A large no. of activities and programmes have been started such as the development of source specific pollution control norms and guidelines based on available scientific understanding, setting up of ambient air and water quality criteria, and fuel quality.

→

NATURAL RESOURCE

Natural Resources

Things/material of the nature, that can be put to some use by human being for their growth, development, comfort and other necessities are called as "Natural resources"

Ex:- Air, water, soil, forest, Animals, minerals, metals energy are some example of natural resources that are utilized by human being.

Types of Natural Resources

a) Exhaustible Natural resources (Resource that can be exhausted through continuous use)

b) Inexhaustible

OR

N. Resources

Exhaustible
(Resource that exhausted through continuous use)

Renewable
(Resource that can be renewed like - groundwater, soil, forest, animals etc.

Non-renewable
that can never be renewed like fossil fuels such as petroleum, natural gas, coal, limestone, other minerals.

Inexhaustible
(Resource that can't be exhausted eg. air, sunlight

Natural resources and associated problems

→ Man apply all their power and intelligence for food and development. They adopt new ways to fulfil their needs and often make improvement in old ways to derive resources and fulfill their desire more efficiently. This is, how they developed new technologies for utilization of natural resources. As Natural resources are exhaustible and Inexhaustible, the exhaustible resources are renewable and non-renewable ~~resources~~ therefore proper utilization of our natural resources is the need of today

→ In the past man was not so advanced and was satisfied what he recieved from the nature due to his limited needs. Then, there was complete balance among all the components of the natural environment in the past At present, the story has become very different due to human activities of consumption and misuse of natural resources and explosion of population. ~~fast~~ growth in human population has led to fast rate of consumption of natural resources and creation of wastes.

→ Directly or indirectly there are some problems from over exploitation of natural resources. They are, lowering of water table, extinction of wild animals, soil erosion, floods, Climatic change, interruption of water ~~cycle~~ cycle, loss of agricultural plant/animal, ozone layer depletion, global warming, acid rain etc.

→ Ocean are also provide different types of food material and minerals. Large quantities of petroleum and natural gas are also obtained from ocean. They are valuable contributors in the development and

prosperity of human being. But due to human activities, ocean have been put under heavy condition of serious stress.

→ therefore, conservation of resource should be the priority of every citizen. By making rules we can't protect natural resources, awareness programme, social forestry, joint forest management, van panchayat, organising seminars, public programmes are some means by which we can protect and conserve natural resources.

→ Human activities should be refered ~~using~~ high technology which adversely affect the natural resource and environment under environmental resource management. population should be controlled bcoz it is the root cause for resource exploitation.

Forest Resource

→ People who live in or near forest know the value of forest resource first hand, because their lives and livelihood depend directly on these resources. How even the rest of us also derive great benifits from the forest, which are rarely aware of

→ the water we use depends on the existence of forest on the watershed around river valleys. our homes, furniture and paper are made from wood from the forest. we use many medicine, and we depend on plants for the oxygen and to remove the carbon dioxide that we breathe.

	Area (km^2)	Geographical area
very dense forest	83,471	2.54 %
moderately dense forest	320,736	9.76 %
open forest	287,820	
Total forest cover	692,027	21.05 %
Total forest cover & Tree cover	782,871	23.81 %

Forest & Tree cover of India in 2011

Deforestation

Deforestation is the loss or continual degradation of forest habitat due to either natural or human related causes.

→ Agriculture, urban sprawl, unsustainable forestry practice, mining and petroleum exploration all contribute to human caused deforestation. Natural deforestation can be linked to tsunamis, forest fires, volcanic eruption, glaciation, and desertification.

→ Deforestation defined broadly can include not only conversion to non-forest but also degradation that ~~causes~~ reduces forest quality - the density and structure of the trees and genetic diversity

Causes of deforestation

(1) Present causes.

While short sighted, market driven forestry practice are often one of the leading cause of forest degradation, the principal human-related causes

of deforestation, are agricultural and livestock grazing, urban sprawl mining and petroleum extraction.

Pre-history

→ Deforestation has been practiced by humans for thousand of years. fire was the first tool that allowed humans to modify the landscape.

→ The first evidence of deforestation shows up in the mesolithic. fire was probably used to drive game into more accessible area with the advent of agriculture fire became the prime tool to clear land for crops.

→ mesolithic foragers used fire to create openings for red deer and wild boar.

Pre-Industrial history

→ A typical pre-agrien trap is that cities are built in a woody area providing wood for some centuries which stands if soil is and without proper replanting that it becomes impossible to obtain it close enough to remain competitive, leading to the city's abandonment, as happened repeatedly in Ancient Asia Minor.

Environmental Effects

→ (1) Atmospheric pollution :-

Deforestation is often identified one of the major causes of the enhanced green house effect. Trees and other plants remove carbon (in the form of CO_2)

from the atmosphere during the process of photosynthesis.

~~Both the decay and burning of~~

(iii) Wild life

→ Some forest are rich in biological diversity. Deforestation can cause the destruction of the habitats that support this biological diversity. ~~thus~~

(iv) Hydrological cycle & Water Resources

→ Trees and plants in general, affect the hydrological cycle in a no. of significant ways

a) their canopies intercept precipitation, some of which evaporates back to the atmosphere

b) their litter, stems and trunks slow down surface runoff

c) their roots creates macropores - large conduits - in the soil that increases infiltration of water

d) they reduce soil moisture via transpiration

As a result, the presence or absence of trees can change the quantity of water on the surface, in the soil or ground water or in the atmosphere.

(iv) Soil erosion

→ Deforestation generally increases rates of soil erosion, by increasing the amount of runoff and reducing the protection of soil from the tree litter

Land slides

→ Tree roots bind soil together and if the soil is sufficiently shallow, they act to keep the soil in place by also binding with underlying bedrock.

controlling Deforestation

(1) farming

→ New methods are being developed to farm more foods crops on less farm land such as high yield hybrid crops greenhouse, autonomous building garden and hydroponics. This reduced farm land is then dependent on massive chemical input to maintain necessary yield.

(2) forest management :-

→ Efforts to stop or slow deforestation have been attempted for many centuries because it has long been known that deforestation can cause environmental damage sufficient in some cases to cause society to collapse.

→ In Tonga, paramount rulers developed policies designed to prevent conflicts, both short term gains from converting forest to farmland and long term problem forest would cause.

A Afforestation

→ Today in china, where large scale destruction of forest has occured, the govt has required that every able-bodied citizen btn age of 11 to 60 plant 3 to 5 trees/yr or do the equivalent amount of work in other forest. the govt claims that at least 1 billion trees have been planted in China every year since 1982.

Case studies

(1) Indonesia

There are large areas of forest in Indonesia that are being lost as native forest is cleared by large-multinational pulp companies and being replaced by plantation.

~~B~~

~~1) United States~~

Timber extraction

- once world bank study in 1989 has argued that tree crop estates are better employement generating option than every forest plantation, ~~not~~ with standing the high density of useable timber in the plantation. In Indonesia timber manufacturing employement is high as 3.7 million. News paper Kompas reported that small regional sawmills alone were supply ~~2000,00~~ 2,00,00 people in Indonesia

→ with good prices, production expanded and at the end of 1980s the peninsula had 681 saw mills, 45 veneer and plywood mills and more than 1200 small wood working plant, furniture factories.

→ In India also millions of people are engaged in timber industries. Not only they are earning but solving the problem of employement to some an extent. There is a gap between damand and supply, this results imports of loggs from other countries like Malaysia, Indonesia etc. Day by day, the demand of loggs is increasing due to population growth. Timber shortage are clearly either real or in prospect, posing a severe threat to both entrepreneurship and employement. Indonesia has already stepped up its reforestation effort using mainly Acacia mangium with a view to the future establishment of pulp and paper mills.

Mining

→ Mining is the extraction of valuable minerals or other geological material from the earth usually from an ore body,

Materials recovered by mining include bauxite, coal, diamonds, iron, precious metal, lead, limestone, nickel, phosphate, rock salt, tin, uranium, molybedenum.

History of Mining

The oldest known mine in archaeological record is "Lion Cave' in Swaziland. At this site, which by radio carbon dating is 43,000 old, Paleolithic humans mined for iron containing mineral ~~hae~~ hematite.

Environmental effects & mitigation

→ Environmental issues can include erosion, formation of sinkholes, loss of biodiversity and contamination of groundwater by chemicals from the mining process and products

→ Modern mining companies in many countries are required to follow strict environmental and rehabilitation codes, ensuring the area mined is returned to close to its original state or even better environmental state than before mining takes place.

Dams

→ Water is essential for sustenance of all forms of life on earth. Some parts of the world, which are scarce in water, are prone to drought, other parts of the world which are abudant of water, face challenging job of optimally managing the available water resources.

→ No ~~doubts~~ doubt rivers are great gift of nature and have been playing a significant role in evolution of various civilization, nevertheless on many occasions, at the time of floods, have been

playing havoc with the life and property of the people.

optimal management of river water resources demands that specific plan should be evolved for various river basin which are found to be technically feasible and economically viable after carrying out extensive surveys.

→ Since advent of civilization, man has been constructing dams and reservoir for storing surplus river water available during wet periods and for utilization of the same during lean periods.

Dams and reservoir contribute significantly in fulfilling the following basic human needs:-

a) water for drinking and industrial use
b) Irrigation
c) flood control
d) Hydro power generation
e) Inland navigation
f) Recreation

Problem from Dams

We have seen benefits of dams, but on the other side of coin is also not good when such project are undertaken and hundred crores of public money is spent, individual or an organisation in the grab of PIL cannot be permitted to challenge the policy decision taken.

→ for such development project thousand of acre land is acquired, results the public become landless.

As far as relief and ~~project~~ rehabilitation are concerned, People are not given properly.

→ Later on people go on strike and other demonstration.

Narmada Bachao Andolan", "Chipko movement" etc are such movement, which work for the relief and rehabilitation of affected people.

→ Due to these dams, most affected people are tribal, labour class people etc. They can not oppose their own.

Water Resource

Water is a natural resource, its availibility greatly influences the health of people and development potential of the area. Proper assesment, of the availibility of this resource from surface and sub-surface sources is crucial for its proper planning, development and efficient management.

→ About 70% of the global surface is covered with water in the form of ocean, seas, rivers, lakes, ponds.

Total quantity of water available on earth is 1386 million cubic kilometer, 97.3% of the water available on earth is saline and 2.7 is available as fresh water.

→ The mean annual rainfall, taking the country as a whole is 1170mm. This gives annual precipitation of about 4000 km^3. A significant part of this

precipitation returns to the atmosphere as evaporation. A large part remaining seeps into the ground and the balance flows through streams, rivers and collect in water bodies adding to the surface flow.

India receives average annual precipitation of 4000 km³, out of which 400 km³ immediately lost to the atmosphere, 2150 km³ soaks into the ground and 1500 km³ flows as surface runoff.

Availability of water Resources :-

→ India is one of the few countries in the world endowed with abundant land and water resources. Average annual precipitation including snowfall over the country is 4000 billion cubic meter (BCM). In addition, it receives another 200 BCM from rivers flowing in from other countries. Average annual water resources in various river basins are estimated to be 1869 BCM of which utilizable volume of water has been estimated to be 1086 BCM including 690 BCM of surface water and 396 BCM of ground water.

Surface water :-

There are 20 river basin of which 12 are major basin having drainage area of 20,000 km².
The annual average runoff estimated to be 1952.87 BCM.

→ The storage built up in various river basin through major and medium irrigation project is about 173.73 BCM. The major and medium irrigation project under construction and identified would amount for 75.42 BCM and 132.3 BCM respectively taking the total of 381.45 BCM. If minor irrigation structure are included

the total storage goes upto 420 BCM.

→ The average annual utilisable water resource through conventional scheme of all the 20 river basin taking into account the uneven nature of distribution of water resources and the topographic constraint is estimated to be 690.3 BCM which is about 35% of the total surface water resources. This indicates the vast amount of runoff is going as waste to sea.

Ground water

→ Replenishable ground water resources assessed is of the order of 431.32 BCM and utilisable ground water resources as 395.6 BCM of which 32.5.6 BCM is available for irrigation and the rest for domestic and industrial use. Thus the total utilisable ground water resource amount to about 92% of potential replenishment.

→ The gross available and utilisable water resource of the country are 2384.5 BCM and 1086.0 BCM respectively. The available and utilisable water resource per capita based on 1991 population are 2830 m^3 and 1288 m^3/capita/yr

Over exploitation of water

The exploitation of groundwater resources more than its annual replenishment has caused the continuous declining of water levels, declining of well yield, drying of shallow wells, deterioration of groundwater quality and high cost of energy required

to lift the water from great depths which becomes uneconomical for poor farmers to continue agriculture

→ Though India is blessed with good water resources but its distribution over the country is not evenly proper. Even in the high rainfall areas like meghalaya and Kerala water scarcity is felt in summer months due to over exploitation of water and mismanagement. there is large amount of ~~water~~ rainfall annually flowing out as run off to sea.

→ There is a gap exist betn available water resource and future need of water for the country. Due to over utilization of water punjab, Haryana, Tamil Nadu and Gujrat the states where the water tables have declined deeply. In Gujrat more than 90% wells water table dropped by 0.5 meters to 9.5 meters.

Conflicts over water

→ water being the basic requirement for life and necessary for almost all socio-economic activities in fact even greater demand. Its relative demand increases with degree of scarcity.

→ A large part of the country already faces water scarcity condition and it is expected that the middle of the next century most regions of the country would face some degree of scarcity. These conditions have already created a number of inter state water dispute.

11) Mineral Resources

→ Mineral are being vital raw materials for many basic industries, Play an important role in the industrialization and overall development of a nation. Minerals are generally called the "stock" as they were non-renewable resources.

→ Minerals are the definite chemically bonded substances created through chemical processes between organic and inorganic matters present in the earth's crust. they may be solid or liquid.

Types of minerals

Minerals available in earth crust can be divided into three types

1. Metallic minerals
2. Non-metallic minerals
3. Mineral fuels

Some other classifications of minerals are also given by scientists. they are classified as strategic and critical depending on the use and importance.

1. Metallic Minerals → We cannot extract metal directly from minerals. there is difference between minerals and ores. therefore for extracting metals, minerals are treated by different processes before extraction. metallic minerals are generally found in combined state. According to availability of metals, metallic Minerals are further divided into following:-

(a) ferrous alloys :- Most common metal (which is used largely) is iron. other than iron are aluminium, lead, zinc, copper etc. All are found in rich quantities, found in nature as well as in combined state, iron pyrite,

Lignonite, haematite, magnetite are examples of ferro alloys. certain other metals, non-metals are contaminated with these as impurities.

(b) Non-ferrous alloys :-

The minerals/alloys of this type contain the metals like titanium, antimony, arsenic, beryllium, copper, Zirconium, cerium, lithium etc. these metals are costlier then proceeding metals. Here the iron found as an impurities.

c The minerals/alloys containing very least quantity of metals whose extraction is costlier. these metals are generally use in jewellary eg. gold, platinum, silver, iridium etc.

② Non-metallic minerals -

Minerals, whose yield products are other than metals comes in this head. they are called the non-metals. they are further divided on the basis of physical and chemical properties. Graphite, pyroluside, dolomite quartz, Kaoline, fire clay, felspar, mica, asbestos, gypsom fluoride, chrome/red ochre. lime stone, borax, phosphorite, Ilmanite, flint, dymond. calcite sand stone, stones like phylite, cyanite lime stone, ruby, sapphire. Emarald, amber, spodumene etc. are the examples of non-metallic minerals.

③ Mineral fuels -

The include the materials use to provide energy, for example coal natural gas, fossil fuels and Petroleum etc. these are the important source of energy. hence they have tremendous importance for mankind.

→ Coal is the most commonly available fuel which is used as domestic as well as industrial fuel. it is of different type i.e. Anthracite, Bituminous, lignite etc. the type and quality of the coal depend upon the percentage of carbon present in them. It is the principle source of energy in world. It is used in various ways in different industries like cement, glass, railways, textile sugar, paper, steel etc. it is also largely use in domestic way. USA, china, Britain, Germany, south Africa, Australia are richest coal contenting countries in world.

Mineral resources of india:

India has sufficient quantities of iron, aluminium, titanium copper, lead, zinc ores, india is fairly rich in mineral resources. We possess good deposits of most of mineral elements which we needed in large quantities. However, other economically important minerals are not present in sufficient quantities.

→ India has a large number of economically useful minerals and they constitute one-quarter of the world's known mineral resources. About two-thirds of its iron deposits lies in a belt along orissa and Bihar border. Other haematite deposits are found in madha pradesh, Karnadaka, Maharashtra and Goa, magnetite iron-ore is found in tamilnadu, Bihar and Himachal.

→ India has the world's largest deposits of coal. Bituminous coal is found in Jharia and bokaro in bihar and raniganj in west Bengal. Lignite coals are found in Neyveli in tamilnadu.

→ Next to Russia, india has the largest supply of manganese. the manganese mining areas are madhya

pradesh, Maharashtra and Bihar - Orissa. chromite deposits are found in bihar, cuttack district in orisse, Krishna district in Andhra and mysore and Hassan in Karnataka. bauxite deposits are found in western bihar, Southwest Kashmir, Central tamilnadu, and parts of Kerala, U.P maharashtra and Karnataka.

→ India also produces third quarters of the world's mica. Belts of high quality mica are, bihar Andra and Rajasthan. Gypsum reserves are in tamilnadu and rajasthan. Nickel ore is found in cuttack in bihar and Mayurbhanj in Orissa. Ilmenite reserves are in Kerala and along the east and the west Coastal beaches.

→ Silimanite reserves are in sonapahar of meghalaya and in pipra in M.P copper ore bearing areas are Agnigundala in Andhra, singhbhum in bihar, Khetri and Dariba in rajasthan and parts of sikkim and Karnataka.

→ The Ramagiri field in Andhra, Kolar and Hutti in Karnataka are the important gold mines.

→ The panna diamond belt is the only diamond Producing area in the country, which covers the districts of panna, chhatarpur and satna in madhya pradesh. as well as some parts of Banda in Uttar pradesh.

→ Petroleum deposits are found in Assam and Gujarat. Fresh reserves were located off Bombay. the potential oil bearing ares are Assam. tripura, manipur, west Bengal, Punjab, Himachal, Kutch and the andmans.

India also possesses the all-too valuable nuclear uranium as well as some varieties of rare earths.

Environmental Effects of Extracting and using Mineral Resources

Mining, minerals and minerals based industry indeed play an extremely important role in the development of mankind. The total geographical area of India is 329 million hectare constitute 2.4% of the world land area. out of 82500 hectares is sustaining mining activities of some kind or the other.

The environment means the surrounding The components of environment include soil, water, air, land land scape and living creatures. The environment is more damaging by open cast mining than the underground mining Not only environment, mining also effects human health. There are following environmental effects of mining

a) Land degradation due to lowering of the surface level at some places and creation of large mound at other place

b) Deforestation in the mining areas i.e. the loss of valuable soil cover, resulting in the possibility of enhancement of soil erosion

c) Due to increased discharge of rain water passing through the terrains, disturbed by surface mining, the local drainage system is polluted.

d) The frequency of land slides increases

e) The erosion of soil is enhanced.

f) The agricultural lands are affected by silt and the fine materials mined but not recovered.

g) The disturbance caused adversely affects the well balanced pH and diminishes the regenerative quality of soil.

(H) The disturbance caused to floral and fauna population.

(I) The heavy earth moving machinery and blasting causes problems of noise, vibration and the release of noxious gas in atmosphere.

(J) mine dranage has polluted streams, rivers, lake every sea.

(K) Fumes from smelter damage forest and spread pollution over large area

(L) Mining and mineral based industries with their effluents create pollution problems. Asbestos, cement and other chemical industries are very hazardous.

(M) Mining reduces the reduction of forest i.e. deforestation. Thus flora and fauna are also destroyed.

(N) The people related with mining and extraction effected by polluted environment

(O) Deforestation and climatic changes results poor rain-fall and affects flora and fauna

WORLD FOOD PROBLEM

Before the 21st century, it was felt that world food production is not sufficient for the present population. Food production was less because people were using the old techniques, seed etc. Later on when population pressure starts, the new ways of food production, using fertilizers, pesticides, insecticides etc. are discovered to increase the yield. In 1999 International Food Policy Research Institute (IFPRI) reported the increase in world food consumption by 2020, discussing the impact of this on both developed and developing countries. The report considers the six emerging issues, nutrition, grain prices, WTO, agroecological approaches to small scale farming, biotechnology,

information technology and precision farming. In world food submit 1996 in Rome the following points were discussed—

(*i*) Reduce world hunger

(*ii*) Agricultural supply and demand

(*iii*) Population growth

With respect to crop production and agricultural growth the similar discussion on "goals, solutions and actions necessary to end hunger" were also held in IFPRI conference held in Bonn, Germany 2001. All this shows the awareness of we people to increase the food production in view of increasing population growth. World leaders also agreed that the contribution of irrigation to incremental food production should be substantial.

Different scenarios have been examined to explore a number of issues such as the expansion of irrigated agriculture, the increase in food production in rainfed areas, and the public acceptance of genetically modified crops. Some opinion were that the world may face urgent food and agriculture problems. Analysis believe that what is needed is a new and greener revolution to once again increase productivity and boost production.

Severe droughts and sharply rising food prices spurred national governments and international agencies to address the food crisis of the 1960s and 1970s. The 'Green Revolution', consisting of crop variety improvements, increased use of fertilizers and expansion of irrigation, averted the projected shortages in food production. According to some experts, another food crisis predicted by advocates of a new boom in investment for irrigation is not yet in view. Food grain prices have remained stable for the last 15 years. There is hunger in the world, but that is because the hungry cannot translate their needs into demand or civil disorders disrupt food flows. However, according to the authoritative Consultative Group on International Agricultural Research (CGIAR), the world is entering the 21st century on the brink of a new world food crisis that is as dangerous, but far more complicated than the threats it faced in the 1960s (Shah and Strong, 2000).

Much could be said on the role of demographic and economic factors, such as world trade, price commodities and agricultural subsidies to farmers in meeting the challenge. However, the purpose of this paper is not to contribute more to the dabate between experts on food security. It is to examine the probable consequences of the business-as-usual scenario that has been the prevailing model for the development of irrigated agriculture, particularly of the large-scale irrigation systems, in many countries. It also projects the likely benefits of increased investment in irrigation and advocates a new approach to design and management of irrigation systems in association with institutional and policy reforms.

Food Resources

Food which is necessary for all living organism consists of proteins, enzymes, carbohydrates, mineral etc. There are various types animals depend upon the types of food.

→ Cereals, pulses, grains, vegetables, fruits etc. we get from agriculture. Domestication of cattle and poultry are necessary food production from animals. Fish is another source of food.

Overgrazing

→ overgrazing occurs under continuous or rotational grazing. It can be caused by having too many animals on the farm or by not controlling their grazing activity.

→ overgrazing reduces plant leaf areas which reduces intercepton of sunlight and plant growth. plant becomes weakened and have reduced root length and pasture sod weakens. The reduced root length makes the plant more susceptible to death during dry weather.

⇒ under continuous grazing, overgrazed pastures are predominately by short grass such as blue grass and will be less than 2-3 inch tall in the grazed areas. soil may be visible between plants in the stand, allowing erosion to occur.

→ under rational grazing overgrazed plants do not have enough time to grow to the proper height between grazing events. The animals are turned into a paddock before the plants have restored carbohydrated reserves.

→ overgrazing can increase soil erosion. Reduced soil depth, soil organic matter and soil fertility hurt the land's future productivity

→ To prevent overgrazing, match the forage supplement to the herd's requirements. This means that a buffer needs to be in the system to adjust for the last spring growth of cool season forages.

→ Another potential buffer is to plant warm season perennial grasses such as switchgrass, which don't grow early in the season. This reduces the acreage that livestock can use early in the season, making it easier for them to keep up with the cool season grasses

Effect of modern Agriculture

Between 1950 and 1975 agricultural productivity in history changed more rapidly. Total farm output increased more than half. This change is due to technological innovations, development of hybrid strains and other genetic improvement and to unfold increase in the use of pesticides and fertilizers.

→ Although the intensification of agriculture has vastly increased productivity, it also has had a number of potentially detrimental environmental consequences ranging from rapid erosion of fertile topsoil to contamination of drinking water supplies by the chemicals used to enhance farmland productivity

Impacts of modern Agriculture

(1) Damage to soil :-

(a) Contamination of chemical with water

Surface runoff carriers manure, fertilizers and pesticides into streams, lakes and reservoir, in some cases causing unacceptable levels of bacteria, nutrients or synthetic organic compounds. Similarly, water percolating down through farm fields carries with it dissolved chemicals which can include nitrate fertilizers and soluble pesticides.

~~(b) fracta to ~~

(b) water logging and salinity

The salinity of the soil is one of the reason of low productivity just because of the improper management of farm drainage. In this situation the roots of plant do not get enough aeh to respiration then leads in low crop yield as well as low mechanical strength.

(c) Excessive use of pesticides

There are many pesticides are used for destroying pests and boosting crop. most importantly, many pesticides are non-biodegradable, which also linked to the food chain are harmful human being

of soil erosion

the top of the soil of the farm land is removed due to extensive water supply. This leads to the loss of nutrient rich soil that hampened the productivity

ENERGY RESOURCES

Energy is needed by all living organism and vegetations for biochemical reaction of their cells. It is power which is needed in one form or other for work done

→ The fire was the first form of known energy used for cooking, heating purpose. Now things are changed drastically, for the develop mented activities, energy sources have their own importances.

Growing Energy Needs

Energy is the prime input of a country. It is converted into heat and electricity, for every activity to be performed required energy in the form of heat, light, electricity and even food for our body.

→ As the economy grows, intensity of energy rises following corresponding increase in energy consumption. However, beyond a certain level of per capita income, energy intensity begins to decline. These linkage between energy and economic factors, manifested in energy elasticity and

energy intensity broadly related to

a) Demographic changes including a relatively faster growth in urban areas, higher per capita GDP and per capita growth saving

b) Efficient end-use devices

c) Technological improvement in conversion equipment

d) Inter fuel substitution with more efficient alternatives

Energy sources

There are 2 types of energy sources to meet the requirement

a) Renewable or non-conventional or Inexhaustible energy resources:-

The resources which are continuously replenished by natural process.

Ex: Solar energy, wind energy, bio energy, hydro power etc.

(2) Non-Renewable / conventional / Exhaustible energy resources

These energy resources are not created in nature after continuously use.

Ex:- natural gas, petroleum products.

LAND RESOURCES

In India, land is generally called as "mother land". It is because of our life depend on it for food, fibre, fuel and other basic amenities.

→ Top layer of the land is called as soil, which is renewable resource and essential for survival of life.

→ out of the total geographical area of 328 million hectares, the land use statistics are available for roughly 306 million hectares, constituting 93% of the total land available for cultivation is approximately 14 million hectares.

Land Degradation

→ Land is vital resource to mankind, like air and water.

→ "Land degradation is the loss of productive capacity of the soils for present and future".

→ Due to use and over exploitation land resources are degraded.

→ Land degradation is a real alarm. Because soil formation is a very slow process. In ~~nature~~ general formation of 1.0cm soil from parent materials take 300-400 years.

→ Some 1.9 billion hectare of agricultural land have been degraded to some on extent and 8 million hectare are converted to non-agricultural use such as houses, road, highways, shopping centers factories etc.

LAND SLIDES

→ A land slides is a sudden collapse of a large mass of hill side.

Land slides mostly occurs
anywhere land slides have occured before
a) on steep slopes
b) on benches
c) where drainage causing problem
d) where certain geologic condition exist

factors causing land slides

(1) Land slides are the sudden downhill movement on earth or other solid materials and are usually caused by rain waves or forces either increasing the top material layers or making the slope too steep. They can be triggered by earthquake, Saturation with heavy rain.

(ii) Extensive rainfall on snow felt, however is also known to saturate and lubricate soil on steep angle.

(iii) Forest fire are indirectly responsible for landslide because they take away making shape vegetation erosion easier.

(iv) Man also caused slides by mining, the earth, underground excavation and pumping and draining ground water level on developing hill sides.

Effects of land slides

- No heavy damages occur in man enduced landslides but thousands of people affected and killed due to land slides.
- Many houses can be damaged and the loss of public properties is also noticed.
- Road and Rail communication may remain cut off from rest of the region.

DESERTIFICATION

→ Desertification is a process by which productive potential of arid or semi arid land falls. The decrease in productivity varies from 10/- 50/-.

→ Thus desertification leads to conversion irrigated crop land into desert. It is characterized by devegetation loss of vegetal cover, depletion of ground water, salinization and soil erosion.

→ Deforestation is also one of the cause of desertification. Because after forest grass land are used by human. So human activities are also responsible for desertification.

→ Mining and Quarrying activities are also responsible for conversion of productive land into desertification. It is studied that, the last 50 years about 900 millions hect. of land have undergone desertification over the world.

→ salinization is also one of the cause for conversion of agricultural land to desert.

Role of an Individual in conservation of Natural Resources:-

It is well known that people destroying, over utilising natural resources for their own interest. Resources are limited, if they will not be properly used, they will exhaust. ~~Therefore~~ Therefore, doing anything, awareness should be aroused by various method.

- people should understand the importance of resources i.e. land water, air, forest, minerals, energy etc. that these are precious and should be used with great care.
- It should not be optional but for all i.e. old, young, rich, poor, industrialist, common man, consumer, slum dweller. Every body should take part in this work. voluntary organisation are doing some work in this regard but it is not sufficient. Some important roles of individual in maintaining peace, harmony and equity in nature as

(i) people should at once stop over utilization ~~should~~ of natural resources they must be properly used.

(ii) Instead of deforestation, representation should keep in mind. We should take help from Govt. for plantation programme.

(iii) We should protect wild life. Though hunting is not allowed even then person are doing so. for this educated young should be teach the lesson of wild life act.

(iv) Mixed cropping, crop rotation, and proper use of fertilizer, ~~pesticides~~ insecticides, pesticides should be taught to farmers.

(v) We should make habit of waste disposal, compose and to restore biodiversity

(vi) Try to educate local people for the protection and judicious use of natural resources.

(vii) We should use light, fans and other domestic appliances when it is needed.

(viii) Maintain a balance bet resources and human needs.

(ix) maintain the essential ecological processes and ~~the~~ the life support systems.

(x) Install rain water harvesting system in houses, colonies

(xi) We should recycle the waste and waste water for agricultural purpose.

(xii) The fossil fuel should be used only when no other alternative source is available.

(xiii) We must develop energy saving methods to avoid waste of energy.

(XIV) Prevent soil erosion.

(XV) Use drip irrigation and sprinkling irrigation to improve irrigation efficiency and reduce evaporation.

(XVI) Utilize renewable energy sources ~~as much~~ as much as possible. Encourage use of solar cooker, pumps etc.

(XVII) Discourage frequent use of car, bike encourage walk and bicycle.

Equitable use of resources for sustainable life Styles

The equal distribution of natural resources should be for all irrespective of rich or poor. There must be balance between the need and consumption particularly for drinking water, food, fuel etc.

- The developed countries are utilizing more resources as compared to developing countries. This imbalance is responsible for rich become richer and poor gone poorer. This is due to sharp increase in population developing countries.

- Developed countries like USA, CANADA, JAPAN have 22% of world population utilising 85% of natural resources. Thus it is needed to divert resources to poor countries to narrow down the gap between the two.

- To achieve sustainable life style, there should be equal distribution of global resources and income to meet everyone need.

ECOSYSTEM

FOR the basic requirement each living organism has to depend and also interact with non-biotic or non-living and living or biotic component of the environment." the scientific study of the interaction with their physical environment and with each other is called as "ECOLOGY."

- The word ecology comes from 2 greek word "oikos" meaning "household" or home or place to live and "logos" mean discourse or study

Ecosystem is defined as a community of organisms interacting with one another and the environment in which they live. i.e. study of home.

Ex: - A home can be a drop of water for an amoeba
- A pond
- A field.

Functioning and types of Ecosystem :-

functioning of ecosystem is self regulating and self-sustaining this depend upon flow of energy, cycling of materials and perturbations both extrinsic and extrinsic.

Depending upon the species, diversity and the manner in which they are organised, Eco system are following types

1. Permanent and Natural Ecosystem

These operate under natural condition without any interference (even by human being). These can be further classified into

a) Terrestrial ecosystem b) Aquatic ecosystem

Terrestrial ecosystem operate on land hence forest, desert and grassland and agao ecosystem included in this type.

While aquatic ecosystem operates in water It can be devided into 2 types

a) fresh water b) marine ecosystem

2. Temporary and Natural Ecosystem

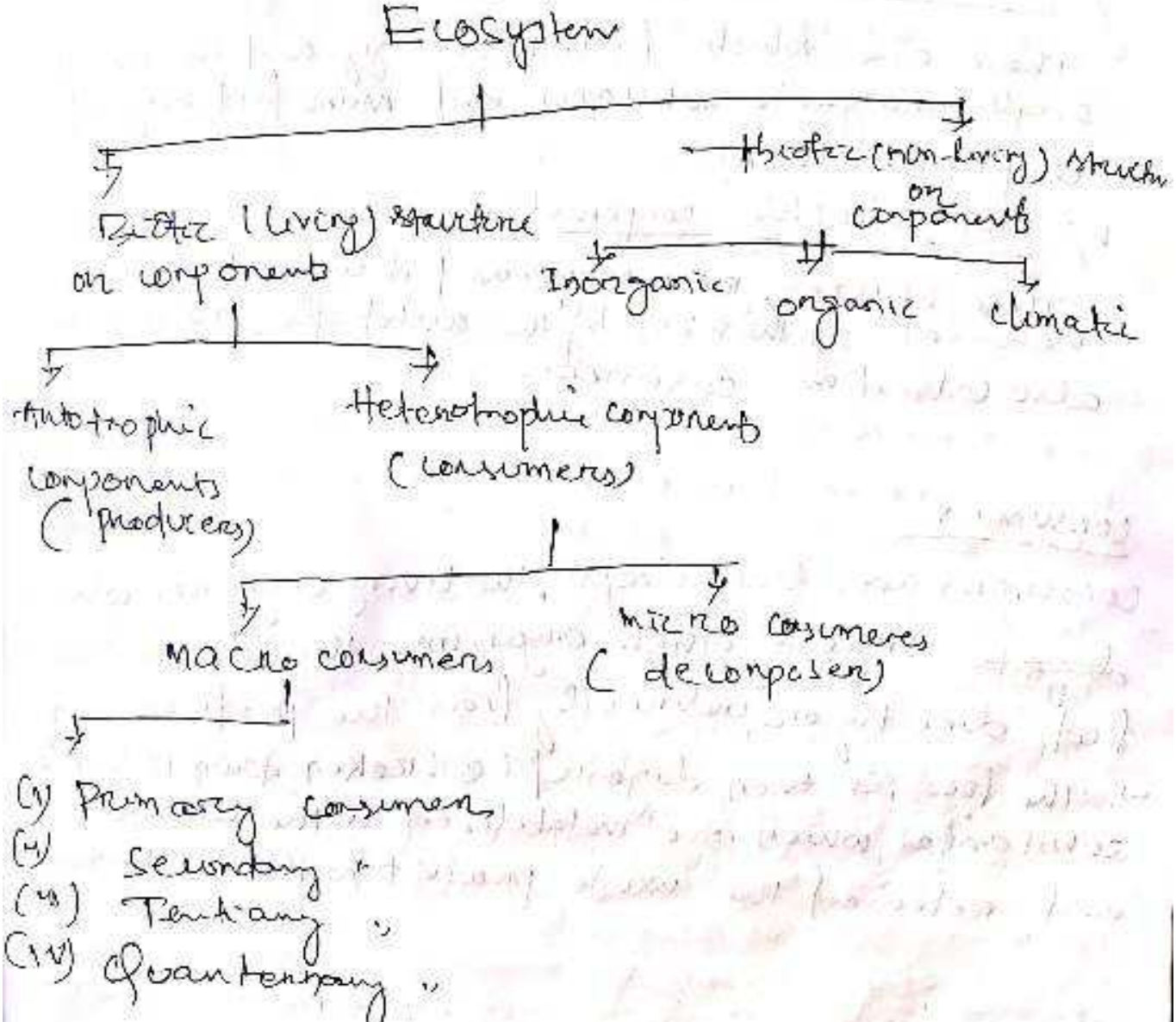
These are short lived but operate under natural condition

3. ~~Artificial or Anthropogenic~~ ecosystem:-

These are man made like fishery tank dame, croplands and space ecosystem also.

Structure of an Ecosystem

- Biological communities and Abiotic compounds constitute the structure of an ecosystem.
- According to Odum, from the trophic (food) point of view, an ecosystem has the following components



Biotic Structure :-

Producers, consumers and decomposer are components of biotic ecosystem.

→ Biotic structure includes plants, animals and micro organism present in an ecosystem.

These can be distinguished on the basis of their source of energy and material

a) Autotrophic component

These are which fix light, energy and the use of simple inorganic substance and manufacturing of complex material.

b) Heterotrophic component :-

These utilizes, rearranges and decompose the complex material synthesized by the autotroph. These are also called as consumers.

Consumers

consumers are heterotroph, the living organism which ~~digest~~ ingest other organism. They derive their food directly or indirectly from the producer.

→ The food is then digested i.e. broken down to simple substances which are metabolized in the consumers body and released the waste product to the environment.

(I) Primary consumer :- These are also called as "Herbivores" which feed directly on the producer.

Ex: Deer, Giraffe is Primary consumer in forest ecosystem
Cow or Goat is in Grassland ecosystem

(II) Secondary consumer :- They are also called as "Carnivores"

Ex:- Small gamefish in a pond ecosystem

(III) Tertiary consumer :- These are organism that eat other carnivores.

(IV) Omnivore :- A person or animal eating plants and animals is called as omnivores.

(V) Top carnivores

Some ecosystem have animals like Lion and vulture which are not killed or rarely killed and eaten by other animals are called as top carnivores.

(VI) Detrivores :- These are bottom living which subsist on the rain of organic detritus from autotrophic layers e.g. beetles, termites, ant crabs etc.

⊗ Decomposer

- These are also the living organism, mainly bacteria and fungi which breakdown complex compound of dead protoplasm of producers and consumer to simple organic compounds and ultimately into inorganic nutrients.

2. Abiotic structure or components :- The physical and chemical component of an ecosystem constitute its biotic structure. It includes two things

(1) materials or chemical factor

The materials are like water, minerals, atmospheric gas and other inorganic salts. They also include some organic matter such as amino acid, decay products, lipids, carbohydrates etc.

(2) Energy or physical factor

This is the form of light, heat and stored energy in chemical bonds. Annual rainfall, wind latitude and altitude etc. are also some physical factors, which have a strong influence on ecosystem.

Energy flow in the Ecosystem

- Energy is needed for every biological activity solar energy is transformed into chemical energy by a process of photosynthesis. The energy stored in plant tissue may then transformed in to mechanical and heat form during metabolic activities.

→ In the biological world the energy flows from sun to plants and then to all heterotrophic organism like nitreo organism, animals and man i.e. from producers to consumers. 1% of the total sunlight falling on the green plants is utilized in photosynthesis.

→ There is no 100% flow of energy from producers to consumers. Some is always lost to environment. Because of this, energy can not be recycled in an ecosystem 'It can flow one way'.

Ecological succession

Biotic communities are not static, they change with time. changes take place continuously in the community structure, organization the associated animals and the ~~environ~~ environment at a place in course of time, this phenomenon is called as ecological succession.

→

Food chains

- The sequence of eaten and being eaten, with the resultant transfer of energy is known as food chain.
  Ex.- Grass → sheep/Goat → Tiger

→ Each step is known as trophic level and the study of the energy flow through the steps is called as trophic ecology.

→ Primary producers traps radiant energy of sun and transfer that to chemical or potential energy of organic compound such as carbohydrates, proteins and fats.

→ when herbivores eats a plant and these compounds are oxidised. when this animals is being eaten by another one along with transfer of energy from a herbivore to carnivore further decrease in energy occurs as the carnivore oxidise the organic substance of the first (herbivore) to liberate energy to synthesize its own cellular constituents.

- the organism of the detritus food chain are algae, bacteria, slime molds, fungi, insects, mites, crustaceans, nematodes etc.

Detritus → Detrivores → Detrivore → small consumer carnivore

Large carnivore ←

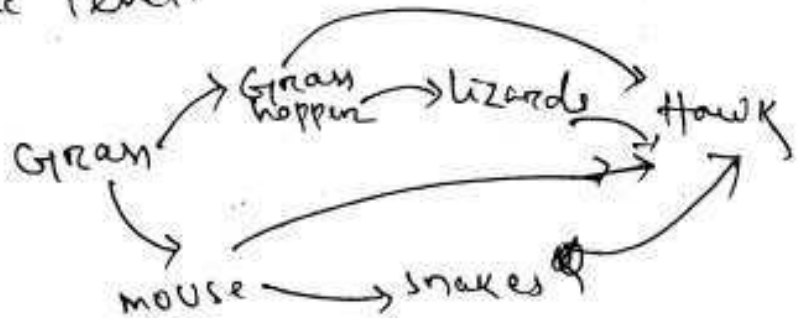
Food webs

In nature simple food chain occur rarely.

→ The same organism may operate in the ecosystem at more than one trophic level (i.e. it derives its food from more than one source. Even the same organism may feed upon several different organism of lower trophic level.

In this way individual food chain interconnect to form complex network with several linkages and are known as food web.

→ Food web is defined as " A network of food chain where different types of organism are connected at different trophic levels, so that there are a number of option of eating and being eaten at each trophic level.



The following five types of food chains are inter connected to form food web in this figure

(i) Grass → Grass hopper → Predatory Bird (Hawk)
(ii) Grass → Grass hopper → Lizzard → Hawk
(iii) Grass → Rabbit → Hawk
(iv) Grass → Mouse/Rat → Hawk
(v) Grass → Mouse/Rat → Snake → Hawk

Ecological pyramid

→ Ecological pyramid refers to a graphical representation to show the number of organism, biomass and productivity at each trophic level.

~~There are 3 types.~~

It is devided into 3 types
a) Pyramid of number (based on the no. of organism at each level)
b) Pyramid of Biomass (Based on the biomass of organism)
c) Pyramid of Energy (Based on the energy at each level)

A. Pyramid of Numbers

- This deals with relationship between the number of producers, herbivores, and carnivores at each trophic level.

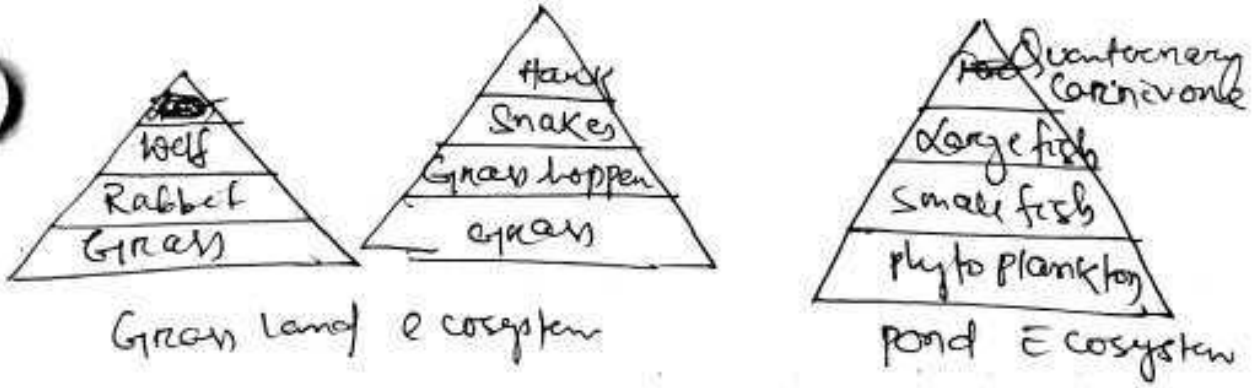
→ At the base level of figure always shows the number of producer, and subsequent structure on this base represented by the no. of consumer at each successive level.

Ex: → In a grassland ecosystem, producers are mainly grass which are many in number. This number then decreases towards the apex, as the primary consumers or herbivores

on herbivores are less in number compare to the number of grasses. The secondary consumer are less in number as compare to the primary one. finally top consumer like hawks or other animals are least in number. Thus the pyramid is becomes upright.

Ex'-2

In Pond ecosystem producers which are mainly phytoplankton as algae, bacteria etc. are maximum in number, the herbivores which are smaller fish are less in no. as compare to the producer. Then the secondary consumer are lesser in number than herbivores. finally top consumer are least in number



Grass land ecosystem

Pond Ecosystem

However in forest ecosystem the pyramid is inverted. In forest ecosystem the number of primary producer (a tree) is less than that of herbivore birds feeding upon the tree. The no. of parasite like bugs and lice living and feeding upon the birds body are higher

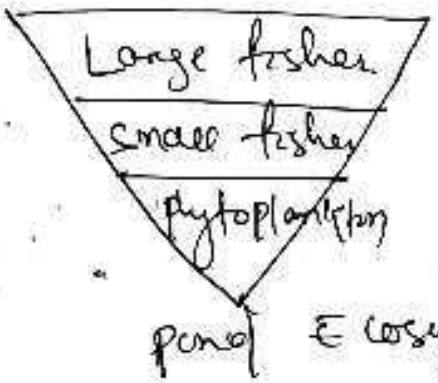
(2) Pyramid of Biomass

- The idea of pyramid of biomass is given where the weight of primary producer forms the base.

Ex:-1] In forest ecosystem the biomass of tree is in very lush compare to the herbivores (birds). Similarly the biomass of parasites living on birds are less than the biomass of herbivores. Therefore the pyramid of biomass for forest ecosystem is straight upright.

2] In forest ecosystem the producers were phytoplankton of which biomass of producer were negligible compared to the primary consumer i.e. small fish. The secondary consumer having more biomass than the primary consumer. Hence the pyramid of biomass for pond ecosystem is inverted.

Forest ecosystem



Pond Ecosystem

(3) Pyramid of Energy

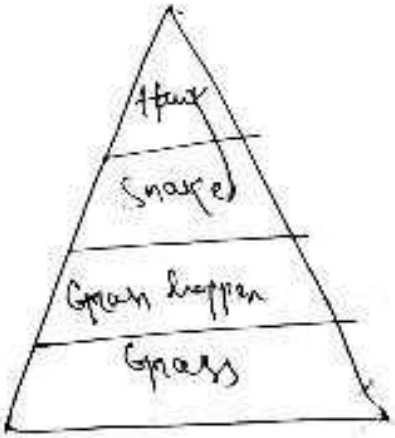
→ The pyramid of energy represents the total quantity of energy utilized by different trophic level organism of an ecosystem per unit area over a set period of time.

→ The base upon which the pyramid of energy is constructed is the quantity of organism produced per unit time or the rate at which food material passes through the food chain.

→ Energy pyramids are always upright because less energy is transferred from each level than was put into it.

EX:- In Grassland ecosystem, producer were grass, which generated the energy, at subsequent trophic level the energy get lost due to some metabolic activities therefore the base of the pyramid was the producer.

Similarly for pond ecosystem



Grassland Ecosystem

pond ecosystem

Some major Ecosystem

There are 3 types of Ecosystem on nature
(1) Terrestrial Ecosystem
(2) freshwater Ecosystem
(3) Marine Ecosystem

Terrestrial Ecosystem

Terrestrial Ecosystem consist of
a) forest Ecosystem
b) Grassland Ecosystem
c) Desert Ecosystem

Forest Ecosystem

Roughly 40% of land is occupied by forest. But in India it was one-tenth.

The different components of forest Ecosystem are
a) Abiotic component :- These are inorganic and organic substance present in the soil and atmosphere.
b) Biotic component :-

The living organism present in food chain occur in the following order:-

1. Producer

These are mainly trees that show much species diversity and greater degree of Stratification specially in moist deciduous forest.

- In northern coniferous forest needle leaved evergreen tree, specially the species, firs and pines are with poor development of shrub and herb forest communities.

2. Consumers :- These are follows

a) Primary consumer :-

These are herbivores that include the animals feeding on tree leaves as ants, beetles, leaf hoppers bugs, spider etc. many of the large herbivore like moose, snowshoe hare, grouse are found on broad leaved developmental communities.

→ Similarly some animals like elephant, nilgai, deer, mules, flying foxes, etc. are ~~grasp~~ grazing on shoots and fruits.

b) Secondary consumer :-

These are carnivore like snakes, hands, lizards, fox etc.

c) Tertiary consumer :-

These are top carnivore like lion, tigen, etc that eat carnivores of secondary consumer level.

3. Decomposer

These are wide variety of micro-organism like ~~actino mycetes~~ actinomycetes, bacteria (Bacillus, Clostridium

fungi (species of aspergillus, Coprinus, Polyporus, fusarium)

2. Grassland Ecosystem

This type of terrestrial ecosystem occupy nearly 19% of the earth surface. Grassland dominated by grass species but some times also allow the growth of few trees and shrubs. there are 3 types of grassland depends upon Climatic region

(i) Tropical grassland :-

Tropical Biomes are found in warm regions with 40-60 inch of rainfall but with a prolonged dry season when fires are an important part of the environment.

- In Africa these are called as Savanna. Grasses belongs to such genera as Penicum, Pennisetum, Andropogon.

(ii) Temperate Grassland :-

- These grassland occurs where rainfall is very slow (10-30 inches)

- In USA & Canada, these grassland are known as Prairies, in South America as pampas, in Africa as Veld.

(iii) Arctic Tundra

There are two tundra biomes covering large areas of arctic, one in the palearctic and other in the Nearctic region. In both continents the boundary between tundra and forest lies further north in the where Climate is moderate by western winds.

The tundra is a wet arctic grassland consist of lichens, grasses, sedges and dwarf woody plants.

The various components of grassland are

Abiotic component

The elements like C, H, O, N, P, S etc are supplied by CO_2, water, nitrates, phosphate etc. is present in soil and atmosphere.

Biotic Component

(1) Primary consumer :-

The herbivores feeding on grasses are grazing animals as cows, buffaloes, deer, sheep, rabbit etc. Beside these some insects like leptocorisa, dysdercus, oxyrhachis etc.

(4) Secondary consumer

The animals like fox, jackals, snakes, lizards, birds etc feed on herbivores.

some times hawk feeds on secondary consumer

Decomposer

The microbes active in the decay of dead organism matter are different species of fungi some bacteria and actinomycetes.

(14). Desert Ecosystem

Desert generally occurs in region having less than 10 inch of rainfall. scarcity of rainfall due to

(1) High subtropical pressure in the Sahara and Australian desert

(2) Geographical position in rain shadow.
(3) High-altitude.

Based on climatic conditions, desert may be classified as a) Sahara, ~~Namib~~, Namib, than are called as tropical desert, which are driest.

b) Mojave in southern California is called temperature desert where days are very hot and cool in winters

c) Gobi desert in China is called cold desert where cold in winter and hot in summer

① Producer

The shrubs, some grasses and few trees were producers sometimes, cacti also present. some lowers plants like lichen, and Xerophytes mosses may be also be present

② Consumer :- The most common animal are reptiles and insects. In addition to them some nocturnal rodents and birds are also found.

Camels "the ship of desert" feed on tender shoots of the plants

(3) Decomposers

Due to poor vegetation, there are very few. They are some fungi and bacteria

Aquatic Ecosystem

more than 70% of the land is covered by water. The important Ecosystems are

a) Pond Ecosystem

→ Temporary ponds are dry for part of the year. Specially interesting and support a unique community organism in such pond must able to survive in a dormant stage during dry period.

→ Ponds play an important role in the village where most of activities like washing clothes, bathing, swimming, cattle bathing etc. centers around ponds.

The components of ponds Ecosystem are

Abiotic component :-

Apart from sunlight the basic organic and inorganic compounds are water, CO_2, oxygen, Calcium, nitrogen, phosphorus, amino acid etc.

Biotic Components They are as follows

1. Producers. These are autotrophic, green plants and bacteria. They fix radiant energy and with the help of minerals from water & mud form complex organic substances like Carbohydrates, proteins & lipids. Producers are of the following types—

(a) Macrophytes. These are mainly rooted larger plants which include partly or completely submerged floating and emergent hydrophytes. The common species of the plants are Trapa, Typha, Sagittaria, Nymphaea, Chara, Hydrilla, Utricularia, Marsilea, Azolla, Sylvinia, Spirodella, Lemna etc.

(b) Phytoplankton. These are minute, floating or suspended lower plants like Ulothrix, Spirogyra, Cladophora, Oedogonium, Cosmarium, Eudorina Pandorina, Volvox, Chlamydomonas etc. and some flagellates. Biomass is estimated as weight of standing crop per unit area or volume. Generally, biomass and energy content of the vegetation decreases from the margin of the pond towards its centre. Energy content is generally expressed in terms of cal/gm dry wt.

2. Consumers. Most of the consumers are herbivores except insects and some large fish. But generally are heterotrophs. In pond consumers are distinguished as—

(*i*) **Primary Consumers.** These are herbivores, also known as "primary macro consumers" feeding directly on living plants. They may be large or in small size. They are further differentiated as—

(*a*) **Benthos.** These are the animals associated with living plants labelled as 'a' in fig and those bottom forms which feed upon the plants remains at the bottom labelled as 'b' in fig. Benthic population include fish, insect larvae, mites, molluses, crustaceans etc. Besides there some animals like cows, buffaloes and birds also visit the pond.

(*b*) **Zooplanktons.** These are chiefly the rotifers, (Brachionus, Lecane etc.), protozonas (Euglena, Coleps etc.) and Crustaceans (Cyclops, Stenocypris etc.). They feed on phytoplanktons lebelled as 'c' in fig.

(*ii*) **Secondary Consumers.** These are Carnivores like insects and fish which feed on primary consumers (herbivores) like Zooplanktons lebelled as 'd' in fig.

(*iii*) **Tertiary Consumers.** These are some large fish feed on smaller fish as shown in fig. In pond fish may occupy more than one trophic levels as shown in figure.

3. Decomposers. These are microconsumers, which absorb only a fraction of the decomposed matter. They decompose organic matter of both producers as well as microconsumers in simple forms. Thus they play an important role in return of mineral elements again to pond. The bacteria, actinomycetes and fungi (species Aspergillus, Cladosporium, Pythium, Penicillium, Circinella etc.) are most common decomposers in water and mud of the pond.

MARINE (OCEAN) ECOSYSTEM

The marine environment of seas and oceans is large occupying 70% of the earth surface. The volume of the surface area of marine environment lighted by sun is small in comparison to the total volume of water involved. All the seas are interconnected by currents, dominated by waves, influenced by tides and characterised by saline water. Each ocean indeed represents a very large and stable ecosystem. Oceans play an important role in regulating many biogeochemical and hydrological cycles, thereby regulating the earths climate. They have some major life zones i.e. coastal, Euphotic, Bathyal and Abyssal zones.

The **biotic components** of an ocean are as follows—

1. PRODUCERS

These are autotrophs, which are mainly the phytoplanktons. They trape radiant energy from sun through their pigments. A number of macroscopic seaweeds (Brown and red algae) are also come in this category. They are in distinct zones at different depths of water.

2. CONSUMERS

These are heterotrophic macroconsumers being dependent for their nutrition on the primary producers. These are

(*i*) The herbivores like Crustacions, molluscs, fishes etc. which feed directly on producers are called primary consumers.

(*ii*) The carnivores fishes like shad, herring etc. feeding on herbivores are called secondary consumers.

(*iii*) The top carnivores fishes like cod, haddock, halibut etc. that feed on secondary consumers are called tertiary consumers.

3. Decomposers.—The microbes active in the decay of dead organic matter are chiefly bacteria and some fungi.

ESTUARIES (ESTUARINE ECOLOGY)

Estuarine is derived from the word *aestus means tide*. Pritchard in 1967 defined as a semi-enclosed coastal body of water, which has a free connection with the open sea. It is thus strongly affected by tidal action and within it sea water is mixed with fresh water from land drainage. River mouths, coastal bays, tidal marshes and bodies of water behind barrier beaches are examples. Estuaries could be considered as transition zones or ecotones between the fresh water and marine habitats.

Not all rivers open in to estuaries, some simply discharge their run off in to ocean. Estuaries differ in size, shape and volume of water flow, all influenced of the region in which they occur. *Deltas* are by accumulation of sediments. When silt and mud accumulations becomes high enough to be exposed at low tide, then *tidal flats* are developed.

To illustrate estuaries, the different classifications will be represented based on

(1) Geomorphology (2) Water Circulation and stratification (3) Systems energetics.

According to Pritchard 1967, four subdivisions of estuaries are from zeomorphological point of view—

(*i*) Drowned river valleys

(*ii*) Fjord type estuaries

(*iii*) Bar - built estuaries

(*iv*) Estuaries formed by tectonic processes.

River - delta estuaries found at the mouths of large livers such as Mississippi or the Nile. It is different from formers. On hydrographic basis esturaries can be placed in three broad categories

(*a*) Highly stratified or salt wedge estuary.

(*b*) The partially mixed or moderately stratified estuary

(*c*) The completely mixed or vertically homogenous estuary

The Hypersaline estuary is a special type.

Physico Chemical Aspects of Estuaries :

Current and salinity both are important here. Estuarine currents result from the interaction of a one direction stream flow which varies with the session and rain fall with oscillation ocean tides and with wind. The salinity varies vertically and horizontally and fluctuates amazingly between 0.3 to 0.35%. The water level in the estuary fluctuate regularly unlike that of river. No Echinodermates Cephalopoda and other molluscs could survive in the estuaries. The temperature in estuaries fluctuate considerably biannually and sessionably.

The sessional and tidal cycles cause changes in nutrient concentration in the estuary. Anyhow, all estuaries have high productivity. The concentration of nutrients and fix carbon is very high level of production within the detritus food chain.

Biotic Communities of Estuaries

Carrikar in 1967 has classified the regions of estuaries in to upper, middle & lower reaches with increasing range of salinities and the mouth with salinity nearly equal to the sea. He has also classified the animals inhabiting the estuarine region into - oligohaline (.5 to 5%), mesohaline (5-18%). Krishnamoorthy has reported the extent of penetration of the polychacts in Madras from the Bay of Bengal. In Hoogly - Matla estuarine, Gopalkrishnan 1971 has reported an abundance of phytoplanktonic forms, several species of diatous synedra, Naricula etc. and blue green algae like microcystis, oscillatoria, adyar estuary of Madras coast is found rich in invertebrates and vertebrate fauna. In short, the esturine ecosystem is a complex and interesting one. It is also very vulnerable environment, because it has served as condiuts for shipping and as sites for cities.

LAKE ECOSYSTEM

Lakes are inland depressions containing standing water. They vary in size and depth (few feet to 5000 feet). Some lakes wave outlet streams. In lake there are three to five well recognized horizontal strata namely.

(*i*) **Littoral zone** — Shallow water near the shore forms this zone.

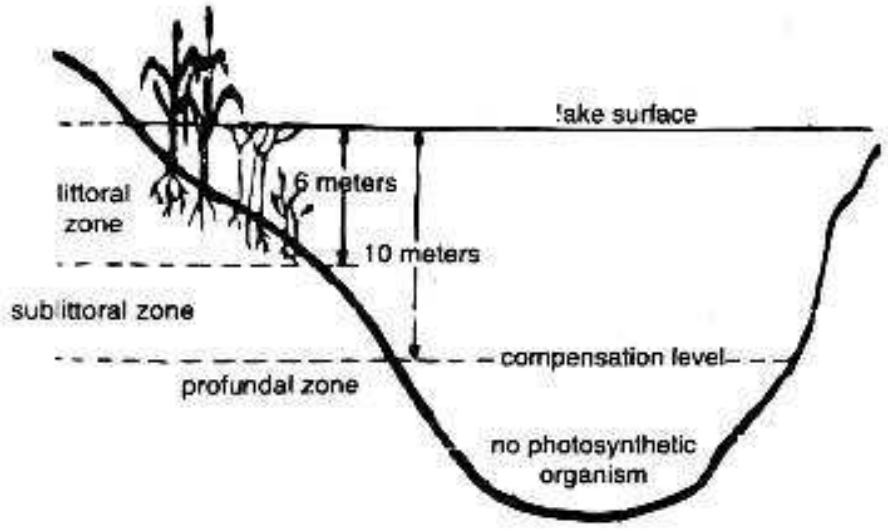


Fig. 3.16 Different zone of a deep freshwater lake.

It contains upper warm and oxygen rich circulating water layer, which is called *epilimnion*. It include rooted vegetation.

(*ii*) **Sublittoral zone.** It extends from rooted vegetation to the non circulating cold water with poor oxygen zone i.e. hypolimnion.

(*iii*) **Limnetic zone.** It is the open water zone away from the shore. It is up to the depth of effective light penetration where rate of photosynthesis is equal to the rate of respiration.

(*iv*) **Profundal zone.** It is the deep water area beneath limnetic zone and beyond the depth of effective light penetration.

(*v*) **Abyssal zone.** It is found only in deep lakes since it begins at about 2000 meter from the surface.

Kinds of lakes. Based on the physical factors, productivity etc. different classifications of lakes are given. Based on temperature, Hutchinson (1957) classified into *dimictic*, *monomictic* and *polymictic*. Based on Humic acid contents, the lakes are classified in to clear water lakes and Brown water lakes.

Physico-chemical properties of lakes

Lakes have the tendency to become thermally stratified during summar and winter to undergo definite seasonal periodicity in depth. Light too penetrates only to a certain depth, depending on turbidity.

Biotic Communities of lakes

Organisms depending on substratum are called *pedonic forms* and that are free from it called limnetic *forms*. The lakes have several type of organisms.

(*i*) **Neuston.** These including floating plants such as duckweeds and many type of animals. Animals are called **epineuston** while others including insects called **hyponeuston.**

(*ii*) **Plankton.** These are small plants and animals whose powers of self locomotion is very limited. Certain zooplanktons are very active some planktons are called as **nektoplanktons.**

(*iii*) **Nekton.** These animals are swimmers.

(*iv*) **Bethos.** These includes the organisms living at the bottom of the water mass. These living above the sediment water interface are termed **benthic epifauna** and those living in sediments itself are termed as **infauna.**

Stratification in lakes. The typical sessional cycle illustrated in fig.3.17.

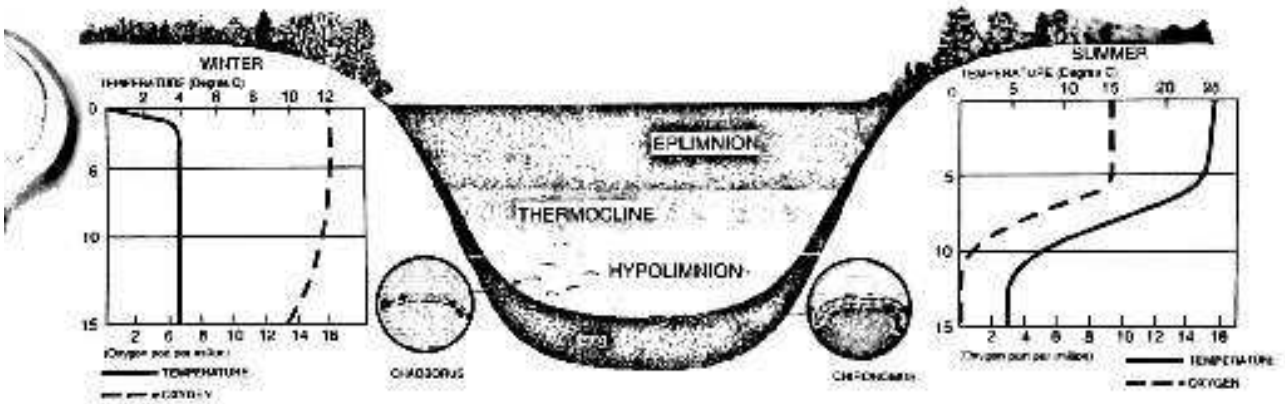


Fig. 3.17 Thermal stratification in a north temperate lake (Linsley Pond. Conn.). Summer conditions are shown on the right, winter conditions on the left. Note that in summer a warm oxygen-rich circulating layer of water, the epilimnion, is separated from the cold oxygen-poor hypolimnion waters by a broad zone, called the thermocline, which is characterized by a rapid change in temperature and oxygen with increasing depth. Two typical hypolimnion organisms are shown (see also Figure 3.18). (After Deevey, 1951).

During the summer the top water become warmer than the bottom waters, as a result only the warm top layer circulates and it does not mix with the more viscous colder water, called thermocline. The upper water layer is epilimnion. Colder noncirculating water is the hypolimnion. Subtropical lakes having surface temperatures that never fall below 4°C. In terms of water circulation patterns most of the lakes of the world can be conveniently assigned to one of the following categories (Hutchinson 1957).

(a) Dimictic (mictic = mixed) Two sessional periods of free circulation.

(b) Cold monomictic. Water never above 4°C (polar regions), seasonal overturn in summer.

(c) Warm monomictic. Water never below 4°C. One period of circulation in winter.

(d) Polymictic. More or less continually circulating with only short, if any, stagnation period.

(e) Oligomictic. Rarely mixed.

(f) Micromictic. Permanently stratified.

UNIT - 4

BIODIVERSITY

Biodiversity describes the richness and variety of life on earth. It is the most complex and important feature of our planet. Without biodiversity, life would not sustain. The term biodiversity was coined in 1985. Biodiversity is the variety and variability of life on Earth. Biodiversity is typically a measure of variation at the genetic, species, and ecosystem level. “Biodiversity” was coined as a contraction of “biological diversity”. It is important in natural as well as artificial ecosystems. It deals with nature’s variety is biosphere. It refers to variabilities among plants, animals and microorganism species.

Biodiversity holds ecological and economic significance. It provides us with nourishment, housing, fuel, clothing and several other resources. It also extracts monetary benefits through tourism. Therefore, it is very important to have a good knowledge of biodiversity for a sustainable livelihood.

Types of Biodiversity

There are the following three different types of biodiversity:

- Genetic Biodiversity
- Species Biodiversity
- Ecosystem Biodiversity

Genetic diversity

Genetic diversity is the variety of genes within a species. Each species is made up of individuals that have their own particular genetic composition. This means a species may have different populations, each having different genetic compositions. To conserve genetic diversity, different populations of a species must be conserved.

Genes are the basic units of all life on Earth. They are responsible for both the similarities and the differences between organisms.

Not all groups of animals have the same degree of genetic diversity. Kangaroos, for example, come from recent evolutionary lines and are genetically very similar. Carnivorous marsupials, called dinosaur, come from more ancient lines and are genetically far more diverse. Some scientists believe that we should concentrate on saving more genetically diverse groups, such as dinosaur, which include the Tasmanian Devil, the Numbat and quolls.

If we lose one species of dinosaur, we lose a substantial genetic resource. Several species of dinosaur are endangered and at least one, the Tasmanian Tiger, has disappeared forever since Europeans arrived in Australia.

Species diversity

Species diversity is the variety of species within a habitat or a region. Some habitats, such as rainforests and coral reefs, have many species. Species diversity refers to the variety of different types of species found in a particular area. It is the biodiversity at the most basic level. It includes all the species ranging from plants to different microorganism.

Ecosystem diversity

Ecosystem diversity is the variety of ecosystems in a given place. An ecosystem is a community of organisms and their physical environment interacting together. An ecosystem can cover a large area, such as a whole forest, or a small area, such as a pond.

An ecosystem is a community of organisms and their physical environment interacting together. An ecosystem may be as large as the Great Barrier Reef or as small as the back of a spider crab's shell, which provides a home for plants and other animals, such as sponges, algae and worms

BIOGEOGRAPHICAL CLASSIFICATION OF INDIA

Biogeographic classification of India is the division of India according to biogeographic characteristics. Biogeography is the study of the distribution of species (biology), organisms, and ecosystems in geographic space and through geological time. There are thirteen biogeographic regions in India.

1. Himalaya
2. The desert
3. Decan peninsula
4. Malabar
5. Andaman Island
6. Nicobar Islands
7. Gangetic planes
8. Laccadive Islands
9. Maldive / Chagoas Island
10. Western Ghats
11. Burman/Bangalian forest
12. Marine Coast
13. Coromondal Mahanandian

VALUE OF BIODIVERSITY

Biodiversity provides a variety of environmental services from its species and ecosystems that are essential at the global, regional and local levels. Biodiversity is essential for preserving ecological processes, such as fixing and recycling of nutrients, soil formation, circulation and cleansing of air and water, global life support, maintaining the water balance within ecosystems, watershed protection, maintaining stream and river flows throughout the year, erosion control and local flood reduction. Food, clothing, housing, energy, medicines are all resources that are directly or indirectly linked to the biological variety present in the biosphere.

Consumptive use value

A straight consumptive use is the direct utilization of timber, food, fuelwood and fodder by local communities. The diversity of organisms provide food, clothing, shelter, medicines, proteins, enzymes, papers, sports goods, musical instruments, beverages, narcotics, pets, zoo specimens, tourism and raw material for business prospects etc.

Productive use value

This category comprises of marketable goods. The biotechnologist uses bio-rich areas to prospect and search for potential genetic properties in plants or animals that can be used to develop better varieties of crops for use in farming and plantation programs or to develop better live stock. To the pharmacist, biological diversity is the raw material from which new drugs can be identified from plant or animal products. To industrialists, biodiversity is rich storehouse from which to develop new products. For the agricultural scientist, the biodiversity is the basis for developing better crops. A variety of industries, like pharmaceuticals are highly dependent on identifying compounds of great economic value from the wide variety of wild species of plants located in undisturbed natural forests called “biological prospecting”.

Social values

Social value of biodiversity prospecting motivated habitat conservation in some areas, as traditional societies valued it as a resource. 'ecosystem people' value biodiversity as a part of their livelihood as well as through cultural and religious sentiments. Now a day's Government is spending a lot of money on lush green vegetation and Coral Reef Island for the purpose of tourism. Apart from traditional agricultural systems, in recent years, farmers have begun to receive economic incentives to grow each crop for national or international markets rather than to supply local needs. This has resulted in local food shortages, unemployment, landlessness and increased tendency to drought and floods.

Ethical Value

Ethical values related to biodiversity conservation are based on the importance of protecting all forms of life against illegal activities like cloning of animals, smuggling of valuable biodiversity instances, bio-piracy, illicit trade etc. In India, several generations have preserved nature through local traditions. However, immediate benefit rather than ethics appears to be modern man's objective.

Aesthetic value

Biodiversity is a direct source of pleasure and aesthetic satisfaction – its contribution to quality of life, outdoor recreation and scenic enjoyment. They provide opportunities for recreational activities such as hiking, canoeing, bird watching, river rafting, rock climbing, trekking, parasailing, bird watching and nature photography. The designing of thousands of new horticultural species, wild life conservation, landscape luxury, national parks, zoological and botanical gardens, snake, crocodile, butterfly parks, and biotechnologically manipulated novel curios species added to the existing aesthetics.

Option value

Keeping future possibilities open for their use is called 'option value'. It is impossible to predict which of our species or traditional varieties of crops and domestic animals will be of greatest use in the future. Important ecosystem services and uses for plants and animals are still unknown and await discovery. It becomes valuable if targets are based on policy of obtaining wealth from wastes.

BIODIVERSITY AT GLOBAL, NATIONAL, LOCAL LEVEL

Biodiversity is the measure of the variety of earth's animal, plant and microbial species; of genetic differences within species; and of the ecosystems that support the species. Out of an estimated 30 million species on earth, only one-sixth has been identified and authenticated in the past 200 years.

There are at present 1.8 million species known and documented by scientists in the world. However, scientists have estimated that the number of species of plants and animals on earth could vary from 1.5 to 20 billion! Thus the majority of species are yet to be discovered.

Biodiversity is the measure of the variety of earth's animal, plant and microbial species; of genetic differences within species; and of the ecosystems that support the species. Out of an estimated 30 million species on earth, only one-sixth has been identified and authenticated in the past 200 years.

An estimated biodiversity covers 400,000 higher plants. Most of the world's bio-rich nations are in the South, which are the developing nations. In contrast, the majority of the countries capable of exploiting biodiversity are Northern nations, in the economically developed world.

These nations however have low levels of biodiversity. Thus the developed world has come to support the concept that biodiversity must be considered to be a 'global resource'. However, if biodiversity should form a 'common property resource' to be shared by all nations, there is no reason to exclude oil, or uranium, or even intellectual and technological expertise as global assets.

National and Local Level

India has over 108,276 species of bacteria, fungi, plants and animals already identified and described (Table 4.2). Out of these, 84 percent species constitute fungi (21.2 percent), flowering plants (13.9 percent), and insect (49.3 percent). In terms of the number of species, the insects alone constitute nearly half of the biodiversity in India.

These species occur on land, fresh and marine waters, or occur as symbionts in mutualistic or parasitic state with other organisms. In the world as a whole, 16, 04,000 species of Monera, Protista, Fungi, Plantae and Animalia have been described so far. However, it is estimated that at least 179, 80,000 species exist in the world, but as a working figure 122, 50,000 species are considered to be near reality.

India is 10th among the plant rich countries of the world, fourth among the Asian countries, eleventh according to the number of endemic species of higher vertebrates (amphibia, birds and mammals), and tenth in the world as far as richness in mammals is concerned. Out of the 10 'Hot spots' identified in the world, India has four. These are Eastern Himalaya, North East India, Western Ghats and Andaman & Nicobar Islands.

The crops which first grew in India and spread throughout the world include rice, sugarcane, jute, mango, citrus, and banana, several species of millets, spices, medicinal, aromatics and ornamentals. India ranks sixth among the centres of diversity and origin in terms of agro-biodiversity.

THREATS TO BIODIVERSITY: HABITAT LOSS, POACHING OF WILD LIFE, MAN WILDLIFE CONFLICTS

HABITAT LOSS

Today, major loss to biodiversity in the world has been done by man. Man has begun to overuse or misuse most of these natural ecosystems. Due to mindless and unsustainable resource use, once productive forest and grasslands have been turned into deserts, and wastelands have increased all over the world. Rapid industrialization, urbanization, and growth in population have resulted in massive deforestation and consequential habitat loss around the world. For instance, mangroves have been cleared for fuel-wood and prawn farming, which has led to a decrease in the habitat essential for breeding of marine fish. Forests all over the world, in particular tropical rainforests such as the Amazon, are under unforeseen threat largely from conversion to other land-uses.

Scientists have estimated that human activities are likely to eliminate approximately10 million species by the year 2050. It is also estimated that at the present rate of extinction about 25 percent of the world's species will undergo extinction fairly rapidly. Rich biodiversity such as tropical forests, wetlands, and coral reefs world over will constitute the major part of this extinction.

POACHING OF WILD LIFE

Poaching of wildlife for trade and commercial activities has been on the rise for the last many decades. It has been a significant cause of the extinction of hundreds of species and the endangerment of many more, such as whales and many African large mammal, Asian tigers, etc. Most extinction over the past several hundred years is mainly due to overharvesting for food, fashion, and profit.

Illicit trade in wildlife in current times is driving many species of wild animals and plants to extinction. Elephants are poached for ivory; tigers and leopards for their skin; pangolins for meat and scales; and rare timber is targeted for hardwood furniture.

The global illegal wildlife trade is estimated to be between $7 billion and $23 billion in illicit revenue annually. It is now considered the most lucrative global crime after drugs, humans, and arms.

In 2015, the United Nations General Assembly unanimously adopted a resolution for tackling illicit trafficking in wildlife. The Sustainable Development Goals has laid down specific targets to combat poaching and trafficking of protected species.

MAN WILDLIFE CONFLICTS

Man-wildlife conflict refers to the interaction between wild animals and people and the consequential negative impact on both of them. Human population growth and the resultant destruction of wildlife habitat for human habitation and economic prosperity create reduction of resources or life to some people and wild animals.

World Wide Fund for Nature (WWF) defines this conflict as “any interaction between humans and wildlife that results in a negative impact on human social, economic, or cultural life, on the conservation of wildlife population, or on the environment.”

Although man-wildlife conflict is as old as human civilization, in modern times the degree of conflict has been on the rise due to high rise in human population in the past several centuries.

Since human populations expand into wild animal habitats, natural wildlife territory is displaced. Reduction in the availability of natural prey/food sources leads to wild animals seeking alternate sources. Alternately, new resources created by humans draw wildlife resulting in conflict. Competition for food resources also occurs when humans attempt to harvest natural resources such as fish and grassland pasture.

There are many consequences of man versus wildlife conflicts. The major consequences are –

- Destruction of wildlife habitat
- Injury and loss of life of both humans and wildlife
- Crop damage and livestock depredation
- Damage to human property
- Decrease in wildlife population and reduction in geographic ranges
- Trophic cascades

UNIT-5

AIR POLLUTION

Definition

Air pollution can be defined as the presence of toxic chemicals or compounds (including those of biological origin) in the air, at levels that pose a health risk. In an even broader sense, air pollution means the presence of chemicals or compounds in the air which are usually not present and which lower the quality of the air or cause detrimental changes to the quality of life (such as the damaging of the ozone layer or causing global warming).

Causes

1. The burning of fossil fuels

Sulphur dioxide emitted from the combustion of fossil fuels like coal, petroleum and other factory combustibles are one the major cause of air pollution. Pollution emitting from vehicles including trucks, jeeps, cars, trains, airplanes cause an immense amount of pollution.

2. Agricultural activities

Ammonia is a very common byproduct from agriculture-related activities and is one of the most hazardous gases in the atmosphere. Use of insecticides, pesticides, and fertilizers in agricultural activities has grown quite a lot. They emit harmful chemicals into the air and can also cause water pollution.

3. Exhaust from factories and industries

Manufacturing industries release a large amount of carbon monoxide, hydrocarbons, organic compounds, and chemicals into the air thereby depleting the quality of air. Manufacturing industries can be found at every corner of the earth and there is no area that has not been affected by it. Petroleum refineries also release hydrocarbons and various other chemicals that pollute the air and also cause land pollution.

4. Mining operations

Mining is a process wherein minerals below the earth are extracted using large equipment. During the process dust and chemicals are released in the air causing massive air pollution. This is one of the reasons which is responsible for the deteriorating health conditions of workers and nearby residents.

5. Indoor air pollution

Household cleaning products, painting supplies emit toxic chemicals in the air and cause air pollution. Suspended particulate matter popular by its acronym SPM, is another cause of pollution. Referring to the particles afloat in the air, SPM is usually caused by dust, combustion etc.

Effects

1. Respiratory and heart problems

The effects of air pollution are alarming. They are known to create several respiratory and heart conditions along with Cancer, among other threats to the body. Several million are known to have died due to direct or indirect effects of Air pollution. Children in areas exposed to air pollutants are said to commonly suffer from pneumonia and asthma.

2. Global warming

Another direct effect is the immediate alterations that the world is witnessing due to global warming. With increased temperatures worldwide, increase in sea levels and melting of ice from colder regions and icebergs, displacement and loss of habitat have already signaled an impending disaster if actions for preservation and normalization aren't undertaken soon.

3. Acid rain

Harmful gases like nitrogen oxides and sulpur oxides are released into the atmosphere during the burning of fossil fuels. When it rains, the water droplets combine with these air pollutants, becomes acidic and then falls on the ground in the form of acid rain. Acid rain can cause great damage to human, animals, and crops.

4. Eutrophication

Eutrophication is a condition where a high amount of nitrogen present in some pollutants gets developed on sea's surface and turns itself into algae and adversely affect fish, plants and animal species. The green coloured algae that are present on lakes and ponds is due to the presence of this chemical only.

5. Effect on wildlife

Just like humans, animals also face some devastating effects of air pollution. Toxic chemicals present in the air can force wildlife species to move to a new place and change their habitat. The toxic pollutants deposit over the surface of the water can also affect sea animals.

6. Depletion of the ozone layer

Ozone exists in the Earth's stratosphere and is responsible for protecting humans from harmful ultraviolet (UV) rays. Earth's ozone layer is depleting due to the presence of chlorofluorocarbons, hydrochlorofluorocarbons in the atmosphere. As the ozone layer will go thin, it will emit harmful rays back on earth and can cause skin and eye related problems. UV rays also have the capability to affect crops.

Control measures

1. Use public mode of transportation

Encourage people to use more and more public modes of transportation to reduce pollution. Also, try to make use of carpooling.

2. Conserve energy

Switch off fans and lights when you are going out. A large number of fossil fuels are burnt to produce electricity. You can save the environment from degradation by reducing the number of fossil fuels to be burned.to make use of carpooling.

3. Understand the concept of Reduce, Reuse and Recycle

Do not throw away items that are of no use to you. In-fact reuse them for some other purpose.

4. Emphasis on clean energy resources

Clean energy technologies like solar, wind and geothermal are on high these days. Governments of various countries have been providing grants to consumers who are interested in installing solar panels for their home. This will go a long way to curb air pollution.

5. Use energy efficient devices

CFL lights consume less electricity as against their counterparts. They live longer, consume less electricity, lower electricity bills and also help you to reduce pollution by consuming less energy.

WATER POLLUTION

Definition

Water pollution is the contamination of water bodies (like oceans, seas, lakes, rivers, aquifers, and groundwater) usually caused due to human activities. Water pollution is any change in the physical, chemical or biological properties of water that will have a detrimental consequence of any living organism.

Causes

1. Natural Sources

Naturally occurring substances found in the soils and rocks can be dissolved in water causing contamination. These substances are sulphates, iron, radionuclides, fluorides, manganese, chlorides and arsenic.

2. Septic Systems

Across the world, septic systems are the main cause of pollution of underground water. The pollutants are out flow from privies, septic tanks and the cesspools.

3. Hazardous waste Disposal

Hazardous wastes such as photographic chemicals, motor oil, cooking oil, paint thinners, medicines, swimming pool chemicals, paints, and garden chemicals should not be disposed into septic tanks or directly into the environment as they cause serious contamination.

4. Petroleum Products

Petroleum storage tanks are either located underground or above ground. Also, the transportation of petroleum products is mainly done underground using pipeline. Leakages from this substances can lead to contamination of water.

5. Solid Waste

The chemicals from these substances are leached into the ground water through precipitation and surface run off.

6. Agricultural Chemicals

Excessive use of chemicals can lead to contamination of groundwater. Chemicals such as pesticides are known to remain in the ground for years and when diluted with the rain water they seep deeper into the groundwater.

Effects

1. Health Issues

Contaminated ground water have detrimental effects on health. In areas where septic tanks installation is not set up correctly, the human waste may contaminate the water source. The waste may contain hepatitis causing bacteria that may lead to irreversible damage to the liver.

2. Affects economic growth

Contamination of ground water sources renders the area incapable of sustaining plant, human, and animal life. The population in the area reduces and the land value depreciates. Another effect is that it leads to less stability in industries relying on ground water to produce their goods.

3. Can lead to damaging impacts on the environment such as aquatic systems and the overall ecosystem

Control measures

1. Legislation

There are federal laws in most countries that help in protecting the quality of ground water. Safe Drinking and Clean Water regulations should ensure protection of drinking water by establishing measures for them to meet the health standards.

2. Municipal wastewater treatment

In urban areas of developed countries, municipal wastewater (or sewage) is typically treated by centralized sewage treatment plants. Well-designed and operated systems (i.e., with secondary treatment steps or more advanced treatment) can remove 90 percent or more of the pollutant load in sewage.

3. On-site sanitation and safely managed sanitation

Households or businesses not served by a municipal treatment plant may have an individual septic tank, which pre-treats the wastewater on site and infiltrates it into the soil.

4. Industrial wastewater treatment

Some industrial facilities generate wastewater that is similar to domestic sewage and can be treated by sewage treatment plants. Industries that generate wastewater with high concentrations of organic matter (e.g. oil and grease), toxic pollutants (e.g. heavy metals, volatile organic compounds) or nutrients such as ammonia, need specialized treatment systems.

Industries generating large volumes of wastewater typically operate their own treatment systems. Some industries have been successful at redesigning their manufacturing processes to reduce or eliminate pollutants, through a process called pollution prevention.

5. Agricultural wastewater treatment

SOIL POLLUTION

Definition

Soil pollution is defined as the presence of toxic chemicals (pollutants or contaminants) in soil, in high enough concentrations to pose a risk to human health and/or the ecosystem. In the case of contaminants which occur naturally in soil, even when their levels are not high enough to pose a risk, soil pollution is still said to occur if the levels of the contaminants in soil exceed the levels that should naturally be present.

Causes

1. Industrial waste

Industries are by far the worst polluters of the soil with all the chemicals they release into the environment be it in liquid or solid form.

2. Deforestation

Clearing of trees leaves soil exposed to the elements so they are easily carried away by soil erosion. This leaves land barren and incapable of supporting vegetation.

3. Excessive use of fertilisers and pesticides

The increased demand for food has forced farmers to use fertilisers and pesticides that release nothing but toxins into the soil, killing useful microorganisms that are important in plant growth.

4. Garbage pollution

Garbage that cannot be recycled is disposed of carelessly and this is not only an eyesore but pollutes the land. Some of this waste can literally take thousands of years to decompose!

5. Acid rain

6. Industrial accidents

7. Nuclear wastes

8. Land fill and illegal dumping

9. Mining and other industries

10. Oil and fuel dumping

11. Disposal of coal ash

12. Electronic waste

Effects

1. Effect on Health of Humans

Crops and plants are grown on polluted soil absorb much of the pollution and then pass these on to us. Long term exposure to such soil can affect the genetic make-up of the body, causing congenital illnesses and chronic health problems that cannot be cured easily. In fact, it can sicken the livestock to a considerable extent and cause food poisoning over a long period of time. The soil pollution can even lead to widespread famines if the plants are unable to grow in it.

2. Effect on Growth of Plants

The ecological balance of any system gets affected due to the widespread contamination of the soil. Most plants are unable to adapt when the chemistry of the soil changes so radically in a short period of time. Fungi and bacteria found in the soil that bind it together begin to decline, which creates an additional problem of soil erosion.

The fertility slowly diminishes, making land unsuitable for agriculture and any local vegetation to survive. The soil pollution causes large tracts of land to become hazardous to health. Unlike deserts, which are suitable for its native vegetation, such land cannot support most forms of life.

3. Decreased Soil Fertility

The toxic chemicals present in the soil can decrease soil fertility and therefore decrease in the soil yield. The contaminated soil is then used to produce fruits and vegetables which lacks quality nutrients and may contain some poisonous substance to cause serious health problems in people consuming them.

4. Toxic Dust

The emission of toxic and foul gases from landfills pollutes the environment and causes serious effects on the health of some people. The unpleasant smell causes inconvenience to other people.

5. Changes in Soil Structure

The death of many soil organisms (e.g. earthworms) in the soil can lead to alteration in soil structure. Apart from that, it could also force other predators to move to other places in search of food.

Control measures

1. Develop necessary legislation on soil pollution control

Although efforts are being put in place to ensure soil pollution control, the process ought to be accelerated by drafting the necessary legislation. The existing registrations such as urban and rural planning, agricultural practices, and land management should be revised and updated to include contemporary soil pollution control and prevention measures.

Legislations on pesticide management, contaminated sites management, and farmland soil management should as well be updated. Furthermore, measures should be put in place to promote continuous improvement of soil pollution control standards.

2. Proper management of agricultural land and the practice of organic farming

Poor utilization of land is a major concern in the prevention and control of soil pollution. Agricultural land pollution usually causes the loss of soil fertility as it involves the loss of organic matter, topsoil and nutrients, and the soil's ability to retain water. In agricultural land management, ideal soil conservation methods include mechanical and biological control techniques.

The biological method refers to forestry and crop-related soil management. The crop related control measures include crop rotation, strip cropping, planting along the contours, protector belt, crop residues, and use of organic composts. Forests also play an important role in preventing soil erosion.

3. Proper Solid Waste Treatment

It is important to dispose of solid waste properly by treated it before it's released into the environment. Acidic and alkaline waste, for example, can be neutralized before they are disposed of to avoid soil contamination. Biodegradable waste should also be broken down in a controlled environment before it is released into the environment. A great example is the proper treatment of sewage sludge.

4 Transfer treatment and remediation costs to polluting companies

The government should make an effort to improve the quality of soil through pollution treatment and remediation. To ensure the sustainability of the project, the individuals and companies that pollute the soil should be held responsible for the treatment and remediation costs.

To ensure consistency, the government should formulate treatment and remediation plans as well as identify responsible entities, identify key tasks, and develop projects database for easy management.

5. Embrace technological research and development

To ensure sustainability in the prevention and control of soil pollution, research on soil pollution prevention and control should be advanced by strengthening technological research. The government should integrate the resources from various research institutions and universities to support relevant research on soil environmental capacity and ecological effects of soil contamination among other possibilities.

6. Proper hygienic condition

People should be trained regarding sanitary habits.

7. Public awareness

Informal and formal public awareness programs should be imparted to educate people on health hazards by environmental education.

8. Recycling and Reuse of wastes

To minimize soil pollution, the wastes such as paper, plastics, metals, glasses, organics, petroleum products and industrial effluents etc should be recycled and reused.

9. Ban on Toxic chemicals

Ban should be imposed on chemicals and pesticides like DDT, BHC, etc which are fatal to plants and animals. Nuclear explosions and improper disposal of radioactive wastes should be banned.

MARINE POLLUTION

Definition

Marine pollution refers to direct or indirect introduction by humans of substances or energy into the marine environment (including estuaries), resulting in harm to living resources, hazards to human health, hindrances to marine activities including fishing, impairment of the quality of sea water and reduction of amenities.

Causes

1. Direct discharge

Pollutants enter rivers and the sea directly from urban sewerage and industrial waste discharges, sometimes in the form of hazardous and toxic wastes, or in the form of plastics.

2. Land runoff

Surface runoff from farming, as well as urban runoff and runoff from the construction of roads, buildings, ports, channels, and harbours, can carry soil and particles laden with carbon, nitrogen, phosphorus, and minerals. This nutrient-rich water can cause fleshy algae and phytoplankton to thrive in coastal areas; known as algal blooms, which have the potential to create hypoxic conditions by using all available oxygen.

3. Ship pollution

Ships can pollute waterways and oceans in many ways. Oil spills can have devastating effects. While being toxic to marine life, polycyclic aromatic hydrocarbons (PAHs), found in crude oil, are very difficult to clean up, and last for years in the sediment and marine environment. Discharge of cargo residues from bulk carriers can pollute ports, waterways, and oceans.

4. Atmospheric pollution

Another pathway of pollution occurs through the atmosphere. Wind-blown dust and debris, including plastic bags, are blown seaward from landfills and other areas.

5. Deep sea mining

Deep sea mining is a relatively new mineral retrieval process that takes place on the ocean floor. Ocean mining sites are usually around large areas of polymetallic nodules or active and extinct hydrothermal vents at about 1,400 – 3,700 meters below the ocean's surface. The vents create sulphide deposits, which contain precious metals such as silver, gold, copper, manganese, cobalt, and zinc. The deposits are mined using either hydraulic pumps or bucket systems that take ore to the surface to be processed. As with all mining operations, deep sea mining raises questions about environmental damages to the surrounding area.

Effects

1. Effect of Toxic Wastes on Marine Animals

The oil spill is dangerous to marine life in several ways. The oil spilled in the ocean could get on to the gills and feathers of marine animals, which makes it difficult for them to move or fly properly or feed their children. The long term effect on marine life can include cancer, failure in the reproductive system, behavioural changes, and even death.

2. Disruption to the Cycle of Coral Reefs

Oil spill floats on the surface of the water and prevents sunlight from reaching to marine plants and affects the process of photosynthesis. Skin irritation, eye irritation, lung and liver problems can impact marine life over a long period of time.

3. Depletes Oxygen Content in Water

Most of the debris in the ocean does not decompose and remain in the ocean for years. It uses oxygen as it degrades. As a result of this, oxygen levels go down. When oxygen levels go down, the chances of survival of marine animals like whales, turtles, sharks, dolphins, penguins for a long time also goes down.

4. Failure in the Reproductive System of Sea Animals

Industrial and agricultural wastes include various poisonous chemicals that are considered hazardous for marine life. Chemicals from pesticides can accumulate in the fatty tissue of animals, leading to failure in their reproductive system.

5. Effect on Food Chain

Chemicals used in industries and agriculture get washed into the rivers and from there are carried into the oceans. These chemicals do not get dissolved and sink at the bottom of the ocean. Small animals ingest these chemicals and are later eaten by large animals, which then affects the whole food chain.

6. Affects Human Health

Animals from impacted food chain are then eaten by humans which affects their health as toxins from these contaminated animals get deposited in the tissues of people and can lead to cancer, birth defects or long term health problems.

Control measures

1. Ban single use plastic and adopt litter control policies
2. Reduce or recycle plastic
3. Diminish discharge of untreated sewage
4. Control chemical and industrial pollution
5. Increase funding for marine pollution prevention and control
6. Strengthen laws on marine litter
7. Integrate prevention and control policies into national policy
8. Raise public awareness
9. Establish partnerships to address marine pollution

NOISE POLLUTION

Definition

unwanted or excessive sound that can have deleterious effects on human health and environmental quality. Noise pollution is commonly generated inside many industrial facilities and some other workplaces, but it also comes from highway, railway, and airplane traffic and from outdoor construction activities.

Causes

1. Industrialization

Most of the industries use big machines which are capable of producing a large amount of noise. Apart from that, various equipment like compressors, generators, exhaust fans, grinding mills also participates in producing big noise.

2. Poor Urban Planning

In most of the developing countries, poor urban planning also plays a vital role. Congested houses, large families sharing small space, fight over parking, frequent fights over basic amenities leads to noise pollution which may disrupt the environment of society.

3. Social Events

Noise is at its peak in most of the social events. Whether it is marriage, parties, pub, disc or place of worship, people normally flout rules set by the local administration and create nuisance in the area.

4. Transportation

A large number of vehicles on roads, airplanes flying over houses, underground trains produce heavy noise and people get it difficult to get accustomed to that. The high noise leads to a situation wherein a normal person loses the ability to hear properly.

5. Construction Activities

6. Household Chores

We people are surrounded by gadgets and use them extensively in our daily life. Gadgets like TV, mobile, mixer grinder, pressure cooker, vacuum cleaners, washing machine and dryer, cooler, air conditioners are minor contributors to the amount of noise that is produced but it affects the quality of life of neighbourhood in a bad way.

Effects

1. Hearing Problems

Any unwanted sound that our ears have not been built to filter can cause problems within the body. Our ears can take in a certain range of sounds without getting damaged. Man-made noises such as jackhammers, horns, machinery, airplanes and even vehicles can be too loud for our hearing range. Constant exposure to loud levels of noise can easily result in the damage of our eardrums and loss of hearing. It also reduces our sensitivity to sounds that our ears pick up unconsciously to regulate our body's rhythm.

2. Health Issues

Excessive noise pollution in working areas such as offices, construction sites, bars and even in our homes can influence psychological health. Studies show that the occurrence of aggressive behaviour, disturbance of sleep, constant stress, fatigue, and hypertension can be linked to excessive noise levels. These, in turn, can cause more severe and chronic health issues later in life.

3. Sleeping Disorders

Loud noise can certainly hamper your sleeping pattern and may lead to irritation and uncomfortable situations. Without a good night sleep, it may lead to problems related to fatigue.

4. Cardiovascular Issues

Blood pressure levels, cardiovascular disease, and stress-related heart problems are on the rise. Studies suggest that high-intensity noise causes high blood pressure and increases heartbeat rate as it disrupts the normal blood flow.

5. Trouble Communicating

High decibel noise can put trouble and may not allow two people to communicate freely. This may lead to misunderstanding and you may get difficult understanding the other person. Constant sharp noise can give you a severe headache and disturb your emotional balance.

6. Effect on Wildlife

Wildlife faces far more problems than humans because of noise pollution since they are more dependent on sound. Animals develop a better sense of hearing than us since their survival depends on it. They become disoriented more easily and face many behavioural problems. In nature, animals may suffer from hearing loss, which makes them easy prey and leads to dwindling populations. Others become inefficient at hunting, disturbing the balance of the eco-system.

Control measures

1. Turn off Appliances at Home and offices
2. Shut the Door when using noisy Machines
3. Use Earplugs
4. Lower the volume
5. Follow the Limits of Noise level
6. planting trees
7. Use Noise absorbents in noisy machineries
8. Use Proper Lubrication and Better maintenance
9. Notify Authorities about Disobedience of Noise Rules

THERMAL POLLUTION

Definition

Thermal pollution is defined as sudden increase or decrease in temperature of a natural body of water which may be ocean, lake, river or pond by human influence. This normally occurs when a plant or facility takes in water from a natural resource and puts it back with an altered temperature. which changes the oxygen levels and can have disastrous effects on local ecosystems and communities.

Causes

1. Water as Cooling Agent in Power, Manufacturing and Industrial plants

Production and Manufacturing plants are biggest source of thermal pollution. These plants draw water from nearby source to keep machines cool and then release back to the source with higher temperature. When heated water returns to the river or ocean, the water temperature rises sharply. When oxygen levels are altered in the water, this can also degrade the quality and longevity of life in wildlife that lives underwater. This process can also wipe away streamside vegetation, which constantly depends on constant levels of oxygen and temperature. By altering these natural environments, industries are essentially helping decrease the quality of life for these marines based life forms and can ultimately destroy habitats if they are not controlled and careful about their practices.

2. Soil Erosion

Soil erosion is another major factor that causes thermal pollution. Consistent soil erosion causes water bodies to rise, making them more exposed to sunlight. The high temperature could prove fatal for aquatic biomes as it may give rise to anaerobic conditions.

3. Deforestation

Trees and plants prevent sunlight from falling directly on lakes, ponds or rivers. When deforestation takes place, these water bodies are directly exposed to sunlight, thus absorbing more heat and raising its temperature.

4. Domestic Sewage

5. Natural Causes

Natural causes like volcanoes and geothermal activity under the oceans and seas can trigger warm lava to raise the temperature of water bodies. Lightening can also introduce massive amount of heat into the oceans.

Effects

1. Decrease in DO (Dissolved Oxygen) Levels

The warm temperature reduces the levels of DO (Dissolved Oxygen) in water. The warm water holds relatively less oxygen than cold water. The decrease in DO can create suffocation for plants and animals such as fish, amphibians and copepods, which may give rise to anaerobic conditions. Warmer water allows algae to flourish on surface of water and over the long term growing algae can decrease oxygen levels in the water.

2. Increase in Toxins

With the constant flow of high temperature discharge from industries, there is a huge increase in toxins that are being regurgitated into the natural body of water. These toxins may contain chemicals or radiation that may have harsh impact on the local ecology and make them susceptible to various diseases.

3. Loss of Biodiversity

A dent in the biological activity in the water may cause significant loss of biodiversity. Changes in the environment may cause certain species of organisms to shift their base to some other place while their could be significant number of species that may shift in because of warmer waters.

4. Ecological Impact

A sudden thermal shock can result in mass killings of fish, insects, plants or amphibians.

5. Affects Reproductive Systems

A significant halt in the reproduction of marine wildlife (although this may be true, reproduction can still occur between fish – but the likelihood of defects in newborns is significantly higher) can happen due to increasing temperatures as reproduction can happen with in certain range of temperature. Excessive temperature can cause the release of immature eggs or can prevent normal development of certain eggs.

6. Increases Metabolic Rate

Thermal pollution increases the metabolic rate of organisms as increasing enzyme activity occurs that causes organisms to consume more food than what is normally required, if their environment were not changed. It disrupts the stability of food chain and alter the balance of species composition.

7. Migration

The warm water can also cause particular species of organisms to migrate to suitable environment that would cater to its requirements for survival. This can result in loss for those species that depend on them for their daily food as their food chain is interrupted.

Control measures

1. Cooling Ponds

Cooling ponds or reservoirs constitute the simplest method of controlling thermal discharges. Heated effluents on the surface of water in cooling ponds maximize dissipation of heat to the atmosphere and minimize the water area and volume. This is the simplest and cheapest method which cools the water to a considerable low temperature. However, the technique alone is less desirable and inefficient in terms of air-water contact.

2. Cooling Towers:

Using water from water sources for cooling purposes, with subsequent return to the water body after passing through the condenser is termed as cooling process. In order to make the cooling process more effective, cooling towers are designed to control the temperature of water. Infact, cooling towers are used to dissipate the recovered waste heat so as to eliminate the problems of thermal pollution.

3. Artificial Lake

Artificial lakes are man-made bodies of water which offer possible alternative to once through cooling. The heated effluents may be discharged into the lake at one end and the water for cooling purposes may be withdrawn from the other end. The heat is eventually dissipated through evaporation.

4. Industrial treated water can be recycled for domestic use or industrial heating.

NUCLEAR POLLUTION

Definition

Radioactive pollution occurs when there is presence or depositions of radioactive materials in the atmosphere or environment, especially where their presence is accidental and when it presents an environmental threat due to radioactive decay. The destruction caused by the radioactive materials is because of the emissions of hazardous ionizing radiation (radioactive decay) like beta or alpha particles, gamma rays or neurons in the environment where they exist.

Since the substances are characterized by radiation – because there is a lot of instability of the particles present in the radioactive materials, it can seriously affect, alter and even destroy plant, animal, and human life. The extent of damage or danger posed to the environment depends upon the radioactive material concentration, the energy emitted by the radiation, proximity of the radioactive materials to those exposes, and the radiation type.

Causes

1. Nuclear accidents from nuclear energy generation plants

In the postmodern world, various forms of energy are being discovered. Among them is nuclear energy, which is touted to be the most potent source of energy due to its high latent power. Reports indicate that the high latent power is due to its high level of radiation.

Its use is, therefore, prohibited but research is underway to determine its environmental safety and to put in place the most appropriate precautionary measures for its use.

2. The use of nuclear weapons as weapons of mass destruction (WMD)

The use of nuclear missiles and atomic bombs, a form of nuclear energy, in the Second World War not only explains cause but also the damaging nature. The effects of those two strikes in Hiroshima and Nagasaki that prompted the end of the war in 1945 have been seen to date with children born with complications such mental retardation as well as conditions such as autism and other disorders. The number of cancer cases present in the two towns is more than those of the rest of Japan.

3. Use of radio isotopes

Radio isotopes are used to make detectors and in other industrial activities.

4. Mining

Mining mostly involves the excavation of the mineral ores which are then broken into smaller manageable pieces. Radium and Uranium, for instance, are naturally occurring in the environment and are equally radioactive. Hence, mining increases the natural geological processes by moving these materials from underneath the earth to the surface. Other minerals with a hint of radiation are thorium, plutonium, radon, potassium, carbon and phosphorus.

5. Spillage of radioactive chemicals

There have been instances of spillages over oceans when ships hit glaciers or coral reefs and end up releasing chemicals on waterways and in the atmosphere. The majority of these chemicals including petroleum products have a significant level of radiation which can be detrimental to the environment.

6. Tests on radiation

Radiation has been seen to have a lot of interesting properties which has promoted a lot of scientists to conduct tests to learn more about it. It is one of the key elements in the cure and treatment of cancer.

Chemotherapy, a cancer curative health initiative uses radiation to prevent further growth of the cancer cells as well as keep the immune system strong. Despite this, scientists have been exposed to radiation leading to their deaths or to complications.

7. Cosmic rays

These come from outer space to our planet with intense radiation as their nature, therefore, causing radioactive pollution. Gamma rays, for example, are said to have the highest level of radiation and yet, depending on their intensity, some are not visible to the human eye.

Effects

1. Genetic mutations

Radiation has adverse effects when it comes to genetics. It leads to damage of DNA strands leading to genetic break up in the course of time. The degree of genetic mutation leading to changes in DNA composition vary due to the level of radiation one has been exposed to and the kind of exposure.

In the event that a human or an animal is exposed to too much radiation from the atmosphere, food consumed and even water used then chances are that their bodies have already absorbed the radiation. Once in the body, it remains active because energy cannot be destroyed.

The resulting mutation makes one highly susceptible to cancer. For pregnant women, kids born have adverse defects caused by genetic mutations like low weight during birth. Effects such as disfigured births and impairment like blindness in children have also been reported. Infertility has also been mentioned as an effect of radiation.

2. Diseases

Cancer is the most dominant radiation related disease. It has developed over the years and poses great risk in global health. Others include leukemia, anemia, hemorrhage, a reduction in the life span leading to premature aging and premature deaths as well as others such as cardiovascular complications. Leukemia, for instance, is caused by radiation in the bone marrow.

3. Soil infertility

Exposure of radiation to the atmosphere means it is present even in soils. Radioactive substances in the soil react together with the various nutrients leading to destruction of those nutrients, thus rendering the soil infertile and highly toxic. Such soil leads to the harvest of crops that are riddled with radiation and thus, unfit for consumption by both humans and animals.

4. Cell destruction

Radioactive pollution has diverse effects such as the alteration of cells. The bodies of living organisms are unique in that there are millions of cells in one single body, where each has its purpose to fulfill. Radiation distorts the cells present leading to permanent damage of the various organs and organ systems. In the face of too much radiation, permanent illnesses and death are inevitable.

5. Burns

Radiation is not easy to feel but it is easy to realize that you have been affected by it. The immediate presence of burns, red lesions and sores is evidence. To make it worse, this can lead to skin cancer.

Control measures

1. Proper method of disposing radioactive waste

Radioactive waste still has some level of radiation. Accordingly, it cannot be disposed in the same way as normal waste. It cannot be incinerated or buried. Since there is likelihood of seepage, this waste should be stored in heavy and thick concrete containers. Another option is to dilute the radiation since storage may not be possible. Since there are no easy ways of disposing of radioactive material, professional assistance should always be sought.

2. Proper labeling

It is necessary for any material with radioactive content to be labeled and the necessary precautions advised on the content of the label. The reason for this is because radiation can enter the body by a mere touch of radioactive material. Containers with such elements should be well labeled in order for one to use protective gear when handling them.

3. Banning of nuclear tests

It has already been proven that nuclear power has a lot of latent power that is very destructive. Tests though done in the deserts end up escaping from one ecosystem to another eventually affecting the lives of many people.

4. Alternative energy sources

The evolution and use of nuclear power was not a bad thing initially. However, considering the damage and threats it has on the environment, it is high time for its use to be discontinued and for the world to perhaps focus on alternative and environmentally friendly energy sources – like renewable sources of energy namely Solar, hydro-electric and wind power.

5. Proper storage

It is mandatory for containers carrying radioactive material to be stored properly. For starters, such substances should be stored in radiation proof containers to ensure no seeping or leakage during handling. Proper storage means no harm and can minimize cases of accidental leakage.

6. Reusing

Since it is not easy to store or dispose the waste, it can be recycled and used for other purposes like in another reactor as fuel thereby protecting the environment.

SOLID WASTE MANAGEMENT

Solid-waste management, the collecting, treating, and disposing of solid material that is discarded because it has served its purpose or is no longer useful. Improper disposal of municipal solid waste can create unsanitary conditions, and these conditions in turn can lead to pollution of the environment and to outbreaks of vector-borne disease—that is, diseases spread by rodents and insects. The tasks of solid-waste management present complex technical challenges. They also pose a wide variety of administrative, economic, and social problems that must be managed and solved.

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Causes of urban and industrial waste

1. Residential

Residences and homes where people live are some of the major sources of solid waste. Garbage from these places include food wastes, plastics, paper, glass, leather, cardboard, metals, yard wastes, ashes and special wastes like bulky household items like electronics, tires, batteries, old mattresses and used oil. Most homes have garbage bins where they can throw away their solid wastes in and later the bin is emptied by a garbage collecting firm or person for treatment.

2. Industrial

Industries are known to be one of the biggest contributors of solid waste. They include light and heavy manufacturing industries, construction sites, fabrication plants, canning plants, power and chemical plants. These industries produce solid waste in form of housekeeping wastes, food wastes, packaging wastes, ashes, construction and demolition materials, special wastes, medical wastes as well as other hazardous wastes.

3. Commercial

Commercial facilities and buildings are yet another source of solid waste today. Commercial buildings and facilities in this case refer to hotels, markets, restaurants, go downs, stores and office buildings. Some of the solid wastes generated from these places include plastics, food wastes, metals, paper, glass, wood, cardboard materials, special wastes and other hazardous wastes.

4. Institutional

The institutional centers like schools, colleges, prisons, military barracks and other government centers also produce solid waste. Some of the common solid wastes obtained from these places include glass, rubber waste, plastics, food wastes, wood, paper, metals, cardboard materials, electronics as well as various hazardous wastes.

5. Construction and Demolition Areas

Construction sites and demolition sites also contribute to the solid waste problem. Construction sites include new construction sites for buildings and roads, road repair sites, building renovation sites and building demolition sites. Some of the solid wastes produced in these places include steel materials, concrete, wood, plastics, rubber, copper wires, dirt and glass.

6. Municipal services

The urban centers also contribute immensely to the solid waste crisis in most countries today. Some of the solid waste brought about by the municipal services include, street cleaning, wastes from parks and beaches, wastewater treatment plants, landscaping wastes and wastes from recreational areas including sludge.

7. Treatment Plants and Sites

Heavy and light manufacturing plants also produce solid waste. They include refineries, power plants, processing plants, mineral extraction plants and chemicals plants. Among the wastes produced by these plants include, industrial process wastes, unwanted specification products, plastics, metal parts just to mention but a few.

8. Agriculture

Crop farms, orchards, dairies, vineyards and feedlots are also sources of solid wastes. Among the wastes they produce include agricultural wastes, spoiled food, pesticide containers and other hazardous materials.

9. Biomedical

This refers to hospitals and biomedical equipment and chemical manufacturing firms. In hospitals there are different types of solid wastes produced. Some of these solid wastes include syringes, bandages, used gloves, drugs, paper, plastics, food wastes and chemicals. All these require proper disposal or else they will cause a huge problem to the environment and the people in these facilities.

Effects

1. Due to improper waste disposal systems particularly by municipal waste management teams, wastes heap up and become a problem. People clean their homes and places of work and litter their surroundings which affects the environment and the community.

This type of dumping of waste materials forces biodegradable materials to rot and decompose under improper, unhygienic and uncontrolled conditions. After a few days of decomposition, a foul smell is produced and it becomes a breeding ground for different types of disease causing insects as well as infectious organisms. On top of that, it also spoils the aesthetic value of the area.

2. Solid wastes from industries are a source of toxic metals, hazardous wastes, and chemicals. When released to the environment, the solid wastes can cause biological and physicochemical problems to the environment and may affect or alter the productivity of the soils in that particular area.

3. Toxic materials and chemicals may seep into the soil and pollute the ground water. During the process of collecting solid waste, the hazardous wastes usually mix with ordinary garbage and other flammable wastes making the disposal process even harder and risky.

4. When hazardous wastes like pesticides, batteries containing lead, mercury or zinc, cleaning solvents, radioactive materials, e-waste and plastics are mixed up with paper and other scraps are burned they produce dioxins and gasses. These toxic gases have a potential of causing various diseases including cancer.

5. When trash and garbage are put into an enormous pile, they begin to rot. This rotting creates methane, a greenhouse gas that is many times more potent than carbon dioxide. Methane exits the landfill and floats up into the atmosphere, contributing to global warming.

6. The effect of human waste on the oceans is becoming more widely known since wide publicity has been given to the "garbage patch" in the Pacific Ocean, an area larger than the continental United States that is overrun with plastic trash. This is only the most dramatic example of the threat to oceans that is posed by human waste.

7. Everyone wants to stay and live in a healthy, clean, fresh, and sanitary place. A city with poor waste management will certainly not attract tourists or investors. Landfill facilities that are mismanaged can cause the local economy to sink, which can then affect the livelihood of the locals.

8. There is revenue in recycling. Cities that do not implement proper removal and recycling of wastes miss on this. They also miss out on the resources that can be reused and on the employment opportunities that a recycling centre brings.

9. Decomposing waste emits gases that rise to the atmosphere and trap heat. Greenhouse gases are one of the major culprits behind the extreme weather changes that the world is experiencing. From extremely strong storms and typhoons to smouldering heat, people are experiencing and suffering the negative effects of greenhouse gases.

10. It is slowly killing the planet.

11. Soil contamination

12. Air contamination

Control measures

1. Sanitary Landfill

This is the most popular solid waste disposal method used today. Garbage is basically spread out in thin layers, compressed and covered with soil or plastic foam. Modern landfills are designed in such a way that the bottom of the landfill is covered with an impervious liner which is usually made of several layers of thick plastic and sand. This liner protects the ground water from being contaminated because of leaching or percolation. When the landfill is full, it is covered with layers of sand, clay, top soil and gravel to prevent seepage of water.

2. Incineration

This method involves burning of solid wastes at high temperatures until the wastes are turned into ashes. Incinerators are made in such a way that they do not give off extreme amounts of heat when burning solid wastes. This method of solid waste management can be done by individuals,

municipalities and even institutions. The good thing about this method is the fact that it reduces the volume of waste up to 20 or 30% of the original volume.

3. Recovery and Recycling

Recycling or recovery of resources is the process of taking useful but discarded items for next use. Traditionally, these items are processed and cleaned before they are recycled. The process aims at reducing energy loss, consumption of new material and reduction of landfills.

4. Composting

Due to lack of adequate space for landfills, biodegradable yard waste is allowed to decompose in a medium designed for the purpose. Only biodegradable waste materials are used in composting. Good quality environmentally friendly manure is formed from the compost and can be used for agricultural purposes.

5. Pyrolysis

This is method of solid waste management whereby solid wastes are chemically decomposed by heat without presence of oxygen. This usually occurs under pressure and at temperatures of up to 430 degrees Celsius. The solid wastes are changed into gasses, solid residue and small quantities of liquid.

ROLE OF AN INDIVISUAL IN PREVENTION POLLUTION

1. Individuals should minimize wastage of resources such as electricity. Every unit of electricity saved is equivalent unit of electricity produced as it not only saves the fuel that would be used to produce that electricity, but also help to prevent pollution that is accompanied by burning of that fuel. Therefore, person should always switch off appliances when not in use.

2. Individuals should prefer walking or use cycles instead of using motor vehicles, especially when distances to be travelled are small.

3. Individuals can make considerable contribution by using mass transport (buses, trains, etc) instead of using personal vehicles.

4. When going to workplace, colleagues from nearby localities should pool vehicles instead of going in individual personal vehicles.

5. Taking personal vehicles for periodic pollution checks at centres approved by authorities.

6. Individuals should reuse items whenever possible.

7. Products that are made of recycled material should be given preference.

8. Use gunny bags made of jute instead of plastic bags.

9. Take part in environment conservation drives such as tree planting drives.

10. Use water resources efficiently.

11. Use renewable resources by installing equipment such as solar heaters and using solar cookers.

12. Dispose potentially harmful products such as cells, batteries, pesticide containers, etc properly.

13. Use of refrigerators should be minimised wherever possible as they are main source of CFC, which is responsible for Ozone layer depletion.

14. Follow and promote family planning, as more population means more resources utilized and more resources utilized imply more pollution.

15. Avoid making noise producing activities such as listening to loud music.

16. Use handkerchiefs instead of paper tissues.

17. Organize drives to clean streets and clean drains with help of other people of locality.

18. Spread awareness and inspire other people to prevent pollution. Individuals should be encouraged to acquire information and innovations from world over and implement them locally.

DISASTER MANAGEMENT

FLOODS

Floods are the most common and widespread of all natural disasters. India is one of the highly flood prone countries in the world. Around 40 million hectares of land in India is prone to floods as per National Flood Commission report. Floods cause damage to houses, industries, public utilities and property resulting in huge economic losses, apart from loss of lives. Though it is not possible to control the flood disaster totally, by adopting suitable structural and non-structural measures the flood damages can be minimised. For planning any flood management measure latest, reliable, accurate and timely information is required. In this context satellite remote sensing plays an important role.

Rescue & Evacuation

Evacuation is a pre-emptive move to protect life and property, where as rescue is a post-disaster phenomenon of helping people to move from areas that have been hit by disaster to a safer place. However, the situation of evacuation and rescue comes along with numerous unanswered queries in mind. Very often, due to lack of information or in haste, living during evacuation and rescue becomes difficult and painful. However, during such the situations, following precautionary norms should be kept in mind.

Preparing for a Flood

Here are some basic steps to take to prepare for the flood:

1. Contact the local geologist or town planning department or meteorology department to find out if your home is located in a flash-flood-prone area or landslide-prone area.

2. Learn about your community's emergency plans, warning signals, evacuation routes, and locations of emergency shelters.

3. Plan and practice a flood evacuation route with your family. Ask an out-of-state relative or friend to be the "family contact" in case your family is separated during a flood. Make sure everyone in your family knows the name, address, and phone number of this contact person.

4. Post emergency phone numbers at every phone.

5. Inform local authorities about any special needs, i.e., elderly or bedridden people, or anyone with a disability.

6. Identify potential home hazards and know how to secure or protect them before the flood strikes. Be prepared to turn off electrical power when there is standing water, fallen power lines etc. Turn off gas and water supplies before you evacuate. Secure structurally unstable building materials.

7. Buy a fire extinguisher and make sure your family knows where it is and how to use it.

8. Buy and install sump pumps with back-up power.

9. Have a licensed electrician to raise electric components (switches, sockets, circuit breakers and wiring) at least 12" above your home's projected flood elevation.

10. For drains, toilets, and other sewer connections, install backflow valves or plugs to prevent floodwaters from entering.

If you are under a flood watch or warning:

1. Gather the emergency supplies you previously stocked in your home and stay tuned to local radio or television station for updates.

2. Turn off all utilities at the main power switch and close the main gas valve if evacuation appears necessary.

3. Have your immunization records handy or be aware of your last tetanus shot, in case you should receive a puncture wound or a wound becomes contaminated during or after the flood.

4. Fill bathtubs, sinks and plastic soda bottles with clean water. Sanitize the sinks and tubs first by using bleach. Rinse and fill with clean water.

5. Bring outdoor possessions, such as lawn furniture, grills and trash cans inside or tie them down securely.

Preparing to Evacuate

Expect the need to evacuate and prepare for it. When a flood watch is issued, you should:

1. Fill your vehicle's gas tank and make sure the emergency kit for your car is ready.

2. If no vehicle is available, make arrangements with friends or family for transportation.

3. Fill your clean water containers.

4. Review your emergency plans and supplies, checking to see if any items are missing.

5. Tune in the radio or television for weather updates.

6. Listen for disaster sirens and warning signals.

7. Put livestock and family pets in a safe area. Due to food and sanitation requirements, emergency shelters cannot accept animals.

If You Are Ordered to Evacuate

1. Take only essential items with you.

2. If you have time, turn off the gas, electricity, and water.

3. Disconnect appliances to prevent electrical shock when power is restored.

5. Follow the designated evacuation routes and expect heavy traffic.

6. Do not attempt to drive or walk across creeks or flooded roads.

EARTH QUAKE

An earthquake is a sudden tremor or movement of the earth's crust, which usually originates at or below the surface. The outer layer of the earth is solid and is divided into many sections known as plates. The point of origin of the earthquake within the crust or mantle is called the seismic focus.

PROTECTION AGAINST EARTHQUAKES

1. The information about earthquakes and their intensity should be shared with the public through radio, television and newspapers

2. Construction of buildings based on earthquake-resistant techniques .

3. Construct buildings over pillars made of concrete and iron that are built deep in the ground

4. Water, ration, first-aid kits, radios, flash lights, battery, blankets, jackets and fire extinguishers should be stored in safe places.

5. If inside a building or a house, take cover under a solid surface like a table, or stand in the doorway

6. If one is outside, move to an open space away from trees, electric poles and buildings .

7. Switch off the gas and electric supply in the house during a quake and do not use elevators .

8. After the quake is over, the affected people should be given immediate medical help .

9. Transport and communication facilities should be restored as soon as possible .

CYCLONE

CYCLONES are atmospheric disturbances and are formed around a low-pressure area.

Mitigation and Management

1. Mitigation is the effort to reduce loss of life and property by lessening the impact of disasters.

2. Main aim of the mitigation process is to save lives, reduce economic disruption, decrease vulnerability.

3. Understanding the way that people are killed and injured in a particular disaster is a best way for reducing casualties.

4. Creating awareness of risk is the main role in Mitigation process. Mitigation also helps in the protection of the economy from disasters.

5. Mobilisation of vehicles for evacuation.

6. Setting up emergency shelter.

7. Search and rescue operation.

8. Establishing communication with cut-off villages and moving population to the safe areas.

9. Medical assistance such as setting up camps.

10 Arrangements of short term food and water.

11. Improvements of damaged infrastructures such as roads, bridges.

12. Re-establishment of electricity, communication networks and contact with remote areas.

13. Clearance of discarded materials.

14. Choosing an agency for disposal of dead.

LANDSLIDES

A landslide is the rapid mass movement of soil, mud and/or rocks downhill due to the pull of gravity. Landslides are very common and occur in a variety of forms. Land may topple off in a big chunk, or slip down in bits. Landslide may be composed of mud or may contain rocks and other debris. Most landslides occur gradually, but some may be sudden.

Before a Landslide:

1. A ground assessment should be done of your property. When this is done you would know the kind of soil type that your property is built on, and would be able to determine how susceptible it would be to ground movements and if landslides are a possibility.

2.Find out whether the area in which you live is prone to landslides. Landslides usually occur in the same areas, so if a landslide has occurred in your area it would mean that the chances of another landslide occurring in the future are high.

3. If you live in a high risk area an evacuation plan should be prepared.

4. Plant trees and other types of vegetation that would help to stabilize soil on the slopes of your property.

During a landslide:

1. If you are inside of a building, stay inside; don't leave your home until it is officially safe to do so.

2.If outdoors, try to get to the nearest high ground in the direction away from the path of the landslide.

3. If you are at a river, be prepared to leave the area immediately if there are signs that a landslide has occurred higher upstream. Don't try to take your belongings, just leave the area as fast as possible.

4. If driving, remain alert and look out for collapsed pavements, mud and fallen rocks.

After a Landslide

1. Don't go into or return to an area that just experienced a landslide since there may be additional landslides. Only return to the area once it is officially safe to do so.

2. Flooding may occur after a landslide since they might be caused by the same factors.

3. Provide assistance to neighbours and to any special needs individuals such as children and to the elderly.

4. Check your property for any structural damage.

UNIT - 6

FROM UNSUSTAINABLE TO SUSTAINABLE DEVELOPMENT

There are two aspects of sustainable development.

1. Inter-generational equity – This emphasizes that we should stop over-exploitation of resources, reduce west discharge and emissions and maintaining an ecological balance. It expects to hand over a safe healthy and resourceful environment to the future generations.

2. Intra-generational equity-This emphasizes that technological development should support economic growth of the poor countries.

Measures for sustainable development

There are following major measures for sustainable development.

1.To promote environmental education and awareness

- Environment as a subject in education from primary stage
- Media can also in this regard
- By making different policies

2.Three "R" approach

- Reduce, Reuse & Recycle

3. Appropriate technology

- Technology should use less resources and produce minimum waste.

4. To utilize resources as per carrying capacity of the environment

- If carrying capacity of a system crossed, environmental degradation starts and continues till it reaches a point of no return.

URBAN PROBLEM RELATED TO ENERGY

Urbanization is a global phenomenon in the developed countries of the world. It is now taking a steady stride in developing countries. The degree of urbanization has increased tremendously. urbanization is largely due to a steady migration of rural population from rural to urban areas. The main reason for heavy concentration of urban population in large metropolitan cities is that they are the centers of major industrial and commercial activities.

They offer much attraction for migration of people and these accounts for rapid increase in their population.

Urbanization has brought into associated problems related with the energy.There are following main causes of energy problem.

1. Increase use of energy for domestic and commercial purposes due to increased population and industrialisation.
2. Industrial plant using big proportion of energy.
3. Non renewable resources of energy like coal, petroleum and natural gas are decreasing.
4. Increasing of transport means.
5. Decreasing production of hydroelectricity due to insufficient rain.
6. Transmission loss due to defected power distribution system.

There are following steps to solve the energy related problems.

1. To control urbanisation.
2. To develop renewable resources of energy like solar radiation, wind power, hydro power, nuclear power, etc
3. Welcome the awareness programs to save energy.
4. Effective measures for transition loss and energy theft.

WATER CONSERAVATION

Water conservation day is celebrated on 22nd of March. Water conservation includes all the policies, strategies and activities to sustainably manage the natural resource of fresh water, to protect the hydrosphere, and to meet the current and future human demand. Population, household size and growth and affluence all affect how much water is used. Factors such as climate change have increased pressures on natural water resources especially in manufacturing and agricultural irrigation. Many countries have already implemented policies aimed at water conservation, with much success.

The goals of water conservation efforts include:

1. Ensuring the availability of water for future generations where the withdrawal of freshwater from an ecosystem does not exceed its natural replacement rate.
2. Habitat conservation where minimizing human water use helps to preserve freshwater habitats for local wildlife and migrating waterfowl, but also water quality. The water that leaks from aquaguard should be collected and could be used for household works.

Conservation of Water

1. Afforestation can help water to penetrate into the soil and replenish the water table.
2. Building Dams and hydropower projects which help in checking flood and regulating the supply of water to agriculture.
3. Treatment of industrial and domestic wastewater in sewage plants before its disposal in water bodies help in conservation of water. It reduces the water pollution.
4. Rainwater harvesting
5. Use of efficient watering systems such as drip irrigation and sprinklers to reduce water consumption by plants and help in conservation of water.

RAIN WATER HARVESTING

Rainwater harvesting is the process of collection of rainwater from surfaces on which rain falls, filtering it and storing it for multiple uses. Rainwater harvesting puts the supply of water back to normal levels. It is the collection and storage of water from surfaces that rain has fallen upon. Rainwater harvesting is an innovative technique utilized to harvest rainwater from roofs and other above surfaces to be stored for later use. Rain harvested water can be used for garden and crop irrigation, watering livestock, laundry, and flushing toilets. However, you cannot use harvested rainwater for showering, bathroom sink or kitchen use because it's not really fit for consumption.

In a normal scenario the rainwater is collected from roof buildings and then stored inside of a special tank. Rainwater harvesting systems are designed after assessing site conditions that include rainfall pattern, incident rainfall, subsurface strata and their storage characteristics. Rainwater harvesting is popular all across the world, although in countries that are very dry, such as Australia, it is even more popular.

Rainwater can be harvested and used by those in the city who have running city water just as well as it can be used by those in more rural towns where adequate water supply may be unavailable. It is simple to replace many things that you are using regular city water with rainwater and enjoy numerous benefits when you do. Not only it helps you to conserve water but can also help you to save energy as the need to maintain centralized water system can be bypassed.

Components of Rainwater Harvesting system

A rainwater harvesting system comprises components of various stages - transporting rainwater through pipes or drains, filtration, and storage in tanks for reuse or recharge. The common components of a rainwater harvesting system involved in these stages are illustrated here.

1. Catchments

The catchment of a water harvesting system is the surface which directly receives the rainfall and provides water to the system. It can be a paved area like a terrace or courtyard of a building, or an unpaved area like a lawn or open ground. A roof made of reinforced cement concrete (RCC), galvanised iron or corrugated sheets can also be used for water harvesting.

2. Coarse mesh

at the roof to prevent the passage of debris.

3. Gutters

Channels all around the edge of a sloping roof to collect and transport rainwater to the storage tank. Gutters can be semi-circular or rectangular.

4. Storage tanks

Rain water stored

5.Water treatment

The filters and equipment as well as additives to settle, filter and disinfect.

Rainwater Harvesting system method and technique

1. Roof top rain water harvesting and its recharge to underground through existing wells or bore wells or by constructing new wells.
2. Harvesting runoff in the catchments by construction structures such as checkdams, bhandaras, percolation trench.
3. Impounding surplus runoff in the village catchment and water sheds in village ponds and percolation tanks.
4. Recharging treated urban and industrial effluents underground by using it for direct irrigation or through recharge ponds or well etc.

The main objectives of rain water harvesting are

- To restore supplies from the aquifers depleted due to over exploitation.
- To improve supplies from aquifers lacking adequate recharge.

- To store excess water for use at subsequent times.
- To improve physical and chemical quality of ground water.
- To reduce storm runoff and soil erosion.
- To prevent salinity ingress in costal areas.

WATER SHED MANAGEMENT

Water shed is an area bounded by the divide line of water flow. It may be drainage basin or stream. The management of rainfall and resultant runoff is based on a natural unit called water shed. The Himalayas are one of the most critical water sheds in the world. Damodar valley corporation in1949 adopted first integrated watershed management.

Water shed management include soil and land use survey, soil conservation in catchments of River valley projects and flood prone rivers, afforestation, social forestry programmes, drought prone area development programme, desert development and control of shifting cultivation.

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

Objective of water shed management are

- Supply and securing of clean and sufficient drinking water for the population.
- To manage the watershed for beneficial developmental activities like domestic water supply, irrigation, hydropower generation etc.
- To minimize the risks of floods, droughts and landslides.
- To develop rural areas in the region with clear plans for improving the economy of the regions.
- To increase agricultural production
- The rational utilisation of natural resources like soil, water and vegetation.

Watershed Management Practices

In the fifth year plan, watershed management approach was included with a number of programs for it and a national policy was developed. In watershed management the aspects of development are considered with regard to availability of the resources.

RESETTLEMENT AND REHABILATION OF PEOPLE; ITS PROBLEMS AND CONCERN

People are forced to move out of their land due to both natural and man made disasters. Natural disasters like earthquakes, cyclones, tsunami etc. render thousands of people homeless and sometime even force them to move and resettle in other areas. Similarly, developmental projects like construction of roads, dams, canals and flyovers displace people form their home. You must all be aware of the recent nuclear leakage in Japan due to which millions of people were forced to leave the area for their safety. Thus, resettlement refer to the process of settling again in a new area. Rehabilitation means restoration to the former state.

Reasons for displacement of people

- Natural disasters like earthquake, cyclones, tsunamis, volcanic eruptions, prolonged droughts conditions, floods, hurricanes etc.
- Man made disasters like industrial accidents (e.g. Bhopal gas tragedy), nuclear accidents(Current disaster in Japan), oil spills(Exxon Valdez oil spill), toxic contamination of sites etc.
- Developmental projects like:

  construction of dams, irrigation canals, reservoirs etc.

- Infrastructural projects like flyovers, bridges, roads etc.
- transportation activities like roads, highway, canal etc.
- Energy related project like power plants, oil exploration, mining activities, pipelines like HBJ pipeline etc.
- Agricultural projects
- Projects related with the conservation of wildlife like national parks, sanctuaries and biosphere reserves.

PROBLEM

- Displacement mainly hits tribal and rural people who usually do not figure in the priority list of any political authorities or parties.

- The compensation for the land lost is often not paid, it is delayed or even if paid, is too small both in monetary terms and social changes forced on them by these mega developmental projects.
- Displacement is not a simple incident in the lives of the displaced people. They have to leave their ancestral land and forests on which they depend for their livelihood. Many of them have no skills to take up another activity or pick up any other occupation. Usually, the new land that is offered to them is of poor quality and the refugees are unable to make a living.
- When people are resettled in a new area, basic infrastructure and amenities are not provided in that area. Very often, temporary camps become permanent settlements. It is also a major problem of displacement or resettlement that people have to face.
- Resettlement disrupt the entire life of the people. They are unable to bear the shocks of emptiness and purposelessness created in their life.
- Lack of nutrition due to the loss of agriculture and forest based livelihood, lead to the general decline in the health of the people. People are used to traditional home remedies. But the herbal remedies and plants gets submerged due to the developmental projects
- Resettlement increases the poverty of the tribal due to the loss of land, livelihood, food insecurity, jobs, skills etc.
- The tribal people are not familiar with the market trends, prices of commodities and policies. As such, they are exploited and get alienated in the modern era.

OBJECTIVES OF REHABILATION

The following objectives of rehabilitation should be kept in mind before the people are given an alternative site for living

- Tribal people should be allowed to live along the lives of their own patterns and others should avoid imposing anything on them.
- They should be provided means to develop their own traditional art and culture in every way.
- The displaced people should be given employment opportunities.
- If resettlement is not possible in the neighbour area, priority should be given to the development of the irrigation facilities and supply of basic inputs for agriculture, drinking water, wells, grazing ground for the cattle, schools for the children, primary healthcare units and other amenities.

ENVIRONMENTAL ETHICS: ISSUES AND POSSIBLE SOLUTION

Environmental ethics is a branch of ethics that studies the relation of human beings and the environment and how ethics play a role in this. Environmental ethics believe that humans are a part of society as well as other living creatures, which includes plants and animals. These items are a very important part of the world and are considered to be a functional part of human life. Thus, it is essential that every human being respect and honour this and use morals and ethics when dealing with these creatures.

In relation to environmental protection or in need of environmental ethics two world views are

1. Eco-centric world view

This states that earth resources are limited, and they are not for the human beings alone but for all species. So we have to draw our requirements from environment, but not to that extent it degrades the environment. A healthy environment depend upon how we cooperate with nature while trying to use resources of environment.

2. Anthropocentric world view

It states that man is the most important species of nature. Earth has unlimited supplies of resources. Most of the industrial societies believe in this view. So success and healthy economy of mankind depend upon how nicely man derives benefits from nature.

We must follow the certain environmental ethics for better future.

1. One should love and honour the earth.
2. Do not waste and exploit the natural resources.
3. We should respect the plant and animal which provide us food.
4. We should not do anything at the cost of nature.
5. We should concentrate on general awareness regarding environmental ethics from primary education.
6. We should conserve the ecosystem and promote appropriate sustainable development.
7. We should consume the natural resources in moderate amounts so that all may share this treasure.

CLIMATE CHANGE

periodic modification of Earth's climate brought about as a result of changes in the atmosphere as well as interactions between the atmosphere and various other geologic, chemical, biological, and geographic factors within the Earth system.

Climate is often defined loosely as the average weather at a particular place, incorporating such features as temperature, precipitation, humidity, and windiness. A more specific definition would state that climate is the mean state and variability of these features over some extended time period. Both definitions acknowledge that the weather is always changing, owing to instabilities in the atmosphere. And as weather varies from day to day, so too does climate vary, from daily day-and-night cycles up to periods of geologic time hundreds of millions of years long.

The atmosphere is a dynamic fluid that is continually in motion. Both its physical properties and its rate and direction of motion are influenced by a variety of factors, including solar radiation, the geographic position of continents, ocean currents, the location and orientation of mountain ranges, atmospheric chemistry, and vegetation growing on the land surface. All these factors change through time.

Some factors, such as the distribution of heat within the oceans, atmospheric chemistry, and surface vegetation, change at very short timescales. Others, such as the position of continents and the location and height of mountain ranges, change over very long timescales. Therefore, climate, which results from the physical properties and motion of the atmosphere, varies at every conceivable timescale.

GLOBAL WARMING

Global warming is a phenomenon of climate change characterized by a general increase in average temperatures of the Earth, which modifies the weather balances and ecosystems for a long time. It is directly linked to the increase of greenhouse gases in our atmosphere, worsening the greenhouse effect.

Causes of global warming

1. Burning fossil fuels
   When we burn fossil fuels like coal, oil and gas to create electricity or power our cars, we release CO2 pollution into the atmosphere.
2. Deforestation & Tree-Clearing
   humans clear vast areas of vegetation around the world for farming, urban and infrastructure development or to sell tree products such as timber and palm oil. When vegetation is removed or burnt, the stored carbon is released back into the atmosphere as CO2, contributing to global warming.
3. Agriculture & Farming
   Some fertilisers that farmers use also release nitrous oxide, which is greenhouse gas.

Animals, particularly livestock like sheep and cattle, produce methane, a greenhouse gas. When livestock are grazed at a large scale, as in Australia, the amount of methane produced is a big contributor to global warming.

4. gases used for refrigeration and industrial processes
5. methane released from landfills, natural gas and petroleum industries
6. Green house effect

ACID RAIN

Acid rain is a rain or any other form of precipitation that is unusually acidic, meaning that it has elevated levels of hydrogen ions (low pH). Acid rain results when sulphur dioxide (SO2) and nitrogen oxides (NOX) are emitted into the atmosphere and transported by wind and air currents. The SO2 and NOX react with water, oxygen and other chemicals to form sulfuric and nitric acids. These then mix with water and other materials before falling to the ground.

While a small portion of the SO2 and NOX that cause acid rain is from natural sources such as volcanoes, most of it comes from the burning of fossil fuels. The major sources of SO2 and NOX in the atmosphere are:

- Burning of fossil fuels to generate electricity. Two thirds of SO2 and one fourth of NOX in the atmosphere come from electric power generators.
- Vehicles and heavy equipment.
- Manufacturing, oil refineries and other industries.

Adverse effects

- Surface waters and aquatic animals

Both the lower pH and higher aluminium concentrations in surface water that occur as a result of acid rain can cause damage to fish and other aquatic animals. At pH lower than 5 most fish eggs will not hatch and lower pH can kill adult fish. As lakes and rivers become more acidic biodiversity is reduced. Acid rain has eliminated insect life and some fish species.

- Soils

Soil biology and chemistry can be seriously damaged by acid rain. Some microbes are unable to tolerate changes to low pH and are killed. The enzymes of these microbes are denatured by the acid. The hydronium ions of acid rain also mobilize toxins, such as aluminium, and leach away essential nutrients and minerals such as magnesium.

- Forests and other vegetation
- Human health effects

Increased amounts of fine particulate matter in the air contribute to heart and lung problems including asthma and bronchitis.

- Other adverse effects

Acid rain can damage buildings, historic monuments, and statues, especially those made of rocks, such as limestone and marble, that contain large amounts of calcium carbonate. Acids in the rain react with the calcium compounds in the stones to create gypsum, which then flakes off.

OZONE LAYER DEPLETION

Ozone layer is a deep layer in earth's atmosphere that contain ozone which is a naturally occurring molecule containing three oxygen atoms. These ozone molecules form a gaseous layer in the Earth's upper atmosphere called stratosphere. This lower region of stratosphere containing relatively higher concentration of ozone is called Ozonosphere. The ozone layer forms a thick layer in stratosphere, encircling the earth, that has large amount of ozone in it. The ozone layer protects life on earth from strong ultraviolet radiation that comes from the sun.

Ozone holes refer to the regions of severely reduced ozone layers.

Causes of Ozone Layer Depletion

The ozone layer depletion is a major concern and is associated with a number of factors. The main causes responsible for the depletion of the ozone layer are listed below:

- Chlorofluorocarbons

Chlorofluorocarbons or the CFC are the main cause of ozone layer depletion. These are released by soaps, solvents, spray aerosols, refrigerators, air-conditioners, etc.The molecules of chlorofluorocarbons in the stratosphere are broken down by the ultraviolet radiations and release chlorine atoms. These atoms react with ozone and destroy it.

- Unregulated Rocket Launches

Researches say that the unregulated launching of rockets result in much more depletion of ozone layer than the CFCs do. If not controlled, this might result in a huge loss of the ozone layer by the year 2050.

- Nitrogenous Compounds

The nitrogenous compounds such as NO2, NO, N2O are highly responsible for the depletion of the ozone layer.

- Natural Causes

The ozone layer has been found to be depleted by certain natural processes such as Sun-spots and stratospheric winds. But it does not cause more than 1-2% of the ozone layer depletion.

Effects of ozone layer depletion

The depletion of ozone layer has harmful effects on the environment. Let us see the major effects of ozone layer depletion on man and environment.

- Effects on Human Health

The humans will be directly exposed to the harmful ultraviolet radiations of the sun due to the depletion of ozone layer. This might result in serious health issues among humans such as skin diseases, cancer, sunburns, cataract, quick ageing, and weekend immune system.

- Effects on Animals

Direct exposure to ultraviolet radiations leads to skin and eye cancer in animals.

- Effects on the Environment

Strong ultraviolet rays may lead to minimal growth, flowering and photosynthesis in plants. The forests also have to bear the harmful effects of the ultraviolet rays.

- Effects on Marine Life

Planktons are greatly affected by the exposure to harmful ultraviolet rays. These are higher in the aquatic food chain. If the planktons are destroyed the organisms present in the lower food chain are also affected.

Solutions to Ozone Layer Depletion

The depletion of ozone layer is a serious issue and various programmes had been launched by the government of various countries to prevent it. But, steps should be taken at the individual level as well to prevent the depletion of ozone layer.Following are some of the points that would help in preventing this problem at a global level:

- Avoid Using Pesticides

Natural methods should be implemented to get rid of pests and weeds instead of using chemicals. One can use eco-friendly chemicals to remove the pests or remove the weeds manually.

- Minimise the Use of Vehicles

The vehicles emit a large amount of greenhouse gases that lead to global warming as well as ozone depletion. Therefore, the use of vehicles should be minimised as much as possible.

- Use Eco-friendly Cleaning Products

Most of the cleaning products have chlorine and bromine releasing chemicals that find way into the atmosphere and affect the ozone layer. These should be substituted with natural products to protect the environment.

- The Use of Nitrous Oxide should be Prohibited

The government should take actions and prohibit the use of harmful nitrous oxide that is adversely affecting the ozone layer. The people should be made aware of the harmful effects of nitrous oxide and the products emitting the gas so that its use is minimised at the individual level as well.

NUCLEAR ACCIDENTS AND HOLOCAUST

A nuclear holocaust, nuclear apocalypse or atomic holocaust is a theoretical scenario involving widespread destruction and radioactive fallout causing the collapse of civilization, through the use of nuclear weapons. Under such a scenario, some or all of the Earth is made uninhabitable by nuclear warfare in future world wars.

Case study

Chernobyl accident (Ukraine)

The Chernobyl Nuclear disaster is widely considered to have been the worst power plant accident in history, and is one of only two classified as a level 7 event on the International Nuclear Event Scale (the other being the Fukushima, Daiichi disaster in 2011).

The plant was built in the late 1970s about 65 miles north of Kiev in the Ukraine, the Chernobyl plant was one of the largest and oldest nuclear power plants in the world. The explosion and subsequent meltdown that occurred there in April 1986 would claim thousands of lives, cause countless birth defects and unleash a thyroid cancer epidemic on the region. However, it would take years for the full story behind the catastrophe to emerge. A bungled experiment at one of the facility's four reactors created a sudden power surge, which in turn led to a series of blasts that blew the 1,000-ton steel top off of the reactor. A lethal cloud of radioactive material gathered over the nearby town of Pripyat—which was not evacuated

until 36 hours after the explosion—before wafting over large parts of Europe. Soviet officials tried to keep the disaster under wraps, but on April 28 Swedish radiation monitoring stations located more than 800 miles from Chernobyl reported radiation levels 40 percent higher than normal.

In the opening days of the crisis, 32 people died at Chernobyl and dozens more suffered radiation burns. The radiation that escaped into the atmosphere–equivalent to several times that produced by the atomic bombs dropped on Hiroshima and Nagasaki–contaminated millions of acres of forest and farmland. The full human toll from the calamity is still being tallied, but experts believe that thousands of people died and as many as 70,000 suffered severe poisoning. In addition, a large area of land may not be livable for as much as 150 years, including the 18-mile radius around Chernobyl–home to some 150,000 people who had to be permanently relocated. In 2000, the last working reactors at Chernobyl were shut down and the plant was officially closed.

Japanese towns of Hiroshima and Nagasaki

The first atom bomb was exploded about 580 meters in the atmosphere over ill fated Hiroshima on August 6, 1945. The second atom bomb was detonated 507 meters high in air over Nagasaki. At least 100000 people were reported killed, severely injured and missing in Hiroshima alone, where the bomb virtually demolished all structures and all buildings in about 15 square km. area. In Nagasaki 49000 civilians are killed, inured and disappeared while an area of 6 to 7 km. was devastated.

AIR (PREVENTION AND CONTROL OF POLLUTION) ACT

It is also a comprehensive legislation with more than fifty sections. It makes provisions, inter alia, for Central and State Boards, power to declare pollution control areas, restrictions on certain industrial units, authority of the Boards to limit emission of air pollutants, power of entry, inspection, taking samples and analysis, penalties, offences by companies and Government and cognizance of offences etc..

The Act specifically empowers State Government to designate air pollution areas and to prescribe the type of fuel to be used in these designated areas. According to this Act, no person can operate certain types of industries including the asbestos, cement, fertilizer and petroleum industries without consent of the State Board. The Board can predicate its consent upon the fulfilment of certain conditions. The Air Act apparently adopts an industry wide "best available technology" requirement.

The Government passed this Act in 1981 to clean up our air by controlling pollution. It states that sources of air pollution such as industry, vehicles, power plants, etc., are not permitted to release particulate matter, lead, carbon monoxide, sulphur dioxide, nitrogen oxide, volatile organic compounds (VOCs) or other toxic substances beyond a prescribed level.

To ensure this, Pollution Control Boards (PCBs) have been set up by Government to measure pollution levels in the atmosphere and at certain sources by testing the air. This is measured in parts per million or in milligrams or micrograms per cubic meter. This Act is created to take appropriate steps for the preservation of the natural resources of the Earth which among other things includes the preservation of high quality air and ensures controlling the level of air pollution.

The main objectives of the Act are as follows

- To provide for the prevention, control and abatement of air pollution.
- To provide for the establishment of central and State Boards with a view to implement the Act.
- To confer on the Boards the powers to implement the provisions of the Act and assign to the Boards functions relating to pollution.

Powers and Functions of the Boards

1. Central Pollution Board

- The main function of the Central Board is to implement legislation created to improve the quality of air and to prevent and control air pollution in the country.
- The-Board advises the Central Government on matters concerning the improvement of air quality and also coordinates activities, provides technical assistance and

guidance to State Boards and lays down standards for the quality of air. It collects and disseminates information in respect of matters relating to air pollution and performs functions as prescribed in the Act.

2. State Pollution Control Boards

- The State Boards have the power to advise the State Government on any matter concerning the prevention and control of air pollution. They have the right to inspect at all reasonable times any control equipment, industrial plant, or manufacturing process and give orders to take the necessary steps to control pollution.
- They are expected to inspect air pollution control areas at intervals or whenever necessary. They are empowered to provide standards for emissions to be laid down for different industrial plants with regard to quantity and composition of emission of air pollutants into the atmosphere.
- A State Board may establish or recognize a laboratory to perform this function. The State Governments have been given powers to declare air pollution control areas after consulting with the State Board and also give instructions to ensure standards of emission from automobiles and restriction on use of certain industrial plants.

Penalties

- The persons managing industry are to be penalized if they produce emissions of air pollutants in excess of the standards laid down by the State Board. The Board also makes applications to the court for restraining persons causing air pollution.
- Whoever contravenes any of the provision of the Act or any order or direction issued is punishable with imprisonment for a term which may extend to three months or with a fine of Rs. 10,000 or with both, and in case of continuing offence with an additional fine which may extend to Rs 5,000 for every day during which such contravention continues after conviction for the first contravention.

WATER (PREVENTION AND CONTROL OF POLLUTION) ACT

This is an Act to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water through various management guidelines and restrictions. The act was introduced and incorporated into the Constitution of India in 1974. The act was passed in pursuance of clause (1) of article 252 of the Constitution. Resolutions have been passed by all the Houses of the Legislatures of the States.

One of the prime objectives of this act is carrying out the purposes mentioned above by assigning a set of responsibilities, powers, and functions to the Boards for the prevention and control of water pollution.

The Water Act applies in the first instance to the whole of the States of Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu and Kashmir, Karnataka, Kerala, Madhya Pradesh, Rajasthan, Tripura and West Bengal and the Union territories.

Central & State Pollution Control Boards (PCBs)

Under this act, one Central board and numerous State boards shall be appointed by notification in the Official Gazette called Central Pollution Control Board (CPCB) and State Pollution Control Board (SPCB) respectively with effect from a date not later than six months of the commencement of this Act.

The State Boards shall investigate, assess, and monitor the issues of concern regarding the quality and pollution of the water resources available in their jurisdiction and shall report the same through quarterly and annual reports during board meetings to the Central Board. The Central Board hereby shall look into the State Board's reports and also monitor and handle major issues regarding national water resources.

Functions of the Central Board

The primary goal of the Central Board as stated in accordance with the Water Act shall be to promote cleanliness of streams and wells in different areas of the States. Highlight functions of the Central Pollution Control Board (CPCB) are as follows:

1. Advise the Central Government on any matter concerning the prevention and control of water pollution.

2. Co-ordinate the activities of the State Boards and resolve disputes among them.

3. Provide technical assistance and guidance to the State Boards, carry out and sponsor investigations and research relating to problems of water pollution and prevention, control or abatement of water pollution.

4. Plan and organize the training of persons engaged or to be engaged in programs for the prevention, control or abatement of water pollution.

5. Collect, compile and publish technical and statistical data relating to water pollution and the measures devised for its effective prevention and control.

Functions of the State Board

Highlight functions of the State Pollution Control Board (SPCB) are as follows:

1. Plan a comprehensive programme for the prevention, control or abatement of pollution of streams and wells in the State.

2. Advise the State Government on any matter concerning the prevention, control or abatement of water pollution.

3. Encourage, conduct and participate in investigations and research relating to problems of water pollution and prevention, control or abatement of water pollution.

4. Collaborate with the Central Board in organizing the training of persons engaged or to be engaged in programmes relating to prevention, control or abatement of water pollution.

5. Inspect sewage or trade effluents, works, and plants for the treatment of sewage and trade effluents and to review plans, specifications or other data relating to plants set up for the treatment of water.

6. Evolve methods of utilization of sewage and suitable trade effluents in agriculture.

7. Evolve economical and reliable methods of treatment of sewage and trade effluents, having regard to the peculiar conditions of soils, climate and water resources of different regions.

Penalties

1. If any person fails to comply with the orders of the board under subsection 2 and 3 of Section 20 then in that case on conviction, he is punishable for imprisonment for 3 months or fine or both.

2. If the person fails to comply with orders of the board under clause e of subsection 1 of Section 32 or with subsection 2 of Section 33 then, in that case, the person would be punishable with imprisonment for 6 months extending to 6 years or a fine or both.

3. from the above-mentioned penalties. Section 42 mentions penalties for different kinds of Acts namely:

- If any person removes, destroys or pull down any notice put up by the board.
- If someone obstructs the member of the board or any other person who is Acting under the board.
- If a person fails to produce any information as required by the member of the board for the performance of his duties.
- Or if he gives any information to the members which he knows to be false.

Then In all the above Acts if the person is convicted he would be punishable by imprisonment for a maximum period of 3 months or fine that may extend up to 10,000 rupees or both.

PUBLIC AWARENESS

Environmental pollution, environmental degradation, environmental deterioration, environmental crisis etc are few words which becoming day by day a subject of concern in every walk of life. This is all due to industrialization, rapid population growth, urbanization, changing lifestyle etc. The formulation of various acts and legislation to control population and conserve or protect environment, underlines the will and concern of the Government. But incomplete knowledge, information and ignorance about many aspects of environment has led to misconception. Therefore it is necessary to make people aware about the laws and legislations and to save environment. There is no single subject by which we can have complete knowledge of environmental aspects. Simultaneously it can not be done by single man, agency or institution. It is of the people, by the people and for the people. Thus public awareness means, making the people conscious about the physical, social and aesthetic aspects of environment. To protect and conserve the environment is the basic duty of all section of people. It is necessary to find the permanent solution of environment and ecological problems. It can be done by following means-

1. Through mass media

2.Through education

3. Through rallies orientation and training program

4. Through voluntary organisation and NGOs

5. Merging the ideas and philosophy of environmentalism with the structure of formal education systems, it strives to increase awareness of environmental problems as well as to foster the skills and strategies for solving those problems.

6. Publications of environment related resources material in the form of pamphlets or booklets published by Ministry of Environment & Forests can also help in keeping this section abreast of the latest developments in the field. Before we can all take up the task of environmental protection and conservation, we have to be environmentally educated and aware. It is aptly said “if you want to act green, first think green”.

UNIT - 7

POPULATION GROWTH AND VARIATION AMONG NATION

The period of 600 million years from the present era witnessed tremendous explosion of life forms through evolutionary process with man at the apex of the evolution, appearing only a few million years ago. At present, it is estimated that earth has about 10 to 30 million life forms of which man is one of the life form.

Each population has a characterized pattern of increase which is termed as its growth form. It increases in size in a characteristic S-Shaped or sigmoid fashion. When a population starts growing, first the growing is slow, and then it be•comes rapid and finally slows down until equilibrium is reached. If we plot time on x-axis and number of organisms on y-axis, on a graph paper, we should get a s-shaped sigmoid curve. Human population shows a s-shaped growth. However, if the growth stops abruptly, a J-shaped growth curve is obtained.

The level beyond which no major increase can occur is called the saturation level or carrying capacity. The following states have been ruined to occur in the population growth form:

1. The Period of Positive Growth

2. The Equilibrium Position

3. Oscillations and Fluctuations

4. Decline and Extinction

The world’s population is not properly balanced, more than half of the world’s people live in Asia (approx. 3.7) billion), which accounts for only one fifth of the world’s land area. While

north, central and south America together occupy more than a quarter of the land surface and have only one -fifth of the population (1.3 billion).

The African continent also accounts for a quarter of the land surface but has just over one eighth (840 million) of the world population. On the other hand Europe whose area is only one twenty fifth of the total has about one- ninth (728 million) of the world's people.

The distribution within the continents is also uneven. In Asia, China alone, with about 1.28 billion people, accounts for one-third Asian and one-fifth of the world population. The Indian subcontinent has a further 1.3 billion people — India, 1.05 billion- Pakistan, 143.5 million- Bangladesh, 133.6 million- Nepal, 23.9 million- Sri Lanka, 18.9 million- Bhutan, 0.3 million- Maldives.

In Europe too, the population is unevenly distributed. Far less people live in Northern European countries than in other European countries. The most populous European countries are Russia (143.5 million), Germany (82.4 million), United Kingdom (60.2 million), France (59.5 million); Italy (58.1 mil•lion), Ukraine (48.2 million), Spain (41.3 million) and Poland (38.6 million).

The distribution of population depends to a large extent on the quality of land. Thus population density (i.e. the number of people living in unit area) varies widely, the densely populated areas include western Europe, the Indian subcon•tinent, the plains and river valleys of China and north eastern USA.

The factors encouraging settlement are good land, flat or undulating terrain the existence of renewable resources, a good climate suitable for wide range of crops or a less equable climate suitable for cultivation of specialized cash crops. Other factors include extension of roads, railways and other modes of transpor•tation. The factors discouraging settlement are usually climate or relief factors; the main factors are cold, altitude, heat, drought, poor soils etc.

POPULATION EXPLOSION – FAMILY WELFARE PROGRAM

Population explosion refers to the rapid and dramatic rise in world population that has occurred over the last few hundred years. Between 1959 and 2000, the world's population increased from 2.5 billion to 6.1 billion people. According to United Nations projections, the world population will be between 7.9 billion and 10.9 billion by 2050. The combination of a continuing high birth rate and a low death rate is creating a rapid population increase in many countries in Asia, Latin America and Africa and people generally lived longer. Due to population explosion the condition of having more people than can live on the earth in comfort, happiness and health and still leave the world a fit place for future generations. But some people now believe that the greatest threat to the future comes from over-population.

Causes of Population Explosion

1. Increase in the birth rate
2. A decrease in infant mortality rate
3. The life expectancy growth
4. High level of illiteracy

National Family Welfare programme

Previously this programme was known as National family planning programme. In the year 1977 the name was changed to National family welfare programme. Family planning programme was launched in India in 1952. India was the first country to do so.During the 3rd five year plan family planning was declared as centre of planned development. Then the emphasis was shifted from clinic approach to extensive education approach.

Importance of family welfare programme

1. The family welfare programme occupies an important position in nation's socio economic development.

2. Indian [population which was 34 crores in 1947 has crossed 100 crores in 2000 AD. India has only 2.4% of worlds land area but it supports about 15.5% of world's population.

3. Indian population is increasing by 1.8 crore every year. To check this galloping growth, the country has laid down long term demographic goal of achieving an NRR of one by the year 2000 AD.

4. Acceptance of family welfare services is made voluntary.

5. The programme was 100% centrally sponsored scheme. FP programme was integrated with the MCH service

ENVIRONMENT AND HUMAN HEALTH

Environment is the main determinant of health status of a community. Poor housing is a contributor to low physical and mental efficiency. Certainly if we aimed at obtaining optimum

condition for physical and mental well being, in addition to preventing disease, we must include improvement of housing condition in this program.

Environment is defined as all external factor present around man. So it is the entire medium in which population lives and interact. The environment may be divided into four components.

1. Physical environment

All non living things and physical forces present around man. The important components of physical environment are water, air, housing, temperature ,noise, vibration etc.

2. Biological environment

All those living things present around us.

3. Social environment

Social interactions between individual such as their socioeconomic status, religion and the way of living, standard of living, and availability and utilisation of health care facilities.

4. Cultural environment

It is the culture in which the individual lives. It include their knowledge, attitude, beliefs, customs, behaviour etc.

Environmental sanitation is defined by WHO as, the control of all those factors in man's physical environment which exercise or may exercise a deleterious effect on his physical environment, health and survival. The world sanitation covers the whole field of controlling environment with a view to prevent disease. It is known fact that in the countries where environmental sanitation is good, there the communicable disease problem is less. The countries having poor environmental sanitation, the communicable disease problem is high.

HUMAN RIGHTS

Human rights are moral principles or norms that describe certain standards of human behaviour and are regularly protected as natural and legal rights in municipal and international law. They are commonly understood as inalienable, fundamental rights "to which a person is inherently entitled simply because she or he is a human being"[4] and which are "inherent in all human beings", regardless of their age, ethnic origin, location, language, religion, ethnicity, or any other status.

There are a variety of human rights, including:

- Civil rights (such as the rights to life, liberty and security),
- Political rights (like rights to the protection of the law and equality before the law),
- Economic rights (including rights to work, to own property and to receive equal pay),
- Social rights (like rights to education and consenting marriages),
- Cultural rights (including the right to freely participate in their cultural community), and
- Collective rights (like the right to self-determination).

The human rights most relevant to trafficking are

1. The prohibition of discrimination on the basis of race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth, or other status;

2. The right to life

3. The right to liberty and security

4. The right not to be submitted to slavery, servitude, forced labour or bonded labour

5. The right not to be subjected to torture and/or cruel, inhuman, degrading treatment or punishment

6. The right to be free from gendered violence

7. The right to freedom of association

8. The right to freedom of movement

9. The right to the highest attainable standard of physical and mental health

10. The right to just and favourable conditions of work

11. The right to an adequate standard of living

12. The right to social security

VALUE EDUCATION

Now a days, more emphasis is unduly laid on knowledge-based and information-oriented education which takes care of only the intellectual development of the child. Consequently, the other aspect of their personality like physical, emotional, social and spiritual are not properly developed in providing for the growth of attitudes, habits, values, skills and interests among the pupils. It is here that we talk in terms of value-education. A complete description of what value-education is, could entail a study in itself.

The very purpose and main function of value education is the development of an all round and well balanced personality of the students, and also to develop all dimensions of the

human intellect so that our children can help make our nation more democratic, cohesive, socially responsible, culturally rich and intellectually competitive nation.

What is Value Education

The meaning of Value Education is to teach universal values like moral values, patience, honesty etc, to the human. The purpose of value education is the development of the personality of the human.

1. The human should develop in all dimensions so that they can serve the nation more democratic, cohesive, socially and responsibly.

2. The full development of human's personality in its physical, mental, emotional and spiritual aspects.

3. Development of good manners and responsibility towards citizenship.

4. The way of thinking and living should be developing at the democratic level.

5. Developing patience, honesty, moral values etc.

6. Inculcation of a spirit of patriotism and national integration.

7. Developing tolerance towards and understanding of different religious faiths.

8. Enabling human to make decisions on the basis of sound moral principles.

ROLE OF INFORMATION TECHNOLOGY IN ENVIRONMENT AND HUMAN HEALTH

Information technology has tremendous potential in the field of environment education and health as in any other field like business, economics, politics or culture. Development of internet facilities, Geographic Information System (GIS) and information through satellites has generated a wealth of up-to- date information on various aspects of environment and health.

A number of software have been developed for environment and health studies which are user friendly and can help an early learner in knowing and understanding the subject.

Database on Environment System

Database is the collection of interrelated data on various subjects. It is usually in computerized form and can be retrieved whenever required. In the computer the information of database and can be very quickly retrieved. The comprehensive database includes wildlife database, conservation database, forest cover database etc. database is also available for diseases like HIV/AIDS, Malaria, Fluorosis, etc.

(a) National Management Information System (NMIS):

NMIS of the Department of Science and Technology has compiled a database on Research and Development Projects along with information about research scientists and personnel involved.

(b) Environmental Information System (ENVIS):

The Ministry of Environment and Forests, Government of India has created an information System called Environmental Information System (ENVIS). With its headquarters in Delhi, it functions in 25 different centres all over the country.

The ENVIS centres work for generating a network of database in areas like pollution control, clean technologies, remote sensing, coastal ecology, biodiversity, western Ghats and eastern environmental management, media related to environment, renewable energy, desertification, mangroves, wildlife, Himalayan ecology, mining etc.

(c) Remote Sensing and Geographical Information System (GIS)

Satellite imageries provide us actual information about various physical and biological resources and also to some extent about their state of degradation in a digital form through remote sensing. Satellite imageries provide us actual information about various physical and biological resources and also to some extent about their state of degradation in a digital form through remote sensing. We are able to gather digital information on environment aspects like water logging, desertification, deforestation, urban sprawl, river and canal network, mineral and energy reserves and so on.

(d) Geographical Information System (GIS):

GIS has proved to be a very effective tool in environmental management. GIS is a technique of superimposing various thematic maps using digital data on a large number of inter-related or inter dependent aspects Different thematic maps containing digital information on a number of aspects like water resources, forest land, soil type, crop land, industrial growth, human settlement etc. are superimposed in a layered form in computer using soft-wares.

(e) The World Wide Web (WWW)

With the availability of resources on every aspect, things like classroom activities, digital files of photos, web-exercises, animations, PowerPoint lecture presentations, and quiz

competitions have proved to be more helpful for both the students as well as the teachers who pursue environmental studies.

Role of Information Technology in Human Health

1. Information technology is playing a major role in bioinformatics, genome sequencing, biotechnology, gene engineering, online medical transcription and in maintaining DTA databases for a better human health. It also helps in identifying several disease-infected areas which are prone to some vector-borne diseases like malaria, schistosomiasis etc. based upon mapping of such areas.

2. Bioinformatics, an emerging field of it is used in curing severe diseases like osteoporosis and in human genome project (HGP) by developing a computer programme that helps in completing the genome sequencing. The aim of HGP is to create a map of entire set of genes (genome) in the human cell by decoding the three billion units of human DNA.

3. It provides vast quantum of information on different subjects including human health and environment. The patient can seek help of a super-specialist doctor placed at far off distance. The National Institute of Occupational Health provides computerized information on occupational health of people working in various hazardous and non-hazardous industries and safety measures etc.