

LAND AND SOIL RESOURCES IN INDIA

19.1 INTRODUCTION

The nation's strength, be it social, economic or political depends mostly on the available resources and their proper utilisation. But what is a resource? In simpler terms, resource is the matter or substance which satisfies human wants at a given time and space. Before any element can be designated as resource three basic pre-conditions must be satisfied. They are the knowledge, technical skills and demand for the material or services produced. If one of these conditions is not satisfied the particular substance remains unutilised. Let us explain it through one example. From time immemorial, water is present on the earth. But it becomes a source of energy when people gained the knowledge and technical skills for hydel power generation. It is therefore human ability and need which create resource value not their sheer physical presence. So the basic concept of resource is also related to human well being.

India has rich endowment of resources. An integrated effort is now being made by our country to make the best use of the existing resource potential. It helps to meet the demands of growing population and also provide opportunities for employment. Simultaneously, it acts as indicator for the levels of development.

In this lesson we will study two vital resources i.e. land and soil.

19.2 OBJECTIVES

After studying this lesson you will be able to :

- recognise the significance of land as a resource;
 - identify the main uses of land;
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- explain some of the problems in land resource and their solutions;
- recognise the significance of soil as a resource;
- recall the main characteristics of each major soil type in India;
- locate major soil regions on the map of India;
- identify the different factors that are responsible for the soil erosion in different parts of India;
- explain the problems created as a result of soil erosion;
- establish the relationship between measures adopted for soil conservation with types of erosion in different parts of India.

19.3 LAND RESOURCE

Land is our basic resource. Throughout history, we have drawn most of our sustenance and much of our fuel, clothing and shelter from the land. It is useful to us as a source of food, as a place to live, work and play. It has different roles. It is a productive economic factor in agriculture, forestry, grazing, fishing and mining. It is considered as a foundation for social prestige and is the basis of wealth and political power. It has many physical forms like mountains, hills, plains, lowlands and valleys. It is characterised by climate from hot to cold and from humid to dry. Similarly, land supports many kinds of vegetation. In a wider sense, land includes soil and topography along with the physical features of a given location. It is in this context that land is identified closely with natural environment. However, it is also regarded as space, situation, factor of production in economic processes, consumption goods, property and capital.

19.4 AVAILABILITY OF ARABLE LAND

India is well endowed with cultivable land which has long been a key factor in the country's socio-economic development. In terms of area, India ranks seventh in the world, while in terms of population it ranks second. With a total area of 328 million hectares, India is one of the big countries. Arable land includes net sown area, current fallow, other fallow and land under tree crops. Arable land covers a total area of 167 million hectares which is 51% of the total area of the country.

However, the arable land-man ratio is not as favourable as in many other countries like Australia, Canada, Argentina, the USA, Chile, Denmark and Mexico. Conversely, the land-man ratio is more favourable in India than Japan, the Netherlands, Egypt, United Kingdom, Israel and China. What is the land-man ratio? Land-man ratio is defined as the ratio between the habitable area and the total population of a country.

The physical features in India are diverse and complex. There are mountains, hills, plateaus and plains which produce varied human response to the use of land resources. About 30% of India's surface area is covered by hills and mountains. They are either too steep or too cold for cultivation. About 25% of this land is topographically usable which is scattered

across the country. Plateaus constitute 28% of the total surface area but only a quarter of this is fit for cultivation. The plains cover 43% of the total area and nearly 95% of it is suitable for cultivation. Considering the differences in proportion of surface area, this allows us to conclude that taking the country as a whole, about two-third of it is topographically usable. Moreover, soils, topography, moisture and temperature determine the limits of cultivability and the quality of arable land is determined by these factors. As a result of this, half of the surface area is cultivated. This proportion is one of the highest in the world.

- * Land includes soil and topography with the physical features of a given location. It is also regarded as space, factor of production in economic processes, consumption goods, situation, property and capital.
- * Land-man ratio is defined as the ratio between the habitable area and the total population of a country.
- * Land-man ratio in India is not as favourable as in many other countries like Australia, Canada, Argentina, USA, Chile, Denmark and Mexico. Conversely, the land-man ratio is more favourable in India than in Japan, the Netherlands, Egypt, U.K., Israel and China.

IN-TEXT QUESTIONS 19.1

1. Define land-man ratio.

2. Name four countries where land-man ratio is much more favourable than in India.
(i) _____ (ii) _____ (iii) _____ (iv) _____
3. Name four countries where land-man ratio is less favourable than in India.
(i) _____ (ii) _____ (iii) _____ (iv) _____

19.5 LAND-USE

Out of the total geographical area (328 million hectare), land utilisation statistics are available for 305 million hectares only. The balance 23 million hectares remains unsurveyed and inaccessible. The relevant statistics are given in Table 19.1. The significant features of land utilisation are :

- (a) high percentage of area suitable for cultivation;
- (b) limited scope for further extension of cultivation and
- (c) small area under pastures despite a large bovine population.

Table No. 19.1 Land Utilisation in India (1990-91)

Category	Area in M. Ha	% of total reporting area
1. Net sown area	142.40	46.30
2. Current fallow	13.70	4.20
3. Other fallow	9.70	3.00
4. Pastures and groves	15.40	5.00

5. Cultivable waste	15.00	4.70
6. Not available for Cultivation		
(a) Barren and uncultivable land	19.60	6.20
(b) Land under non-arable use	21.20	8.60
7. Forest	68.00	22.00
Total	305.0	100.0

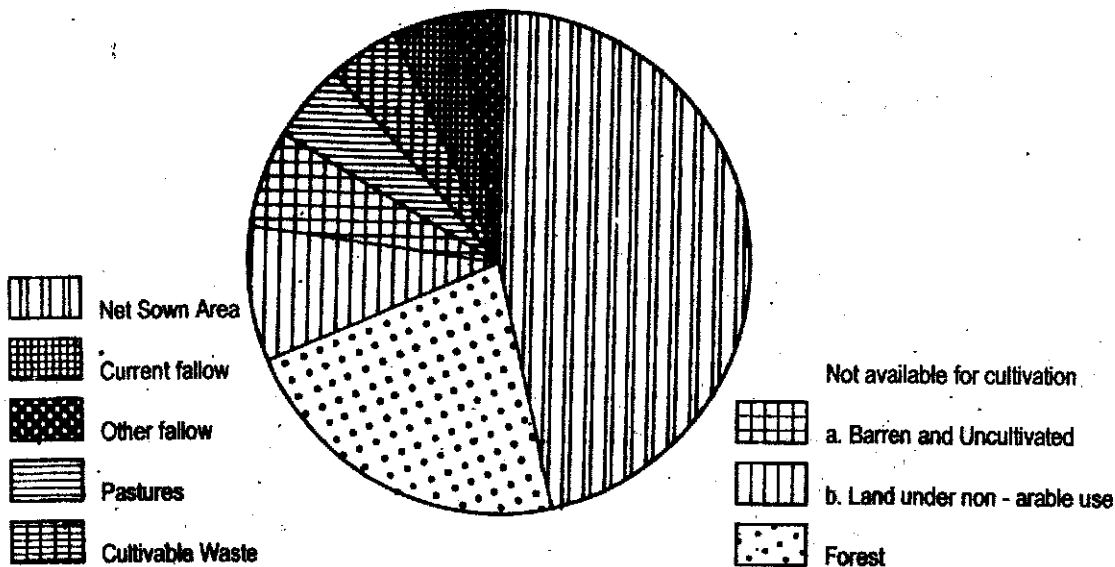


Fig. 19.1 Land utilisation in India

Presently, a little more than 40 million hectares of land is not available for cultivation. Area under this category has shown a decline from 50.7 million hectares in 1960-61 to 40.8 million hectares in 1990-91. There has been a marginal decline in fallow land from 9.9% in 1950-51 to 7.5% in 1990-91. Cultivable waste lands also witnessed an appreciable decline of 34% between 1950-51 and 1990-91. During 1950-51 and 1990-91, the net sown area has witnessed notable increase of about 20%. This area in 1950-51 was 118.7 million hectares which increased to 142.4 million hectares in 1990-91. Only 14% of the net sown area or 41.7 million hectares yielded two or more harvests in 90-91. Surprisingly, only 5% of the land is under permanent pastures and grazing in a country with the largest bovine population of the world. Land under non-agricultural use has increased with the accelerated growth in economy. The process of industrialisation and urbanisation demands more land under roads, railways, airports, human settlements and industries not excluding huge multi-purpose dams. Essentially, on the limited total area all the cultural uses of land must be accommodated. Obviously it can be realised mainly at the cost of land under agriculture. In 1950-51, the total area under non-agricultural use was 9.3 million hectares which increased to 21.2 million hectares in 1990-91. Contrary to general belief, the percentage of land under forest is one of the lowest in the world. Forests occupy not more than 22% of the total geographical area of the country, while the world average is 30%. According to land use statistics, area under forests has

increased from 40 million hectares in 1950-51 to 68 million hectares in 1990-91. It is much below the desired national goal of one-third of the total area.

Thus, land use is a dynamic process. It changes over time due to a number of factors, including increasing population and changes in cropping system and technology. As the various sectors of the economy develop, there may be a shift in the pattern of land use. However, the bulk of the land continues to be used for raising crops. With unabated population growth, the pressure of population on arable land is bound to grow. Indeed, it should be a matter of great national concern.

19.6 LAND PROBLEMS

Out of the total land area, as many as 175 million hectares suffer from degradation. Land degradation is caused largely by soil erosion, but also by water logging and excessive salinity. The most serious threat to the soil is posed by deforestation. Heavy rainfall during monsoon damages the soils. Steep slopes encourage rapid run off leading to soil erosion especially on the southern slopes of the Himalayas and the western slopes of the Western Ghats. Major portions of the Himalayas are prone to landslides and erosion. Wind erosion is prevalent in Rajasthan, gully erosion in the Chambal Valley, Chotanagpur, Gujarat, submontane Punjab Himalaya. Water logging and salinisation which constitute the second major threat to soil have already claimed 13 million hectares and threaten many more. The lands affected are mostly situated in canal irrigated areas. They have suffered because of the absence of adequate drainage. Land is also degraded due to mining operations in many parts of the country. The total land area affected is about 80 thousand hectares by mining. Urban encroachment on good quality agricultural land is another problem by which the amount of land used for agriculture is steadily declining. In other words, there is a tough competition between agriculture, urban and industrial development. There are social conflicts that arising out of the rights to occupy and transfer land. The tenant cultivators face major disincentives such as the fear of eviction, the insecurity of tenure, high rents and inadequate surplus to invest. Land ceiling laws have not been implemented with adequate strictness.

19.7 SOLUTION OF LAND PROBLEMS

To deal with these problems, the country has adopted a two-fold approach-physical and social, as they are complementary to each other. Physical reclamation of land is achieved through chemical treatment of water logged soils and is followed with scientific rotation of crops. Similarly land rendered useless by river action and river floods are also reclaimed after necessary treatment to restore their fertility and texture etc. Physical reclamation of desert lands calls for more sustained efforts. It requires introduction of suitable natural vegetation and canal or well irrigation or even both. It helps to raise water table. Social approach on the other hand is reflected through state legislation aiming at overall rural reconstruction, promoting agriculture and its productivity in particular. Consolidation of land holdings is one measure among many. It provides necessary motivation and empowerment of a tiller by confirming on him the rights of land tenure/ownership etc. Elements of social exploitation are promptly removed e.g. absentee landlords. Thus legislation is used to ensure social justice.

Remote sensing data have shown that about 200 square kilometres of the Gulf of Kutch have been covered by sedimentation. The National Remote Sensing Agency has estimated 53 million hectares (16%) as wasteland in the country. Among the states, the highest incidence of wastelands is recorded in Jammu and Kashmir (60%) followed by Rajasthan (38%), Sikkim and Himachal Pradesh (37% each) and Gujarat (17%). The Government of India constituted the National Wasteland Development Board in 1985 with a view to enhancing productivity of wastelands. It includes the programme of afforestation of 5 million hectares per year.

India does not have shortage of land. But, land reform policies need to be reoriented for further increase in food production.

- * Land use is a dynamic process. It changes over time due to a number of factors including increasing population and changes in cropping system and technology. As various sectors of the economy develop, there may be a shift in the pattern of land use.
- * The major land problems include land degradation due to soil erosion, water logging and salinisation, by mining operations and urban encroachment on good quality agricultural land.
- * India has adopted two ways to develop land :
(a) physical (reclamation of land) and (b) social (land reforms)

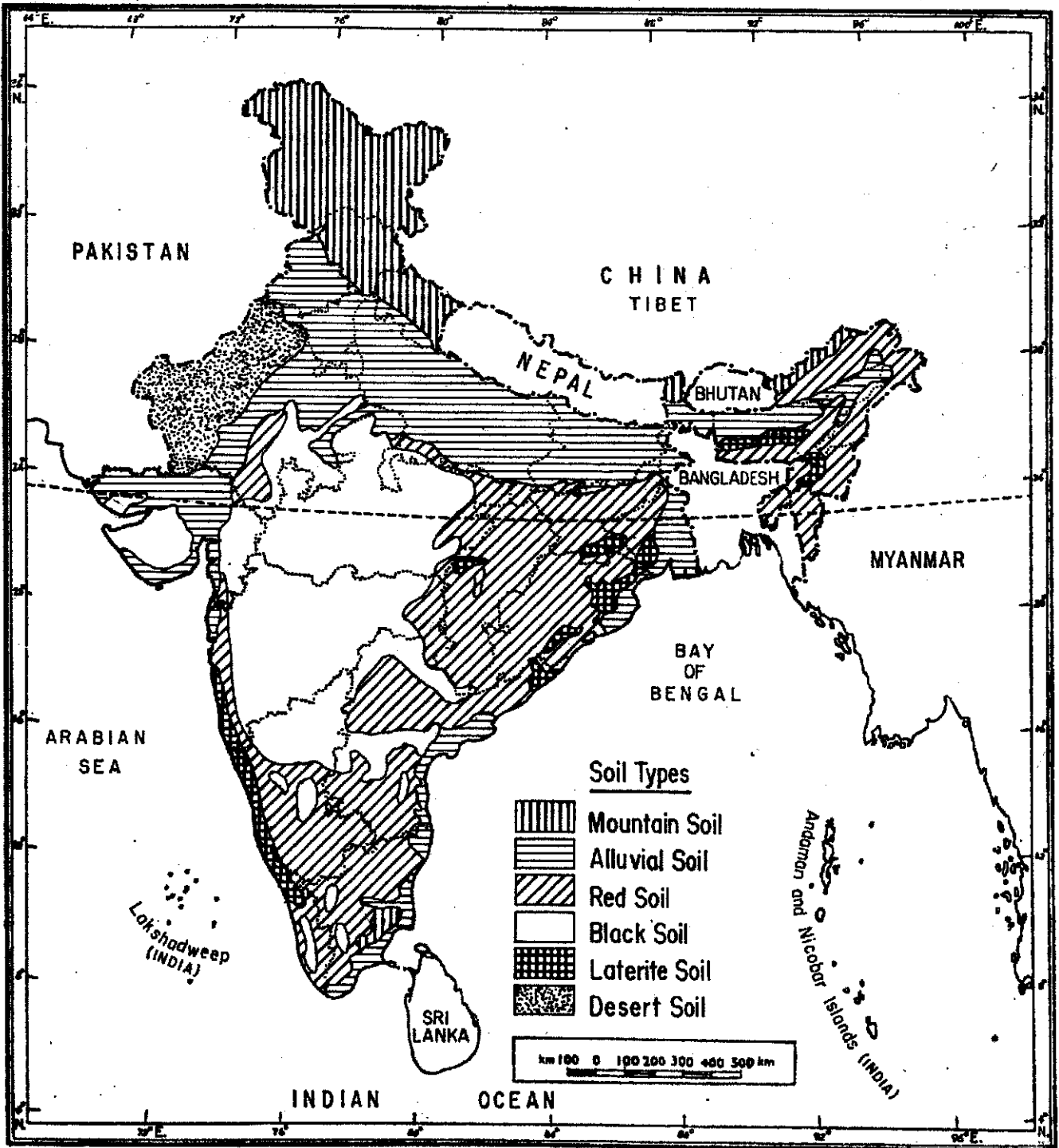
INTEXT QUESTIONS 19.2

1. Name three areas where gully erosion is much more prominent.
(i) _____ (ii) _____ (iii) _____
2. What is the most serious threat posed to the soil?

3. Name two methods adopted to develop land.
(i) _____ (ii) _____
4. Which is the area where wind erosion is more prominent?

19.8 SOIL RESOURCE

Soil is defined as upper layer of the earth composed of loose surface material. It is a mixture of many substances including endless variety of minerals, remnants of plants and animals, water and air. It is the end product of continuing interaction between the parent material, local climate, plant and animal organisms and elevation of land. Since each of the elements varies areally, soils also differ from place to place. Soil is an important segment of our ecosystem, as it serves as an anchorage for plants and source of nutrients. Thus, soil is the seat, the medium and fundamental raw material for plant growth. Through its relative fertility, it affects man's economic activities and shapes the destiny of our country. When the soil is lost, property and culture are also lost. Therefore, it is a valuable national and fundamental earth resources of India.



Based upon Survey of India outline map printed in 1979.

The territorial waters of India extend into the sea to a distance of twelve nautical miles measured from the appropriate base line.

The boundary of Madhya Pradesh shown on this map is as prescribed from the North-Eastern Areas (Reorganisation) Act, 1971, but has yet to be verified.

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* Reg. No. 7340 HD/79-2000.

* Printed at the IGI (H.L.O.) Printing Group of Survey of India.

* Price: Twentyfive Paise.

* These may be deleted when printing a map based on this outline map.

19.9 MAJOR SOIL TYPES

The soils of India are broadly divided into following six types :

1. Alluvial Soils

Alluvial soil is the most important soil type of India. It covers the vast valley areas of the Sutlej, Ganga and Brahmaputra and the fringes of the southern peninsula. It is thin near the fringe of the plateau. The alluvial soils occupy 64 million hectares of the most fertile land. The soils vary from sandy loam to clay in texture and are rich in potash but deficient in nitrogen and organic matter. Generally, the colour varies from grey to reddish brown. These soils are formed of deposits of silt and sand brought down by the rivers flowing from the Himalayas and the Great Indian plateau. Being young, the soils lack profile development. Being extremely productive, these soils are most important from the point of view of Indian agriculture. Based on geographical considerations, this soil can be subdivided into two divisions: newer alluvium (khadar) and older alluvium (bangar). Both are different in texture, chemical composition, drainage capacity and fertility. The newer alluvium is a light friable loam with a mixture of sand and silt. It is found in river valley, the floodplains and deltas. On the other hand, the older alluvium lies on the inter fluves. The higher proportion of clay makes the soil sticky and drainage is often poor. Almost all crops are grown on these soils.

2. Black Soils (Regur)

The black soils are found mainly on the Deccan lava region covering large parts of Maharashtra, some parts of Gujarat and Madhya Pradesh and small parts of Karnataka, Andhra Pradesh and Tamil Nadu. The soils are formed by disintegration of volcanic basaltic lava. The colour of the soil is generally black due to presence of compounds of aluminium and iron. The soil is locally known as regur which extends roughly to 64 million hectares. It is generally clayey deep and has low permeability and impregnable. But its depth varies from place to place. It is very thick in lowlands but very thin in highlands. The most important characteristics of this soil are its ability to retain moisture even during the dry season. The soils form wide cracks during summer due to moisture loss and swell and become sticky when saturated. Thus, the soil is aerated and oxidised to deep levels which contribute to maintain its fertility. This continued fertility is favourable in the area of low rainfall for cotton cultivation even without irrigation. Other than cotton, this soil is favourable for the cultivation of crops like sugarcane, wheat, onion and fruits.

3. Red Soils

Red soils cover large part of the Peninsular upland in Tamil Nadu, Karnataka, Goa, South east Maharashtra, Andhra Pradesh, Orissa, Chotanagpur Plateau and Meghalaya Plateau. They encircle the black cotton soil zone. They have developed on the crystalline rocks like granite, gneisses and cover roughly 72 million hectares of the arable land. Iron compounds are abundant making the soil reddish in colour but they are deficient in organic matter. The red soils are generally less fertile and are not as important agriculturally as the black and alluvial soils. But the productive capacity can be raised through irrigation and use of fertilisers. This soil is suitable for rice, millet, maize, groundnut, tobacco and fruits.

4. Laterite Soils

The laterite soils are commonly found in area of high altitude and heavy rainfall in Karnataka, Tamil Nadu, Madhya Pradesh, Bihar, Orissa, Assam and Meghalaya extending over 13 million hectares. They generally form under hot and humid climatic conditions. The lateritic soils are particularly found on high flat erosion surfaces in areas of high and seasonal rainfall. Loss of nutrients by accelerated leaching is the most common feature which renders the soil infertile. The pebbly crust is the important feature of laterites which is formed due to alteration of wet and dry periods. As a result of weathering, laterite becomes extremely hard. Thus, their characteristics include complete chemical decomposition of the parent rock, complete leaching of silica, a reddish brown colour given by the oxides of aluminium and iron and lack of humus. The crops which are generally grown are rice, millets, sugarcane on lowland and tropical plantation such as rubber, coffee and tea on uplands.

5. Desert Soils

The desert soils occur in western Rajasthan, Saurashtra, Kutchch, western Haryana and southern Punjab. The occurrence of these soils is related to desert and semi-desertic conditions and is defined by the absence of water availability for six months. The soil is sandy to gravelly with poor organic matter, low humus contents, infrequent rainfall, low moisture and long drought season. The soils exhibit poorly developed horizons. Plants are widely spaced. Chemical weathering is limited. The colour of the soil is either red or light brown. Generally, these soils lack the basic requirements for agriculture, but when water is available, variety of crops like cotton, rice, wheat etc. can be grown with proper dose of fertilisers.

6. Mountain Soils

The mountain soils are complex and extremely varied. The soils vary from deep alluvium in the river basins and lower slopes to highly immature residual gravelly on higher altitudes. Because of complex topographic, geologic, vegetation and climatic conditions, no large areas of homogenous soil groups are found. Areas of steep relief are mostly devoid of soil. Various types of crops are grown in different regions like rice in valley, orchards area on slopes and potato in almost all areas.

19.10 SOIL EROSION

Soil erosion is described as the carrying away of soil. It is the theft of the soil by natural elements like water, wind, glacier and wave. Gravity tends to move soil down slope either very slowly as in soil creep or very rapidly as in landslides. The present shape of land has been carved through thousands of years. Soil erosion has become now one of the major environmental problems and a serious constraint for agricultural production. There are many physical and social factors which determine the extent and severity of soil erosion. The principal physical factors are erosivity of rainfall, erodibility of soil, severity of periodic floods, length and steepness of the slope. The important social factors are deforestation, overgrazing, nature of land use and methods of cultivation. Ravines, gullies and landslides are most serious and highly visible forms of land erosion. On the other hand, sheet erosion caused by rains and erosion due to winds are least visible but equally serious as they too take a heavy toll of our precious top soils. Soil erosion by ravines and gullies is widespread in India. It has been estimated that 3.67 million hectares are damaged. There are four major areas of ravines

and gullies in India. They are (1) The Yamuna-Chambal ravine zone, (2) the Gujarat ravine zone, (3) The Punjab Siwalik foothills zone and (4) the Chotanagpur zone. There are other areas of substantial ravine erosion in the Mahanadi valley, upper Son valley, upper Narmada and Tapi valleys, Siwalik and *Bhabbar* tract of the western Himalayan foothills and edges of Ganga Khadar in western Uttar Pradesh. The relatively less affected areas are whole of Deccan south of the Godavari, the Ganga-Bharamputra plains, east of Varanasi, Kutchch and western Rajasthan. Sheet erosion is widespread over sloping deforested terrain, untterraced uplands of the Peneisular region, the Sutlej-Ganga plains, coastal plains, Western Ghats and North-Eastern hills.

The occurrence of landslides is common in earthquake sensitive belts, particularly the Siwaliks. Heavy rainfall and cutting of slopes for roads, buildings and mining activities trigger landslides. In the last 50 years, the Rajasthan desert has encroached upon 13000 hectares of land in Rajasthan, Gujarat, Haryana and U.P. Glacial erosion is limited to high Himalayas and sea erosion is confined to coasal areas only. Soil erosion and soil exhaustion due to loss of soil nutrients pose serious threats to our efforts of increasing the productivity of soil faster than the population growth.

19.11 SOIL CONSERVATION

Methods by which soil is prevented from being eroded constitute soil conservation. If the soil is wasted or blown away, it is not easy to reet it. Therefore, the most important step of soil conservation is to hold the soil in place. This is possible by improved agricultural practices in different regions. Contour ploughing and terracing are generally practised on the hill slopes. They are the simplest conservation methods. Rows of trees or shelter belts are planted to protect the fields in desert regions from wind erosion. Afforestation of the catchment areas and slopes in the Himalayas, the Upper Damodar valley in Bihar and the Nilgiri hills in the south has been implemented. It reduces the surface run-off and binds the soil. Ravines are noted for their enormous size and depth with vertical sides. The Central Soil Conservation Board has established 3 research stations: (1) Kota in Rajasthan, (2) Agra in Uttar Pradesh and (3) Valsad in Gujarat to suggest methods of reclamation of ravine lands. Overgrazing by sheep, goat and other livestock has been partly responsible for land erosion. Erosion due to this factor has been reported from Jammu & Kashmir, Himachal Pradesh, Rajasthan and Karnataka. Soil exhaustion can be prevented by the application of manure and fertilisers.

- * The six major types of soils found in India are alluvial, black, red, laterite, desert and mountain soil.
- * Both physical and social factors cause soil erosion. The physical factors are erosivity of rainfall, erodibility of soil, severity of periodic floods and length and steepness of the slope. The social factors are deforestation, overgrazing, nature of land-use and methods of cultivation.
- * Major forms of soil erosion are ravines, gullies, landslides and sheet erosion.
- * Contour ploughing, terracing, planting of shelter belt afforestation and cheching of overgrazing and application of manures and fertilisers are the methods of soil conservation.

IN-TEXT QUESTIONS 19.3

1. (a) Name the two important regions of alluvial soils.
(i) _____ (ii) _____
 - (b) Which element is responsible for red colour in red soils?

 2. (a) Name the three major types of soil erosion.
(i) _____ (ii) _____ (iii) _____
 - (b) Name four methods of soil conservation adopted for preventing soil erosion.
(i) _____ (ii) _____ (iii) _____ (iv) _____
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WHAT YOU HAVE LEARNT

- Land is our basic resource. It has different roles like productive economic factor, foundation for social prestige and is the basis of wealth and political power. India is well endowed with cultivable land. It has favourable land-man ratio than Japan, and Netherlands, whereas it is not as favourable as it is in Australia, Canada and the U.S.A.
- Land use is a dynamic process. It changes over time due to a number of factors including increasing population and changes in cropping pattern and technology. However, bulk of land continues to be used for raising crops. India faces a lot of problems related to land. They are land degradation, tenure or ownership of land and deforestation. India has adopted two broad measures, land reclamation and land reforms to solve these problems
- Soil is defined as upper layer of the earth composed of loose surface material. The soils of India are broadly divided into six groups. They are alluvial, regur or black, red, laterite, desert and mountain soils. Like land, soil also has problems such as soil erosion and soil exhaustion. Various soil conservation methods like contour ploughing, terracing, shelter belt formation and afforestation are adopted in India.

TERMINAL QUESTIONS

1. What are the significant features of land utilisation in India?
 2. Give a brief description of various types of land use in India.
 3. Write two main characteristics of each soil type of India.
 4. Describe various measures undertaken for conservation of soils.
 5. Differentiate between these :
 - (a) Laterite soil and red soil
 - (b) Soil erosion and soil conservation
 - (c) New alluvium and old alluvium
-

CHECK YOUR ANSWERS**IN-TEXT QUESTIONS****19.1**

1. Land-man ratio is defined as the ratio between the habitable area and the total population of a country.
2. Australia, Canada, Argentina, USA, Chile, Denmark and Mexico (Any four)
3. Japan, Netherland, Egypt, U.K., Israel & China.(Any four)

19.2

1. Chambal valley, Chotanagpur, Gujarat, Submountane Punjab Himalaya (any three)
2. Deforestation
3. (i) Physical (Land reclamation) (ii) Social (land reforms)
4. Rajasthan

19.3

1. (i) Valley areas of Sutlej, Ganga, Brahmaputra (ii) Fringes of the southern peninsula.
(b) Compounds of Iron
2. (a) gully erosion, sheet erosion, landslides, ravine erosion (any three)
(b) contour ploughing, terracing, shelter belt formation, afforestation.

TERMINAL QUESTIONS

1. There are mainly three significant features of land utilisation
(i) high percentage of area suitable for cultivation (ii) limited scope for further extension of cultivation (iii) small area under pastures despite a large bovine population.
 2. Refer section 19.5
 3. Refer section 19.9
 4. Refer section 19.11
 5. (a) Refer section 19.9 (1&3)
(b) Refer section 19.10 & 19.11
(c) Refer section 19.9(1)
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