DEPARTMENT OF CIVIL
ENGINEERING MNNIT, ALLAHABAD

CE-12101 ENVIRONMENT AND CLIMATE CHANGE

Natural Resources

INTRODUCTION

Natural resources occur naturally within environments that exist relatively undisturbed by mankind, in a natural form. A natural resource is often characterized by amounts of biodiversity and geo-diversity existent in various ecosystems.

Natural resources are derived from the environment. Many of them are essential for our survival while others are used for satisfying our wants. Natural resources may be further classified in different ways.

Classification of Natural Resources

Renewability is a very popular topic and many natural resources can be categorized as either renewable or non-renewable:

a) Renewable resources are ones that can be replenished naturally. Some of these resources, like sunlight, air, wind, etc., are continuously available and their quantity is not noticeably affected by human consumption.

b) Non-renewable resources are resources that form extremely slowly and those that do not naturally form in the environment. Minerals and fossil fuels are the most common resource included in this category.

Resources:

- Forest
- Water
- Minerals
- Foods
- Energy
- Land

Forest Resources

Forests are of immense value to us.

1. They are useful for industry and rural economic growth.
    - Timber: Lumber, plywood, Boards, Doors Windows, Furniture, Carts, Sports, Goods, Paper,
    - Commercial uses of forests are for timber (Furniture), firewood, pulpwood, food items, medicine, drugs and even tourism etc
    - Resins, Fruits, Nuts, Bamboos
    - Developed countries produce less than 50% of industrial wood but use 80%. Whereas developing countries produce more than 50% and use 20%.
2. World consumption of fuelwood is estimated to be more than 1000 million m^3. 58% of total Energy used in Africa and 42% in South East Asia comes from fuelwood.
3. Ecological services of forests are:
    a) Production of Oxygen
    b) Reduce global warming / Pollution Moderation
    c) Wildlife habitat
    d) Regulation of water cycle
    e) Soil conservation

Overexploitation of forests has been due to:

a) Excessive logging
b) Deforestation for Road development
c) Clearing forests due to Grazing
d) Mining activities and large scale projects
e) Expansion of Cities

Effects of Deforestation

1. Soil Erosion
2. Desert Expansion
3. Decreased Rainfall
4. Loss of Fertile Land
5. Lower Water Table
6. Loss of Flora and Fauna
7. Loss of Biodiversity
8. Loss of Medicinal Plants
9. Environmental Changes

Forest Resources in India

Every two years, Forest Survey of India (FSI) undertakes assessment of country's forest resources, the results of which are presented as the 'India State of Forest Report (ISFR).

The country’s **forest cover** includes all patches of land with a tree canopy density of more than 10% and more than 1 ha in area, irrespective of land use, ownership and species of trees.

Very Dense Forest with a canopy density more than 70%,
Moderately Dense: Forest with a canopy density between 40-70% and
Open Forest with a canopy density between 10-40%.

Tree cover includes all patches of trees less than 1 ha.

Salient Features of ISFR-2019

In the current assessment, ortho-rectified LISS III data of IRS Resourcesat-2 with a spatial resolution of 23.5 meters for the period October to December 2017.

Ground truthing has been carried out at more than 2,200 locations across the country.

The total forest cover of the country is 7,12,249 sq km which is 21.67% of the geographical area of the country. The tree cover of the country is estimated as 95,027 sq km which is 2.89% of the geographical area.

The total Forest and Tree cover of the country is 8,07,276 sq km which is 24.56% of the geographical area of the country.

The current assessment shows an increase of 3,976 sq km (0.56%) of forest cover, 1,212 sq km (1.29%) of tree cover and 5,188 sq km (0.65%) of forest and tree cover put together, at the national level as compared to the previous assessment i.e. ISFR 2017.

The **top five States** in terms of increase in forest cover are Karnataka (1,025 sq km), Andhra Pradesh (990 sq km), Kerala (823 sq km), Jammu & Kashmir (371 sq km) and Himachal Pradesh (334 sq km).

Forest cover in the hill districts of the country is 2,84,006 sq km, which is 40.30% of the total geographical area of these districts. The current assessment shows an increase of 544 sq km (0.19%) in 140 hill districts of the country.

TABLE 1 Forest and Tree cover of India in 2019

Class	Area (sq km)	Percentage of Geographical Area
	Forest Cover	
Very Dense Forest	99,278	3.02
Moderately Dense Forest	3,08,472	9.38
Open Forest	3,04,499	9.26
Total Forest Cover*	**7,12,249**	**21.67**
Tree Cover	95,027	2.89
Total Forest and Tree Cover	**8,07,276**	**24.56**
Scrub	46,297	1.41
Non-Forest#	25,28,923	76.92
Total Geographic Area	**32,87,469**	**100.00**

Forest Conservation:

- In 1988, the Forest Conservation Act of 1980 was amended to facilitate stricter conservation measures. A new target was to increase the forest cover to 33% of India's land area from the then-official estimate of 23%.
- The Ministry of Environment and Forest (MoEF) formulated the National Forest Policy of 1988 to give added importance to Joint Forest Management (JFM), which co-opts local village communities and the Forest Department to work together to sustainably manage our forests. Another resolution in 1990 provided a formal structure for community participation through the formation of Village Forest Committees (VFCs).

  Based on these experiences, new JFM guidelines were issued in 2000. This stipulates that at least 25% of the income from the area must go to the community. From the initiation of the programme until 2002, there were 63,618 JFM Committees managing over 140,953 sq km of forest in 27 states in India. Various states have tried a variety of approaches to JFM.

  The share of profits for the VFCs ranges from 25% in Kerala to 50% in Gujarat, Maharashtra, Orissa and Tripura and 100% in Andhra Pradesh. In many states, non-timber forest products (NTFPs) are available to the people free of cost.

  Furthermore, some states have stopped grazing while others have rotational grazing schemes that have helped in forest regeneration.

- In June 1990, the central government adopted resolutions that combined forest science with social forestry, that is, taking the sociocultural traditions of the local people into.

Draft National Forest Policy 2018 (DNFP-2018).

The Ministry of Environment, Forest and Climate Change (MoEFCC) has now published the Draft National Forest Policy 2018 (DNFP-2018).

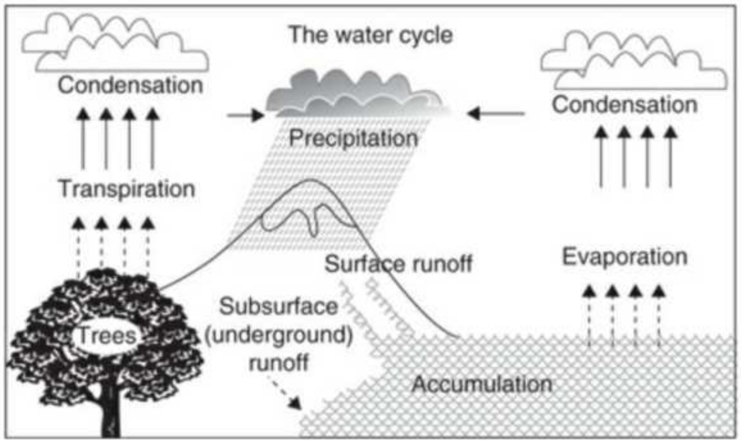
The new draft policy's overall goal is to "Safeguard the ecological and livelihood security of people, of the present and future generations, based on sustainable management of the forests for the flow of ecosystem services."

The draft policy also aims to maintain at least one-third of India's total land area under forest and tree cover. In the hills and mountainous regions, the policy's goal is to maintain two-thirds of the area under forest and tree cover to both "prevent soil erosion and land degradation and also to ensure the stability of the fragile ecosystems."

The draft policy lists multiple other objectives, including the

1. Maintenance of environmental stability and
2. Conservation of biodiversity;
3. Reversal of the degradation of forests;
4. Improvement of the livelihoods of people through the sustainable use of ecosystem services; and
5. Improve soil quality;
6. Safeguarding forestlands;
7. Managing protected areas and other wildlife-rich areas;
8. Protecting watersheds; and
9. Increasing tree cover outside forests.

WATER RESPOURCES



The water cycle, through evaporation and precipitation, maintains hydrological systems which form rivers and lakes and support in a variety of aquatic ecosystems. Solar energy drives the water cycle. Plants also play a role in this by absorbing the groundwater from the soil and releasing it into the atmosphere by the process of transpiration. Wetlands are intermediate forms between terrestrial and aquatic eco systems and contain species of plants and animals that are highly moisture dependent. All aquatic ecosystems are used by a large number of people for their daily needs such as drinking water, washing, cooking, watering animals, and irrigating fields.

- The world depends on a limited quantity of fresh water. Water covers 70% of the earth's surface but only 3% of this is freshwater.

- Of this, 2% is in polar ice caps and only 1% is usable water in rivers, lakes and subsoil aquifers. Only a fraction of this can be actually used.

- At a global level <u>70% of water is used for agriculture</u> about <u>25% for industry</u> and <u>only 5% for domestic use</u>.

- However this varies in different countries and industrialized countries use a greater percentage for industry. <u>India uses 90% for agriculture</u>, 7<u>% for industry</u> and <u>3% for domestic use</u>.
- Studies indicate that a person needs a minimum of 20 to 40 liters of water per day for drinking and sanitation. More than one billion people worldwide have no access to clean water, and to many more, supplies are unreliable
- The total annual fresh-water withdrawals today are estimated at 3800 cubic kilometers, twice as much as just 50 years ago (World Commission on Dams, 2000).
- More people die from lack of clean water and Sanitation than are killed from all forms of Sanitation

- 90% of deaths of Children under 5 die from Diarrheal Disease. Diarrheal Disease due to lack of clean water is the second leading cause of children death around the world.
- Women are twice as likely to collect water as compared to men.
- In Sub-Saharan Africa, 16 million hours are spent each day by women for water Collection
- $28 Billion is lost in Africa due to lack of clean water and Sanitation (5% of GDP)

Overutilization and pollution of surface and groundwater:

1. With the growth of human population there is an increasing need for larger amounts of water to fulfill a variety of basic needs. Today in many areas this requirement cannot be met. Overutilization of water occurs at various levels.
2. Excess water usage has resulted in depletion of ground water reserves.
3. In some places in India, prolonged rainfall has resulted in floods.
4. Shortage of water in India is a common sight. In many places, absence of rainfall has led to draught.
5. Conflict between countries and within the country has also occurred. Such as the water conflict in the Middle East and in India the infamous Cauvery Water Dispute.
6. Rising incidents of floods has been due to rapid industrialization, deforestation and urbanization.

Agriculture also pollutes surface water and underground water stores by the

- Excessive use of chemical fertilizers and pesticides.

Industry tends to maximise short-term economic gains by

- Not bothering about its liquid waste and releasing it into streams, rivers and the sea.

Most people use more water than they really need.

- Most of us waste water during a bath by using a shower or during washing of clothes.

Status of Water Resources in India

India has plenty of freshwater. The sub-continent receives most of its fresh water during monsoon months (almost 75%). Remaining months are drier which necessitates the use of ground water or stored water during the dry spells. The uneven distribution of rains in different months of the year is matched by its equally uneven distribution over different regions of the country. Parts of Rajasthan receive very little rains while there are places like Cherapunji, which had the reputation of being the wettest place in the world.

India receives about 4,000 cubic kms of fresh water as precipitation every year. About 700 cubic kms of water thus received evaporate immediately and are lost to the atmosphere. About 2,150 cubic kms go to the soil whereas about 1,650 cubic kms are retained as soil moisture while about

500 cubic kms permeate through the soil surface to underground water deposits. Only 1,150 cubic kms of fresh water received annually are retained on land surface.

1 . Surface waters : To 1,150 cubic kms of fresh water, which appear as surface water, may be added about 200 cubic kms of surface flow, which comes from outside India. The surface flow is further enlarged by addition of about 450 cubic kms of fresh water from ground water flow while about 50 cubic kms are added as runoff from irrigated areas. The surface loses almost 50 cubic kms of its water, which percolates down to the ground water deposits. The total surface flow per year is about 1,780 cubic kms, which are distributed among a number of river basins.

2 . Ground Water: The major portion of fresh water, which goes to earth's crust, is retained by its upper layers as soil moisture (about 1,650 cubic kms). Only 500 cubic kms percolate down to the ground water deposits. A large amount of fresh water applied to agricultural fields (about 120 cubic kms) moves down to ground water table while about 50 cubic kms of surface flow also end up as ground water. Therefore, a total of about 670 cubic kms of fresh water enters the ground water annually. It is upto this amount that we can withdraw fresh water from our sub-surface deposits. Any withdrawal above this limit shall be detrimental to the resource base.

1. Indus (Sindhu): Origin: Mansarovar (Tibet), Length = 1114 km, Basin Area = 321289 km^2
2. Ganga: Origin: Gangotri (Uttarkashi), Length = 2525 km, Basin Area = 861452 km^2
3. Brahmaputra: Kailash Range (Tibet), Length = 916 km, Basin Area = 194413 km^2

Ground Water Potential:

Ganga = 170.99 bcm
Godavari = 40.65 bcm
Brahmaputra = 26.55 bcm
Total = 431.42 bcm

Groundwater Level:

Areas in Rajasthan, Punjab, Hariyana have depth to water table more than 20 m.
The coastal regions have better situation having water table as low as 2 m.
Average depth to water Table is about 5-10 m

Per Capita Water Availability in India

In 1951, the per capita water availability is 14183 lt/day
In 2001 it was 6052 lt/day
In 2050, it will be 3123 lt/day

Water Conservations

Water conservation encompasses the policies, strategies and activities to manage fresh water as a sustainable resource, to protect the water environment, and to meet current and future human demand. Population, household size and growth and affluence all affect how much water is used. Factors such as climate change will increase pressures on natural water resources especially in manufacturing and agricultural irrigation

The goals of water conservation efforts include as follows: To ensure availability for future generations, the withdrawal of fresh water from an ecosystem should not exceed its natural replacement rate.

Habitat conservation. Minimizing human water use helps to preserve fresh water habitats for local wildlife and migrating waterfowl, as well as reducing the need to build new dams and other water diversion infrastructures.

1. Social solutions (farming, Landscaping etc)
2. Household Applications (Rain water harvesting, Low flush Toilets, Low Shower etc.)
3. Commercial Applications (Waterless Urinal, Waterless carwash…etc)
4. Agricultural Applications: Minimum Water Networks and Design, Use of drip irrigation systems.
5. Public awareness may increasingly put pressures on industry to produce only eco-friendly products which are already gaining in popularity.
6. Methods such as the use of biomass as fertilizer and nontoxic pesticides such as neem products and using integrated pest management systems reduces the agricultural pollution of surface and ground water

Mineral Resources

The term mineral resources refer to a wide variety of materials obtained from earth. In general they can be divided into following two categories:

1. Metallic minerals: Minerals which when processed provide metals such as Iron, Aluminium, Copper, Zinc etc.

2. Non-metallic minerals: Minerals, which yield products other than metals such as phosphate rocks, potash, soda ash, various salts, clay, sand, and stones etc.

To these may be added materials, which provide energy such as coal, oil, natural gas etc.

Copper was the first metal to come into a widespread use. Gold and silver were probably known to humanity much earlier as they were often found in their metallic state. However, they are rare elements. They were never available in quantities large enough for a general use except perhaps for ornamental purposes.

Age of Metals in human history commenced early by 4000 B.C.

It was about 1100 B.C. that furnaces capable of attaining temperatures high enough to reduce Iron ores were developed. The widespread availability of Iron minerals made it possible for the metal to be used on an unprecedented scale. A little amount of carbon had to be mixed to produce harder steel. Initially trees were used to produce this charcoal (carbon). As steel production expanded, much of the forests had to be felled, to be turned into coal required for the steel industry of the time.

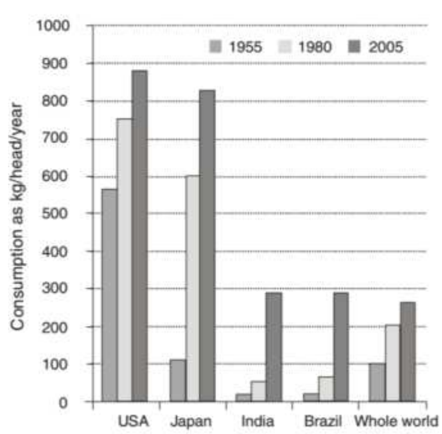


Fig 7.1 *Per capita steel consumption in selected ocuntries*

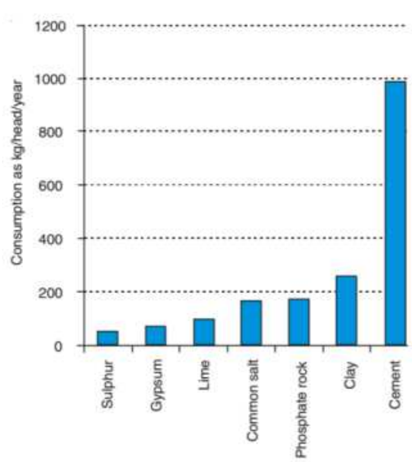


Fig. 7.2 *Global consumption of non-metallic minerals*

The total quantity of materials of all kinds obtained from earth amounts to an enormous 150 billion tons.

In fact, economically viable mineral resources are created by the interaction of three factors, which are geological knowledge, technology and economic forces.

1**. Geologic knowledge:** The minerals in earth's crust cannot be considered usable resources unless they are known. Therefore, there must be a constant input of time, money and effort to find out what is there. We have to increase our geologic knowledge. A comprehensive study of ore-bodies has to be made so that the deposits can reliably be defined in terms of location, quantity and grade. They have to be technically and economically quantified as mineral reserves. This is being done regularly today. The measured resources of many minerals are increasing much faster than they are being used. Explorations bring to light new reserves almost every year. Simply on geological grounds, there is no reason to suppose that this trend will not continue. Today, proven mineral resources worldwide are more than what we had fifty years ago.

2. Technological knowledge: It is meaningless to talk of a resource until the technology to use it is not there. Human ingenuity can create useful things out of useless wastes. It is the ingenuity and technology, which creates new resources by making particular minerals usable in new ways, which substitute, to some degree for others, which are becoming scarcer. More particularly, if a known mineral deposit cannot be mined, processed and marketed economically, it does not constitute a resource in any practical sense. Many factors determine the value of a particular mineral deposit as a usable resource. These are the location of the deposit in relation to processing set up and the markets, the ease of mining and processing operations, the cost of technology, labour costs and so on. The application of human ingenuity, through technology, alters the significance of all these factors and thus, in a way creates a resource.

For instance, Pilbara region of Western Australia is an excellent example of application of technology to create a resource. Until the 1960s, huge iron ore deposits of this area were simply geological curiosities, despite their excellent quality and grade. Australia has been a country noted for its lack of iron deposits. With the application of modern mining technology, heavy-duty railways and bulk shipping through the ports of Dampier and Hedland it was possible to obtain the ore from inland mines and carry it to Japan economically.

3. Economic forces: Whether a particular mineral deposit is sensibly available as a resource depends on the market price of the mineral concerned. If it costs more to get it out of the ground than its value requires, it can hardly be classified as a resource. Therefore, the value of a resource depends on the market price, which in turn depends on world demand for the particular mineral and the costs of supplying that demand. The dynamic equilibrium between supply and demand also gives rise to substitution of other materials when scarcity looms (or the price is artificially elevated). This is the third aspect of creating resources.

Minerals and their ores need to be extracted from the earth's interior so that they can be used; this process is known as mining.

CONSEQUENCES OF OVER EXPLOITATION OF MINERAL RESOURCES

In the entire history of human civilization such an unusually high demand has never been placed on natural resources of our planet. Although there is little danger of exhaustion of our mineral wealth the consequences of the rapid exploitation of mineral wealth have to be serious, drastic and enormously damaging to the entire biosphere. These can be summed up as follows:

1. Rapid depletion of high-grade mineral deposits: Exploitation of mineral wealth at a rapid rate shall naturally deplete our good quality deposits. The ever-rising demands shall compel miners to carry on the extraction from increasingly lower and lower grade of deposits, which possess a poorer percentage of the metal.
For example, copper was extracted from ores containing 8-10% of metal content before the industrial age commenced nearly three hundred years ago. Now we are using deposits, which contain only 0.35% of copper. To produce one ton of copper metal we have to dig out 285 tons of ore. This shall naturally involve a large amount of energy expenditure as well as a large quantity of waste material production. We may never reach an end as matter is indestructible. Most of the metals we require are present in highly dispersed state in the soil, the rocks and the trash or wastes we discard. With a sophisticated technology, we can fulfill most of our requirements from these sources, but the overall cost could be heavy, causing the metals to become more and more costly

2. Wastage and dissemination of mineral wealth: Most of our mineral deposits occur as a complex mixture of a number of mineral elements. After removal of top soil and rocks we dig out the desired mineral leaving behind others which are often left in the open as waste materials. Extraction of one element usually scatters and wastes a number of other elements, many of which are in short supply. This wastage rises as more and more ores are extracted and processed. Worldwide smelting of minerals for extraction of metals introduces an enormous quantity of sulphur, heavy metals such as mercury, cadmium, nickel, arsenic, zinc etc. into the environment which are separately mined elsewhere. We are technologically competent enough to extract these metals from the wastes produced from one mining industry rather than excavating fresh deposits. The cost could be heavier indeed but the practice shall pay in the long run. It will conserve our resources and also reduce the burden of pollutants which we have to introduce in the environment

3. Pollution of environment from mining and processing wastes: Mining is a dirty industry. It has created some of the largest 'Environmental disaster' zones in the world. The mining and processing of minerals generally involves following steps:

1. The soil and rock overlying the mineral deposits, called the ‘over-burden’ in miner’s language, has to be removed before actual mining operations commence.
2. The ore is then mined and crushed.
3. After being converted to fine powdered state it is run through concentrators which remove unwanted material and impurities which are called ‘tailings’.
4. The concentrated ore is then reduced to crude metal often at a high temperature by various methods depending upon the chemical nature of the ore.
5. Crude metal is then refined or purified in refineries.

4. Pollution Caused by Heavy Energy Requirement of Mining Industry: Moving huge amounts of sand silt and clay etc. requires energy. Concentration of ore requires energy. Smelting and refining operations require energy. Electrolytic processes used for refining of some metals, like Aluminium, require energy. Transportation and disposal of wastes or tailings requires energy. Transportation of finished products requires energy. The overall worldwide requirement of energy in mining industry adds up to an enormous amount. This energy comes from diverse sources which mostly include fire-wood, coal, petroleum, natural gas and electricity. In order to provide energy to mining industry a huge quantity of these materials are burned which causes a variety of pollution problems (7).

II) **Conservation of Mineral Resources**

1. Economy in use of mineral resources: The simplest way to conserve mineral resources is to practice economy in the use of metals and minerals. Careful use or use only where it is necessary can reduce much of consumption of metals and minerals. Most of the metals and minerals are cheap because of the importance of mining industry in the development of a country, governments provide plenty of subsidies in the form of land at a throw away prices, cheap power, subsidized fossil fuels, large loans and generous tax exemptions. Many industrialized nations also try to ensure access to cheap mineral supplies through their international trade and policies. The lure of large revenues, generous financial assistance, finished products, arms and other necessities force poor countries to sell their mineral wealth at a cheap price. It is mainly due to their low prices that minerals and mineral products are freely used, even at places where they are hardly required. A little restriction and taxation could cause the minerals to become more expensive which in turn shall curtail unnecessary over-consumption.

2. Making finished products long lasting: The ‘use and throw away practice’ of Western society after a product has lost its utility is a wasteful practice. The metal components in the product are also discarded and wasted. A study by the United States Office of Technology (Washington D.C.) in 1979 pointed out that repairs and re-use is a very promising method of conservation of metals and mineral products. Metal containing products, for example automobiles, should be so manufactured as to last longer, and be repairable to be used again or their components if in working condition may be used again and again. Some metals are irrecoverably lost to the environment due to mishandling, corrosion, wear and tear. Of about 600 kg of per capita steel used in USA, for example, more than one-third is lost to be never recovered. The average life span of all steel in use varies between 25-30 years while that of other metals is somewhat shorter. To make a mineral product or an object made of metal last longer we shall have to prevent its corrosion, wear and tear and the irrecoverable losses.

3. Re-use and re-cycling of metals: As rapid consumption of virgin minerals depletes our resources – why not use mineral products more efficiently or again and again. A machine having brass components can be pulled apart, its components used to make another object of utility. In India most of the copper, brass, bronze and aluminium objects are regularly recycled.

4. Use of cheaper substitutes: There are a number of finished products in which cheaper material other than metals may be used. Why use a metal bucket when cheaper plastic buckets are available. Wherever possible cheaper materials may be substituted for mineral products and metals. Synthetic

5. More efficient recovery of materials from minerals: A number of minerals occur as a complex mixture of a number of elements. An ore is never pure. Even ores with a metal content as high as 20% may contain other elements, which are discarded as tailings either during concentration or during smelting. We are technologically competent enough to devise methods to recover or separate out most of the useful elements present in an ore. The cost may be heavy but the practice shall pay in the long run.

6. Search for new deposits: We have entered an era of an advanced state of science and technology. Still we do not know much about our planet. Much of the rock formations and earth's treasures are still unknown to science. Greater part of South America, Africa, and Asia have not yet been thoroughly explored. An intensive search is expected to reveal a number of deposits, which shall naturally enlarge our mineral resources.

7. Protection of existing mineral Deposits: Most of the mineral deposits are left as such on the mercy of agencies of weathering, decay and dissemination after extraction of good quality materials. As we deplete our better grade ores, it is likely that low quality ores which were once discarded as waste material could be in demand again. The reclamation of mining site, which involves restoration of deposit's original plant and soil cover, should be made a statutary responsibility of every miner. Apart from preventing wastage of resources, the practice shall also curb a number of pollution problems.

Iron minerals, which are the most important ingredient of today's economy, are found in sufficient quantity in our country. We are not only producing sufficient amounts of iron ore for our own use but are presently exporting it to other countries.

Our country ranks fifth among the Aluminium rich countries of the world.

Copper ores are in short supply in India. We have already run out of our good quality deposits of copper. Hindustan Coppers Ltd. is the sole producer of the primary metal in India.

Table 7.3 *Recoverable reserves of mineral deposits in India*

	Minerals	Reserves in million metric tons	Life span in years
1	Iron ores	13460.00	257
2	Aluminium ores (Bauxite)	2462.40	299
3	Copper ores	416.80	34
4	Zinc ores	10.10	5
5	Tin ores	29.00	4
6	Tngston ore	54.00	3
7	Nickel	281.00	12
8	Gold metal	57.00	97

As far as identified until date, Zinc-Lead ore reserves in India are estimated to be about 390 million tons. However, mineable reserves, the bulk of which is localized in Rajasthan, are about 167 million tons only, with 8.16% of zinc and about 2.17% of lead content. Hindustan Zinc Ltd. a public sector metal producer has a dominant role in the development of zinc-lead industry in India.

They are used in:

a) Industrial Development
b) Generation of energy
c) Construction
d) Transportation
e) Communication
f) Medicinal
g) Formation of alloys

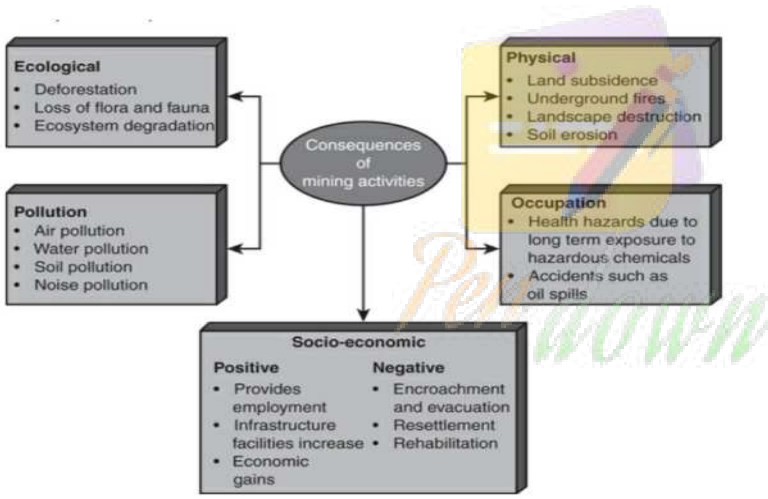
Mineral Resources

Some of the common minerals in India are:

1. Energy generating minerals
    a) Coal and lignite (Brown Coal, Low Quality)
    b) Uranium
2. Other commonly used minerals
    a) Aluminium

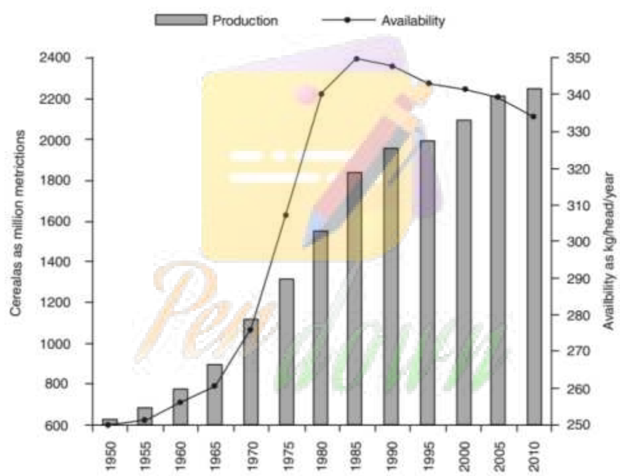
b) Iron
c) Copper
d) Mica
e) Gold and other precious / bullion metals

Excess mining for minerals has resulted in:
a) De-vegetation and defacing landscape
b) Subsidence of land
c) Groundwater contamination
d) Surface water pollution
e) Air pollution
f) Occupational health hazards
g) Soil Erosion



Food Resources

Every day the world has to find food for more than six billion people and this number is steadily growing. Each of us requires sufficient food to provide energy to carry out our day-to-day activities and materials from which our bodies can be built and maintained in healthy state. To keep our bodies in proper functional state and ensure good health our diets must also include foods, which have vitamins and minerals. Energy comes largely from carbohydrates and fats, materials to build our bodies are provided by proteins whereas minerals and vitamins usually come from fresh fruits and vegetables. Global food supplies largely come from plants, which provide cereals, legumes and pulses, fruits and vegetables. On worldwide basis, produce from animals constitute rather a small part of our daily diets.



For calculation of food values, our food consumption is usually measured in terms of calorie, which is the unit of heat energy. A calorie is equivalent to the amount of heat, which raises the temperature of one gram of pure water by one degree centigrade.

The average daily energy requirement of an individual varies from person to person according to their body weight, sex and the physical work they do. Pregnant female and lactating mothers require more calories to nourish the baby. On an average a daily per capita food intake which provides 2,500 to 3000 kilocalories (one kilocalorie = 1000 calories) is usually considered sufficient for a common man. In terms of grains, a per capita intake of about 200 kg/year is considered sufficient to provide the required energy. Our body is a versatile machine, which can utilize carbohydrates, fats, as well as proteins as a source of energy. However, to built up and maintain our bodies in a healthy state certain amino acids, which are building blocks of proteins and a number of minerals and vitamins have to be provided in appropriate amounts from an external source. They cannot be generated within our bodies. Our diets, therefore, have to include carbohydrates, proteins, fats, vitamins and minerals in right proportions or in other words, it should be a balanced diet. Generally, an average per capita intake of about 60 gm/day of proteins is considered sufficient for an individual.

The world produces about two billion metric tons of cereals every year. The three major cereals, which constitute a large part of our food supplies, are wheat, rice and corn.

Today more than 300 kg/year of grains are available to every person in the world if we equitably distribute the cereals produced annually – a quantity, which is considered more than sufficient

To this may be added course cereals, legumes and pulses as well as numerous types of fruits and vegetables, sugars and syrups, which are, produced all over the world to feed humans and his dependents. In addition to the supplies of eatables, which we obtain from plants, there are many animal products such as milk, meat, eggs, fishes and the produce from aquaculture that satisfy our hunger.

The most common food consumed all over the world are wheat, rice, maize, barely, oats, potatoes and cereals.

Dairy products being milk, cheese and butter.

Seafood, and meat products have their highest consumption in North America, Europe and Japan.

Food production in 64 of the 105 developing countries is lagging behind their population growth levels.

The average calorie intake is 2500 calories per day.

People receiving less than 90% of this are called 'undernourished', less than 80% are called 'seriously undernourished'

Deficiency of nutrition has led to 'malnuitriton'

Efforts to increase food production has resulted in some side effects:

1. Overgrazing has caused:
    a) Land degradation
    b) Soil Erosion
    c) Loss of useful Species
2. Traditional agriculture has caused:
    a) Soil Erosion
    b) Loss of vital nutrients
    c) Deforestation

3. Modern Agriculture has caused:

1. Nitrate pollution
2. Eutrophication (Excess nutrition) (Important) Eutrophication is the enrichment of an ecosystem with chemical nutrients, typically compounds containing nitrogen, phosphorus, or both. Eutrophication can be a natural process in lakes, occurring as they age through geological time.
3. Pesticide related problems
4. Water logging
5. Salinity problem

Energy Resources

Renewable Resources

Renewable Resources are those which can be generated continuously in nature and are inexhaustible e.g. wood, solar energy, wind energy, tidal energy, hydropower, biomass energy, bio-fuels, geo-thermal energy and hydrogen.

They are also known as non-conventional sources of energy and they can be used again and again in an endless manner.

Renewable Energy Sources:

1. Hydroelectric Energy
2. Solar Energy
3. Wind Energy
4. Tidal Energy
5. Ocean Thermal Energy (OTE)
6. Geothermal Energy
7. Bio-Gas
8. Bio-Fuels
9. Hydrogen as a Fuel

Non-renewable Resources

Which have accumulated in nature over a long span of time and cannot be quickly replenished when exhausted e.g. coal, petroleum, natural gas and nuclear fuels like uranium and thorium.

They constitute

1. Coal
2. Petroleum
3. Natural Gas
4. Nuclear Energy

Energy Scenario in India

- (40%) Non commercial fuel: Fuel Wood, Animal waste, Agricultural residue
- (60%) Commercial: Coal, lignite, petroleum, natural gas.

Power generation capacity

1947- 1400 MW and in

1998- 92,864 MW

- 69% Coal (thermal power)
- 25% hydro power
- 4% diesel and gas
- 2% nuclear power
- >1% from non conventinal sources (solar, wind, ocean)

The electricity sector in India had an installed capacity of 255.012 GW as of end November 2014 India became the world's third largest producer of electricity in the year 2013 with 4.8% global share in electricity generation surpassing Japan and Russia.

Every year there is about 10% growth in Energy Sector

A Human Being: 2000 cal of energy/day (last 100s of years as a biological energy to maintain their Metabolism.
Today a human being need 2,00,000 cal/day (industrialized nation).
So, 01 cal of energy need for life 100 cal are consume for other purpose.
In next 20 years 8,00,000 cal/person/day

Developing countries do not obtain even 2000 cal/capita/day

Land Resources

Land is a finite valuable resource upon which we depend on for food, fiber and fuel.
Soil, especially top soil is classified as renewable resources. Nearly 200 yrs is needed to form one inch of top soil.
Land degradation is occurring 20-100 times more than the renewal rate.
Soil erosion, water logging and salinization and contamination of the soil due to industrial wastes has resulted in degradation of land.

Soil Properties are:

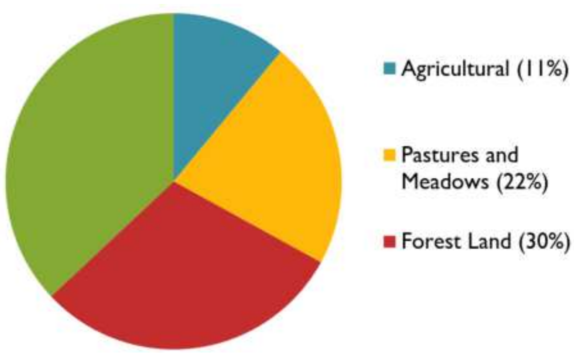
- Soil texture,
- Structure,
- Permeability,
- Soil water porosity,
- Soil pH,
- Organic and inorganic content
- Cation exchange capacity
- Microbial properties etc

Soil play important role to determine its productivity Topography, Climate and biotic factors control the condition of soil

Important function of Soil

1. Provides mechnical support to the flora
2. Act as a reservoir of water and supply water to plant, due to its porosity and water holding capacity
3. Ion –exchange capacity ensures the availability and supply of micro and macro nutrients for the growth of plants, microbes and animals.
4. Prevents excessive leaching of nutrient ions, while maintaining the pH.
5. Contains wide variety of bacteria (i.e., nitrifying, nitrogen-fixing, organotropic etc.) fuingi, protozoans and microbes (helps in decomposition and mineralization of organic matter and regeneration of nutrients)

Pattern of Land Use:Varies from country to country, Land use pattern on Earth

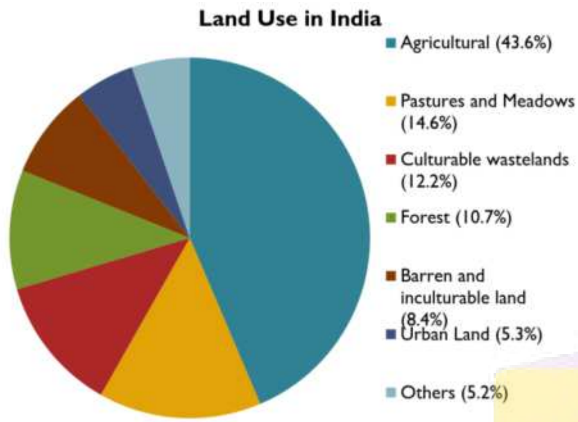


About Our Country:

Area: 3,287,263 sq km
Population: 1,352,603,573
Literacy: 74.04%
Unemployment: 6.1%
GDP: $3.16 trillion

Chief Occupations: Agriculture is the chief occupation of the country followed by service and industrial jobs.

Pattern of Land Use in India:



Land Degradation and its Causes

1. Refers as deterioration or loss of fertility or productive capacity of soil.
2. Soil Erosion (rainfall, slopes of ground, soil type, vegetation, soil mismanagement)
3. Salination (increase in conc. of soluable salts), poor drainage of irrigation and flood water
4. Water Logging (due to surface flood, high water table.
5. Excessive use of canal, productivity severely reduce due to lesser availability of oxygen for respiration.
6. Desertification: Slow process of Land degradation that leads to desert formation. It is like SKIN Disease over the planet (overcultivation, overgrazing, deforestation, poor irrigation

Soil conservation practices are:

1. Till farming
2. Contour farming
3. Terracing
4. Strip cropping
5. Alley cropping
6. Wind breaks or shelterbelts

Threats to Natural Resources

1. Urbanisation and Industrialisation
2. Overpopulation
3. Overconsumption and irresponsible use
4. Deforestation
5. Erosion
6. Habitat Destruction
7. Natural Hazards
8. No proper access to resources such as Water

The Government of India has undertaken many measures for the conservation of the resources

1. Regulations and reforms for proper housing and infrastructure development to avoid land acquisition problems
2. Mass media public service messages to educate the people on the importance of conservation of resources
3. Increase the wildlife and forest reserves in the country
4. Schemes to do a proper inventory of the resources and monitor changes in the environment.
5. Various projects and schemes that promote conservation of resources.

Essential Notes

The choices we have decided to make are:

1. To be knowledgeable of the wonderful resources available to us
2. To make every effort to protect and conserve these resources in our own way
3. To inform and make other people aware of the importance of natural resources
4. To learn about other issues affecting our country and the world at large and learn to be a responsible citizen