

UNIT I

Environmental Studies: Definition, scope and importance, need for public awareness.

Natural resources: Water resources; use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams: benefits and problems. Effects of modern agriculture, fertilizer- pesticide problems, water logging and salinity.

1.1 ENVIRONMENTAL STUDIES

1.1.1 Definition

Q1. Define Environmental Studies.

Ans. :

Meaning

Environmental studies deals with every issue that affects a living organism. It is essentially a multidisciplinary approach that brings about an appreciation of our natural world and human impact on its integrity. It is an applied science, as it seeks practical answers to the increasingly important question of how to make human civilization sustainable on the finite resources that are available.

Its components include biology, geology, chemistry, physics, engineering, sociology, health, anthropology, economics, statistics, computers and philosophy.

Definitions

Some important definitions of environment are as under:

1. **According to Boring:** 'A person's environment consists of the sum total of the stimulation which he receives from his conception until his death.' It can be concluded from the above definition that Environment comprises various types of forces such as physical, intellectual, economic, political, cultural, social, moral and emotional. Environment is the sum total of all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturation of living organisms.

2. **According to Douglas and Holland:** The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms.

1.1.2 Scope

Q2. Write briefly about the scope of Environmental Studies.

Ans. :

(Imp.)

Scope of Environment

The environment consists of four segments as under:

1. **Atmosphere:** The atmosphere implies the protective blanket of gases, surrounding the earth:
 - (a) It sustains life on the earth.
 - (b) It saves it from the hostile environment of outer space.
 - (c) It absorbs most of the cosmic rays from outer space and a major portion of the electromagnetic radiation from the sun.
 - (d) It transmits only here ultraviolet, visible, near infrared radiation (300 to 2500 nm) and radio waves. (0.14 to 40 m) while filtering out tissue-damaging ultraviolet waves below about 300 nm.

The atmosphere is composed of nitrogen and oxygen. Besides, argon, carbon dioxide, and trace gases.

2. **Hydrosphere:** The Hydrosphere comprises all types of water resources oceans, seas, lakes, rivers, streams, reservoir, polar icecaps, glaciers, and ground water.

- (i) Nature 97% of the earth's water supply is in the oceans,
- (ii) About 2% of the water resources is locked in the polar icecaps and glaciers.
- (iii) Only about 1% is available as fresh surface water-rivers, lakes streams, and ground water fit to be used for human consumption and other uses.

3. **Lithosphere:** Lithosphere is the outer mantle of the solid earth. It consists of minerals occurring in the earth's crusts and the soil e.g. minerals, organic matter, air, and water.

4. **Biosphere:** Biosphere indicates the realm of living organisms and their interactions with environment, viz atmosphere, hydrosphere and lithosphere.

Q3. State the elements of environment.

Ans : (Imp.)

Environment is constituted by the interacting systems of physical, biological and cultural elements inter-related in various ways, individually as well as collectively. These elements may be explained as under:

1. **Physical elements:** Physical elements are as space, landforms, water bodies, climate soils, rocks and minerals.

They determine the variable character of the human habitat, its opportunities as well as limitations.

2. **Biological Elements:** Biological elements such as plants, animals, microorganisms and men constitute the biosphere.

3. **Cultural elements:** Cultural elements such as economic, social and political elements are essentially manmade features, which make cultural milieu.

1.1.3 Importance

- Q4. Describe the Importance of environmental studies.

Ans :

1. Environmental studies helps to understand the current environmental problems through biological, and social processes. It provides the skills necessary to obtain solutions to environmental problems. It encourages the development and application of scientific principles to solve environmental problems. (Imp.)
2. Environmental studies helps to maintain ecological balance through basic operating knowledge of environmental systems and processes. It gives information regarding the changes in the environment due to anthropogenic factors. It helps gain skills to analyze the various environment systems and the effect of human activities on them.
3. Environmental studies helps to achieve sustainable development through the understanding of the relationships of development and environment. The concepts of environmental studies can be applied to study agriculture and design sustainable production systems.
4. Environmental studies applies economic methods, concepts of environmental policy analysis and environmental management. It helps to formulate the broad social, economic and regulatory frameworks in which environmental problems can be resolved. It includes property rights, cost-benefit analysis, economic instruments for pollution control etc.
5. Environmental studies aims to protect biodiversity. Growth in human population, increased material consumption, and technological development has increased rate and scale of environmental degradation leading to loss of biodiversity.
6. Environmental studies helps to educate people regarding their duties towards environmental protection. It provides basic

information about the various environmental issues like energy needs, global climate change, toxic emissions, and waste disposal. It provides knowledge about development and utilization of energy resources and importance of environmental stability in the contemporary culture.

Q5. Describe the multi disciplinary nature of environmental studies.

Ans :

The multidisciplinary nature of environmental studies encompasses an understanding of the following, how natural systems (like oceans, atmosphere) work, how human activities affect these systems, the changes in one system affecting the other systems and well-being of humans and so on. For example, oceanic circulation patterns may be affected by patterns of atmospheric circulation, the pattern of rainfall, the topography of ocean floor, chemical properties of water, temperature of the medium and so on. The terrestrial ecosystems are affected by vegetation, land use patterns, climate of the area etc. The species within ecosystem are affected by physicochemical properties, population genetics, interaction between species, involvement of humans and so on. Therefore, understanding the physical, chemical and biological processes is integral to the study of environment.

Q6. Explain the components of environmental studies.

Ans : (Imp.)

Some of the components of environmental studies are,

(i) Atmospheric Sciences

It deals with the study of Earth's gaseous outer layer including meteorological studies, greenhouse effect, noise pollution and light pollution.

(ii) Ecology

It is the study of relationship between living organisms and non-living organisms of the environment. It includes the study of endangered species, predator/prey interactions, integrity of habitat, environmental contaminants and its effect on living organisms, impact analysis of industrialization and urbanization.

(iii) Environmental Chemistry

It involves the study of alteration in the chemical components of the environment and its effect on the biotic components.

(iv) Geosciences

It deals with the study of environmental geology, soil science, hydrology, physical geography, climatology, oceanography and geomorphology.

(v) Environmental Assessment

It involves the study of protection and sustainable development of the environment, evaluation of the environment through which protection and sustainable development of the environment may be considered.

(vi) Environmental Microbiology

It deals with the composition and physiology of micro-organisms in the environment particularly the soil, water, air, animals and plants.

(vii) Environmental Biology

It includes the study about the effects of changing environmental conditions on biological systems. Environmental biology also includes the study of living organisms, their biological processes and genetics.

(viii) Environmental Pollution

It focuses on different types of pollution and their impacts on the surrounding environment. It comprises the study of sources of pollution, its impact on living organisms and mode of elimination/mitigation measures and proper management in the future.

1.1.4 Need for Public Awareness

Q7. Explain the Need for Public Awareness.

Ans :

It is essential to make the public aware of the formidable consequences of the Environmental Degradation, if not retorted and reformative measures undertaken, would result in the extinction of life. We are facing various environmental challenges. It is essential to get the country acquainted with these challenges so that their acts may be eco-friendly.

Some of these challenges are as under:

1. Growing Population

A population of over thousands of millions is growing at 2.11 per cent every year. Over 17 million people are added each year. It puts considerable pressure on its natural resources and reduces the gains of development. Hence, the greatest challenge before us is to limit the population growth. Although population control does automatically lead to development, yet the development leads to a decrease in population growth rates. For this development of the women is essential.

2. Poverty

India has often been described a rich land with poor people. The poverty and environmental degradation have a nexus between them. The vast majority of our people are directly dependent on the nature resources of the country for their basic needs of food, fuel shelter and fodder. About 40% of our people are still below the poverty line. Environment degradation has adversely affected the poor who depend upon the resources of their immediate surroundings. Thus, the challenge of poverty and the challenge environment degradation are two facets of the same challenge. The population growth is essentially a function of poverty. Because, to the very poor, every child is an earner and helper and global concerns have little relevance for him.

3. Agricultural Growth

The people must be acquainted with the methods to sustain and increase agricultural growth without damaging the environment. High yielding varieties have caused soil salinity and damage to physical structure of soil.

4. Need to Ground water

It is essential of rationalizing the use of groundwater. Factors like community wastes, industrial effluents and chemical fertilizers and pesticides have polluted our surface water and affected quality of the groundwater. It is essential to restore the water quality of our rivers and other water bodies as lakes is an important challenge. It so finding our suitable strategies for consecration of water, provision of safe drinking water and keeping water bodies clean which are difficult challenges is essential.

5. Development and Forests

Forests serve catchments for the rivers. With increasing demand of water, plan to harness the mighty river through large irrigation projects were made. Certainly, these would submerge forests such, the dams on the river Narmada, Bhagirathi and elsewhere have become areas of political and scientific debate.

Forests in India have been shrinking for several centuries owing to pressures of agriculture and other uses. Vast areas that were once green, stand today as wastelands. These areas are brought back under vegetative cover. The tribal communities inhabiting forests respects the trees and birds and animal that gives them sustenance. We must recognise the role of these people in restoring and conserving forests. The modern knowledge and skills of the forest deptt. should be integrated with the traditional knowledge and experience of the local communities. The strategies for the joint management of forests should be evolved in a well planned way.

6. Degradation of Land

At present out of the total 329 mha of land, only 266 mha possess any potential for production. Of this, 143 mha is agricultural land nearly and 85 suffers from varying degrees of soil degradation. Of the remaining 123 mha, 40 are completely unproductive. The remaining 83 mha is classified as forest land, of which over half is denuded to various degrees. Nearly 406 million head of livestock have to be supported on 13 mha, or less than 4 per cent of the land classified as pasture land, most of which is overgrazed. Thus, our of 226 mha, about 175 mha or 66 per cent is degraded to varying degrees. Water and wind erosion causes further degradation of almost 150 mha. This degradation is to be avoided.

7. Reorientation of Institutions

The people should be roused to orient institutions, attitudes and infrastructures, to suit conditions and needs today. The change has to be brought in keeping in view India's traditions for resources use managements and education etc. Change should be brought in education, in attitudes, in administrative procedures and in institutions. Because it affects way people view technology resources and development.

UNIT - I**8. Reduction of Genetic Diversity**

Proper measures to conserve genetic diversity need to be taken. At present most wild genetic stocks have been disappearing from nature. Wilding including the Asiatic Lion are facing problem of loss of genetic diversity. The protected areas network like sanctuaries, national parks, biosphere reserves are isolating populations. So, they are decreasing changes of one group breeding with another. Remedial steps are to be taken to check decreasing genetic diversity.

9. Evil Consequences of Urbanisation

Nearly 27 per cent Indians live in urban areas. Urbanisation and industrialisation has given birth to a great number of environmental problem that need urgent attention. Over 30 percent of urban Indians live in slums. Out of India's 3,245 towns and cities, only 21 have partial or full sewerage and treatment facilities. Hence, coping with rapid urbanization is a major challenge.

10. Air and water Population

Majority of our industrial plants are using outdated and population technologies and makeshift facilities devoid of any provision of treating their wastes. A great number of cities and industrial areas that have been identified as the worst in terms of air and water pollution. Acts are enforced in the country, but their implement is not so easy. The reason is their implementation needs great resources, technical expertise, political and social will. Again the people are to be made aware of these rules. Their support is indispensable to implement these rules.

Q8. Explain various types of environment of environment.***Ans :***

According to Kurt Lewin, environment is of three types which influence the personality of an individual as under:

- Physical Environment,
- Social and Cultural Environment, and
- Psychological Environment.

These may be explained as under:

Physical Environment: Physical environment, refers to geographical climate and weather or physical conditions wherein and individual lives. The human races are greatly influenced by the climate. Some examples are as under:

- In the cold countries i.e. European countries the people are of white colour. Likewise, in Asian and African countries, that is, in hot countries people are of dark complexion.
- The physique of an individual depends on climate conditions as the individual tries to adjust in his physical environment.
- The human working efficiency also depends on the climatic conditions.

2. Social Environment: Social Environment includes an individual's social, economic and political condition wherein he lives. The moral, cultural and emotional forces influence the life and nature of individual behaviour. Society may be classified into two categories as under:

- An open society is very conducive for the individual development.
- A closed society is not very conducive for the development.

3. Psychological Environment: Although physical and social environment are common to the individual in a specific situation. Yet every individual has his own psychological environment, in which he lives. Kurt Lewin has used the term 'life space' for explaining psychological environment. The Psychological environment enables us to understand the personality of an individual. Both the person and his goal form psychological environment.

If a person is unable to overcome the barriers, he can either get frustrated or completed to change his goal for a new psychological environment. But adopting this mechanism, the individual is helped in his adjustment to the environment.

1.2 NATURAL RESOURCES

Q9. What are Natural Resources? How will you classify Natural Resources?

Ans :

Meaning

Natural resources are naturally occurring materials that form an important part of the ecosystem. These include air, water, soil, minerals and many more.

Classification

The natural resources can be classified based on several parameters i.e., origin, renewability, development.

1. Classification of Natural Resources based on Origin

Based on the origin, natural resources are classified as follows.

(I) **Biotic Natural Resources (Living Natural Resources):** Biotic natural resources include all the living resources such as plants and animals as well as some classified minerals which are formed by the decay of living matter (petrol, coal).

(II) **Abiotic Natural Resources (Non-living Natural Resources):** Abiotic natural resources include all the non-living resources such as sun, wind, water, minerals etc.

2. Classification of Natural Resources based on Renewability

Natural resources can be categorized as renewable or non-renewable.

(I) **Renewable Resources:** Renewable resources are inexhaustible or indepletable resources which are present naturally and are in continuous supply.

Examples: Food resources, water resources and wind energy.

(II) **Non-renewable Resources:** Non-renewable resources are exhaustible or depletable resources that are present in limited quantity. It cannot be replenished once it gets exhausted.

Examples: Fossil fuels, mineral resources etc.

3. Classification of Natural Resources based on Development Stage

Considering their stage of development, natural resources are classified as follows,

(I) **Potential Resources:** Natural resources which need further development. Examples: Extraction of petroleum crude oil. Here, crude oil is a potential natural resource as it contains petrol which needs to be extracted.

(II) **Actual Resources or Developed Natural Resources:** Natural resources which need no further development, as in the case of example of petrol cited above.

Q10. What are the different types of resources on the earth?

Ans :

(Imp.)

The different types of resources are as mentioned below.

1. Forest Resources

They cover around 12% of the land in India, but estimated value should be around 33%. It is a renewable resource, but over exploitation or destruction of forests takes many years for it to develop, hence it becomes non-renewable.

2. Water Resources

It is the most abundant and inexhaustible renewable resource. It covers 70% of the globe in the form of oceans, rivers, lakes etc. Out of 70% only 3% is present as fresh water. Out of 3%, only 2% is present in polar ice caps and a fraction of 1% is potable or drinking water. 90% of the water is utilized for agricultural purpose in India.

3. Mineral Resources

Minerals are defined as solid inorganic substances occurring naturally and are characterized by identifiable physical properties and definite chemical composition. Ore is a naturally occurring material from which metal or valuable minerals can be extracted. Minerals are formed in the earth's

crust over a time period of millions of years. These are non-renewable and gets depleted if over exploited. Mineral resources are present on the land, in sea or seabed.

Some examples of minerals are diamond, emerald, rubies, granite, marble, limestone, stone, oil, gas, coal.

4. Food Resources

The demand of food supply and the production of food is inadequate and unable to meet the demands of the public due to the overgrowing population. Even though, modern agricultural methods are implemented in cultivation, the demands of food supply of the public are unable to met. The agricultural production is also declining due to loss of genetic diversity of the crop plants. Apart from the crops, even livestock and fishery contribute to food resources.

5. Energy Resources

It refers to any material in the environment that can be used to generate energy for a useful purpose. They are categorized as,

(I) Renewable Energy Resources:

These energy resources are inexhaustible and include solar energy, wind energy, water energy, geothermal energy and energy from bio-fuels.

(II) Non-renewable Energy Resources:

These energy resources are exhaustible and include the fossil fuels like coal, oil, natural gas, etc. All these fossil fuels that pollute the environment are limited in nature.

➤ **Fossil Fuels:** They include coal, gas and oil as they are formed from the organic remains of prehistoric plants and animals. These fossil fuels provide about 66% of the world electrical power and 95% of the total energy demands all over the world. They are non-renewable energy resource, because once they are burnt, there isn't any more left.

- **Nuclear Power:** It contributes to 16% of the world's energy demands. The energy is generated from splitting uranium atoms.
- **Solar Power:** It is the energy obtained from the sun which is free, does not produce waste or contribute to pollution. Solar power is renewable.
- **Wind Power:** It is the energy obtained from the wind by setting up windmills in areas where the wind is strong and reliable like coastal areas, hill tops, open plains and gaps in mountains. The energy obtained from the wind is free, does not produce waste or greenhouse gases. This is one of the best methods to provide energy to remote areas.
- **Tidal Power:** It is the energy obtained from the seas, which is harnessed to generate electricity. The tidal energy is renewable as the tides continue to ebb and flow.
- **Hydroelectric Power:** It is the power generated from falling water.
- **Wave Power:** It is the energy obtained from the waves, which is used in the operation and maintenance of wave power stations.
- **Geothermal Energy:** It is the energy produced from the earth which is practised in around 20 countries all over the globe including America, Siberia and the Pacific Rein. The geothermal energy does not contribute to pollution and greenhouse effect and no fuel is required to generate electricity from geothermal sources.

- **Biomass Energy:** It is the energy derived from organic material like wood, animal, crops, etc.

6. Land Resources

The total land estimated in India is around 328 million hectares. Proper utilization of land considers it to be renewable, but when the land is dumped with wastes from industries and nuclear power plants then it becomes non-renewable.

1.2.1 Water Resources

1.2.1.1 Uses

Q11. Define water. State the uses of water resources.

Ans :

Meaning

Water is a vital elixir for all living beings. Although it is a renewable resource, scarcity of quality water is felt in many parts of the world. We need water to grow food, keep clean, generate electricity, control fire, and last but not the least, we need it to stay alive.

World Ocean water covers about 75 percent of the surface of the earth. Therefore, the earth is called the water planet. Ocean water is saline and not fit for human consumption. Fresh water is just about 2.7 percent of the total water. Global warming and perpetuating water pollution have made a considerable part of available freshwater unfit for human consumption. As a result, water is very scarce.

Steps need to be taken to conserve water. Water is renewable, but its overuse and pollution make it unfit for use. Sewage, industrial use, chemicals, etc. pollute water with nitrates, metals, and pesticides.

Use of Water Resources

Water resources are used for agricultural, industrial, domestic, recreational, and environmental activities. Majority of the uses require fresh water.

However, about 97 percent of water found on the earth is salt water and only three percent is fresh water. A little over two-thirds of the available fresh water is frozen in glaciers and polar ice caps.

The remaining freshwater is found mainly in groundwater and a negligible portion of it is present on the ground or in the air.

Following is a brief account of how water is used in different sectors.

1. Agricultural Use

Agriculture accounts for 69 percent of all water consumption basically in agricultural economies like India. Agriculture, therefore, is the largest consumer of the Earth's available freshwater.

By 2050, the global water demand of agriculture is estimated to increase by a further 19% due to irrigational needs. Expanding irrigation needs are likely to put undue pressure on water storage. It is still inconclusive whether further expansion of irrigation, as well as additional water withdrawals from rivers and groundwater, will be possible in future.

2. Industrial Use

Water is the lifeblood of the industry. It is used as a raw material coolant, a solvent, a transport agent, and as a source of energy. Manufacturing industries account for a considerable share in the total industrial water consumption. Besides, paper and allied products, chemicals and primary metals are major industrial users of water.

Worldwide, the industry accounts for 19 percent of total consumption. In industrialized countries, however, industries use more than half of the water available for human use.

3. Domestic Use

It includes drinking, cleaning, personal hygiene, garden care, cooking, washing of clothes, dishes, vehicles, etc. Since the end of World War II there has been a trend of people moving out of the countryside to the ever-expanding cities. This trend has important implications on our water resources.

Government and communities have had to start building large water-supply systems to deliver water to new populations and industries. Of all water consumption in the world, domestic use accounts for about 12 percent.

4. Use for Hydropower Generation.

Electricity produced from water is hydropower. Hydropower is the leading renewable source



of electricity in the world. It accounts for about 16 percent of total electricity generation globally. There are many opportunities for hydropower development throughout the world.

Today, the leading hydropower generating countries are China, the US, Brazil, Canada, India, and Russia.

5. Use for Navigation and Recreation

Navigable waterways are defined as watercourses that have been or may be used for transport of interstate or foreign commerce. Agricultural and commercial goods are moved on water on a large scale in a number of regions in the world.

Water is also used for recreational purposes such as boating, swimming, and sporting activities. These uses affect the quality of water and pollute it. Highest priority should be given to public health and drinking water quality while permitting such activities in reservoirs, lakes, and rivers.

Q12. Explain about surface flow of water.

Ans : (Imp.)

1. River

Surface flow takes place through 14 major river systems. They are Brahmani, Bhramaputra, Cauvery, Ganga, Godavari, Indus, Krishna, Mahanadi, Mahi, Narmada, Periyar, Sabarmati, Subarnarekha and Tapti. Between them, the position is as under:

- (a) They share 83% of the drainage basin,
- (b) They account for 85% of the surface flow,
- (c) They house 80% of the total population on the country.

Besides, there are 44 medium and 55 minor river system. These rivers are fast flowing, monsoon fed and originate in the coastal mountains of the major river viz Brahmaputra, Ganga and Indus basins along with Godavri. They cover more than 50% of the country. Only 4, Brahmaputra, Ganga, Mahanadi and Brahmani are perennial. Their minimum discharge is of $0.47 \text{ Mm}^3/\text{km}^3 \text{ year}$.

2. Lakes and Ponds

Lakes

Lakes are inland depressions that contain standing water. They may vary in size from small ponds of fewer acres to large seas covering thousands of square miles. They may range in depth from a few feet to over 5,000 feet.

In a lake, there are three to five well recognized horizontal strata namely:

- (i) Shallow water near the shore forms the littoral zone. It contains upper warm and oxygen rich circulating water layer zone. The littoral zone includes rooted vegetation.
- (ii) Sublittoral zone-extends from rooted vegetation to the non-circulating cold water with poor oxygen i.e. hypolimnion.
- (iii) Limnetic zone is the open water zone away from the shore.
- (iv) Profundal zone is the deep-water area beneath limnetic zone and beyond the depth of effective light penetration.
- (v) Abyassal zone is found only in deep lakes, since it being at about 2,000 metres from the surface.

Pond

Ponds are considered as small bodies of standing water so shallow that rooted plants can grow over most of the bottom. Most ponds and lakes have outlet streams and both are more or less temporary features on the landscape the reason is filling, no matter how slow, is inevitable.

Stratification of Ponds

Ponds have little vertical stratification. In them littoral zone is large than and limnetic zone and profundal zone. In a small pond the limnetic profundal zones are not found. The warm top layer, the epilimnion is heated by the sun and homogenised by the wind and other currents. On the contrary to it, the deep cold layer, the hypolimnion is not heated by sun and not circulated by wind. The basis

upon which the layers are maintained is strictly thermal and is caused by the fact that the warmer water is lighter than the colder water. After the formation of a thermocline, no exchange of water occurs between the epilimnion and hypolimnion.

1.2.1.2 Over-utilization of surface and ground water

Q13. Explain the position of surface water in the India.

Ans : (Imp.)

India has been bestowed with substantial surface water resources. Overall water resources of the country have been assessed at 1880 km^3 annually. Of thus, it may be possible to harness about 690 km^3 of water for beneficial use. In addition, Ground Water Resources of the Country are assessed at about 452 km^3 .

Storages

India has constructed a large number of storages and diversions for harness its vast water potential.

1. Live storages built-up in the completed projects so far is about 163 km^3 .
2. Another 7 km^3 of live storage will be available from project under construction.
3. 131 km^3 from projects under consideration.
4. In addition, there is a large number of small tanks whose storage adds upto about 30 km^3 .

Total Hydro-Power Potential of the Country has been assessed at $84,000 \text{ mW}$ at 60 per cent load factor. Presently, Completed and on-going Schemes will exploit about $15,600 \text{ mW}$ i.e. 20 per cent of the assesses potential. Hydropower installed capacity at the end of the Sixth Plan was $14,450 \text{ mW}$. Forming about 34 per cent of the total installed capacity.

In the absence of information on actual water use by various sectors, estimates made in this regard (1985) indicated that water use may be of the order of 530 km^3 is from surface Water and 180 km^3 from Ground Water. Out of this, 470 km^3 is for Irrigation and 70 km^3 for other including Domestic (16.7 km^3), Industrial (10 km^3) and Thermal Plants (2.7 km^3) requirements. A recent assessment puts domestic requirements in 1991 at about 26 km^3 .

The surface water resources continue to be contaminated with run-off water from agricultural fields, containing pesticides, fertilizers, soil particles, waste chemicals from industrial and sewage from cities and rural areas.

During the dry months, water scarcity is faced even in the places like Cherrapunji and Konkan which receive heavy rainfall. Due to the unequal distribution of rainfall our countrymen face problems of flood and famine in some parts every year.

The mass balance of annual rainfall that about 70% is lost by direct evaporation and transpiration by plants, while the remaining 30% goes into the stream flow shows it. The approximate breakup of this streamflow, as consumed by man, is 18% for irrigation, 2% for domestic use, 4% for industry and 12% for electrical utilities. Irrigation for agricultural purposes and electric power plants are the major consumer of water.

Q14. Explain the position of ground water in India.

Ans :

Ground water resources are abundant only in the northern and coastal plains. In other parts its supply is not adequate. Ground water is roughly 210 million m^3 . This quantity includes recharge through infiltration, seepage and evaporation. Even at present, our country has not been able to provide safe drinking water to all villages and towns.

Ground water contains dissolved minerals from the soil layers through which it passes. In the process of seepage through the ground, the water gets depleted of most of the microorganism originally present in the surface water. Though the salt content may be excessively high on occasions, it is generally superior as a domestic water source. Surface water contains a lot of organic matter and mineral nutrients, which feed algae and large bacteria populations.

The total replenishable Ground Water Resources in the Country have been provisionally estimated at 45.23 million hectares meters per year. Of this, 6.93 million hectares metres is for drinking, industrial and other uses leaving 38.34 million hectares metres as utilizable Ground Water Resources for Irrigation.

1.2.2 Floods

Q15. Define floods. Explain different types of floods.

Ans :

Meaning

Floods are defined as a relatively high flow of water discharged from river and stream network, which sets the river bank margins to overflow and lead to the inundation of low land areas surrounding the riverbed. It is essentially a physical phenomenon. Floods arise from abnormally heavy rains, dam failures, snow melts, river blockages. Flood disasters rank second only to droughts in the total number of people affected worldwide.

Types of Floods

Floods can be classified into three categories as under:

(I) **River floods:** Rivers get charged due to heavy rains over large catchments areas or by melting of snow or sometimes both especially in the mountainous tracts. The floods take place in river systems with tributaries that may drain into large geographic areas and encompass many independent river basins. Amount of flooding depends on moisture in the soil, vegetation cover, and depth of snow and size of catchments basin.

(II) **Coastal floods:** Coastal flooding is associated with tropical cyclones/ harsh winds arising at the ocean surface. Coastal floods are often aggravated by wind induced storm surges along the coastline. Sea and ocean 'water floods the inland coasts affecting kilometers of tracts. Ocean tides, storm surges or tsunamis play a definite role. Prolonged and indefinite rains in the rainy season marked from June-September results in extreme flood in coastal river basins.

(III) **Flash floods:** These floods occur within six' hours of the beginning of rainfall and; are characterized with rising clouds, thunder storms and tropical cyclones. These result from runoff from a torrential downpour, particularly if the catchments slope is unable to absorb and hold a significant part of water. Other causes of flash floods include dam

failure, sudden break up of glaciers etc. These offer potential threats in the areas where the terrain is steep, surface run off is high, water flows through canyons and where severe rainstorms are likely.

Q16. State the General Characteristics and effects of floods.

Ans :

Characteristics

1. Man made structures and forest vegetation exhibits different levels of tolerance towards effects of floods.
2. Intensity of damage is governed by the time interval of standing floodwaters.
3. High velocity of running water may uproot or weaken foundations of buildings.
4. Rate of rise and discharge of a river is important as a basis for flood control.
5. Frequency of occurrence estimated over a length of period would determine the kind of activities the flood plain should be put to.
6. Generally the rainy season is characterized by the floods during which agricultural economy suffers a huge loss.

Effects of Floods

1. Rising water, erosion and the force damages the residential and commercial building. They are dangerous for villages lying in the coastal areas as it sweeps away everything, which comes into its path. In mountainous areas it is the chief cause of landslides.
2. Fisherman, local people, cattle, animals and vegetation suffer a great loss of life and property. Most of the deaths are reported to be from drowning.
3. Fresh water supplies by all sources are nearly destroyed and contaminated hence the areas falling under its impact bear a great risk of suffering from water borne diseases.
4. The destruction of food and fodder crops result in acute food shortage.
5. Floods also make soil infertile, as the topsoil is lost due to erosional activity.
6. Floods are also known to preserve, wetlands and recharge ground water.

1.2.3 Drought

Q17. What are the causes and types of Drought?

Ans :

Meaning

Droughts may be defined as a condition that arises from too little precipitation (rain and snow) for an extended period of time for normal farming practices to be conducted.

Causes

The various factors causing drought are described as under,

- When the delicate balance between water supply and demand is disturbed. It means when the demand for usable water increases even during periods of average or above average rainfall
- Change in water quantity
- Contamination of the usable water.

Types of Droughts

The droughts may be categorized into three types. They are,

- (i) **Meteorological Drought:** This type of drought occurs when the average rainfall and snowfall is below average for an extended period of time, thereby causing a natural shortage of available water.
- (ii) **Agricultural Drought:** This type of drought occurs when the soil moisture is not sufficient to support the production of crops.
- (iii) **Hydrological Drought:** This type of drought occurs when the water levels in aquifers, lakes and reservoirs fall below the average levels. This can occur even during average or above average precipitation, when water consumption by humans is more, thus lowering the water reserves.

Impacts of Drought

1. The Economic Impacts of Drought

It includes the monetary effects of drought to people. Following are some of the examples,

- (a) Droughts destroy the growth of crops, with lower yields and the crops are of poor quality. In order to provide

sufficient water to the crops, farmers have to spend more money to irrigate their fields.

- (b) The livestock of ranchers may be affected. More money might have to be spent to feed and water the livestock.
- (c) The income from timber products may be lost owing to reduced timber production due to wild fires, impact productivity of forest land and loss of young trees.
- (d) Loss in fishery production. The habitat gets damaged, fish and other aquatic organisms are lost due to drought.
- (e) The recreation and tourism industry incurs loss. The recreational equipment like the boats and fishing equipment have no buyers. Activities like hunting, fishing, bird watching, boating etc., be curtailed as the water dries up in lakes and other water bodies.
- (f) Business that process various food stuffs may lose business due to loss of customers by drought.
- (g) Since the hydroelectric power will be affected due to short supply, the power companies will have to spend more to provide alternative sources of power to the customers.
- (h) Revenue shortfalls for water supply companies. Water companies will have to spend more money for new supplemental water resource development.
- (i) The transportation industry suffers due to impaired navigability of barges and ships in streams, rivers and canals owing to decreased water levels.
- (j) Shortage in food production and disrupted food supply causes increase in the import of food at higher cost. Therefore, people will have to pay more for increased food prices.

2. Environmental Impact of Drought

It includes loss to the environment by way of forest fires, erosion of soil, damage to all living forms and their habitat, decline in the air and water quality. Some of the example are as under,

- (a) Due to lack of food and drinking water, due to loss of wet lands, lakes and vegetation, there is a greater mortality of fish and wildlife habitat.
- (b) Shortage of food and water leads to diseases in animals.
- (c) The wildlife may leave the drought stricken areas and migrate to areas not affected by drought, causing loss of wildlife in drought stricken area.
- (d) The endangered species are at an increased stress.
- (e) The water levels in the reservoirs, ponds and lakes decrease, coupled with loss of wetlands.
- (f) Drought causes the soil to dry up and become prone to erosion by wind, resulting in reduced soil quality leading to loss of biological productivity of the landscape.
- (g) Loss of biodiversity and extinction of species.

3. Social Impacts of Drought

It involves public safety and health, disputes arising due to water shortage and life-style changes. Some of the examples in this category are,

- (a) The revenue loss caused by drought may cause mental and physical stress on people.
- (b) The heat stress, mental stress and physical stress may contribute to loss of human life and suicidal tendencies.
- (c) Reduction in recreational activities.

Q18. Write a note on the Drought control measures adopted across the globe.

Ans :

(Imp.)

1. Rainwater Harvesting

This is one of the most important and economical tool of water conservation, used for collecting and storing the rainwater from roof tops and land surface to provide water for agriculture, industries and domestic use.

2. Crop Rotation

Rotation of perennial crops and leguminous plants alternating with cash crops controls soil erosion and helps the formation of better quality soil.

3. Channelizing the Rivers by Building Canals in Drought Prone Areas

The above mentioned measures can be worked out by individuals or groups.

4. Cloud Seeding

It is an artificial technique to stimulate the precipitation process and form rain. The method involves spreading silver iodide aerosols into the upper part of clouds. The water droplets in the clouds attach to silver iodide and freeze. The ice crystals stick together and fall as snow.

5. Desalination of Sea Water

Desalination plants are set up to convert sea water and contaminated water to drinking water. Desalinated water is used mostly in the Middle East, North Africa, California and parts of Florida in the United States.

6. Risk mitigation Efforts by the Government

These include Drought Prone Area Programme (DPAP), Desert Development Programme (DDP), National Watershed Development Project for Rain-fed Areas (NWDPR), Watershed Development Programme for Shifting Cultivation (WDPSC), Integrated Water Development Project (IWDP), Integrated Afforestation and Eco-development Project Scheme (IAEPS).

1.2.4 Conflicts over Water

Q19. Write about Interstate water disputes and efforts to resolve.

Ans :

The water wealth of India is enormous. The National Water Policy of 1987 recognizes River Basin as a unit for the purpose of harnessing the water potential.

Reasons for Differences

Major River Basin of the Country are all almost inter-state. With so many rivers flowing through more than one state, it is a natural phenomenon that differences would arise sometime or other amongst concerned states with regard to use and distribution of control of water of such rivers. This is especially so in view of the rapid pace of water resources development to meet the increasing demand for irrigation, Hydel-Power Generation, domestic and industrial water supply etc.

Effort to Resolve Disputes

Efforts are made, as far as possible, to resolve all disputes by negotiations amongst states concerned or with the assistance of the Centre. Adjudication through Tribunal is resorted to when warranted. Several of Inter-State Water Dispute have been resolved in the recent past.

- Some of these are agreements regarding construction of Thein Dam (Ravi), Barakar, Ajoy, Mayurakshi, Mahanada, Subarnarekha River and Kanhar Rivers, some common rivers between Madhya Pradesh and Orissa and some between Maharashtra and Madhya Pradesh.
- Sharing of river waters of the Krishna, the Godavari and Narmada by concerned Basin States has been settled through respective Tribunals set-up by the Government under the Inter-State Water Dispute Act, 1956.
- The Ravi and Beas Waters Tribunal, which was set-up on second April 1986, submitted its report to the Central Government on 30 January 1987.

- In August, 1987 a further reference was made to the Tribunal comprising a *Suo motu* Reference by the Central Government and reference received from Punjab, Haryana and Rajasthan Government's seeking explanation/guidance on certain points in their report.
- Two major inter-state river dispute have not yet been resolved. They relate to utilization of the waters of the Kaveri and the Yamuna.
- The Kaveri Water Dispute had to be referred to a tribunal are still continuing. Keeping in view the response of the party states concerned, it should be possible to find solution to the Yamuna Water Dispute without recourse to a tribunal.

1.2.5 Dams

Q20. List out the description, benefits and problems of various dams in India.

Ans :

(Imp.)
A number of big, medium and minor dams have been envisaged under different river valley projects. These dams have been undertaken for irrigation, power generation and water supply. These dams, hailed as the Temples of Modern India by the country's first Prime Minister, Jawaharlal Nehru, have increased agricultural production, power generation and reduced dependence on imports. A brief description of the dams and benefit accruing from them is as under:

1. Farakka Barrage Project

The Farakka Barrage Project is designed to subserve the need for preservation and maintenance of the Calcutta Port by improving the regime and navigability of the Bhagirathi-Hooghly River System. The Bhagirathi, the feeder canal and the navigation lock at the Farakka Barrage form part of the Haldi-Allahabad Inland Waterway for which an act has been passed.

The principles components of the Farakka Barrage Project are:

- (a) 2,240 metre-long barrage across the Ganga, designed to pass a flood discharge of 76,455 cumec or 27 lakh, with rail-cum-road bridge, the necessary river draining works and a head regulator on the right side;
- (b) 213 metre-long garrage across the Bhagirathi at Jangipur, designed to pass flood discharge of 1,700 cusecs or 60,000 cusecs;
- (c) Feeder canal of 1,133 cusecs or 40,000 cusecs carrying capacity and 38.38 km long taking off from the head regulator on the right-side of the Faraka Barrage, tailing off into the Bhagirathi below Jangipur Barrage;
- (d) Navigation works such as locks, channels, shelter navigation lights and other infrastructures.

2. Damodar River Valley Project

Damodar River Valley Project serves several objectives. This huge dam is, in fact, a series of small dams built on a river and its tributaries, serves as man-made lake that is now able to impound huge amount of rain water. In this way, it helps in flood control and soil protection. This water is used for irrigation during dry periods. Since catchments areas of dam are afforested, there is available additional wild land that helps to preserve ecosystems.

The water stored here is used for power generation i.e. hydle power or hydro-electricity. These projects also provide for inland water navigation, cheapest means of transport for heavy goods. They are also used to develop fish hatcheries and nurseries.

Damodar Valley Project consists of series of small dams of the tributaries of Damodar, flowing from Chota nagpur in South Bihar to West Bengal. The hydle power has been integrated in a common grid.

3. Bhakra Nangal Project

This project has been built where two hills on either side of Sotlej are very close to each other. It claims to be highest gravity dam in the world (height 226 metres from river bed).

The project serves the states of Himachal Pradesh, Punjab, Harayana, Rajasthan and U.T. of Delhi.

4. Indira Gandhi Rajasthan Canal Project

It is ambitious plan to bring new areas under irrigation. The water of the Beas and Ravi has to be diverted to Sotlej. The Pong Dam on the Beas impounds 6,90,000 ha metres water. This dam helped in the division of Beas into Sotlej in a regulated manner. It enabled Rajasthan canal to irrigation Ganganagar, Bikaner and Jaiselmer Districts. The main canal is 468 km long.

5. Kosi Project

Kosi Project or river Kosi in North Bihar has a main canal to irrigate 8,73,000 ha of land in Bihar.

6. Hirakud Dam

Hirakud Dam in Orissa is longest serves Karnataka and Andhra Pradesh. This 2.5 km long dam imigates nearly 4,00,000 ha land.

7. The Tungabhadra

The Tungabhadra Project serves Karnataka and Andhra Pradesh. This 2.5 km long dam irrigates nearly 4,00,000 ha land.

8. The Nagarjuna sagar

The Nagarjun sagar Project is built on river Krishna in Andhra Pradesh. It irrigates 8,67,00 ha land.

9. The Chambal Project

The Chambal irrigation parts of M.P. and Rajasthan. There are many other such projects on different rivers in the country.

1.3 EFFECTS OF MODERN AGRICULTURE, FERTILIZER- PESTICIDE PROBLEMS

Q21. Explain the effects of Modern agriculture.

Ans : (Imp.)

With a view to feed rapidly increasing new mouths and to cope with the necessity of providing sufficient food to the people, various techniques and methods have been applied in the field of agriculture.

1. Agriculture Census

The Department of Agriculture and Cooperation has been conducting agriculture census in each of the plan period since 1970-71. Census in 1970-71 and 1980-81 were organized as part of the World Agricultural Census Programmes sponsored by the Food and Agriculture Organization of United Nations. They were conducted on a complete enumeration basis in most States/Uts. The other two census with agriculture years 1976-77 and 1985-86 as reference period were conducted on a census-cum sample basis to reduce burden in collection and processing of primary as also to keep costs low.

The agriculture Census seeks to collect information on distribution of holding an area operated along with its related characteristics such as tenancy and terms of leasing, land use and cropping pattern, irrigation and sources of irrigation etc by different six classes. Data is utilized for formulation of Poverty Alleviation Programmes in general and uplifts of Small and Marginal Farmers in particular. Skewness in distribution of land holdings and pattern of tenancy are also extremely useful for the Department of Rural Development for certain programmes.

2. Agricultural Research and Education

The Department of Agriculture Research and Education, which was set up in 1973 in the Ministry of Agriculture is responsible for coordinating research and educational activities in agriculture, animal Husbandry and fisheries. Besides, it helps to

bring about inter-departmental and inter-institutional with the National and International Agencies engaged in the same and allied fields. The Department provides Government support, service and linkage to Indian.

3. Indian Council of Agriculture Research

The Indian Council of Agricultural Research (ICAR) is a registered society and is the apex body responsible for promoting, conducting and co-ordinating research education and primary extension education in the fields of agriculture, animals science, fisheries and the allied sectors in the country.

The Council is directly involved in undertaking research through its 46 Central Institutes including Four Nation Bureaus, 20 National Research Centres and Nine Project Directorates on Fundamental and Applied Aspects of Individual Crops, commodities and disciplines which have direct relevance to Agriculture Animal Husbandry, Fisheries and Allied Sectors. In addition the ICAR also operates 71 All India Coordinated Research Projects, which are multi-locational and multi-disciplinary in nature on important commodities, and research has proved its efficacy and utility over the last successive plan period as an effective instrument to tackle the diverse problems characteristic of India Agriculture.

The educational programmes at the National Level are being conducted through 26, Agriculture Universities located in various important states. Four of the ICAR's Institutes viz Indian Agriculture Research Institute, New Delhi, Indian Karnal and Central Institute of Fishery Education, Bombay, also perform educational functional and offer Post Graduated, Bombay Programmes in the capacity of well-recognized Deemed University and award degrees. The ICAR is also supporting the educational programmes of the State Agriculture Universities by providing developmental grants to these universities.

The ICAR is also conducting first-line demonstration for the transfer of improved technology to the extension/state functionaries and the village-level workers as well as to selected farmers. The council has been operating projects like National Demonstrations, Operational Research Projects and Lab-to-Land Programmes at 301 Centres in the country including 45 centres for upliftment of Scheduled Castes and Scheduled Tribes. A network of 109 Krishi Vigyan Kendras has also been established for imparting on-farm training in various aspect of agriculture. Animal Husbandry, Fisheries and allied areas for youth, from men and women and other categories of rural workers. These programmes also have a degree up-support in the form of Trainers Training Centres for providing an up-to-date knowledge of farm-worthy advancement made in research.

Attempted are being made to make Agriculture more science-based and industry linked. Biotechnology, Genetic Engineering, Photosynthesis, Tissue Culture, Bio-insecticides and Pheromones are the merging area of research to promote growth of agriculture productivity. Accordingly, the ICAR has established Three Nation Research Centres in Biotechnology in agriculture, animal health and animal production at Three National Institutes. It involves Biological Nitrogen Fixation, Plant Cell and Tissue Culture, Molecular Biology and Biochemistry of monoclonal antibodies and hybridomas for cheaper and more effective Immuno-diagnostic and Immunoprophylactic Agents and Multiple Ovulation, Embryo Transfer Technology, Genetic Manipulation and Cryo-Preservation. The following priorities and thrust areas in respect of Agriculture Research and Educational have been identified which are based on the present need to make agriculture knowledge intensive using also frontier technologies to accelerate the Research and Development output in critical areas, developing appropriate rural technologies for farm women, research in agricultural, economic and policy planning and creating genetic enhancement centers and technology blending centures etc.:

- (a) Conservation and planned exploitation of Germ-plasm Resources.
- (b) Enhancing productivity through evolution of new high-yielding Hybrids /varieties/starins with tolerance to biotic and abiotic stresses.
- (c) Development of Integrated Pest Management Practices to optimize plant protection.
- (d) Breeder Seed Production;
- (e) Research on Export Oriented Commodities;
- (f) Diversification of agriculture with emphasis on Agro-forestry, livestock and fishers;
- (g) Development and refinement of Dry Farming Technology.
- (h) Improving Nutrient Management System.
- (i) Inventory of Natural Resources.
- (j) Energy Management in Agriculture.
- (k) Post-harvest Technology and Engineering with emphasis on on-farm storage.
- (l) Fostering excellence in research and educational programmes.
- (m) Transfer of Technology an Improving Information and Communication Systems,
- (n) Human Resources Development.

Q22. Explain various measures for improvement in agriculture.

Ans :

(Imp.)

The effects of modern agriculture can be summarised as under:

1. Horticulture

The scientific cultivation of Horticultural Crops and Plantation Crops has helped to increase both production and productivity. In fruits, a production level of 265 lakh tones has been reached largely due to superior vegetatively

propahated planning material, regular bearing Hybrids of Mango, high-yielding varieties of Grapes, Papaya, Pomegranate, banana, Ber, Aonal, Lime and Kinnow Mandarin, etc better crop production technology and Pest and disease control measures.

The vegetable Production has reached 495.3 lakh tones from an area of 45-lakh hectare due to 106 improved high-yielding varieties including F1 hybrids in 17 vegetable crops evolved so far. A few of these tare resistant to diseases and pets. Similarly, the Potato Production has reached 140 lakh tones as a result of 14 newly evolved disease resistant varieties growing in different parts of the country, use of Virus Free Seeds being produced through advanced techniques and improved production technologies. Introduction of 'True Potato Seeds' has been done successfully to reduce the over-all cost of Potato Production.

Release of 18 improved high-yielding varieties in six other Tuber Crops like Cassava, Sweet Potato, Yam etc. have improved prospects of higher production of these crops for food and industrial purpose.

2. Agriculture

Availability of Edible Oils including Vanaspati has increased significantly. The country has been able to sustain and improve availability of basis consumption articles and has, thus, raised the standard of living.

3. Land Utilization

Land utilization statistics are available for 92.7 per cent of total geographical area of 3287.3 lakh hectares. According to land use statistical available from states, area under forests has increased from 404.8-lakh hectare in 1950-51 to 667.3 lakh hectares during the same period. Broad cropping pattern indicates that though foodgrains have preponderance in gross cropped area as compared to non-foodgrains, their relative share came down from 76.7 per cent during 1950-51 per cent during 1986-87.

4. Seeds

India has transformed itself from a subsistence economy and food importing country to one, which is self-sufficient in foodgrains. Recognizing seed as the primary input for increasing agriculture production, the Central Government established the National Seeds Corporation (NSC) in 1963 and the State Farms Corporation of India (SFCI) in 1969 to encourage the production and distribution of certified seeds of various crops. Thirteen State Seed Corporations have also been established to supply improved seeds to farmers.

5. Quality Control

The Seeds Act was passed by Parliament in 1966 to ensure that farmers get good quality seeds. There is a Central Seed Testing Laboratory and 90 State Seed Testing Laboratories functioning in various states/union territories. There are also 19 seeds certification agencies. New varieties of seeds are notified by the Central Seed Committee.

About 1775 new varieties have been notified so far. This has been possible due to the collection efforts of research scientists, seeds technologists, progressive farmers and administrators involved in agricultural development.

6. Breeder Seeds

Production of Breeder Seeds is organized by the Indian Council of Agriculture Research (ICAR) through the concerned breeders and scientists on receipt of indents from the state governments. The National Seeds Corporation (NSC) and State Farms Corporation of India (SFCI) also produce Breeder Seed.

7. High-Yielding Variety programme

This High-Yielding Variety programme was started in 1966-67 as a major plank of agriculture strategy for increase strategy of increasing production of foodgrains in the country.

The main objectives of the programmes for increasing food grains production during the Seventh Plan inter-alia included the following:

- (i) Achieving self-sufficiency in food grains with the complete elimination of imports;
- (ii) Imparting greater stability of foodgrains production;
- (iii) Acceleration of growth rate in production of pulses and coarse grains, and
- (iv) Protection of the interest both of farmers and consumers through price support and better distribution measures.

High-yielding variety programmes is supported by the Central sector Scheme of:

- (i) Mini-kit programmes of Rice, Wheat, Jowar, Bajra, Maize and Ragi,
- (ii) Maize demonstrations in tribal/backward areas,
- (iii) State-level training of extension workers.

Mini-kit Demonstration Programmes aims at popularizing newly released varieties and getting the newly evolved varieties tested under field conditions. For this, all large number of seed mini-kit containing 0.25 kg. 5 kg seeds are distributed at a nominal cost to farmers.

The objectives of Maize and Millets Demonstrations in backward and tribal areas is to increase the adopting of latest Maize and Millets Protection Technology, bring about an increase in the per unit area production of Maize and Millets and improve the economic condition of the backward and tribal farmers.

8. Dryland/Rainfed Farming

About 990 lakh hectare in the country is rainfed accounting for 70 per cent of the net sown area of 1410.6 lakh hectare crops grown and cropping practices followed in these areas entirely depend upon the rainfall which is often erratic and unpredictable. Bulk of the crops like Rice, Jowar, Bajra, Other Millets, Pulses, Oilseeds and Cotton are grown in this area under rainfed conditions. Farmers in these areas, particularly, small and Marginal farmers, are still practicing subsistence farming

and are not in the vertex of vicious circle. Wide fluctuations in production in these areas is therefore of crucial importance.

The Government has given high-priority for the development of Dryland Areas and accorded the importance for utilization of potential of these areas for:

- (i) Realising the projected requirement of about 240 M.T. of annual food production and to smooth out fluctuation in an annual production.
- (ii) Reducing regional disparities between irrigated and vast rainfed areas;
- (iii) Restoring ecological balance by 'greening' rainfed areas through appropriate mixture of trees, shrubs and grasses and
- (iv) Generating employment for rural masses and reducing large-scale migration from rural area to already congested cities in towns. Holistic approach for Integrated Farming Systems Development on Watershed Basis in rainfed areas would be the main pursuit of the development activities.

9. Himalayan Watershed Management Project in Uttar Pradesh This Himalayan Watershed Management Project in Uttar Pradesh was launched in 1983 with the assistance of the World Bank. The main objective of this project is to minimize further deterioration of the Himalayan Ecosystem caused by depletion of forests cover, over-grazing, bad land use and careless road construction. The project is spread over 3.12 lakh hectare in Two Watersheds namely; Nayar in Garhwal and Panar in Kumaon Regions of Uttar Pradesh with a total cost of US\$ 660 lakh and World Bank Loan US\$ 462 lakh.

Q23. Explain the uses and of problems of pesticide.

Ans :

Use of Pesticides

Until 1940's the following chemicals were used to control pests:

S, Cu, Hg, organo-
al diseases.

dium aresenite and
st weeds.

e.g. pyrethrum and
es and aphids.

against and red spider
caterpillars.

were sparingly used.
used to be confined to
omercury to kill-borne

ecticides and herbicides
the mid and late 1950s
dangerous compounds
in USA, UK, and other
ritish Govt. approved
s pesticides/herbicides

mortality have occurred
of poisonous biocides
to nearby rivers or
Great concern was
e-scale fish kill in the
U.S.A. wherein five
reful investigation
had died due to
n agriculture wastes
ary of the Mississippi

DT as an insecticide
derable concern in
ome countries have
use.

Herbicides

weedicides and
ate in agricultural
re designed to kill
y not be toxic to
, some herbicides
ng both desirable
ded target. They

may adversely affect such soils microbes as
nitroes fixing blue-green algae and bacteria.
This, in turn, may impair the growth and
production of higher plants.

Damage to the Extent of Complete Destruction of Vegetation

The impact of some chemical wastes as
phenols, metals etc. applied to soil may go to
the extent of complete destruction of
vegetation and also soil sterilization.

Findings of the Researches

Extensive researches in the USA found
widespread distribution of DDT residues
through food grains in several lakes. Residues
were detected in shallow and deep-water mud
samples, crustaceans, whitefish, duck ring-
billed and herring gulls and other fauna. Both
DDT and Dieldrin are found passing from
mother off spring through the placenta in
mice and certain other animals, possible
including man.

Adverse Consequence of Pesticides like DDT

Most pesticides tend to accentuate the
problems of both production and pollution
instead of containing them. The consequence
of pesticides is almost invariably adverse and
harmful. In the Ninteenth century, the
ladybird beetle was brought from Australia
to California to control a scale insect pest of
oranges. It is reported that the beetle
successfully kept the pest under check for
more than five decades until about 1946
when DDT began to be used in the citrus
orchards. The beetle was susceptible to DDT
and hence its population declined. However,
a subsequent withdrawal of DDT again
restored the natural balance of biological
control within a few years.

In fact, DDT is one of the most effective
pesticides known. This is the reason why it
was banned in the USA in 1972. its remarked
insecticidal properties were first discovered in
1939. it became a ubiquitous contaminant
of fish, penguins, birds and human being.
Hence a popular public movement started

in the USA that asked the Government to protect the public from the general toxification of the environment by DDT and persistent poisons.

Harm to Human Beings

Human beings are exposed to pesticides mainly through the intake of food and water but also by inhaling contaminated air. Several pesticides are teratogenic, mutagenic, or carcinogenic.

Harm to Bees

Bees vitally aid the pollination of several plants. Pesticides have adversely affected some honey bees and other useful insects whose populations have declined. According to Pimental, annual agriculture losses due to poor pollination from pesticides can be as high as US\$ 4000 million in the USA.

Damage to Crops

- (i) Sometimes crops are damaged by pesticide applications, e.g. application of improper dosage under unfavourable conditions.
- (ii) Herbicides that drift from a treated crop to a nearby crop also cause serious environmental problems. Persistent herbicides also can injure crops planted in rotation.

Harm Caused to Fishery and Wildlife

Drifting or leaching pesticides drain into nearby water bodies causing fishery and wildlife losses. Wild birds and mammals exposed to pesticides suffer by death from direct exposure to high doses and reduced survival growth and reproduction from exposure to subtle dosages.

Harmful Effect on Decomposers

Pesticides have harmful effects on insects, earthworms, invertebrates, protozoa, and microbes found in soils, especially the decomposers. It is reported that human pesticide poisonings, reeducation in insects and mites, and honeybee poisonings account for about 70 per cent of the calculated socio-environmental costs for pesticides in the USA.

11. Development of Secondary Pests

The use of pesticides kills natural enemies and creates such problems as the development of secondary pests e.g. Red spider mites. Resurgence of primary pests can also occur. To illustrate, caterpillars of the small cabbage white butterfly in Brussels sprouts reappeared after DDT has killed their natural enemies. Resistance to pesticides is a cause for serious concern. Other hazards include those to the operator or worker who sprays pesticide, those to the consumer of the crop and those to wildlife.

12. Elimination of Birds

Some species of Eagles and top carnivores are known to be eliminated by DDT because contaminated adults failed to lay viable eggs. Populations of peregrine falcons and some pelicans have disappeared from some areas from some areas where excessive use of DDT interfered with the bird's ability to transport calcium to growing eggs, leading to marked thinning of the egg shells. Such weak eggs fail to reach the hatching stage. It is discovered that in ringdoves, DDT greatly reduced the activity of carbonic anhydrase. This enzyme is critical in providing calcium for eggshell growth. When the pesticide inhibits this enzyme, eggshell grows thinner.

13. Growth of New Pests

Artificial introduction of pesticides in the environment upsets natural biological controls. This is the reason why new pests are created in this way because their natural predators, which previously checked their populations, are eliminated. In this way mites have become a pest as a consequence of the emergence of the pesticide industry. Indiscriminate and excessive use of DDT killed some insect predators of these mites, enabling the mites to multiply to pest status.

14. Effect on Algae

Some of the pesticides inhibit division in aquatic algae. They may decrease their rates of photosynthesis. In this way they almost produce changes in the species composition and/or diversity of algal communities. The algae-grazing animals are more affected by the level of blooms.

15. Flora And Fauna

Pesticides have adverse effects on the flora and fauna of soils. Effects on mycorrhizal fungi decomposer bacteria in forests would almost certainly alter plant community structure in forests. Some soil animals consume plant debris and contribute to soil fertility. Use of insecticides changes the populations of some of these animals. It leads to reduction in soil fertility especially in woodland.

1.3.1 Water Logging and Salinity

Q24. Explain about Water logging and salinity.

Ans :

Water logging refers to the saturation of soil with water. Soil may be regarded as waterlogged when the water table of the ground water is too high to conveniently permit an anticipated activity like agriculture. Crops need air to a greater or lesser depth in the soil. Waterlogging of the soil stops air getting in.

The practice of irrigation results in consumptive uses of water through evapotranspiration, leaving behind salts concentrated in a smaller volume of water. In irrigated agricultural land, waterlogging is often accompanied by soil salinity as waterlogged soils prevent leaching of the salts imported by the irrigation water.

Salts are a major water quality factor in choosing disposal options for subsurface drainage in arid irrigated areas. Salinity can restrict the urban or agricultural re-use of drainage water, as it is the most significant long-term water quality concern for managing irrigated agriculture in arid zones. Salinity has not been noted as a serious concern with subsurface drainage waters from humid areas. This is generally due to the higher rainfall, higher dilution capacity in surface waters and lower initial salt content in the soil.

Drainage of irrigated land serves two purposes: to reduce waterlogging and to control and reduce salinization. Subsurface drainage water from arid areas always has a higher salinity than the supply water, a higher proportion of Na and Cl, an increased hardness and a higher sodium adsorption ratio (SAR). The higher salinity and higher levels of specific ions often reflect the characteristics of the soil through which the irrigation water has percolated. This in turn is influenced by the shallow groundwater quality, by the ionic composition of the irrigation water, and by the irrigation efficiency. Salt species are also influenced by a number of interdependent, multi-phase chemical interactions. A full salinity appraisal is an essential component of any subsurface drainage water re-use or disposal scheme.