Social Science

Contemporary India II

Textbook in Geography for Class X

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FOREWORD

The National Curriculum Framework (NCF), 2005, recommends that children's life at school must be linked to their life outside the school. This principle marks a departure from the legacy of bookish learning which continues to shape our system and causes a gap between the school, home and community. The syllabi and textbooks developed on the basis of NCF signify an attempt to implement this basic idea. They also attempt to discourage rote learning and the maintenance of sharp boundaries between different subject areas. We hope these measures will take us significantly further in the direction of a child-centred system of education outlined in the National Policy on Education (1986).

The success of this effort depends on the steps that school principals and teachers will take to encourage children to reflect on their own learning and to pursue imaginative activities and questions. We must recognise that, given space, time and freedom, children generate new knowledge by engaging with the information passed on to them by adults. Treating the prescribed textbook as the sole basis of examination is one of the key reasons why other resources and sites of learning are ignored. Inculcating creativity and initiative is possible if we perceive and treat children as participants in learning, not as receivers of a fixed body of knowledge.

These aims imply considerable change in school routines and mode of functioning. Flexibility in the daily time-table is as necessary as rigour in implementing the annual calendar so that the required number of teaching days are actually devoted to teaching. The methods used for teaching and evaluation will also determine how effective this textbook proves for making children's life at school a happy experience, rather than a source of stress or boredom. Syllabus designers have tried to address the problem of curricular burden by restructuring and reorienting knowledge at different stages with greater consideration for child psychology and the time available for teaching. The textbook attempts to enhance this endeavour by giving higher priority and space to opportunities for contemplation and wondering, discussion in small groups, and activities requiring hands-on experience.

The National Council of Educational Research and Training (NCERT) appreciates the hard work done by the textbook development committee responsible for this book. We wish to thank the Chairperson of the advisory committee for textbooks in Social Sciences, at the higher secondary level, Professor Hari Vasudevan and the Chief Advisor for this book, Professor M.H. Qureshi for guiding the work of this committee. Several teachers contributed to the development of this textbook; we are grateful to their principals for making this possible. We are indebted to

the institutions and organisations which have generously permitted us to draw upon their resources, material and personnel. We are especially grateful to the members of the National Monitoring Committee, appointed by the Department of Secondary and Higher Education, Ministry of Human Resource Development under the Chairpersonship of Professor Mrinal Miri and Professor G.P. Deshpande, for their valuable time and contribution. As an organisation committed to systemic reform and continuous improvement in the quality of its products, NCERT welcomes comments and suggestions which will enable us to undertake further revision and refinement.

Director
National Council of Educational
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New Delhi
20 November 2006

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THE CONSTITUTION OF INDIA

PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a [1]**[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC]** and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the [2][unity and integrity of the Nation];

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949 do **HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.**

---

1. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)
2. Subs. by the Constitution (Forty-second Amendment) Act, 1976, Sec.2, for "Unity of the Nation" (w.e.f. 3.1.1977)

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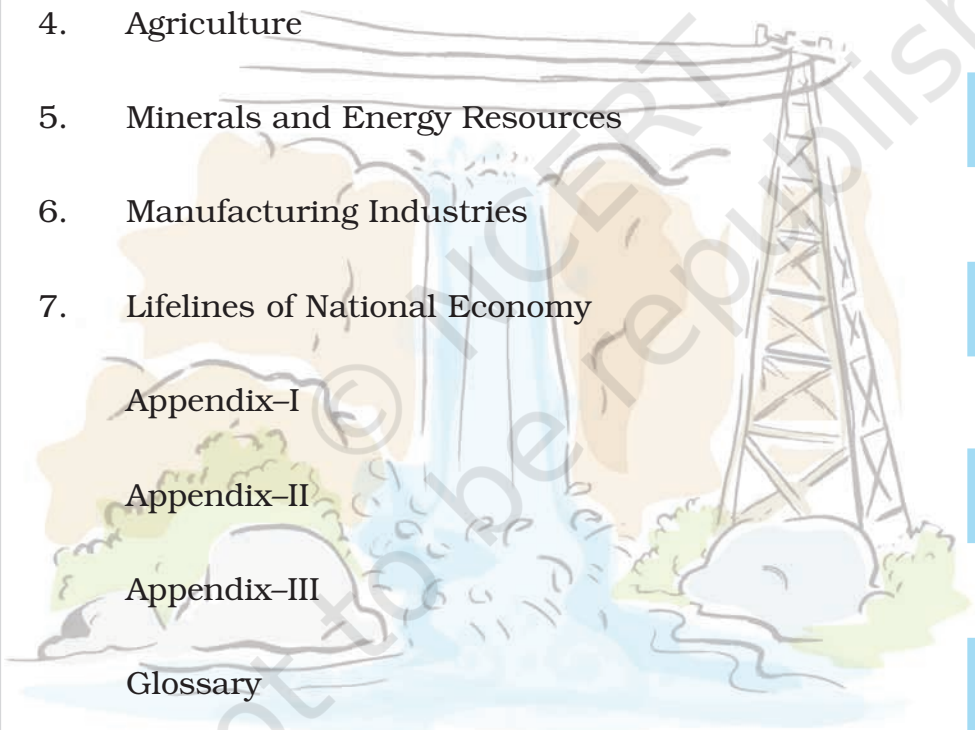
4. The administrative headquarters of Chandigarh, Haryana and Punjab are at Chandigarh.
5. The interstate boundaries amongst Arunachal Pradesh, Assam and Meghalaya shown on this map are as interpreted from the "North-Eastern Areas (Reorganisation) Act.1971," but have yet to be verified.
6. The external boundaries and coastlines of India agree with the Record/Master Copy certified by Survey of India.
7. The state boundaries between Uttarakhand & Uttar Pradesh, Bihar & Jharkhand and Chhattisgarh & Madhya Pradesh have not been verified by the Governments concerned.
8. The spellings of names in these maps have been taken from various sources.

School Bhuvan–NCERT an Online web portal

Web based online e-learning Geo spatial portal **School Bhuvan–NCERT** (URL: http://bhuvan.nrsc.gov.in/governance/mhrd_ncert/) has been launched by NCERT and ISRO in collaboration to enhance geo spatial skills among students. This online e-learning portal includes thematic maps given in Geography textbooks. This portal enables students to use Geo-spatial technology for better understanding of concepts in Geography. Online activities available on the portal as Level 1, Level 2 and Level 3 encourage learners from Classes VI to XII to develop neighbourhood maps and their attributes on satellite imageries available on **School Bhuvan–NCERT**.

CONTENTS



Constitution of India

Part IV A (Article 51 A)

Fundamental Duties

It shall be the duty of every citizen of India —

(a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;

(b) to cherish and follow the noble ideals which inspired our national struggle for freedom;

(c) to uphold and protect the sovereignty, unity and integrity of India;

(d) to defend the country and render national service when called upon to do so;

(e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;

(f) to value and preserve the rich heritage of our composite culture;

(g) to protect and improve the natural environment including forests, lakes, rivers, wildlife and to have compassion for living creatures;

(h) to develop the scientific temper, humanism and the spirit of inquiry and reform;

(i) to safeguard public property and to abjure violence;

(j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;

*(k) who is a parent or guardian, to provide opportunities for education to his child or, as the case may be, ward between the age of six and fourteen years.

Note: The Article 51A containing Fundamental Duties was inserted by the Constitution (42nd Amendment) Act, 1976 (with effect from 3 January 1977).

*(k) was inserted by the Constitution (86th Amendment) Act, 2002 (with effect from 1 April 2010).

RESOURCES AND DEVELOPMENT

Can you identify and name the various items used in making life comfortable in our villages and towns. List the items and name the material used in their making.

Everything available in our environment which can be used to satisfy our needs, provided, it is technologically accessible, economically feasible and culturally acceptable can be termed as 'Resource'.

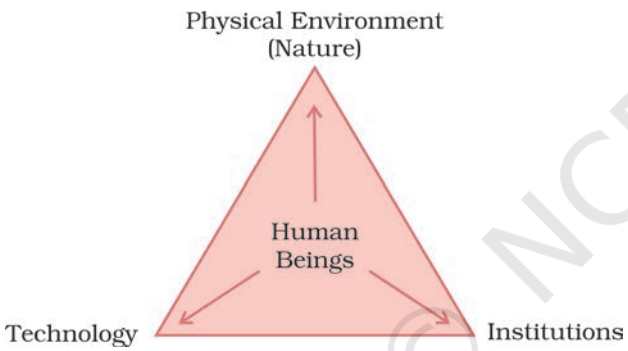


Fig. 1.1: Interdependent relationship between nature, technology and institutions

The process of transformation of things available in our environment involves an interactive relationship between nature, technology and institutions. Human beings interact with nature through technology and create institutions to accelerate their economic development.

Do you think that resources are free gifts of nature as is assumed by many? They are not. Resources are a function of human activities. Human beings themselves are essential components of resources. They transform material available in our environment into resources and use them. These resources can be classified in the following ways–

(a) On the basis of origin – biotic and abiotic
(b) On the basis of exhaustibility – renewable and non-renewable
(c) On the basis of ownership – individual, community, national and international
(d) On the basis of status of development – potential, developed stock and reserves.

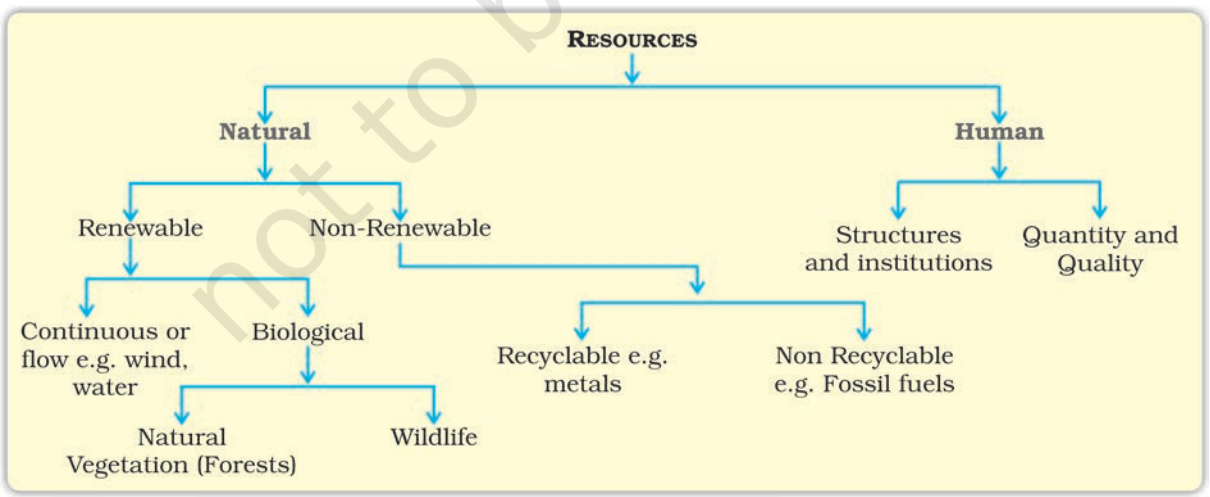


Fig. 1.2: Classification of resources

Activity

Identify at least two resources from each category.

Types of Resources

On the Basis of Origin

Biotic Resources: These are obtained from biosphere and have life such as human beings, flora and fauna, fisheries, livestock etc.

Abiotic Resources: All those things which are composed of non-living things are called abiotic resources. For example, rocks and metals.

On the Basis of Exhaustibility

Renewable Resources: The resources which can be renewed or reproduced by physical, chemical or mechanical processes are known as renewable or replenishable resources. For example, solar and wind energy, water, forests and wildlife, etc. The renewable resource may further be divided into continuous or flow (Fig.1.2).

Non-Renewable Resources: These occur over a very long geological time. Minerals and fossil fuels are examples of such resources. These resources take millions of years in their formation. Some of the resources like metals are recyclable and some like fossil fuels cannot be recycled and get exhausted with their use.

On the Basis of Ownership

Individual Resources: These are also owned privately by individuals. Many farmers own land which is allotted to them by government against the payment of revenue. In villages there are people with land ownership but there are many who are landless. Urban people own plots, houses and other property. Plantation, pasture lands, ponds, water in wells etc. are some of the examples of resources ownership by individuals. Make a list of resources owned by your household.

Community Owned Resources: There are resources which are accessible to all the members of the community. Village commons (grazing grounds, burial grounds, village ponds, etc.) public parks, picnic spots, playgrounds in urban areas are de facto accessible to all the people living there.

National Resources: Technically, all the resources belong to the nation. The country has legal powers to acquire even private property for public good. You might have seen roads, canals, railways being constructed on fields owned by some individuals. Urban Development Authorities get empowered by the government to acquire land. All the minerals, water resources, forests, wildlife, land within the political boundaries and oceanic area upto 12 nautical miles (22.2 km) from the coast termed as territorial water and resources therein belong to the nation.

International Resources: There are international institutions which regulate some resources. The oceanic resources beyond 200 nautical miles of the *Exclusive Economic Zone* belong to open ocean and no individual country can utilise these without the concurrence of international institutions.

Do you know?

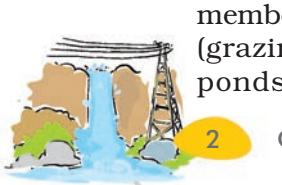
Do you know that India has got the right to mine manganese nodules from the bed of the Indian Ocean from that area which lies beyond the exclusive economic zone. Identify some other resources which are international in nature.

On the Basis of the Status of Development

Potential Resources: Resources which are found in a region, but have not been utilised. For example, the western parts of India particularly Rajasthan and Gujarat have enormous potential for the development of wind and solar energy, but so far these have not been developed properly.

Developed Resources: Resources which are surveyed and their quality and quantity have been determined for utilisation. The development of resources depends on technology and level of their feasibility.

Stock: Materials in the environment which have the potential to satisfy human needs but human beings do not have the appropriate technology to access these, are included among



stock. For example, water is a compound of two gases; hydrogen and oxygen. Hydrogen can be used as a rich source of energy. But we do not have advanced technical 'know-how' to use it for this purpose. Hence, it can be considered as stock.

Reserves are the subset of the stock, which can be put into use with the help of existing technical 'know-how' but their use has not been started. These can be used for meeting future requirements. River water can be used for generating hydroelectric power but presently, it is being utilised only to a limited extent. Thus, the water in the dams, forests etc. is a reserve which can be used in the future.

Activity

Prepare a list of stock and reserve, resources that you are familiar with from your local area.

Development of Resources

Resources are vital for human survival as well as for maintaining the quality of life. It was believed that resources are free gifts of nature. As a result, human beings used them indiscriminately and this has led to the following major problems.

- Depletion of resources for satisfying the greed of a few individuals.
- Accumulation of resources in few hands, which, in turn, divided the society into two segments i.e. haves and have nots or rich and poor.
- Indiscriminate exploitation of resources has led to global ecological crises such as, global warming, ozone layer depletion, environmental pollution and land degradation.

Activity

1. Imagine, if the oil supply gets exhausted one day, how would this affect our life style?
2. Plan a survey in your colony/village to investigate people's attitude towards recycling of the domestic/agricultural wastes. Ask questions about :
   (a) What do they think about resources they use?
   (b) What is their opinion about the wastes, and its utilisation?
   (c) Collage your results.

An equitable distribution of resources has become essential for a sustained quality of life and global peace. If the present trend of resource depletion by a few individuals and countries continues, the future of our planet is in danger.

Therefore, resource planning is essential for sustainable existence of all forms of life. Sustainable existence is a component of sustainable development.

Sustainable development

Sustainable economic development means 'development should take place without damaging the environment, and development in the present should not compromise with the needs of the future generations.'

Rio de Janeiro Earth Summit, 1992

In June 1992, more than 100 heads of states met in Rio de Janeiro in Brazil, for the first International Earth Summit. The Summit was convened for addressing urgent problems of environmental protection and socio-economic development at the global level. The assembled leaders signed the Declaration on Global Climatic Change and Biological Diversity. The Rio Convention endorsed the global Forest Principles and adopted *Agenda 21* for achieving Sustainable Development in the 21st century.

Agenda 21

It is the declaration signed by world leaders in 1992 at the United Nations Conference on Environment and Development (UNCED), which took place at Rio de Janeiro, Brazil. It aims at achieving global sustainable development. It is an agenda to combat environmental damage, poverty, disease through global co-operation on common interests, mutual needs and shared responsibilities. One major objective of the Agenda 21 is that every local government should draw its own local Agenda 21.

Resource Planning

Planning is the widely accepted strategy for judicious use of resources. It has importance

in a country like India, which has enormous diversity in the availability of resources. There are regions which are rich in certain types of resources but are deficient in some other resources. There are some regions which can be considered self sufficient in terms of the availability of resources and there are some regions which have acute shortage of some vital resources. For example, the states of Jharkhand, Chhattisgarh and Madhya Pradesh are rich in minerals and coal deposits. Arunachal Pradesh has abundance of water resources but lacks in infrastructural development. The state of Rajasthan is very well endowed with solar and wind energy but lacks in water resources. The cold desert of Ladakh is relatively isolated from the rest of the country. It has very rich cultural heritage but it is deficient in water, infrastructure and some vital minerals. This calls for balanced resource planning at the national, state, regional and local levels.

Activity

Prepare a list of resources found in your state and also identify the resources that are important but deficit in your state.

Resource Planning in India

Resource planning is a complex process which involves : (i) identification and inventory of resources across the regions of the country. This involves surveying, mapping and qualitative and quantitative estimation and measurement of the resources. (ii) Evolving a planning structure endowed with appropriate technology, skill and institutional set up for implementing resource development plans. (iii) Matching the resource development plans with overall national development plans.

India has made concerted efforts for achieving the goals of resource planning right from the First Five Year Plan launched after Independence.

Find out

What resources are being developed in your surroundings by the community/village panchayats/ward level communities with the help of community participation?

The availability of resources is a necessary condition for the development of any region, but mere availability of resources in the absence of corresponding changes in technology and institutions may hinder development. There are many regions in our country that are rich in resources but these are included in economically backward regions. On the contrary there are some regions which have a poor resource base but they are economically developed.

Can you name some resource rich but economically backward regions and some resource poor but economically developed regions? Give reasons for such a situation.

The history of colonisation reveals that rich resources in colonies were the main attractions for the foreign invaders. It was primarily the higher level of technological development of the colonising countries that helped them to exploit resources of other regions and establish their supremacy over the colonies. Therefore, resources can contribute to development only when they are accompanied by appropriate technological development and institutional changes. India has experienced all this in different phases of colonisation. Therefore, in India, development, in general, and resource development in particular does not only involve the availability of resources, but also the technology, quality of human resources and the historical experiences of the people.

Conservation of Resources: Resources are vital for any developmental activity. But irrational consumption and over-utilisation of resources may lead to socio-economic and environmental problems. To overcome these problems, resource conservation at various levels is important. This had been the main concern of the leaders and thinkers in the past. For example, Gandhiji was very apt in voicing his concern about resource conservation in these words: "There is enough for everybody's need and not for any body's greed." He placed the greedy and selfish individuals and exploitative nature of modern technology as the root cause for resource depletion at the global level. He was against mass production and wanted to replace it with the production by the masses.

At the international level, the Club of Rome advocated resource conservation for the first time in a more systematic way in 1968. Subsequently, in 1974, Gandhian philosophy was once again presented by Schumacher in his book **Small is Beautiful**. The seminal contribution with respect to resource conservation at the global level was made by the Brundtland Commission Report, 1987. This report introduced the concept of 'Sustainable Development' and advocated it as a means for resource conservation, which was subsequently published in a book entitled **Our Common Future**. Another significant contribution was made at the Earth Summit at Rio de Janeiro, Brazil in 1992.

Land Resources

We live on land, we perform our economic activities on land and we use it in different ways. Thus, land is a natural resource of utmost importance. It supports natural vegetation, wild life, human life, economic activities, transport and communication systems. However, land is an asset of a finite magnitude, therefore, it is important to use the available land for various purposes with careful planning.

India has land under a variety of relief features, namely; mountains, plateaus, plains and islands. About 43 per cent of the land area is plain, which provides facilities for agriculture and industry. Mountains account for 30 per cent of the total surface area of the country and ensure perennial flow of some rivers, provide facilities for tourism and ecological aspects. About 27 per cent of the area of the country is the plateau region. It possesses rich reserves of minerals, fossil fuels and forests.

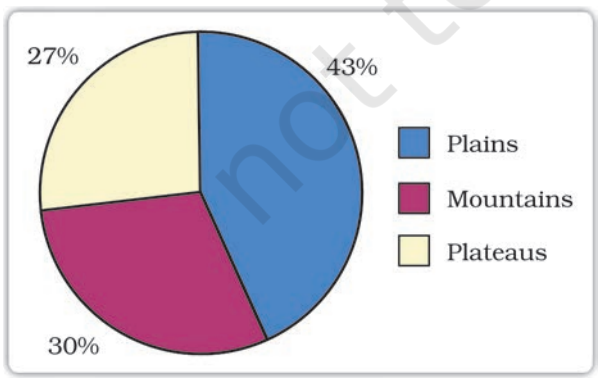


Fig 1.3: India : Land under important Relief Features

Land Utilisation

Land resources are used for the following purposes:

1. Forests
2. Land not available for cultivation
   (a) Barren and waste land
   (b) Land put to non-agricultural uses, e.g. buildings, roads, factories, etc.
3. Other uncultivated land (excluding fallow land)
   (a) Permanent pastures and grazing land,
   (b) Land under miscellaneous tree crops groves (not included in net sown area),
   (c) Cultruable waste land (left uncultivated for more than 5 agricultural years).
4. Fallow lands
   (a) Current fallow-(left without cultivation for one or less than one agricultural year),
   (b) Other than current fallow-(left uncultivated for the past 1 to 5 agricultural years).
5. Net sown area
   Area sown more than once in an agricultural year plus net sown area is known as *gross cropped area*.

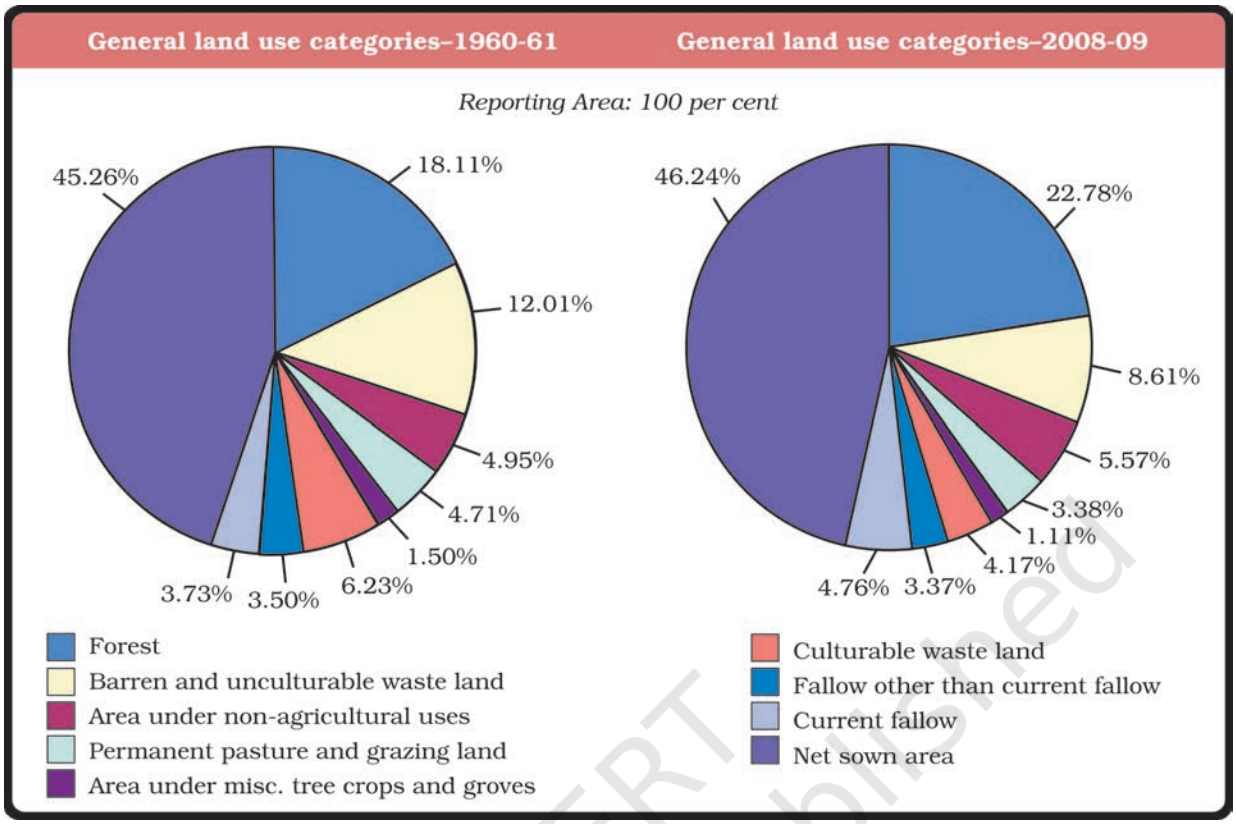
Land Use Pattern in India

The use of land is determined both by physical factors such as topography, climate, soil types as well as human factors such as population density, technological capability and culture and traditions etc.

Total geographical area of India is 3.28 million sq km. Land use data, however, is available only for 93 per cent of the total geographical area because the land use reporting for most of the north-east states except Assam has not been done fully. Moreover, some areas of Jammu and Kashmir occupied by Pakistan and China have also not been surveyed.

Activity

Try to do a comparison between the two pie charts (Fig. 1.4) given for land use and find out why the net sown area and the land under forests have changed from 1960-61 to 2008-09 very marginally.



Source : Directorate of Economics and Statistics, Ministry of Agriculture, 2008-09

Fig. 1.4

The land under permanent pasture has also decreased. How are we able to feed our huge cattle population on this pasture land and what are the consequences of it? Most of the other than the current fallow lands are either of poor quality or the cost of cultivation of such land is very high. Hence, these lands are cultivated once or twice in about two to three years and if these are included in the net sown area then the percentage of NSA in India comes to about 54 per cent of the total reporting area.

The pattern of net sown area varies greatly from one state to another. It is over 80 per cent of the total area in Punjab and Haryana and less than 10 per cent in Arunachal Pradesh, Mizoram, Manipur and Andaman Nicobar Islands.

Find out reasons for the low proportion of net sown area in these states.

Forest area in the country is far lower than the desired 33 per cent of geographical area, as it was outlined in the National Forest Policy (1952). It was considered essential for maintenance of the ecological balance. The livelihood of millions of people who live on the fringes of these forests depends upon it. A part of the land is termed as waste land and land put to other non-agricultural uses. Waste land includes rocky, arid and desert areas and land put to other non-agricultural uses includes settlements, roads, railways, industry etc. Continuous use of land over a long period of time without taking appropriate measures to conserve and manage it, has resulted in land degradation. This, in turn, has serious repercussions on society and the environment.

Land Degradation and Conservation Measures

We have shared our land with the past generations and will have to do so with the future generations too. Ninety-five per cent of our basic needs for food, shelter and clothing

are obtained from land. Human activities have not only brought about degradation of land but have also aggravated the pace of natural forces to cause damage to land.

At present, there are about 130 million hectares of degraded land in India. Approximately, 28 per cent of it belongs to the category of forest degraded area, 56 per cent of it is water eroded area and the rest is affected by saline and alkaline deposits. Some human activities such as deforestation, over grazing, mining and quarrying too have contributed significantly in land degradation.

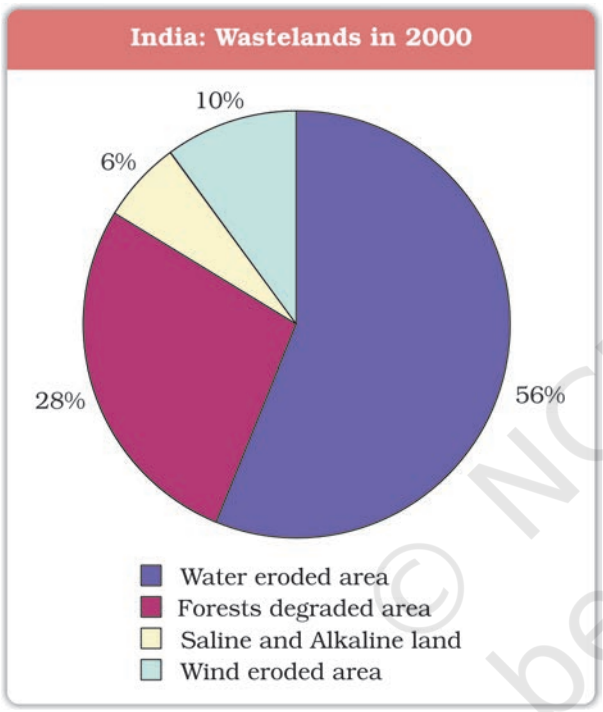


Fig. 1.5

Mining sites are abandoned after excavation work is complete leaving deep scars and traces of over-burdening. In states like Jharkhand, Chhattisgarh, Madhya Pradesh and Odisha deforestation due to mining have caused severe land degradation. In states like Gujarat, Rajasthan, Madhya Pradesh and Maharashtra overgrazing is one of the main reasons for land degradation. In the states of Punjab, Haryana, western Uttar Pradesh, over irrigation is responsible for land degradation due to water logging leading to increase in salinity and alkalinity in the soil. The mineral processing like grinding of limestone for cement industry and calcite and soapstone for ceramic industry generate huge quantity of dust in the atmosphere. It retards the process of infiltration of water into the soil after it settles down on the land. In recent years, industrial effluents as waste have become a major source of land and water pollution in many parts of the country.

There are many ways to solve the problems of land degradation. Afforestation and proper management of grazing can help to some extent. Planting of shelter belts of plants, control on over grazing, stabilisation of sand dunes by growing thorny bushes are some of the methods to check land degradation in arid areas. Proper management of waste lands, control of mining activities, proper discharge and disposal of industrial effluents and wastes after treatment can reduce land and water degradation in industrial and suburban areas.

Soil as a Resource

Soil is the most important renewable natural resource. It is the medium of plant growth and supports different types of living organisms on

Fig. 1.6: Soil Profile

the earth. The soil is a living system. It takes millions of years to form soil upto a few cm in depth. Relief, parent rock or bed rock, climate, vegetation and other forms of life and time are important factors in the formation of soil. Various forces of nature such as change in temperature, actions of running water, wind and glaciers, activities of decomposers etc. contribute to the formation of soil. Chemical and organic changes which take place in the soil are equally important. Soil also consists of organic (humus) and inorganic materials (Fig. 1.6).

On the basis of the factors responsible for soil formation, colour, thickness, texture, age, chemical and physical properties, the soils of India are classified in different types.

Classification of Soils

India has varied relief features, landforms, climatic realms and vegetation types. These have contributed in the development of various types of soils.

Alluvial Soils

This is the most widely spread and important soil. In fact, the entire northern plains are made of alluvial soil. These have been deposited by three important Himalayan river systems– the Indus, the Ganga and the Brahmaputra. These soils also extend in Rajasthan and Gujarat through a narrow corridor. Alluvial soil is also found in the eastern coastal plains particularly in the deltas of the Mahanadi, the Godavari, the Krishna and the Kaveri rivers.

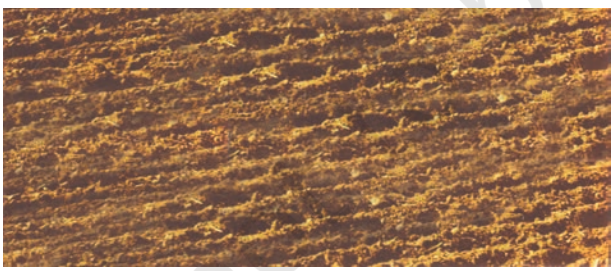


Fig. 1.7: *Alluvial Soil*

The alluvial soil consists of various proportions of sand, silt and clay. As we move inlands towards the river valleys, soil particles appear some what bigger in size. In the upper reaches of the river valley i.e. near the place of the break of slope, the soils are coarse. Such soils are more common in piedmont plains such as **Duars, Chos** and **Terai**.

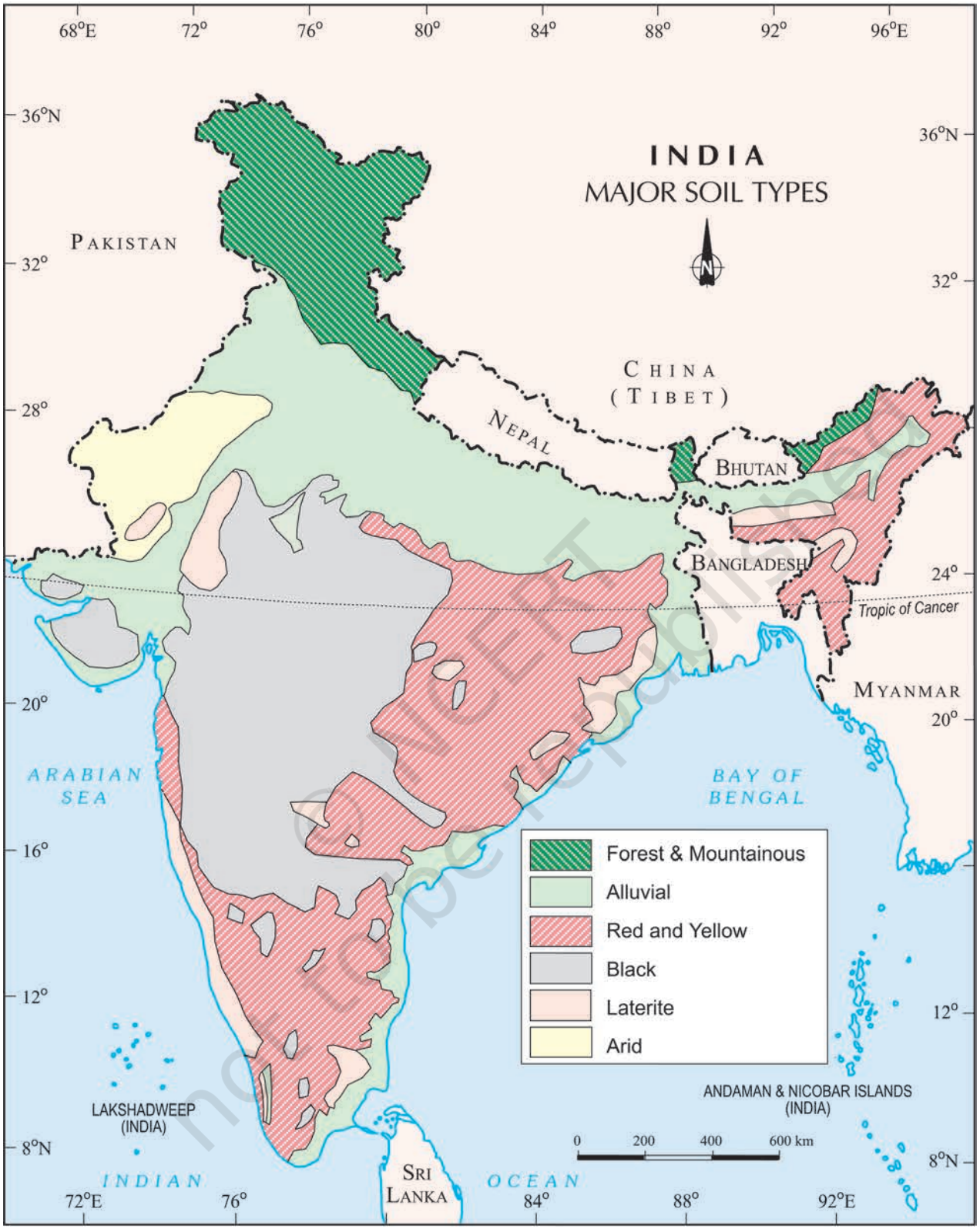
Apart from the size of their grains or components, soils are also described on the basis of their age. According to their age alluvial soils can be classified as old alluvial (**Bangar**) and new alluvial (**Khadar**). The **bangar** soil has higher concentration of *kanker* nodules than the **Khadar.** It has more fine particles and is more fertile than the **bangar**.

Alluvial soils as a whole are very fertile. Mostly these soils contain adequate proportion of potash, phosphoric acid and lime which are ideal for the growth of sugarcane, paddy, wheat and other cereal and pulse crops. Due to its high fertility, regions of alluvial soils are intensively cultivated and densely populated. Soils in the drier areas are more alkaline and can be productive after proper treatment and irrigation.

Black Soil

These soils are black in colour and are also known as *regur* soils. Black soil is ideal for growing cotton and is also known as *black cotton soil.* It is believed that climatic condition along with the parent rock material are the important factors for the formation of black soil. This type of soil is typical of the Deccan trap (*Basalt*) region spread over northwest Deccan plateau and is made up of lava flows. They cover the plateaus of Maharashtra, Saurashtra,

Fig. 1.8: *Black Soil*



India: *Major Soil Types*

Malwa, Madhya Pradesh and Chhattisgarh and extend in the south east direction along the Godavari and the Krishna valleys.

The black soils are made up of extremely fine i.e. clayey material. They are well-known for their capacity to hold moisture. In addition, they are rich in soil nutrients, such as calcium carbonate, magnesium, potash and lime. These soils are generally poor in phosphoric contents. They develop deep cracks during hot weather, which helps in the proper aeration of the soil. These soils are sticky when wet and difficult to work on unless tilled immediately after the first shower or during the pre-monsoon period.

Red and Yellow Soils

Red soil develops on crystalline igneous rocks in areas of low rainfall in the eastern and southern parts of the Deccan plateau. Yelllow and red soils are also found in parts of Odisha, Chhattisgarh, southern parts of the middle Ganga plain and along the piedmont zone of the Western Ghats. These soils develop a reddish colour due to diffusion of iron in crystalline and metamorphic rocks. It looks yellow when it occurs in a hydrated form.

Laterite Soil

Laterite has been derived from the Latin word 'later' which means brick. The laterite soil develops under tropical and subtropical climate with alternate wet and dry season. This soil is the result of intense leaching due to heavy rain. Lateritic soils are mostly deep to very deep, acidic (pH<6.0), generally deficient in plant nutrients and occur mostly in southern states, Western Ghats region of Maharashtra, Odisha, some parts of West Bengal and North-east regions. Where these soils support deciduous and evergreen forests, it is humus rich, but under sparse vegetation and in semi-arid environment, it is generally humus poor. They are prone to erosion and degradation due to their position on the landscape. After adopting appropriate soil conservation techniques particularly in the hilly areas of Karnataka, Kerala and Tamil Nadu, this soil is very useful for growing tea and coffee. Red laterite soils in Tamil Nadu, Andhra Pradesh and Kerala are more suitable for crops like cashew nut.

Fig. 1.9: Laterite Soil

Arid Soils

Arid soils range from red to brown in colour. They are generally sandy in texture and saline in nature. In some areas the salt content is very high and common salt is obtained by evaporating the water. Due to the dry climate, high temperature, evaporation is faster and the soil lacks humus and moisture. The lower horizons of the soil are occupied by *Kankar* because of the increasing calcium content downwards. The *Kankar* layer formations in the bottom horizons restrict the infiltration of water. After proper irrigation these soils become cultivable as has been in the case of western Rajasthan.

Fig. 1.10: Arid Soil

Forest Soils

These soils are found in the hilly and mountainous areas where sufficient rain forests are available. The soils texture varies

according to the mountain environment where they are formed. They are loamy and silty in valley sides and coarse grained in the upper slopes. In the snow covered areas of Himalayas, these soils experience denudation and are acidic with low humus content. The soils found in the lower parts of the valleys particularly on the river terraces and alluvial fans are fertile.

Soil Erosion and Soil Conservation

The denudation of the soil cover and subsequent washing down is described as soil erosion. The processes of soil formation and erosion, go on simultaneously and generally there is a balance between the two. Sometimes, this balance is disturbed due to human activities like deforestation, over-grazing, construction and mining etc., while natural forces like wind, glacier and water lead to soil erosion. The running water cuts through the clayey soils and makes deep channels as **gullies**. The land becomes unfit for cultivation and is known as **bad land**. In the Chambal basin such lands are called ravines. Sometimes

Fig. 1.11: Soil Erosion

Fig. 1.12: Gully Erosion

water flows as a sheet over large areas down a slope. In such cases the top soil is washed away. This is known as **sheet erosion**. Wind blows loose soil off flat or sloping land known as wind erosion. Soil erosion is also caused due to defective methods of farming. Ploughing in a wrong way i.e. up and down the slope form channels for the quick flow of water leading to soil erosion.

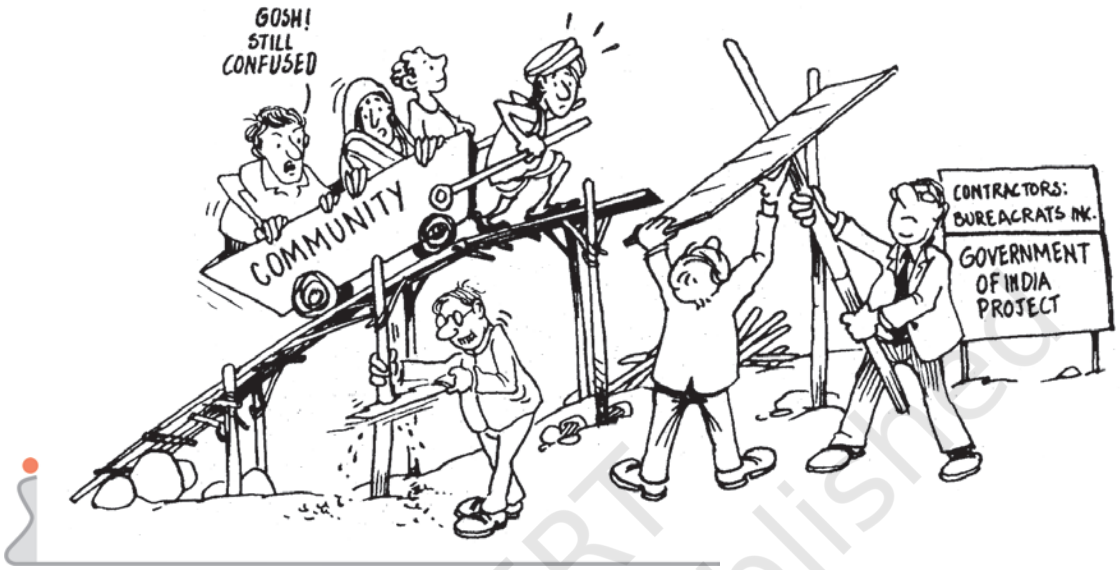
Ploughing along the contour lines can decelerate the flow of water down the slopes. This is called contour ploughing. Steps can be cut out on the slopes making terraces. Terrace cultivation restricts erosion. Western and central Himalayas have well developed terrace farming. Large fields can be divided into strips. Strips of grass are left to grow between the crops. This breaks up the force of the wind. This method is known as strip cropping. Planting lines of trees to create shelter also works in a similar way. Rows of such trees are called shelter belts. These shelter belts have contributed significantly to the stabilisation of sand dunes and in stabilising the desert in western India.

State of India's Environment

- The village of Sukhomajri and the district of Jhabua have shown that it is possible to reverse land degradation. Tree density in Sukhomajri increased from 13 per hectare in 1976 to 1,272 per hectare in 1992;
- Regeneration of the environment leads to economic well-being, as a result of greater resource availability, improved agriculture and animal care, and

consequently, increased incomes. Average annual household income in Sukhomajri ranged from Rs 10,000-15,000 between 1979 and 1984;

- People's management is essential for ecological restoration. With people being made the decision-makers by the Madhya Pradesh government, 2.9 million hectares or about 1 per cent of India's land area, are being greened across the state through watershed management.



Source: *The Citizens' Fifth Report, 1999 Centre of Science and Environment (CSE), New Delhi*

EXERCISES EXERCISES EXERCISES EXERCISES EXERCISES

1. Multiple choice questions.

(i) Which one of the following type of resource is iron ore?
- (a) Renewable
- (b) Biotic
- (c) Flow
- (d) Non-renewable

(ii) Under which of the following type of resource tidal energy cannot be put?
- (a) Replenishable
- (b) Human-made
- (c) Abiotic
- (d) Non-recyclable

(iii) Which one of the following is the main cause of land degradation in Punjab?
- (a) Intensive cultivation
- (b) Deforestation
- (c) Over irrigation
- (d) Overgrazing

(iv) In which one of the following states is terrace cultivation practised?
- (a) Punjab
- (b) Plains of Uttar Pradesh
- (c) Haryana
- (d) Uttarakhand

(v) In which of the following states black soil is predominantly found?
- (a) Jammu and Kashmir
- (b) Maharashtra
- (c) Rajasthan
- (d) Jharkhand

2. Answer the following questions in about 30 words.
   (i) Name three states having black soil and the crop which is mainly grown in it.
   (ii) What type of soil is found in the river deltas of the eastern coast? Give three main features of this type of soil.
   (iii) What steps can be taken to control soil erosion in the hilly areas?
   (iv) What are the biotic and abiotic resources? Give some examples.

3. Answer the following questions in about 120 words.
   (i) Explain land use pattern in India and why has the land under forest not increased much since 1960-61?
   (ii) How have technical and economic development led to more consumption of resources?

Project/Activity

1. Make a project showing consumption and conservation of resources in your locality.
2. Have a discussion in the class– how to conserve various resources used in your school.
3. Imagine if oil supplies get exhausted, how will this affect our life style?
4. Solve the puzzle by following your search horizontally and vertically to find the hidden answers.

S	F	G	S	F	O	B	R	O	M	S	U	A	P	J
Q	G	A	F	F	O	R	E	S	T	A	T	I	O	N
P	N	R	E	C	P	R	S	L	D	M	I	L	N	F
S	N	A	T	Q	X	U	O	V	A	I	O	L	A	L
O	D	E	I	D	R	J	U	J	L	D	B	N	B	D
T	G	H	M	I	N	E	R	A	L	S	A	X	M	W
B	V	J	K	M	E	D	C	R	U	P	F	M	H	R
L	A	T	E	R	I	T	E	M	V	A	Z	T	V	L
A	B	Z	O	E	N	M	F	T	I	S	D	L	R	C
C	G	N	N	S	Z	I	O	P	A	X	T	Y	J	H
K	J	G	K	D	T	D	C	S	L	S	E	G	E	W

(i) Natural endowments in the form of land, water, vegetation and minerals.
(ii) A type of non-renewable resource.
(iii) Soil with high water retaining capacity.
(iv) Intensively leached soils of the monsoon climate.
(v) Plantation of trees on a large scale to check soil erosion.
(vi) The Great Plains of India are made up of these soils.

2 FOREST AND WILDLIFE RESOURCES

Narak! My Lord, you are the creator of music in the world of Lepchas

Oh Narak! My Lord, let me dedicate myself to you

Let me gather your music from the springs, the rivers, the mountains, the forests, the insects and the animals

Let me gather your music from the sweet breeze and offer it to you

Source: *Lepcha folk song from northern part of West Bengal*

We share this planet with millions of other living beings, starting from micro-organisms and bacteria, lichens to banyan trees, elephants and blue whales. This entire habitat that we live in has immense biodiversity. We humans along with all living organisms form a complex web of ecological system in which we are only a part and very much dependent on this system for our own existence. For example, the plants, animals and micro-organisms re-create the quality of the air we breathe, the water we drink and the soil that produces our food without which we cannot survive. Forests play a key role in the ecological system as these are also the primary producers on which all other living beings depend.

Biodiversity or Biological Diversity is immensely rich in wildlife and cultivated species, diverse in form and function but closely integrated in a system through multiple network of interdependencies.

Flora and Fauna in India

If you look around, you will be able to find that there are some animals and plants which are unique in your area. In fact, India is one of the world's richest countries in terms of its vast array of biological diversity, and has nearly 8 per cent of the total number of species in the world (estimated to be 1.6 million). This is possibly twice or thrice the number yet to be discovered. You have already studied in detail about the extent and variety of forest and wildlife resources in India. You may have realised the importance of these resources in our daily life. These diverse flora and fauna are so well integrated in our daily life that we take these for granted. But, lately, they are under great stress mainy due to insensitivity to our environment.

Do you know?

Over 81,000 species of fauna and 47,000 species of flora are found in this country so far? Of the estimated 47,000 plant species, about 15,000 flowering species are endemic (indigenous) to India.

Activity

Find out stories prevalent in your region which are about the harmonious relationship between human beings and nature.

Some estimates suggest that at least 10 per cent of India's recorded wild flora and 20 per cent of its mammals are on the threatened list. Many of these would now be categorised as 'critical', that is on the verge of extinction like the cheetah, pink-headed duck, mountain quail, forest spotted owlet, and plants like *madhuca insignis* (a wild

variety of mahua) and *hubbardia heptaneuron*,(a species of grass). In fact, no one can say how many species may have already been lost. Today, we only talk of the larger and more visible animals and plants that have become extinct but what about smaller animals like insects and plants?

Do you know?

Do you know that among the larger animals in India, 79 species of mammals, 44 of birds, 15 of reptiles, and 3 of amphibians are threatened? Nearly 1,500 plant species are considered endangered. Flowering plants and vertebrate animals have recently become extinct at a rate estimated to be 50 to 100 times the average expected natural rate.

Vanishing Forests

The dimensions of deforestation in India are staggering. The forest and tree cover in the country is estimated at 79.42 million hectare, which is 24.16 per cent of the total geographical area (dense forest 12.2 per cent; open forest 9.14 per cent; and mangrove 0.14 per cent). According to the State of Forest Report (2015), the dense forest cover has increased by 3,775 sq km since 2013. However, this apparent increase in the forest cover is due to conservation measures, management interventions and plantation, etc., by different agencies.

Fig. 2.1

Let us now understand the different categories of existing plants and animal species. Based on the International Union for Conservation of Nature and Natural Resources (IUCN), we can classify as follows –

Normal Species: Species whose population levels are considered to be normal for their survival, such as cattle, sal, pine, rodents, etc.

Endangered Species: These are species which are in danger of extinction. The survival of such species is difficult if the negative factors that have led to a decline in their population continue to operate. The examples of such species are black buck, crocodile, Indian wild ass, Indian rhino, lion tailed macaque, sangai (brow anter deer in Manipur), etc.

Vulnerable Species: These are species whose population has declined to levels from where it is likely to move into the endangered category in the near future if the negative factors continue to operate. The examples of such species are blue sheep, Asiatic elephant, Gangetic dolphin, etc.

Rare Species: Species with small population may move into the endangered or vulnerable category if the negative factors affecting them continue to operate. The examples of such species are the Himalayan brown bear, wild Asiatic buffalo, desert fox and hornbill, etc.

Endemic Species: These are species which are only found in some particular areas usually isolated by natural or geographical barriers. Examples of such species are the Andaman teal, Nicobar pigeon, Andaman wild pig, mithun in Arunachal Pradesh.

Extinct Species: These are species which are not found after searches of known or likely areas where they may occur. A species may be extinct from a local area, region, country, continent or the entire earth. Examples of such species are the Asiatic cheetah, pink head duck.

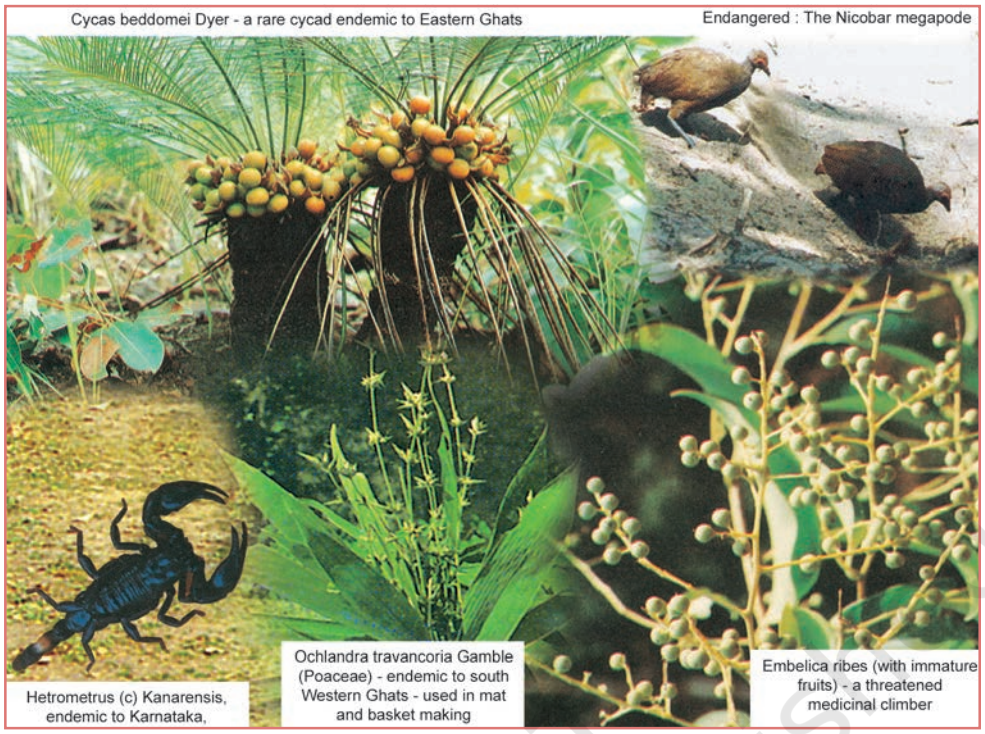


Fig. 2.2: A few extinct, rare and endangered species

Asiatic Cheetah: where did they go?

The world's fastest land mammal, the cheetah (Acinonyx jubantus), is a unique and specialised member of the cat family and can move at the speed of 112 km./hr. The cheetah is often mistaken for a leopard. Its distinguishing marks are the long teardrop-shaped lines on each side of the nose from the corner of its eyes to its mouth. Prior to the 20th century, cheetahs were widely distributed throughout Africa and Asia. Today, the Asian cheetah is nearly extinct due to a decline of available habitat and prey. The species was declared extinct in India long back in 1952.

What are the negative factors that cause such fearful depletion of the flora and fauna?

If you look around, you will be able to find out how we have transformed nature into a resource obtaining directly and indirectly from the forests and wildlife – wood, barks, leaves, rubber, medicines, dyes, food, fuel, fodder, manure, etc. So it is we ourselves who have depleted our forests and wildlife. The greatest damage inflicted on Indian forests was during the colonial period due to the expansion of the railways, agriculture, commercial and scientific forestry and mining activities. Even after Independence, agricultural expansion continues to be one of the major causes of depletion of forest resources. Between 1951 and 1980, according to the Forest Survey of India, over 26,200 sq. km. of forest area was converted into agricultural land all over India. Substantial parts of the tribal belts, especially in the north-eastern and central India, have been deforested or degraded by shifting cultivation (jhum), a type of 'slash and burn' agriculture.

Are colonial forest policies to be blamed?

Some of our environmental activists say that the promotion of a few favoured species, in many parts of India, has been carried through the ironically-termed "enrichment plantation", in which a single commercially valuable species was extensively planted and other species eliminated. For instance,

teak monoculture has damaged the natural forest in South India and Chir Pine (*Pinus roxburghii*) plantations in the Himalayas have replaced the Himalayan oak (*Quercius* spp.) and *Rhododendron* forests.

Large-scale development projects have also contributed significantly to the loss of forests. Since 1951, over 5,000 sq km of forest was cleared for river valley projects. Clearing of forests is still continuing with projects like the Narmada Sagar Project in Madhya Pradesh, which would inundate 40,000 hectares of forest. Mining is another important factor behind deforestation. The Buxa Tiger Reserve in West Bengal is seriously threatened by the ongoing dolomite mining. It has disturbed the natural habitat of many species and blocked the migration route of several others, including the great Indian elephant.

Many foresters and environmentalists hold the view that the greatest degrading factors behind the depletion of forest resources are grazing and fuel-wood collection. Though, there may be some substance in their argument, yet, the fact remains that a substantial part of the fuel-fodder demand is met by lopping rather than by felling entire trees. The forest ecosystems are repositories of some of the country's most valuable forest products, minerals and other resources that meet the demands of the rapidly expanding industrial-urban economy. These protected areas, thus mean different things to different people, and therein lies the fertile ground for conflicts.

The Himalayan Yew in trouble

The Himalayan Yew (*Taxus wallachiana*) is a medicinal plant found in various parts of Himachal Pradesh and Arunachal Pradesh. A chemical compound called 'taxol' is extracted from the bark, needles, twigs and roots of this tree, and it has been successfully used to treat some cancers – the drug is now the biggest selling anti-cancer drug in the world. The species is under great threat due to over-exploitation. In the last one decade, thousands of yew trees have dried up in various parts of Himachal Pradesh and Arunachal Pradesh.

Tribal girls using bamboo saplings in a nursery at Mukhali near Silent Valley

Tribal women selling minor forest produce

Leaf litter collection by women folk

Fig. 2.3

Habitat destruction, hunting, poaching, over-exploitation, environmental pollution, poisoning and forest fires are factors, which have led to the decline in India's biodiversity. Other important causes of environmental destruction are unequal access, inequitable consumption of resources and differential sharing of responsibility for environmental well-being. Over-population in third world countries is often cited as the cause of environmental degradation. However, an average American consumes 40 times more resources than an average Somalian. Similarly, the richest five per cent of Indian society probably cause more ecological damage because of the amount they consume than the poorest 25 per cent. The former shares minimum responsibilities for environmental well-being. The question is: who is consuming what, from where and how much?

Do you know?

Do you know that over half of India's natural forests are gone, one-third of its wetlands drained out, 70 per cent of its surface water bodies polluted, 40 per cent of its mangroves wiped out, and with continued hunting and trade of wild animals and commercially valuable plants, thousands of plant and animal species are heading towards extinction?

Activity

Have you noticed any activity which leads to the loss of biodiversity around you? Write a note on it and suggest some measures to prevent it.

The destruction of forests and wildlife is not just a biological issue. The biological loss is strongly correlated with the loss of cultural diversity. Such losses have increasingly marginalised and impoverished many indigenous and other forest-dependent communities, who directly depend on various components of the forest and wildlife for food, drink, medicine, culture, spirituality, etc. Within the poor, women are affected more than men. In many societies, women bear the major responsibility of collection of fuel, fodder, water and other basic subsistence needs. As these resources are depleted, the drudgery of women increases and sometimes they have to walk for more than 10 km to collect these resources. This causes serious health problems for women and negligence of home and children because of the increased hours of work, which often has serious social implications. The indirect impact of degradation such as severe drought or deforestation-induced floods, etc. also hits the poor the hardest. Poverty in these cases is a direct outcome of environmental destruction. Therefore, forest and wildlife, are vital to the quality of life and environment in the subcontinent. It is imperative to adapt to sound forest and wildlife conservation strategies.

Conservation of Forest and Wildlife in India

Conservation in the background of rapid decline in wildlife population and forestry has become essential. But why do we need to conserve our forests and wildlife? Conservation preserves the ecological diversity and our life support systems – water, air and soil. It also preserves the genetic diversity of plants and animals for better growth of species and breeding. For example, in agriculture, we are still dependent on traditional crop varieties. Fisheries too are heavily dependent on the maintenance of aquatic biodiversity.

In the 1960s and 1970s, conservationists demanded a national wildlife protection programme. The Indian Wildlife (Protection) Act was implemented in 1972, with various provisions for protecting habitats. An all-India list of protected species was also published. The thrust of the programme was towards protecting the remaining population of certain endangered species by banning hunting, giving legal protection to their habitats, and restricting trade in wildlife. Subsequently, central and many state governments established national parks and wildlife sanctuaries about which you have already studied. The central government also announced several projects for protecting specific animals, which were gravely threatened, including the tiger, the one-

Fig. 2.4: *Rhino and deer in Kaziranga National Park*

horned rhinoceros, the Kashmir stag or *hangul*, three types of crocodiles – fresh water crocodile, saltwater crocodile and the *Gharial*, the Asiatic lion, and others. Most recently, the Indian elephant, black buck (chinkara), the great Indian bustard (*godawan*) and the snow leopard, etc. have been given full or partial legal protection against hunting and trade throughout India.

Project Tiger

Tiger is one of the key wildlife species in the faunal web. In 1973, the authorities realised that the tiger population had dwindled to 1,827 from an estimated 55,000 at the turn of the century. The major threats to tiger population are numerous, such as poaching for trade, shrinking habitat, depletion of prey base species, growing human population, etc. The trade of tiger skins and the use of their bones in traditional medicines, especially in the Asian countries left the tiger population on the verge of extinction. Since India and Nepal provide habitat to about two-thirds of the surviving tiger population in the world, these two nations became prime targets for poaching and illegal trading.

"Project Tiger", one of the well-publicised wildlife campaigns in the world, was launched in 1973. Initially, it showed success as the tiger population went up to 4,002 in 1985 and 4,334 in 1989. But in 1993, the population of the tiger had dropped to 3,600. There were 39 tiger reserves in India covering an area of 32137.14 sq km*. Tiger conservation has been viewed not only as an effort to save an endangered species, but with equal importance as a means of preserving biotypes of sizeable magnitude. Corbett National Park in Uttarakhand, Sunderbans National Park in West Bengal, Bandhavgarh National Park in Madhya Pradesh, Sariska Wildlife Sanctuary in Rajasthan, Manas Tiger Reserve in Assam and Periyar Tiger Reserve in Kerala are some of the tiger reserves of India.

The conservation projects are now focusing on biodiversity rather than on a few of its components. There is now a more intensive search for different conservation measures. Increasingly, even insects are beginning to find a place in conservation planning. In the notification under Wildlife Act of 1980 and 1986, several hundred butterflies, moths, beetles, and one dragonfly have been added to the list of protected species. In 1991, for the first time plants were also added to the list, starting with six species.

Activity

Collect more information on the wildlife sanctuaries and national parks of India and cite their locations on the map of India.

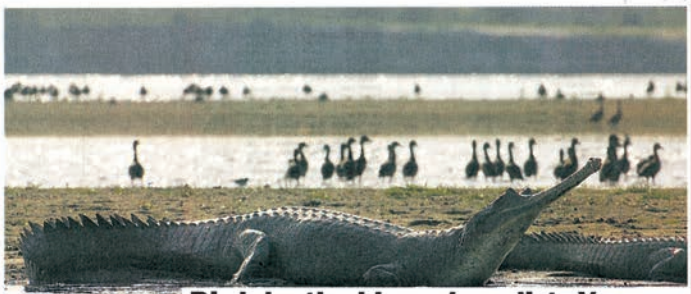
Source: *National Tiger Conservation Authority, Ministry of Environment and Forests, Government of India, 2009–10

Gharial on the brink

The gharial population has been at its lowest since the 1970s. What went wrong and what can we do?

ROMULUS WHITAKER and JANAKI LENIN

WISPY tendrils of mist rise delicately from the water surface, tinged gold by the dawn. Your breath hangs as little clouds of vapour as you gaze upon the Girwa River on a cold winter morning. A trio of hollow clapping sounds from the other side of the river, half a kilometre away tells you that an adult male gharial is advertising his presence. It is the height of the breeding season. The place seems trapped in a time in early history when man was still clad in animal skins. It is only as the sun rises higher and burns the mist off the water that the world comes into focus with appalling clarity. The five-km stretch of the Girwa River in Katerniaghat Wildlife Sanctuary is one of the only three wild breeding sites left in the world for the most unique of all the



CRITICALLY ENDANGERED: *Captive gharial at the Madras C*

hatched by FAO consultant Bob Bustard. When they reached a metre in length, they were released in the wild.

ability to support larger numbers of the animal.

During the dry summer months, the

Dhruva Basu compile of the last 10 years drastic decline in g

Bird deaths blamed on dirty Yamuna

Delhi Govt Report Points To Toxic Elements in Stagnant Water

By Nidhi Sharma/TNN

New Delhi: It is official now. The recent bird deaths reported in Okhla sanctuary were because of polluted Yamuna water and contaminated fish and not because of bird flu. The wildlife departments of UP and Delhi have sent reports to respective governments saying that more such deaths cannot be ruled out till the polluted water in this sanctuary is cleaned.

Fifty-three migratory birds were found dead in Okhla bird sanctuary earlier this month. Later UP authorities had arrested three fishermen and claimed that they had added poison to water to kill fish. These poisoned fish were reportedly

Can you find out the reasons for the above mentioned problems?

Types and Distribution of Forest and Wildlife Resources

Even if we want to conserve our vast forest and wildlife resources, it is rather difficult to manage, control and regulate them. In India, much of its forest and wildlife resources are either owned or managed by the government through the Forest Department or other government departments. These are classified under the following categories.

(i) ***Reserved Forests:*** More than half of the total forest land has been declared **reserved forests**. Reserved forests are regarded as the most valuable as far as the conservation of forest and wildlife resources are concerned.

(ii) ***Protected Forests:*** Almost one-third of the total forest area is protected forest, as declared by the Forest Department. This forest land are protected from any further depletion.

(iii) ***Unclassed Forests:*** These are other forests and wastelands belonging to both government and private individuals and communities.

Reserved and protected forests are also referred to as permanent forest estates maintained for the purpose of producing timber and other forest produce, and for protective reasons. Madhya Pradesh has the largest area under permanent forests, constituting 75 per cent of its total forest area. Jammu and Kashmir, Andhra Pradesh, Uttarakhand, Kerala, Tamil Nadu, West Bengal, and Maharashtra have large percentages of reserved forests of its total forest area whereas Bihar, Haryana, Punjab, Himachal Pradesh, Odisha and Rajasthan have a bulk of it under protected forests. All North-eastern states and parts of Gujarat have a very high percentage of their forests as unclassed forests managed by local communities.

Community and Conservation

Conservation strategies are not new in our country. We often ignore that in India, forests are also home to some of the traditional communities. In some areas of India, local communities are struggling to conserve these habitats along with government officials, recognising that only this will secure their own long-term livelihood. In Sariska Tiger Reserve, Rajasthan, villagers have fought against mining by citing the Wildlife Protection Act. In many areas, villagers themselves are protecting habitats and explicitly rejecting government involvement. The inhabitants of five villages in the Alwar district of Rajasthan have declared 1,200 hectares of forest as the Bhairodev Dakav 'Sonchuri', declaring their own set of rules and regulations which do not allow hunting, and are protecting the wildlife against any outside encroachments.

Sacred groves - a wealth of diverse and rare species

Nature worship is an age old tribal belief based on the premise that all creations of nature have to be protected. Such beliefs have preserved several virgin forests in pristine form called Sacred Groves (the forests of God and Goddesses). These patches of forest or parts of large forests have been left untouched by the local people and any interference with them is banned.

Certain societies revere a particular tree which they have preserved from time immemorial. The Mundas and the Santhal of Chota Nagpur region worship mahua (**Bassia latifolia**) and kadamba (**Anthocaphalus cadamba**) trees, and the tribals of Odisha and Bihar worship the tamarind (**Tamarindus indica**) and mango (**Mangifera indica**) trees during weddings. To many of us, peepal and banyan trees are considered sacred.

Indian society comprises several cultures, each with its own set of traditional methods of conserving nature and its creations. Sacred qualities are often ascribed to springs, mountain peaks, plants and animals which are closely protected. You will find troops of macaques and langurs around many temples. They are fed daily and treated as a part of temple devotees. In and around Bishnoi villages in Rajasthan, herds of blackbuck, (chinkara), nilgai and peacocks can be seen as an integral part of the community and nobody harms them.

Activity

Write a short essay on any practices which you may have observed and practised in your everyday lives that conserve and protect the environment around you.

The famous **Chipko** movement in the Himalayas has not only successfully resisted deforestation in several areas but has also shown that community afforestation with indigenous species can be enormously successful. Attempts to revive the traditional conservation methods or developing new methods of ecological farming are now widespread. Farmers and citizen's groups like the **Beej Bachao Andolan** in Tehri and **Navdanya** have shown that adequate levels of diversified crop production without the use of synthetic chemicals are possible and economically viable.

In India joint forest management (JFM) programme furnishes a good example for involving local communities in the management and restoration of degraded forests. The programme has been in formal existence since 1988 when the state of Odisha passed the first resolution for joint forest management. JFM depends on the formation of local (village) institutions that undertake protection activities mostly on degraded forest land managed by the forest department. In return, the members of these communities are entitled to intermediary benefits like non-timber forest produces and share in the timber harvested by 'successful protection'.

The clear lesson from the dynamics of both environmental destruction and reconstruction in India is that local communities everywhere have to be involved in some kind of natural resource management. But there is still a long way to go before local communities are at the centre-stage in decision-making. Accept only those economic or developmental activities, that are people centric, environment-friendly and economically rewarding.

"The tree is a peculiar organism of unlimited kindness and benevolence and makes no demand for its sustenance, and extends generously the products of its life activity. It affords protection to all beings, offering shade even to the axemen who destroy it".

Gautama Buddha (487 B.C.)

Exercises Exercises Exercises Exercises Exercises

1. Multiple choice questions.

   (i) Which of these statements is not a valid reason for the depletion of flora and fauna?
   - (a) Agricultural expansion.
   - (b) Large scale developmental projects.
   - (c) Grazing and fuel wood collection.
   - (d) Rapid industrialisation and urbanisation.

   (ii) Which of the following conservation strategies do not directly involve community participation?
   - (a) Joint forest management
   - (b) Beej Bachao Andolan
   - (c) Chipko Movement
   - (d) Demarcation of Wildlife sanctuaries

2. Match the following animals with their category of existence.

Animals/Plants	Category of existence
Black buck	Extinct
Asiatic elephant	Rare
Andaman wild pig	Endangered
Himalayan brown bear	Vulnerable
Pink head duck	Endemic

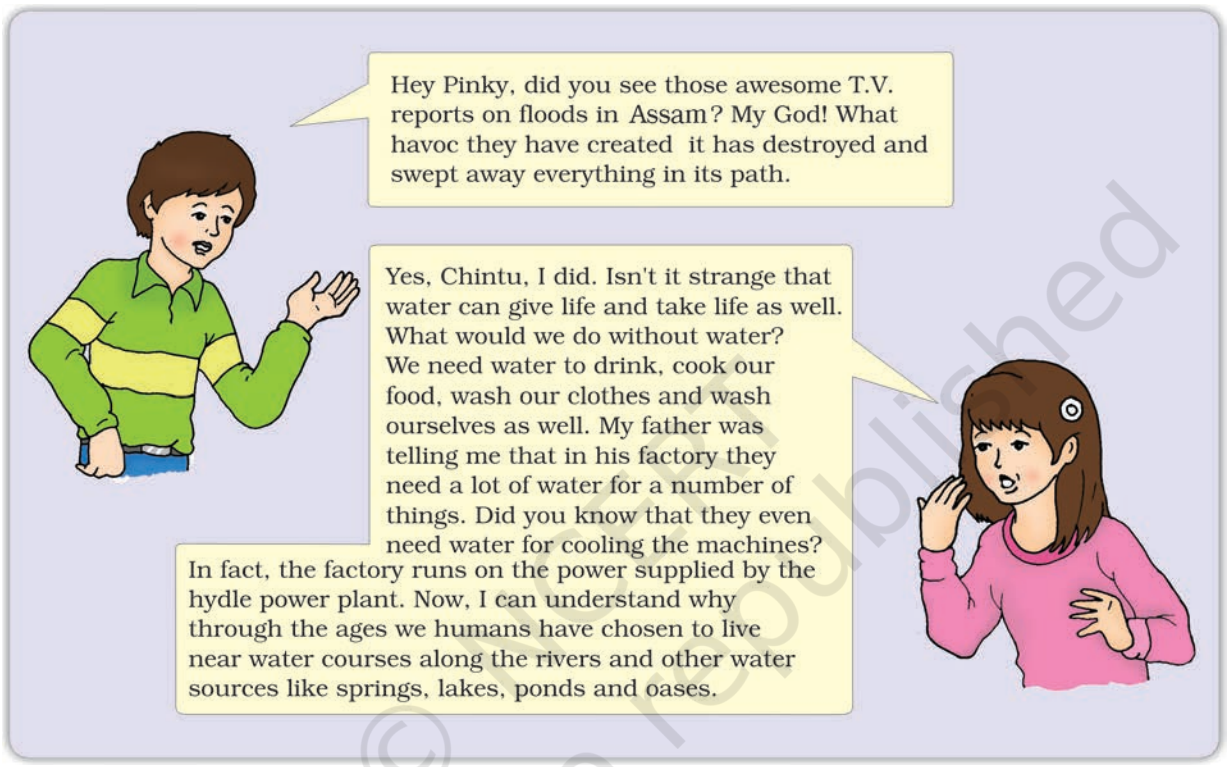
3. Match the following.

Reserved forests	other forests and wastelands belonging to both government and private individuals and communities
Protected forests	forests are regarded as most valuable as far as the conservation of forest and wildlife resources
Unclassed forests	forest lands are protected from any further depletion

4. Answer the following questions in about 30 words.
   (i) What is biodiversity? Why is biodiversity important for human lives?
   (ii) How have human activities affected the depletion of flora and fauna? Explain.

5. Answer the following questions in about 120 words.
   (i) Describe how communities have conserved and protected forests and wildlife in India?
   (ii) Write a note on good practices towards conserving forest and wildlife.

3 WATER RESOURCES



You already know that three-fourth of the earth's surface is covered with water, but only a small proportion of it accounts for freshwater that can be put to use. This freshwater is mainly obtained from surface run off and ground water that is continually being renewed and recharged through the hydrological cycle. All water moves within the hydrological cycle ensuring that water is a renewable resource.

You might wonder that if three-fourth of the world is covered with water and water is a renewable resource, then how is it that countries and regions around the globe suffer from water scarcity? Why is it predicted that by 2025, nearly two billion people will live in absolute water scarcity?

Water: Some facts and figures

- 96.5 per cent of the total volume of world's water is estimated to exist as oceans and only 2.5 per cent as freshwater. Nearly 70 per cent of this freshwater occurs as ice sheets and glaciers in Antarctica, Greenland and the mountainous regions of the world, while a little less than 30 per cent is stored as groundwater in the world's aquifers.
- India receives nearly 4 per cent of the global precipitation and ranks 133 in the world in terms of water availability per person per annum.
- The total renewable water resources of India are estimated at 1,897 sq km per annum.

- By 2025, it is predicted that large parts of India will join countries or regions having absolute water scarcity.

Source: *The UN World Water Development Report, 2003*

Water Scarcity and the Need for Water Conservation and Management

Given the abundance and renewability of water, it is difficult to imagine that we may suffer from water scarcity. The moment we speak of water shortages, we immediately associate it with regions having low rainfall or those that are drought prone. We instantaneously visualise the deserts of Rajasthan and women balancing many '*matkas*' (earthen pots) used for collecting and storing water and travelling long distances to get water. True, the availability of water resources varies over space and time, mainly due to the variations in seasonal and annual precipitation, but water scarcity in most cases is caused by over-exploitation, excessive use and unequal access to water among different social groups.

Water, Water Everywhere, Not a Drop to Drink: After a heavy downpour, a boy collects drinking water in Kolkata. Life in the city and its adjacent districts was paralysed as incessant overnight rain, meaning a record 180 mm, flooded vast area and disruted traffic.

एक ओर इजराइल जैसे 25 सेमी. औसत वार्षिक वर्षा वाले देश में जल का कोई अभाव नहीं है तो दूसरी ओर 114 सेमी. औसत वार्षिक वर्षा वाले हमारे देश में प्रति वर्ष किसी भाग में सूखा अवश्य पड़ता है। देश में जल की उपलब्धता और उसके स्वरूप के अनुसार समुचित जलप्रबंधन न होने के कारण ही वर्षा का जल नदी-नालों में तेजी से बहकर समुद्र में चला जाता है जिससे वर्षा के बाद के लगभग नौ महीने देश के लिए पानी की कमी के होते हैं। ये ही मूल कारण हैं देश में जलीय अभाव के, जिसे हम उचित प्रबंधन के द्वारा ही नियंत्रित कर सकते हैं।

A Kashmiri earthquake survivor carries water in the snow in a devastated village.

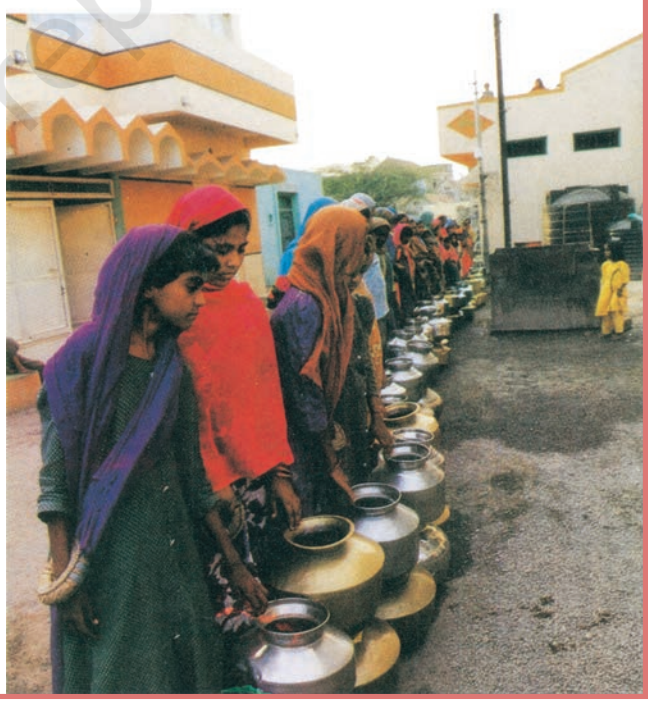


Fig. 3.1: Water Scarcity

According to Falkenmark, a Swedish expert, water stress occurs when water availability is between 1,000 and 1,600 cubic metre per person per year.

Where is then water scarcity likely to occur? As you have read in the hydrological cycle, freshwater can be obtained directly from precipitation, surface run off and groundwater.

Is it possible that an area or region may have ample water resources but is still facing water scarcity? Many of our cities are such examples. Thus, water scarcity may be an outcome of large and growing population and consequent greater demands for water, and unequal access to it. A large population requires more water not only for domestic use but also to produce more food. Hence, to facilitate higher food-grain production, water resources are being over-exploited to expand irrigated areas for dry-season agriculture. Irrigated agriculture is the largest consumer of water. Now it is needed to revolutionise the agriculture through developing drought resistant crops and dry farming techniques. You may have seen in many television advertisements that most farmers have their own wells and tube-wells in their farms for irrigation to increase their produce. But have you ever wondered what this could result in? That it may lead to falling groundwater levels, adversely affecting water availability and food security of the people.

Post-independent India witnessed intensive industrialisation and urbanisation, creating vast opportunities for us. Today, large industrial houses are as commonplace as the industrial units of many MNCs (Multinational Corporations). The ever-increasing number of industries has made matters worse by exerting pressure on existing freshwater resources. Industries, apart from being heavy users of water, also require power to run them. Much of this energy comes from hydroelectric power. Today, in India hydroeclectric power contributes approximately 22 per cent of the total electricity produced. Moreover, multiplying urban centres with large and dense populations and urban lifestyles have not only added to water and energy requirements but have further aggravated the problem. If you look into the housing societies or colonies in the cities, you would find that most of these have their own groundwater pumping devices to meet their water needs. Not surprisingly, we find that fragile water resources are being over-exploited and have caused their depletion in several of these cities.

So far we have focused on the quantitative aspects of water scarcity. Now, let us consider another situation where water is sufficiently available to meet the needs of the people, but, the area still suffers from water scarcity. This scarcity may be due to bad quality of water. Lately, there has been a growing concern that even if there is ample water to meet the needs of the people, much of it may be polluted by domestic and industrial wastes, chemicals, pesticides and fertilisers used in agriculture, thus, making it hazardous for human use.

India's rivers, especially the smaller ones, have all turned into toxic streams. And even the big ones like the Ganga and Yamuna are far from being pure. The assault on India's rivers – from population growth, agricultural modernisation, urbanisation and industrialisation – is enormous and growing by the day..... This entire life stands threatened.

Source: *The Citizens' Fifth Report, CSE, 1999.*

You may have already realised that the need of the hour is to conserve and manage our water resources, to safeguard ourselves from health hazards, to ensure food security, continuation of our livelihoods and productive activities and also to prevent degradation of our natural ecosystems. Over exploitation and mismanagement of water resources will impoverish this resource and cause ecological crisis that may have profound impact on our lives.

Activity

From your everyday experiences, write a short proposal on how you can conserve water.

Multi-purpose River Projects and Integrated Water Resources Management

But, how do we conserve and manage water? Archaeological and historical records show that from ancient times we have been constructing sophisticated hydraulic structures like dams built of stone rubble, reservoirs or lakes, embankments and canals for irrigation. Not surprisingly, we have continued this tradition in modern India by building dams in most of our river basins.

Hydraulic Structures in Ancient India

- In the first century B.C., Sringaverapura near Allahabad had sophisticated water harvesting system channelling the flood water of the river Ganga.
- During the time of Chandragupta Maurya, dams, lakes and irrigation systems were extensively built.
- Evidences of sophisticated irrigation works have also been found in Kalinga, (Odisha), Nagarjunakonda (Andhra Pradesh), Bennur (Karnataka), Kolhapur (Maharashtra), etc.
- In the 11th Century, Bhopal Lake, one of the largest artificial lakes of its time was built.
- In the 14th Century, the tank in Hauz Khas, Delhi was constructed by Iltutmish for supplying water to Siri Fort area.

Source: *Dying Wisdom, CSE, 1997.*

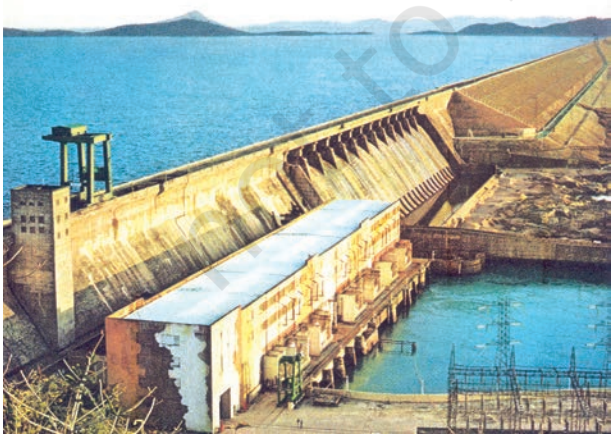


Fig. 3.2: *Hirakud Dam*

What are dams and how do they help us in conserving and managing water? Dams were traditionally built to impound rivers and rainwater that could be used later to irrigate agricultural fields. Today, dams are built not just for irrigation but for electricity generation, water supply for domestic and industrial uses, flood control, recreation, inland navigation and fish breeding. Hence, dams are now referred to as multi-purpose projects where the many uses of the impounded water are integrated with one another. For example, in the Sutluj-Beas river basin, the Bhakra – Nangal project water is being used both for hydel power production and irrigation. Similarly, the Hirakud project in the Mahanadi basin integrates conservation of water with flood control.

A **dam** is a barrier across flowing water that obstructs, directs or retards the flow, often creating a reservoir, lake or impoundment. "Dam" refers to the reservoir rather than the structure. Most dams have a section called a spillway or weir over which or through which it is intended that water will flow either intermittently or continuously. Dams are classified according to structure, intended purpose or height. Based on structure and the materials used, dams are classified as timber dams, embankment dams or masonry dams, with several subtypes. According to the height, dams can be categorised as large dams and major dams or alternatively as low dams, medium height dams and high dams.

Multi-purpose projects, launched after Independence with their integrated water resources management approach, were thought of as the vehicle that would lead the nation to development and progress, overcoming the handicap of its colonial past. Jawaharlal Nehru proudly proclaimed the dams as the 'temples of modern India'; the reason being that it would integrate development of agriculture and the village economy with rapid industrialisation and growth of the urban economy.

Activity

Find out more about any one traditional method of building dams and irrigation works.

We have sown the crops in Asar
We will bring Bhadu in Bhadra
Floods have swollen the Damodar
The sailing boats cannot sail
Oh! Damodar, we fall at your feet
Reduce the floods a little
Bhadu will come a year later
Let the boats sail on your surface

(This popular Bhadu song in the Damodar valley region narrates the troubles faced by people owing to the flooding of Damodar river known as the river of sorrow.)

In recent years, multi-purpose projects and large dams have come under great scrutiny and opposition for a variety of reasons. Regulating and damming of rivers affect their natural flow causing poor sediment flow and excessive sedimentation at the bottom of the reservoir, resulting in rockier stream beds and poorer habitats for the rivers' aquatic life. Dams also fragment rivers making it difficult for aquatic fauna to migrate, especially for spawning. The reservoirs that are created on the floodplains also submerge the existing vegetation and soil leading to its decomposition over a period of time.

Multi-purpose projects and large dams have also been the cause of many new environmental movements like the 'Narmada Bachao Andolan' and the 'Tehri Dam Andolan' etc. Resistance to these projects has primarily been due to the large-scale displacement of local communities. Local people often had to give up their land, livelihood and their meagre access and control over resources for the greater good of the nation. So, if the local people are not benefiting from such projects then who is benefited? Perhaps, the landowners and large farmers, industrialists and few urban centres. Take the case of the landless in a village – does he really gain from such a project?

Narmada Bachao Andolan or Save Narmada Movement is a Non Governmental Organisation (NGO) that mobilised tribal people, farmers, environmentalists and human rights activists against the Sardar Sarovar Dam being built across the Narmada river in Gujarat. It originally focused on the environmental issues related to trees that would be submerged under the dam water. Recently it has re-focused the aim to enable poor citizens, especially the oustees (displaced people) to get full rehabilitation facilities from the government.

People felt that their suffering would not be in vain... accepted the trauma of displacement believing in the promise of irrigated fields and plentiful harvests. So, often the survivors of Rihand told us that they accepted their sufferings as sacrifice for the sake of their nation. But now, after thirty bitter years of being adrift, their livelihood having even being more precarious, they keep asking: "Are we the only ones chosen to make sacrifices for the nation?"

Source: *S. Sharma, quoted in In the Belly of the River. Tribal conflicts over development in Narmada valley, A. Baviskar, 1995.*

Do you know?

Sardar Sarovar Dam has been built over the Narmada River in Gujarat. This is one of the largest water resource projects of India covering four states—Maharashtra, Madhya Pradesh, Gujarat and Rajasthan. The Sardar Sarovar project would meet the requirement of water in drought-prone and desert areas of Gujarat (9,490 villages and 173 towns) and Rajasthan (124 villages).

Source: *http://www.sardarsarovardam.org/project.aspx*

Irrigation has also changed the cropping pattern of many regions with farmers shifting to water intensive and commercial crops. This has great ecological consequences like salinisation of the soil. At the same time, it has transformed the social landscape i.e.

India: Major Rivers and Dams

increasing the social gap between the richer landowners and the landless poor. As we can see, the dams did create conflicts between people wanting different uses and benefits from the same water resources. In Gujarat, the Sabarmati-basin farmers were agitated and almost caused a riot over the higher priority given to water supply in urban areas, particularly during droughts. Inter-state water disputes are also becoming common with regard to sharing the costs and benefits of the multi-purpose project.

Do you know?

Do you know that the Krishna-Godavari dispute is due to the objections raised by Karnataka and Andhra Pradesh governments? It is regarding the diversion of more water at Koyna by the Maharashtra government for a multipurpose project. This would reduce downstream flow in their states with adverse consequences for agriculture and industry.

Activity

Make a list of inter-state water disputes.

Most of the objections to the projects arose due to their failure to achieve the purposes for which they were built. Ironically, the dams that were constructed to control floods have triggered floods due to sedimentation in the reservoir. Moreover, the big dams have mostly been unsuccessful in controlling floods at the time of excessive rainfall. You may have seen or read how the release of water from dams during heavy rains aggravated the flood situation in Maharashtra and Gujarat in 2006. The floods have not only devastated life and property but also caused extensive soil erosion. Sedimentation also meant that the flood plains were deprived of silt, a natural fertiliser, further adding on to the problem of land degradation. It was also observed that the multi-purpose projects induced earthquakes, caused water-borne diseases and pests and pollution resulting from excessive use of water.

FLOODS

Basic Safety Precautions To Be Taken :

- Listen to radio/TV for the latest weather bulletins and flood warnings. Pass on the information to others.
- Make a family emergency kit which should include; a portable radio/transistor, torch, spare batteries, a first aid box along with essential medicines, ORS, dry food items, drinking water, matchboxes, candles and other essential items.
- Keep hurricane lamp, ropes, rubber tubes, umbrella and bamboo stick in your house. These could be useful.
- Keep your cash, jewellery, valuables, important documents etc. in a safe place.
- If there is a flood, move along with your family members and cattle to safe areas like relief camps, evacuation centres, elevated grounds where you can take shelter.
- Turn off power and gas connections before leaving your house.

During floods

- Don't enter into flood waters; it could be dangerous.
- Don't allow children to play in or near flood waters.
- Stay away from sewerage line, gutters, drains, culverts etc.
- Be careful of snakes; snakebites are common during floods.
- Stay away from electric poles and fallen power-lines to avoid electrocution.
- Don't use wet electrical appliances - get them checked before use.
- Eat freshly cooked and dry food. Always keep your food covered.
- Use boiled and filtered drinking water.
- Keep all drains, gutters near your house clean.
- Stagnation of water can breed vector/water-borne diseases .In case of sickness, seek medical assistance.
- Use bleaching powder and lime to disinfect the surroundings.

THE RIDE OF HIS LIFE

Lift-off : An IAF helicopter rescues a woman and her child from the Dongargaon village of Maharashtra's Hingoli district. In all, 11 choppers were pressed into rescue operations across the state (Related reports on P)

UP, UP & AWAY : An IAF helicopter rescues a worker who was trapped in the floodwaters of the Tawi river in Jammu on Thursday

Heavy rain drowns Kolkata

Durga Puja Preparations Go Awry As Met Predicts Downpour For Next 2 Days

BARELY AFLOAT: A bus is stuck in a waterlogged street in Kolkata on Friday

Collect information about flood prone areas of the country

Rainwater Harvesting

Many thought that given the disadvantages and rising resistance against the multi-purpose projects, water harvesting system was a viable alternative, both socio-economically and environmentally. In ancient India, along with the sophisticated hydraulic structures, there existed an extraordinary tradition of water-harvesting system. People had in-depth knowledge of rainfall regimes and soil types and developed wide ranging techniques to harvest rainwater, groundwater, river water and flood water in keeping with the local ecological conditions and their water needs. In hill and mountainous regions, people built diversion channels like the 'guls' or 'kuls' of the Western Himalayas for agriculture. 'Rooftop rainwater harvesting' was commonly practised to store drinking water, particularly in Rajasthan. In the flood plains of Bengal, people developed inundation channels to irrigate their fields. In arid and semi-arid regions, agricultural fields were converted into rain fed storage structures that allowed the water to stand and moisten the soil like the 'khadins' in Jaisalmer and 'Johads' in other parts of Rajasthan.

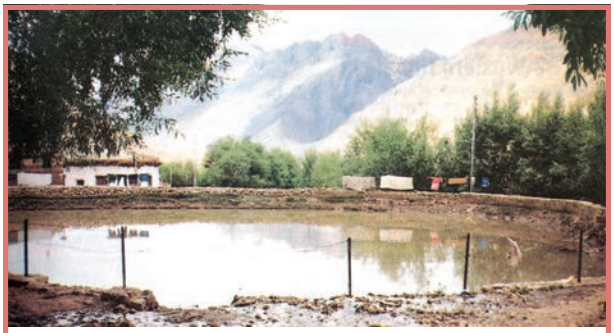
Fig. 3.3

(a) Recharge through Hand Pump

(b) Recharge through Abandoned Dugwell

Fig 3.4: *Rooftop Rainwater Harvesting*

- Rooftop rainwater is collected using a PVC pipe
- Filtered using sand and bricks
- Underground pipe takes water to sump for immediate usage
- Excess water from the sump is taken to the well
- Water from the well recharges the underground
- Take water from the well (later)



A kul leads to a circular village tank, as the above in the Kaza village, from which water is released as and when required.

Fig 3.5: *Traditional method of rainwater harvesting*

In the semi-arid and arid regions of Rajasthan, particularly in Bikaner, Phalodi and Barmer, almost all the houses traditionally had underground tanks or *tankas* for storing drinking water. The tanks could be as large as a big room; one household in Phalodi had a tank that was 6.1 metres deep, 4.27 metres long and 2.44 metres wide. The tankas were part of the well-developed rooftop rainwater harvesting system and were built inside the main house or the courtyard. They were connected to the sloping roofs of the houses through a pipe. Rain falling on the rooftops would travel down the pipe and was stored in these underground 'tankas'. The first spell of rain was usually not collected as this would clean the roofs and the pipes. The rainwater from the subsequent showers was then collected.

The rainwater can be stored in the **tankas** till the next rainfall making it an extremely reliable source of drinking water when all other sources are dried up, particularly in the summers. Rainwater, or **palar pani**, as commonly referred to in these parts, is considered the purest form of natural water. Many houses constructed underground rooms adjoining the 'tanka' to beat the summer heat as it would keep the room cool.

Interesting Fact

Rooftop rainwater harvesting is the most common practice in Shillong, Meghalaya. It is interesting because Cherapunjee and Mawsynram situated at a distance of 55 km. from Shillong receive the highest rainfall in the world, yet the state capital Shillong faces acute shortage of water. Nearly every household in the city has a rooftop rainwater harvesting structure. Nearly 15-25 per cent of the total water requirement of the household comes from rooftop water harvesting.

Activity

Find out other rainwater harvesting systems existing in and around your locality.

Today, in western Rajasthan, sadly the practice of rooftop rainwater harvesting is on the decline as plenty of water is available due to the perennial Indira Gandhi Canal, though some houses still maintain the tankas since they do not like the taste of tap water. Fortunately, in many parts of rural and urban India, rooftop rainwater harvesting is being successfully adapted to store and conserve water. In Gendathur, a remote backward village in Mysuru, Karnataka, villagers have installed, in their household's rooftop, rainwater harvesting system to meet their water needs. Nearly 200 households have installed this system and the village has earned the rare distinction of being rich in rainwater. See Fig. 3.6 for a better

Rooftop harvesting was common across the towns and villages of the Thar. Rainwater that falls on the sloping roofs of houses is taken through a pipe into an underground *tanka* (circular holes in the ground). built in the main house or in the courtyard. The picture above shows water being taken from a neighbour's roof through a long pipe. Here the neighbour's rooftop has been used for collection of rainwater. The picture shows a hole through which rainwater flows down into an underground *tanka*.

Fig. 3.6

Bamboo Drip Irrigation System

In Meghalaya, a 200-year-old system of tapping stream and spring water by using bamboo pipes, is prevalent. About 18-20 litres of water enters the bamboo pipe system, gets transported over hundreds of metres, and finally reduces to 20-80 drops per minute at the site of the plant.

Picture 1: Bamboo pipes are used to divert perennial springs on the hilltops to the lower reaches by gravity.

Picture 2 and 3: The channel sections, made of bamboo, divert water to the plant site where it is distributed into branches, again made and laid out with different forms of bamboo pipes. The flow of water into the pipes is controlled by manipulating the pipe positions.

Picture 4: If the pipes pass a road, they are taken high above the land.

Picture 5 and 6

Reduced channel sections and diversion units are used at the last stage of water application. The last channel section enables water to be dropped near the roots of the plant.

Fig 3.7

understanding of the rooftop rainwater harvesting system which is adapted here. Gendathur receives an annual precipitation of 1,000 mm, and with 80 per cent of collection efficiency and of about 10 fillings, every house can collect and use about 50,000 litres of water annually. From the 200 houses, the net amount of rainwater harvested annually amounts to 1,00,000 litres.

Interesting Fact

Tamil Nadu is the first state in India which has made rooftop rainwater harvesting structure compulsory to all the houses across the state. There are legal provisions to punish the defaulters.

Activity

1. Collect information on how industries are polluting our water resources.
2. Enact with your classmates a scene of water dispute in your locality.

EXERCISES EXERCISES EXERCISES EXERCISES EXERCISES

1. Multiple choice questions.

   (i) Based on the information given below classify each of the situations as 'suffering from water scarcity' or 'not suffering from water scarcity'.

   (a) Region with high annual rainfall.

   (b) Region having high annual rainfall and large population.

   (c) Region having high annual rainfall but water is highly polluted.

   (d) Region having low rainfall and low population.

   (ii) Which one of the following statements is not an argument in favour of multi-purpose river projects?

   (a) Multi-purpose projects bring water to those areas which suffer from water scarcity.

   (b) Multi-purpose projects by regulating water flow helps to control floods.

   (c) Multi-purpose projects lead to large scale displacements and loss of livelihood.

   (d) Multi-purpose projects generate electricity for our industries and our homes.

   (iii) Here are some false statements. Identify the mistakes and rewrite them correctly.

   (a) Multiplying urban centres with large and dense populations and urban lifestyles have helped in proper utilisation of water resources.

   (b) Regulating and damming of rivers does not affect the river's natural flow and its sediment flow.

   (c) In Gujarat, the Sabarmati basin farmers were not agitated when higher priority was given to water supply in urban areas, particularly during droughts.

   (d) Today in Rajasthan, the practice of rooftop rainwater water harvesting has gained popularity despite high water availability due to the Indira Gandhi Canal.

2. Answer the following questions in about 30 words.

   (i) Explain how water becomes a renewable resource.

   (ii) What is water scarcity and what are its main causes?

   (iii) Compare the advantages and disadvantages of multi-purpose river projects.

3. Answer the following questions in about 120 words.

   (i) Discuss how rainwater harvesting in semi-arid regions of Rajasthan is carried out.

   (ii) Describe how modern adaptations of traditional rainwater harvesting methods are being carried out to conserve and store water.

4 AGRICULTURE

India is an agriculturally important country. Two-thirds of its population is engaged in agricultural activities. Agriculture is a primary activity, which produces most of the food that we consume. Besides food grains, it also produces raw material for various industries.

Can you name some industries based on agricultural raw material?

Moreover, some agricultural products like tea, coffee, spices, etc. are also exported.

Types of Farming

Agriculture is an age-old economic activity in our country. Over these years, cultivation methods have changed significantly depending upon the characteristics of physical environment, technological know-how and socio-cultural practices. Farming varies from subsistence to commercial type. At present, in different parts of India, the following farming systems are practised.

Primitive Subsistence Farming

This type of farming is still practised in few pockets of India. Primitive subsistence agriculture is practised on small patches of land with the help of primitive tools like hoe, dao and digging sticks, and family/community labour. This type of farming depends upon monsoon, natural fertility of the soil and suitability of other environmental conditions to the crops grown.

It is a 'slash and burn' agriculture. Farmers clear a patch of land and produce cereals and other food crops to sustain their family. When the soil fertility decreases, the farmers shift and clear a fresh patch of land for cultivation. This type of shifting allows Nature to replenish the fertility of the soil through natural processes; land productivity in this type of agriculture is low as the farmer does not use fertilisers or other modern inputs. It is known by different names in different parts of the country.

Can you name some such types of farmings?

It is *jhumming* in north-eastern states like Assam, Meghalaya, Mizoram and Nagaland; Pamlou in Manipur, Dipa in Bastar district of Chhattishgarh, and in Andaman and Nicobar Islands.

Jhumming: The 'slash and burn' agriculture is known as 'Milpa' in Mexico and Central America, 'Conuco' in Venzuela, 'Roca' in Brazil, 'Masole' in Central Africa, 'Ladang' in Indonesia, 'Ray' in Vietnam.

In India, this primitive form of cultivation is called 'Bewar' or 'Dahiya' in Madhya Pradesh, 'Podu' or 'Penda' in Andhra Pradesh, 'Pama Dabi' or 'Koman' or Bringa' in Odisha, 'Kumari' in Western Ghats, 'Valre' or 'Waltre' in South-eastern Rajasthan, 'Khil' in the Himalayan belt, 'Kuruwa' in Jharkhand, and 'Jhumming' in the North-eastern region.

Fig. 4.1

Rinjha lived with her family in a small village at the outskirts of Diphu in Assam. She enjoys watching her family members clearing, slashing and burning a patch of land for cultivation. She often helps them in irrigating the fields with water running through a bamboo canal from the nearby spring. She loves the surroundings and wants to stay here as long as she can, but this little girl has no idea about the declining fertility of the soil and her family's search for fresh a patch of land in the next season.

Can you name the type of farming Rinjha's family is engaged in?

Can you enlist some crops which are grown in such farming?

Intensive Subsistence Farming

This type of farming is practised in areas of high population pressure on land. It is labour-intensive farming, where high doses of biochemical inputs and irrigation are used for obtaining higher production.

Can you name some of the states of India where such farming is practised?

Though the 'right of inheritance' leading to the division of land among successive generations has rendered land-holding size uneconomical, the farmers continue to take maximum output from the limited land in the absence of alternative source of livelihood. Thus, there is enormous pressure on agricultural land.

Commercial Farming

The main characteristic of this type of farming is the use of higher doses of modern inputs, e.g. high yielding variety (HYV) seeds, chemical fertilisers, insecticides and pesticides in order to obtain higher productivity. The degree of commercialisation of agriculture varies from one region to another. For example, rice is a commercial crop in Haryana and Punjab, but in Odisha, it is a subsistence crop.

Can you give some more examples of crops which may be commercial in one region and may provide subsistence in another region?

Plantation is also a type of commercial farming. In this type of farming, a single crop is grown on a large area. The plantation has an interface of agriculture and industry. Plantations cover large tracts of land, using capital intensive inputs, with the help of migrant labourers. All the produce is used as raw material in respective industries.

In India, tea, coffee, rubber, sugarcane, banana, etc., are important plantation crops. Tea in Assam and North Bengal coffee in

Fig. 4.2: *Banana plantation in Southern part of India*

Fig. 4.3: *Bamboo plantation in North-east*

Karnataka are some of the important plantation crops grown in these states. Since the production is mainly for market, a well-developed network of transport and communication connecting the plantation areas, processing industries and markets plays an important role in the development of plantations.

Cropping Pattern

You have studied the physical diversities and plurality of cultures in India. These are also reflected in agricultural practices and cropping patterns in the country. Various types of food and fibre crops, vegetables and fruits, spices and condiments, etc. constitute some of the important crops grown in the country. India has three cropping seasons — **rabi**, **kharif** and **zaid**.

Rabi crops are sown in winter from October to December and harvested in summer from April to June. Some of the important rabi crops are wheat, barley, peas, gram and mustard. Though, these crops are grown in large parts of India, states from the north and north-western parts such as Punjab, Haryana, Himachal Pradesh, Jammu and Kashmir, Uttarakhand and Uttar Pradesh are important for the production of wheat and other rabi crops. Availability of precipitation during winter months due to the western temperate cyclones helps in the success of these crops. However, the success of the green revolution in Punjab, Haryana, western Uttar Pradesh and parts of Rajasthan has also been an important factor in the growth of the above-mentioned rabi crops.

Kharif crops are grown with the onset of monsoon in different parts of the country and these are harvested in September-October. Important crops grown during this season are paddy, maize, jowar, bajra, tur (arhar), moong, urad, cotton, jute, groundnut and soyabean. Some of the most important rice-growing regions are Assam, West Bengal, coastal regions of Odisha, Andhra Pradesh, Telangana, Tamil Nadu, Kerala and Maharashtra, particularly the (Konkan coast) along with Uttar Pradesh and Bihar. Recently, paddy has also become an important crop of Punjab and Haryana. In states like Assam, West Bengal and Odisha, three crops of paddy are grown in a year. These are *Aus*, *Aman* and *Boro*.

In between the rabi and the kharif seasons, there is a short season during the summer months known as the **Zaid** season. Some of the crops produced during 'zaid' are watermelon, muskmelon, cucumber, vegetables and fodder crops. Sugarcane takes almost a year to grow.

Major Crops

A variety of food and non food crops are grown in different parts of the country depending upon the variations in soil, climate and cultivation practices. Major crops grown in India are rice, wheat, millets, pulses, tea, coffee, sugarcane, oil seeds, cotton and jute, etc.

Rice: It is the staple food crop of a majority of the people in India. Our country is the second largest producer of rice in the world after China. It is a kharif crop which requires high temperature, (above 25°C) and high humidity with annual rainfall above 100 cm. In the areas of less rainfall, it grows with the help of irrigation.

Rice is grown in the plains of north and north-eastern India, coastal areas and the deltaic regions. Development of dense network

Fig. 4.4 (a): Rice Cultivation

Fig. 4.4 (b): Rice is ready to be harvested in the field

India: *Distribution of Rice*

of canal irrigation and tubewells have made it possible to grow rice in areas of less rainfall such as Punjab, Haryana and western Uttar Pradesh and parts of Rajasthan.

Wheat: This is the second most important cereal crop. It is the main food crop, in north and north-western part of the country. This rabi crop requires a cool growing season and a bright sunshine at the time of ripening. It requires 50 to 75 cm of annual rainfall evenly-distributed over the growing season. There are two important wheat-growing zones in the country – the Ganga-Satluj plains in the north-west and black soil region of the Deccan. The major wheat-producing states are Punjab, Haryana, Uttar Pradesh, Bihar, Rajasthan and parts of Madhya Pradesh.

Fig. 4.5: *Wheat Cultivation*

Millets: Jowar, bajra and ragi are the important millets grown in India. Though, these are known as coarse grains, they have very high nutritional value. For example, ragi is very rich in iron, calcium, other micro nutrients and roughage. Jowar is the third most important food crop with respect to area and production. It is a rain-fed crop mostly grown in the moist areas which hardly needs irrigation. Major Jowar producing States are Maharashtra, Karnataka, Andhra Pradesh and Madhya Pradesh.

Bajra grows well on sandy soils and shallow black soil. Major Bajra producing States are Rajasthan, Uttar Pradesh, Maharashtra, Gujarat and Haryana. Ragi is a crop of dry

Fig. 4.6: *Bajra Cultivation*

regions and grows well on red, black, sandy, loamy and shallow black soils. Major ragi producing states are: Karnataka, Tamil Nadu, Himachal Pradesh, Uttarakhand, Sikkim, Jharkhand and Arunachal Pradesh.

Maize: It is a crop which is used both as food and fodder. It is a kharif crop which requires temperature between 21°C to 27°C and grows well in old alluvial soil. In some states like Bihar

Fig. 4.7: *Maize Cultivation*

maize is grown in rabi season also. Use of modern inputs such as HYV seeds, fertilisers and irrigation have contributed to the increasing production of maize. Major maize-producing states are Karnataka, Uttar Pradesh, Bihar, Andhra Pradesh, Telangana and Madhya Pradesh.

Pulses: India is the largest producer as well as the consumer of pulses in the world. These are the major source of protein in a vegetarian diet. Major pulses that are grown in India are tur (arhar), urad, moong, masur, peas and

India: *Distribution of Wheat*

gram. Can you distinguish which of these pulses are grown in the kharif season and which are grown in the rabi season? Pulses need less moisture and survive even in dry conditions. Being leguminous crops, all these crops except arhar help in restoring soil fertility by fixing nitrogen from the air. Therefore, these are mostly grown in rotation with other crops. Major pulse producing states in India are Madhya Pradesh, Uttar Pradesh, Rajasthan, Maharashtra and Karnataka.

Food Crops other than Grains

Sugarcane: It is a tropical as well as a subtropical crop. It grows well in hot and humid climate with a temperature of 21°C to 27°C and an annual rainfall between 75cm. and 100cm. Irrigation is required in the regions of low rainfall. It can be grown on a variety of soils and needs manual labour from sowing to harvesting. India is the second largest producer of sugarcane only after Brazil. It is the main source of sugar, gur (jaggary), khandsari and molasses. The major sugarcane-producing states are Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh, Telangana, Bihar, Punjab and Haryana.

Fig. 4.8: Sugarcane Cultivation

Oil Seeds: In 2014 India was the second largest producer of groundnut in the world after china. In rapeseed production India was third largest producer in the world after Canada and China in 2014. Different oil seeds are grown covering approximately 12 per cent of the total cropped area of the country. Main oil-seeds produced in India are groundnut, mustard, coconut, sesamum (til), soyabean, castor seeds, cotton seeds, linseed and sunflower. Most of these are edible and used as cooking mediums. However, some of these are also used as raw material in the production of soap, cosmetics and ointments.

Groundnut is a kharif crop and accounts for about half of the major oilseeds produced in the country. Gujarat was the largest producer of groundnut followed by Rajasthan and Tamil Nadu in 2015–16. Linseed and mustard are rabi crops. Sesamum is a kharif crop in north and rabi crop in south India. Castor seed is grown both as rabi and kharif crop.

Tea: Tea cultivation is an example of plantation agriculture. It is also an important beverage crop introduced in India initially by the British. Today, most of the tea plantations are owned by Indians. The tea plant grows well in tropical and sub-tropical climates endowed with deep and fertile well-drained soil, rich in humus and organic matter. Tea bushes require warm and moist frost-free climate all through the year. Frequent showers evenly distributed over the year ensure continuous growth of tender leaves. Tea is a labour-intensive industry. It requires abundant,

Fig. 4.9: Groundnut, sunflower and mustard are ready to be harvested in the field

cheap and skilled labour. Tea is processed within the tea garden to restore its freshness. Major tea-producing states are Assam, hills of Darjeeling and Jalpaiguri districts, West Bengal, Tamil Nadu and Kerala. Apart from these, Himachal Pradesh, Uttarakhand, Meghalaya, Andhra Pradesh and Tripura are also tea-producing states in the country. In 2014 India was the second largest producer of tea after China.

Fig. 4.10: Tea Cultivation

Fig. 4.11: Tea-leaves Harvesting

Coffee: In 2014 India produced 3.5 per cent of the world coffee production. Indian coffee is known in the world for its good quality. The Arabica variety initially brought from Yemen is produced in the country. This variety is in great demand all over the world. Intially its cultivation was introduced on the Baba Budan Hills and even today its cultivation is confined to the Nilgiri in Karnataka, Kerala and Tamil Nadu.

tropical as well as temperate fruits. Mangoes of Maharashtra, Andhra Pradesh, Telangana, Uttar Pradesh and West Bengal, oranges of Nagpur and Cherrapunjee (Meghalaya), bananas of Kerala, Mizoram, Maharashtra and Tamil Nadu, lichi and guava of Uttar Pradesh and Bihar, pineapples of Meghalaya, grapes of Andhra Pradesh, Telangana and Maharashtra, apples, pears, apricots and walnuts of Jammu and Kashmir and Himachal Pradesh are in great demand the world over.

Fig. 4.12: Apricots, apple and pomegranate

Horticulture Crops: In 2014 India was the second largest producer of fruits and vegetables in the world after China. India is a producer of

India produces about 13 per cent of the world's vegetables. It is an important producer of pea, cauliflower, onion, cabbage, tomato, brinjal and potato.

Fig. 4.13: Cultivation of vegetables – peas, cauliflower, tomato and brinjal

Non-Food Crops

Rubber: It is an equatorial crop, but under special conditions, it is also grown in tropical and sub-tropical areas. It requires moist and humid climate with rainfall of more than 200 cm. and temperature above 25°C.

Rubber is an important industrial raw material. It is mainly grown in Kerala, Tamil Nadu, Karnataka and Andaman and Nicobar islands and Garo hills of Meghalaya. In 2012–13 India ranked fourth among the world's natural rubber producers.

Activity

List the items which are made of rubber and are used by us.

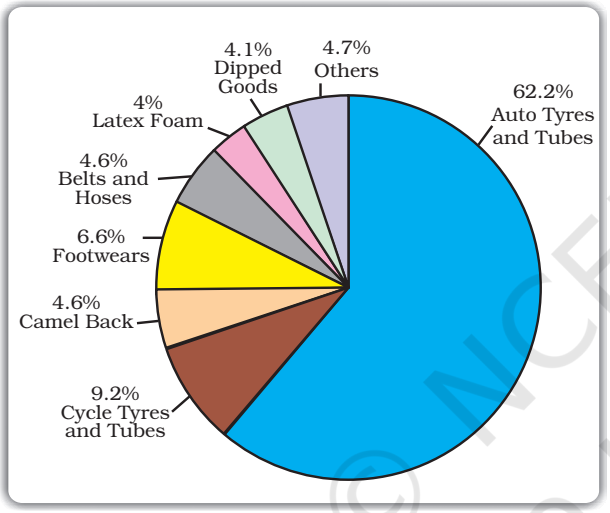


Fig. 4.14: *Consumption of natural rubber - 2010-11*

Source : Statistics and Planning Department Rubber Board, Kottayam, Kerala

Fibre Crops: Cotton, jute, hemp and natural silk are the four major fibre crops grown in India. The first three are derived from the crops grown in the soil, the latter is obtained from cocoons of the silkworms fed on green leaves specially mulberry. Rearing of silk worms for the production of silk fibre is known as **sericulture**.

Cotton: India is believed to be the original home of the cotton plant. Cotton is one of the main raw materials for cotton textile industry. In 2014 India was second largest producer of cotton after China. Cotton grows well in drier parts of the black cotton soil of the Deccan plateau. It requires high temperature, light rainfall or irrigation, 210 frost-free days and bright sun-shine for its growth. It is a kharif crop and requires 6 to 8 months to mature. Major cotton-producing states are– Maharashtra, Gujarat, Madhya Pradesh, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu, Punjab, Haryana and Uttar Pradesh.

Fig. 4.15: *Cotton Cultivation*

Jute: It is known as the golden fibre. Jute grows well on well-drained fertile soils in the flood plains where soils are renewed every year. High temperature is required during the time of growth. West Bengal, Bihar, Assam, Odisha and Meghalaya are the major jute producing states. It is used in making gunny bags, mats, ropes, yarn, carpets and other artefacts. Due to its high cost, it is losing market to synthetic fibres and packing materials, particularly the nylon.

Technological and Institutional Reforms

It was mentioned in the previous pages that agriculture has been practised in India for thousands of years. Sustained uses of land without compatible techno-institutional changes have hindered the pace of agricultural development. Inspite of development of sources of irrigation most of the farmers in large parts of the country still depend upon monsoon and natural fertility in order to carry on their agriculture. For a growing population, this poses a serious challenge. Agriculture which provides livelihood for more than 60 per cent of its population, needs some serious technical and

Fig. 4.16: Modern technological equipments used in agriculture

institutional reforms. Thus, collectivisation, consolidation of holdings, cooperation and abolition of zamindari, etc. were given priority to bring about institutional reforms in the country after Independence. 'Land reform' was the main focus of our First Five Year Plan. The right of inheritance had already lead to fragmentation of land holdings necessitating consolidation of holdings.

The laws of land reforms were enacted but the implementation was lacking or lukewarm. The Government of India embarked upon introducing agricultural reforms to improve Indian agriculture in the 1960s and 1970s. The Green Revolution based on the use of package technology and the White Revolution (Operation Flood) were some of the strategies initiated to improve the lot of Indian agriculture. But, this too led to the concentration of development in few selected areas. Therefore, in the 1980s and 1990s, a comprehensive land development programme was initiated, which included both institutional and technical reforms. Provision for crop insurance against drought, flood, cyclone, fire and disease, establishment of Grameen banks, cooperative societies and banks for providing loan facilities to the farmers at lower rates of interest were some important steps in this direction.

Kissan Credit Card (KCC), Personal Accident Insurance Scheme (PAIS) are some other schemes introduced by the Government of India for the benefit of the farmers. Moreover, special weather bulletins and agricultural programmes for farmers were introduced on the radio and television. The government also announces minimum support price, remunerative and procurement prices for important crops to check the exploitation of farmers by speculators and middlemen.

Bhoodan – Gramdan

Mahatma Gandhi declared Vinoba Bhave as his spiritual heir. He also participated in Satyagraha as one of the foremost satyagrahis. He was one of the votaries of Gandhi's concept of **gram swarajya**. After Gandhiji's martyrdom, Vinoba Bhave undertook **padyatra** to spread Gandhiji's message covered almost the entire country. Once, when he was delivering a lecture at Pochampalli in Andhra Pradesh, some poor landless villagers demanded some land for their economic well-being. Vinoba Bhave could not promise it to them immediately but assured them to talk to the Government of India regarding provision of land for them if they undertook cooperative farming. Suddenly, Shri Ram Chandra Reddy stood up and offered 80 acres of land to be distributed among 80 land-less villagers. This act was known as 'Bhoodan'. Later he travelled and introduced his ideas widely all over India. Some zamindars, owners of many villages offered to distribute some villages among the landless. It was known as **Gramdan**. However, many land-owners chose to provide some part of their land to

the poor farmers due to the fear of land ceiling act. This Bhoodan-Gramdan movement initiated by Vinoba Bhave is also known as the **Blood-less Revolution**.

Contribution of agriculture to the national economy, employment and output

Agriculture has been the backbone of the Indian economy though its share in the Gross Domestic Product (GDP) has registered a declining trend from 1951 onwards; in 2010-11 about 52 per cent of the total work force was employed by the farm sector which makes more than half of the Indian Population dependent on agriculture for sustenance.

The declining share of agriculture in the GDP is a matter of serious concern because any decline and stagnation in agriculture will lead to a decline in other spheres of the economy having wider implications for society.

Considering the importance of agriculture in India, the Government of India made concerted efforts to modernise agriculture. Establishment of Indian Council of Agricultural Research (ICAR), agricultural universities, veterinary services and animal breeding centres, horticulture development, research and development in the field of meteorology and weather forecast, etc. were given priority for improving Indian agriculture. Apart from this, improving the rural infrastructure was also considered essential for the same.

Activity

Find out why an Indian farmer does not want his son to become a farmer.

From the Table 4.1, it is clear that though the GDP growth rate is increasing over the years, it is not generating sufficient employment opportunities in the country. The growth rate in agriculture has been decelerating which is an alarming situation. Today, Indian farmers are facing a big challenge from international competition and reduction in the public investment in agriculture sector. Subsidy on fertilisers is decreased leading to increase in the cost of production. Moreover, reduction in import duties on agricultural products have proved detrimental to agriculture in the country. Farmers are withdrawing their investment from agriculture causing a downfall in the employment in agriculture.

Table 4.1: India: Growth Rate of GDP and Major Sectors (in %)

Sector	2013–14	2014–-15	2015–16
Agriculture	4.2	-0.2	1.1
Industry	5.0	5.9	7.3
Services	7.8	10.3	9.2
GDP	6.6	7.2	7.6

Source: *Economic Survey 2015–16*

Note: These are provisional figures.

When farmers have been facing so many problems and land under agriculture is decreasing, can we think of alternative employment opportunities in the agriculture sector?

Why are farmers committing suicides in several states of the country?

Food Security

You know that food is a basic need and every citizen of the country should have access to food which provides minimum nutritional level. If any segment of our population does not have this access, that segment suffers from lack of food security. The number of people who do not have food security is disproportionately large in some regions of our country, particularly in economically less developed states with higher incidence of poverty. The remote areas of the country are more prone to natural disasters and uncertain food supply. In order to ensure availability of food to all sections of society our government carefully designed a national food security system. It consists of two components (a) buffer stock and (b) public distribution system (PDS).

As you know, PDS is a programme which provides food grains and other essential commodities at subsidised prices to Below Poverty Line (BPL) population in rural and urban areas.

India's food security policy has a primary objective to ensure availability of foodgrains to the common people at an affordable price. It has enabled the poor to have access to food. The focus of the policy is on growth in agriculture production and on fixing the support price for procurement of wheat and rice, to maintain their stocks. Food Corporation of India (FCI) is responsible for procuring and stocking foodgrains, whereas distribution is ensured by public distribution system (PDS).

The FCI procures foodgrains from the farmers at the government announced minimum support price (MSP). The government used to provide subsidies on agriculture inputs such as fertilizers, power and water. These subsidies have now reached unsustainable levels and have also led to large scale inefficiencies in the use of these scarce inputs. Excessive and imprudent use of fertilizers and water has led to waterlogging, salinity and depletion of essential micronutrients in the soil. The high MSP, subsidies in input and committed FCI purchases have distorted the cropping pattern. Wheat and paddy crops are being grown more for the MSP they get. Punjab and Haryana are foremost examples. This has also created a serious imbalance in inter-crop parities.

You already know that the consumers are divided into two categories : below poverty line (BPL) and above poverty line (APL), with the issue price being different for each category. However, this categorisation is not perfect and a number of deserving poor have been excluded from the BPL category. Moreover, some of the so called APL slip back to BPL, because of the failure of even one crop and it is administratively difficult to accommodate such shifts.

Each district and block can be made self sufficient in foodgrain production if government provides proper agricultural infrastructure, credit linkages and also encourages the use of latest techniques. Instead of concentrating only on rice or wheat, the food crop with a better growth potential in that particular area must be encouraged. Creation of necessary infrastructure like irrigation facilities, availability of electricity etc. may also attract private investments in agriculture.

The focus on increasing foodgrain production which should be on a sustainable basis and also free trade in grains will create massive employment and reduce poverty in rural areas.

There has been a gradual shift from cultivation of food crops to cultivation of fruits, vegetables, oil-seeds and industrial crops. This has led to the reduction in net sown area under cereals and pulses. With the growing population of India, the declining food production puts a big question mark over the country's future food security. The competition for land between non-agricultural uses such as housing etc. and agriculture has resulted in reduction in the net sown area. The productivity of land has started showing a declining trend. Fertilisers, pesticides and insecticides, which once showed dramatic results, are now being held responsible for degrading the soils. Periodic scarcity of water has led to reduction in area under irrigation. Inefficient water management has led to water logging and salinity.

Activity

Draw bar diagram showing the trend of food grain production in India during last five years. Find out the reason of this trend.

Table 4.2: India: Foodgrains production

(in million tonnes)

Cereals	2011–12	2012–13	2013–14	2014–15	2015–16
Rice	105.30	105.24	106.54	105.48	104.32
Wheat	94.88	93.51	95.85	86.53	93.50
Maize	21.76	22.26	24.26	24.17	21.81
Coarse grains	42.01	40.04	43.29	42.86	37.94
Pulses	17.09	18.34	19.25	17.15	16.47
Total	**281.04**	**279.39**	**289.19**	**276.19**	**274.04**

Source: *Directorate of Economics and Statistics. DAC@FW, Ministry of Agriculture, Economic Survey 2015–16.*

One important reason is land degradation. Free power to a section of farmers has encouraged them to pump groundwater to grow water-intensive crops in low-rainfall areas (rice in Punjab, sugarcane in Maharashtra). This unsustainable pumping has reduced water storage in aquifers. Consequently, many wells and tubewells have run dry. This has pushed the marginal and small farmers out of cultivation.

The big farmers with deeper tubewells still have water, but many others face a water crisis. Inadequate storage and marketing facilities also act as a disincentive to the farmer. Thus, the farmers are badly affected by the uncertainties of production and market. They suffer from a double disadvantage as they pay high prices for inputs such as HYV seeds, fertilisers etc. but lack the bargaining power to fix prices in their favour. All the production reaches the market simultaneously. The higher the supply the lower is the demand. This causes distress sale also. Therefore, there can be no food security without the security of the small farmers.

Impact of Globalisation on Agriculture

Globalisation is not a new phenomenon. It was there at the time of colonisation. In the nineteenth century when European traders came to India, at that time too, Indian spices were exported to different countries of the world and farmers of south India were encouraged to grow these crops. Till today it is one of the important items of export from India.

During the British period cotton belts of India attracted the British and ultimately cotton was exported to Britain as a raw material for their textile industries. Cotton textile industry in Manchester and Liverpool flourished due to the availability of good


'11th Plan must focus on farming'

Produce more foodgrain

The seeds of farmer suicides

Deaths Keeping Pace With Rising Indebtedness

Crop failure, price crash act as triggers

16th October, 2006

World Food Day

Theme : Invest in Agriculture for Food Security

Centre eases imports to check price rise

Beyond GM food

What Delhi Govt is not doing...

Diversify your diet for Achieving better Nutrition for Health and Development

Activity

Organise a debate on food security of India, its need and efforts

quality cotton from India. You have read about the Champaran movement which started in 1917 in Bihar. This was started because farmers of that region were forced to grow indigo on their land because it was necessary for the textile industries which were located in Britain. They were unable to grow foodgrains to sustain their families.

Under globalisation, particularly after 1990, the farmers in India have been exposed to new challenges. Despite being an important producer of rice, cotton, rubber, tea, coffee, jute and spices our agricultural products are not able to compete with the developed countries because of the highly subsidised agriculture in those countries.

Fig. 4.17: Tissue culture of teak clones

Today, Indian agriculture finds itself at the crossroads. To make agriculture successful and profitable, proper thrust should be given to the improvement of the condition of marginal and small farmers. The green revolution promised much. But today it's under controversies. It is being alleged that it has caused land degradation due to overuse of chemicals, drying aquifers and vanishing biodiversity. The keyword today is "gene revolution", which includes genetic engineering.

Genetic engineering is recognised as a powerful supplement in inventing new hybrid varieties of seeds.

Can you name any gene modified seed used vastly in India?

Fig. 4.18: Problems associated with heavy pesticide use are widely recognised in developed and developing countries

Infact organic farming is much in vogue today because it is practised without factory made chemicals such as fertilisers and pesticides. Hence, it does not affect environment in a negative manner.

A few economists think that Indian farmers have a bleak future if they continue growing foodgrains on the holdings that grow smaller and smaller as the population rises. India's rural population is about 833 million (2011) which depends upon 250 million (approximate) hectares of agricultural land, an average of less than half a hectare per person.

Indian farmers should diversify their cropping pattern from cereals to high-value crops. This will increase incomes and reduce environmental degradation simultaneously. Because fruits, medicinal herbs, flowers, vegetables, bio-diesel crops like jatropha and jojoba need much less irrigation than rice or sugarcane. India's diverse climate can be harnessed to grow a wide range of high-value crops.

Change in cropping pattern for example from cereals to high-value crops will mean that India will have to import food. During 1960's this would have been seen as a disaster. But if India imports cereals while exporting high-value commodities, it will be following successful economies like Italy, Israel and Chile. These countries exports farm products (fruits, olives, speciality seeds and wine) and import cereals. Are we ready to take this risk? Debate the issue.

1. Multiple choice questions.

   (i) Which one of the following describes a system of agriculture where a single crop is grown on a large area?
   - (a) Shifting Agriculture
   - (b) Plantation Agriculture
   - (c) Horticulture
   - (d) Intensive Agriculture

   (ii) Which one of the following is a rabi crop?
   - (a) Rice
   - (b) Gram
   - (c) Millets
   - (d) Cotton

   (iii) Which one of the following is a leguminous crop?
   - (a) Pulses
   - (b) Jawar
   - (c) Millets
   - (d) Sesamum

   (iv) Which one of the following is announced by the government in support of a crop?
   - (a) Maximum support price
   - (b) Minimum support price
   - (c) Moderate support price
   - (d) Influential support price

2. Answer the following questions in 30 words.
   (i) Name one important beverage crop and specify the geographical conditions required for its growth.
   (ii) Name one staple crop of India and the regions where it is produced.
   (iii) Enlist the various institutional reform programmes introduced by the government in the interest of farmers.
   (iv) The land under cultivation has got reduced day by day. Can you imagine its consequences?

3. Answer the following questions in about 120 words.
   (i) Suggest the initiative taken by the government to ensure the increase in agricultural production.
   (ii) Describe the impact of globalisation on Indian agriculture.
   (iii) Describe the geographical conditions required for the growth of rice.

PROJECT WORK

1. Group discussion on the necessity of literacy among farmers.
2. On an outline map of India show wheat producing areas.

Activity

Solve the puzzle by following your search horizontally and vertically to find the hidden answers.

A	Z	M	X	N	C	B	V	N	X	A	H	D	Q
S	D	E	W	S	R	J	D	Q	J	Z	V	R	E
D	K	H	A	R	I	F	G	W	F	M	R	F	W
F	N	L	R	G	C	H	H	R	S	B	S	V	T
G	B	C	W	H	E	A	T	Y	A	C	H	B	R
H	R	T	K	A	S	S	E	P	H	X	A	N	W
J	I	E	S	J	O	W	A	R	J	Z	H	D	T
K	C	L	A	E	G	A	C	O	F	F	E	E	Y
L	T	E	F	Y	M	T	A	T	S	S	R	G	I
P	D	E	J	O	U	Y	V	E	J	G	F	A	U
O	U	M	H	Q	S	U	D	I	T	S	W	S	P
U	O	A	C	O	T	T	O	N	E	A	H	F	O
Y	O	L	F	L	U	S	R	Q	Q	D	T	W	I
T	M	U	A	H	R	G	Y	K	T	R	A	B	F
E	A	K	D	G	D	Q	H	S	U	O	I	W	H
W	Q	Z	C	X	V	B	N	M	K	J	A	S	L

1. The two staple food crops of India.
2. This is the summer cropping season of India.
3. Pulses like arhar, moong, gram, urad contain...
4. It is a coarse grain.
5. The two important beverages in India are...
6. One of the four major fibers grown on black soils.

5 MINERALS AND ENERGY RESOURCES

Haban comes to Guwahati with his father from a remote village.

He sees people getting into strange house like objects which move along the road. He also sees a "kitchen" dragging a number of house along with it. He is amazed and asked his father "Why don't our houses move like the one we saw in Guwahati, Ba?"

Ba replies, "These are not houses, they are buses and trains. Unlike our houses these are not made of bricks and stones, metal like iron and alluminium are used in making these. They do not move on their own. They are driven by an engine which needs energy to work."

We use different things in our daily life made from metal. Can you list a number of items used in your house made of metals. Where do these metals come from?

You have studied that the earth's crust is made up of different minerals embedded in the rocks. Various metals are extracted from these minerals after proper refinement.

Minerals are an indispensable part of our lives. Almost everything we use, from a tiny pin to a towering building or a big ship, all are made from minerals. The railway lines and the tarmac (paving) of the roads, our implements and machinery too are made from minerals. Cars, buses, trains, aeroplanes are manufactured from minerals and run on power resources derived from the earth. Even the food that we eat contains minerals. In all stages of development, human beings have used minerals for their livelihood, decoration, festivities, religious and ceremonial rites.

A bright smile from toothpaste and minerals

Toothpaste cleans your teeth. Abrasive minerals like silica, limestone, aluminium oxide and various phosphate minerals do the cleaning. Fluoride which is used to reduce cavities, comes from a mineral fluorite. Most toothpaste are made white with titanium oxide, which comes from minerals called rutile, ilmenite and anatase. The sparkle in some toothpastes comes from mica. The toothbrush and tube containing the paste are made of plastics from petroleum. Find out where these minerals are found?

Dig a little deeper and find out how many minerals are used to make a light bulb?

All living things need minerals

Life processes cannot occur without minerals. Although our mineral intake represents only about 0.3 per cent of our total intake of nutrients, they are so potent and so important that without them we would not be able to utilise the other 99.7 per cent of foodstuffs.

Dig a little deeper and collect "Nutritional Facts" printed on food labels.

What is a mineral?

Geologists define mineral as a "homogenous, naturally occurring substance with a definable internal structure." Minerals are found in varied forms in nature, ranging from the hardest diamond to the softest talc. Why are they so varied?

You have already learnt about rocks. Rocks are combinations of homogenous substances called **minerals**. Some rocks, for instance limestone, consist of a single mineral only, but majority of the rock consist of several minerals in varying proportions. Although, over 2000 minerals have been identified, only a few are abundantly found in most of the rocks.

A particular mineral that will be formed from a certain combination of elements depends upon the physical and chemical conditions under which the material forms. This, in turn, results in a wide range of colours, hardness, crystal forms, lustre and density that a particular mineral possesses. Geologists use these properties to classify the minerals.

Study of Minerals by Geographers and Geologists

Geographers study minerals as part of the earth's crust for a better understanding of landforms. The distribution of mineral resources and associated economic activities are of interest to geographers. A geologist, however, is interested in the formation of minerals, their age and physical and chemical composition.

However, for general and commercial purposes minerals can be classified as under.

CLASSIFICATION OF MINERALS

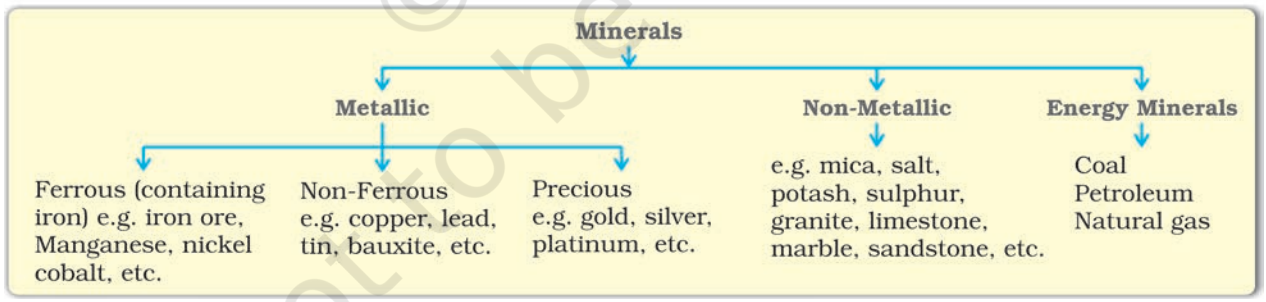


Fig. 5.1

MODE OF OCCURRENCE OF MINERALS

Where are these minerals found?

Minerals are usually found in "ores". The term ore is used to describe an accumulation of any mineral mixed with other elements. The mineral content of the ore must be in sufficient concentration to make its extraction commercially viable. The type of formation or structure in which they are found determines the relative ease with which mineral ores may be mined. This also determines the cost of extraction. It is, therefore, important for us to understand the main types of formations in which minerals occur.

Minerals generally occur in these forms:

(i) In igneous and metamorphic rocks minerals may occur in the cracks, crevices, faults or joints. The smaller occurrences are called **veins** and the larger are called **lodes**. In most cases, they are formed when minerals in liquid/molten and gaseous forms are forced upward through cavities towards the earth's surface. They cool and solidify as they rise. Major metallic minerals like tin, copper, zinc and lead etc. are obtained from veins and lodes.

(ii) In sedimentary rocks a number of minerals occur in **beds** or **layers**. They have been formed as a result of deposition, accumulation and concentration in horizontal strata. Coal and some forms of iron ore have been concentrated as a result of long periods under great heat and pressure. Another group of sedimentary minerals include gypsum, potash salt and sodium salt. These are formed as a result of **evaporation** especially in arid regions.

(iii) Another mode of formation involves the decomposition of surface rocks, and the removal of soluble constituents, leaving a **residual mass of weathered material** containing ores. Bauxite is formed this way.

(iv) Certain minerals may occur as **alluvial deposits** in sands of valley floors and the base of hills. These deposits are called 'placer deposits' and generally contain minerals, which are not corroded by water. Gold, silver, tin and platinum are most important among such minerals.

(v) The ocean waters contain vast quantities of minerals, but most of these are too widely diffused to be of economic significance. However, common salt, magnesium and bromine are largely derived from ocean waters. The ocean beds, too, are rich in manganese nodules.

Interesting Fact

Rat-Hole Mining. Do you know that most of the minerals in India are nationalised and their extraction is possible only after obtaining due permission from the government? But in most of the tribal areas of the north-east India, minerals are owned by individuals or communities. In Meghalaya, there are large deposits of coal, iron ore, limestone and dolomite etc. Coal mining in Jowai and Cherapunjee is done by family member in the form of a long narrow tunnel, known as 'Rat hole' mining.

Dig a little deeper: What is the difference between an open pit mine, a quarry and an underground mine with shafts?

India is fortunate to have fairly rich and varied mineral resources. However, these are unevenly distributed. Broadly speaking, peninsular rocks contain most of the reserves of coal, metallic minerals, mica and many other non-metallic minerals. Sedimentary rocks on the western and eastern flanks of the peninsula, in Gujarat and Assam have most of the petroleum deposits. Rajasthan with the rock systems of the peninsula, has reserves of many non-ferrous minerals. The vast alluvial plains of north India are almost devoid of economic minerals. These variations exist largely because of the differences in the geological structure, processes and time involved in the formation of minerals.

Let us now study the distribution of a few major minerals in India. Always remember that the concentration of mineral in the ore, the ease of extraction and closeness to the market play an important role in affecting the economic viability of a reserve. Thus, to meet the demand, a choice has to be made between a number of possible options. When this is done a mineral 'deposit' or 'reserve' turns into a **mine**.

Ferrous Minerals

Ferrous minerals account for about three-fourths of the total value of the production of metallic minerals. They provide a strong base for the development of metallurgical industries. India exports substantial quantities of ferrous minerals after meeting her internal demands.

Iron Ore

Iron ore is the basic mineral and the backbone of industrial development. India is endowed with fairly abundant resources of iron ore. India is rich in good quality iron ores. Magnetite is the finest iron ore with a very high content of iron up to 70 per cent. It has excellent magnetic qualities, especially valuable in the electrical industry. Hematite ore is the most important industrial iron ore in terms of the quantity used, but has a slightly lower iron content than magnetite. (50-60 per cent).

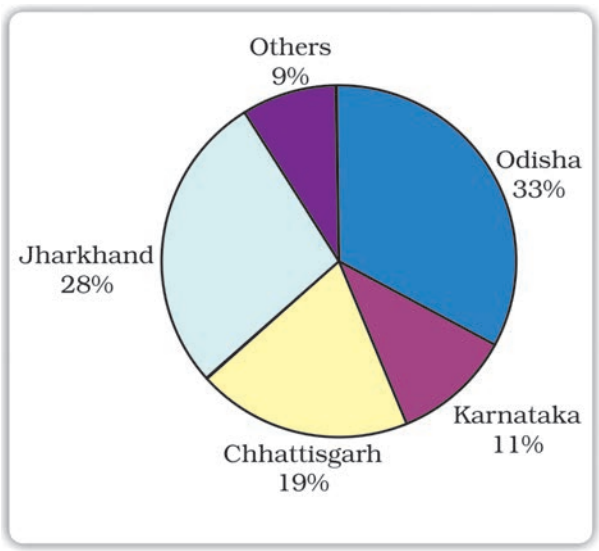


Fig. 5.2: *Production of iron ore showing statewise share in per cent, 2009-10*

Do you know?

Kudre in Kannada means horse. The highest peak in the western ghats of Karnataka resembles the face of a horse. The Bailadila hills look like the hump of an ox, and hence its name.

Fig. 5.3: Iron ore mine

The major iron ore belts in India are:

- *Odisha-Jharkhand belt*: In Odisha high grade hematite ore is found in Badampahar mines in the Mayurbhanj and Kendujhar districts. In the adjoining Singbhum district of Jharkhand haematite iron ore is mined in Gua and Noamundi.
- *Durg-Bastar-Chandrapur belt* lies in Chhattisgarh and Maharashtra. Very high grade hematites are found in the famous Bailadila range of hills in the Bastar district of Chhattisgarh. The range of hills comprise of 14 deposits of super high grade hematite iron ore. It has the best physical properties needed for steel making. Iron ore from these mines is exported to Japan and South Korea via Vishakhapatnam port.
- *Ballari-Chitradurga-Chikkamagaluru-Tumakuru belt* in Karnataka has large reserves of iron ore. The Kudremukh mines located in the Western Ghats of Karnataka are a 100 per cent export unit. Kudremukh deposits are known to be one of the largest in the world. The ore is transported as slurry through a pipeline to a port near Mangaluru.
- *Maharashtra-Goa belt* includes the state of Goa and Ratnagiri district of Maharashtra. Though, the ores are not of very high quality, yet they are efficiently exploited. Iron ore is exported through Marmagao port.

Manganese

Manganese is mainly used in the manufacturing of steel and ferro-manganese alloy. Nearly 10 kg of manganese is required to manufacture one tonne of steel. It is also used in manufacturing bleaching powder, insecticides and paints.

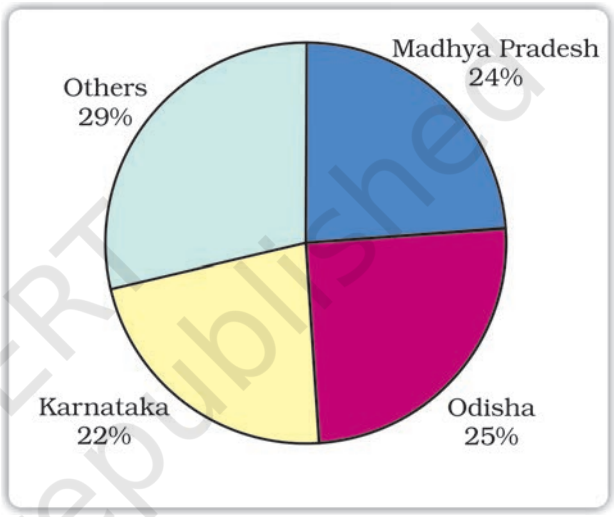


Fig. 5.4: Production of Manganese showing statewise share in per cent, 2009-2010

Odisha is the largest producer of manganese ores in India. It accounted for one-third of the country's total production in 2000-01.

Dig a little deeper: Superimpose the maps showing distribution of iron ore, manganese, coal and iron and steel industry. Do you see any correlation. Why?

Non-Ferrous Minerals

India's reserves and production of non- ferrous minerals is not very satisfactory. However, these minerals, which include copper, bauxite, lead, zinc and gold play a vital role in a number of metallurgical, engineering and electrical industries. Let us study the distribution of copper and bauxite.

India: *Distribution of Iron Ore, Manganese, Bauxite and Mica*

Copper

India is critically deficient in the reserve and production of copper. Being malleable, ductile and a good conductor, copper is mainly used in electrical cables, electronics and chemical industries. The Balaghat mines in Madhya Pradesh, Khetri mines in Rajasthan and Singhbhum district of Jharkhand are leading producers of copper.

Fig. 5.5: Copper mines at Malanjkhand

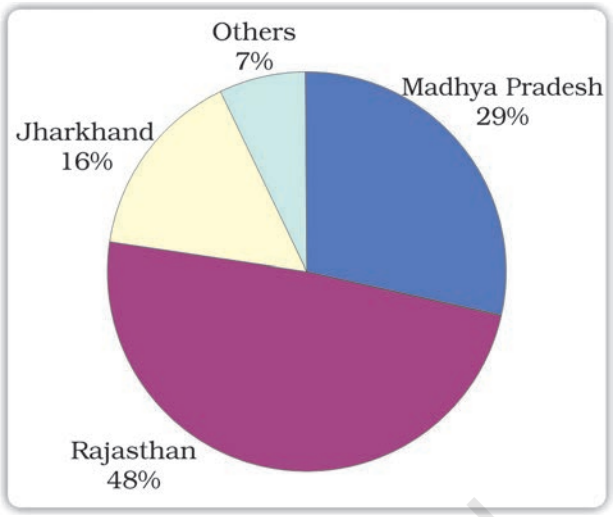


Fig. 5.6: Production of Copper showing state-wise share in per cent, 2009-10

Bauxite

Though, several ores contain aluminium, it is from bauxite, a clay-like substance that alumina and later aluminium is obtained. Bauxite deposits are formed by the decomposition of a wide variety of rocks rich in aluminium silicates.

Aluminium is an important metal because it combines the strength of metals such as iron, with extreme lightness and also with good conductivity and great malleability.

India's bauxite deposits are mainly found in the Amarkantak plateau, Maikal hills and the plateau region of Bilaspur-Katni.

Odisha was the largest bauxite producing state in India with 34.97 per cent of the country's total production in 2009-10. Panchpatmali deposits in Koraput district are the most important bauxite deposits in the state.

Fig.5.7: Bauxite Mine

Dig a little deeper: Locate the mines of Bauxite on the physical map of India.

Interesting Fact

After the discovery of aluminium Emperor Napoleon III wore buttons and hooks on his clothes made of aluminium and served food to his more illustrious guests in aluminium utensils and the less honourable ones were served in gold and silver utensils. Thirty years after this incident aluminium bowls were most common with the beggars in Paris.

Non-Metallic Minerals

Mica is a mineral made up of a series of plates or leaves. It splits easily into thin sheets. These sheets can be so thin that a thousand can be layered into a mica sheet of a few centimeters high. Mica can be clear, black, green, red yellow or brown. Due to its excellent di-electric strength, low power loss factor, insulating properties and resistance to high voltage, mica is one of the most indispensable minerals used in electric and electronic industries.

Mica deposits are found in the northern edge of the Chota Nagpur plateau. Koderma Gaya – Hazaribagh belt of Jharkhand is the leading producer.

In Rajasthan, the major mica producing area is around Ajmer. Nellore mica belt of Andhra Pradesh is also an important producer in the country.

Rock Minerals

Limestone is found in association with rocks composed of calcium carbonates or calcium and magnesium carbonates. It is found in sedimentary rocks of most geological formations. Limestone is the basic raw material for the cement industry and essential for smelting iron ore in the blast furnace.

Dig a little deeper: Study the maps to explain why Chota Nagpur is a storehouse of minerals.

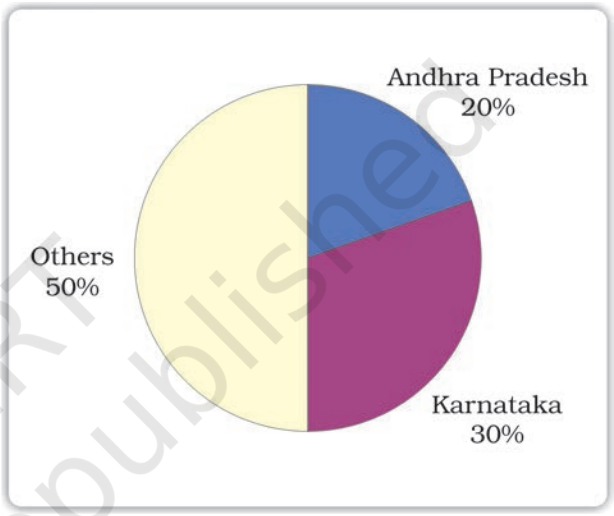


Fig. 5.8: Production of Limestone showing state-wise share in per cent, 2009-10

Hazards of Mining

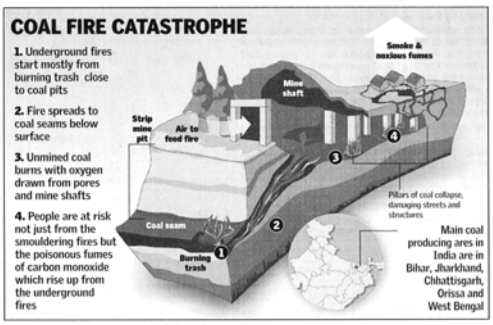
Have you ever wondered about the efforts the miners make in making life comfortable for you? What are the impacts of mining on the health of the miners and the environment?

The dust and noxious fumes inhaled by miners make them vulnerable to pulmonary diseases. The risk of collapsing mine roofs, inundation and fires in coalmines are a constant threat to miners.

The water sources in the region get contaminated due to mining. Dumping of waste and slurry leads to degradation of land, soil, and increase in stream and river pollution.

Fig. 5.9: Air pollution due to generation of dust in mining areas

Jharia to be shifted



Law Kumar Mishra | TNN

Dhanbad: The government has decided to relocate an entire township — Jharia — because of the uncontrollable spread of underground fires that have been burning for years in the coal belt.

"The Centre has already sanctioned Rs 14 crore for the first phase of shifting."

Claiming it to be one of the world's major evacuation drives, Soren said the shifting would be done in three phases in five years and he also assu

1990. According to the Rana panel, the cost of shifting people will be at Rs 20,000 crore. The Rana panel had also said, "It is profitable to shift people from Jharia, since coal worth Rs 60,000 crore is lying unutilised beneath the Jharia

Coal unit fined Rs 300 cr in damages

Dhananjay Mahapatra | TNN

New Delhi: The Supreme Court has asked India's largest coal producing company — South Eastern Coalfields Ltd — to pay within a month Rs 300 crore as compensation for using forest land in Chhattisgarh. This is in addition to Rs 50 crore already paid by the PSU, which is a subsidiary of Coal India Ltd, to continue its operations in the state.

SECL will have to pay Rs 100 crore within a week and the rest within a month, the forest Bench comprising CJI Y K Sabharwal and Justices Arijit Pasayat and S H Kapadia directed on Friday.

The court, in its earlier judgment, had said that all companies were liable to pay Penal Compensatory Afforestation cost and amount of Net Present Value to continue operations in forest land already allotted to them by the states.

Appearing for the PSU, solicitor general G E Vahanvati argued that the company had one of the best records for protection of environment and had won awards at the national and state level. He said the Rs 50 crore already deposited by the company was compensation enough for it to be allowed coal mining operations. Appearing for the ministry of environment and forests, counsel A D N Rao

'Over 50% of coal-belt mines unsafe'

Law Kumar Mishra | TNN

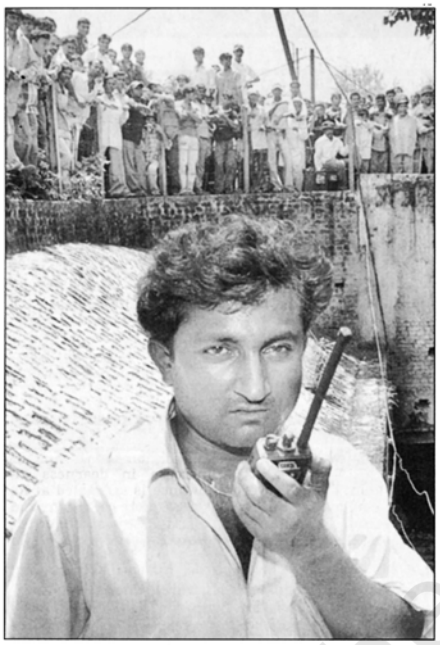
Dhanbad: Three days after one of the worst mining disasters in decades left 54 people dead, the chief of the company which owns these mines, said no less than half the mines in the area did not meet the basic safety standards.

Bharat Coking Coal Ltd (BCCL) chairman Partho S Bhattacharya, however, said on Saturday the company shouldn't be blamed for operating unsafe mines because workers and trade unions had blocked moves to shut these for fear of losing jobs. He said only one out of 41 mines was operated scientifically and of the rest, the many were functioning against the advice of the Directorate General of Mines Safety. He described safety standards in 24 mines as poor.

Bhattacharya said workers were aware that they would have to seek voluntary retirement if unsafe mines were shut.

Bharat Coking Coal management on Saturday also handed over employment letters to the immediate people nominated by families of victims. Ironically, these people, most likely, would go to work in mines deemed unsafe by the company.

BCCL's audit of the safety status of mines, graded second and third degrees,



WAIT AND WATCH: A crowd watches the ongoing rescue operation outside the Bharat Coking Coal Ltd mine at Bhatdih in Jharkhand on Thursday

'Safety standards were not in place'

Law Kumar Mishra | TNN

Dhanbad: Union coal minister Shibu Soren on Thursday announced an ex gratia of Rs 3 lakh to the families of the mine tragedy victims. Soren said: "Dependents of the victims will be provided employment by the Bharat Coking Coal from today. A probe by the director general of mines safety and the labour commissioner will also be initiated."

Soren also held discussions with Bharat Coking Coal officials and promised medical help to the four survivors.

tained, even though the director general of mine safety carries out surveys of the safety norms," an expert said.

Some agitating miners alleged that "there is no emergency measures inside the mine. We go deep — between 400 feet and 1,500 ft — into the mines with only an oxygen mask." The tragedy points to the lack of security measures by Bharat Coking Coal despite previous instances of disasters due to methane leak.

At least 48 people were killed in explosions in Jeetpur mine, 43 in Sudamdeeh and 30 in

Stricter safety regulations and implementation of environmental laws are essential to prevent mining from becoming a "killer industry".

Conservation of Minerals

We all appreciate the strong dependence of industry and agriculture upon mineral deposits and the substances manufactured from them. The total volume of workable mineral deposits is an insignificant fraction i.e. one per cent of the earth's crust. We are rapidly consuming mineral resources that required millions of years to be created and concentrated. The geological processes of mineral formation are so slow that the rates of replenishment are infinitely small in comparison to the present rates of consumption. Mineral resources are, therefore, finite and non-renewable. Rich mineral deposits are our country's extremely valuable but short-lived possessions. Continued extraction of ores leads to increasing costs as mineral extraction comes from greater depths along with decrease in quality.

A concerted effort has to be made in order to use our mineral resources in a planned and sustainable manner. Improved technologies need to be constantly evolved to allow use of low grade ores at low costs. Recycling of metals, using scrap metals and other substitutes are steps in conserving our mineral resources for the future.

Dig a little deeper: Make a list of items where substitutes are being used instead of minerals. Where are these substitutes obtained from?

Energy Resources

Energy is required for all activities. It is needed to cook, to provide light and heat, to propel vehicles and to drive machinery in industries.

Energy can be generated from fuel minerals like coal, petroleum, natural gas, uranium and from electricity. Energy resources can be classified as conventional and non-conventional sources. Conventional sources include: firewood, cattle dung cake, coal, petroleum, natural gas and electricity (both hydel and thermal). Non-conventional sources include solar, wind, tidal, geothermal, biogas and atomic energy. Firewood and cattle dung cake are most common in rural India. According to one estimate more than 70 per cent energy requirement in rural households is met by these two ; continuation of these is increasingly becoming difficult due to decreasing forest area. Moreover, using dung cake too is being discouraged because it consumes most valuable manure which could be used in agriculture.

Conventional Sources of Energy

Coal: In India, coal is the most abundantly available fossil fuel. It provides a substantial part of the nation's energy needs. It is used for power generation, to supply energy to industry as well as for domestic needs. India is highly dependent on coal for meeting its commercial energy requirements.

As you are already aware that coal is formed due the compression of plant material over millions of years. Coal, therefore, is found in a variety of forms depending on the degrees of compression

Fig. 5.10 (a): A view from inside of a coal mine

Fig. 5.10 (b): A view from outside of a coal mine

and the depth and time of burial. Decaying plants in swamps produce peat. Which has a low carbon and high moisture contents and low heating capacity. **Lignite** is a low grade brown coal, which is soft with high moisture content. The principal lignite reserves are in Neyveli in Tamil Nadu and are used for generation of electricity. Coal that has been buried deep and subjected to increased temperatures is **bituminous** coal. It is the most popular coal in commercial use. Metallurgical coal is high grade bituminous coal which has a special value for smelting iron in blast furnaces. **Anthracite** is the highest quality hard coal.

In India coal occurs in rock series of two main geological ages, namely Gondwana, a little over 200 million years in age and in tertiary deposits which are only about 55 million years old. The major resources of Gondwana coal, which are metallurgical coal, are located in

India: *Distribution of Coal, Oil and Natural Gas*

Damodar valley (West Bengal-Jharkhand). Jharia, Raniganj, Bokaro are important coalfields. The Godavari, Mahanadi, Son and Wardha valleys also contain coal deposits.

Tertiary coals occur in the north eastern states of Meghalaya, Assam, Arunachal Pradesh and Nagaland.

Remember coal is a bulky material, which loses weight on use as it is reduced to ash. Hence, heavy industries and thermal power stations are located on or near the coalfields.

Petroleum

Petroleum or mineral oil is the next major energy source in India after coal. It provides fuel for heat and lighting, lubricants for machinery and raw materials for a number of manufacturing industries. Petroleum refineries act as a "nodal industry" for synthetic textile, fertiliser and numerous chemical industries.

Most of the petroleum occurrences in India are associated with anticlines and fault traps in the rock formations of the tertiary age. In regions of folding, anticlines or domes, it occurs where oil is trapped in the crest of the upfold. The oil bearing layer is a porous limestone or sandstone through which oil may flow. The oil is prevented from rising or sinking by intervening non-porous layers.

Petroleum is also found in fault traps between porous and non-porous rocks. Gas, being lighter usually occurs above the oil.

About 63 per cent of India's petroleum production is from Mumbai High, 18 per cent from Gujarat and 16 per cent from Assam. From the map locate the 3 major off shore fields of western India. Ankeleshwar is the most important field of Gujarat. Assam is the oldest oil producing state of India. Digboi, Naharkatiya and Moran-Hugrijan are the important oil fields in the state.

Natural Gas

Natural gas is an important clean energy resource found in association with or without petroleum. It is used as a source of energy as well as an industrial raw material in the petrochemical industry.

Natural gas is considered an environment friendly fuel because of low carbon dioxide emissions and is, therefore, the fuel for the present century.

Large reserves of natural gas have been discovered in the Krishna-Godavari basin. Along the west coast the reserves of the Mumbai High and allied fields are supplemented by finds in the Gulf of Cambay. Andaman and Nicobar islands are also important areas having large reserves of natural gas.

The 1700 km long Hazira-Vijaipur-Jagdishpur cross country gas pipeline links Mumbai High and Bassien with the fertilizer, power and industrial complexes in western and northern India. This artery has provided an impetus to India's gas production. The power and fertilizer industries are the key users of natural gas. Use of Compressed Natural Gas (CNG) for vehicles to replace liquid fuels is gaining wide popularity in the country.

Electricity

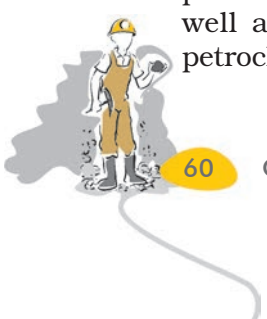
Electricity has such a wide range of applications in today's world that, its percapita consumption is considered as an index of development. Electricity is generated mainly in two ways: by running water which drives hydro turbines to generate *hydro electricity;* and by burning other fuels such as coal, petroleum and natural gas to drive turbines to produce *thermal power.* Once generated the electricity is exactly the same.

Activity

Name some river valley projects and write the names of the dams built on these rivers.

Hydro electricity is generated by fast flowing water, which is a renewable resource. India has a number of multi-purpose projects like the Bhakra Nangal, Damodar Valley corporation, the Kopili Hydel Project etc. producing hydroelectric power.

Thermal electricity is generated by using coal, petroleum and natural gas. The thermal power stations use non-renewable fossil fuels for generating electricity. There are over 310 thermal power plants in India.



India: *Distribution of Nuclear and Thermal Power Plants*

Collect information about thermal/hydel power plants located in your state. Show them on the map of India.

Non-Conventional Sources of Energy

The growing consumption of energy has resulted in the country becoming increasingly dependent on fossil fuels such as coal, oil and gas. Rising prices of oil and gas and their potential shortages have raised uncertainties about the security of energy supply in future, which in turn has serious repercussions on the growth of the national economy. Moreover, increasing use of fossil fuels also causes serious environmental problems. Hence, there is a pressing need to use renewable energy sources like solar energy, wind, tide, biomass and energy from waste material. These are called non-conventional energy sources.

India is blessed with an abundance of sunlight, water, wind and biomass. It has the largest programmes for the development of these renewable energy resources.

Nuclear or Atomic Energy

It is obtained by altering the structure of atoms. When such an alteration is made, much energy is released in the form of heat and this is used to generate electric power. Uranium and Thorium, which are available in Jharkhand and the Aravalli ranges of Rajasthan are used for generating atomic or nuclear power. The Monazite sands of Kerala is also rich in Thorium.

Locate the 6 nuclear power stations and find out the state in which they are located.

Solar Energy

India is a tropical country. It has enormous possibilities of tapping solar energy. Photovoltaic technology converts sunlight directly into electricity. Solar energy is fast becoming popular in rural and remote areas. Some big solar power plants are being established in different parts of India which will minimise the dependence of rural households on firewood and dung cakes, which in turn will contribute to environmental conservation and adequate supply of manure in agriculture.

Fig. 5.11: Solar operated electronic milk testing equipment

Activity

Collect information about newly established solar power plants in India.

Wind power

India has great potential of wind power. The largest wind farm cluster is located in Tamil Nadu from Nagarcoil to Madurai. Apart from these, Andhra Pradesh, Karnataka, Gujarat, Kerala, Maharashtra and Lakshadweep have important wind farms. Nagarcoil and Jaisalmer are well known for effective use of wind energy in the country.

Fig. 5.12: Wind mills – Nagarcoil

Biogas

Shrubs, farm waste, animal and human waste are used to produce biogas for domestic consumption in rural areas. Decomposition of organic matter yields gas, which has higher thermal efficiency in comparison to kerosene, dung cake and charcoal. Biogas plants are set up at municipal, cooperative and individual levels. The plants using cattle dung are known as *'Gobar gas plants'* in rural India. These provide twin benefits to the farmer in the form of energy and improved quality of manure.

Biogas is by far the most efficient use of cattle dung. It improves the quality of manure and also prevents the loss of trees and manure due to burning of fuel wood and cow dung cakes.

Fig. 5.13: Biogas Plant

Tidal Energy

Oceanic tides can be used to generate electricity. Floodgate dams are built across inlets. During high tide water flows into the inlet and gets trapped when the gate is closed. After the tide falls outside the flood gate, the water retained by the floodgate flows back to the sea via a pipe that carries it through a power-generating turbine.

In India the Gulf of Khambhat, the Gulf of Kuchchh in Gujarat on the western coast and Gangetic delta in Sunderban regions of West Bengal provide ideal conditions for utilising tidal energy.

Geo Thermal Energy

Geo thermal energy refers to the heat and electricity produced by using the heat from the interior of the Earth. Geothermal energy exists because, the Earth grows progressively hotter with increasing depth. Where the geothermal gradient is high, high temperatures are found at shallow depths. Groundwater in such areas absorbs heat from the rocks and becomes hot. It is so hot that when it rises to the earth's surface, it turns into steam. This steam is used to drive turbines and generate electricity.

There are several hundred hot springs in India, which could be used to generate electricity. Two experimental projects have been set up in India to harness geothermal energy. One is located in the Parvati valley near Manikarn in Himachal Pradesh and the other is located in the Puga Valley, Ladakh.

Conservation of Energy Resources

Energy is a basic requirement for economic development. Every sector of the national economy – agriculture, industry, transport, commercial and domestic – needs inputs of energy. The economic development plans implemented since Independence necessarily required increasing amounts of energy to remain operational. As a result, consumption of energy in all forms has been steadily rising all over the country.

In this background, there is an urgent need to develop a sustainable path of energy development. Promotion of energy conservation and increased use of renewable energy sources are the twin planks of sustainable energy.

India is presently one of the least energy efficient countries in the world. We have to adopt a cautious approach for the judicious use of our limited energy resources. For example, as concerned citizens we can do our bit by using public transport systems instead of individual vehicles; switching off electricity when not in use, using power-saving devices and using non-conventional sources of energy. After all, "energy saved is energy produced".

EXERCISES

1. Multiple choice questions.

   (i) Which one of the following minerals is formed by decomposition of rocks, leaving a residual mass of weathered material?

   (a) coal (b) bauxite (c) gold (d) zinc

   (ii) Koderma, in Jharkhand is the leading producer of which one of the following minerals?

   (a) bauxite (b) mica (c) iron ore (d) copper

(iii) Minerals are deposited and accumulated in the stratas of which of the following rocks?

(a) sedimentary rocks (c) igneous rocks

(b) metamorphic rocks (d) none of the above

(iv) Which one of the following minerals is contained in the Monazite sand?

(a) oil (b) uranium (c) thorium (d) coal

2. Answer the following questions in about 30 words.

(i) Distinguish between the following in not more than 30 words.

(a) ferrous and non-ferrous minerals

(b) conventional and non-conventional sources of energy

(ii) What is a mineral?

(iii) How are minerals formed in igneous and metamorphic rocks?

(iv) Why do we need to conserve mineral resources ?

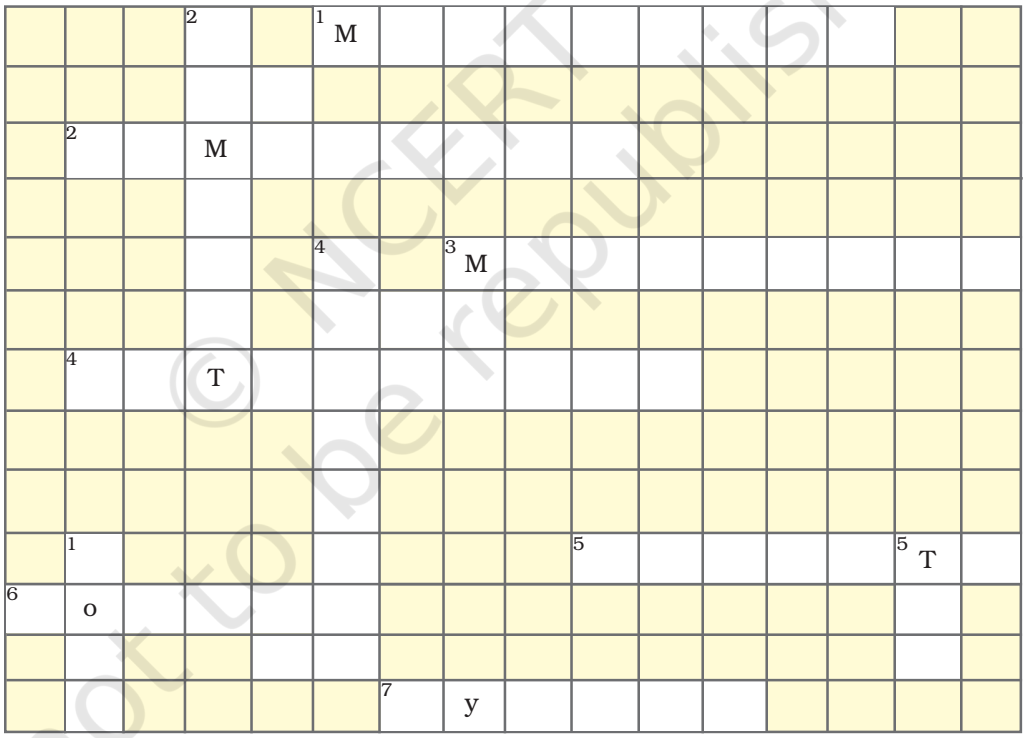
3. Answer the following questions in about 120 words.

(i) Describe the distribution of coal in India.

(ii) Why do you think that solar energy has a bright future in India?

Activity

Fill the name of the correct mineral in the crossword below:

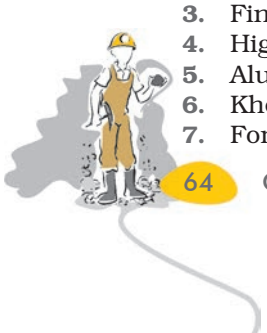


Across

1. A ferrous mineral (9)
2. Raw material for cement industry (9)
3. Finest iron ore with magnetic properties (9)
4. Highest quality hard coal (10)
5. Aluminium is obtained from this ore (7)
6. Khetri mines are famous for this mineral (6)
7. Formed due to evaporation (6)

Down

1. Found in placer deposit (4)
2. Iron ore mined in Bailadila (8)
3. Indispensable for electrical industry (4)
4. Geological Age of coal found in north east India (8)
5. Formed in veins and lodes (3)



6 MANUFACTURING INDUSTRIES

On the occassion of Diwali, Harish went to a market with his parents. They purchased shoes and clothes for him. His mother purchased utensils, sugar, tea and diyas (earthen lamps). Harish observed that the shops in the market were flooded with items for sale. He wondered how so many items could be made in such large quantities. His father explained that shoes, clothes, sugar etc. are manufactured by machines in large industries, some utensils are manufactured in small industries, while items like **diyas** are made by individual artisans in household industry.

Do you have some ideas about these industries?

Production of goods in large quantities after processing from raw materials to more valuable products is called manufacturing. Do you know that paper is manufactured from wood, sugar from sugarcane, iron and steel from iron ore and aluminium from bauxite? Do you also know that some types of clothes are manufactured from yarn which itself is an industrial product?

People employed in the secondary activities manufacture the primary materials into finished goods. The workers employed in steel factories, car, breweries, textile industries, bakeries etc. fall into this category. Some people are employed in providing services. In this chapter, we are mainly concerned with manufacturing industries which fall in the secondary sector.

The economic strength of a country is measured by the development of manufacturing industries.

Importance of Manufacturing

Manufacturing sector is considered the backbone of development in general and economic development in particular mainly because–

- Manufacturing industries not only help in modernising agriculture, which forms the backbone of our economy, they also reduce the heavy dependence of people on agricultural income by providing them jobs in secondary and tertiary sectors.
- Industrial development is a precondition for eradication of unemployment and poverty from our country. This was the main philosophy behind public sector industries and joint sector ventures in India. It was also aimed at bringing down regional disparities by establishing industries in tribal and backward areas.
- Export of manufactured goods expands trade and commerce, and brings in much needed foreign exchange.
- Countries that transform their raw materials into a wide variety of finished goods of higher value are prosperous. India's prosperity lies in increasing and diversifying its manufacturing industries as quickly as possible.

Agriculture and industry are not exclusive of each other. They move hand in hand. For instance, the agro-industries in India have given a major boost to agriculture by raising its productivity. They depend on the latter for raw materials and sell their products such as irrigation pumps, fertilisers, insecticides, pesticides, plastic and PVC pipes, machines and tools, etc. to the farmers. Thus, development and competitiveness of manufacturing industry has not only assisted agriculturists in increasing

their production but also made the production processes very efficient.

In the present day world of globalisation, our industry needs to be more efficient and competitive. Self-sufficiency alone is not enough. Our manufactured goods must be at par in quality with those in the international market. Only then, will we be able to compete in the international market.

Contribution of Industry to National Economy

Over the last two decades, the share of manufacturing sector has stagnated at 17 per cent of GDP – out of a total of 27 per cent for the industry which includes 10 per cent for mining, quarrying, electricity and gas.

This is much lower in comparison to some East Asian economies, where it is 25 to 35 per cent. The trend of growth rate in manufacturing over the last decade has been around 7 per cent per annum. The desired growth rate over the next decade is 12 per cent. Since 2003, manufacturing is once again growing at the rate of 9 to 10 per cent per annum. With appropriate policy interventions by the government and renewed efforts by the industry to improve productivity, economists predict that manufacturing can achieve its target over the next decade. The National Manufacturing Competitiveness Council (NMCC) has been set up with this objective.

Industrial Location

Industrial locations are complex in nature. These are influenced by availability of raw material, labour, capital, power and market, etc. It is rarely possible to find all these factors available at one place. Consequently, manufacturing activity tends to locate at the most appropriate place where all the factors of industrial location are either available or can be arranged at lower cost. After an industrial activity starts, urbanisation follows. Sometimes, industries are located in or near the cities. Thus, industrialisation and urbanisation go hand in hand. Cities provide markets and also provide services such as banking, insurance, transport, labour, consultants and financial advice, etc. to the industry. Many industries tend to come together to make use of the advantages offered by the urban centres known as **agglomeration economies**. Gradually, a large industrial agglomeration takes place.

In the pre-Independence period, most manufacturing units were located in places from the point of view of overseas trade such as Mumbai, Kolkata, Chennai, etc. Consequently, there emerged certain pockets of industrially developed urban centres surrounded by a huge agricultural rural hinterland.

Industry – Market Linkage

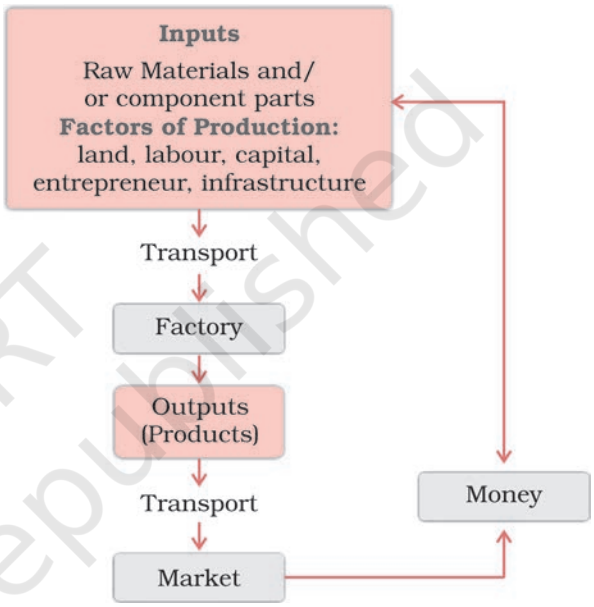


Fig. 6.1

The key to decision of the factory location is the least cost. Government policies and specialised labour also influence the location of industry.

Ideal Location of an Industry

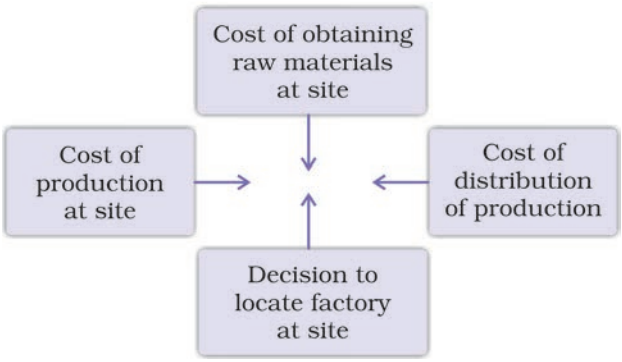


Fig. 6.2

Classification of Industries

List the various manufactured products you use in your daily life such as – transistors, electric bulbs, vegetable oil, cement, glassware, petrol, matches, scooters, automobiles, medicines and so on. If we classify the various industries based on a particular criterion then we would be able to understand their manufacturing better. Industries may be classified as follows:

On the basis of source of raw materials used:

- Agro based: cotton, woollen, jute, silk textile, rubber and sugar, tea, coffee, edible oil.
- Mineral based: iron and steel, cement, aluminium, machine tools, petrochemicals.

According to their main role:

- Basic or key industries are those which supply their products as raw materials to manufacture other goods e.g. iron and steel and copper smelting, aluminum smelting.
- Consumer industries that produce goods for direct use by consumers – sugar, toothpaste, paper, sewing machines, fans etc.

On the basis of capital investment:

- A small scale industry is defined with reference to the maximum investment allowed on the assets of a unit. This limit has changed over a period of time. At present the maximum investment allowed is rupees one crore.

On the basis of ownership:

- Public sector, owned and operated by government agencies – BHEL, SAIL etc.
- Private sector industries owned and operated by individuals or a group of individuals –TISCO, Bajaj Auto Ltd., Dabur Industries.
- Joint sector industries which are jointly run by the state and individuals or a group of individuals. Oil India Ltd. (OIL) is jointly owned by public and private sector.
- Cooperative sector industries are owned and operated by the producers or suppliers of raw materials, workers or both. They pool in the resources and share the profits or losses proportionately. Such examples are the sugar industry in Maharashtra, the coir industry in Kerala.

Based on the bulk and weight of raw material and finished goods:

- Heavy industries such as iron and steel
- Light industries that use light raw materials and produce light goods such as electrical goods industries.

Activity

Classify the following into two groups on the basis of bulk and weight of raw material and finished goods.

(i) Oil	(vi) Sewing Machines
(ii) Knitting needles	(vii) Shipbuilding
(iii) Brassware	(viii) Electric Bulbs
(iv) Fuse wires	(ix) Paint brushes
(v) Watches	(x) Automobiles

Agro-based Industries

Cotton, jute, silk, woollen textiles, sugar and edible oil, etc. industries are based on agricultural raw materials.

Textile Industry: The textile industry occupies unique position in the Indian economy, because it contributes significantly to industrial production (14 per cent), employment generation (35 million persons directly – the second largest after agriculture) and foreign exchange earnings (about 24.6 per cent). It contributes 4 per cent towards GDP. It is the only industry in the country, which is self-reliant and complete in the value chain i.e., from raw material to the highest value added products.

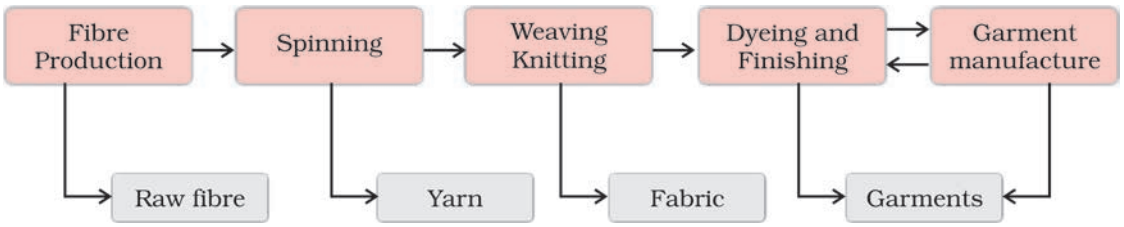


Fig. 6.3: Value addition in the textile industry

Cotton Textiles: In ancient India, cotton textiles were produced with hand spinning and handloom weaving techniques. After the 18th century, power-looms came into use. Our traditional industries suffered a setback during the colonial period because they could not compete with the mill-made cloth from England.

- The first successful textile mill was established in Mumbai in 1854.
- The two world wars were fought in Europe, India was a British colony. There was a demand for cloth in U.K. hence, they gave a boost to the development of the cotton textile industry.

As on 30 November 2011, there were 1946 cotton and human-made fibre textile mill in the country. About 80 per cent of these are in the private sector and the rest in the public and cooperative sectors. Apart from these, there are several thousand small factories with four to ten looms.

In the early years, the cotton textile industry was concentrated in the cotton growing belt of Maharashtra and Gujarat. Availability of raw cotton, market, transport including accessible port facilities, labour, moist climate, etc. contributed towards its localisation. This industry has close links with agriculture and provides a living to farmers, cotton boll pluckers and workers engaged in ginning, spinning, weaving, dyeing, designing, packaging, tailoring and sewing. The industry by creating demands supports many other industries, such as, chemicals and dyes, packaging materials and engineering works.

While spinning continues to be centralised in Maharashtra, Gujarat and Tamil Nadu, weaving is highly decentralised to provide scope for incorporating traditional skills and designs of weaving in cotton, silk, zari, embroidery, etc. India has world class production in spinning, but weaving supplies low quality of fabric as it cannot use much of the high quality yarn produced in the country. Weaving is done by handloom, powerloom and in mills.

The handspun khadi provides large scale employment to weavers in their homes as a cottage industry.

Why did Mahatma Gandhi lay emphasis on spinning yarn and weaving khadi?

Table 6.1: India: Production of Fabrics in India

Sector	2009-10	2010-11* (Provisional)
Mill Sector	3.3	3.5
Powerlooms (in Hosiery)	84.1	84.1
Handlooms	11.3	11.1
Others	1.3	1.3
Total	**100%**	**100%**

Source: *Office of Textile Commissioner, Mumbai, Economic Survey, 2011-12.*

Note: *90 per cent of the weaving, cutting and processing is in decentralised sector.*

Study the figures above and note the share of mills in the production of fabric.

Why is it important for our country to keep the mill sector loomage lower than power loom and handloom?

India exports yarn to Japan. Other importers of cotton goods from India are U.S.A., U.K., Russia, France, East European countries, Nepal, Singapore, Sri Lanka, and African countries.

India: *Distribution of cotton, woollen and silk industries*

India has the second largest installed capacity of spindles in the world, with 43.13 million spindles (2011-12) after China. Since the mid-eighties, the spinning sector has received a lot of attention.

We have a large share in the world trade of cotton yarn, accounting for one fourth of the total trade. However, our trade in garments is only 4 per cent of the world's total. Our spinning mills are competitive at the global level and capable of using all the fibres we produce. The weaving, knitting and processing units cannot use much of the high quality yarn that is produced in the country. There are some large and modern factories in these segments, but most of the production is in fragmented small units, which cater to the local market. This mismatch is a major drawback for the industry. As a result, many of our spinners export cotton yarn while apparel/garment manufactures have to import fabric.

Suppose that yarn is sold at Rs. 85 per kg. If it is sold as a trouser it fetches Rs 800 per kg. Value is added at every stage from fibre to yarn to fabric and to garment.

Why is it important for us to improve our weaving sector instead of exporting yarn in large quantities?

Although, we have made significant increase in the production of good quality long staple cotton (301.5 lakh bales of 170 kgs each during 2015–16), the need to import is still felt. Power supply is erratic and machinery needs to be upgraded in the weaving and processing sectors in particular. Other problems are the low output of labour and stiff competition with the synthetic fibre industry.

Jute Textiles

India is the largest producer of raw jute and jute goods and stands at second place as an exporter after Bangladesh. There were about 80 jute mills in India in 2010-11. Most of these are located in West Bengal, mainly along the banks of the Hugli river, in a narrow belt (98 km long and 3 km wide).

The first jute mill was set up near Kolkata in 1855 at Rishra. After Partition in 1947, the jute mills remained in India but three-fourth of the jute producing area went to Bangladesh (erstwhile East Pakistan).

Factors responsible for their location in the Hugli basin are: proximity of the jute producing areas, inexpensive water transport, supported by a good network of railways, roadways and waterways to facilitate movement of raw material to the mills, abundant water for processing raw jute, cheap labour from West Bengal and adjoining states of Bihar, Odisha and Uttar Pradesh. Kolkata as a large urban centre provides banking, insurance and port facilities for export of jute goods.

In 2010-11 the jute industry was supporting 3.7 lakh workers directly and another 40 lakhs small and marginal farmers who were engaged in cultivation of jute and mesta. Many more people were associated indirectly.

Challenges faced by the industry include stiff competition in the international market from synthetic substitutes and from other competitors like Bangladesh, Brazil, Philippines, Egypt and Thailand. However, the internal demand has been on the increase due to the Government policy of mandatory use of jute packaging. To stimulate demand, the products need to be diversified. In 2005, National Jute Policy was formulated with the objective of increasing productivity, improving quality, ensuring good prices to the jute farmers and enhancing the yield per hectare. The main markets are U.S.A., Canada, Ghana, Saudi Arabia, U.K. and Australia. The growing global concern for environment friendly, biodegradable materials, has once again opened the opportunity for jute products.

Sugar Industry

India stands second as a world producer of sugar but occupies the first place in the

production of *gur* and *khandsari.* The raw material used in this industry is bulky, and in haulage its sucrose content reduces. Where should the mills be ideally located? In 2010-11 there were over 662 sugar mills in the country spread over Uttar Pradesh, Bihar, Maharashtra, Karnataka, Tamil Nadu, Andhra Pradesh and Gujarat along with Punjab, Haryana and Madhya Pradesh. Sixty per cent mills are in Uttar Pradesh and Bihar. This industry is seasonal in nature so, it is ideally suited to the cooperative sector. Can you explain why this is so?

In recent years, there is a tendency for the mills to shift and concentrate in the southern and western states, especially in Maharashtra, This is because the cane produced here has a higher sucrose content. The cooler climate also ensures a longer crushing season. Moreover, the cooperatives are more successful in these states.

Major challenges include the seasonal nature of the industry, old and inefficient methods of production, transport delay in reaching cane to factories and the need to maximise the use of baggase.

Mineral-based Industries

Industries that use minerals and metals as raw materials are called mineral-based industries. Can you name some industries that would fall in this category?

Iron and Steel Industry

The iron and steel industry is the basic industry since all the other industries — heavy, medium and light, depend on it for their machinery. Steel is needed to manufacture a variety of engineering goods, construction material, defence, medical, telephonic, scientific equipment and a variety of consumer goods.

Activity

Make a list of all such goods made of steel that you can think of.

Production and consumption of steel is often regarded as the index of a country's development. Iron and steel is a heavy industry because all the raw materials as well as finished goods are heavy and bulky entailing heavy transportation costs. Iron ore, coking coal and lime stone are required in the ratio of approximately 4 : 2 : 1. Some quantities of manganese, are also required to harden the steel. Where should the steel plants be ideally located? Remember that the finished products also need an efficient transport network for their distribution to the markets and consumers.

In 2016 with 95.6 million tonnes of crude steel production, India ranked 3rd among the world crude steel producers. It is the largest producer of sponge iron. In 2016 per capita consumption of steel in the country was only around 63 kg per annum against the world average of 208 kg.

Processes of Manufacture of Steel

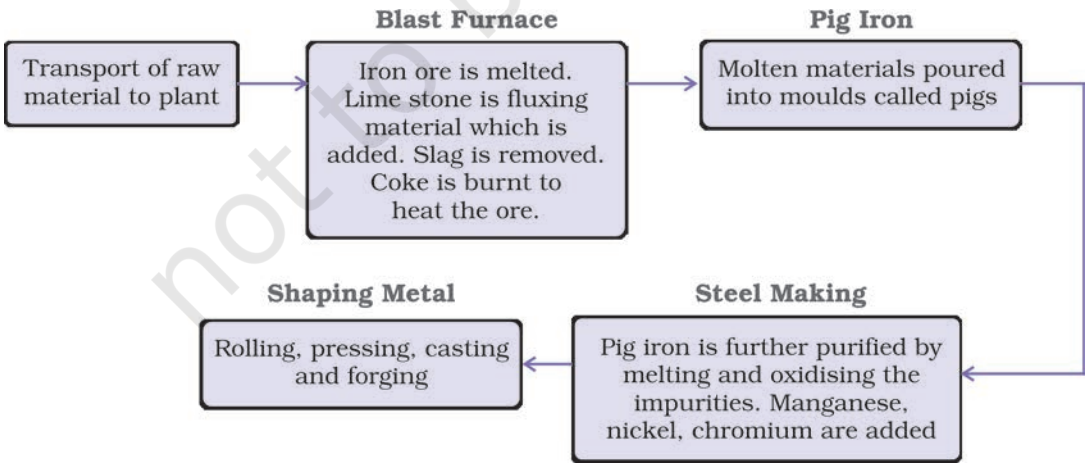


Fig. 6.4

India: *Iron and Steel Plants*

Activity

Table 6.2: Total production of finished steel in India

Year	Production (in metric tonnes per annum)
2010–11	68.62
2011–12	75.70
2012–13	81.68
2013–14	87.67
2014–15	92.16
2015–16	91.00
2016–17	101.3

Source: Ministry of Steel, Government of India

Why is the per capita consumption of steel so low in India?

Activity

Collect information about products of steel plants in India.

Mini steel plants are smaller, have electric furnaces, use steel scrap and sponge iron. They have re-rollers that use steel ingots as well. They produce mild and alloy steel of given specifications.

An integrated steel plant is large, handles everything in one complex – from putting together raw material to steel making, rolling and shaping.

Most of the public sector undertakings market their steel through Steel Authority of India Ltd. (SAIL).

In the 1950s China and India produced almost the same quantity of steel. Today, China is the largest producer of steel. China is also the world's largest consumer of steel.

Chhotanagpur plateau region has the maximum concentration of iron and steel industries. It is largely, because of the relative advantages this region has for the development of this industry. These include, low cost of iron ore, high grade raw materials in proximity, cheap labour and vast growth potential in the home market. Though, India is an important iron and steel producing country in the world yet, we are not able to perform to our full potential largely due to: (a) High costs and limited availability of coking

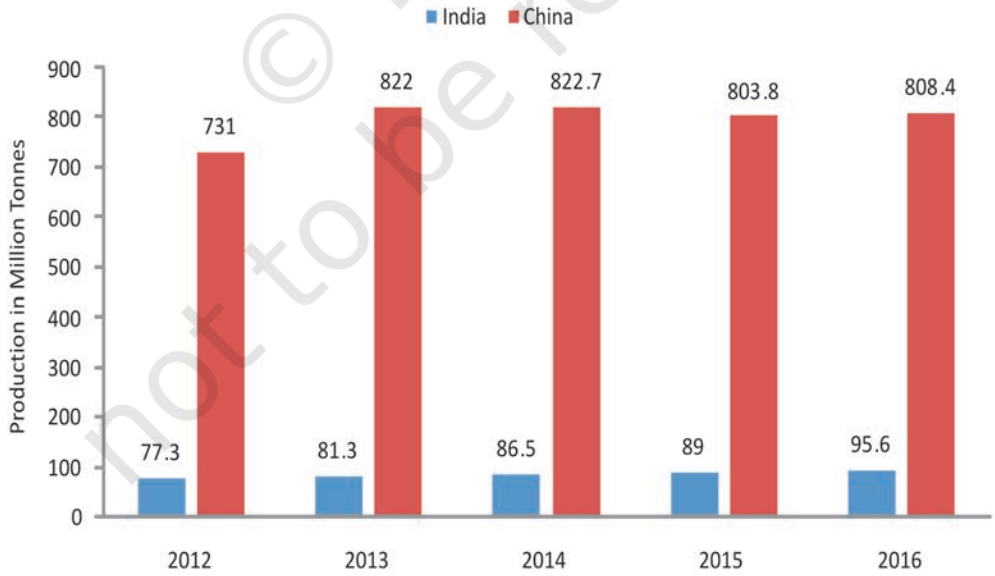


Fig. 6.5: *Crude Steel Production in India and China*

Source: *World Steel Association, website: www.worldsteel.org*

coal (b) Lower productivity of labour (c) Irregular supply of energy and (d) Poor infrastructure.

We also import good quality steel from other countries. However, the overall production of steel is sufficient to meet our domestic demand.

Liberalisation and Foreign Direct Investment have given a boost to the industry with the efforts of private entrepreneurs. There is a need to allocate resources for research and development to produce steel more competitively.

Activity

Have you read about the Kalinganagar controversy? Collect information from different sources and discuss.

Aluminium Smelting

Aluminium smelting is the second most important metallurgical industry in India. It is light, resistant to corrosion, a good conductor of heat, malleable and becomes strong when it is mixed with other metals. It is used to manufacture aircraft, utensils and wires. It has gained popularity as a substitute of steel, copper, zinc and lead in a number of industries.

Aluminium smelting plants in the country are located in Odisha, West Bengal, Kerala, Uttar Pradesh, Chhattisgarh, Maharashtra and Tamil Nadu. In 2014–15 India produced about 3.96 million tonnes of aluminium.

Fig. 6.6: Strip coasting mill at smelter of NALCO

Bauxite, the raw material used in the smelters is a very bulky, dark reddish coloured rock. The flow chart given below shows the process of manufacturing aluminium. Regular supply of electricity and an assured source of raw material at minimum cost are the two prime factors for location of the industry.

Activity

A factory produces aluminium saucepans with plastic handles. It obtains aluminium from a smelter and a plastic component from

4 to 6 tonnes of bauxite → 2 tonnes of alumina → 1 tonne of aluminium

Fig. 6.7

Process of Manufacturing in Aluminium Industry

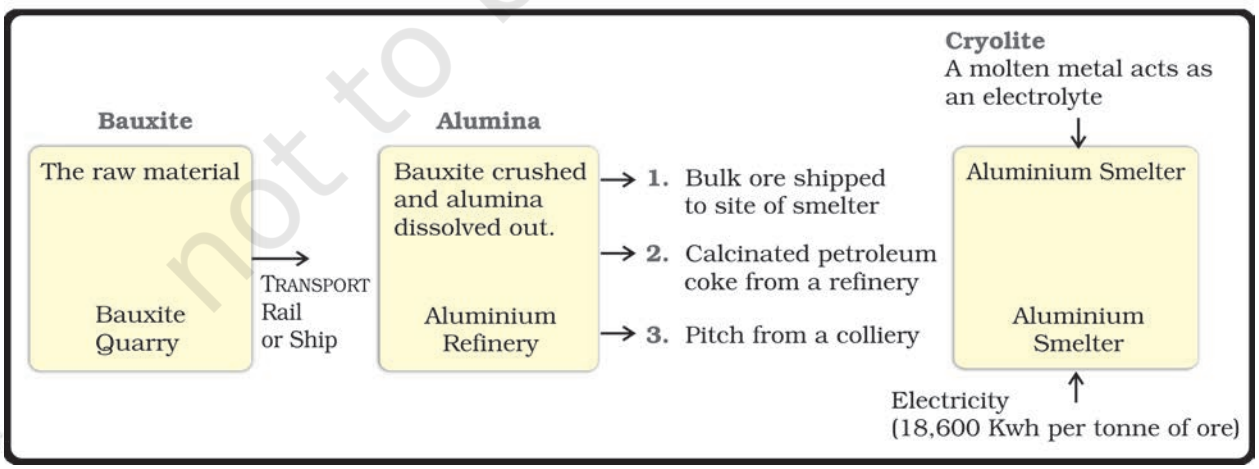


Fig. 6.8

another factory. All the manufactured saucepans are sent to a warehouse:

1. (a) Which raw material is likely to be most expensive to transport and why?
   (b) Which raw material is likely to be the cheapest to transport and why?
2. Do you think the cost of transporting the finished products after packaging is likely to be cheaper or more expensive than the cost of transporting aluminium and plastic? Why?

Chemical Industries

The Chemical industry in India is fast growing and diversifying. It contributes approximately 3 per cent of the GDP. It is the third largest in Asia and occupies the twelfth place in the world in term of its size. It comprises both large and small scale manufacturing units. Rapid growth has been recorded in both inorganic and organic sectors. Inorganic chemicals include sulphuric acid (used to manufacture fertilisers, synthetic fibres, plastics, adhesives, paints, dyes stuffs), nitric acid, alkalies, soda ash (used to make glass, soaps and detergents, paper) and caustic soda. These industries are widely spread over the country.

Why do you think it is so?

Organic chemicals include petrochemicals, which are used for manufacturing of synthetic fibers, synthetic rubber, plastics, dye-stuffs, drugs and pharmaceuticals. Organic chemical plants are located near oil refineries or petrochemical plants.

The chemical industry is its own largest consumer. Basic chemicals undergo processing to further produce other chemicals that are used for industrial application, agriculture or directly for consumer markets. Make a list of the products you are aware of.

Fertiliser Industry

The fertiliser industry is centred around the production of nitrogenous fertilisers (mainly urea), phosphatic fertilisers and ammonium phosphate (DAP) and complex fertilisers which have a combination of nitrogen (N), phosphate (P), and potash (K). The third, i.e. potash is entirely imported as the country does not have any reserves of commercially usable potash or potassium compounds in any form. India is the third largest producer of nitrogenous fertilisers. There are 57 fertiliser units manufacturing nitrogenous and complex nitrogenous fertilisers, 29 for urea and 9 for producing ammonium sulphate as a by-product and 68 other small units produce single superphosphate. There are 10 public sector undertakings and one in cooperative sector at Hazira in Gujarat under the Fertiliser Corporation of India.

After the Green Revolution the industry expanded to several other parts of the country. Gujarat, Tamil Nadu, Uttar Pradesh, Punjab and Kerala contribute towards half of the fertiliser production. Other significant producers are Andhra Pradesh, Odisha, Rajasthan, Bihar, Maharashtra, Assam, West Bengal, Goa, Delhi, Madhya Pradesh and Karnataka.

Cement Industry

Cement is essential for construction activity such as building houses, factories, bridges, roads, airports, dams and for other commercial establishments. This industry requires bulky and heavy raw materials like limestone, silica and gypsum. Coal and electric power are needed apart from rail transportation.

Activity

Where would it be economically viable to set up the cement manufacturing units?

The industry has strategically located plants in Gujarat that have suitable access to the market in the Gulf countries.

Activity

Find out where the plants are located in other States of India. Find their names.

The first cement plant was set up in Chennai in 1904. After Independence the industry expanded. Decontrol of price and distribution since 1989 and other policy reforms led the cement industry to make rapid strides in capacity, process, technology and production.

Improvement in the quality has found the produce a readily available market in East Asia, Middle East, Africa and South Asia apart from a large demand within the country. This industry is doing well in terms of production as well as export. Efforts are being made to generate adequate domestic demand and supply in order to sustain this industry.

Automobile Industry

Automobiles provide vehicle for quick transport of good services and passengers. Trucks, buses, cars, motor cycles, scooters, three-wheelers and multi-utility vehicles are manufactured in India at various centres. After the liberalisation, the coming in of new and contemporary models stimulated the demand for vehicles in the market, which led to the healthy growth of the industry including passenger cars, two and three-wheelers. This industry had experienced a quantum jump in less than 15 years. Foreign Direct Investment brought in new technology and aligned the industry with global developments. At present, there are 15 manufacturers of passenger cars and multi-utility vehicles, 9 of commercial vehicles, 14 of the two and three-wheelers. The industry is located around Delhi, Gurugram, Mumbai, Pune, Chennai, Kolkata, Lucknow, Indore, Hyderabad, Jamshedpur and Bengaluru.

Information Technology and Electronics Industry

The electronics industry covers a wide range of products from transistor sets to television, telephones, cellular telecom, pagers, telephone exchange, radars, computers and many other equipments required by the telecommunication industry. Bengaluru has emerged as the electronic capital of India. Other important centres for electronic goods are Mumbai, Delhi, Hyderabad, Pune, Chennai, Kolkata, Lucknow and Coimbatore. By 2010-11 (STPI) Software Technology Parks of India have come up across 46 locations at different centres of India. However, the major industry concentration is at Bengaluru, Noida, Mumbai, Chennai, Hyderabad and Pune. A major impact of this industry has been on employment generation. It is encouraging to know that 30 per cent of the people employed in this sector are *women*. This industry has been a major foreign exchange earner in the last two or three years because of its fast growing Business Processes Outsourcing (BPO) sector. The continuing growth in the hardware and software is the key to the success of IT industry in India.

Fig. 6.9: Cable manufacturing facilities at HCL, Rupnarainpur (West Bengal)

Fig. 6.10: Gas turbine rotor an assembly bed at BHEL, Hyderabad

Industrial Pollution and Environmental Degradation

Although industries contribute significantly to India's economic growth and development, the increase in pollution of land, water, air, noise and resulting degradation of environment that they have caused, cannot be overlooked. Industries are responsible for four types of

India: Some Software Technology Parks

pollution: (a) Air (b) Water (c) Land (d) Noise. The polluting industries also include thermal power plants.

Air pollution is caused by the presence of high proportion of undesirable gases, such as sulphur dioxide and carbon monoxide. Air-borne particulate materials contain both solid and liquid particles like dust, sprays mist and smoke. Smoke is emitted by chemical and paper factories, brick kilns, refineries and smelting plants, and burning of fossil fuels in big and small factories that ignore pollution norms. Toxic gas leaks can be very hazardous with long-term effects. Are you aware of the Bhopal Gas tragedy that occurred? Air pollution adversely affects human health, animals, plants, buildings and the atmosphere as a whole.

Water pollution is caused by organic and inorganic industrial wastes and affluents discharged into rivers. The main culprits in this regard are paper, pulp, chemical, textile and dyeing, petroleum refineries, tanneries and electroplating industries that let out dyes, detergents, acids, salts and heavy metals like lead and mercury pesticides, fertilisers, synthetic chemicals with carbon, plastics and rubber, etc. into the water bodies. Fly ash, phospo- gypsum and iron and steel slags are the major solid wastes in India.

Thermal pollution of water occurs when hot water from factories and thermal plants is drained into rivers and ponds before cooling. What would be the effect on aquatic life?

Wastes from nuclear power plants, nuclear and weapon production facilities cause cancers, birth defects and miscarriages. Soil and water pollution are closely related. Dumping of wastes specially glass, harmful chemicals, industrial effluents, packaging, salts and garbage renders the soil useless. Rain water percolates to the soil carrying the pollutants to the ground and the ground water also gets contaminated.

Noise pollution not only results in irritation and anger, it can also cause hearing impairment, increased heart rate and blood pressure among other physiological effects. Unwanted sound is an irritant and a source of stress. Industrial and construction activities, machinery, factory equipment, generators, saws and pneumatic and electric drills also make a lot of noise.

Control of Environmental Degradation

Every litre of waste water discharged by our industry pollutes eight times the quantity of freshwater. How can the industrial pollution of fresh water be reduced? Some suggestions are-

(i) minimising use water for processing by reusing and recycling it in two or more successive stages

(ii) harvesting of rainwater to meet water requirements

(iii) treating hot water and effluents before releasing them in rivers and ponds. Treatment of industrial effluents can be done in three phases

(a) Primary treatment by mechanical means. This involves screening, grinding, flocculation and sedimentation.

(b) Secondary treatment by biological process

(c) Tertiary treatment by biological, chemical and physical processes. This involves recycling of wastewater.

Overdrawing of ground water reserves by industry where there is a threat to ground water resources also needs to be regulated legally. Particulate matter in the air can be reduced by fitting smoke stacks to factories with electrostatic precipitators, fabric filters, scrubbers and inertial separators. Smoke can be reduced by using oil or gas instead of coal in factories. Machinery and equipment can be used and generators should be fitted with silencers. Almost all machinery can be redesigned to increase energy efficiency and reduce noise. Noise absorbing material may be used apart from personal use of earplugs and earphones.

Fig. 6.11: Sewage Treatment plant under Yamuna action plan at Faridabad

The challenge of sustainable development requires integration of economic development with environmental concerns.

NTPC shows the way

NTPC is a major power providing corporation in India. It has ISO certification for EMS (Environment Management System) 14001. The corporation has a proactive approach for preserving the natural environment and resources like water, oil and gas and fuels in places where it is setting up power plants. This has been possible through-

(a) Optimum utilisation of equipment adopting latest techniques and upgrading existing equipment.

(b) Minimising waste generation by maximising ash utilisation.

(c) Providing green belts for nurturing ecological balance and addressing the question of special purpose vehicles for afforestation.

(d) Reducing environmental pollution through ash pond management, ash water recycling system and liquid waste management.

(e) Ecological monitoring, reviews and on-line database management for all its power stations.

Fig. 6.12: Ramagundam plant

EXERCISES EXERCISES EXERCISES EXERCISES EXERCISES

1. Multiple choice questions.

(i) Which one of the following industries uses limestone as a raw material.
(a) Aluminium (b) Cement (c) Plastic (d) Automobile

(ii) Which one of the following agencies markets steel for the public sector plants?
(a) HAIL (b) SAIL (c) TATA Steel (d) MNCC

(iii) Which one of the following industries uses bauxite as a raw material?
(a) Aluminium Smelting (b) Cement (c) Paper (d) Steel

(iv) Which one of the following industries manufactures telephones, computer, etc.
(a) Steel (c) Aluminium Smelting
(b) Electronic (d) Information Technology

2. Answer the following briefly in not more than 30 words.

(i) What is manufacturing?
(ii) Name any three physical factors for the location of the industry.
(iii) Name any three human factors for the location of an industry.
(iv) What are basic industries? Give an example.
(v) Name the important raw materials used in the manufacturing of cement?

3. Write the answers of the following questions in 120 words.

(i) How are integrated steel plants different from mini steel plants? What problems does the industry face? What recent developments have led to a rise in the production capacity?

(ii) How do industries pollute the environment?

(iii) Discuss the steps to be taken to minimise environmental degradation by industry?

Activity

Give one word for each of the following with regard to industry. The number of letters in each word are hinted in brackets.

(i) Used to drive machinery (5) P.....

(ii) People who work in a factory (6) W.....

(iii) Where the product is sold (6) M.....

(iv) A person who sells goods (8) R.....

(v) Thing produced (7) P.....

(vi) To make or produce (11) M.....

(vii) Land, Water and Air degraded (9) P.....

Project Work

Select one agro-based and one mineral-based industry in your area.

(i) What are the raw materials they use?

(ii) What are the other inputs in the process of manufacturing that involve transportation cost?

(iii) Are these factories following environmental norms?

Activity

Solve the puzzle by following your search horizontally and vertically to find the hidden answers.

G	G	G	P	V	A	R	A	N	A	S	I
U	O	J	I	P	G	X	K	M	Q	W	V
K	S	U	G	A	R	C	A	N	E	E	N
O	T	T	O	N	O	Z	V	O	P	T	R
A	U	E	L	U	B	H	I	L	A	I	U
T	K	O	C	R	A	Q	N	T	R	L	N
E	I	R	O	N	S	T	E	E	L	S	J
E	N	A	N	O	E	P	I	T	L	R	Y
G	A	N	U	J	D	R	A	G	D	T	A
N	T	A	R	P	O	A	P	U	E	P	Y
A	S	N	A	E	N	J	D	I	Y	S	K
S	M	H	V	L	I	A	J	H	S	K	G

1. Textiles, sugar, vegetable oil and plantation industries deriving raw materials from agriculture are called...
2. The basic raw material for sugar industry.
3. This fibre is also known as the 'Golden Fibre'.
4. Iron-ore, coking coal, and limestone are the chief raw materials of this industry.
5. A public sector steel plant located in Chhattisgarh.
6. Railway diesel engines are manufactured in Uttar Pradesh at this place.

7 LIFELINES OF NATIONAL ECONOMY

We use different materials and services in our daily life. Some of these are available in our immediate surroundings, while other requirements are met by bringing things from other places. Goods and services do not move from supply locales to demand locales on their own. The movement of these goods and services from their supply locations to demand locations necessitates the need for transport. Some people are engaged in facilitating these movements. These are known to be traders who make the products come to the consumers by transportation. Thus, the pace of development of a country depends upon the production of goods and services as well as their movement over space. Therefore, efficient means of transport are prerequisites for fast development.

Movement of these goods and services can be over three important domains of our earth i.e. land, water and air. Based on these, transport can also be classified into land, water and air transport.

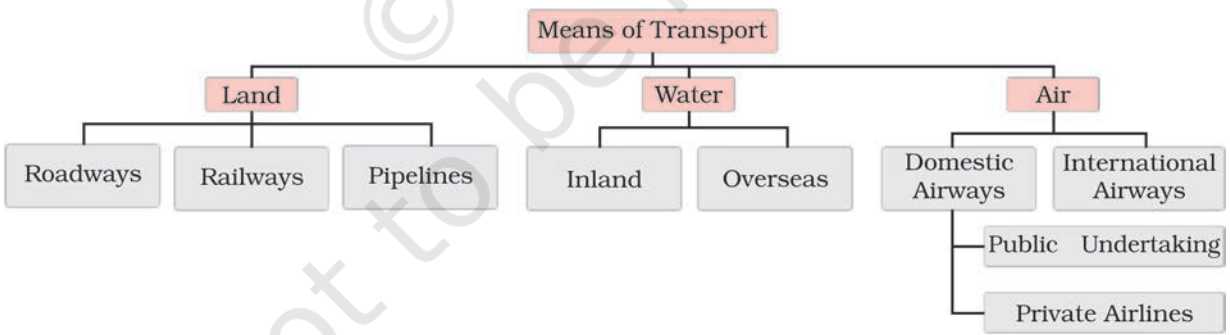


Fig. 7.1

For a long time, trade and transport were restricted to a limited space. With the development in science and technology, the area of influence of trade and transport expanded far and wide. Today, the world has been converted into a large village with the help of efficient and fast moving transport. Transport has been able to achieve this with the help of equally developed communication system. Therefore, transport, communication and trade are complementary to each other.

Today, India is well-linked with the rest of the world despite its vast size, diversity and linguistic and socio-cultural plurality. Railways, airways, waterways, newspapers, radio, television, cinema and internet, etc. have been contributing to its socio-economic progress in many ways. The trades from local to international levels have added to the vitality of its economy. It has enriched our life and added substantially to growing amenities and facilities for the comforts of life.

In this chapter, you will see how modern means of transport and communication serve as lifelines of our nation and its modern economy. It is thus, evident that a dense and efficient network of transport and communication is a prerequisite for local, national and global trade of today.

Transport

Roadways

India has one of the largest road networks in the world, aggregating to about 54.7 lakh km (2014–15). In India, roadways have preceded railways. They still have an edge over railways in view of the ease with which they can be built and maintained. The growing importance of road transport vis-à-vis rail transport is rooted in the following reasons; (a) construction cost of roads is much lower than that of railway lines, (b) roads can traverse comparatively more dissected and undulating topography, (c) roads can negotiate higher gradients of slopes and as such can traverse mountains such as the Himalayas, (d) road transport is economical in transportation of few persons and relatively smaller amount of goods over short distances, (e) it also provides door-to-door service, thus the cost of loading and unloading is much lower, (f) road transport is also used as a feeder to other modes of transport such as they provide a link between railway stations, air and sea ports.

In India, roads are classified in the following six classes according to their capacity. Look at the map of the National Highways and find out about the significant role played by these roads.

- ***Golden Quadrilateral Super Highways:*** The government has launched a major road development project linking Delhi-Kolkata-Chennai-Mumbai and Delhi by six-lane Super Highways. The North-South corridors linking Srinagar (Jammu & Kashmir) and Kanniyakumari (Tamil Nadu), and East-West Corridor connecting Silchar (Assam) and Porbander (Gujarat) are part of this project. The major objective of these Super Highways is to reduce the time and distance between the mega cities of India. These highway projects are being implemented by the National Highway Authority of India (NHAI).
- ***National Highways:*** National Highways link extreme parts of the country. These are the primary road systems and are laid and maintained by the Central Public Works Department (CPWD). A number of major National Highways run in North-South and East-West directions. The historical Sher-Shah Suri Marg is called National Highway No. 1, between Delhi and Amritsar.

Fig.7.2: Ahmedabad- Vadodara Expressway

Activity

Find out places linked by the National Highway 2 and 3.

Do you Know?

Do you know that National Highway-7 is the longest and traverses 2, 369 km between Varanasi and Kanniyakumari via Jabalpur, Nagpur, Hyderabad, Bengaluru and Madurai. Delhi and Mumbai are connected by National Highway-8, while National Highway-15 covers most of Rajasthan.

- ***State Highways:*** Roads linking a state capital with different district headquarters are known as State Highways. These roads are constructed and maintained by the State Public Works Department (PWD) in State and Union Territories.
- ***District Roads:*** These roads connect the district headquarters with other places of the district. These roads are maintained by the Zila Parishad.
- ***Other Roads:*** Rural roads, which link rural areas and villages with towns, are classified under this category. These roads received special impetus under the *Pradhan Mantri Grameen Sadak Yojana*. Under this scheme special provisions are made so that every village in the country is linked to a major town in the country by an all season motorable road.

India: National Highways

- ***Border Roads:*** Apart from these, Border Roads Organisation a Government of India undertaking constructs and maintains roads in the bordering areas of the country. This organisation was established in 1960 for the development of the roads of strategic importance in the northern and north-eastern border areas. These roads have improved accessibility in areas of difficult terrain and have helped in the economic development of these area.

Fig. 7.3: Hilly Tracts

Fig. 7.4: Traffic on north-eastern border road (Arunachal Pradesh)

Roads can also be classified on the basis of the type of material used for their construction such as metalled and unmetalled roads. Metalled roads may be made of cement, concrete or even bitumen of coal, therefore, these are all weather roads. Unmetalled roads go out of use in the rainy season.

Road Density

The length of road per 100 sq. km of area is known as density of roads. Distribution of road is not uniform in the country. Density of all roads varies from only 12.14 km in Jammu and Kashmir to 517.77 km in Kerala (as on 31 March 2011) with the national average of 142.68 km (31 March 2011). Road transportation in India faces a number of problems. Keeping in view the volume of traffic and passengers, the road network is inadequate. About half of the roads are unmetalled and this limits their usage during the rainy season. The National Highways are inadequate too. Moreover, the roadways are highly congested in cities and most of the bridges and culverts are old and narrow. However, in recent years fast development of road network has taken place in different parts of the country

Railways

Railways are the principal mode of transportation for freight and passengers in India. Railways also make it possible for people to conduct multifarious activities like business, sightseeing, pilgrimage along with transportation of goods over longer distances. Apart from an important means of transport the Indian Railways have been a great integrating force for more than 150 years. Railways in India bind the economic life of the country as well as accelerate the development of the industry and agriculture. The Indian Railway have a network of 7,137 stations spread over a route length of 66,687 km with a fleet of 11,122 locomotives, 54,506 passenger service vehicles, 6,899 other coach vehicles and 2,51,256 wagons as on March 2016.

The Indian Railways is the largest public sector undertaking in the country. The first train steamed off from Mumbai to Thane in 1853, covering a distance of 34 km.

Table 7.1: India: Railway Track

The Indian Railway network runs on multiple gauge operations extending over 66,687 km (excluding Metro Kolkata)

Gauge in metres	Route (Km)	Running Track (Km)	Total Track (Km.)
Broad Gauge (1.676)	60,510	85,614	1,12,388
Metre Gauge (1.000)	3,880	4,170	4,747
Narrow Gauge (0.762 and 0.610)	2,297	2,297	2,495
Total	**66,687**	**92,081**	**1,19,630**

Source: Railway Yearbook 2015–16, Ministry of Railways, Government of India.
Website: www.indianrailways.gov.in

The Indian Railway is now reorganised into 16 zones.

Activity

Find out the current Railway zones and their headquarters. Also locate the headquarters of Railway zones on the map of India.

The distribution pattern of the Railway network in the country has been largely influenced by physiographic, economic and administrative factors. The northern plains with their vast level land, high population density and rich agricultural resources provided the most favourable condition for their growth. However, a large number of rivers requiring construction of bridges across their wide beds posed some obstacles. In the hilly terrains of the peninsular region, railway tracts are laid through low hills, gaps or tunnels. The Himalayan mountainous regions too are unfavourable for the construction of railway lines due to high relief, sparse population and lack of economic opportunities. Likewise, it was difficult to lay railway lines on the sandy plain of western Rajasthan, swamps of Gujarat, forested tracks of Madhya Pradesh, Chhattisgarh, Odisha and Jharkhand. The contiguous stretch of Sahyadri could be crossed only through gaps or passes (Ghats). In recent times, the development of the Konkan railway along the west coast has facilitated the movement of passengers and goods in this most important economic region of India. It has also faced a number of problem such as sinking of track in some stretches and landslides.

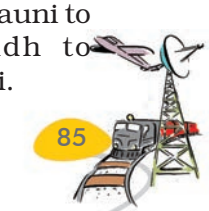
Today, the railways have become more important in our national economy than all other means of transport put together. However, rail transport suffers from certain problems as well. Many passengers travel without tickets. Thefts and damaging of railway property has not yet stopped completely. People stop the trains, pull the chain unnecessarily and this causes heavy damage to the railway. Think over it, how we can help our railway in running as per the scheduled time?

Pipelines

Pipeline transport network is a new arrival on the transportation map of India. In the past, these were used to transport water to cities and industries. Now, these are used for transporting crude oil, petroleum products and natural gas from oil and natural gas fields to refineries, fertilizer factories and big thermal power plants. Solids can also be transported through a pipeline when converted into slurry. The far inland locations of refineries like Barauni, Mathura, Panipat and gas based fertilizer plants could be thought of only because of pipelines. Initial cost of laying pipelines is high but subsequent running costs are minimal. It rules out trans-shipment losses or delays.

There are three important networks of pipeline transportation in the country.

- From oil field in upper Assam to Kanpur (Uttar Pradesh), via Guwahati, Barauni and Allahabad. It has branches from Barauni to Haldia, via Rajbandh, Rajbandh to Maurigram and Guwahati to Siliguri.



Activity

Railway line has been extended from Banihal to Baramula in the Kashmir Valley. Locate these two towns on the map of India.

- From Salaya in Gujarat to Jalandhar in Punjab, via Viramgam, Mathura, Delhi and Sonipat. It has branches to connect Koyali (near Vadodara, Gujarat) Chakshu and other places.
- Gas pipeline from Hazira in Gujarat connects Jagdishpur in Uttar Pradesh, via Vijaipur in Madhya Pradesh. It has branches to Kota in Rajasthan, Shahajahanpur, Babrala and other places in Uttar Pradesh.

Waterways

Since the ancient period, India was one of the seafaring countries. Its seamen sailed far and near, thus, carrying and spreading Indian commerce and culture. Waterways are the cheapest means of transport. They are most suitable for carrying heavy and bulky goods. It is a fuel-efficient and environment friendly mode of transport. India has inland navigation waterways of 14,500 km in length. Out of these only 5685 km are navigable by mechanised vessels. The following waterways have been declared as the National Waterways by the Government.

Fig. 7.5: Inland waterways widely used in north-eastern states

- The Ganga river between Allahabad and Haldia (1620 km)-N.W. No.1
- The Brahmaputra river between Sadiya and Dhubri (891 km)-N.W. No.2
- The West-Coast Canal in Kerala (Kottapurma-Kollam, Udyogamandal and Champakkara canals-205 km) – N.W. No.3
- Specified stretches of Godavari and Krishna rivers along with Kakinada Puducherry stretch of canals (1078 km) – N.W. No.4
- Specified stretches of river Brahmani along with Matai river, delta channels of Mahanadi and Brahmani rivers and East Coast Canal (588 km) – N.W. No.5

There are some other inland water ways on which substantial transportation takes place. These are Mandavi, Zuari and Cumberjua, Sunderbans, Barak and backwaters of Kerala.

Apart from these, India's trade with foreign countries is carried from the ports located along the coast. 95 per cent of the country's trade volume (68 per cent in terms of value) is moved by sea.

Major Sea Ports

With a long coastline of 7,516.6 km, India is dotted with 12 major and 200 notified non-majors (minor/intermediate) ports. These major ports handle 95 per cent of India's foreign trade.

Kandla in Kuchchh was the first port developed soon after Independence to ease the volume of trade on the Mumbai port, in the wake of loss of Karachi port to Pakistan after the Partition. Kandla is a tidal port. It caters to the convenient handling of exports and imports of highly productive granary and industrial belt

Fig. 7.6: Trucks being driven into the vessel at Mumbai port

stretching across the states of Jammu and Kashmir, Himachal Pradesh, Punjab, Haryana, Rajasthan and Gujarat.

Mumbai is the biggest port with a spacious natural and well-sheltered harbour. The Jawaharlal Nehru port was planned with a view to decongest the Mumbai port and serve as a hub port for this region. Marmagao port (Goa)

Fig. 7.7: Tanker discharging crude oil at New Mangalore port

is the premier iron ore exporting port of the country. This port accounts for about fifty per cent of India's iron ore export. New Mangalore port, located in Karnataka caters to the export of iron ore concentrates from Kudremukh mines. Kochchi is the extreme south-western port, located at the entrance of a lagoon with a natural harbour.

Moving along the east coast, you would see the extreme south-eastern port of Tuticorin, in Tamil Nadu. This port has a natural harbour and rich hinterland. Thus, it has a flourishing trade handling of a large variety of cargoes to even our neighbouring countries like Sri Lanka, Maldives, etc. and the coastal regions of India. Chennai is one of the oldest artificial ports of the country. It is ranked next to Mumbai in terms of the volume of trade and cargo. Vishakhapatnam is the deepest landlocked and well-protected port. This port was, originally, conceived as an outlet for iron ore exports. Paradwip port located in Odisha, specialises in the export of iron ore. Kolkata is an inland

Fig. 7.8: Handling of oversize cargo at Tuticorin port

riverine port. This port serves a very large and rich hinterland of Ganga- Brahmaputra basin. Being a tidal port, it requires constant dredging of Hoogly. Haldia port was developed as a subsidiary port, in order to relieve growing pressure on the Kolkata port.

Airways

The air travel, today, is the fastest, most comfortable and prestigious mode of transport. It can cover very difficult terrains like high mountains, dreary deserts, dense forests and also long oceanic stretches with great ease. Think of the north-eastern part of the country, marked with the presence of big rivers, dissected relief, dense forests and frequent

Why is air travel preferred in the north-eastern states?

Fig. 7.9

floods and international frontiers, etc. in the absence of air transport. Air travel has made access easier.

The air transport was nationalised in 1953. On the operational side, Indian Airlines, Alliance Air (subsidiary of Indian Airlines), private scheduled airlines and non- scheduled operators provide domestic air services. Air India provides international air services. Pawanhans Helicopters Ltd. provides helicopter services to Oil and Natural Gas Corporation in its off-shore operations, to inaccessible areas and difficult terrains like the north-eastern states and the interior parts of Jammu and Kashmir, Himachal Pradesh and Uttarakhand. Indian Airlines operations also extend to the neighbouring countries of South and south-east Asia and the Middle east.

Find out the names of the countries connected by Indian Airlines.

Air travel is not within the reach of the common people. It is only in the north-eastern states that special provisions are made to extend the services to the common people.

India: *Major Ports and Some International Airports*

Communication

Ever since humans appeared on the earth, they have used different means of communication. But, the pace of change, has been rapid in modern times. Long distance communication is far easier without physical movement of the communicator or receiver. Personal communication and mass communication including television, radio, press, films, etc. are the major means of communication in the country. The Indian postal network is the largest in the world. It handles parcels as well as personal written communications. Cards and envelopes are considered first-class mail and are airlifted between stations covering both land and air. The second-class mail includes book packets, registered newspapers and periodicals. They are carried by surface mail, covering land and water transport. To facilitate quick delivery of mails in large towns and cities, six mail channels have been introduced recently. They are called Rajdhani Channel, Metro Channel, Green Channel, Business Channel, Bulk Mail Channel and Periodical Channel.

Do you know?

Digital India is an umbrella programme to prepare India for a knowledge based transformation. The focus of Digital India Programme is on being transformative to realise – IT (Indian Talent) + IT (Information Technology)=IT (India Tomorrow) and is on making technology central to enabling change.

Fig.7.10 : Emergency call box on NH-8

India has one of the largest telecom networks in Asia. Excluding urban places more than two-thirds of the villages in India have already been covered with Subscriber Trunk Dialling (STD) telephone facility. In order to strengthen the flow of information from the grassroot to the higher level, the government has made special provision to extend twenty-four hours STD facility to every village in the country. There is a uniform rate of STD facilities all over India. It has been made possible by integrating the development in space technology with communication technology.

Mass communication provides entertainment and creates awareness among people about various national programmes and policies. It includes radio, television, newspapers, magazines, books and films. All India Radio (Akashwani) broadcasts a variety of programmes in national, regional and local languages for various categories of people, spread over different parts of the country. Doordarshan, the national television channel of India, is one of the largest terrestrial networks in the world. It broadcasts a variety of programmes from entertainment, educational to sports, etc. for people of different age groups.

India publishes a large number of newspapers and periodicals annually. They are of different types depending upon their periodicity. Newspapers are published in about 100 languages and dialects. Did you know that the largest number of newspapers published in the country are in Hindi, followed by English and Urdu? India is the largest producer of feature films in the world. It produces short films; video feature films and video short films. The Central Board of Film Certification is the authority to certify both Indian and foreign films.

International Trade

The exchange of goods among people, states and countries is referred to as trade. The market is the place where such exchanges take place. Trade between two countries is called international trade. It may take place through sea, air or land routes. While local trade is carried in cities, towns and villages, state level trade is carried between two or more states. Advancement of international trade of a country is an index to its economic prosperity. It is, therefore, considered the economic barometer for a country.

As the resources are space bound, no country can survive without international trade. Export and import are the components of trade. The balance of trade of a country is the difference between its export and import. When the value of export exceeds the value of imports, it is called a favourable balance of trade. On the contrary, if the value of imports exceeds the value of exports, it is termed as unfavourable balance of trade.

India has trade relations with all the major trading blocks and all geographical regions of the world. Among the commodities in export the share of agriculture and allied products has been 8.64 per cent, base metals 6.91 per cent, gems and jewellery 17.02 per cent, chemicals and related products 12.06 per cent in 2016-17.

The commodities imported to India include petroleum crude and products (22.4 per cent),gems and jewellery (12.8 per cent), chemicals and related products (9.76 per cent), base metals (5.95 per cent), electronic items (10.94%) machinery (8.9 per cent), agriculture and allied products (5.84 per cent) in 2016–17*. International trade has undergone a sea change in the last decades. Exchange of commodities and goods have been superseded by the exchange of information and knowledge. India has emerged as a software giant at the international level and it is earning large foreign exchange through the export of information technology.

Tourism as a Trade

Tourism in India has grown substantially over the last three decades. Foreign tourist's arrivals in the country witnessed an increase of 4.5 per cent during the year 2015 as against the year 2014, contributing ₹1,35,193 crore of foreign exchange in 2015.

8.03 million foreign tourists visited India in 2015. More than 15 million people are


Kufri

Arunancal Pradesh

बुलंद होती जा रही मेडिकल टूरिज्म क्षेत्र की सेहत

दो अरब डालर से अधिक का है मेडिकल टूरिज्म उद्योग

Ecotourism along the mangrove forests in Goa

India ranked world's 4th best holiday haven

TIMES NEWS NETWORK

New Delhi: India seems to have made its mark on the world travel map. Overseas holidayers and travellers have put India in the big league, ranking it as the fourth most attractive and satisfying holiday destination in the world. It stands ahead of several developed and traditional hot spots like US, France, Singapore, Thailand and South Africa. According to the 2006 Conde Nast Readers' Trav-

Dream Destinations

1	Italy	6	France
2	New Zealand	7	Thailand
3	Australia	8	Spain
4	INDIA	9	Brazil
5	South Africa	10	Switzerland

Prepare a project on the heritage tourism in India.

***Source:** Annual Report 2016–17, Ministry of Commerce and Industry, Government of India.*

directly engaged in the tourism industry. Tourism also promotes national integration, provides support to local handicrafts and cultural pursuits. It also helps in the development of international understanding about our culture and heritage. Foreign tourists visit India for heritage tourism, eco tourism, adventure tourism, cultural tourism, medical tourism and business tourism.

There is a vast potential for development of tourism in all parts of the country. Efforts are being made to promote different types of tourism for this upcoming industry.

Activity

On the map of India show important tourist places of your State/UT and its connectivity with other parts of the country by railways/ roadways/airways.
Discuss in the class:

- What type of tourism may be developed in your state/UT and why?
- Which areas in your state/UT you find more attractive for development of tourism and why?
- How tourism may be helpful for the economic development of a region adopting sustainable development approach?

EXERCISES EXERCISES EXERCISES EXERCISES EXERCISES

1. Multiple choice questions.

(i) Which two of the following extreme locations are connected by the east-west corridor?

(a) Mumbai and Nagpur (c) Mumbai and Kolkata
(b) Silchar and Porbandar (d) Nagpur and Siliguri

(ii) Which mode of transportation reduces trans-shipment losses and delays?

(a) Railways (c) Pipeline
(b) Roadways (d) Waterways

(iii) Which one of the following states is not connected with the H.V.J. pipeline?

(a) Madhya Pradesh (c) Gujarat
(b) Maharashtra (d) Uttar Pradesh

(iv) Which one of the following ports is the deepest land-locked and well-protected port along the east coast?

(a) Chennai (c) Tuticorin
(b) Paradwip (d) Vishakhapatnam

(v) Which one of the following is the most important modes of transportation in India?

(a) Pipeline (c) Roadways
(b) Railways (d) Airways

(vi) Which one of the following terms is used to describe trade between two or more countries?

(a) Internal trade (c) External trade
(b) International trade (d) Local trade

2. Answer the following questions in about 30 words.

(i) State any three merits of roadways.

(ii) Where and why is rail transport the most convenient means of transportation?

(iii) What is the significance of the border roads?

(iv) What is meant by trade? What is the difference between international and local trade?

3. Answer the following questions in about 120 words.
   (i) Why are the means of transportation and communication called the lifelines of a nation and its economy?
   (ii) Write a note on the changing nature of the international trade in the last fifteen years.

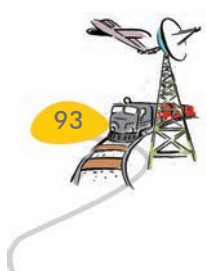
Quiz Drive

1. Northern terminal of the North-south corridor.
2. The name of National Highway No.2.
3. The headquarter of the southern railway zone.
4. The rail gauge with a track width of 1.676 m.
5. The southern terminal of the National Highway No.7.
6. A Riverine Port.
7. Busiest railway junction in Northern India.

Activity

Start your search vertically, horizontally or diagonally and reach various destinations across the country!

S	H	E	R	S	H	A	H	S	U	R	I	M	A	R	G
A	R	T	P	R	N	X	E	L	A	T	A	D	L	A	Y
J	M	M	X	I	P	O	R	A	Y	M	P	G	H	T	X
Y	C	H	E	N	N	N	A	I	I	K	M	C	A	I	M
O	D	C	D	A	L	M	C	S	O	T	P	O	R	C	P
A	P	T	R	G	S	K	J	M	J	L	E	A	N	E	R
R	A	E	T	A	J	P	O	R	M	W	M	A	S	X	O
I	L	S	B	R	O	A	D	G	A	U	G	E	L	O	T
A	S	N	L	C	M	E	C	U	K	Z	M	A	A	J	E
L	M	U	G	H	A	L	S	A	R	A	I	B	S	N	A
G	O	E	T	V	R	A	Y	F	T	O	R	E	A	J	M
K	Q	A	I	P	M	N	Y	R	Y	A	Y	H	L	I	N
Q	K	O	L	K	A	T	A	E	U	I	T	W	B	E	A
N	I	T	N	K	D	E	M	O	U	R	P	N	P	J	D



APPENDIX-I

Websites you can see

Bombay Natural History Society: http://www.bnhs.org/

Birding in India and South Asia: http://www.birding.in/

Website of Project Tiger: http://projecttiger.nic.in/

Nature Conservation Foundation: http://www.ncf-india.org/

Wildlife Conservation Society of India: http://www.wildlife.in/

Wildlife Trust of India: http://www.wildlifetrustofindia.org/

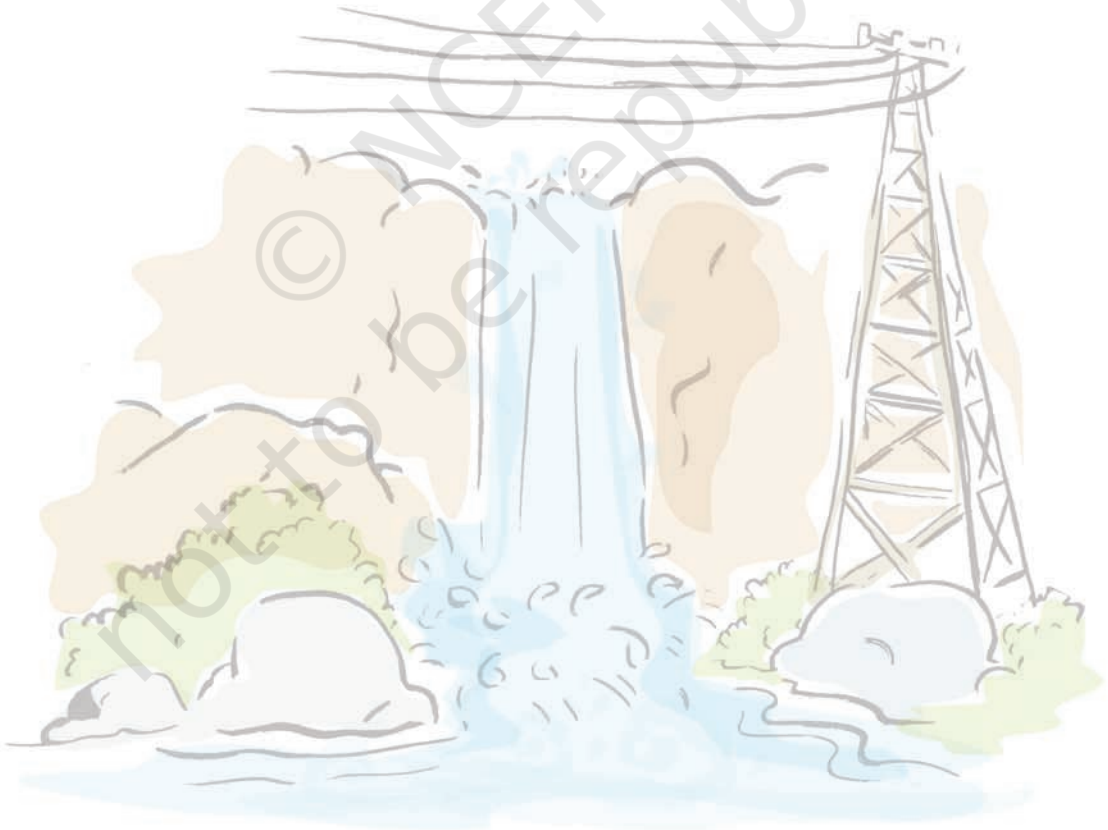
Kalpavriksh Environment Action Group: http://www.kalpavriksh.org/

Down to Earth Magazine: http://www.downtoearth.org.in/

Centre for Environment Education, India: http://www.ceeindia.org/cee/index.html

World Steel Association : http://www.worldsteel.org

India Tourism Statistics, 2010, http://tourism.gov.in



APPENDIX-II

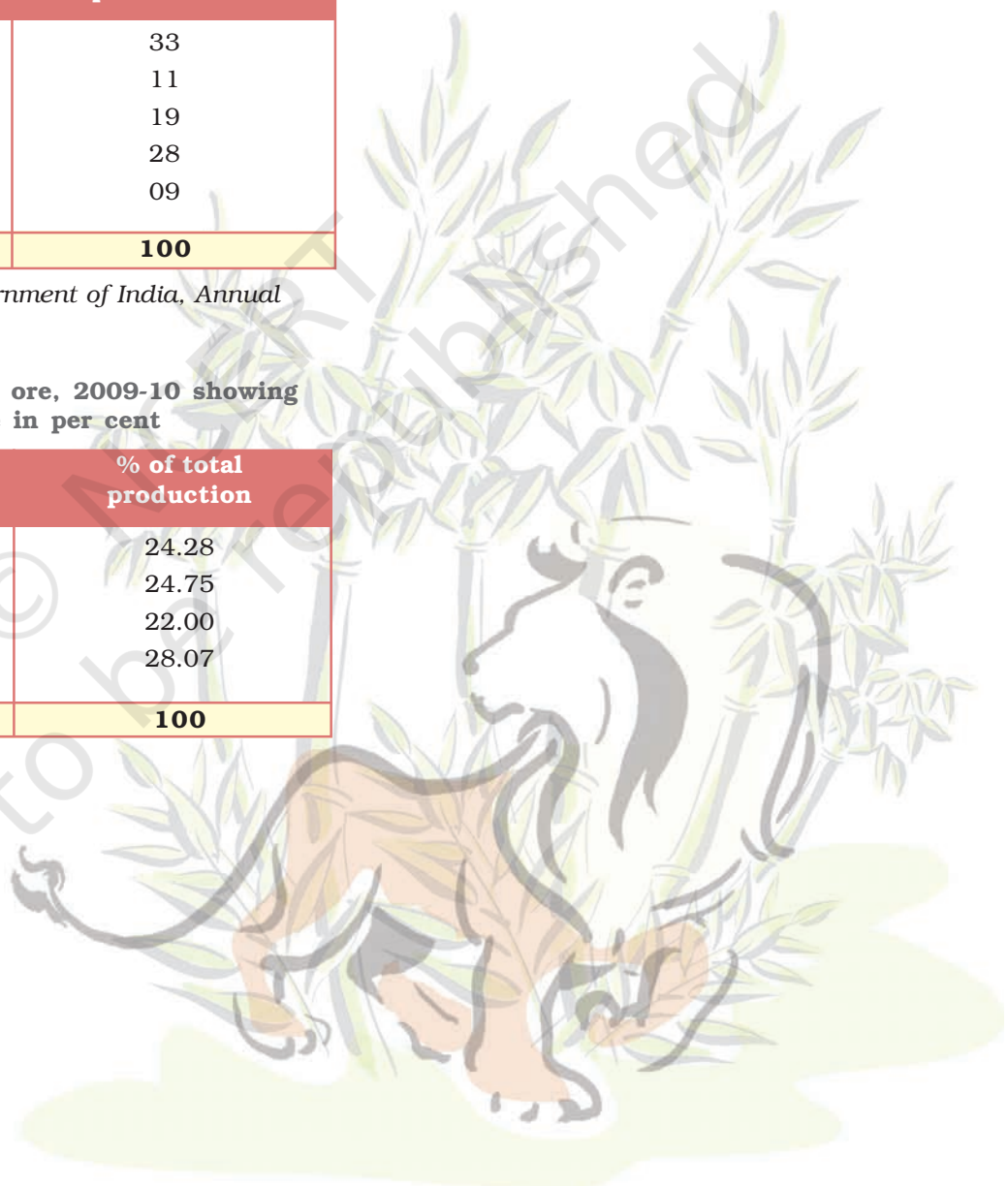
Production of Iron ore, 2009-10 showing statewise share in per cent

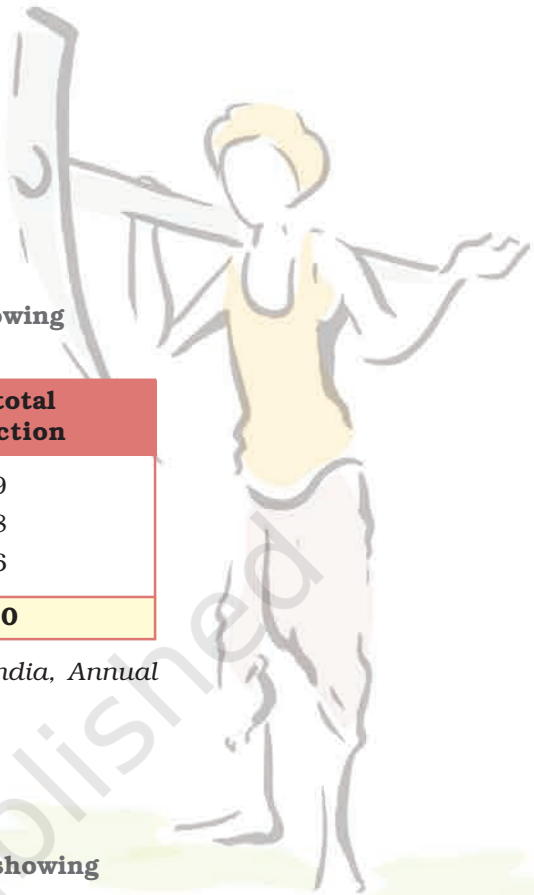
State	% of total production
Odisha	33
Karnataka	11
Chhattisgarh	19
Jharkhand	28
Others	09
Total	**100**

Source: *Ministry of Mines, Government of India, Annual Report 2009-10*

Production of Manganese ore, 2009-10 showing statewise share in per cent

State	% of total production
Madhya Pradesh	24.28
Odisha	24.75
Karnataka	22.00
Others	28.07
Total	**100**





Production of Copper, 2009-10 showing statewise share in per cent

State	% of total production
Madhya Pradesh	29
Rajasthan	48
Sikkim	16
Total	**100**

Source: *Ministry of Mines, Government of India, Annual Report 2009-10*

Production of Limestone, 2009-10 showing statewise share in per cent

State	% of total production
Andhra Pradesh	20
Karnataka	30
Others	50
Total	**100**

Source: *Ministry of Mines, Government of India, Annual Report 2009-10*

APPENDIX-III

Steel Plants	Year of Establishment	Collaborating Country	Location
IISCO	1870-1913 (Private initially)	(Nationalised in 1972)	Kulti and Burnpur (W.B.)
TISCO	1907 (Private ownership)	Jamshedji Tata	Jamshedpur (Jharkhand)
VISL	1923 Private as MISCO	Nationalised later	Bhadravati (Karnataka)
Bhilai	1959 (Public Sector)	Soviet Union	Bhilai (M.P.)
Bokaro	1972 (Public Sector)	Soviet Union	Bokaro (Jharkhand)
Durgapur	1959 (Public Sector)	U.K.	Durgapur (W.B.)
Rourkela	— (Public Sector)	Germany	Rourkela (Odisha)
Vishakhapatnam	— (Public Sector)	—	Vishakhapatnam Andhra Pradesh
Salem	— (Public Sector)	—	Salem (T. Nadu)
Vijay Nagar	— Public Sector	—	Karnataka

GLOSSARY

Anticline: A fold in sedimentary strata that resembles an arch.

Gross Domestic Product: It is a monetary measure of the value of goods and services produced within a natural economy at a given period of time. Normally it is one year.

Geologist: A scientist who studies the composition, structure and history of the earth.

Geothermal Gradient: The gradual increase in temperature with depth in the crust. The average is 30°C per kilometer in the upper crust.

Humus: Dead and decayed organic matter adds to the fertility of the top soil.

Igneous Rocks: Rocks which have solidified from molten magma.

Manganese Nodules: A type of sediment scattered on the ocean floor, consisting mainly of manganese and iron, and usually containing small amounts of copper, nickel and cobalt.

Metamorphic Rocks: Rocks which were originally igneous or sedimentary, but have changed in character and appearance.

Oil Trap: A geological structure that allows for significant amounts of oil and gas to accumulate.

Rock: A consolidated mixture of minerals

Sedimentary Rocks: Rocks which have been deposited as beds and layers of sediments.