

CHAPTER 2

NATURAL RESOURCES

2.1. Introduction to Natural Resources

Any material which can be transformed in a way that it becomes more valuable and useful can be termed as resource. In other words, it is possible to obtain valuable items from any resources. Resource, therefore, are the means to attain given ends. The aspect of satisfaction is so important that we consider a thing or substance a resource, as so long it meets our needs. Life on this planet depends upon a large number of things and services provided by the nature, which are known as Natural Resources. Thus water, air, soil, minerals, coal, forests, crops and wild life are all examples of natural resources.

2.1.1. Classification of natural resources

Depending upon availability of natural resources can be divided into two categories such as (1) renewable and (2) Non renewable resources.

1. Renewable resources

Renewable resources are in a way inexhaustible resources. They have the ability to replenish themselves by means such as recycling, reproduction and replacement. Examples of renewable resources are sunlight, animals and plants, soil, water, etc.

2. Non-Renewable Resources

Non renewable resources are the resources that cannot be replenished once used or perished. Examples of non renewable resources are minerals, fossil fuels, etc.

Resources can also be classified as biotic or abiotic.

a) Biotic resources

These are living resources (e.g. forest, agriculture, fish and wild life) that are able to reproduce or replace them and to increase.

b) Abiotic resources

These are non-living resources (e.g. petrol, land, minerals etc.) that are not able to replace themselves or do so at such a slow rate that they are not useful to consider them in terms of the human life times.

2.1. 3 Problems associated with natural resources

1. The unequal consumption of natural resources

A major part of natural resources today are consumed in the technologically advanced or ‘developed’ world, usually termed ‘the west’. The ‘developing nations’ of ‘the east’, including India and China, also overuse many resources because of their greater human population. However, the consumption of resources per capita (per individual) of the developed countries is up to 50 times greater than in most developing countries. Advanced countries produce over 75% of global industrial waste and greenhouse

gases.

2. Planning land use

Land is a major resource, needed for not only for food production and animal husbandry, but also for industry and growing human settlements. These forms of intensive land use are frequently extended at the cost of ‘wild lands’, our remaining forests, grasslands, wetlands and deserts. This demands for a pragmatic policy that analyses the land allocation for different uses.

3. The need for sustainable lifestyles

Human standard of living and the health of the ecosystem are indicators of sustainable use of resources in any country or region. Ironically, both are not in concurrence with each other. Increasing the level of one, usually leads to degradation of other. Development policies should be formulated to strike a balance between the two.

2.2. 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.

Uses of forests

Forest can provide prosperity of human being and to the nations. Important uses of forest can be classified as under

- Commercial values
- Ecological significance
- Aesthetic values
- Life and economy of tribal

Commercial values

- Forests are main source of many commercial products such as wood, timber, pulpwood etc. About 1.5 billion people depend upon fuel wood as an energy source. Timber obtained from the forest can be used to make plywood, board, doors and windows, furniture, and agriculture implements and sports goods. Timber is also a raw material for preparation of paper, rayon and film.
- Forest can provide food, fibre, edible oils and drugs.
- Forest lands are also used for agriculture and grazing.
- Forest is important source of development of dams, recreation and mining.

Life and economy of tribal

Forests provide food, medicine and other products needed for tribal people and play a vital role in the life and economy of tribes living in the forest.

Ecological uses

Forests are habitat to all wild animals, plants and support millions of species. They help in reducing global warming caused by green house gases and produces oxygen upon photosynthesis.

Forest can act as pollution purifier by absorbing toxic gases. Forest not only helps in soil conservation but also helps to regulate the hydrological cycle.

Aesthetic values

All over the world people appreciate the beauty and tranquillity of the forest because forests have a greatest aesthetic value. Forest provides opportunity for recreation and ecosystem research.

2.2.1. Over exploitation of forests

Forests contribute substantially to the national economy. With increasing population increased demand of fuel wood, expansion of area under urban development and industries has led to over exploitation of forest. At present international level we are losing forest at the rate of 1.7 crore hectares annually.

Overexploitation also occurs due to overgrazing and conversion of forest to pastures for domestic use.

2.2.2. Deforestation

1. Forests are burned or cut for clearing of land for agriculture, harvesting for wood and timber, development and expansion of cities. These economic gains are short term whereas long term effects of deforestation are irreversible
2. Deforestation rate is relatively low in temperate countries than in tropics. If present rate of deforestation continues we may lose 90% tropical forest in coming six decades

3. For ecological balance 33% area should be under forest cover but our nation has only 20.6% forest cover.

Causes of deforestation

Forest area in some developed area has expanded. However in developing countries area under forest is showing declining trend particularly in tropical region. Main causes of deforestation are

a) Shifting cultivation or jhum cultivation

This practice is prevalent in tribal areas where forest lands are cleared to grow subsistence crops. It is estimated that principle cause of deforestation in tropics in Africa, Asia and tropical America is estimated to be 70, 50, and 35% respectively. Shifting cultivation which is a practice of slash and burn agriculture are posses to clear more than 5 lakh hectares of land annually. In India, shifting cultivation is prevalent in northeast and to limited extent in M.P, Bihar and Andhra Pradesh and is contributing significantly to deforestation.

b) Commercial logging

It is a important deforestation agent. It may not be the primary cause but definitely it acts as secondary cause, because new logging lots permits shifting cultivation and fuel wood gatherers access to new logged areas.

c) Need for fuel wood

Increased population has lead to increasing demand for fuel wood which is also acting as an important deforestation agent, particularly in dry forest.

d) Expansion for agribusiness

With the addition of cash crops such as oil palm, rubber, fruits and ornamental plants, there is stress to expand the area for agribusiness products which results in deforestation.

e) Development projects and growing need for food

The growing demand for electricity, irrigation, construction, mining, etc. has lead to destruction of forest. Increased population needs more food which has compelled for increasing area under agriculture crops compelling for deforestation.

f) Raw materials for industrial use

Forest provides raw material for industry and it has exerted tremendous pressure on forest. Increasing demand for plywood for backing has exerted pressure on cutting of other species such as fir to be used as backing material for apple in J&K and tea in northeast states.

Major effects of deforestation

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

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

2.2.3. Case studies

1. Jhum cultivation

Jhum Agriculture or shifting agriculture has destroyed large number of hectare of forest tracts in North-Eastern states and Orissa. Jhum agriculture is subsidence agriculture in which tract of forest land is cleared by cutting trees and it is used for cultivation. After few years, when productivity of the land decreases, cultivators abandon the land and clear next tract. As a result of this practice, combined with increasing population there is rapid deforestation as more and more cultivators clear forest to cultivate land. Also, with increase in population there is cultivators are forced to return to previous tracts of land in relatively shorter durations, not allowing the land to regain its productivity.

2. Chipko movement

The Chipko movement or Chipko Andolan is a social-ecological movement that practiced the Gandhian methods of satyagraha and non-violent resistance, through the act of hugging trees to protect them from being felled. The modern Chipko movement started in the early 1970s in the Garhwal Himalayas of Uttarakhand,with growing awareness towards rapid deforestation. The landmark event in this struggle took place on March 26, 1974, when a group of peasant women in Reni village, Hemwalghati, in Chamoli district, Uttarakhand, India, acted to prevent the cutting of trees and reclaim their traditional forest rights that were threatened by the contractor system of the state Forest Department. Their actions inspired hundreds of such actions at the grassroots level throughout the region. By the 1980s the movement had spread throughout India and led to formulation of people-sensitive forest policies, which put a stop to the open felling of trees in regions as far reaching as Vindhya and the Western Ghats.

3. Western himalayan region.

Over the last decade, there has been widespread destruction and degradation of forest resources in Himalayas, especially western Himalayas. This has resulted in various problems such as erosion of top

soil, irregular rainfall, changing weather patterns and floods. Construction of roads on hilly slopes, have not only undermined their stability, but also damaged protective vegetation and forest cover. Tribes in these areas are increasingly facing shortage of firewood and timber, due large scale tree cutting. Increased traffic volumes on these roads leads to increased pollution in the area.

2.2.4. Timber extraction

There has been unlimited exploitation of timber for commercial use. Due to increased industrial demand; timber extraction has significant effect on forest and tribal people.

Logging

- Poor logging results in degraded forest and may lead to soil erosion especially on slopes.
- New logging roads permit shifting cultivators and fuel wood gatherers to gain access to the logging area.
- Loss of long term forest productivity
- Species of plants and animals may be eliminated
- Exploitation of tribal people by contractor.

2.2.5. Mining

Major effects of mining operations on forest and tribal people are:

- Mining from shallow deposits is done by surface mining while that from deep deposits is done by sub-surface mining. It leads to degradation of lands and loss of top soil. It is estimated that about eighty thousands hectare land is under stress of mining activities in India
- Mining leads to drying up perennial sources of water sources like spring and streams in mountainous area.
- Mining and other associated activities remove vegetation along with underlying soil mantle, which results in destruction of topography and landscape in the area. Large scale deforestation has been reported in Mussorie and Dehradun valley due to indiscriminating mining.
- The forested area has declined at an average rate of 33% and the increase in non-forest area due to mining activities has resulted in relatively unstable zones leading to landslides.
- Indiscriminate mining in forests of Goa since 1961 has destroyed more than 50000 ha of forest land. Coal mining in Jharia, Raniganj and Singrauli areas has caused extensive deforestation in Jharkhand.

- Mining of magnetite and soapstone have destroyed 14 ha of forest in hilly slopes of Khirakot, Kosi valley and Almora.
- Mining of radioactive minerals in Kerala, Tamilnadu and Karnataka are posing similar threats of deforestation.
- The rich forests of Western Ghats are also facing the same threat due to mining projects for excavation of copper, chromites, bauxite and magnetite.

2.2.6. Effects of dams on forests and tribal people

India is one of the largest dam-building nations in the world and the fact is that dams are the single largest cause of human displacement in India and account for 75 per cent to 80 per cent of displacement of about four to five crore people.

The impact of large dams on forests and on the lifestyle and identity of tribal people is extremely high. Almost 40 per cent of those displaced by dams belong to scheduled tribes and 20 per cent to schedule castes. Only 25 per cent of the displaced people have been rehabilitated so far.

A government report based on a study of 110 dam projects stated that more than 50 per cent of the total 1.69 million people displaced by these projects were tribals. This means that the tribal communities which account for just 8 per cent of India's total population constitute about 40 per cent of the displaced persons. About 92 per cent of the tribal people in India live in rural areas which are dry, forested or hilly. Most of them depend on agriculture and minor forest produce for sustenance. These largely self-sufficient tribal communities live in close proximity to forests, rivers and mountains. Since these areas are rich in natural resources they are most likely to be developed for dams, mines, industries and so on.

Immediately after Independence, only a few dams were built in tribal areas. However, by the 1970s, when the resources in more accessible areas were exhausted, more dams were planned in tribal areas thereby displacing a large number of tribal people.

Tribals are socially, economically and politically the weakest and the most deprived community in India. They have been evicted from their ancestral homes and are either forced to migrate to urban slums in search of employment or become landless labourers in rural areas to pay the price of development'. Unfortunately, tribal people hardly get to share the benefits of development projects that cause their displacement. They are always forced to live without the basic amenities like roads, electricity, transport, communication, healthcare, drinking water or sanitation. On the contrary, a majority of them end up with less income than before, less work opportunities, inferior houses, less access to the resources of the common people such as fuel wood and fodder, poor nutrition and poor physical and mental health.

Developmental projects have invariably led to the dispersal of communities, the breakdown of traditional support systems and the devaluation of their cultural identity. Therefore, the government should devise a strategy to minimize tribal displacement. It must ensure 100 per cent rehabilitation and make sure that the fruits of development are shared with the dispersed people as well. It must augment the rehabilitation of the displaced persons of previous projects, protect the customary rights of the tribal people over natural resources and take their opinions into consideration for future projects.

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 Uttarakhand 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 Bahuguna, 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 marvelous 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.

2.3. WATER RESOURCES

Water resources are sources of water that are potentially useful. Uses of water include agricultural, industrial, household, recreational and environmental activities. The majority of human uses require fresh water. 97% of the water on the Earth is salt water and only three percent is fresh water; slightly over two thirds of this is frozen in glaciers and polar ice caps. The remaining unfrozen fresh water is found mainly as ground water, with only a small fraction present above ground or in the air.

Fresh water is a renewable resource, yet the world's supply of ground water is steadily decreasing. The depletion is occurring most prominently in Asia, South America and North America. The framework for allocating water resources to water users (where such a frame-work exists) is known as water rights.

2.3.1. Surface water and Ground water use and over exploitation

Surface water is water in a river, lake or fresh water wetland. Surface water is naturally replenished by precipitation and naturally lost through discharge to the oceans, evaporation, evapo transpiration and groundwater recharge. Although the only natural input to any surface water system is precipitation within its watershed, the total quantity of water in that system at any given time is also dependent on many other factors. These factors include storage capacity in lakes, wetlands and artificial reservoirs, the permeability of the soil beneath these storage bodies, the runoff characteristics of the land in the watershed, the timing of the precipitation and local evaporation rates. All of these factors also affect the proportions of water loss.

Human activities can have large and sometimes devastating impact on these factors. Humans often increase storage capacity by constructing reservoirs and decrease it by draining wetlands. Humans increase runoff quantities and velocities by paving areas and channelizing the stream flow. The total quantity of water available at any given time is an important consideration. Some human water users have an intermittent need for water. For example, many farms require large quantities of water in the spring, and no water at all in the winter. To supply such a farm with water, a surface water system may require a large storage capacity to collect water throughout the year and release it in a short period of time. Other users have a continuous need for water, such as a power plant that requires water for cooling. To supply such a power plant with water, a surface water system only needs enough storage capacity to fill in when the average stream flow is below the power plant's need.

Nevertheless, over long term, the average rate of precipitation within a watershed is the upper bound for average consumption of natural surface water from that watershed.

Natural surface water can be augmented by importing surface water from another water-shed through a canal or pipeline. It can also be artificially augmented from any of the other sources; however, in practice the quantities are negligible.

Brazil is the country estimated to have the largest supply of fresh water in the world, followed by Russia and Canada.

Groundwater is fresh water located in the subsurface pore space of soil and rocks. It is also water that is flowing within aquifers below the water table. Sometimes it is useful to make a distinction between ground water that is closely associated with surface water and deep groundwater in an aquifer (sometimes called “fossil water”).

Ground water can be thought of in the same terms as surface water: inputs, outputs and storage. The critical difference is that due to its slow rate of turnover, groundwater storage is generally much larger (in volume) compared to inputs than it is for surface water. This difference makes it easy for humans to use groundwater unsustainably for a long time with-out severe consequences. Nevertheless, over the long term, the average rate of seepage above a ground water source is the upper bound for average consumption of water from that source.

The natural input to groundwater is seepage from surface water. The natural outputs from ground water are springs and seepage to the oceans.

If the surface water source is also subject to substantial evaporation, a ground water source may become saline. This situation can occur naturally under endorheic bodies of water, or artificially under irrigated farmland. In coastal areas, human use of a ground water source may cause the direction of seepage to ocean to reverse which can also cause soil salinization. Humans can also cause ground water to be “lost” (i.e become unusable) through pollution. Human can increase the input to a ground water source by building reservoirs or detention ponds.

Ground water depletion is primarily caused by sustained ground water pumping. Some of the negative effects of ground water depletion are:

- \ Lowering of the Water Table

Excessive pumping can lower the ground water table, and cause wells to no longer be able to reach ground water.

- \ Increased Costs

As the water table lowers, the water must be pumped farther to reach the surface, using more energy. In extreme cases, using such a well can be cost prohibitive.

•\ Reduced Surface Water Supplies

Ground water and surface water are connected. When groundwater is overused, the lakes, streams, and rivers connected to ground water can also have their supply diminished.

•\ Land Subsidence

Land subsidence occurs when there is a loss of support below ground. This is most often caused by human activities, mainly from the overuse of ground water, when the soil collapses, compacts and drops.

•\ Water Quality Concerns

Excessive pumping in coastal areas can cause salt water to move inland and upward, resulting in salt water contamination of the water supply.

Case Study 4

Coca-Cola ground water exploitation in Kerala

In 1999, the Hindustan Coca-Cola Beverages Private Limited, a subsidiary of the Atlanta based Coca-Cola Company, established a plant in Plachimada, in the Palakkad district of Kerala, southern India. The Perumatty Village Council gave a license to the company to commence production in 2000. Coca-Cola drew around 510,000 litres of water each day from boreholes and open wells. For every 3.75 litres of water used by the plant, it produced one litre of product and a large amount of waste water.

Local residents started to protest after two years. Local communities complained that water pollution and extreme water shortages were endangering their lives. In 2003, women from the Vijayanagaram Colony in the village of Plachimada, protested that their wells had dried up because of the over exploitation of groundwater resources by the Coca-cola plant. In April 2003, the Perumatty Grama Panchayat (Village Council) refused renewal of Coca-Cola's license to operate on the grounds that it was not in the public interest to renew the license stating:

“...the excessive exploitation of ground water by the Coca-Cola Company in Plachimada is causing acute drinking water scarcity in Perumatty Panchayat and nearby places...” The Village Council considered revocation of the license to be necessary in order to protect the interests of local people.

Since December 2003, various cases were filed by the accused and Perumatty Grama Panchayat. Finally in 2017, the Supreme Court of India ordered Coca-cola company authorities not to resume operations at Plachimada, thus ending a 12-year-long legal battle with local people.

2.3.2. Conflicts over water

Water conflict is a term describing the conflict between countries, states, or groups over access to water resources. The United Nations recognizes that water disputes result from opposing interests of water users- public or private.

A wide range of water conflicts appear throughout history, though rarely are traditional wars waged over water alone. Instead, water has historically been a source of tension and a factor in conflicts that start for other reasons. However, water conflicts arise for several reasons, including territorial disputes, a fight for resources, and strategic advantage. A comprehensive online database of water-related conflicts-the Water Conflict Chronology-has been developed by the Pacific Institute. This database lists violence over water going back nearly 5,000 years.

These conflicts occur over both fresh water and salt water, and both between and within nations. However conflicts occur mostly over fresh water; because fresh water resources are necessary, yet limited. They are the center of water disputes arising out of need for potable water and irrigation. As freshwater is a vital, yet unevenly distributed natural resource, its availability often impacts the living and economic conditions of a country or region. The lack of cost-effective water supply options in areas like the Middle East, among other elements of water crises can put severe pressure on all water users, whether corporate, government, or individual, leading to tension and possibly, aggression. Recent humanitarian catastrophes, such as the Rwandan Genocide or the war in Sudanese Darfur, have been linked to water conflicts.

Case study 5

Kaveri river water issue

The sharing of waters of the Kaveri River has been the source of a serious conflict between the two states of Tamil Nadu and Karnataka. The genesis of this conflict rests in two agreements in 1892 and 1924 between the erstwhile Madras Presidency and Kingdom of Mysore. The 802 kilometers Kaveri river has 44,000 Km² area in Tamil Nadu and 32,000 Km² basin area in Karnataka. The inflow from Karnataka is 425 TMC ft whereas that from Tamil Nadu is 252 TMC ft.

Based on inflow, Karnataka is demanding its due share of water from the river. It states that the pre-independence agreements are invalid and are skewed heavily in the favour of the Madras Presidency and has demanded a renegotiated settlement based on “equitable sharing of the waters”. Tamil Nadu, on the other hand, pleads that it has already developed almost 3,00,000 acres (12,000 Km²) of land and as a result, has come to depend very heavily on the existing pattern of usage. Any change in this pattern, it says, will adversely affect the livelihood of millions of farmers in the state.

Decades of negotiations between the parties bore no fruit. The Government of India then constituted a tribunal in 1990 to look into the matter. After hearing arguments of all the parties involved for the next 16 years, the tribunal delivered its final verdict on 5th February 2007. In its verdict, the tribunal allocated 419 TMC of water annually to Tamil Nadu and 270 TMC to Karnataka; 30 TMC of Kaveri river water to Kerala and 7 TMC to Puducherry. Karnataka and Tamil Nadu being the major shareholders, Karnataka was ordered to release 192 TMC of water to Tamil Nadu in a normal year from June to May. The dispute however, did not end there, as all four states decided to file review petitions seeking clarifications and possible renegotiation of the order.

2.3.3. Dams – benefits and problems

A dam is a barrier that impounds water or underground streams. Dams generally serve the primary purpose of retaining water apart from managing or preventing water flow into specific land regions eg: Bakranamgal, Hirakud, Mullapaeriyar Dam, Damodar Valley Dam etc.

Dams are built across rivers to store water for irrigation, hydroelectric power generation and flood control. The dams built to serve more than one purpose are called “multi-purpose dams”. These dams were called the “temples of modern India” by the country’s first Prime Minister, Jawaharlal Nehru.

Benefits of dams:

- 1.\ Dams are built to control flood and store flood water
- 2.\ Sometimes dams are used for diverting part or all of the water from river into a channel.
- 3.\ Water in dams are used mainly for drinking and agricultural purposes.
- 4.\ Dams are built for generating electricity
- 5.\ Dams are used for recreational purpose
- 6.\ Navigation and fishery can be developed in the dam areas.

Problems of dams – Dams may face problems upstream or downstream as listed below:

Upstream problems:-

- 1.\ Displacement of tribal people
- 2.\ Loss of non-forest land
- 3.\ Loss of forests, flora and fauna
- 4.\ Landslides, sedimentation and siltation occurs
- 5.\ Stagnation and water logging around reservoirs retards plant growth

- 6.\ Breeding of vectors and vector-borne diseases
- 7.\ Reservoir Induced Seismicity (RIS) causes earthquakes
- 8.\ Navigation and aquaculture activities can be developed in the dam area

Down stream problems:

- 1.\ Water logging and salinity due to over irrigation
- 2.\ Reduced water flow and silt deposition in rivers
- 3.\ Salt intrusion at river mouth
- 4.\ Since the sediments carrying nutrients gets deposited in the reservoir, the fertility of the land along the river gets reduced
- 5.\ Structural defects or faulty design of the dam may cause sudden dam failure leading to collapse and destruction to life and property.

2.4. MINERAL RESOURCES-USE AND EXPLOITATION

2.4.1. Use and Exploitation

A mineral is pure, inorganic substance that occurs naturally in the Earth's crust. All of the Earth's crust, except the rather small proportion of the crust that contains organic material, is made up of minerals. Some minerals consist of a single element such as gold, silver, diamond (carbon), and sulphur. Minerals provide the material used to make most of the things of industrial – based society: roads, cars, computers, fertilizers, etc. Demand for minerals is increasing world wide as the population increases and the consumption demands of individual people increase. The mining of earth's natural resources is, therefore accelerating, and it has accompanying environmental consequences.

More than two-thousand minerals have been identified and most of these contain inorganic compounds formed by various combinations of the eight elements (O, Si, Al, Fe, Ca, Na, K, and Mg) that make up 98.5% of the Earth's crust. Industry depends on about 80 of the known minerals.

A mineral deposit is a concentration of naturally occurring solid, liquid, or gaseous material, in or on the Earth's crust in such form and amount that its extraction and its conversion into useful materials or items are profitable now or may be so in the future. Mineral resources are non renewable and include metals (e.g. iron, copper, and aluminum) and non-metals (e.g. salt, gypsum, clay, sand, phosphates).

Minerals are valuable natural resources that are finite and non-renewable. They constitute the vital raw materials for many basic industries and are a major resource for development. therefore, Management of

mineral resources has, to be closely integrated with the overall strategy of development; and exploitation of minerals is to be guided by long-term national goals and perspectives.

The use of minerals varies greatly between countries. The greatest use of minerals occurs in developed countries. Like other natural resources, mineral deposits are unevenly distributed around on the earth. Some countries are rich in mineral deposits and other countries have no deposits. The use of the mineral depends on its properties. For example, aluminum is light but strong and durable, so it is used for aircraft, shipping and car industries.

Recovery of mineral resources has been with us for a long time. Early Paleolithic man found flint arrowheads and clay for pottery before developing codes for warfare. This was done without geologists for exploration, mining engineers for recovery or chemists for extraction techniques. Tin and copper mines were necessary for a Bronze Age; gold, silver, and gemstones adorned the wealth of early civilizations; and iron mining introduced a new age of man.

Human wealth basically comes from agriculture, manufacturing, and mineral resources. Our complex modern society is built around the exploitation and use of minerals resources. Since the future of humanity depends on minerals resources, we must understand that these resources have limits; our known supply of minerals will be used up early in the third millennium of our calendar.

Furthermore, modern agriculture and the ability to feed an overpopulated world is dependent on mineral resources; to construct the machines that till the soil, enrich it with mineral fertilizers and to transport the products.

We are now reaching limits of reserves for many minerals. Human population growth and increased industrialization are depleting our available resource at increasing rates. The pressure of human growth upon the planet's resources is a very real problem.

The consumption of natural resources proceeded at a phenomenal rate during the past hundred years and population and production increases cannot continue without increasing pollution and depletion of mineral resources.

2.4.2. Environmental effects of mineral extraction

The scale and level of requirement of minerals have increased manifold in our country and it is heading towards the stage where much larger consumption of minerals will be inevitable to sustain even the minimum growth rate of our economy.

It is pertinent to note that out of the total land area of the country (3.29 million sq.kms), the area leased out of mining, as on 1-9-94, was 7126.13 sq.kms. Comprising about 9,213 mining leases, excluding atomic

minerals, minor minerals, petroleum and natural gas, this constitutes only about 0.25 per cent of the geographic area of the country and that including atomic minerals and minor minerals it may be around 0.28 per cent of the total area.

Although the area occupied for mining activity is small, the damage to the environment on account of mining is causing grave concern. Environmental degradation resulting from mining activity in general can be briefly enumerated as flows:

- 1.\ Air pollution with dust and gases due to drilling, blasting, mine haulage and transportation by road, and also from waste heaps.
- 2.\ Water pollution when atomic elements and other harmful elements are present in the ore/mineral mine effluents.
- 3.\ Modifying water regimes such as surface flow, ground water availability and lowering down of water table.
- 4.\ Soil erosion, soil modification with dust and salt.
- 5.\ Noise and vibration problem in the mine and adjoining habitat including wild life.
- 6.\ Alteration of the landform.
- 7.\ Deforestation affecting flora and fauna; and
- 8.\ Spoiling aesthetics with untreated waste dumps

Case Study 6

Mining and Quarrying in Udaipur

About 200 open cast mining and quarrying centers in Udaipur, about half of which are illegal, are involved in stone mining including soapstone, building stone, rock phosphate and dolomite. The mines spread over 1500 hectares in Udaipur have caused many adverse impact on environment. About 150 tons of explosives are used per month in blasting. The overburden, wash off, discharge of mine water etc. pollute the water. The Maton mines have badly polluted the Aharriver. The hills around the mines are devoid of any vegetation except a few scattered patches and the hills are suffering from acute soil erosion. The waste flows towards a big tank of “Bag Dara”. Due to scarcity of water, people are compelled to use this effluent for irrigation purpose. The blasting activity has adversely affected the fauna and the animals like tiger, lion, deer and even hare, fox, wild cats and birds have disappeared from the mining area.

2.5. FOOD RESOURCES

Food is usually of plant or animal origin, and contains essential nutrients, such as carbohydrates, fats, proteins, vitamins, or minerals. The substance is ingested by an organism and assimilated by the organism's cells to provide energy, maintain life, or stimulate growth. Historically, humans secured food through two methods: hunting and gathering and agri-culture. Today, the majority of the food energy required by the ever increasing population of the world is supplied by the food industry.

Food safety and food security are monitored by agencies like the International Association for Food Protection, World Resources Institute, World Food Programme, Food and Agriculture Organization, and International Food Information Council. They address issues such as sustainability, biological diversity, climate change, nutritional economics, population growth, water supply, and access to food.

The food resources are a composite of the goods (the foodstuffs) and the services in commerce and distribution through which these are made available for consumption.

The 3 major sources of food for humans are: - the croplands, the rangelands and fisheries.

- The croplands provide the bulk amount of food for human. Though there are thousands of edible plants in the Earth, solely 4 are essential crops ; potatoes, rice, wheat and corn account for many of the caloric consumption of human beings. Few animals are raised for milk, meat and eggs (for example. poultry, cattle and pigs)
- The rangelands provide a different source of milk and meat from animals.
- The fisheries provide fish which are a major source of animal protein in the Earth, particularly in coastal areas and Asia.

Most food has its origin in plants. Some food is obtained directly from plants; but even animals that are used as food sources are raised by feeding them food derived from plants. Cereal grain is a staple food that provides more food energy worldwide than any other type of crop. Corn (maize), wheat, and rice in all of their varieties account for 87% of all grain production worldwide. Most of the grain that is produced worldwide is fed to livestock.

Food products produced by animals include milk produced by mammary glands, which in many cultures is consumed raw or processed into dairy products (cheese, butter, etc.). In addition, birds and other animals lay eggs, which are often eaten, and bees produce honey, reduced nectar from flowers, which is a popular sweetener in many cultures.

Some cultures and people do not consume meat or animal food products for cultural, dietary, health, ethical, or ideological reasons. Vegetarians choose to forgo food from animal sources to varying degrees. Vegans do not consume any foods that are or contain ingredients from an animal source.

2.5.1. World Food Problems

Food is essential to survive. There are three degrees of hunger: acute, chronic, and hidden. Famine is caused by food shortage and the inability of people to obtain food. It is usually caused by low food production resulting from drought, other factors, or it could be a result of the inability of a country or its population to afford to buy food.

Every year, 15 million children die of hunger. It is estimated that 925 million people in the world do not have enough to eat. The WHO estimates that one-third of the world population is well-fed, one third is under-fed and one-third is starving. There are many factors that have contributed in making food security one of the most important global issues. An increasing population wants a more varied diet, but trying to grow more food on less land with limited access to water, all the time facing increased costs for fertilizer, and fuel for storage and transport poses great problems for which there are no easy solutions.

The available water is decreasing at an alarming rate. This warns us that there is not going to be enough water on the agricultural land that is needed for producing enough food in order to feed the projected population of 9 billion people by 2050. Also, the food prices have skyrocketed in the past few years making it difficult for average earners to afford a three course meal. These effects are witnessed in developing countries that rely heavily on imported food, such as North Africa, Latin America, and Middle East.

Currently, the world food situation is being defined by some new driving forces. These include climate change, globalization, urbanization, energy prices, and income growth as they are responsible in transforming food production, consumption and markets. The security of food in the world depends from the available food supply, the income of the targeted population, accessibility of food, food consumption rate, as well as the amount that can be stocked for future use.

• The Problem of Distribution of Food

In the world today, there are many people dying because of the shortage of food, however, there are also many people who are obese. So evidently there is a problem in the way food is distributed .There are wide gaps of economy between countries. In short, the problem of “distribution” is to devise ways to feed

people in the world with no shortage. If the world population grows in current pace, the amount of production of food crops is said to be unable to catch up with the population in the future.

Case Study 7

In May 2008 Cyclone Nargis devastated much of the southern part of Myanmar, causing 4000 deaths, displacing nearly 1,00,000 people and disrupting food supplies so badly as to create a real risk of famine. The government could not provide the required emergency aid or accept help from other countries. Four months later, parts of Myanmar were struck by another natural disaster — a plague of rats.

Once every 50 years or so, bamboo plants in the western part of Myanmar produce a fruit. The fruit attracts hordes of rats, which feed on its seeds. These seeds are rich in nutrients and allow the rats to multiply rapidly. Once the seeds have been devoured, the hungry rats turn on villagers' crops, destroying rice and maize, bringing the inhabitants to the brink of starvation. The Chin region was the part of Myanmar worst hit by the plague of rats. An estimated 20% of the population were thought to be in immediate need of food aid.. Despite appeals, little or no emergency food aid was sent to the area. In desperation, many people migrated and sought food and help in India.

2.5.2. Changes Caused by Agriculture and overgrazing

Agriculture is the world's oldest and largest industry. Agriculture has both primary and secondary environmental effects. A primary effect is an effect on the area where the agriculture takes place i.e. on-site effect. A secondary effect, also called an off-site effect, is an effect on an environment away from the agricultural site.

The effects of agriculture on the environment can be broadly classified into three groups, viz. global, regional and local.

(1) Global Effects: These include climate changes as well as potentially extensive changes in chemical cycles.

(2) Regional Effects: This is caused by the combined effects of farming practices in the same large region. Regional effects include deforestation, desertification, large scale pollution, increase in sedimentation in major rivers and in the estuaries at the mouths of the rivers and changes in the chemical fertility of soils over large areas. In tropical waters, sediments entering the ocean can destroy coral reefs.

(3) Local Effects: Soil erosion and increase in sedimentation downstream in local rivers in the vicinity of the agricultural land can be called local effects. Fertilizers carried by sediments can also transport toxins and destroy the local fish population.

The environmental impact of agriculture is the effect that different farming practices have on the ecosystems around them. The environmental impact depends on the production practices of the system used by farmers. There are two types of indicators of environmental impact: “means-based”, which is based on the farmer’s production methods, and “effect-based”, which is the impact that farming methods have on the farming system or on emissions to the environment.

The environmental impact of agriculture involves a variety of factors from the soil, to water, the air, animal and soil variety, people, plants, and the food itself. Some of the environmental issues that are related to agriculture are climate change, deforestation, genetic engineering, irrigation problems, pollutants, soil degradation, and waste.

2.5.3. Problems of Modern Agriculture

Agriculture is the management of the growth of plants and animals for human use. Agriculture includes preparation of soil for cultivation of crops, harvesting crops, breeding and raising livestock, dairying and forestry.

The two major types of agriculture are:

- Traditional agriculture
- Modern or Industrialized agriculture

The development of agriculture was achieved in terms of:

1. Expansion and/or conversion of agricultural lands
2. Increased agricultural productivity
3. Multiple-cropping pattern
4. Conversion of single-cropping system to two tier and / or three tier cultivation

In due course of time, agricultural development became possible due to

- (a) Development of modern scientific techniques
- (b) Advanced technology
- (c) Expansion of irrigational facilities
- (d) Use of chemical fertilizers
- (e) Use of pesticides and insecticides
- (f) Development and use of high yielding varieties of seeds
- (g) Mechanization of agriculture
- (h) Varying crop sequences

It will be difficult for us to maintain our present standard of living and current consumption-pattern if we continue to destroy land. Considering this, it becomes essential to understand the related incidences causing environmental degradation.

Pests and diseases such as gall midge, brown plant hopper, bacterial blight and tungro virus (or paddy) considered as minor diseases earlier to the Green Revolution suddenly appeared as major diseases.

Agricultural losses due to such pests and/or diseases increased tremendously since the high-yielding varieties were more prone to pests and diseases. Naturally, use of pesticides increased and this brought about widespread occurrence of pesticide-residues practically in every agricultural produce, widespread pesticide resistance in vectors and finally even resistance to pesticides in stored grains.

Such pesticide resistance to wards pests of agricultural importance became a major constraint in improving agricultural productivity.

2.5.4. Fertilizer and Pesticide Problems

To assure enhanced productivity in areas where intensive cultivation has been initiated, increased application of chemical fertilizers supplying the plant nutrients has become an essential component of modern agriculture.

Fertilizer application in South Asia including India has multiplied with widespread introduction of the Green Revolution. The number of fertilizer plants has gone up and the production has multiplied.

Problems caused by using Fertilizers:

1. Micronutrient imbalance: Chemical fertilizers used in modern agriculture contain Nitrogen, Phosphorus and Potassium (N,P,K) which are macronutrients. Excess use of fertilizers in fields causes micronutrient imbalance. Ex: Excessive use of fertilizers in Punjab and Haryana caused deficiency of micronutrient Zinc thereby affecting productivity of soil.
2. Nitrate pollution: Excess Nitrogenous fertilizers applied in fields contaminates the groundwater.
3. Eutrophication: The application of excess fertilizers in fields leads to wash off of the nutrient loaded water into nearby lakes causing over-nourishment. This is called “Eutrophication”. Eutrophication causes the lakes to be attacked by “algal blooms”. Algal blooms use up nutrients rapidly and they die and pollute water thereby affecting aquatic life in the lakes.

Problems in using Pesticides :

In order to improve crop yield, pesticides are used indiscriminately in agriculture. Pesticides are of two types:

1. First generation pesticides that use Sulphur, Arsenic, Lead or Mercury to kill pests
2. Second generation pesticides such as Dichloro Diphenyl Trichloroethane (DDT) used to kill pests. These pesticides are organic in nature

Although pesticides protect our crops from severe losses due to pests, they have several side-effects as listed below:

- Death of non-target organisms: Several insecticides kill not only the target species but also several beneficial non-target organisms
- Pesticide resistance: Some pests that survive the pesticide generate highly resistant generations that are immune to all kinds of pesticides. These pests are called “superpests”
- Bio-magnification: Most pesticides are non-biodegradable and accumulate in the food chain. This is called bioaccumulation or bio-magnification. These pesticides in a biomagnified form are harmful to human beings.
- Risk of cancer: Pesticide enhances the risk of cancer in two ways (i) It acts as a carcinogen and (ii) It indirectly suppresses the immune system.

Case Study 8

Potato farmers in the province of Carchi in northern Ecuador suffer a number of health problems caused by high exposure to chemical insecticides. The dangers to both workers and their families are heightened by the fact that the most commonplace pesticides used in Ecuador are also among the world's most dangerous. Carbofuran (used to control the Andean weevil) and methamidophos (used to combat foliage pests) account for 47 percent and 43 percent, respectively, of all active insecticide ingredients applied in Carchi. Both of those chemicals are classified as highly toxic by the World Health Organization and are restricted in Northern countries because of their acute toxicity and ease of absorption. Exposure to pesticides such as these is associated with genetic and reproductive disorders and cancers, dermatitis and other skin problems, as well as neurological disorders. In the Carchi case, scientists have also speculated that the high rate of suicide may be related to the mood-altering effects of pesticide exposure.

2.5.5. Water logging

If water stands on land for most of the year, it is called water logging. Water logging refers to the saturation of soil with water. Soil may be regarded as waterlogged when it is saturated with water much of the time such that its air phase is restricted. In water logged conditions the soil gets filled with water and soil-air gets depleted. In such a condition the roots of plants do not get enough air for respiration. Water logging also leads to low crop yield. In agriculture, various crops need air. In irrigated agricultural land, water logging is often accompanied by soil salinity.

Causes of Water logging:

1. Excessive water supply to the croplands
2. Heavy rain
3. Poor drainage

Measures To Prevent Water Logging:

1. Avoid and prevent excessive irrigation
2. Bio-drainage by trees like Eucalyptus

2.5.6. Salinity

The term salinity refers to the amount of dissolved salts that are present in water. Salinity is an important factor in determining many aspects of the chemistry of natural waters and of biological process within it. The salts are compounds like sodium chloride, magnesium chloride, etc

2.6. ENERGY RESOURCES

Energy is essential for the existence of mankind. Energy production and energy utilization indicates a country's progress. It is available on earth in different forms and today every country draws its energy needs from a variety of sources. *Major energy sources are fossil fuels, nuclear fuels, hydro energy, geothermal, solar energy, wind energy, tidal energy, bio-mass, hydrogen etc. However, sun is the main source of our energy resources.* The energy policy of India is largely defined by the country's expanding energy deficit and increased focus on developing alternative energy sources, particularly nuclear, solar and wind energy. India has been ranked 78th among 114 countries on the world economic Forum's energy transition index.

2.6.1. Growing energy needs

All developmental activities of the world depend directly or indirectly on energy. Most of the industrial processes like mining, transport, lighting, heating and cooling in buildings need energy. With the growing population, the world is facing an energy deficit. Lifestyle changes from simple to complex and luxurious lifestyle adds to this energy deficit. Almost 95% of commercial energy is available from fossil fuels like coal and natural gas. These fossil fuels will not last for more than a few years. Hence, we must explore alternative fuel or energy options.

Indian Scenario:

In India, commercial energy like coal, oil, gas and water constitute the main sources of energy. The share of agriculture in commercial energy consumption has risen rapidly over the past four decades. Industries like fertilizer, aluminium, textiles, cement, iron, steel, paper etc consume about 80% of the coal and 70% of the electrical energy in India. The transport sector accounts for 65% of the total oil consumption (petrol and diesel). The energy consumption of household sector has also increased due to air conditioners, refrigerators and other electrical appliances. Apart from commercial energy, a large amount of traditional energy sources in the form of wood, agricultural waste and animal residue are also used.

Due to rapid economic expansion, India has to increase not only the indigenous availability but also aim at efficient utilization of energy. Our ambitious plan is to expand its renewable and nuclear power industries. India has the second highest wind capacity in Asia and is the only Asian country apart from China, with a total capacity of 35 GW. India's solar power installed capacity reached 34.404 GW as of February 2020. India also envisages to increase the contribution of nuclear power to overall electricity generation capacity from 4.2% to 9% within 25 years. Five nuclear reactors are under construction and plans are to construct 18 additional nuclear reactors by 2025.

2.6.2. Renewable and Nonrenewable energy sources

Based on continual utility, natural resources can be classified into two types:

Renewable energy sources: These resources can be generated continuously and are in-exhaustible. They are available in plenty and are the cleanest sources of energy available on this planet. Examples include Wood, Solar energy, Wind energy, Hydro power, Tidal energy, Geo-thermal energy, forest, etc. They have low carbon emission; therefore, they are considered as green and environmental friendly.

Non-renewable energy sources: They are natural resources that cannot be regenerated once they are exhausted. They cannot be used again. They are not environmental friendly and can have serious effect on

our health. Ex: Coal, Petroleum, Natural gas and Nuclear fuels. Non-renewable sources release toxic gases in the air when burnt, which are the major cause for global warming.

The points of differences between renewable and non-renewable resources include:

Renewable energy resources	Non-renewable energy resources
They are natural resources around us	They are formed deep down the earth crust millions of years ago
It can be generated continuously and are in-exhaustible	It cannot be regenerated once they are exhausted
It is environmental friendly as the amount of carbon emission is low	It is not environmental friendly as the amount of carbon emission is high
They are pollution free	They are not pollution free
These resources are sustainable	These resources are exhaustible
They are present in unlimited quantity	They are present in a limited quantity
These resources cause no harm to life on earth	These resources adversely affect the health of organisms by emitting radiations, smoke, carcinogenic elements to environment
The rate of renewal of these resources are greater than the rate of consumption	The rate of renewal of these resources are lower than the rate of consumption

2.6.3. Alternative energy sources

Energy sources that are not popularly used and are environmental friendly are called alternative energy sources. They cause little or no pollution. They help us to maintain the balance of nature without causing much harm as compared to conventional energy sources. Alternative or renewable energy sources show significant promise in helping us to reduce the amount of toxins that are byproducts of energy use and help preserve many of the natural resources that we currently use as sources of energy. They are available free of cost and is clean and green.

The damage that we have caused to earth due to industrialization is huge and if we want to keep the planet sustainable for our future generation, use of alternative energy sources is very important. Examples for alternative energy source include *wind energy*, *solar energy*, *geothermal energy*, *hydroelectric energy*, *biomass*, *tidal energy etc.*

(i) Wind energy

It is an effective source of energy in areas where the velocity of wind flow is high. Wind energy harnesses the power of the wind to propel the blades of wind turbines. The rotation of turbine blades is converted into electrical current by means of an electrical generator. Wind towers are built together in wind farms. They can be also built off-shore.

Advantages:

- No pollution (a clean form of energy)
- Source of power generation
- Free of cost
- It is a renewable source of energy

Disadvantages:

- Wind power is intermittent. Consistent wind is needed for continuous power generation. If wind speed decreases, the turbine lingers and less electricity is generated.
- Large wind farms can have a negative effect on the scenery.
- They sometimes create noise disturbances and cannot be used near residential areas.

(ii) Solar energy

It is one of the promising alternative energy sources which the Earth receives from sun. The solar power generation is done using a series of photovoltaic cells where the solar rays are converted to electricity. Solar energy is also used commonly for heating, cooking and in the desalination of seawater.

Advantages:

- It is a renewable resource and will not deplete
- Solar power generation releases no by-products
- It is free of cost and can be very efficiently used for heating and lighting
- Solar power generation is quiet, absolutely clean and pollution free

Disadvantages:

- Solar power stations are very expensive to build
- Solar power does not produce energy when sun is not shining
- Night time and cloudy days limit the amount of energy produced

(iii) Geothermal energy

Geothermal literally means “earth heat”. Geothermal energy harnesses the heat energy present underneath the Earth. Hot rocks under the ground will heat the water to produce steam. When holes are drilled in the region, the steam that shoots up is purified and is used to drive turbines, which power electric generators.

Advantages:

- It does not produce any harmful by-products

- Geothermal plant is self-sufficient (energy wise)
- They are small and has little effect on landscape
- Cost is less

Disadvantages:

- If constructed incorrectly, it produces pollutants
- Improper drilling into the earth can release hazardous minerals and gases
- It is suitable only to particular region and cannot be harnessed everywhere
- The areas where this energy is harnessed are prone to earthquakes and volcanoes.
- Setting up of geothermal power stations requires huge installation cost

(iv) Hydroelectric energy

Hydropower is the largest producer of alternative energy in the world. Hydroelectric power stations capture the kinetic energy of moving water to give mechanical energy to turbines. The moving turbines convert mechanical energy to electricity through generators.

Advantages:

- Hydropower is renewable, constant and predictable
- Hydroelectric power produces no waste or pollution since there is no chemical reaction to produce power
- Electricity can be generated constantly, because there are no outside forces
- Water used for hydropower can be reused

Disadvantages:

- Dams are very expensive to build.
- They cause adverse effect on aquatic life

Another form of hydropower is tidal energy, where rise and fall of ocean tides are captured by tidal energy generators which run turbines. The movement of turbines is responsible for producing electricity. The main advantage of tidal energy is that it is completely renewable and more predictable than wave energy.

(v) Hydrogen Energy

Hydrogen is a clean fuel and an energy carrier that can be used for a broad range of applications as a possible substitute to liquid and fossil fuels. It has tremendous potential and can be used to power homes, vehicles and space rockets. NASA has used liquid hydrogen in space shuttles since 1970s. A fuel cell combines hydrogen and oxygen to produce electricity, heat and water. Fuel cells are often compared to batteries. Both convert the energy produced by a chemical reaction into usable electric power.

Advantages:

- It is a renewable and clean energy source

- It is non-toxic
- It is more efficient than other forms of energy
- Used for powering space ships

Disadvantages:

- Production of hydrogen is expensive
- Difficulty in handling, storing and transportation of hydrogen.
- Its low availability in pure form
- Requirement of energy for the production of Hydrogen

2.6.4. Case study 9

Kochi International airport becomes world's first airport to completely operate on solar power

Cochin International airport has scripted another chapter in aviation history by becoming the first airport in the world that completely operates on solar power. The CIAL solar power project is a 40-megawatt power station built at COK airport, India. Now, Cochin airport's solar power plant is producing 50,000 to 60,000 units of electricity per day to be consumed for all its operational functions, which technically make the airport absolutely power neutral. This plant will produce 18 million units of power from 'sun' annually-the power equivalent to feed 10,000 homes for one year. Over the next 25 years, this green power project will avoid carbon dioxide emissions from coal fired power plants by more than 3 lakh metric tons, which is equivalent to planting 3 million trees or not driving 750 miles. Inspired by the success of the above plant, CIAL decided to set up a larger scale 12MWpsolar PV plant as part of their green initiatives. This was set up in an area of 45 acres near the International cargo complex.



2.7. LAND RESOURCES

2.7.1. Land as a resource

The term 'Environment' includes all physical and social resources. It includes all the resources such as rivers, oceans, soil, forests, animals etc. Land is a free gift of the nature. The progress and prosperity of any country largely depends upon the geographical nature. Natural resources are derived from the environment. A natural resource is often characterized by amounts of biodiversity existent in various ecosystems.

Land resources mean the resources available from the land. No one can deny the importance of land and natural resource endowments as factors in the growth process. The quality of land can markedly affect the level of agricultural productivity in the economic development.

Land can be broadly divided into Urban land, Rural land, Forest land and Sea bed. Man needs land for building houses, for agriculture purpose , maintaining pastures for domestic animals and developing industries. If land is utilized carefully it can be considered a renewable resource.

Land is also converted into a non-renewable resource when highly toxic industrial and nuclear wastes are dumped on it. Man needs to preserve our grasslands, wetlands, wilderness area in forests, mountains etc to protect our vitally valuable biodiversity. A rational use of land needs careful planning. Land use may be defined as man's activities on land which are directly related to the land.

2.7.2. Land degradation

Land degradation takes place when land use exceeds the carrying capacity of a system. It is a process in which the value of the biophysical environment is affected by a combination of human induced processes acting upon the land. Houghton and Charman defines land degradation “It encompasses soil degradation and the deterioration of natural landscape and vegetation”. *Human induced degradation includes the adverse effects of overgrazing, erosion, urbanization, disposal of industrial wastes, road construction, decline of plant communities and pollution of the air with its effects on land.*

During the last few decades, there has been tremendous pressure on land in India due to increase in population. As urban centers grow and industrial expansion occurs, the agricultural land and forests shrink.

According to studies, water and wind erosion are the two primary causes of land degradation. Combined, they are responsible for about 84% of the global extent of degraded land. And the excessive erosion is now one of the most significant environmental problems worldwide.

Effects

- Deteriorated Soil texture
- Loss of soil fertility
- Increase in water logging, salinity and acidity problems
- Affects social, economic and biodiversity level

2.7.3. Man induced landslides

The sudden movement of the soil and the down slope of weathered rock material due to the force of gravity is called landslide. *During construction of roads and mining activities huge portions of mountainous regions are cut down and thrown into adjacent areas and streams. When the rivers are in flood they greatly add to landslides. These land masses weaken the already delicate mountain slopes leading to man-induced landslides.* It results in the loss of habitat and biodiversity and loss of infrastructure and hence in economic loss. *Man induced activities such as deforestation in hilly areas, excessive mining in hilly areas, dam construction, road and other infrastructure developments are also responsible for man induced landslides.*

2.7.4. Soil erosion and desertification

Soil erosion is a naturally occurring process that affects all landforms. *It is the removal of the top fertile layer of the soil.* In other words, it is the displacement of the upper layer of soil. Soil erosion by water and wind is the most common and extensive form of soil erosion. The loss of soil from farmlands may be reflected in *reduced crop production, lower surface water quality and damaged drainage networks.* **Intensive agriculture, deforestation and climate change** are the most significant factors responsible for soil erosion.

Desertification is a type of land degradation in which a relatively *dry area of land becomes increasingly arid, typically losing its water bodies as well as vegetation and wildlife.* It is caused by *climate change and soil erosion.* When deserts appear automatically over the natural course of an Earth's life cycle, then it can be called a natural phenomenon. Desertification is a significant global ecological and environmental problem. The UNO Conference on Desertification has defined it as "*the destruction of the biological potential of land and can lead ultimately to desert like conditions.*"

The major causes of desertification are *mismanagement of forests, overgrazing, mining and quarrying.* The increasing rate of desertification will be a threat to food security.

2.8. ROLE OF AN INDIVIDUAL IN CONSERVATION OF NATURAL RESOURCES

Resource management may be defined as "*the conservation of natural resources by technical and managerial practices for the purpose of man's utilitarian needs under prevailing socio-economic conditions.*"

Man has exploited nature excessively at the cost of the environment. Continuing current practices will lead to a massive and unsustainable gap between global supply and demand for natural resources.

What Can We do?

Public awareness and participation are highly effective to improve environmental conditions.

- Conducting education programmes relating to environmental management and awareness can go a long way in controlling environmental degradation. Education and public participation may change and improve the quality of environment. According to UNESCO “Environmental education is a way of implementing the goals of environmental protection”.
- Building a sustainable society will require participation by governments, businesses and individuals. The goals of sustainable development cannot be met without individuals support and actions. Citizens are an integral part of the economic system as consumers of goods and services, and they are also vital to the adoption of sustainable practices.
- By becoming conscientious consumers/ individuals (buying green products, buying what you need etc) you can help to stimulate the transition to sustainability. Transition to a sustainable society requires participation of human beings.
- Citizens can take actions to promote a sustainable future (Driving fuel efficient vehicles, carpooling, bicycling, walking or using public transport etcall make significant contributions.)
- Do Recycling.

2.9. EQUITABLE USE OF RESOURCES FOR SUSTAINABLE LIFESTYLES

Economic development and growth strategies encourage rapid accumulation of physical and human capital, but it is at the expense of excessive depletion and degradation of natural resources and eco systems. Depleting the world’s resources for development and growth have had detrimental impacts on the well-being of present generations and results challenges for the future. *Equity is supposed to be a central ethical principle of sustainable development.* It means that *there should be a minimum level of income and environmental quality below which nobody falls.* It is generally agreed that equity implies a need for fairness (not necessarily equality) in the distribution of gains and losses, and the entitlement of everyone to an acceptable quality and standard of living.

Environmental inequities already exist in all societies. There is a big divide in the world as North and South, the more developed countries (MDC’S) and less developed countries (LDC’S), the haves and the have nots. The MDC’s have only 22% of world’s population, but they use 88% of its natural resources, 73% of its energy and command 85% of its income. In order to achieve sustainable development, it is desirable to achieve a more balanced and equitable distribution of global resources and income to meet everyone’s basic needs. Reduction of the unsustainable and unequal use of resources and control of

population growth are essential for the survival of our nation. A fairer sharing of resources will narrow down the gap between the rich and the poor and will lead to sustainable development for all.

SECTION A (2 marks)

1. What are renewable resources?
2. Describe non-renewable resources.
3. State biotic resources.
4. What are abiotic resources?
5. What is the commercial values forest?
6. How forest affects life and economy of tribes?
7. Explain the ecological uses of forest.
8. Enumerate aesthetic values of forest.
9. What is Jhum cultivation?
10. Write notes on Chipko movement.
11. What are renewable energy resources? Give examples.
12. What are non-renewable energy resources? Give examples.
13. List the advantages of using solar power over other forms of energy.
14. What is geothermal energy? What are its advantages?
15. List one advantage and one disadvantage of using wind as energy resource.
16. What is soil erosion?
17. What do you mean by equitable use of resources?
18. What you mean by land as a resource?
19. List out the important cause of land degradation. What are its effects?
20. Define desertification.
21. What is man induced landslides. What are its effects?
22. Define resource management.

SECTION B (5 marks)

23. Differentiate renewable and non-renewable energy sources
24. Write briefly on alternate energy sources
25. What are the advantages and disadvantages of hydrogen as a fuel?
26. What are the advantages and disadvantages of solar and wind energy?
27. How geothermal energy can be used to generate electricity. What are its advantages and disadvantages?

28. What is land degradation? State its causes.
29. What do you mean by soil erosion and desertification?
30. Write a note on Man induced landslides.
31. Write notes on classification of natural resources.
32. Enumerate the uses of forest.
33. Write critical notes on overexploitation of forests.
34. How timber extraction does affect forest and tribes?
35. What are the major effects of mining operation on forest and tribes?
36. List out the effects of dams on forest and tribes
37. What is the impact of human activities on water resources?
38. What are the effects of mineral exploitation on environment?
39. What are the negative effects of ground water depletion?
40. List the benefits of a dam.
41. What are the upstream problems caused by a dam?
42. Explain the harmful effects of over exploitation of water resources.
43. Write a note on the conflicts over water.
44. Briefly describe the benefits and problems caused by dams.
45. Explain the use and exploitation of mineral resources.
46. Name the agencies that monitor food safety.
47. Why is food security important?
48. How has agriculture altered the environment?

SECTION C (15 marks)

49. Write notes on a) Renewable and non-renewable energy sources b) alternate energy sources.
50. Discuss the role of an individual in conservation of natural resources.
51. Describe the classification of natural resources and problems associated with natural resources.
52. How forests help to provide prosperity of human beings and to the nation?
53. What is deforestation? Enumerate causes and major effects of deforestation