



UNIT-I

ENVIRONMENTAL SCIENCES

The science of Environment studies is a multi-disciplinary science because it comprises various branches of studies like chemistry, physics, medical science, life science, agriculture, public health, sanitary engineering etc. It is the science of physical phenomena in the environment. It studies of the sources, reactions, transport, effect and fate of physical a biological species in the air, water and soil and the effect of from human activity upon these.

Definitions of Environment: Some important definitions of environment are as under:

1. 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. 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.'

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 2500nm) 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.



ENVIRONMENT STUDIES: IMPORTANCE

Importance of Environment Studies: The environment studies enlighten us, about the importance of protection and conservation of our indiscriminate release of pollution into the environment.

At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. We study about these issues besides and effective suggestions in the Environment Studies. Environment studies have become significant for the following reasons:

1. Environment Issues Being of International Importance

It has been well recognised that environment issues like global warming and ozone depletion, acid rain, marine pollution and biodiversity are not merely national issues but are global issues and hence must be tackled with international efforts and cooperation.

2. Problems Cropped in The Wake of Development

Development, in its wake gave birth to Urbanization, Industrial Growth, Transportation Systems, Agriculture and Housing etc. However, it has become phased out in the developed world. The North, to cleanse their own environment has, fact fully, managed to move 'dirty' factories of South. When the West developed, it did so perhaps in ignorance of the environmental impact of its activities. Evidently such a path is neither practicable nor desirable, even if developing world follows that.



3. Explosively Increase in Pollution

World census reflects that one in every seven persons in this planted lives in India. Evidently with 16 per cent of the world's population and only 2.4 per cent of its land area, there is a heavy pressure on the natural resources including land. Agricultural experts have recognized soils health problems like deficiency of micronutrients and organic matter, soil salinity and damage of soil structure.

NEED FOR PUBLIC AWARENESS

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
2. Poverty
3. Agricultural Growth
4. Need to Ground water
5. Development And Forests
6. Degradation of Land
7. Reorientation of Institutions
8. Reduction of Genetic Diversity
9. Evil Consequences of Urbanisation
10. Air and water Population



VARIOUS TYPES OF ENVIRONMENT

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

- (a) Physical Environment,
- (b) Social and Cultural Environment, and
- (c) Psychological Environment.

These may be explained as under:

1. 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:

- (a) 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.
- (b) The physique of an individual depends on climate conditions as the individual tries to adjust in his physical environment.
- (c) 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:

- I. An open society is very conducive for the individual development.



II. 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.

Natural Resources

A natural resource may be defined as any material given to us by nature which can be transformed in a way that it becomes more valuable and useful.

For an example wood is used for making furniture. Yarn obtained from cotton is used for weaving cloth. Likewise, various machine, tools and household goods are made of metals. Now furniture, clothes, machine, tools are more valuable than their raw form i.e. raw form i.e. wood, cotton and metal, respectively. It is impossible to obtain valuable items from any resources. Thus, water, minerals, forests, wildlife as well as human beings are resources. Any material may be called, as a resource provided and appropriate technology is available to transform that into more valuable goods.

Natural Resources are resources that exist without actions of humankind. This includes all valued characteristics such as magnetic, gravitational, and electrical properties and forces. On earth it includes: sunlight, atmosphere, water, land (includes all minerals) along with all vegetation and animal life that naturally subsists upon or within the heretofore identified characteristics and substances.



Some natural resources such as sunlight and air can be found everywhere, and are known as ubiquitous resources. However, most resources only occur in small sporadic areas, and are referred to as localized resources. There are very few resources that are considered inexhaustible - these are solar radiation, geothermal energy, and air. The vast majority of resources are theoretically exhaustible, which means they have a finite quantity and can be depleted if managed improperly.

Classification

There are various methods of categorizing natural resources, these include source of origin and by their renewability.

On the basis of origin, natural resources may be divided into two types:

1. Biotic

Biotic resources are obtained from the biosphere (living and organic material), such as forests and animals, and the materials that can be obtained from them. Fossil fuels such as coal and petroleum are also included in this category because they are formed from decayed organic matter.

2. Abiotic

Abiotic resources are those that come from non-living, non-organic material. Examples of abiotic resources include land, fresh water, air and heavy metals including ores such as gold, iron, copper, silver, etc.



Renewable and Non-renewable Resources

On the basis of renewability, the resources are classified as under:

- (1) Renewable Resources
- (2) Non-renewable Resources.

1. Renewable Resources

Resources, which can be renewed along with their exploitation, are always available for use. Hence they are called renewable resources. For instance, forests are renewable. If trees are felled for wood, original forest covers may be maintained through planning new trees i.e. a forestation. Likewise, solar energy and wind energy are examples of renewable resources.

2. Non-renewable Resources

The formation of some resources like iron ore, coal, mineral oil etc. has taken several thousand years. Once they are used in unlimited way, they cannot be easily replaced. Thus, their exploitation at large scale will result in their fast depletion. Some such resources are called non-renewable resources or exhaustible.

Natural Resources and Associated Problems

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



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

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

Forest resources and associated problems

1. Use and over-exploitation.
2. Deforestation.
3. Timber extraction.
4. Mining and its effects on forest.
5. Dams and their effects on forests and tribal people.

Water resources and associated problems

1. Use and overutilization of water.
2. Floods, droughts etc.
3. Conflicts over water.
4. Dams and problems.

Mineral resource and associated problems

1. Use and exploitation.
2. Environmental effects of extracting and using minerals.

Food resources and associated problems

1. World food problems.
2. Changes caused by agriculture and over grazing.
3. Effects of modern agriculture.



FOREST RESOURCES

Forest is important renewable resources. Forest vary in composition and diversity and can contribute substantially to the economic development of any country .Plants along with trees cover large areas, produce variety of products and provide food for living organisms, and also important to save the environment.

It is estimated that about 30% of world area is covered by forest whereas 26% by pastures. Among all continents, Africa has largest forested area (33%) followed by Latin America (25%), whereas in North America forest cover is only 11%. Asia and former USSR has 14% area under forest. European countries have only 3% area under forest cover. India's Forest Cover accounts for 20.6% of the total geographical area of the country as of 2005.

Importance of Forest Resources

The importance of forest resources can be explained as under:

- 1. Ecological Balance:** Forests and wildlife are essential to maintain ecological balance of an area.
- 2. Renewable Natural Resources:** Forests are an important renewable natural resources.
- 3. Eco-system:** Trees dominate forest ecosystem; their species content varieties in different parts of the world.
- 4. Economic Development:** Forest contributes to the economic development of the country because they provide goods and services to the people and industry.



- 5. Environment Quality:** The forest enhance the quality of environment by influencing the life supporting system.
- 6. Safeguard against Pollution:** Forest check air pollution and soil erosion. Thus, they exercise safety and against pollution.
- 7. Soil Conservation:** Forest save the hill-slopes from landslides.
- 8. Wind Erosion:** In deserts, trees reduce wind erosion by checking wind velocity.
- 9. Check the Extension Balance:** The forest checks strong gales and keeps the soil intact beneath the roots of trees and thus checks extension of desert.
- 10. Maintains Ecological Balance:** The forest check pollution of air through increasing oxygen content of the air.
- 11. Attract Rainfall:** By causing condensation of water vapour in clouds, forests attract rains.
- 12. Control Floods:** The floods are controlled because forests dry up rainwater like sponge.
- 13. Linked with Cultural and Civilization:** Forests are linked with our cultural and civilization.



Deforestation:

Meaning of Deforestation

Deforestation is the process of felling trees indiscriminately resulting in nude or seminude surface of the hill hitherto covered by thick forests.

Causes of Deforestation

Main causes responsible for deforestation are as under:

- A. Felling of trees to meet the ever increasing demand of the cities.
- B. Grazing by the local cattle, goats, sheep etc. They not only destroy the vegetation but also pull out the roots of plants. After denudation of our Himalayas, the process of deforestation started in the Shivalik range. Shivalik sal forests were over-exploited for industry use, i.e. railway sleepers etc. Consequently, the foothills of the Shivalik are in semi desert conditions.
- C. Meeting out the growing hunger for land. It has hit the ecology of the country badly very soon India is likely to have more of wasteland than productive land. Large-scale deforestation has badly affected the weather facing almost each year more of bleak than the normal weather.
- D. The increase in shifting cultivation in North east and Orissa has also laid large in forest tracts bare. As the jhum cycle is shortened to six years only (in some districts, even 2-3 years only), too short period does not provide enough time for natural repair of damaged ecosystem.
- E. A major cause of deforestation has been the construction of hill roads. About a decade back, they were about 30, 000 km long. Most of these roads are in state and most fragile belt of Himalayas. Road construction damaged the protective vegetation cover both above and below roads. It blocked natural and pollution streams.



Major effects of deforestation

Deforestation adversely and directly affects and damages the environment and living beings. Major causes of deforestation are

- A. Soil erosion and loss of soil fertility
- B. Decrease of rain fall due to affect of hydrological cycle
- C. Expansion of deserts
- D. Climate change and depletion of water table
- E. Loss of biodiversity ,flora and fauna
- F. Environmental changes and disturbance in forest ecosystems

TIMBER EXTRACTION: MINING, DAMS AND THEIR EFFECTS IN FORESTS AND TRIBAL PEOPLE

Timber Extraction

It is estimated that India is losing 15 million hectares of forests cover year. If this trend continuous unchecked, it could take only a period 9 of 20 years hence to reach to zero forest value in our country. During a period of 25 years (1951-1976) India has lost 4.1 million hectares of forests area. Trees have been felled in large number of fuel, fodder, valley projects, Industrial uses, road construction etc. India consumes nearly, 170 million tonnes of firewood annually, and 10-15 million hectares of forests cover is being stripped every year to meet fuel requirements. The rise in fuelwood consumption can be noticed from the comparative study of the fuel consumption in earlier years. It was 86.3 million ton in 1953. It reached about 135 million ton in 1980. During a period of 20 years (1951 to 1971) forests have been cut for various purposes as under:



1. For Agriculture (24-32 lakh hectares)
2. River valley projects (4.01 lakh hectares)
3. Industrial uses (1.24 lakh hectares)
4. Road construction (0.55 lakh hectares)
5. Miscellaneous uses (3.88 lakh hectares)

In this way, a total of 3.4 million hectares of forests were lost during this period. The disastrous of the heavy deforestation are visible. Nearly 1 percent of the land surface of India is turning barren every year due to deforestation. In the Himalayan range, the rainfall has declined from 3 to 4 percent.

Mining

- 1) It is often remarked that in our country most mining work has been unscientific. Consequently no heed is paid to environment protection. The consequences have been disastrous. For example:
- 2) They have developed large tracts that lost productivity. There have been water and air pollution, despoliation of land and deforestation, noise and ground vibration problems etc.

As such, to ameliorate the situation, the mined areas to be reclaimed for agriculture, forestry, fisheries and recreation. During last 20-30 years, a number of mining operation have been started in the country. These operations affected forest and cultivated land areas. Such operations have been taken mainly in U.P., Bihar, M.P., Orissa and Andhra Pradesh.



Effects of dams on forests and tribal people

Pandit Jawaharlal Nehru referred dam and valley projects as “Temples of modern India”. These big dams and rivers valley projects have multi-purpose uses. However, these dams are also responsible for the destruction of forests. They are responsible for degradation of catchment areas, loss of flora and fauna, increase of water borne diseases, disturbance in forest ecosystems, rehabilitation and resettlement of tribal peoples.

India has more than 1550 large dams, the maximum being in the state of Maharashtra (more than 600), followed by Gujarat (more than 250) and Madhya Pradesh (130).

The highest one is Tehri dam, on river Bhagirathi in Uttaranchal and the largest in terms of capacity is Bhakra dam on river Satluj in Himachal Pradesh. Big dams have been in sharp focus of various environmental groups all over the world, which is mainly because of several ecological problems including deforestation and socio-economic problems related to tribal or native people associated with them.

The Silent valley hydroelectric project was one of the first such projects situated in the tropical rain forest area of Western Ghats which attracted much concern of the people.

The crusade against the ecological damage and deforestation caused due to Tehri dam was led by Shri. Sunder Lal Bahaguna, the leader of Chipko Movement.

The cause of Sardar Sarovar Dam related issues have been taken up by the environmental activist Medha Patkar, joined by Arundhati Ray and Baba



Amte. For building big dams, large scale devastation of forests takes place which breaks the natural ecological balance of the region.

Floods, droughts and landslides become more prevalent in such areas. Forests are the repositories of invaluable gifts of nature in the form of biodiversity and by destroying them (particularly, the tropical rain forests), we are going to lose these species even before knowing them. These species could be having marvellous economic or medicinal value and deforestation results in loss of this storehouse of species which have evolved over millions of years in a single stroke.

Forest conservation and management

Forest is one of the most valuable resources and thus needs to be conserved. To conserve forest, following steps should be taken.

- 1) Conservation of forest is a national problem, thus it should be tackled with perfect coordination between concerned government departments.
- 2) People should be made aware of importance of forest and involved in forest conservation activities.
- 3) The cutting of trees in the forests for timber should be stopped.
- 4) A forestation programmes should be launched
- 5) Grasslands should be regenerated.
- 6) Forest conservation Act should be strictly implemented to check deforestation.
- 7) Awards should be instituted for the deserving.



WATER RESOURCES:

Water claims to be an important resource. An important use of water in our country is for irrigation. Besides, water is also required in large amounts for industrial and domestic consumption.

Significant of Water

- 1) The significant of water needs no elucidation. It is as under:
It is revealed by the history of human civilization that water supply and civilization are most synonymous.
- 2) Several cities and civilizations have disappeared due to water shortages originating from climatic changes.
- 3) Millions of people all over the world, particularly in the developing countries, are losing their lives every year from water-borne disease.
- 4) An understanding of water chemistry is the basis of knowledge of the multidimensional aspects of aquatic environment chemistry, which involve the sources, composition, reactions, and transport of the water.
- 5) About 97% of the earth's water supply is in the ocean, which is unfit of the remaining 3%, 2% is locked in the polar ice-caps and only 1% is available as fresh water in rivers, lakes, streams, reservoirs and ground water which is suitable for human consumption.

Unlike land, which remains available as it is, the availability of water varies from place to place and time to time. Our country is a monsoon land. The bulk of rainfall is confined to a brief period of 3-4 months that is from July to October. As such, large part of the country lacks surface water supply for a greater part of the year.



Water Use

More than 99% of earth water is unavailable for use; only 1% water is available for people, animal, plants and earth. There is an uneven distribution of water resources, tropical rain forest are receive maximum rainfall where as desert receive only little rainfall.

Fresh water crisis

On global scale water availability is not a problem itself, but it's availability in right form, right time and right place is a problem. Irregularities in duration and intensity of rainfall cause floods and droughts. Out of the total water reserves of the world, about 97% is salty water (marine) and only 3% is fresh water.

Due to increased demands overuse of groundwater for drinking, irrigation and domestic purposes has lead to rapid depletion of groundwater in various regions leading to lowering of water table.

Problems associated with water resources

These are some problems associated with use of water

- 1) Water Scarcity (precipitation/evapotranspiration balance, temporal availability, per capita availability)
- 2) Floods and droughts (spatio-temporal distribution; regular floods related to heavy winter or spring rains, increasing damage level due to shifting land use (settlements in flood zones) recurrent summer droughts coinciding with peak demand periods for agriculture and tourism)
- 3) Groundwater availability and quality (aquifer size and access, yield, saltwater intrusion, pollution of shallow aquifers)



- 4) Watershed degradation (deforestation, land use, increasing impervious (sealed) areas due to urbanization the main concern here is land use change (primarily deforestation and urbanization) and its effects on runoff patterns (flooding) and water quality including erosion/sediments with subsequent problems such as reservoir siltation/capacity loss)
- 5) Coastal interaction (salinity intrusion in groundwater and estuaries, coastal pollution due to pollution runoff)

Over-Exploitation of Water

Groundwater

About 9.86% of the total fresh water resources are in the form of groundwater and it is about 35-50 times that of surface water supplies.

Effects of extensive and reckless groundwater usage:

- 1) Subsidence
- 2) Lowering of water table
- 3) Water logging

Surface water

Surface water mainly comes directly from rain or snow covers. The various surface sources are natural lakes and ponds, rivers and streams, artificial reservoirs. Availability of surface water decides the economy of the country. On one side surface water availability affects the productivity, but on the other side water sources may cause floods and drought. Due to unequal distribution, water may lead to national (interstate) or international disputes. Sharing of surface



water due to these disputes is affecting productivity of different agro eco-zone and creating problems for government.

Recently many water conflicts at national and international levels relating to sharing of surface water are catching the headlines of newspaper.

Dams - Benefits and Problems

Water is a precious resource and its scarcity is increasing at global level. There is a pressure to utilise surface water resources efficiently for different purposes. According to World Commission on Dam Report -2001 there are 45000 large dams spread over 140 countries

Major benefits of dams

The major benefits of dams are

- 1) Hydroelectricity generation
- 2) Year round water supply to ensure higher productivity
- 3) Equal water distribution by transferring water from area of excess to area of deficit
- 4) Helps flood control and protects soil
- 5) Assure irrigation during dry periods
- 6) River valley projects provide inland water navigation ,employment opportunities and can be used to develop fish hatcheries and nurseries
- 7) River valley projects have tremendous potential for economic upliftment and will help to raise the standard of living and can help to improve the quality of life



Disadvantages/problems

Although dams have proved very useful over the centuries but recent past big dams has created lot of human as well as environmental issues

- 1) Submergence of large areas may lead to loss of fertile soil and displacement of tribal people
- 2) Salt left behind due to evaporation increase the salinity of river water and makes it unusable when reaches down stream
- 3) Siltation and sedimentation of reservoirs not only makes dams use less but also is responsible for loss of valuable nutrients
- 4) Loss of non-forest land leads to loss of flora and fauna
- 5) Changes in fisheries and the spawning grounds

MINERAL RESOURCES

Minerals are essential for the formation and functioning of organisms, plant animals and human beings. In the modern era, human life needs variety of minerals to sustain industry based civilization. Mineral resources are broadly defined as elements, chemical compounds, and mixtures which are extracted to manufacture sustainable commodity. India has rich mineral resource base to provide suitable base for industrial development in the country. Sufficient reserve of nuclear energy minerals is available in India.

India's reserves, as well as production are adequate in petroleum, ores of copper, lead, zinc, tin, graphite, mercury, tungsten, and in the minerals required for fertilizer industry such as sulphur, potassium and phosphorus.

Significance



The economic development of a country depends, to a great extent. On the availability of minerals, got as ores, from the earth by mining coal and iron are the basic minerals which man needs to develop iron and steel industry. Minerals like mica, copper, lead and zinc are of vast economic importance. Thorium and uranium are atomic energy minerals.

Position of Minerals in India

India is rich endowed with minerals like coal, bauxite, barytes, iron, one mica, gypsum, chromite, dolomite and limestone while it is deficient in minerals like asbestos, phosphates, lead, tungsten, tin platinum group of metals, gold and diamonds.

Need for an Appropriate Policy

An appropriate policy regarding extraction of minerals is needed in view of the limited availability and nature of minerals as under:

1. Mineral resources are finite and non-renewable.
2. Mineral resources constitute raw materials for many basic industries.
3. Mineral resources are major resources of nation's development.

National Mineral Policy

In view of the above Nations Mineral Policy has been adopted which encompasses the various Policy Guidelines, which have been issued from time to time. The policy also emphasizes certain new aspects and elements as under:

1. Mineral Exploration in the seabed,
2. Development of proper inventory,



3. Proper linkage between exploitation of minerals and development of mineral industry,
4. Preference to members of the scheduled tribes for development of small deposits in scheduled areas
5. Protection of forests, environment and ecology from the adverse effects of mining
6. Enforcement of mining plan for adoption of proper mining methods.
7. Optimum utilization of minerals, export of minerals in value added form and recycling of metallic scrap and mineral waste.

Exploitation of Minerals

Depending on their use, mineral resources can be divided into several broad categories such as elements for metal production and technology, building materials, minerals for the chemical industry and minerals for agriculture. When usually we think about mineral resources we often think of metals but the predominant mineral resources are not metallic. The picture of annual world consumption of some elements is as under:

1. Sodium and iron are used at a rate of about 0.1 to 1.0 billion metric tons per year.
2. Nitrogen, sulphur, potassium and calcium are primarily used as fertilizers at a rate of about 10 to 100 million metric tons per year.
3. Zinc, copper, aluminium and lead are used at a rate of about 3 to 10 million metric tons per year;
4. Gold and silver are used at a rate of about 10 thousand metric tons per year.
5. Out of all the metallic minerals, iron consumption is 95% of the metals consumed



Thus, with the exception of iron, the non-metallic minerals are consumed at much greater rates than the elements used for their metallic properties.

Uses of Minerals

Due to increased population, there is increased demand of minerals by the industry, transport, agriculture and defence preparation. Depletion of almost all known and easily accessible deposits is anticipated in near future. Moreover, there may be shortage of some crucial elements such as mercury, tin, copper, gold, silver and platinum. The limited resource of phosphorus, which is an essential component of chemical fertilizers, is another area of concern.

Environmental Impacts of Mineral Extraction

Extracting and use of mineral resources can affect the environment adversely. Environmental affect may depend on factors such as mining procedures, ore quality, climate, size of operation, topography, etc. Some of major environmental impacts of mining and processing operations are as under

1. Degradation of land.
2. Pollution of surfaces and ground water resources.
3. Effect on growth of vegetation due to leaching out effect of minerals.
4. Surface water pollution and groundwater contamination lead to occupational health hazards etc.
5. Air pollution due to emission of gases.
6. Deforestation affects flora and fauna.
7. Rehabilitation of affected population.

Conservation of Minerals



Conservation of minerals can be done in number of ways and these are as follows:

Industries can reduce waste by using more efficient mining and processing methods.

In some cases, industries can substitute plentiful materials for scarce ones.

Some mineral products can be recycled. Aluminum cans are commonly recycled. Although bauxite is plentiful, it can be expensive to refine. Recycling aluminum products does not require the large amounts of electric power needed to refine bauxite.

Products made from many other minerals, such as nickel, chromium, lead, copper, and zinc, can also be recycled.

Strict laws should be made and enforced to ensure efficient management of mining resources.

Case Study

Ara villi mountains which covers about 10% of geographical area is rich source of minerals wealth. This mountain range play important role in control of climate and act as mini water shed. On the request of environmentalist, Honourable Supreme Court has passed the order to stop these mines in Rajasthan Marble mining near Rajsamant Lake has lead to drying up of lake. Marble mining was stopped on December 2002.

Recently, mining in Goa has attained the attention of the press and media and ultimately government has to take the decision to stop this mining.



FOOD RESOURCES

Food is essential for growth and development of living organisms. These essential materials are called nutrients and these nutrients are available from variety of animals and plants. There are thousands of edible plants and animals over the world, out of which only about three dozen types constitute major food of humans.

Food sources

The majority of people obtain food from cultivated plants and domesticated animals. Although some food is obtained from oceans and fresh waters, but the great majority of food for human population is obtained from traditional land-based agriculture of crops and livestock.

Food crops

It is estimated that out of about 2,50,000 species of plants, only about 3,000 have been tried as agricultural crops. Under different agro-climatic condition, 300 are grown for food and only 100 are used on a large scale.

Some species of crops provide food, whereas others provide commercial products like oils, fibres, etc. Raw crops are sometimes converted into valuable edible products by using different techniques for value addition. At global level, only 20 species of crops are used for food. These, in approximate order of importance are wheat, rice, corn, potatoes; barley, sweet potatoes, cassavas, soybeans, oats, sorghum, millet, sugarcane, sugar beets, rye, peanuts, field beans, chick-peas, pigeon-peas, bananas and coconuts. Many of them are used directly, whereas other can be used by changing them by using different techniques for enhancing calorific value.



Livestock

Domesticated animals are an important food source. The major domesticated animals used as food source by human beings are 'ruminants' (e.g. cattle, sheep, goats, camel, reindeer, llama, etc.).

Ruminants convert indigestible woody tissue of plants (cellulose) which are earth's most abundant organic compound into digestible food products for human consumption. Milk, which is provided by milking animals, is considered to be the complete food. Other domestic animals like sheep, goat, poultry and ducker can be used as meat.

Aquaculture

Fish and seafood contributes 17 million metric tonnes of high quality protein to provide balance diet to the world. Presently aquaculture provides only small amounts for world food but its significance is increasing day by day.

World Food Problems

As per estimates of Food and Agriculture Organization (FAO), about 840 million people remain chronically hungry and out of this 800 million are living in the developing world. In last decade, it is decreasing at the rate of 2.5 million per year, but at the same time world's population is increasing. Target of cutting half the number of world's chronically hungry and undernourished people by 2015 will difficult to meet, if the present trend continues. Due to inadequate purchasing power to buy food, it is difficult to fulfil minimum calorific requirement of human body per day. Large number of people are in India are poor which can be attribute to equitable distribution of income. Food



insufficiency can be divided into two categories into under-nourishment and malnourishment. Both of these insufficiencies are global problems.

Under-nourishment

The FAO estimates that the average minimum daily caloric intake over the whole world is about 2,500 calories per day. People who receive less than 90% of their minimum dietary intake on a long-term basis are considered undernourished. Those who receive less than 80% of their minimum daily caloric intake requirements are considered 'seriously' undernourished. Children in this category are likely to suffer from stunted growth, mental retardation, and other social and developmental disorders. Therefore, Under-nourishment means lack of sufficient calories in available food, resulting in little or no ability to move or work.

Malnourishment

Person may have excess food but still diet suffers from due to nutritional imbalance or inability to absorb or may have problem to utilize essential nutrients. If we compare diet of the developed countries with developing countries people in developed countries have processed food which may be deficient in fibre, vitamins and other components where as in the diet of developing countries, may be lack of specific nutrients because they consume less meat ,fruits and vegetables due to poor purchasing power .

Malnourishment can be defined as lack of specific components of food such as proteins, vitamins, or essential chemical elements.



The major problems of malnutrition are:

1. **Marasmus:** a progressive emaciation caused by lack of protein and calories.
2. **Kwashiorkor:** a lack of sufficient protein in the diet which leads to a failure of neural development and therefore learning disabilities.
3. **Anemia:** it is caused by lack of iron in the diet or due to an inability to absorb iron from food.
4. **Pellagra:** it occurs due to the deficiency of tryptophan and lysine, vitamins in the diet.

Every year, food problem kill as many people as were killed by the atomic bomb dropped on Hiroshima during World War II. This shows that there is drastic need to increase food production, equitably distribute it and also to control population growth. Although India is the third largest producer of staple crops, it is estimated that about 300 million Indians are still undernourished. India has only half as much land as USA, but it has nearly three times population to feed. Our food problems are directly related to population.

Balanced diet

Supply of adequate amount of different nutrient can help to improve malnutrition and its ill effects. Cereals like wheat and rice can supply only carbohydrate which are rich in energy supply, are only fraction of nutrition requirement. Cereal diet has to be supplemented with other food that can supply fat, protein and minor quantity of minerals and vitamins. Balanced diet will help to improve growth and health.



Changes Caused by Agriculture and Overgrazing

From centuries, agriculture is providing inputs to large number of industries involved in production, processing and distribution of food. Accordingly, agriculture has significant effect on environment. The effects of agriculture on environment can be classified as local, regional, and global level. The agriculture also makes impact on the usage of land generally as follows:

1. Deforestation
2. Soil Erosion
3. Depletion of nutrients
4. Impact related to high yielding varieties (HYV)
5. Fertilizers related problems include micronutrient imbalance, nitrite pollution and eutrophication.
6. Pesticide related problems include creating resistance in pests and producing new pests, death of non-target organisms, biological magnification.
7. Some other problems include water logging, salinity problems and such others.

The carrying capacity of land for cattle depends upon micro climate and soil fertility. If carrying capacity is exceeded than land is overgrazed. Because of overgrazing the agricultural land gets affected as follows,

1. Reduction in growth and diversity of plant species
2. Reduce plant cover leads to increased soil erosion
3. Cattle trampling leads to land degradation



Effects of Modern Agriculture

For sustainable production modern techniques are used to enhance productivity of different cropping systems under different agro-eco-zones. Adoption of modern agricultural practises has both positive and negative effects on environment. Effects of modern agriculture are briefly discussed under different heads as under:

Soil erosion

Raindrops bombarding bare soil result in the oldest and still most serious problem of agriculture. The long history of soil erosion and its impact on civilization is one of devastation. Eroded fields record our failure as land stewards.

Irrigation

Adequate rainfall is never guaranteed for the dry land farmer in arid and semiarid regions, and thus irrigation is essential for reliable production. Irrigation ensures sufficient water when needed and also allows farmers to expand their acreage of suitable cropland. In fact, we rely heavily on crops from irrigated lands, with fully one-third of the world's harvest coming from that 17% of cropland that is under irrigation. Unfortunately, current irrigation practices severely damage the cropland and the aquatic systems from which the water is withdrawn.

Agriculture and the loss of genetic diversity

As modern agriculture converts an ever-increasing portion of the earth's land surface to monoculture, the genetic and ecological diversity of the planet



erodes. Both the conversion of diverse natural ecosystems to new agricultural lands and the narrowing of the genetic diversity of crops contribute to this erosion.

Fertilizer-pesticide problems

For photosynthesis apart from water, sunshine and CO₂, plants need micro and macro nutrients for growth. These nutrients are supplied in the shape of fertilizers. There is lot of potential to increase food productivity by increasing fertilizer use. On one hand application of artificial chemical fertilizers increases the productivity at faster rate as compare to organic fertilizers, on the other hand application of fertilizers can be a serious problem of pollution and can create number of problems. Excessive level of nitrates in ground water has created problems in developed countries. These are:

- a. Accumulated phosphorous as a consequence of use of phosphoric fertilizer are posing serious threat as residues in domestic water supply and for ecology of river and other water bodies. Increased level of phosphates in different water results in eutropication.
- b. Effect of chemical fertilizer is long term, therefore leads to net loss of soil organic matter.

To control insects, pests, diseases and weeds which are responsible for reduction in productivity different chemicals are used as insecticides, pesticides and herbicides. Successful control of insects, pests and weeds increases productivity and reduces losses and provide security for harvest and storage. Applications of these synthetic chemicals have great economic values and at the same time cause number of serious problems such as:



- a. Affects human health which includes acute poisoning and illness caused by higher doses and accidental exposures
- b. As long term effect, cause cancer, birth defects, Parkinson's disease and other regenerative diseases.
- c. Long term application of pesticides can affect soil fertility.
- d. Danger of killing beneficial predators.
- e. Pesticides resistance and pest resurgence

Water Logging

High water table or surface flooding can cause water logging problems. Water logging may lead to poor crop productivity due to anaerobic condition created in the soil. In India, deltas of Ganga, Andaman and Nicobar Islands and some areas of Kerala are prone to frequent water logging.

Salinity

Due to adoption of intensive agriculture practices and increased concentration of soluble salts leads to salinity. Due to poor drainage, dissolved salts accumulate on soil surface and affects soil fertility. Excess concentration of these salts may form a crust on the surface which may injurious to the plants. The water absorption process is affected and uptake of nutrient is disturbed. According to an estimate, in India, 7 million hectare of land is saline and area is showing in increasing trends due to adoption of intensive agriculture practises.



ENERGY RESOURCES

Growing Energy Needs

Energy consumption of a nation is usually considered as an index of its development, because almost all the development activities are directly or indirectly dependent upon energy. Power generation and energy consumption are crucial to economic development as economy of any nation depends upon availability of energy resources. There are wide disparities in per capita energy use of developed and the developing nations. With increased speed of development in the developing nations energy needs are also increasing.

The very original form of energy technology probably was the fire, which produced heat and the early man used it for cooking and heating purposes.

Wind and hydropower has also been used. Invention of steam engines replaced the burning of wood by coal and coal was further replaced by oil.

The oil producing has started twisting arms of the developed as well as developing countries by dictating the prices of oil and other petroleum products.

Energy resources are primarily divided into two categories viz. renewable and non-renewable sources.

Renewable energy resources must be preferred over the non-renewable resources.

It is inevitable truth that now there is an urgent need of thinking in terms of alternative sources of energy, which are also termed as non-conventional energy sources which include:



Solar energy needs equipments such as solar heat collectors, solar cells, solar cooker, solar water heater, solar furnace and solar power plants .

Wind energy

Hydropower, Tidal energy, ocean thermal energy, geothermal energy, biomass, biogas, biofuels etc.

The non renewable energy sources include coal, petroleum, natural gas, nuclear energy.

Energy Scenario

Energy is a key input in the economic growth and there is a close link between the availability of energy and the future growth of a nation. Power generation and energy consumption are crucial to economic development.

In India, energy is consumed in a variety of forms such as fuel wood; animal waste and agricultural residues are the traditional sources of energy. These non-commercial fuels are gradually getting replaced by commercial fuels i.e. coal, petroleum products, natural gas and electricity.

Out of total energy, commercial fuels account for 60% where as the balance 40% is coming from non-commercial fuels. Of the total commercial energy produced in the form of power or electricity,

- 69% is from coal (thermal power),
- 25% is from hydel power,
- 4% is from diesel and gas,
- 2% is from nuclear power, and



Less than 1% from non- conventional sources like solar, wind, ocean, biomass, etc.

Petroleum and its products are the other large sources of energy. In a developing country like India, in spite of enhanced energy production, there is still shortage due to increased demand of energy. In spite of the fact that there is a phenomenal increase in power generating capacity, still there is 30% deficit of about 2,000 million units.

Policy makers are in the process of formulating an energy policy with the objectives of ensuring adequate energy supply at a minimum cost, achieving self-sufficiency in energy supplies and protecting environment from adverse impact of utilizing energy resources in an injudicious manner. The main features of this policy are

1. Accelerated exploitation of domestic conventional energy resources, viz., oil, coal, hydro and nuclear power;
2. Intensification of exploration to achieve indigenous production of oil and gas;
3. Efficient management of demand of oil and other forms of energy;
4. To formulate efficient methods of energy conservation and management;
5. Optimisation of utilisation of existing capacity in the country
6. Development and exploitation of renewable sources of energy to meet energy requirements of rural communities;
7. Organisation of training for personnel engaged at various levels in the energy sector.
8. Government private partnership to exploit natural energy resources.



Renewable Resources

- The resources that can be replenished through rapid natural cycles are known as renewable resource.
- These resources are able to increase their abundance through reproduction and utilization of simple substances.
- Examples of renewable resources are plants (crops and forests), and animals who are being replaced from time to time because they have the power of reproducing and maintain life cycles.
- Some examples of renewable resources though they do not have life cycle but can be recycled are wood and wood-products, pulp products, natural rubber, fibres (e.g. cotton, jute, animal wool, silk and synthetic fibres) and leather.
- In addition to these resources, water and soil are also classified as renewable resources. Solar energy although having a finite life, as a special case, is considered as a renewable resource in as much as solar stocks is inexhaustible on the human scale.

Non-Renewable Resources

- The resources that cannot be replenished through natural processes are known as non-renewable resources.
- These are available in limited amounts, which cannot be increased. These resources include fossil fuels (petrol, coal etc.), nuclear energy sources (e.g. uranium, thorium, etc). metals (iron, copper, gold, silver, lead, zinc etc.), minerals and salts (carbonates, phosphates, nitrates etc.).
- Once a non-renewable resource is consumed, it is gone forever. Then we have to find a substitute for it or do without it.



- Non-renewable resources can further be divided into two categories, viz. Recyclable and non-recyclable

Recyclable resources

These are non-renewable resources, which can be collected after they are used and can be recycled. These are mainly the non-energy mineral resources, which occur in the earth's crust (e.g. ores of aluminium, copper, mercury etc.) and deposits of fertilizer nutrients (e.g. phosphate rock and potassium and minerals used in their natural state (asbestos, clay, mica etc.)

Non-recyclable resources

These are non-renewable resources, which cannot be recycled in any way. Examples of these are fossil fuels and nuclear energy sources (e.g. uranium, etc) which provide 90 per cent of our energy requirements.

Use of Alternate Energy Sources

There is a need to develop renewable energy sources which are available and could be utilized (solar or wind) or the sources which could be created and utilized (bio-mass). The main renewable energy sources for India are solar, wind, hydel, waste and bio-mass. Bio-mass are resources which are agriculture related like wood, bagasse, cow dung, seeds, etc.

Hydel energy

India has a total hydro energy potential of about 1.5 lakh MW, of which only about 20 % is installed. Small hydro plant potential is about 15000 MW and most of it is in the northern and eastern hilly regions.



Wind energy

The wind power potential of India is about 45,000 MW out of which capacity of 8748 MW has been installed in India till 2008. India is one of the leading countries in generating the power through wind energy.

Gujarat, AP, Karnataka, MP and Rajasthan are states having more than 5000 MW potential each. These potentials could be improved if the technology of putting turbines in sea is embraced. There are wind farms on sea generating as high as 160 MW of power.

Geothermal energy

Geothermal energy is thermal energy generated and stored in the Earth. Thermal energy is the energy that determines the temperature of matter. Earth's geothermal energy originates from the original formation of the planet (20%) and from radioactive decay of minerals (80%). Geothermal power is cost effective, reliable, sustainable, and environmentally friendly, but has historically been limited to areas near tectonic plate boundaries. Recent technological advances have dramatically expanded the range and size of viable resources, especially for applications such as home heating, opening a potential for widespread exploitation. Geothermal wells release greenhouse gases trapped deep within the earth, but these emissions are much lower per energy unit than those of fossil fuels. As a result, geothermal power has the potential to help mitigate global warming if widely deployed in place of fossil fuels.

Ocean thermal energy conversion (OTEC)

Ocean Thermal Energy Conversion (OTEC) uses the difference between cooler deep and warmer shallow or surface ocean waters to run a heat engine and



produce useful work, usually in the form of electricity. A heat engine gives greater efficiency and power when run with a large temperature difference. In the oceans the temperature difference between surface and deep water is greatest in the tropics, although still a modest 20 to 25 °C. It is therefore in the tropics that OTEC offers the greatest possibilities. OTEC has the potential to offer global amounts of energy that are 10 to 100 times greater than other ocean energy options such as wave power

Biomass energy

Biomass is the oldest means of energy used by humans along with solar energy. As soon as the fire was discovered, it was used widely among humans mainly for heat and light. Fire was generated using wood or leaves, which is basically a biomass. The biomass could be used to generate steam or power or used as a fuel. Power is generated using rice husk in Andhra Pradesh, while several bagasse based plants are there. India has a potential of 3500 MW from bagasse. Other fast growing plants could be planned over a huge area, so that it provides biomass for generating power.

Organic waste such as dead plant and animal material, animal dung, and kitchen waste can be converted by the anaerobic digestion or fermentation into a gaseous fuel called biogas. Biogas is a mixture of 65% methane (CH₄) and of 35% CO₂ and may have small amounts of hydrogen sulphide (H₂S), moisture and siloxanes. It is a renewable energy resulting from biomass. Biogas can be used as a fuel in any country for any heating purpose, such as cooking. It can also be used in anaerobic digesters where it is typically used in a gas engine to convert the energy in the gas into electricity and heat. Biogas can be compressed, much like natural gas, and used to power motor vehicles.



Bio-fuels

India has more than 50 million hectare of wasteland, which could be utilized for cultivating fuel plants. Jatropha is one of the options which can be planted on arid lands and be used for production of bio fuels.

Solar energy

India being a tropical country has potential to use solar energy on commercial bases. According to estimates, 35 MW of power could be generated from one sq km. With such potential, solar energy has bright future as energy source for the development of the country. Initial cost is the biggest limitation which has led to the low realization of its potential. For solar energy to become one of the front runners, it will require lot of research, cheap technology and low capital.

Problems Relate To the Use of Energy Resources

Fossil fuel

- Global warming
- Acid rains
- Dangers posed by leaded fuels ,Oil spills
- Water pollution caused by poorly managed coal mines
- Air pollution.

Alternate energy resources

- The initial cost of establishment of alternate energy generation is costlier than conventional resources.
- Maintenance of these structures is difficult.
- It requires more space.



- Energy supply is unpredictable during natural calamities.

Case Study

Importance of the energy resources in present economy and as a base for our future can be underlined by the fact that recent confrontations between some powerful nations of the world have primarily been attributed driven by objective to secure their energy supplies. Examples of this have been the two gulf wars. It was the hunger for energy resources that drove Iraq to lead an offensive over Kuwait and also reason for second Gulf war has been attributed to energy security by defence experts. In recent times, world has witnessed a confrontation at South China Sea between India, Vietnam and China over the issue of exploring natural gas and petroleum under the sea bed.

LAND RESOURCES

Land area constitutes about 1/5 of the earth surface. To meet out the challenging demand of food, fibre and fuel for human population, fodder for animals and industrial raw material for agro based industries, efficient management of land resources will play critical role. Soil, water, vegetation and climate are basic natural resources for agricultural growth and development.

Land Degradation

Due to increasing population, the demands for arable land for producing food, fibre and fuel wood is also increasing. Hence there is more and more pressure on the limited land resources which are getting degraded due to over-exploitation. Nearly 56% of total geographical area of the country is suffering due to land resource degradation. Out of 17 million hectare canal irrigated area, 3.4 million hectare is suffering from water logging and salinity. Soil erosion,



water logging, salinization and contamination of the soil with industrial wastes like fly-ash, press mud or heavy metals all cause degradation of land.

Soil Erosion

Soil erosion refers to loss or removal of superficial layer of soil due to the action of wind, water and human factors. In other words, it can be defined as the movement of soil components, especially surface-litter and top soil from one place to another. It has been estimated that more than 5000 million tonnes topsoil is being eroded annually and 30% of total eroded mass is getting loosed to the sea .It results in the loss of fertility. It basically is of two types, viz. geologic erosion and accelerated erosion. Various factors which affect soil erosions include soil type, vegetation cover, slope of ground, soil mismanagement and intensity and amount of rainfall. Wind is also responsible for the land erosion through saltation, suspension and surface creep.

In order to prevent soil erosion and conserve the soil the following conservation practices are employed,

- Conservational till farming, Contour farming and Terracing
- Strip cropping and alley cropping
- Wind breaks or shelterbelts

Salinization

It refers to accumulation of soluble salts in the soil. Concentration of soluble salts increases due to poor drainage facilities. In dry land areas, salt concentration increases where poor drainage is accompanied by high temperature. High concentration of salts affects the process of water absorption hence affects the productivity.



Water Logging

Excessive utilization of irrigation may disturb the water balance which can lead to water logging due to rise of water table. Anaerobic condition due to poor availability of oxygen in water logged soils may affect respiration process in plants which will ultimately affect the productivity of water logged soil.

Desertification

Desertification is a process whereby the productive potential of arid or semiarid lands falls by ten percent or more. Desertification is characterized by devegetation and depletion of groundwater, salinization and severe soil erosion.

Causes of desertification

1. Deforestation
2. Overgrazing
3. Mining and quarrying

Shifting Cultivation

Shifting cultivation is a practice of slash and burn agriculture adopted by tribal communities and is a main cause for soil degradation particularly tropical and sub tropical regions. Shifting cultivation which is also popularly known as 'Jhum Cultivation' has led to destruction of forest in hilly areas. It is responsible for soil erosion and other problems related to land degradation in mountainous areas.

Man Induced Landslides



Human race has exploited land resources for his own comfort by constructing roads, railway tracks, canals for irrigation, hydroelectric projects, large dams and reservoirs and mining in hilly areas. Moreover productive lands under crop production are decreasing because of development activities. These factors are affecting the stability of hill slopes and damage the protective vegetation cover. These activities are also responsible to upset the balance of nature and making such areas prone to landslides.

INDIVIDUAL'S ROLE IN CONSERVATION OF NATURAL RESOURCES

Meaning of Conservation

Conservation broadly means sound land or water use planning. It is concerned with the maintenance of natural systems and with their moderate, systematic, planned and regulated utilization and exploitation for the long-term benefit of mankind.

Conservation has been defined as “As management of the benefit of all life including humankind of the biosphere so that it may yield sustainable benefit to the present generation which maintaining its potential to meet the needs and aspirations of the future generations.”

Need for Conservation

As expanding human population resulted into expanding needs of man, man started utilizing natural resources at a much larger scale with scientific progress and technological development. Continuous increase in population caused and increasing demand for resources. It created a situation when the non-renewable resources are likely to come to an end after some time. In fact, we would be



using all those resources, which are, in real sense, the property future generation. As such, there must be some sort of balance between the population growth and the utilization of natural resources.

It is apparent to all of us that, the non-availability of resources leads to their pricerise which has an adverse affect on the economics of countries. During 1980s the world experienced a state of imbalance between the growth rates of food production and economic development suffered setbacks. We are facing contrary positions.

In some areas, there is not enough water for agriculture and industry. On the country to it in other areas there are problems of waterlogging due to over-irrigation. In some countries much of underground water is being utilized for food grain production. It is resulting in lowering of water table in northern China.

Objectives of conservation

1. To maintain essential ecological processes and life support system;
2. To preserve biological dividers;
3. To ensure that any utilization of species and ecosystems is sutainable.

Categories of Conservation

There are two categories of conservation as under:

(1) In Situ Conservation

This is the conservation of genetic resources through their maintenanced within natural or even human-made ecosystems in which they occur. It includes a system of protected areas of different categories, managed with different



objectives to bring benefit to the society. For example National parks, Sociometries, Nature Reserves, Natural Monuments, Cultural Landscapes, Biosphere Reserve etc. Evidently in situ conservation is not practicable for domesticates.

(2) Ex Situ Conservation

This is conservation outside habitats by perpetuating sample population in genetic resource centers, zoos, botanical gardens, culture collections etc. or in the form of gene pools and gamete storage for fish; germplasm banks for seeds, pollen, semen, ova, cells etc. Plants are more readily maintained than animals. In this kind of conservation vital role is played by seed banks, botanical gardens, pollen storage, tissue culture and genetic engineering.

Under Ministries of Environment and Forests, Agriculture, and Science and Technology a large number of institutions are involved in conservation and utilization of natural resources. Between them, they are dealing with in situ conservation including sphere reserves, national parks. Wildlife sanctuaries and ex situ conservation such as field gene banks, seed and other banks, and utilization involving gene and drug prospecting respectively.

Individuals Role in Conservation of Natural Resources

An individual can play his role in the conservation of natural resources as under:

1. Soil Conservation

An individual can play a vital role in conservation of soil. Main principles of soil conservation are as under:



1. To Protect soil from impact of raindrops.
2. To Slow down the water movement if it flowed along the slope.
3. To slow down the water from moving down the slope in narrow path.
4. To encourage more water to enter the soil.
5. To increase the size of soil particle.

Keeping in view the above said principles an individual may adopt several methods to prevent the loss of soil during its erosion.

Methods of Conservation

Various methods of soil conservation may be broadly arranged into the following types:

(1) Biological Methods

Conservation achieved by the use of plan vegetation cover the following:

- (i) **Agronomic Practices:** In areas with normal farming, where vegetation itself is used for soil protection.
- (ii) **Dry Farming:** In areas with low and moderate rainfall, where normal farming is not possible.
- (iii) **Agrostological Methods :** In areas which are suitable for successful growth of grasses used as soil binders to check soil erosion.

(2) Mechanical Methods

Conservation achieved by supplementing the biological methods with a view to increase the time of concentration of water, to reduce the velocity of water, or afford protection against damage due to run off:



- (i) **Basin Listing:** To construct small basins along the contours.
- (ii) **Contour Terracing:** To construct small basins along the slope to intercept and divert the runoff water.

2. Less exploitation of Resources

We must bear in mind that resource exploitation and pollution are two faces of the same coin since exploitation of resources in one place can become environmental degradation either in the same place or in a remote area. We are aware of the adverse effects on the ocean harvest, which are often caused by man's activities on land. Thus, biocides and persistent inorganic pesticides, which are used to increase crop yields on land, lead to decrease the yields of fish and other proteins from the oceans. Increasing use of biocides for boosting carbohydrate yields on land is likely to lead to such high increase in their concentration in the oceans as to significantly reduce its productivity.

3. Control over Population Increase

We should aim at striving for an optimum instead of maximum, sustainable population size on Earth, and to arrive at the optimum figure after due consideration of the complex environmental problems. The optimum size permits long-term persistence of the population in equilibrium with its environment. The optimum represents that stage when any further addition of more members would result in deterioration of the quality of life of those already present.

4. To Make An Integrated and Holistic Approach in Tackling Environmental Problem



Environmental strategies and programmes must be based on a thorough analysis of technical and economic factors as well as of social and political dimensions of the environmental problem. Such an approach includes an analysis of balance of political forces besides issues of livelihood for disadvantaged groups.

5. Increase in the Plant Cover

The plant cover is essential for the maintenance of the soil in a balanced and healthy state. Over-exploitation of forests and deforestation practices lead to soil erosion with the topsoil washing down the stream. It results in the ruin of soil fertility. We are annually losing millions of tons of nitrogen, phosphorus and potassium through soil erosion. Nearly 5,000 million tons of soil are being annually lost by water erosion, and the loss of valuable nutrients in this way often reaches colossal proportions. It is estimated that thousands of acres of arable soil are also being rendered unfit for farming due to salinity and alkalinity problems. Here it may be mentioned that the Green Revolution has further generated some newer problems of soil fertility depletion, mineral nutrient imbalances, agricultural residues, etc. In some parts of Punjab for instance, paddy straw of the high-yielding rice variety IR- 8 is found responsible for the deterioration in health of cattle because of its abnormally high content of certain mineral salts.

6. Proper Use of Water

Agricultural use of soil is linked with the use of water which is required for irrigation. Much progress has been achieved in the large-scale storage of water in Dams and Reservoirs for agricultural use and for generation of hydroelectric power, but economy in its use is paid no heed. We must remember that policies directed toward the maximum economic yield from a fixed amount of water will



result in maximum conservation and also that planning for the maximum use of water ought to be correlated with planning for the optimum use of land resources.

7. Proper Irrigation for Soil Conservation

The land resources of India have been increasingly degraded. Excessive unplanned canal irrigation without proper drainage and water management has resulted in seepage, water logging and salinity. Seven million hectares are already affected and another ten million are threatened. About 150 million hectare area suffers from wind and water erosion. This results in the loss of valuable topsoil. Rising water tables is also responsible for increasing salinization of farm lands. Soil erosion causes premature silting up on many reservoirs and tanks.

8. Proper Use of Wood

Our country is gifted with a fairly considerable potentiality for increasing the supply of such renewable resources as forests and forest products that could substitute for some of the scarce non-renewable resources. As such, it is advisable to substitute wood and wood products for the non-renewable fuel and energy sources, as has been commonly practiced in villages since times immemorial. Wood has certain advantages as fuel. As compared to coal, its sulphur content and ash content are very low. The ash which is left, can be used as a fertilizer. Wood and vegetable fibres might also some day furnish us certain primary organic chemicals. In our country and other tropical countries wood residues may profitably be converted into liquid and gaseous fuels. This can relieve, to some extent the problem of scarcity of large-scale exploitable oil and coal resources, which are non-renewable ones.



9. Substitution of Biomass for Petroleum Product

Biomass conversion has unique advantages over other commonly used energy technologies. Unlike petroleum or coal, biomass resources are renewable. Conversion of municipal and industrial wastes into useful fuels will serve two purposes as with it:

- (i) The energy supplies are increased, and
- (ii) The environment is cleaned up.

Biomass is amenable to genetic manipulations and is flexible through crop switching.

Biomass encompasses wood chips, sawdust, maize stalks, other vegetable matter, municipal and organic wastes.

10. Fuel Alcohol from Biomass

Ethanol and methanol can be used as fuels or may be blended with petrol and used in a spark type internal combustion engine. These alcohols can be produced from biomass and agricultural residues, etc.

11. Use of Solar Energy

Solar thermal systems are the best developed and simplest of the solar technologies. It is proved that Solar energy can be gainfully conserved by suitable architectural designs that gainfully exploit the site and building materials to turn a building into a solar collector. In Active solar thermal systems the basic unit is the solar collector- a panel commonly made of aluminium, glass, plastic and copper. When fitted to a roof, these panels absorb direct sunlight and transfer heat to a fluid that passes through the collector. The



fluid flows through pipes into the building where it is used to heat water or warm the rooms. The solar cell is a device that converts sunlight directly into electricity. Photovoltaics (solar cells) generate an electromotive force in a material as a result of its absorbing ionizing radiation.

Solar cells have already proved their usefulness in the space exploration programme.

Solar cells successfully developed at the Bhabha Atomic Research Centre in Trombay, Bombay, have been tested in the satellite Bhaskara. They have successfully met part of the power requirement aboard.

EQUITABLE USE OF RESOURCES FOR SUSTAINABLE TO LIFE STYLE

Introduction

Man has a great responsibility to render equitable use of resources capable of inducing significant alternations in the environment either intentionally or inadvertently. He is capable of altering the basic functioning of the atmosphere, hydrosphere, lithosphere and the whole biosphere. The most essential basic attribute of most environments is that they are multidimensional systems of complex relationships in a continuing state of change. It is also generally recognized that the loss of life caused by such calamities as floods, droughts, cyclones and earthquakes, is largely due to the quality of natural environments as well as mankind's misdeeds.

Cragg (1970) has highlighted the link between conservation and quality of human environment. Cragg advocates a study of the biogeochemical cycles disturbed by man. He has pointed out many hazards arising from the recent



marked increases in the CO₂ content of the atmosphere and similar decreases in oxygen level of natural water bodies. He has warned against the present evil practices. If precautions were not observed in time, the earth would not remain inhabitable.

- a) Cragg has listed the following basic arguments for conservation:
- b) Maintenance and perpetuation of environmental quality
- c) Aesthetic considerations;
- d) Food production;
- e) Preservation of gene pools and germplasms;
- f) Ecological diversity.

Methods for Equitable Use of Resources

The following methods may be suggested:

1. Equitable Use of Soil

It is due to our misdeeds that many of our once-fertile soils have been converted to agriculturally unfit alkaline or saline lands or marshlands. More than 25 million hectares of such barren lands are now estimated to be distributed throughout the world. This can be achieved by following the methods mentioned as under:

1. To prepare accurate land use data through remote sensing,
2. A time bound nationwide survey programme of micro-level land use planning giving short and long-term scenarios,
3. To prepare land use classes,



4. To review all existing legislations and to update them and(v) Management plans for land amelioration are to be prepared. This would lead to a dynamic land-use policy.

2. Proper Management of Water Resources

Water is an integral part of land/soil productivity base. Its misuse can cause soil degradation and soil erosion. Water management is necessary for crop yields and other activities. Primary channel flow originates in upper catchments and these watersheds are very important for future.

3. Watershed Management

In India floods bring much havoc causing loss of life and property each year. Due to floods, the plains have become silted with mud and sand, thus affecting the cultivable land areas. Extinction of civilisation in some coastal areas is mainly due to such natural calamities as flood. Flood damage cost the country Rs. 21 crore in 1951, which increased to Rs. 1,130 crore in 1977. the worst suffering states are Assam, Bihar, Orissa, U.P. and West Bengal. Through modern technology and scientific knowledge steps are to be taken. There is need of a proper understanding of the ecosystem so that changes could be forecast well in time. Thus management of rainfall and resultant runoff, which is essential, can be best based on a natural unit called watershed. A watershed is an area bounded by the divide line of water flow. Thus it may be drainage basin or stream. The Himalayas are one of the most critical watersheds in the world. The cast hydroelectric power potential can be harnessed from Himalayan watersheds if proper control measures are taken. They are inclusive of soil and land use survey, soil conservation in catchments of River Valley Projects and flood prone rivers, afforestation or social forestry programmes, Drought Prone



Area Development Programmes and Desert Development and Control of Shifting Cultivation.

4. Afforestation

Top priority should be given to the forestry. Forests occupy central position in nature.

They restore ecological balance of all ecosystems (including desert), maintain biological diversity, act as catchments for soil and water conservation, prevent floods and safeguard future of tribals. We should develop massive afforestation programmes of indigenous and exotic fast growing species for production and protection forestry on suitable land including wasteland. A massive social forestry programme is needed to meet demands of local people for fuel, fodder, timber etc. the two major goals for forestry are:

1. Supply of goods and services to people and industry by a well thought out plan of production,
2. Long term ecological security through conservation of forests cover and its restoration.

The areas where our water regimes are located i.e. Himalayas and Western and Eastern ghats together with catchment areas; National Parks; Sanctuaries, Sacred Groves; Biosphere Reserves and all ecologically fragile areas should be protected from fuel-starved villagers and fodder-starved cattle. For this, public support must be generated in order to fulfil the real goal of eco-development. Such awareness will be very helpful for supply of goods and services to meet the local villager's needs. One very good example of public support is the Chipko Movement of Bishnoi Women in U.P. We, have only about 14% forest



cover, and thus need to plant nearly 70 million hectares of additional land. This can be done by:

- i. Intensive plantations,
- ii. Production/captive plantations.

These are explained as under:

- i. **Intensive plantations:** Intensive plantation is planting all the available land from villagers' fields, to community land, to road/rail sides every available space. Indigenous and/or exotic species can be used for plantations that remove pressure on natural forests. Social/participative/agro-forestry programmes are included in this category.
- ii. **Production/Captive plantations:** Plantations are to be done on fallow land not being used for agriculture; mostly on free grazing lands. A part of such plantations may be used to generate fodder for cattle. Moreover short rotations of indigenous or exotic species are to be preferred over long duration sal or teak.

5. Proper Management of Drinking Water

This Resource (water) is renewable. However, it is subject to abuse and misuse. Infact, most of our water problems, are not those of quantity or even necessarily of quality, but are rather caused by our way of thinking and attitudes. If man learns to live with man on a cooperative basis, the water problem, like many other ecological problems, could be solved. The replenishable ground water resources in India are sufficient to provide assured irrigation to 40 million



hectares. The present level of development is estimated at 25 million hectares, i.e. about 40 per cent of the total irrigation potential created in the country.

Drinking water becomes more significant in a developing country because it serves as a source of micronutrients that are so essential for good health. Deficiency or excess of the essential trace elements can cause disorders. Drinking water is an important source of intake of trace elements.

