Biyani's Think Tank

Concept based notes

Indian Geography

(M.A)

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Preface

I am glad to present this book, especially designed to serve the needs of the students. The book has been written keeping in mind the general weakness in understanding the fundamental concepts of the topics. The book is self-explanatory and adopts the "Teach Yourself" style. It is based on question-answer pattern. The language of book is quite easy and understandable based on scientific approach.

Any further improvement in the contents of the book by making corrections, omission and inclusion is keen to be achieved based on suggestions from the readers for which the author shall be obliged.

I acknowledge special thanks to Mr. Rajeev Biyani, *Chairman* & Dr. Sanjay Biyani, *Director* (*Acad.*) Biyani Group of Colleges, who are the backbones and main concept provider and also have been constant source of motivation throughout this endeavour. They played an active role in coordinating the various stages of this endeavour and spearheaded the publishing work.

I look forward to receiving valuable suggestions from professors of various educational institutions, other faculty members and students for improvement of the quality of the book. The reader may feel free to send in their comments and suggestions to the under mentioned address.

Author

Chapter 1
Physiography of India

Q. 1: Explain the Himalayan division of India.
Ans

The Himalayan mountain system developed in a series of stages 30 to 50 million years ago. Himalayas are the young fold mountains. The extreme cold, snow and rugged topography discourage the neighbors to enter India through Himalayas. Himalayas mountain system forming a broad continuous arc for nearly 2600 km (1600 mi) along the northern fringes from the bend of the Indus River in the northwest to the Brahmaputra River in the east. The Himalayas range, averaging 320 to 400 km (200 to 250 mi) in width. For most of its length, the Himalayas comprise two nearly parallel ranges separated by a wide valley in which the Indus and Sutlej rivers flow westward and the Brahmaputra flows eastward. The Himalayas form the earth's highest mountain region, containing 9 of the 10 highest peaks in the world. The Himalayan range was developed from powerful earth movements that occurred as the Indian plate pressed against the Eurasian continental plate. Even today the mountains continue to develop and change, and earthquakes and tremors are frequent in the area. The highest mountain system in the world, located in the territories of India, China, Nepal, and Pakistan, between the Tibetan Plateau on the north and the Indo-Gangetic Plain on the south. The Himalayas are the world's greatest mountain system, with the tallest peaks, the greatest differences in elevation over short distances, and the deepest gorges (as much as 4-5 km.

The Hmalayas may be divided into three parallel ranges: (1)the Great Himalayas, (2) the Inner Himalayas also known as Middle or lesser Himalayas and (3) the Sub-Himalayan foothills which includes the Siwalik Range and the Tarai and Duars *piedmont*.

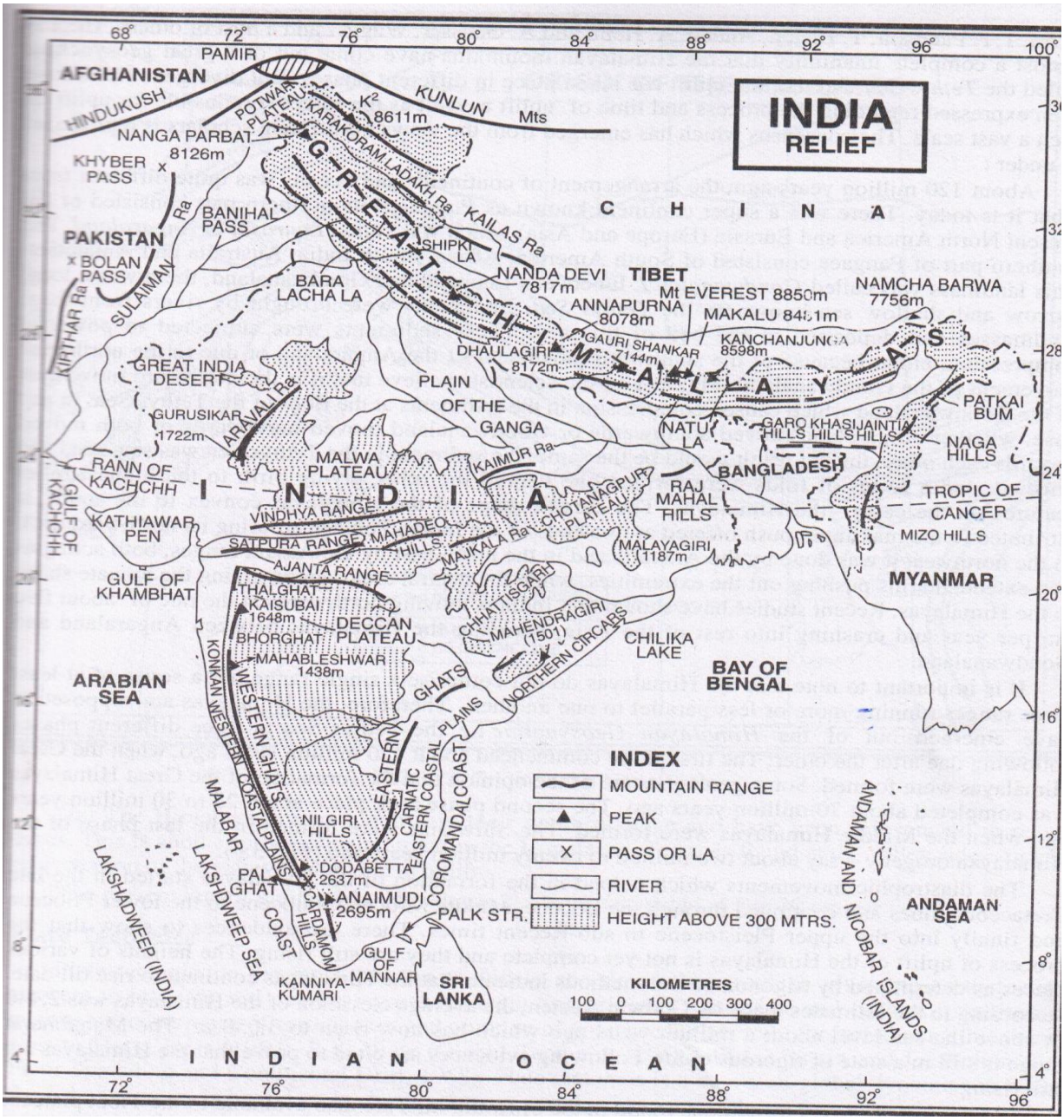
1. The Great Himalayas:

The Great Himalayas, the highest zone, contains vast snowy peaks with an average height exceeding 20,000 ft. The width of this zone, composed largely of gneiss and granite, is about 15 miles. .It is the most continuous range. It is snow

bound and many glaciers come down from this range. The Nepal and Sikkim portion of the Great Himalayas contains the greatest number of high peaks. Great Himalaya is least highest in Assam. The snow line on the southern slopes of the Great Himalayas varies from 4480 m (14,700 ft) in the eastern and central Himalayas of Nepal and Sikkim to 5180 m (17,000 ft) in the western Himalayas. To the north of the Great Himalayas are several ranges such as the Zaskar, Ladakh, and the Kailas. The Karakoram Range lies on the Tibetan side of the Great Himalayas. High Mountain passes also exist in this range, namely, Bara Lacha-La, Shipki-La, Nathu-La, Zoji-La, Bomidi-La etc. The Ganga and Yamuna rivers originates from this Himalayas. The Great Himalayan region is one of the few remaining isolated and inaccessible areas in the world today. Some high valleys in the Great Himalayas are occupied by small clustered settlements.

2. The Middle Himalayas:

The Middle Himalayas has a width of about 80 km (about 50 mi), borders the Great Himalayan range on the south. Some of the ranges of the Middle Himalayas are the Mahabharat, the Nag Tibba, the Pir Panjal and the Dhaola Dha. It consists principally of high ranges issuing diagonally from the Great Himalalaya range at point where the latter changes its path and several outer disconnected ranges.



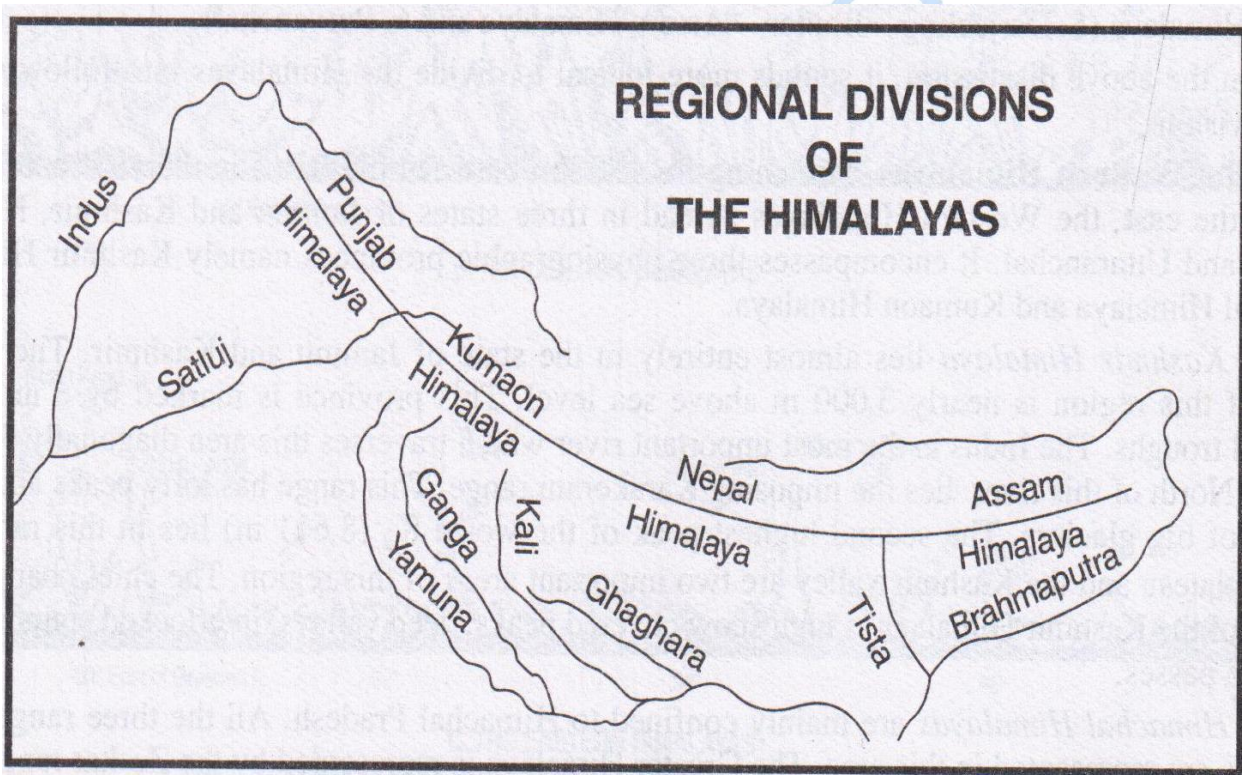
Source: D.R. Khullar

These comprises Nag Tibba given off from Dhaulagiri , the Dhauladhar range from the neighborhood of Badrinath, the Pir Panjal range and the north Kashmir range from the Zoji La, separating the Jhelum and Kishanganga rivers. The Middle Himalayas possess a remarkable uniformity of height; most are between 1830 and 3050m.The Middle Himalayas region is a complex variety of forest-covered ranges and fertile valleys. Except for the major valley centers such as Srinagar, Kangra, and Kathmandu, and hill towns such as Simla, Mussoorie, and Darjiling (Darjeeling), the region is moderately populated. Within the Middle

Himalayas the intervening mountain ranges tend to separate the densely populated valleys. The several gorges and rugged mountains make surface travel not easy in any direction. Only major population centers are linked by air and roads with principal cities in India and Pakistan.

3. The Sub-Himalayas:

It is the outer most range of the Himalayas which is, borders the plains of North India and Pakistan. It comprises the Siwalik Range and foothills as well as the narrow piedmont plain at the base of the mountains. The width of the Sub-Himalayas gradually narrows from about 48 km. A characteristic feature of the Sub-Himalayas is the large number of long, flat-bottomed valleys known as *duns*, like DehraDun, Kotli Dun and Patli Dun. which are usually spindle-shaped and filled with gravelly alluvium. South of the foothills lies the Tarai and Duars plains. The southern part of the Tarai and Duars plains is heavily farmed. Most of the forests of this region have been damaged, and much of the land has been cultivated for agriculture.



Source: D.R. Khullar

Regional Section of the Himalaya

Region wise, the Himalaya consist of (a) the Kashmir Himalaya, (b) the Punjab Himalaya, (c) the Kumaon Himalaya, (d) the Central Himalaya, (e) the Eastern Himalaya

(a) The Kashmir Himalaya covering an area of 350000 km^2. They are about 700km. long and 500km. wide with an average elevation of 3000 m.in the Pirpanjal range exist two passes, Pirpanjal and Banihal.vale of Kashmir lies in this region.

(b) The Punjab Himalaya stretches from Sutlej for about 570 km. and covers an area of 45000km^2 . the southern slopes of this range are bare and rugged and northern slopes are covered with forests. In this section Lahul and Spiti valleys are situated.

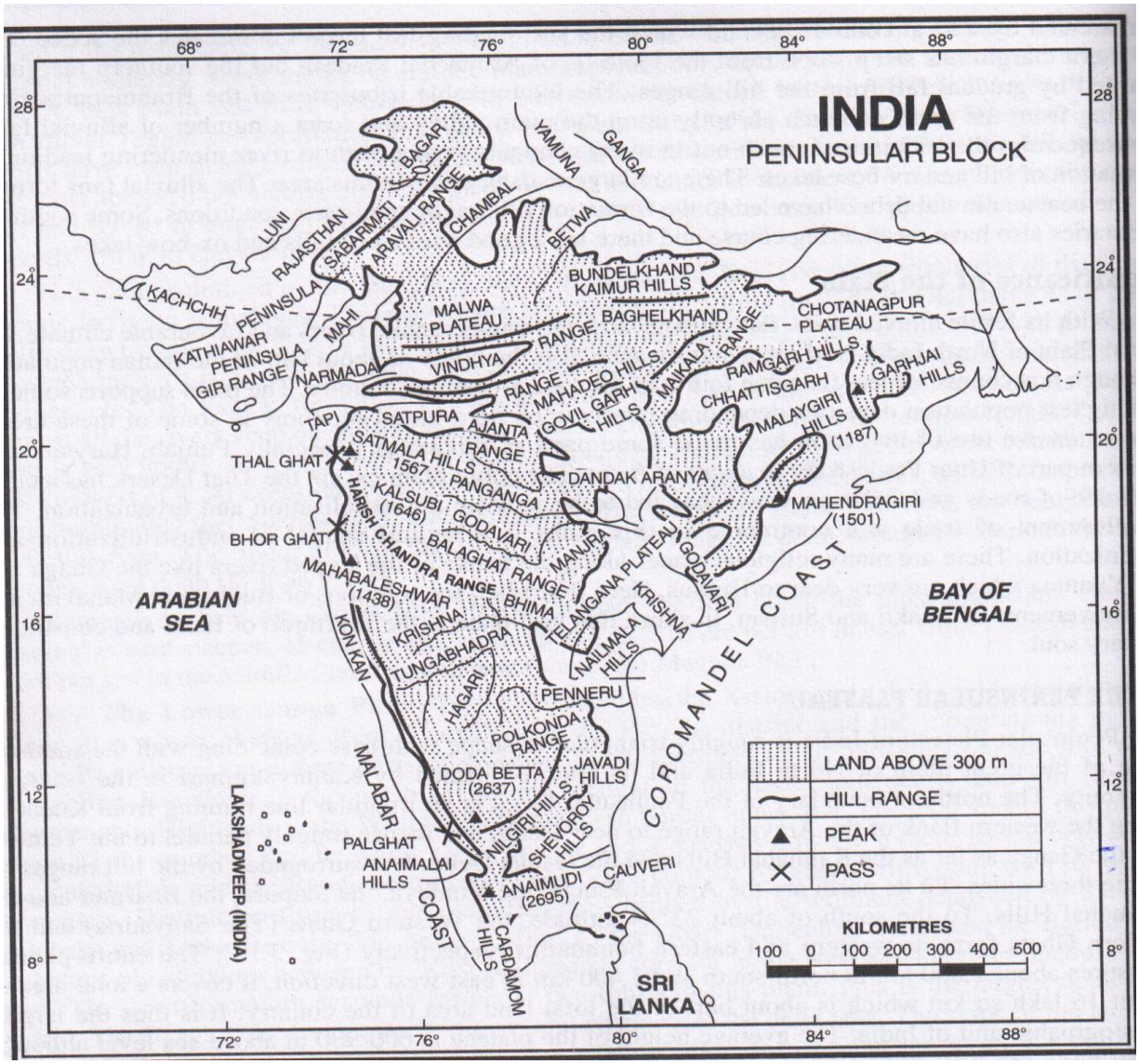
(c) The Kumaon Himalaya extends from the river Sutlej to the Kali and covers about 38000 km^2 areas. The highest peak is Nanda Devi. This section of Himalayas has great significance for the Hindus due to the Bhagirathi, the Ganga and the Jamuna, which have their source in this zone.

(d) The Central Himalaya stretches from river Kali to river Tista for about 800 km. covering an area of about 116800 km^2. It has the distinction of carrying the highest peaks in the world, Dhaulagiri, Annapurna, Mansalu, Gosainthan, Mt. Everest, etc, this range is known as the Sikkim Himalaya in Sikkim ; Darjeeling Himalaya in West Bengal ; and Bhutan Himalayas in Bhutan.

(e) The Eastern Himalaya known as the Assam Himalaya stretches from Tista to the Bramputra to a distance of about 720 km. it covers about 67500km^2 area. It rises over 800 m. above the Bramputra Valley.

Q. 2 Write the note on the Peninsular Plateau of India.

Ans This is an elevated plateau seprated from the Indo-Gangetic plain by the Vindhyan, the Satpura, Mahadeo, Maikal and Sarguja ranges, the elevation varying from 300 to 900 m. The Peninsular plateau is a triangular shaped stand land. It is division of ancient land mass called Gondwana level. The plateau covers 4, 22,000 km^2., 43 percent of India's landmass It is spread over the states of Gujarat, Maharashtra, Bihar, Karnataka and Andhra PradeshThe uplands, areas of higher land, make up a triangle nested within the familiar downward-pointing triangle of the Indian sub-continent's coastline. In the south of India the plateau is mostly over 1,000 m above sea level. In the north it is mostly about 500 m above sea level. . River Narmada divides the peninsular plateau into two parts: The central highlands and Deccan Plateau.



Source: D.R. Khullar, pg: 12

(i) The Central Highlands:

It spread out from Narmada River and the northern plains. Aravallis is the important mountain which extends from Gujrat through Rajasthan to Delhi. The highest peak of the Aravallis hills is Gurushikhar (1722m) near Mt. Abu. The Malwa Plateau and Chhota Nagpur plateau are division of the central highlands. The Malwa plateauin Madhya Pradesh occurs to the north of the Vindhya and is composed of extensive lava flows. The broken areas are known as the ravines, which are more numerous in the valleys of the Chambal, the Banas and the Jamuna. To the west and north-west of the Malwa plateau are the worn – down Aravalli ranges. At the south west extremely they are over 1000 m above the sea level.

The area between Jamuna and Vindhyan plateau is known as the Bundelkhand Uplands. In the north east of the Malwa plateau lie the eastern plateau, consisting of the Baghelkand, Chota Nagpur plateau and the Mahanadi Basin.

The Chota Nagpur plateau lies to the weat of the Bengal basin, the largest and most typical part of which is the Ranchi plateau. At the end of Chota Nagpur plateau are the Rajmahal hills, which are covered by the lava flows. The dissected southern edge of the Malwa plateau is formed by the Vindhyan upland. It forms an important watershed and constitutes the northern boundary of Deccan. The valley of Narmada is lies between the Vindhyas and the satpura which flows east to west and joins the Arabian sea. narmada velly has rightly been regarded as the enthic boundary between the two different people, viz., the indo Aryans in the northern part with their indo Aryan language and the dravidiyan with Dravidian language in the southern part.

(ii) The Deccan Plateau:

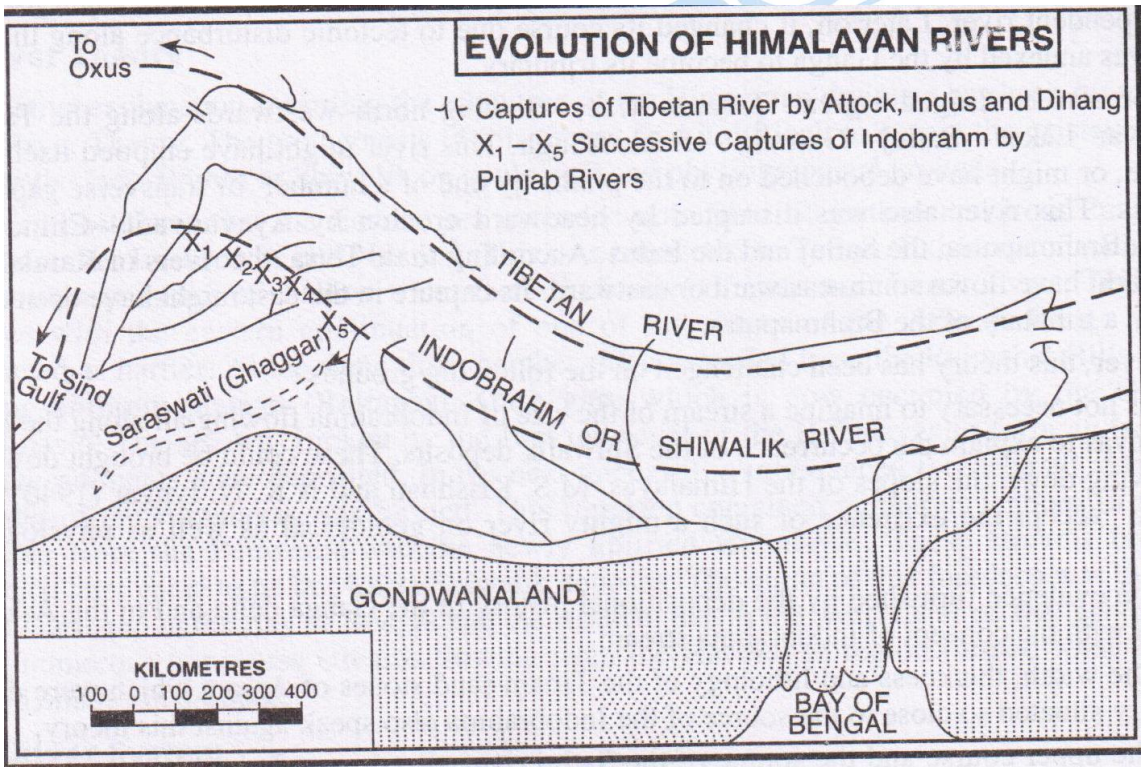
The Deccan Plateau is a largest volcanic features located on west-central India . It covers an areas of 7005000km^2 . it lies between the eastern and the western ghats and south of the line of the Satpuras, Maikal and Hazaribag ranges. The peninsula is triangular in shape. The Deccan plateau is separated by a fault, from Chhota Nagpur plateau. Towards the north are the Satpura hills rising to a height of 1200 m. The Mahadeo and Maikall hills lie further eastwards. The part of Deccan plateau in Maharastra is formed of basalts. The valleys of the Godavari, the Bhima and the Krishna are flanked by flat- topped, steep sided hills. Ajanta and Ellora hills lie south of the Tapi and are noted for their caves. The middle belt of deccan plateau consists of Karanataka plateau, which has an elevation of 600 m above sea level. The plateau is divided into Malnad and Maidan. The Malnad is hilly and dissected into deep valleys covered with dense forests; while the Maidan is formed of rolling plains with low geanitic hills. The black soil area in the Deccan plateau is known as Deccan trap. It is formed due to volcanic eruptions. This soil is good for cotton & sugarcane cultivation.

Chapter 2
Drainage

Q. 1: Explain the Drainage Pattern of India.

Ans

The direct source of rivers is rain and the melting snow. During the monsoon season the rivers carry very heavy flows, which dwindle down to negligible quantities in the fair weather. The great Himalayas range is the gathering ground of snow. India is fortunate in having a large number of big rivers with numerous tributaries spread over the whole country. The rivers of India can be divided into two main groups: the Himalayan Rivers and the rivers of Peninsula.



Source: D.R. Khullar

The Himalayan Rivers:

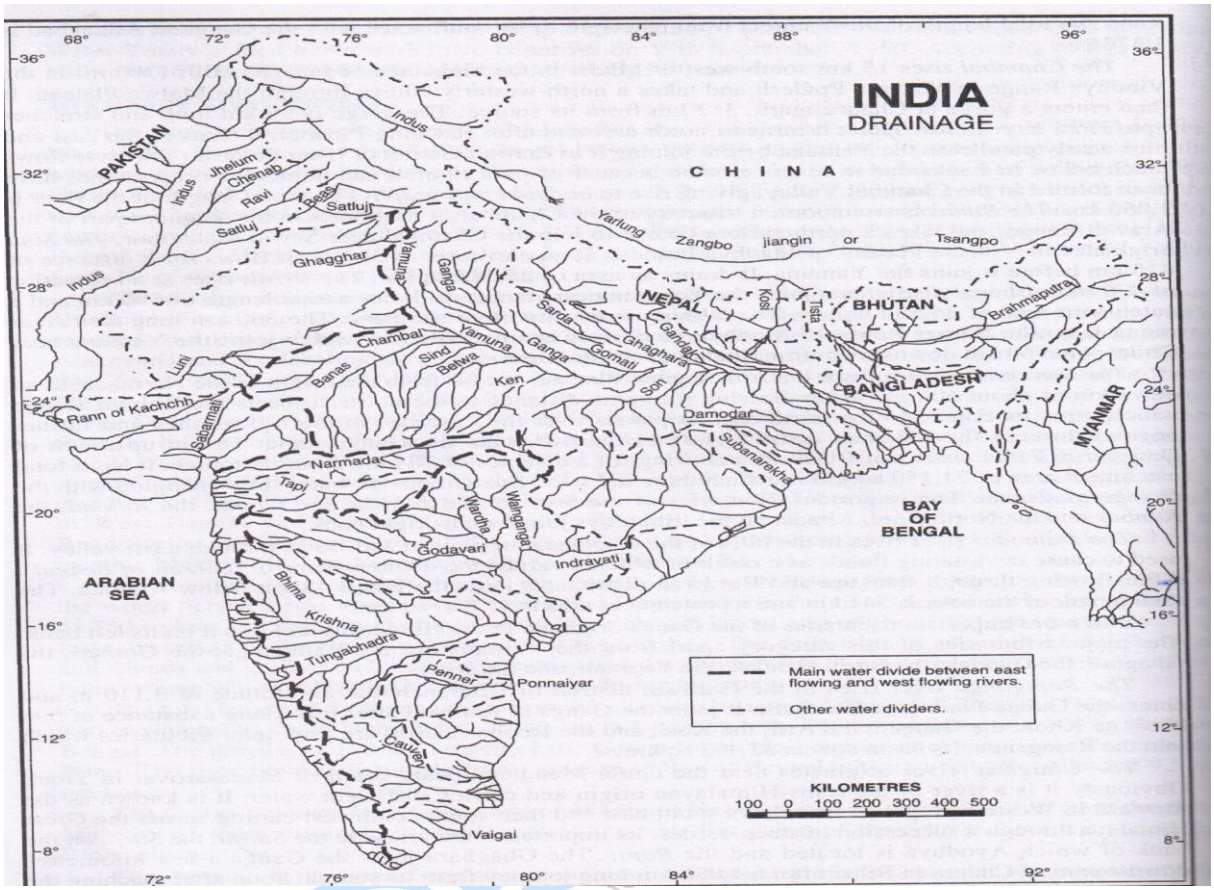
The Himalayan Rivers (the Bhagirathi, the Alaknanda, the Bramputra, the Sutlej, the Indus) were in existence even before the uplift of the Himalaya. These rivers originate in the Tibetan side beyond the high mountain peaks of the Himalaya. The Himalayan rivers fall into four broad groups: the pre Himalayan group like the arun, Indus, the Sutlej, the Bramputra: (b) the Great Himalayan rivers like the Ganga, The Ghagra and the Teesta, they are believed to have been formed after the second upheaval of the Himalaya: (c) the Lesser Himalayan rivers such as the Beas, the Ravi, the Chenab and the Jhelum and (d) the Siwalik rivers like the Hindon and the Solani.

On account of the extensive over the Himalaya, the rivers are perennial in nature. The Himalayan rivers rise from the the Great Himalaya, Karakoram, Ladakh, Zanskar, Kailas and the Trans-Himalayan ranges and ultimately join together to from the three great river system (the Indus, the Ganga, the Brahamputra).

The Indus river system was developed for irrigation purposes and for the canals that were taken out from these, the irrigated area produced very large quantities of wheat and cotton in the undivided Punjab. The total length of this river in india is 709 km. and its cover an area about 117844 km^2. An important tributary of this river is Shyok, Skardu, Shigar, Gilgit, Jhelum, Chenab, Ravi and Beas.

The Ganga system consists of the Ganga and a large number of its tributaries. It gathers the waters of Ramganga, the Yamuna, the Ghaghra, the Son and the Kosi etc. the Ganga has a large number of spill channels running into the Bay of Bangal. The most important of these are Bhagirathi – Hooghly, the Gorai, the Bhairab. The Damoodar flows into Hooghly. In plains a large number of canals have been taken out from the Ganga, Jamuna and Gomati etc.

The Bramputa system consists of the Brahaputra (known as Tsangpo in Tibet) and a large number of its tributaries – the Manas, the Tista, the Ngang Chu, the Lohit, the Kyi Chu, the Kameng, the Kopili etc. its rises from the snout of Chemayungdung glacier about 100 km. S.W. of Mansarover lake at an elevation of 5150 m. Its total length in india is 885 km. and drained area is 240000 km^2.



Source: D.R. Khullar

Rivers of Peninsular India:

The peninsular rivers fall into two categories, viz., the coastal rivers and the inland rivers. The West Coast Rivers are of great importance. Although only 3 per cent of the total extent of the basins of india is drained by these rivers as much as 14 per cent of the country's water resources are contained in them.
The drainage of the peninsular India is towards the east and south – east:

(A). The Mahanadi system consists of the Mahanadi, the Brahmani, the Baitarni, the Subarnarekha, the Godawari, the Wardha, the Irawadi, the Sabari. The Mahanadi rises from Sihawa in Raipur district at an elevation of 442 m. its length is 858 km. and drained area is 132090 km^2. These all rivers drain to the Bay of Bengal. These rives are wide, fanshaped with corspicuous delta. They are less turbulent and capricious than the rivers of the Indus and the Ganga – Brahamputra.

(B). Rivers Narmada, Tapti, Sharavati and alarge number of small rivers flow to the Arabian Sea. The first two rivers flow in the fault created by them during the Himalayan

upliftment. It was this movement which was also followed by the peninsular block tilting eastwards slightly resulting into east and south – east drainage pattern. These rivers have narrow, elongated catchments.

(C). Besides these, there are many rivers (the Chamble, Kali Sind, Parbati, The Betwa, The Ken. etc.) which originates in the Vindhyas and Satpuras, but flow north – east towards the Ganga. These rivers are characterized by seasonal flows. They are large in the rainy season but become insignificant during the dry season.

The peninsular rivers originate at much lower altitudes than the Himalayan ones. The channels have reached base levels and have low gradients. Large delta are formed by larger rivers at their mouths.

Chapter 3

Climate

Q.1: Explain the different Monsoon theory of India.

Ans Climate of a country includes the study of temperature, rainfall, atmospheric pressure, as well as the direction and velocity of winds over a long period of time. These elements of climate are largely influenced by latitudinal extent, relief, and areal distribution of land and water. The whole of India, south of the Himalayas is climatically treated as a tropical country. In the south, the Indian coasts are washed by the Arabian Sea and the Bay of Bengal braches of the Indian Ocean which give it a typical tropical monsoon climate.

Factors influencing the climate of India

1. Location and Latitudinal Extent. The northern parts on the other hand lie in the warm temperature zone. Hence they experience comparatively low temperatures. Some places record considerably low temperatures particularly in winter. Water bodies comprising the Arabian sea and the Bay of Bengal surround the peninsular India and make climatic conditions mild along the coastal areas.
2. The Northern Mountain Ranges. India is separated from the rest of Asia by the impenetrable wall of the Himalayan mountain ranges. These ranges protect India from the bitterly cold and dry winds of Central Asia during winter.
3. Physiography. Physiography of India has a great bearing on major elements of climate. The physiographic control of the mighty Himalayas over the climate of the country goes without saying. The monsoon winds from the Bay of Bengal are bifurcated into two branches by the physiographic features. One branch goes to the Brahmaputra valley through the Meghalaya plateau. The other branch of monsoons from the Bay of Bengal enters the Ganga valley. Its northwar-movement is obstructed by the Himalayan ranges and it advances westwards up the Ganga plain. Initially this branch causes heavy rainfall but the amount of rainfall decreases as the monsoons loose much of the moisture content while advancing westwards.
4. Tropical Cyclones and Western Disturbances. Tropical cyclones originate in the Bay of Bengal and Arabian sea and the influence large parts of the peninsular India. Majority of the cyclones originate in the Bay of Bengal and influence the weather conditions during the south-west monsoon season.
5. E1-Nono Effect. E1-Nino is a narrow warm current which occasionally appears off the coast of Peru in December. This current is responsible for wide spread floods and

droughts in the tropical regions of the world. Meteorologists believe that the severe drought of 1987 in India was caused by E1-Nino.

6. La Nina. After an E1-Nino, weather conditions return to normal. However, some times trade winds become so strong that they cause abnormal accumulation of cold water in the central and eastern Pacific region. This event is called La Nina, which in effect is the complete opposition of E1- Nino.
7. Southern Oscillation. It has been noticed that whenever the surface level pressure is high over the Indian Ocean, there is low pressure over the Pacific Ocean and vice-versa. This interrelation of high and low pressure over the Pacific and the Indian Ocean is called Southern Oscillation.

The Monsoon winds

The terms monsoon has been derived from the Arabic world 'mausam' meaning 'season'. In other words, the monsoon is a double system of seasonal winds, that is, the sum of summer and winter winds. According to A.A. Rama Sastry,"Monsoons are large scale seasonal wind systems flowing over vast areas of the globe, persistently in the same direction, only to be reversed with the change of season. Koppen (1923), Hann (1932) and Angot (1943) believe that the "monsoons represents simply a land and sea breeze on a large scale, and that the annual period of the monsoon corresponds to the diurnal period of the breezes."

While discussing the monsoon winds C.S. Ramage (1971) suggested four features of monsoon winds:

1. The prevailing wind direction should shift by at least 120 degree between January and July.
2. The average frequency of prevailing wind directions in January and July should exceed 40 per cent.
3. The mean resultant wind velocity in at least one of the months should exceed 3 m/s.
4. There should be fewer than one cyclone-anticyclone alternation every two years, in either month, over a five degree latitude/longitude grid.

Mechanism of the Monsoons

The origin of monsoons is still shrouded in mystery. The theories regarding the monsoons are generally divided into following two broad categories:

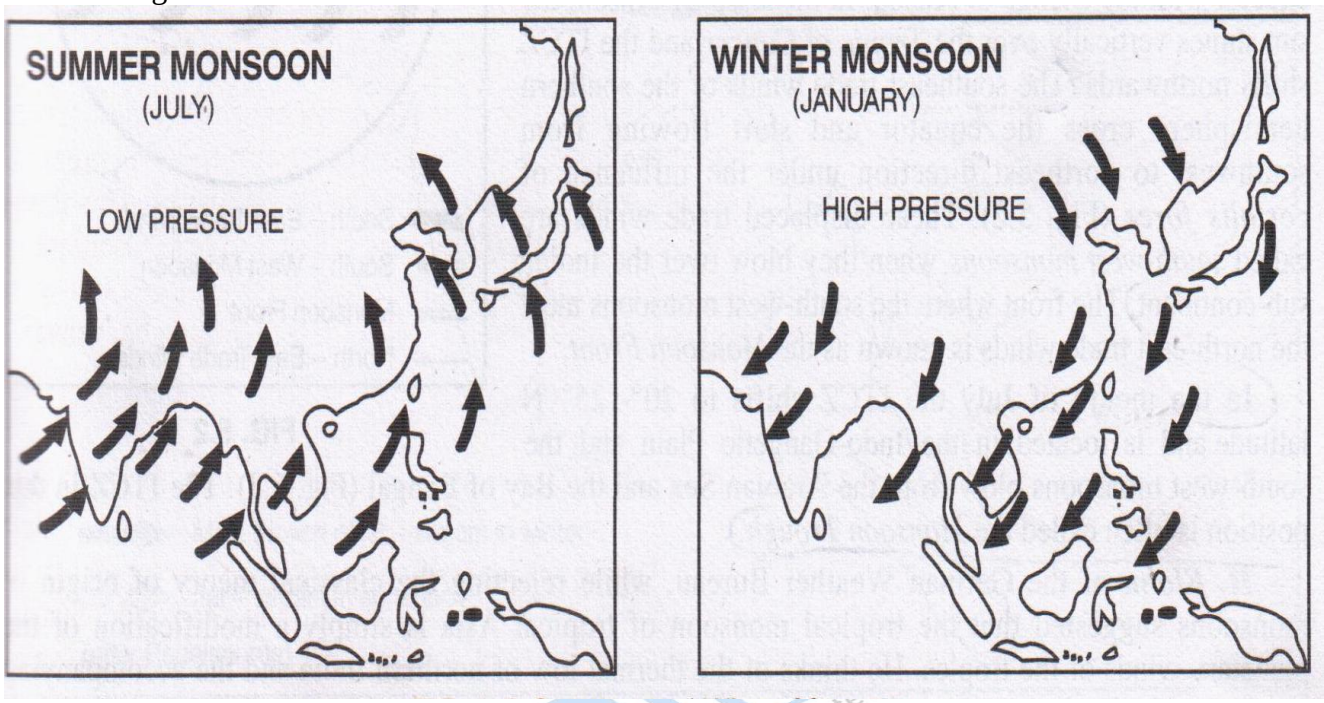
(i) Classical Theory and (ii) Modern Theories.

1. Classical Theory. In 1686 the famous Englishman Sir Edmund Halley explained the monsoon as resulting in thermal contrasts between continents and oceans due to their differential heating. Accordingly, Halley conceived summer and winter monsoons depending upon the season.

   (a) Summer Monsoon. In summer the sun shines vertically over the Tropic of Cancer resulting in high temperature and low pressure in Central Asia while the pressure is still sufficiently high over Arabian Sea and Bay of Bengal. This induces air flow from sea to land and brings heavy rainfall to India and her neighbouring countries.

   (**b) Winter Monsoon**. In winter the sun shines vertically over the Tropic of

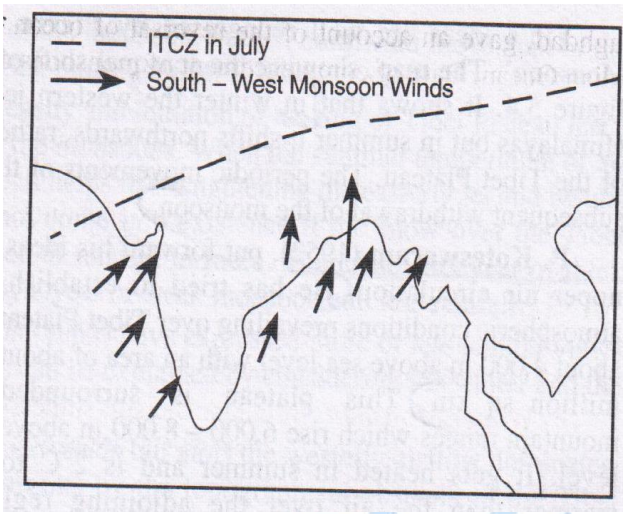
Capriocorn. The north western part of India grows colder than Arabian Sea and Bay of Bengal and the flow of the monsoon is reversed.

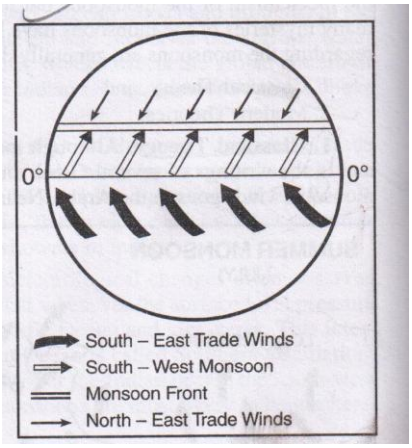


Source: D.R. Khullar

2. Modern Theories. Air Mass Theory.

The southeast trade winds in the southern hemisphere and the northeast trade winds in the northern hemisphere meet each other near the equator. The meeting place of these winds is known as the Inter-Tropical Convergence Zone (ITCZ). The location of ITCZ shifts north and south of equator with the change of season. The southeast trade winds of the southern hemisphere cross the equator and start flowing from southwest to northeast direction under the influence of coriolis force. These displaced trade winds are called south-west monsoons when they blow over the Indian sub-continent.



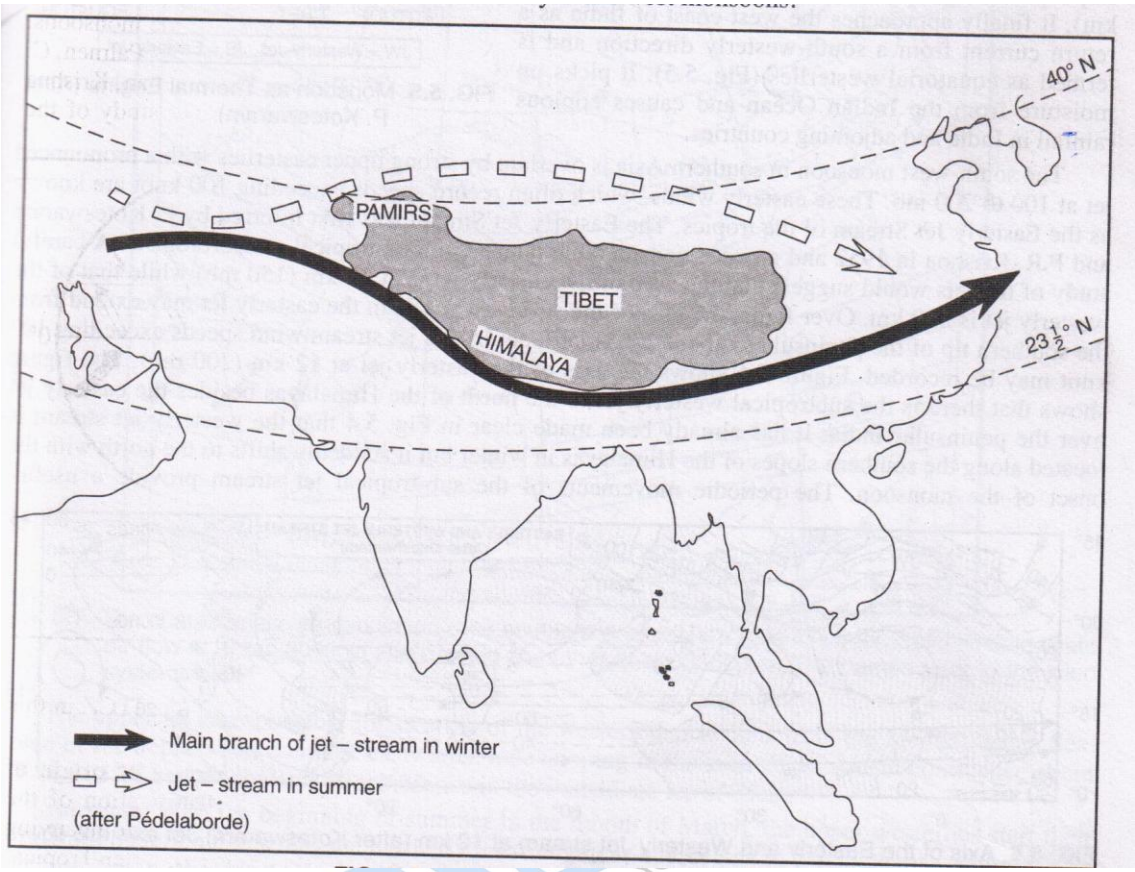


Source: D.R. Khullar

In the month of July the ITCZ shifts to 20 degree – 25 degree N latitude and is located in the Indo-Gangetic Plain and the south-west monsoons blow from the Arabian Sea and the Bay of Bengal. The ITCZ in this position is often called the Monsoon Trough.

Jet Stream Theory.

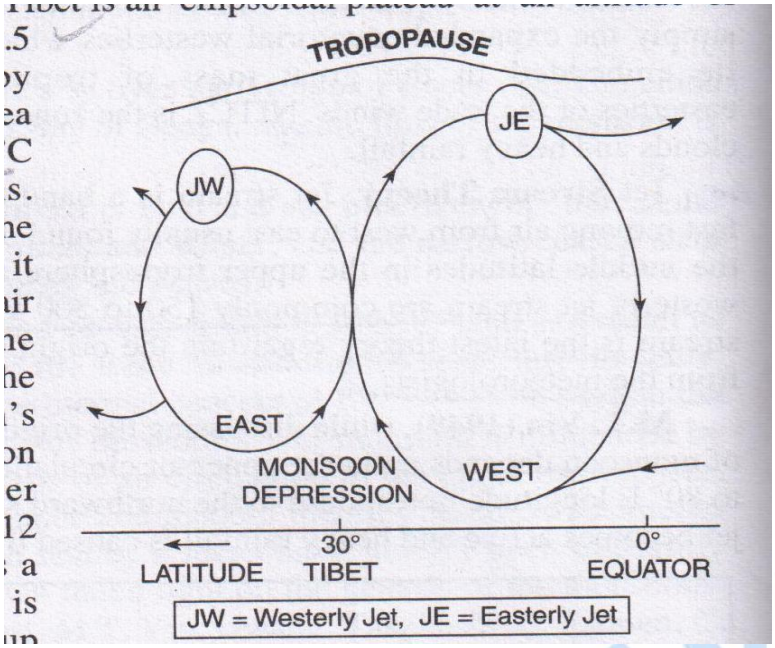
Jet stream is a band of fast moving air from west to east usually found in the middle latitudes in the upper troposphere at a height of about 12 km. The wind speeds in a westerly jet stream are commonly 150 to 300 km p.h. with extreme values reaching 400 km p.h. Jet stream is the latest theory regarding the origin of the monsoons and has earned world wide acclaim from the meteorologists.



Source: D.R. Khullar

In winter the western jet stream flows along the southern slopes of the Himalayas but in summer it shifts northwards, rather dramatically, and flows along the northern edge of the Tibet Plateau. The periodic movements of the Jet stream are often indicators of the onset and subsequent withdrawal of the monsoon.

P. Koteswarm he has tried to establish a relationship between the monsoons and the atmospheric conditions prevailing over Tibet Plateau. Tibet is an ellipsoidal plateau at an altitude of about 4000 m above sea level with an area of about 4.5 million sq km. It gets heated in summer and is 2 degree C to 3 degree C warmer than the air over the adjoining regions.



Source: D.R. Khullar

During its ascent the air spreads outwards and gradually sinks over the equatorial part of the Indian Ocean. At this stage, the ascending air is deflected to the right by the earth's rotation and moves in an anti-clockwise direction leading to anticyclonic condition in the upper troposphere over Tibet around 300-200 mb (9 to 12 km). It finally approaches the west coast of India as a return current from a south-westerly direction and is termed as equatorial westerlies.

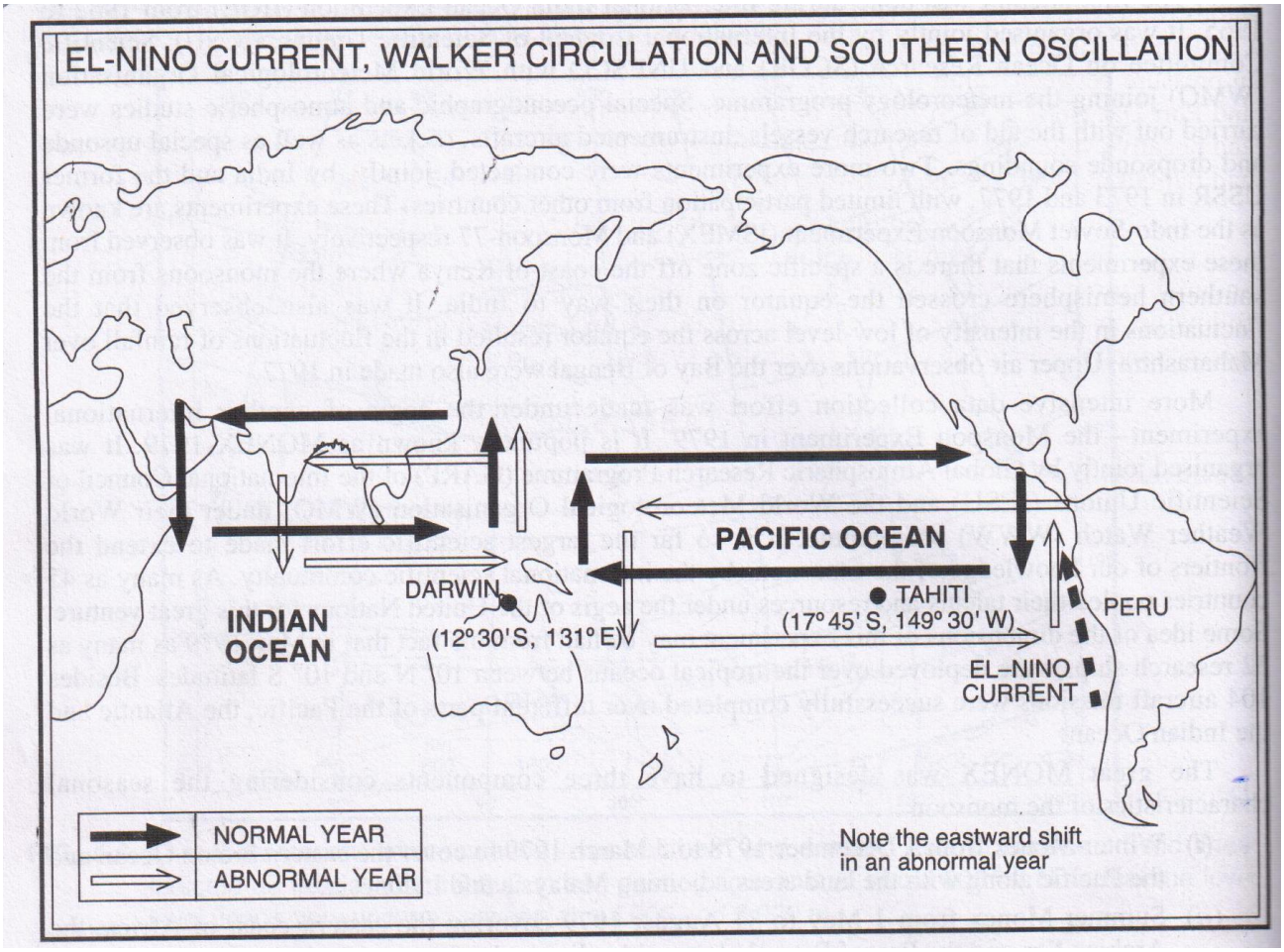
Recent ovservations have revealed that the intensity and duration of heating of Tibet Plateau has a direct bearing on the amount of rainfall in India by the monsoons. When the summer temperature of air over Tibet remains high for a sufficiently long time, it helps in strengthening the easterly jet and results in heavy rainfall in India. The easterly jet does not come into existence if the snow over the Tibet Plateau does not melt. This hampers the occurrence of rainfall in India. Therefore, any year of thick and widespread snow over Tibet will be followed by a year of weak monsoon and less rainfall.

Teleconnections, the Southern Oscillation and the E1 Nino:

Recent studies have revealed that there seems to be a link between meteorological events which are separated by long distances and large intervals of time. They are called meteorological teleconnections. The one which has aroused considerable interest among the meteorologists is the difference between an E1 Nino and the Southern Oscillation. E1

Nino (EN) is a narrow warm current which appears off the coast of Peru in December. In Spanish, it means The Child Christ because it appears around Christmas. In some years this warm current is more intense than usual.

The E1 Nino phenomena, which influences the Indian monsoon, revels that when the surface temperature goes up in the southern Pacific Ocean, Indian receives deficient rainfall. However, there had been some years during which the E1 Nino phenomena did not occur, but India still got deficient rainfall, and conversely, India received sufficient rainfall during an E1 Nino year. A study of the last one hundred years of the Indian monsoons shows that out of 43 deficient monsoon years, 19 were associated with an E1 Nino.



Source: D.R. Khullar

Southern Oscillation.

Is the name ascribed to the curious phenomena of sea-saw pattern of meteorological changes observed between the Pacific and Indian Oceans. This great discovery was made by Sir Gilbert Walker in 1920. While working as the head of the Indian Meteorological service, he noticed that when the pressure was high over equatorial south Pacific, it was low over the equatorial south Indian Ocean and vice versa. The pattern of low and high pressures over the Indian and Pacific Oceans gives rise to vertical circulation along the equator with its rising limb over low pressure area and descending limb over high pressure area. This is known as Walker circulation. The location of low pressure and hence the rising limb over Indian Ocean is considered to be conductive to good monsoon rainfall in India.

Chapter 4
Soil

Q. 1 Describe the different soil type of India.

Ans Soil is the thin surface-layer on the earth, comprising mineral particles formed by the break-down of rocks, decayed organic materials, living organisms, water and air. Soil is a very important natural resource of India because agricultural production is basically dependent on the fertility of soil.

In Indian conditions, there is wide diversity with respect to geographical setting, physiography, climate and vegetation. Animals, insects and man also play an important role in soil formation. Some of the important factors of soil formation are mentioned below.

1. Parent Material. The material for soil formation is mainly derived from the rocks and is termed as the parent material by soil scientists. India possesses a great variety of parent material which is generally categorized into following six classes:

(i) Ancient crystalline and metamorphic rocks
(ii) Cuddapah and Vindhyan rocks
(iii) Gondwana rocks
(iv) Deccan basalts
(v) Tertiary and Mesozoic sedimentary rocks of extra peninsular India
(vi) . Recent and sub-recent rocks.

The soils of the Northern Plain of India have been largely derived from the depositional work of the Himalayan rivers. On the other hand, the soils of peninsular plateau are generally coarse-grained and are closely related to the parent rocks. The peninsular soils are generally less fertile.

2. Relief. Steep slope encourages the swift flow of water and hinders the process of soil formation. The areas of low relief or gentle slope generally experience deposition and have deep soils. The degree of slope also largely determines the fertility of soil.

3. Climate. Climate is the single most important factor in soil formation. Most

important climatic factors affecting soil formation are the amount and seasonal distribution of temperature and rainfall. Climate controls the type and effectiveness of weathering of the parent material, the quantity of water seeping through the soil and the type of micro-organisms present therein. In cold climates of the Himalayan region, the process of vegetation decay is very low and the soils formed under such circumstances are acidic in nature. The crystalline granites produce laterite soil in relatively moist parts of the monsoonal region and non-laterite in drier areas. Hot summer and low rainfall develops black soil as is found in some parts of Tamil Nadu irrespective of the parent rock. In Rajasthan, both granite and sandstone give birth to sandy soil under arid climate. This soil is poor in organic matter.

4. Natural Vegetation. Natural vegetation reflects the combined effects of relief and climate. The formation and development of soil is very much influenced by the growth of vegetation. The decayed leaf material adds much needed humus to soil thereby increasing its fertility. The densely forested areas contain some of the best soils in India.

Major soil groups of India

India is a country of vast dimensions with varied conditions of geology, relief, climate and vegetation. Therefore, India has a large variety of soil groups, distinctly different from one another. The Indian Council of Agricultaral Research (ICAR) set up an All India Soil Survey Committee in 1953 which divided the Indian soils into eight major groups. They are (1) Alluvial soils, (2) Black soils, (3) Red soils, (4) Lateritic soils, (5) Forest and Mountain soils, (6) Arid and Desert soils, (7) Saline and Alkaline soils and (8) Peaty and Marshy soils. This is a very logical classification of Indian soils and has gained wide acceptance. A brief account of these eight soils is given as under.

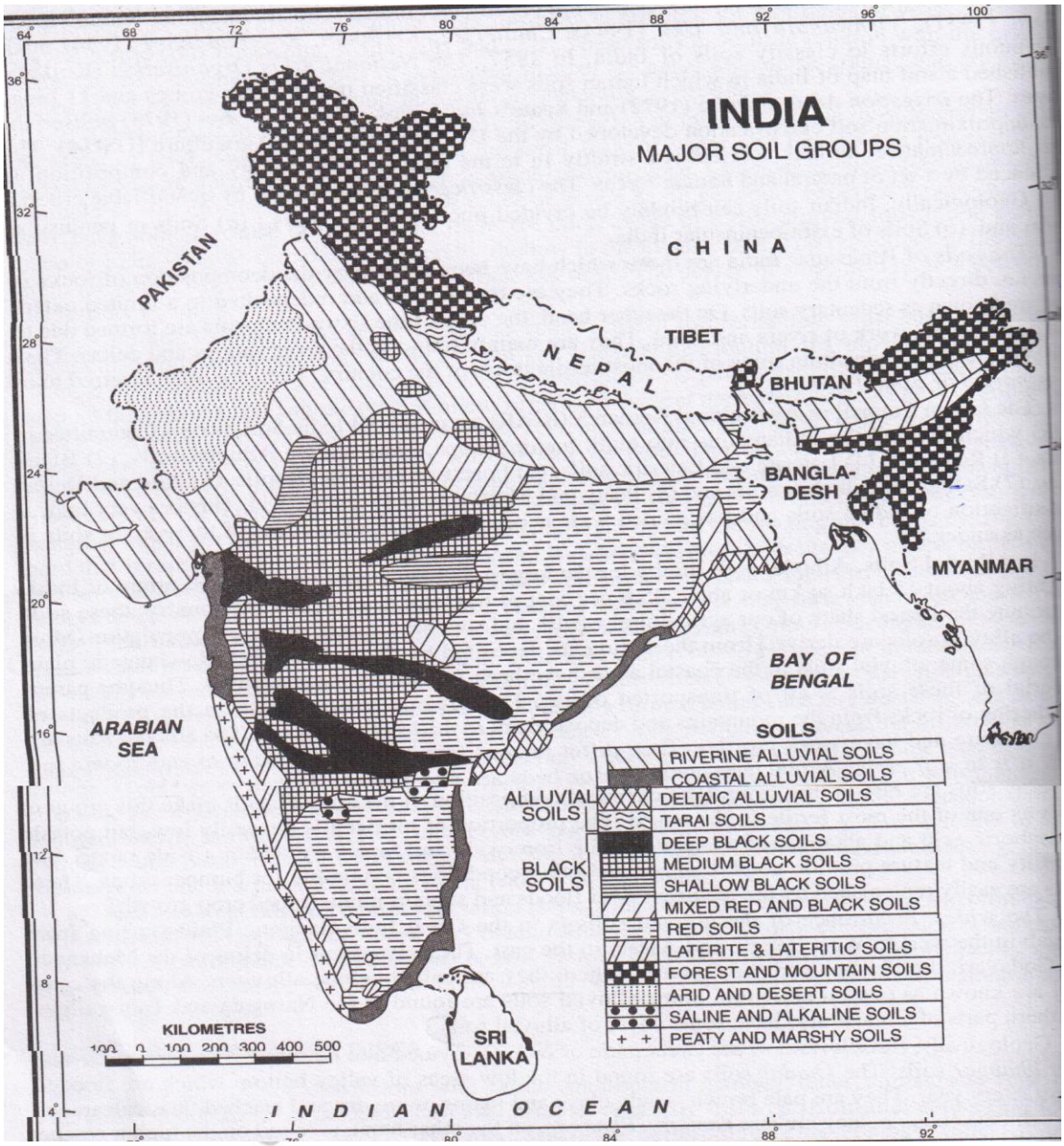
1. Alluvial Soils. Alluvial soils are by far the largest and the most important soil group of India. Most of the alluvial soils are derived from the sedments deposited by rivers as in the Indo-Gangetic plain. The parent material of these soils is all of transported origin. The chemical composition of the alluvial soils make this group of soils as one of the most fertile in the world. The proportion of nitrogen is generally low, but potash, phosphoric acid and alkalies are adequate, while iron oxide and lime vary within a wide range.

The widest occurrence of the alluvial soils is in the Great Indo-Gangetic Plain starting from Punjab in the west to West Bengal and Assam in the east. They also occur in deltas of the Mahanadi, the Godavari, the Krishna and the Cauvery, where they are called deltaic

alluvium. Along the coast they are known as coastal alluvium. Some alluvial soils are found in the Narmada and Tapi valleys. Northern parts of Gujarat also have some cover of alluvial soils. Due to their softness of the strata and fertility the alluvial soils are best suited to irrigation and respond well to canal and well/tube-well irrigated, the alluvial soils yield splendid crops of rice, wheat, sugarcane, tobacco, cotton, jute, maize, oilseeds, vegetables and fruits.

2. Black Soils. The black soils are also called regur and black cotton soils because cotton is the most important crop grown on these soils. Most of the black soils are derived from two types of rocks, the Deccan and the rajmahal trap, and ferruginous gneisses and schists occurring in Tamil Nadu. The former are sufficiently deep while the later are generally shallow.

In some parts of Gujarat and Tamil Nadu, the origin of black cotton soils is ascribed to old lagoons in which the rivers deposited the materials brought down from the interior of Peninsula covered with lava.



Source: D.R. Khullar

Geographically, black soils are spread over 5.46 lakh sq km. This is the region of high temperature and low rainfall. It is, therefore, a soil group of the dry and hot regions of the Peninsula. These soils are mainly found in Maharashtra, Madhya Pradesh, parts of Karnataka, Andhra Pradesh, Gujarat and Tamil Nadu.

The black soil is very retentive of moisture. It swells greatly and becomes sticky when wet

in rainy season. In the hot dry season, the moisture evaporates, the soil shrinks and is seamed with broad and deep cracks. This soil has been used for growing a variety of crops for centuries without adding fertilizers and manures, or even fallowing with little or no evidence of exhaustion.

A typical black soil is highly argillaceous with a large clay factor, 62 per cent or more, without gravel or coarse sand. It also contains 10 per cent of alumina, 9-10 per cent of iron oxide and 6-8 per cent of lime and magnesium carbonates. Potash is variable (less than 0.5 per cent) and phosphates, nitrogen and humus are low. As a general rule, black soils of uplands are of low fertility but they are darker, deeper and richer in the valleys. Because of their high fertility and retentivity of moisture, the black soils are widely used for producing several important crops. Some of the major crops grown on the black soils are cotton, wheat, jowar, linseed, Virginia tobacco, castor, sunflower and millets. Large varieties of vegetables and fruits are also successfully grown on the black soils.

3. Red Soils. Most of the red soils have come into existence due to weathering of ancient crystalline and metamorphic rocks. The main parent rocks are acid granites and gneisses, quartzitic and felspathic. The red soils occupy a vast area of about 3.5 lakh sq km which is about 10.6 per cent of the total geographical area of the country. These soils are spread on almost the whole of Tamil Nadu, parts of Karnataka, south-east of Maharashtra, eastern parts of Andhra Pradesh and Madhya Pradesh, Chhattisgarh, Orissa and Chota Nagpur in Jharkhand.

In their chemical composition they are mainly siliceous and aluminous, with free quartz as sand, the alkali content is fair, some parts being quite rich in potassium. The red soils respond well to the proper use of fertilizers and irrigation and give excellent yields of cotton, wheat, rice, pulses, millets, tobacco, oil seeds, potatoes and fruits.

4. Laterite and Laeritic Soils. The latrite soil is formed under conditions of high temperature and heavy rainfall with alternate wet and dry periods. We have numerous varieties of laterite which have bauxite at one end and an indefinite mixture of ferric oxides at the other. Almost all laterite soils are very poor in lime and magnesia and deficient in nitrogen. At some places, there may be higher content of humus. They are mainly found on the summits of Western Ghats. Eastern Ghats, the Rajamahal Hills, Vindhyas, Satpuras and Malwa Plateau. Some laterites and lateritics are suitable for growing plantation crops like tea, coffee, rubber, cinchona, coconut, arecanut, etc. In some areas, these soils support grazing grounds and scrub forests. Laterite and lateritic soils

have a unique distinction of providing valuable building material.

5. Forest and Mountain Soils. Such soils are mainly found on the hill slopes covered by forests. These soils are heterogeneous in nature and their character changes with parent rocks, ground-configuration and climate. In the Himalayan region, such soils are mainly found in valley basins, depressions, and less steeply inclined slopes. The forest soils are very rich in humus but are deficient in potash, phosphorus and time. They are especially suitable for plantations of tea, coffee, spices and tropical fruits in Karnataka, Tamil Nadu and Kerala and wheat, maize, barley and temperate fruits in Jammu and Kashmir, Himachal Pradesh and Uttaranchal.

6. Arid and Desert Soils. A large part of the arid and semi-arid region in Rajasthan and adjoining areas of Punjab and Haryana lying between the Indus and the Aravalis, covering an area of 1.42 lakh sq km (ir 4.32% of total area) and receiving less than 50 cm of annual rainfall, is affected by desert conditions.

The phosphate content of these soils is as high as in normal alluvial soils. Nitrogen is originally low but its deficiency is made up to some extent by the availability of nitrogen in the form of nitrates. Thus, the presence of phosphates and nitrates make them fertile soils wherever moisture is available in large areas of desert soils, only the drought resistant and salt tolerant crops such as barley, rape, cotton, wheat, millets, maize and pulses are grown. Consequently, these soils support a low density of population.

7. Saline and Alkaline Soils. These soils are found in Andhra Pradesh and Karnataka. These soils are liable to saline and alkaline efflorescences and are known by different names such as reh, kallar, usar, thur, rakar, karl, and chopan. Some of the salts are transported in solution by the rivers, which percolate in the sub-soils of the plains.

The accumulation of these salts makes the soil infertile and renders it unfit for agriculture. Vast areas comprising the estuaries of the Narmada, the Tapi, the Mahi and the Subarmati have thus become infertile.

8. Peaty and Marshy Soils. Peaty soils originate in humid regions as a result of accumulation of large amounts of organic matter in the soils. These soils contain considerable amount of soluble salts and 10-40 per cent of organic matter. Marshy soils with a high proportion of vegetable matter also occur in the coastal areas of Orissa and Tamil Nadu, Sunderbans of West Bengal. The peaty soils are black, heavy and highly acidic. They are deficient in potash and phosphate.

Characteristics of Indian Soils:

Following are the chief characteristics of Indian soils:

- The Indian soils have been formed under varied geographical conditions and differ widely in their physical properties, chemical composition and fertility level.
- Most soils are old and mature. Soils of the peninsular plateau are much older than the soils of the great northern plain.
- Indian soils are largely deficient in nitrogen, mineral salts, humus and other organic materials.
- Plains and valleys have thick layers of soils while hilly and plateau areas depict thin soil cover.
- Some soils like alluvial and black soils are fertile while some other soils such as laterite, desert and alkaline soils lack in fertility and do not yield good harvest.
- Indian soils have been used for cultivation for hundreds of years and have lost much of their fertility. As such there is urgent need of giving scientific treatment to our soils.
- Indian climate is characterized by seasonal rainfall and our soils need irrigation during the dry period.
- Indian soils suffer from soil erosion and other allied problems.

Problems of Indian Soils

Some of the important problems faced by Indian soils are (i) soil erosion, (ii) deficiency in fertility, (iii) desertification, (iv) waterlogging (v) salinity and alkalinity.

Soil Erosion

Soil erosion is the removal of soil by the forces of nature, particularly wind and water, more rapidly than the various soil forming processes can replace it. Soil erosion is a serious menace which is adversely affecting our agricultural productivity and the economy of the country as a whole.

Type of Soil Erosion

Two natural agents' water and wind are constantly at work indulging in soil erosion.

Water Erosion. During heavy rains, water removes a lot of soil. Run off water is responsible for much soil erosion, moving the soil particles by surface creep, saltation and suspension. Water erosion consisting of rilling, gullying sheet-wash and rain peeling process mainly confirmed to the mountains, hills and upper slopes of the piedmont zone. If one cubic metre of soil be lost from one hectare of land each week for a period of 30 years, the loss would amount to 15 cm from the entire surface.

The slope of the land is a potent factor in determining the velocity of water and the

consequent soil erosion. Other things being equal, the steeper the slope the more rapidly does water run down resulting in more soil erosion. In the coastal areas, tidal waves dash along the coast and cause heavy damage to soil. This is called sea erosion. In the higher reaches of the Himalayan region, soil erosion on a large scale is caused by glaciers. This is called glacial erosion.

Wind Erosion. In arid and semi arid lands with little rainfall, the wind acts as a powerful agent of soil erosion causing heavy loss to agricultural land. Winds blowing at considerable speed, remove the fertile, arable, loose soils leaving behind a depression devoid of top soil. Very fine, fine and medium sands are moved by wind in a succession of bounds and leaps, known as saltation. Coarse sand is not usually airborne but rather is rolled along the soil surface. This type of erosion is called surface creep.

Human Factors of Soil Erosion

Soil erosion is the result of a number of factors, working in isolation or in association with one another. Apart from the natural factors such as torrential rainfall, resulting in swift flow of water, strong winds in dry areas, nature of soil and the physiography, man is an important factor responsible for soil erosion. Man's ill gudged activities such as deforestation, overgrazing and faulty method of agriculture have made soil erosion a serious national problem. It is rightly said that soil erosion is essentially a problem created by man and also faced by man himself.

1. Deforestation. With the increase in population, the pressure on forest resources is increasing with each passing day. This has resulted in reckless cutting of forests which has led to the problems of soil erosion. The large scale damage to soil in Shiwalik range, the Chos of Punjab, parts of Haryana and the ravines of Madhya Pradesh, Uttar Pradesh and Rajasthan is largely due to deforestation.

2. Overgrazing. Forests and grasslands provide much needed fodder for animals during the long dry period, there is shortage of fodder and the grass is grazed to the ground and torn out by the roots by animals. This leads to loose structure of the soil and the soil is easily washed away by rains.

3. Faulty Methods of Agriculture. Much of the soil erosion in India is caused by faulty methods of agriculture. The most outstanding are wrong ploughing, lack of crop rotation and practice of shifting cultivation. In some parts of the country, the same crop is grown year after year which spoils the chemical balance of the soil. The soil becomes unfit for cultivation and the tribes move to another piece of land after 2-3 years, returning to the earlier one after a gap of 10-

15 years. In this way, the whole of the forest area is adversely affected by shifting cultivation resulting in intensive soil erosion in vast areas.

Effects of Soil Erosion

The adverse effects of soil erosion are reflected in the following points :

- Top soil is eroded which leads to loss of soil fertility and fall in agricultural productivity.
- Flooding and leaching result in loss of mineral nutrients.
- Ground water level is lowered and there is decrease in soil moisture.
- Natural vegetation cover dries up and arid lands expand.
- Frequency and intensity of floods and drought increase.
- Rivers, canals and tanks are silted and their water holding capacity decreases.
- The incidence and damaging power of landslides increases.
- Economy as whole suffers a great setback.

Soil Salinity and Soil Alkalinity. Soil salinity and soil alkalinity are the results of over irrigation in canal irrigated areas. In canal irrigated areas plenty of the water is available and the farmers indulge in over irrigation of their fields. Salinity means the predominance of chlorides and sulphates of sodium, calcium and magnesium in the soils in sufficient quantity to be able to seriously interfere with the growth of most plants. Alkalinity implies the dominance of sodium salts, specially sodium carbonate. Increasing salinity and alkalinity always indicate extension of waterlogging salt encrustation.

Vast tracts of canal irrigated areas in Uttar Pradesh, Punjab and Haryana; arid regions of Rajasthan, semi-arid areas of Maharashtra, Gujarat, Andhra Pradesh and Karnataka and coastal areas of Orissa, Gujarat and West Bengal are facing this problem. Indira Gandhi canal in Rajasthan has turned the sandy desert into granary, it has given birth to serious problem of salinity and to alkalinity.

Soil salinity and alkalinity has many adverse effects, some important effects are as under :

- Soil fertility is reduced which results in crop failure. Cultivation is not possible on saline soils unless they are flushed out with large quantities or irrigation water to leach out the salts.
- Choice of crops is limited because some crops are sensitive to salinity and alkalinity. Only high salt tolerant crops such as cotton, rape, barley etc. and medium salt tolerant crops like wheat, rice, linseed, pulses, millets etc. can be grown.
- Quality of fodder becomes poor.
- Salinity and alkalinity create difficulties in building and road construction.
- It causes floods due to reduced infiltration, leading to crop damage in the adjoining areas.

Following steps are necessary to treat salinity and alkalinity and restore the fertility of soil.

- Providing outlets for water to drain out excess water and lower water table. Efforts should also be made to seal all points and strips of the leakage from canals, tanks and ponds by lining them.
- Minimising the use of water. Making judicious use of irrigation facilities.
- Planting salt tolerant vegetation and crops such as cotton, rape, barely, date palm, linseed etc. and certain grasses as fodder crops can be helpful.
- It has been found that crop rotation involving dhaincha (green fodder) – cotton, in the Deccan plateau, dhaincha-rice in the Uttar Pradesh and dhaincha-rice-barseem in Punjab and Haryana have been very helpful.

Desertification. Desertification can be defined as spread of desert like conditions in arid or semi-arid areas due to man's influence or climatic change. Desert soils suffer maximum erosion by wind. The sand carried by wind is deposited on the adjoining fertile lands whose fertility dwindles and sometimes the fertile land merges with the advancing desert. It has been estimated that the Thar Desert is advancing at an alarming rate of about 0.5 km per year. Semi arid conditions prevail in large parts of Rajasthan, Gujarat, Punjab, Haryana, Maharashtra, Andhra Pradesh, Karnataka, Jammu and Kashmir, Uttar Pradesh, Tamil Nadu and Madhya Pradesh.

The process of desertification is attributed to various causes of which more important are uncontrolled grazing, reckless felling of trees and growing population. Climate changes have also contributed to the spread of deserts.

Desertifications has several ecological implications. Some important implications are listed below.

- Drifting of sand and its accumulation on fertile agricultural land.
- Excessive soil erosion by wind and to some extent by water.
- Deposition of sand in rivers, lakes and other water bodies thereby decreasing their water containing capacity.
- Lowering of water table leading to acute water shortage.
- Increase in area under wastelands.
- Decrease in agricultural production.
- Increase in frequency and intensity of droughts.

Measures of Controlling Desertification

- Intensive tree plantation programme should be initiated.
- Central Arid Zone Research Institute, Jodhpur has suggested mulching them with different plant species.
- Grazing should be controlled and new pastures should be developed.
- Indiscriminate felling of trees should be banned.

- Alternative sources of fuel can reduce the demand for fuel wood and save the trees from destruction hence checking the onward march of the desert.
- Sandy and wastelands should be put to proper use by judicious planning.

Water logging. Waterlogged soils are soaked or saturated with water. It has been estimated that extent of waterlogged soils is about 12 millions hectares in India; half of which lies long its coast and the other half in the inland area under existing or newly created irrigation command areas.

Water logging is believed to be one of the chief causes of salinity. The problems of land reclamation under water logging conditions is a complex one and must therefore, be tackled with great care as the scheme involves huge expenditure. The basic methods of removing excess water from waterlogged soils are (a) surface drainage and (b) vertical drainage.

(a) Surface Drainage. Surface drainage involves the disposal of excess water over ground surface through an open drainage system with an adequate outlet. Surface drainage is helpful where (i) soils are deep with low infiltration rates, where (ii) intensity of rainfall is high, where (iii) terrain is level of nearly level and where (iv) the water table is high.

(b) Vertical Drainage. Any bore or well from which the underlying water is extracted is defined as vertical drainage. The success of vertical drainage depends upon the presence of favorable aquifer and water table for lifting the ground water on sustainable basis and the favorable quantity of water that could be re-utilised for irrigation purpose.

Soil conservation

Soil Conservation includes all those measures which help in protecting the soil from erosion and exhaustion. Soil erosion has been continuing over such a large part of India for such a long time that it has assumed alarming proportions. According to Prof. S.P. Chatterjee, "Soil erosion is the greatest single evil to Indian agriculture and animal husbandry". Soil is our most precious asset and no other gift of nature is so essential to human life as soil. An urgent need to conserve soil for the sake of prosperity of our masses. Following methods are normally adopted for conserving soil:

1. Afforestation. The best way to conserve soil is to increase area under forests. A minimum area of forest land for the whole country that is considered healthy for soil and water conservation is between 20 to 25 per cent but it was raised to 33 per cent in the second five year plan; the proportion being 20 per cent for the plains and 60 per cent for hilly and mountainous regions.
2. Checking Overgrazing. Overgrazing of forests and grass lands by animals, especially by goats and sheep, should be properly checked. Separate grazing grounds should be earmarked and fodder crops should be grown in larger quantities. Animals freely move

about in the fields for grazing and spoil the soil by their hoofs which leads to soil erosion. This should be avoided.

3. Constructing Dams. Much of the soil erosion by river floods can be avoided by constructing dams across the rivers. This checks the speed of water and saves soil from erosion.
4. Changing Agricultural Practices. We can save lot of our valuable soil by bringing about certain changes in our agricultural practices such as Crop rotation, Strip cropping, Use of Early Maturing Varieties, Contour Ploughing, Terracing and contour Bunding, Checking shifting Cultivation and Ploughing the Land in Right Direction.

Chapter 5
Population

Q.1 Describe the Population of India.

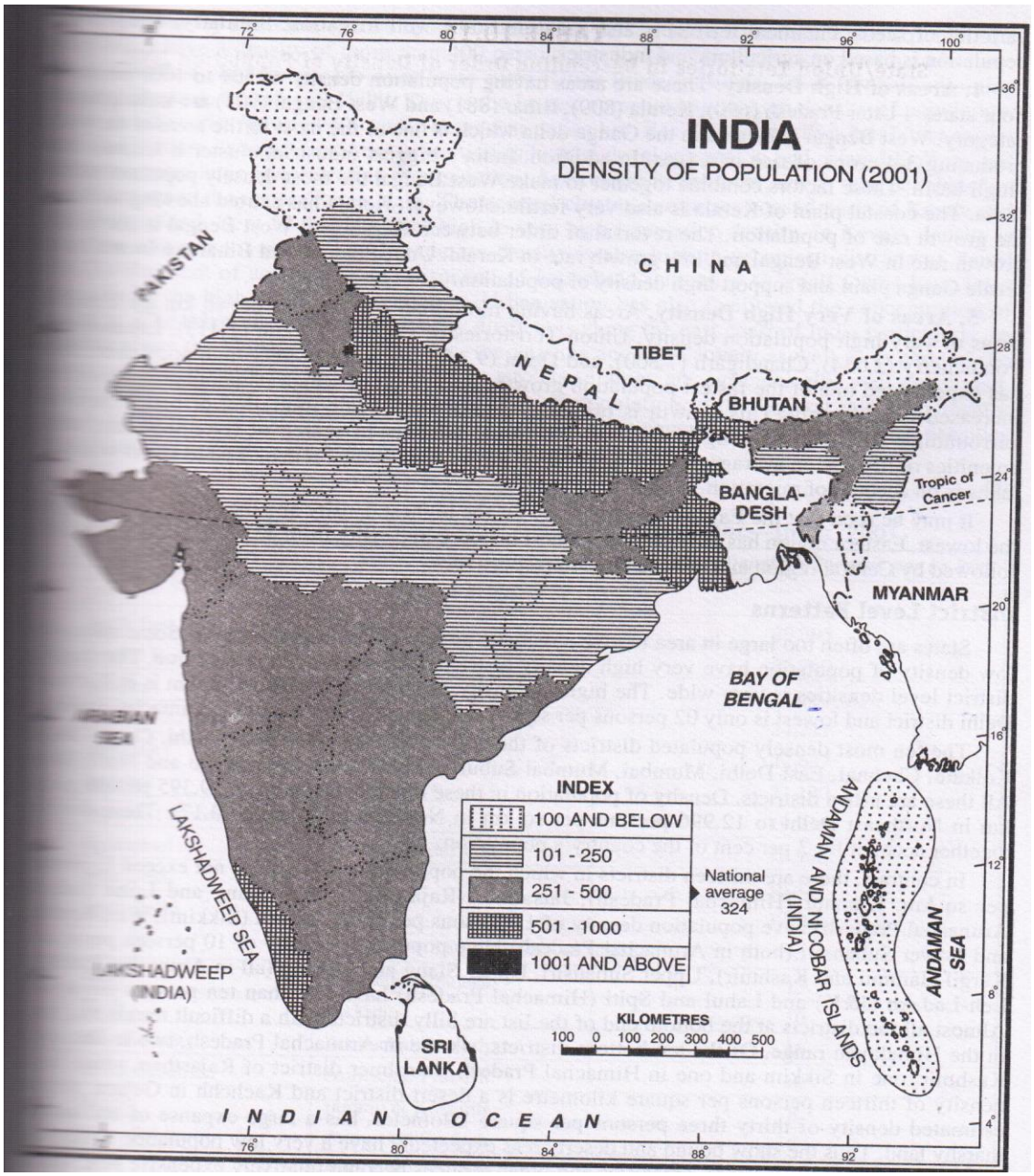
Ans India is the second most heavily populated country in the world. About every sixth person in the world there is an Indian. Population distribution means the pattern of where people live. Population of the world or of any country is not consistently distributed. The same is correct about India also. World population distribution is uneven. Some parts of the country are densely populated, some parts moderately populated and some parts are sparsely populated.

Population density is an amount of the number of people in an area. Population density is shown as the number of people per km^2. The amount of population of different areas can be compared in various ways. One of the method can be to compare the complete size of the population. But it does not provide any idea about the association of population with the area or resource base of the country. This type of comparison is therefore not sufficient. The population of countries is compared in terms of density of population. This is a way of comparing the man-land ratio of different areas. For this reason, the population of an area is assumed to be distributed evenly in all its parts and the number of people per km^2 is thus calculated. This is called arithmetic density of population. Which calculate by dividing the total population of a region by the total area. Therefore the density of population is expressed as the number of persons per km^2.

Factors Influencing Distribution and Density of Population:

Physical Factors	High Density	Low Density
Relief & Altitude	Low land which is flat e.g. Indo-Ganges Plain in India	A highly mountainous state of Arunachal Pradesh
Mineral Resources	Areas full of resources (e.g. coal, oil, wood, fishing etc.) tend to densely populated e.g. The Chhota Nagpur plateau of Jharkhand	Resources with low amount tend to be sparsely populated e.g. The Sahel

Climate	Areas with moderate climates tend to be densely populated as there is enough rain and heat to grow crops e.g. Kerala and West Bengal	Areas with extreme climates of hot and cold tend to be sparsely populated e.g. hot and dry deserts of Rajasthan
Soil	Fertile soil support higher population density e.g. the Indus river basin	Infertile soil leads to low density e.g. desert soils and mountain soil areas.



Source: D.R. Khullar

Density of Population:

Density of population is a better measure of understanding the variation in the distribution of population. It is the ratio of total population to the total area of the country or a part thereof. Therefore the density of population in India in 2001 is :

Total population 1028.73

---------- = ---------- = 325 persons per sq km

Total Area 3.166

With an average density of 325 persons per sq km in 2001, India is considered to one of the most thickly populated countries of the world. The most striking feature of India's density of population is that it has been consistently increasing since 1901.

Increase in density of population of India show in below table

Census Year	Density of Population (persons per sq km)
1901	77
1911	82
1921	81
1931	90
1941	103
1951	117
1961	142
1971	177
1981	216
1991	267
2001	325

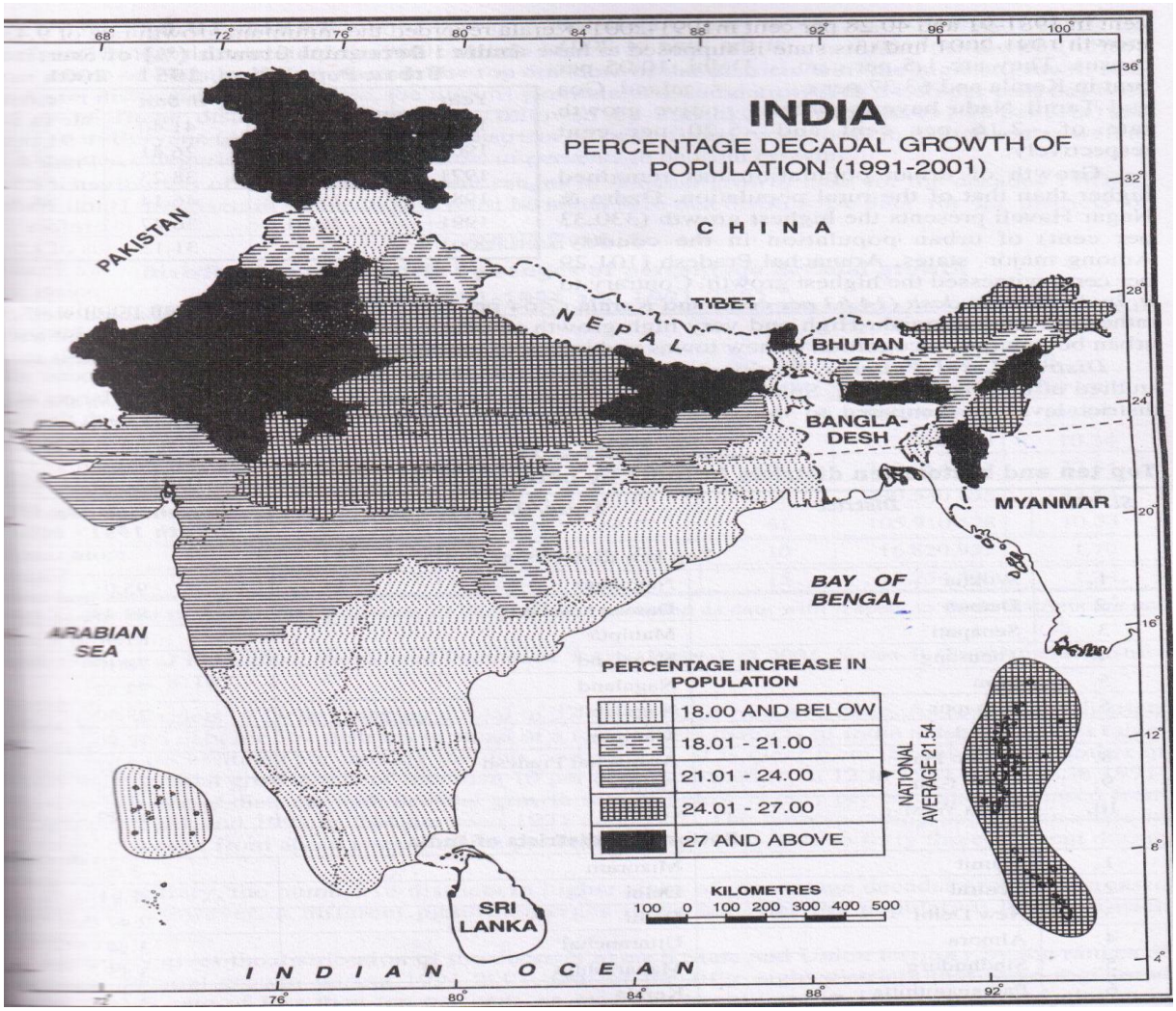
Population density at state level:

There are large scale variations in the population density from one state to another. For the sake of convenience, the spatial distribution of population density is classified into following categories:

1. Area of Extremely Low Density: Area having 100 persons per sq km and less than that are included in this class. Arunachal Pradesh and Mizoram are located in a remote and inaccessible part of north east India. Jammu and Kashmir has vast areas devoid of population. Only some parts of Jammu region and Kashmir valley are thickly populated.
2. Area of Low Density: Area having population density of 101 to 250 persons per sq km are included in this class. Rajasthan is the largest state of India. There are obviously large variations in the density of population in different parts of the state depending upon the local conditions. H.P. and Uttaranchal are parts of the north western Himalayan region and very little level land to support high population density.
3. Area of Moderate Density: This class includes those areas which are having 251 to 500 persons per sq km. The average for whole of India also falls in this class. These areas are wide apart from one another and there are different reasons for moderate density of population in different areas. Assam has tea estates whereas Andhra Pradesh, Karnataka and Jharkhand have agriculture and mineral resources. Punjab and Haryana have highly developed agriculture based on heavy inputs in the form of high yielding varieties of seeds, chemical fertilizers and canal and tube well irrigation.

4. Area of High Density: these are areas having population density of 501 to 1000 per sq km. West Bangal is the Ganga delta which is one of the most fertile areas of the world, producing 3-4 crops of rice in a year. Uttar Pradesh and Bihar are located in the fertile Ganga plain and support high density of population.
5. Areas of Very high Density: Areas having more than 1000 persons per sq. km are termed as areas of very high population density. Delhi has experienced one of the fastest population growths as a result of which its population density has increased considerably. This growth is primarily due to large scale migration of people from the surrounding areas.

   It may be seen that the Eastern region has by far the highest density and the North Eastern region the lowest. Eastern region has recorded the highest increase in highest from 431 in 1991 to 525 in 2001 followed by Central region and Western region respectively.



Source: D.R. Khullar

Chapter 6
Foreign Trade

Q.1: Explain the structure of foreign trade of India?

Ans The exchange of goods or merchandise or their sale-purchase is known as trade. Trade is of three types Local trade, Regional trade, Foreign or International or Overseas trade. International Trade of a country is rightly known as its Economic Barometer. With the establishment of British rule in india, our trade ties became stronger with Britain. India used to export raw materials such as cotton, tea, iron-ore, etc. to Britain and import manufacture goods, machinery, medicines, etc. from that country.

Basis of overseas trade

Overseas trade depends upon several factors. Some important factors are discussed as under.

1. Differences in Natural Resources: The fundamental base of international trade is the difference in natural resources of different countries. There are variations in relief, structure, geology, climate and soil from one country to the another.
2. Marketable Surplus: Some countries are capable of producing certain things more than their internal consumption. For example, tea from India, coffee from Brazil, paper and pulp from Norway are available for export.
3. Scarcity of Goods: there is not even a single country in the world which does not have scarcity of one commodity or the other. Japan and Britain do not have raw material.
4. Transport and Communication: Trade involves exchange of goods which requires proper arrangement for transportation and communication. Countries with poor transport system have not been able to develop international trade. India has launched an ambitious programme to improve surface transport.
5. Disparities in Economic Growth: There are disparities in the economic growth in different parts of the world. Some countries are still engaged in primary activities. These countries mainly export minerals and agriculture raw materials.
6. Trade Policy: free trade policy encourages international trade whereas restrictions of the trade discourage it.
7. War and Peace: Peace is the most important condition for the development of international trade. International trade gets disrupted during the time of war.
8. Political Relations: Countries having cordial political relations have better exchange of goods which encourage international trade. For example, india and Russia have good political relations and trade between these two countries has increased. On the other hand, U.S.A. and Russia have strained political relations and trade between these two big countries is at low level.

Composition of export trade of India

India has been a traditional exporter of raw material since time immemorial. At present, Indian exports cover a wide range of items of agricultural, handicrafts, handlooms and cottage sector Rs.

1. **Tea:**India is a traditional exporter of tea in the world market. Our percentage of tea and mate export in the world market has decreased from 33.4 per cent in 1970 to 27.7 per cent in 1980 and to 12.6 per cent in 2002, primarily, due to increased exports from other countries. Britain has been the traditional buyer of our tea.
2. **Leather and Leather Goods:** India has the largest population of livestock in the world which provide large quantity of leather in the shape of hides and skins. India exported leather goods worth Rs. 28 crore in 1960-61 which rose to Rs. 9938 crore in 2003-04. France and Japan are the main importers of our leather and leather goods.
3. **Ores and Minerals:** India imports gems and precious stones in their raw form and export them after proper cutting and polishing. India exports were worth Rs. 7 crore only in 1960-61 which increased to Rs. 48,586 crore in 2003-04. Israel and Belgium have emerged as our main competitors in the recent years. Iron Ore is the single largest metal exported by India. India exported iron ore worth Rs. 5173 crore in the2003-04. India holds monopoly in the productions of mica and is the largest exporter of mica in the world. In 2003-04, india exported mica valued at Rs. 106 crore. Chemical and allied products account for about 3.5 percent of our exports. The value of chemical and allied products was Rs. 34,915 crore in 2003-04.
4. **Engineering goods:** As a result of industrial progress, india is in a positions to export engineering goods even to some of the advanced countries. In 1950-51 , the Indian engineering goods exports were just Rs. 3 crore which jumped to Rs. 47,853.28 crore in 2003-04. Exports of engineering goods grew on the back of rising demands from countries in South East Asia and China.
5. **Cotton and textiles and yarn:** india now exports both inferior and superior quality cloth and yarn to the different countries. In the year 2003-04 india exported cotton yarn worth Rs. 15,600 crore.
6. **Readymade garments:** readymade garments have become a very important item of export during the last few yeaRs. The total earnings from the exports of readymade garments were Rs. 1067 crore in 1985-86 which increased to Rs. 28634 crore in 2003-04.
7. **Jute manufactures:** india exported jute manufactures including twist and yarn valued at Rs. 9938 crore in 2003-04. Eight countries purchase about two third of our jute exports.
8. **Marine products**: the main items of marine products exports are fish, dried prawn and shrimps. India exports these products to over 80 countries. Japan and USA purchase about 90 per cent of our exports.
9. **Coffee:** in 2003-04, 188 thousand tones of coffee worth Rs. 1066 crore was exported.
10. **Spices:** the total quantity of spices exported in 2003-04 was 267 thousand tones and the total earning from the export of spices in that year was Rs. 1544 crore.

Performance of Exports, Imports and Balance of Trade

Value in Rs. Crores

S. No.	Year	Exports	%Growth	Imports	%Growth	Trade Balance
1.	2004-2005	375,340	27.94	501,065	39.53	-125,725
2.	2005-2006	456,418	21.60	660,409	31.80	-203,991
3.	2006-2007	571,779	25.28	840,506	27.27	-268,727
4.	2007-2008	655,864	14.71	1,012,312	20.44	-356,448
5.	2008-2009	840,755	28.19	1,374,436	35.77	-533,680
6.	2009-2010	845,534	0.57	1,363,736	-0.78	-518,202
7.	2009-10 (Apr-Dec)	608,882		991,605		-382,723
8.	2010-11 (Apr-Dec)	751,633	23.44	1,126,513	13.61	-374,880

Composition of import trade of India

1. Petroleum and Petroleum Products. This is the largest single item of import by India these days. There is great demand for petroleum and petroleum products and this demand is increasing at an accelerated rate. In 2003-04, 99.5 million tonnes of petroleum, oil and lubricants worth Rs. 94,520 crore were imported which accounted for 26.3 per cent of our total imports. Iran, Saudi Arabia, UAE, Iraq, Kuwait, Venezuela, Indonesia and Malaysia are the main sources of oil supply to India.
2. Machines. Textile machinery, electrical machines, farm implements and mining machines are the main items of import. These machines are mainly imported from the USA, Britain, Germany, Russia, France, Japan, Belgium, Poland, Italy. The Netherlands, Canada, Australia, etc.
3. Iron and Steel. Although there has been a considerable increase in the production of iron and steel in India, yet out production always falls short of our demand.
4. Minerals. Apart from iron and steel, India imports a large variety of minerals including copper, lead, tin, zinc, brass, aluminum, etc. These minerals are imported from the USA, Britain, Japan, Germany, Switzerland, Australia, Myanmar and Malaysia, etc.
5. Fertilizers. The increasing demand for fertilizers for agricultural growth has to be met by imports. India imported 5,756.3 thousands tonnes of fertilizers worth Rs. 2,916 crore in 2003-04. The USA, Germany and Japan are the main sources of fertilizers.
6. Pearls and Precious Stones. India imports a large quantity of pearls and precious stones in their raw form and exports them after cutting and polishing.
7. Gold and Silver. Gold and Silver have also become a very important items of import. After a decline of 6.4 per cent in 2002-03, the gold and silver imports (excluding imports through passenger baggage), picked up sharply by 59.9 per cent in 2003-04, not withstanding a rise in international bullion market.

8. Edible Oils. The production of edible oils has always been falling short of our demand which is met by imports. The USA, Brazil and Malaysia are the main sources of edible oils for India. There three countries supply about three fourths of our edible oils.
9. Chemicals. India imports a large variety of chemicals including ammonia, sulphate, super phosphate, nitric acid, soda ash, bleaching powder and potash. India imported chemical elements and components worth Rs. 21,429 crore in 2003-04. The main sources of our chemicals are the USA, Japan, Germany, the Netherlands, Belgium, France, Britain, Italy, Kuwait and Korea.
10. Medicines. Large quantities of medicines are required to provide increasing medical treatment to the fast-growing population of India. India spent Rs. 1,358 crore in 1995-96 to import medicinal and pharmaceutical products. About half the imports are from Germany, Italy, China, Switzerland, Spain, Belgium and Poland.
11. Paper. With the increase in literacy and publication, India is finding it hard to meet her requirements from the indigenous production and has to import paper. The shortage of newsprint is badly felt. Pulp and scrap paper are also imported to manufacture paper. India imported 1,758.8 thousand tonnes of pulp and waste paper worth Rs. 1,880 crore and 1,075.5 thousand tonnes of paper, paper board and manufactures thereof worth Rs. 3,022 crore in 2003-04. Russia, Sweden, Germany, Bangladesh, Brazil, China, Czech Republic, Slovakia and Korea are the main suppliers of these items.

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Chapter 7
Agriculture

Q.1 Explain the different agriculture feature of India.

Ans It plays a vital role in the economy of India. The relative importance of agriculture has reduced considerably since then due to rapid development of other occupations such as mining, manufacturing, transport and trade. In addition to providing food and fodder to large population of human beings and livestock, respectively, agriculture is the main source of raw materials for several key industries.

Agriculture has double relation with industry. It acts as a supplier of raw materials to the industries and as consumer of industrial products. Prosperity of the entire nation depends upon the prosperity of agriculture.

Salient features of Indian agriculture.

1. Subsistence agriculture. Most parts of India have subsistence agriculture. The farmer owns a small piece of land, grows crops with the help of his family members and consumes almost the entire farm produce with little surplus to sell in the market.

2. Pressure of population on agriculture. The population in India is increasing at a rapid pace and exerts heavy pressure on agriculture. Agriculture has to provide employment to a large section of work force and has to feed the teeming millions. It is now estimated that about 4 lakh hectares of farm land is now being diverted to non-agriculture uses each year.

3. Importance of animals. Animals force has always played a significant role in agricultural operations such as ploughing, irrigation, threshing and transporting the agriculture products.

4**. Dependent upon Monsoon. I**ndian agriculture is mainly dependent upon monsoon which is uncertain, unreliable and irregular.

5. Variety of crops. India is a vast country with varied types of relief, climate and soil conditions. Therefore, there is a large variety of crops grown in India. Both the tropical and temperate crops are successfully grown in India.

6. Insignificant place to given fodder crops. Although India has the largest population of livestock in the world, fodder crops are given a very insignificant place in our cropping pattern. Only four percent of the reporting area is devoted to permanent

pastures and other grazing lands.

Problems of Indian Agriculture and their Solution

1. Small fragmented land-holdings. The average size of holdings was 2.28 hectares in 1970-71 which was reduced to 1.82 hectares in 1980-81 and 1.50 hectares in 1995-96. The problems of small and fragmented holdings is more serious in densely populated and intensively cultivated states like Kerala, West Bengal, Bihar and eastern part of Uttar Pradesh where the average size of land holdings is less than one hectare and in certain parts it is less than even 0.5 hectare.

Sub-division and fragmentation of the holdings is one of the main causes of our low agricultural productivity and backward state of our agriculture. Irrigation becomes difficult on such small and fragmented fields, Further, a lot of fertile agricultural land is wasted in providing boundaries. Under such circumstances, the farmer cannot concentrate on improvement.

The other solution to this problem is cooperative farming in which the farmers pool their resources and share the profit.

2. Seeds. Seed is a critical and basic input for attaining higher crop yields and sustained growth in agriculture production. In order to solve this problem, the Government of India established the National Seeds Corporation (NSC) in 1963 and the State Farmers Corporation of India (SFCI) in 1969. The Indian seed industry had exhibited impressive growth in the past and is expected to provide further potential for growth in agricultural production.

The policy statements are designed towards making available to the Indian farmer, adequate quantities of seed of superior quality at the appropriate time and place and at an affordable price so as to meet the country's food and nutritional security goals. Production of breeder and foundation seeds, and certified seeds distribution have gone up at an annual average rate of 3.4 per cent, 7.5 per cent and 9.5 per cent respectively, between 2001-02 and 2005-06.

3. Manures, Fertilizers and Biocides. Indian soils have been used for growing crops over thousands of years without caring much for replenishing. This is a serious problem which can be solved by using more manures and fertilizers. Manures and fertilizers play the same role in relation to soils as good food in relation to body. It has been estimated that about 70 per cent of growth in agricultural production can be

attributed to increased fertilizer application. Cow used as kitchen fuel in the shape of dung cakes. The fertilizer problem is, therefore, both acute and complex. The country has a potential of 650 million tonnes of rural and 160 lakh tonnes of urban compost which is not fully utilized at present.

In order to maintain the quality of the fertilizers, 52 fertilizer quality control laboratories have been set up in different parts of the country. In addition, there is one Central Fertilizer Quality Control and Training Institute at Faridabad with its three regional centers at Mumbai, Kolkata and Chennai.

4. Irrigation. Although India is the second largest irrigated country of the world after China, only tropical monsoon country like India where rainfall is uncertain, unreliable and erratic. Large tracts still await irrigation to boost the agricultural ouput. In the Indira Gandhi Canal command area also intensive irrigation has led to sharp rise in sub-soil water level, leading to waterlogging, soil salinity and alkalinity.

5. Lack of mechanization. Most of the agricultural operations in larger parts are carried on by human hand using simple and conventional tools and implements like wooden plough, sickle, etc. This is specially the case with small and marginal farmers. It results in huge wastage of human labour and in low yields per capita labour force.

There is urgent need to mechanise the agricultural operations so that wastage of labour force is avoided and farming is made convenient and efficient. The share of mechanical and electrical power has increased from 40 per cent in 1971 to 84 per cent in 2003-04. Strenuous efforts are being made to encourage the farmers to adopt technically advanced agricultural equipments in order to carry farm operations timely and precisely, and to economics the agricultural production process.

6. Soil erosion. Large tracts of fertile land suffer from soil erosion by wind and water. This area must be properly treated and restored to its original fertility.

7. Agricultural Marketing. Agricultural marketing still continues to be in a bad shape in rural India. In the absence of sound marketing facilities, the farmers have to depend upon local traders and middlemen fro the disposal of their farm produce which is sold at throw-away price. According to an estimate 85 per cent of wheat and 75 per cent of oil seeds in Uttar Pradesh, 90 per cent of Jute in West Bengal, 70 per cent of oilseeds and 35 per cent of cotton in Punjab is sold by farmers in he village itself.

The Rural Credit Survey Report rightly remarked that the producers in general sell their produce at an unfavorable place and at an unfavorable time and usually they get

unfavorable terms. Many market surveys have revealed that middlemen take away about 48 per cent of the price of rice, 52 per cent of the price of groundnuts and 60 per cent of the price of potatoes offered by consumers. In order to save the farmer from the clutches of the money lenders and the middle men, the government has come out with regulated markets.

8. Inadequate storage facilities. Storage facilities in the rural areas either totally absent under such condition the farmers are compelled to sell their produce immediately after the harvest at the prevailing market prices which are bound to be low. Scientific storage is, therefore, very essential to avoid losses and to benefit the farmers and the consumers alike. At present there are number of agencies engaged in warehousing and storage activities. The Food Corporation of India, the Central Warehousing Corporation and State Warehousing Corporation are among the principal agencies engaged in this task. The working group on additional storage facilities in rural areas has recommended a scheme of establishing a network of Rural Storage Centers to serve the economic interests of the farming community.

9. Inadequate transport. One of the main handicaps with Indian agriculture is the lack of cheap and efficient means of transportation. Even at present there are lakhs of villages which are not well connected with main roads or with market centers. Linking each village by metal led road is a gigantic task and it needs huge sums of money to complete this task.

10. Scarcity of capital. Agriculture is an important industry and like all other industries it also requires capital. The role of capital input is becoming more and more important with the advancement of farm technology. Since the agriculturists' capital is locked up in his lands and stocks, he is obliged to borrow money for stimulation the tempo of agricultural production. The main suppliers of money to the farmer are the money-lenders, traders and commission agents who charge high rate of interest and purchase the agricultural produce at very low price. Rural credit scenario has undergone a significant change and institutional agencies such as Central Cooperative Banks, State Cooperative Banks, Commercial Banks, Cooperative Credit Agencies and some Government Agencies are extending loans are extending loans to farmers on easy terms.

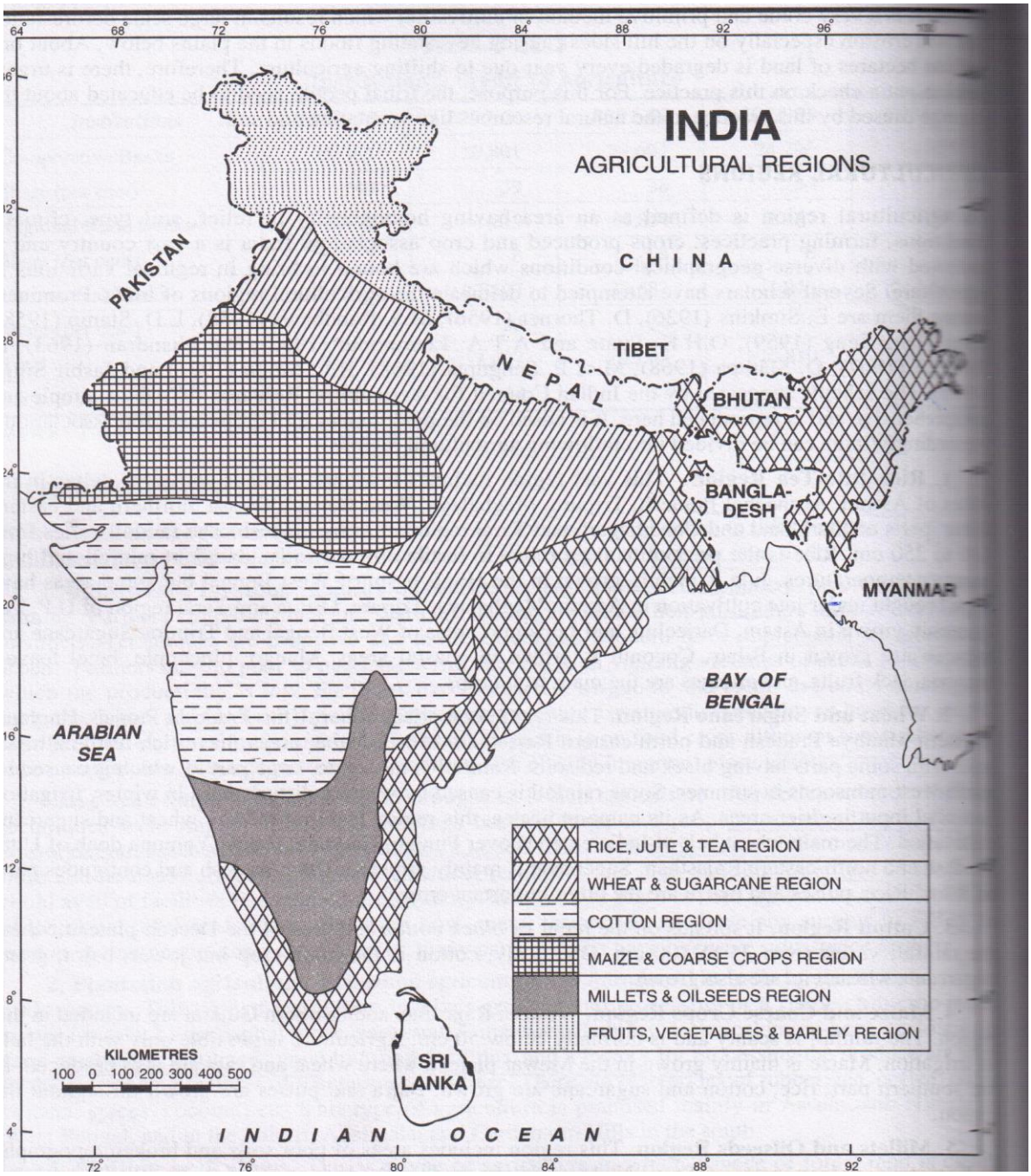
Agricultural Regions

An agricultural region is defined as an area having homogeneity in relief, soil type, climatic conditions, farming practices, crops produced and crop association. India is a vast country and is endowed with diverse geographical conditions which are bound to bring in regional variations in agriculture. India can be divided into following agricultural regions :

1. Rice-Jute-Tea Region. This vast region includes lowlands, valleys and river deltas in the states of Assam, Arunachal Pradesh, Tripura, Meghalaya, West Bengal, Orissa, northern and eastern Bihar parts of Jharkhand and Chhattisgarh and Tarai region of Uttar Pradesh. The rainfall varies from 180 to 250 cm. Rice is the predominant crop due to fertile alluvial soils, abundant rainfall and high summer temperatures. Jute is mainly grown in the Hugli basin of West Bengal but some areas have been brought under jute cultivation in Assam, Meghalaya, Tripura, Orissa and Tarai region of U.P. Tea in mainly grown in Assam, Darjeeling and Jalpaiguri areas of West Bengal and Tripura. Coconut is grown in coastal areas. Mango, Pineapple, betal leaves, bananas, jack fruits, and oranges are the main fruit crops.

2. Wheat and Sugarcane Region. This region comprises Bihar, Uttar Pradesh, Punjab, Haryana, Western Madhya Pradesh and north eastern Rajasthan. Irrigation is a vital input in drier areas. The main wheat belt of India extends over Punjab, Haryana, Ganga-Yamuna doab of Uttar Pradesh and north-eastern Rajasthan. Sugarcane is mainly grown in Uttar Pradesh and contiguous parts of Bihar. Rice, pulses and maize are the other important crops.

3. Cotton Region. It spreads on the regur or black cotton soil area of the Deccan plateau, where the rainfall varies from 75 to 100 cm. Obviously, cotton is the main crop but jowar, bajra, gram, sugarcane, wheat, etc. are also grown.



Source: D.R. Khullar

4. Maize and Coarse Crops Region. Western Rajasthan and Northern Gujarat are included in this region. Maize is mainly grown in the Mewar plateau where wheat and ragi are also produced . In the southern part, rice, cotton and sugarcane are grown. Bajra and pulses are

grown throughout the region.

5. Millets and Oilseeds Region This region includes areas of poor soils and broken topography in Karnataka plateau, parts of Tamil Nadu, southern Andhra Pradesh and eastern Kerala. The rainfall varies from 75 to 125 cm. The millets include bajra, ragi and jowar while the oilseeds grown are groundnut and caster. Pulses are also grown. Mangoes and bananas are important fruit crops.

6. Fruits and Vegetable Region This region extends from Kashmir Valley in the West to Assam in the cast. The rainfall varies from 60 cm in the west to 200 cm in the east. Apple, peach, cherries, plum, apricot are grown in the west while oranges are important in the east.

Q Explain about the Green Revolution.

Ans Green Revolution owes its origin in the findings of new dwarf variety of wheat seed by Dr. Norman earnest Borlaug. He was incharge of Wheat Development Programme in Mexico in the 1950s and was the genetic architect of the dwarf wheat. His efforts at breeding a suitable dwarf variety were crowned with success by 1951 in Mexico and that country became self sufficient in food by 1956. The term Green revolution was first used by the then Administrator of the U.S. AID, William S. Gadd on 8 March, 1968 in Washington D.C. when he addressed the society for international development on the subject Green Revolution – Accomplishments and Apprehensions.

In India, the seeds of Green Revolution were first field tested in the drought year of 1964-65. They were introduced to the Indian scientists by Dr. Borlaug in 1963. These seeds were planted in different soils in Delhi, Ludhiana, Pusa and Kanupur. The yield was over 4,000 kg per hectare which was about four times the yield of local varieties. These varieties were released for general cultivation after experimentation, multiplication and demonstrations by Indian scientists in about 100 different farmers' fields. The production of food grains in 1967-68 was 25 per cent higher than that of 1966-67. This increase was more than the increase recorded in the preceding 16 years of plan period. This unprecedented increase in production was nothing less than a revolution and it was termed as Green Revolution.

Unfortunately, Green Revolution left its impact only in Punjab, Haryana and Western U.P. in respect of wheat production and Andhra Pradesh and Tamil Nadu in respect of rice

production.

Components of The Green Revolution

Following are the 12 components of the Green Revolution :

1. High Yielding Varieties (HYV) of seeds.	2. Irrigation (a) surface and (b) ground.
3. Use of fertilizers (chemical)	4. Use of Insecticides and Pesticides.
5. Command Area Development (CAD)	6. Consolidation of holdings
7. Land reforms	8. Supply of agricultural credit
9. Rural electrification	10. Rural roads and marketing
11. Farm Mechanisation	12. Agricultural Universities

It must be notes that majority of the components do not act I isolation, rather they are closely inter-related and heavily dependent upon one another. In order to make optimum use of the farm inputs, the farmer must know the why, where, what, when and how much of each for which there is ample scope.

1. High Yielding Varieties (HYV) of seeds. According to R.N. Chopra, "The high yielding variety seeds are major input of agricultural production under the Green Revolution technology. Their main characteristic is increased responsiveness to chemical fertilizers, their period of maturing is short, it helps double cropping; their short stems can easily carry fertilizer load, resist wind damage, their large leaf surface helps the process of photosynthesis." The development of HYV seeds of wheat in 1960s and those of rice in 1969-70 laid the foundation for Green Revolution in India. The Pearson Commission Report hailed it as one of the authentic marvels of our time. Its most important effect was to be seen in the attainment of self-sufficiency in cereals, which enabled us to have a break from the ship-to-mouth situation and move forward ahead of population. The production, distribution and utilization of quality seeds has been increasing since the beginning of Green Revolution.
2. Irrigation. Irrigation is the second most important component of Green Revolution technology after HYV seeds. Indian rainfall being unreliable, irregular and seasonal, there is urgent need to expand irrigation potential to meet the requirements of the Green Revolution strategy. The ground water gives the advantage of push-button irrigation, made possible by a pumpset or a tube well and is completely under farmer's own control. There is serious threat of depletion of ground water due to over-exploitation when the rate of drawal of ground water is higher than the rate at which it is replenished.
3. Use of Fertilizers (Chemical). The use of chemical fertilizers has been the third most important input of Green Revolution after HYV seeds and irrigation. Generally the use of chemical fertilizers is made according to the soil properties. Soil testing is very essential to know the nutrient status of the soil. As a normal practice, it is suggested that NPK

(Nitrogen, Phosphorus, Potasium) should be used in the ratio of 4 : 2 : 1 but it depends upon the quality and requirement of the soil and differs from place to place. To encourage balanced fertilizer use and make fertilizers available to farmers at affordable prices, the Central Government determines and notifies the selling price of urea as well as decontrolled P&K fertilizers. Although the use of fertilizers has considerably increased over the years, this increase is more prominent in areas where Green Revolution has shown its impact. The regional variations come in sharp focus when we look at the per hectare consumption of fertilizers. The national average consumption was 89.8 kg per hectare in 2003-04. Majority of the states have consumption much below this average. In spite of the fact that India is the fourth largest consumer of chemical fertilizers in the world, after the USA, Russia and China, per hectare consumption still remains low compared to the world averages. This means that there is still large scope for using chemical fertilizers, increasing the yields and converting the dreams of Green Revolution into reality.

4. Use of Insecticides and Pesticides. Though intensive use of irrigation and fertilizers under the Green Revolution technology has increased the farm production, it has also given birth to the problem of pests, insects, weeds, rodents, etc. The monoculture promoted by the Green Revolution technology is more vulnerable to the insects and pests. These pests, weeds and diseases are to be checked by proper doses of insecticides, pesticides and weedicides. Pest surveillance should be an integral part of crop production. The first disease surveillance in this country related to wheat diseases in 1966-67 followed by ad hoc rice survey and surveillance of pests and disease in 1970, 71 and 72. The regional distribution makes it clear that areas with Green Revolution technology are the main consumes of pesticides. For example, Punjab, Haryana, Andhra Pradesh and Tamil Nadu consumed over 55 per cent of the country's pesticides in 2003-04.
5. Command Area Development (CAD) Command Area Development Programme is a centrally sponsored scheme which was launched in January 1975. Its aim was to bridge the gap between potential created and utilized in selected major/medium irrigation projects of the country for optimising agricultural production from the irrigated land. The programme covers the following components : (i) On-farm development (OFD) (ii) Selection and introduction of suitable cropping pattern. (iii) Development of groundwater to supplement surface water. (iv) Development and maintenance of the main and intermediate drainage system. (v) Modernisation, maintenance and efficient operation of the irrigation system upon the outlet of one cusec capacity. The programme would cover 133 project commands with total culturable command area of 1.7 million hectares. The work is already in progress.
6. Consolidation of Holdings. Small and fragmented land holdings have been one of the main obstacles in the progress of agriculture in India. Consolidation of holdings has been introduced to solve this problem.
7. Land Reforms. Immediately after the Independence, it was felt that land reforms must be brought in to improve the agricultural situation in the country. In 1947 half of India was under Zamindari system in which 80 per cent of theland was in the hands of the absentee landlords. Raitwari system prevailed in Madras, Bombay, Assam and Punjab. Mahotwari

was another system in which a chosen peasant (Lambardar) was responsible for depositing the rent varying from 40 to 70 per cent of the produce. These systems were to be abolished in the interest of better agricultural performance. After obtaining the ownership rights, farmers worked whole-heartedly on their farms and this led to a tremendous increase in agricultural production.

8. Supply of Agricultural Credit. A large percentage of Indian farming community consists of small and marginal farmers who do not have their own resource to invest in agriculture. They depend upon agricultural credit to carry on most of their agricultural operations. Now Cooperatives, Commercial Banks and Regional Rural Banks extend loans to farmers on easy terms.
9. Rural Electrification. Rural electrification is one of the essential inputs in modern agricultural system. It is a cheap source of energy which can be used for lifting water by tubewells/pumpsets, processing and preserving agricultural produce, sprinkler irrigation and so many other farm operations. The development of ground water, so vital for Green Revolution, requires uninterrupted supply of electricity at cheaper rates. Haryana was the first state to electrify all its 6759 villages in 1970. Punjab, Kerala, Andhra Pradesh, Karnataka, Gujarat, Himachal Pradesh, Tamil Nadu, J and K, Maharashtra and Nagaland have 97 to 100 per cent villages electrified.
10. Rural Roads and Marketing. Rural roads are very essential for connecting the villages to the neighbouring markets and villages. Unfortunately, there is still a big gap between the requirement and availability of village roads. Road network upto town level is fairly satisfactory. The weakest point is that of rural roads. Marketing is essential for progressive agriculture. Regulated markets enable the farmer to sell his agricultural produce and to purchase farm implements and tools, fertilizers, pesticides and other agricultural inputs as well as goods of every day use. In the words of Leo E. Holman, "Marketing is the part and parcel of a modern productive process, the part of the end that gives point and purpose to all that had gone before. Benefits from mechanization can be minimized if corresponding improvements are not made in the marketing system."
11. 11. Farm Mechanisation. Much success of The Green Revolution depends upon farm mechanization. Mechanisation saves a lot of human labour and quickens the farm operations, thereby adding to the farm efficiency and productivity.
12. Agricultural Universities. Agricultural universities and other agricultural institutes are primarily engaged in agricultural research and passing on the research findings to the farmers. A good deal of research and extension work done by these universities has paid rich dividends in the agricultural field. Success of Green Revolution largely depends upon the work done by these universities. Punjab, Haryana and Uttar Pradesh, are the best examples of such a progress.

Production, Imports and Consumption of Fertilizers ('000 tonnes of nutrients)

Year	Nitrogenous fertilizers (N)			Phosphate fertilizers (P)			Potassic fertilizers (K)			All fertilizers (NPK)		
	Production	Imports	Consumption	Production	Imports	Consumption	Production	Imports	Consumption	Production	Imports	Consumption
1960-61	98	399	210	52	—	53	—	20	29	150	419	292
1970-71	830	477	1487	229	32	462	—	120	228	1059	629	2177
1980-81	2164	1510	3678	841	452	1214	—	797	624	3005	2759	6516
1990-91	6993	414	7997	2052	1311	3221	—	1328	1328	9045	2758	12546
2000-01	11004	154	10920	3748	396	4215	—	1541	1567	14752	2090	16702
2001-02	10771	269	11310	3861	429	4382	—	1701	1667	14632	2399	17360
2002-03	10562	67	10474	3906	170	4019	—	1520	1601	14468	1757	16094
2003-04	10634	132	11076	3631	338	4124	—	1548	1598	14265	2018	16798

Source : The Economic Survey, 2004-05, p. 5.24.

Subsidy on fertilizers (Rs. crore)

Year	Imported Urea	Domestic Urea	Decontrolled P&K Fertilizers	Total
1960-61	—	—	—	—
1970-71	—	—	—	—
1980-81	335	170	—	505
1990-91	659	3,730	—	4,389
2000-01	1	9,480	4,319	13,800
2001-02	47	8,044	4,504	12,595
2002-03	0	7,790	3,224	11,014
2003-04	0	8,521	3,326	11,847

Source : The Economid Survey, 2004-05, p. 183.

Kilograms per hectare Consumption of NPK Fertilizers (Based on 2000-01 Provisional Gross Cropped Area)

Sl. No.	State/Union Territory	2003-04	2002-03
1.	Andhra Pradesh	136.8	123.5
2.	Karnataka	74.9	89.5
3.	Kerala	63.6	67.7
4.	Tamil Nadu	112.5	117.2
5.	Gujarat	95.1	73.8
6.	Madhya Pradesh	55.0	39.4
7.	Chhattisgarh	46.5	47
8.	Maharashtra	65.7	75.3
9.	Rajasthan	40.5	28.6
10.	Haryana	167.1	150.4
11.	Himachal Pradesh	49.4	41.9
12.	Jammu & Kashmir	71.4	58.1
13.	Punjab	184.1	172
14.	Uttar Pradesh+	126.7	124.6
15.	Bihar++	80.5	86.5
16.	Orissa	41.4	36.9
17.	West Bengal	122.4	128
18.	Arunachal Pradesh	2.8	2.8
19.	Assam	46.6	43
20.	Tripura	29.4	21.6
21.	Manipur	130.5	128.7
22.	Meghalaya	17.0	16.1
23.	Nagaland	2.2	1.7
24.	Mizoram	0.0*	19.9
25.	Sikkim	3.5	9.9
	All India	**89.8**	**86.0**

+ Includes Uttaranchal. ++Includes Jharkhand.
*non-response
Source : The Ecoinomic Survey, 2004-05, p. 182.

Impact of Green Revolution

1. Increase in Agricultural Production. The introduction of Green revolution in 1967-68 has resulted in phenomenal increase in the production of agricultural crops especially in food grains. The production of wheat increased by more than three times between 1967-68 and 2003-04 while the overall increase in the production of cereals was only two times. On account of this reason, it is said that the Green Revolution in India is largely the Wheat Revolution.
2. Prosperity of Farmers. With the increase in farm production the earnings of the farmers also increased and they became prosperous. This has, especially, bee the case with big farmers having more than 10 hectares of land.
3. Reduction in import of food grains. The main benefit of Green Revolution was the increase in the production of food grains, as a result of which there was a drastic reduction in their imports. We are now self sufficient in food grains and have sufficient stock in the central pool. Sometimes we are in a position to export food grains.
4. Capitalistic Farming. Big farmers having more than 10 hectares of land have tended to get the maximum benefit from Green Revolution technology by investing large amount of money in various inputs like HYV seeds, fertilizers, machines, etc. This has encouraged capitalistic farming.
5. Ploughing back of profit. The introduction of Green Revolution helped the farmers in raising their level of income. Wiser farmers ploughed back their surplus income for improving agricultural productivity. This led to further improvement in agriculture. According to a study conducted by Punjab Agriculture University, Ludhiana farmers plough back about 55 percent of their income for agricultural progress.
6. Industrial Growth. Green Revolution brought about large scale farm mechanization which created demand for different types of machines like tractors, harvestors, threshers, combines, diesel engines, electric motors, pumping sets, etc. Besides, demand for chemical fertilizers, pesticides, insecticides, weedicides, etc. also increased considerably. Consequently, industries producing these items progressed by leaps and bounds.
7. Rural Empployment. While on one hand, large scale unemployment was feared due to mechanization of farming with the introduction of Green Revolution technology in India, there was an appreciable increase in the demand for labour force due to multiple cropping and use of fertilizers. The drive towards mechanization was caused mainly by the scarcity of labour and relatively high wage rate especially during peak agricultural operations. During the last few years, a large number of farm labours have migrated from Bihar and eastern Uttar Pradesh to Punjab where they find better opportunities of earning a livehood.
8. Change in the Attitude of Farmers. The Indian farmer had remained illiterate, backward and traditional and had been using conventional methods of cultivation since the early times. But Green Revolution has brought about a basic change in his attitude towards farming. The way he has readily adopted the Green Revolution technology has exploded the myth that the Indian farmer is basically tradition bound and does not use new methods and techniques.

Demerits OR Problems of Green Revolution

Green Revolution is a unique event in the agricultural history y of Independent India. This has saved us from the disasters of hunger and starvation and made our peasants more confident than ever before. But it has its own inherent deficiency segments. The fatigue of the Green Revolution is already visible. Still the main lacuna in the Green Revolution is that up till now it is an unfinished task. Some of the demerits or problems of Green Revolution are briefly discussed as under.

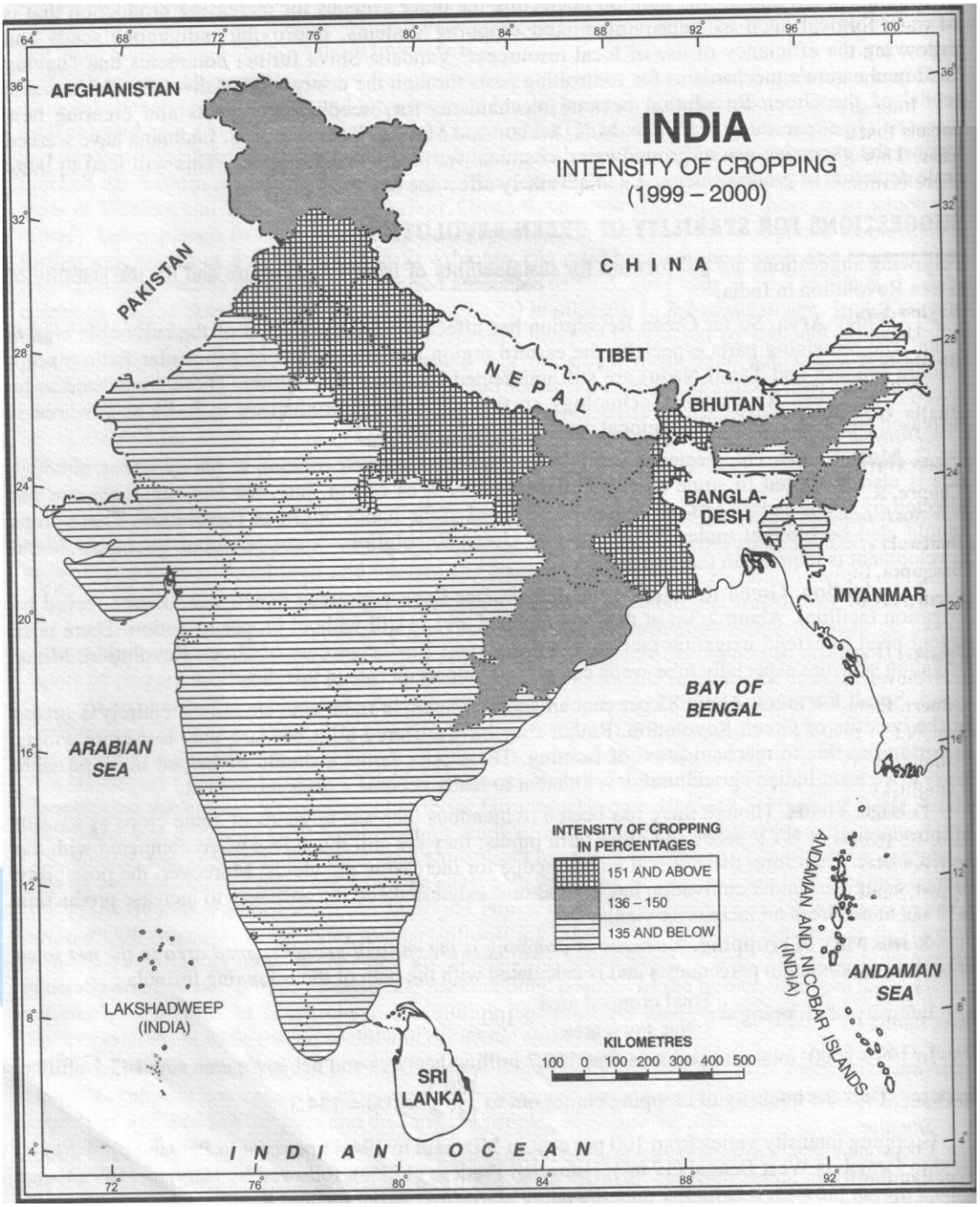
1. Inter-Crop Imbalances. The effect of Green Revolution is primarily felt on foodgrains. Although all foodgrains including wheat, rice, jower, bajra and maize have gained from the Green Revolution, it is wheat which has benefited the most. Major commercial crops like cotton, jute, tea and sugarcane are also almost untouched by the Green Revolution. The rate of growth in production of pulses has declined from 1.39 per cent per annum in the pre-Green Revolution period to only 0.79 per cent per annum during the period from 1967-68 to 1994-95. This is not good for a balanced growth of Indian agriculture. Central Government has taken some steps to remove these imbalances.
2. Regional Disparities. Green Revolution technology has given birth to growing disparities in economic development at inter and inter regional levels. The most affected areas are Punjab, Haryana and western Uttar Pradesh in the north and Andhra Pradesh and Tamil Nadu in the south. In short, Green Revolution affected only those areas which were already better placed from agricultural point of view. Thus the problem of regional disparities has further aggravated as a result of Green Revolution. Regional disparities in crop yields can be reduced by evolving suitable disease resistant high-yield strains of paddy for most eastern parts and by developing irrigation facilities and a suitable dry farming technology for the arid and semi-arid western and southern regions.
3. Increase in Inter-Personal Inequalities. It has been observed that it is the big farmer having 10 hectares or more land, who is benefited the most from Green Revolution because he has the financial resources to purchase farm implements, better seeds, fertilizers and can arrange for regular supply of irrigation water to the crops. As against this, the small and marginal farmers do not have the financial resources to purchase these farm inputs and are deprived of the benefits of Green Revolution Technology. Green Revolution has made the rich richer and rendered the poor poorer resulting in wide-spread social and economic tensions.
4. Unemployment. Except in Punjab, and to some extent in Haryana, farm mechanization under Green Revolution has created widespread unemployment among agricultural labourers in the rural poorer resulting in wide-spread social and economic tensions.
5. Other Problems. Agricultural under Green Revolution has not grown at a rate which was expected in the beginning. The differential rates of growth of different crops and their regional variations have already been discussed. Some scholars have expressed serious doubts about the capability of HYV seeds itself. Analysing the role played by miracle seeds in the Green Revolution, Vandana Shiva says that the term HYV is a misnomer. In actuality, these seeds are highly responsive to certain key inputs such as fertilizer and

irrigation and as such they should have been called highly responsive varieties. In a case study of Punjab, M.K. Sekhon and Manjeet Kaur of P.A.U. Ludhiana have warned against the excessive use of groundwater, chemical fertilizers and pesticides. This will lead to large scale depletion of groundwater and will adversely affect the health of soil.

Suggestions for stability of Green Revolution

Following suggestions are put forward for sustainability of Indian Agriculture and for the stability of Green Revolution in India.

1. Wider Area. So far Green Revolution has affected only 40 per cent of the culturable area in India. The remaining parts especially the eastern region and larger parts of peninsular India (except Andhra Pradesh and Tamil Nadu) are still unaffected by Green Revolution. These areas need to be covered by Green Revolution Technology so that agricultural production in India as a whole is increased and at the same time regional disparities are removed.
2. More Crops. The greatest benefit drawn from the Green Revolution is that by wheat, although rice is also benefited to some extent. Other crops such as cotton, jute, tea and sugarcane are not affected by it and pulses and oilseeds have suffered at the hands of Green Revolution. These crops should also be brought under the canvass of Green Revolution. A greater input for research and development is required in this connection.


INDIA
INTENSITY OF CROPPING
(1999 – 2000)
AFGHANISTAN
PAKISTAN
CHINA
TIBET
NEPAL
BHUTAN
BANGLA-
DESH
MYANMAR
BAY OF
BENGAL
ARABIAN
SEA
ANDAMAN
SEA
ANDAMAN AND NICOBAR ISLANDS
(INDIA)
LAKSHADWEEP
(INDIA)
SRI
LANKA
INDIAN OCEAN
INTENSITY OF CROPPING
IN PERCENTAGES
151 AND ABOVE
136 – 150
135 AND BELOW
KILOMETRES
100 0 100 200 300 400 500

3. Irrigation. Green Revolution has left greater impact in areas which were better served by irrigation facilities. About 2/3rd of the total cropped area is still without proper irrigation. There is an urgent need to extend irrigation facilities to these areas for the success of Green Revolution. Minor irrigation schemes especially tube-wells can play an important role in this direction.
4. Small Farmers. About 85 per cent are small farmers in India who are almost entirely deprived of the benefits of Green Revolution. Rather they have suffered a lot because they lost employment opportunities due to mechanization of farming. These poor farmers should be helped in all possible ways if we want Indian agricultural development to really become a mass movement.
5. High Yields. Though there has been a tremendous increase in yields of some crops as a result of introduction of HYV seeds and other farm inputs; they are still much less when compared with the world's best. Therefore, there is still large scope for increasing the yields. Moreover, the possibility of increasing area under cultivation has been almost exhausted and the only way to increase production is to lay more stress on increasing yields.
6. Intensity of cropping. Intensity of cropping is the ratio of gross cropped area to the net sown area. It is expressed in percentages and is calculated with the help of the following formula :

   Intensity of cropping = Total cropped area / Net sown area X100

   In 1999-2000, total cropped area was 189.7 million hectares and net sown area was 142.2 million hectares. Thus the intensity of cropping comes out to 189.7 / 141.2 X 100 = 134.3.

Chapter 8
Industry

Q.1 Explain the iron and steel industry on India.

Ans We live essentially in an age of iron and steel. Its hardness, strength and durability, iron is the most important and widely used metal in the service of man. Most of the subsidiary industries such as automobiles, locomotives, rail tracks, ship building, machine building, bridges, dams and a host of other industrial and commercial activities depend upon iron and steel industry. The real beginning of modern iron and steel industry was made in 1907 only when Tata Iron and Steel Company (TISCO) was set up at Jamshedpur. The development of iron and steel industry was envisaged during the first Five-year Plan, but it was during the Second Five-year plan, that the three integrated steel projects were started at Bhilai, Rourkela and Durgapur.

Steel Authority of India (SAIL) Established in 1973, SAIL is a government undertaking and is responsible for the management of steel plants at Bhilai, Durgapur, Rourkela, Bokaro and Burnpur and also the Alloy Steel Plant at Durgapur and Salem Steel Plant. Visweswarya Iron and Steel Limited was also taken over by SAIL in August 1989.

Locational Factors

Iron and steel industry uses large quantities of heavy and weight losing raw materials and its localization is primarily controlled by the availability of raw materials. Coal and iron ore are the two basic raw materials used by iron and steel industry and on the basis of minimum transportation cost most of the steel plants are located at three distinct places viz. (i) near coal fields, (ii) near iron ore mining centers and (iii) at places between areas of coal and iron ore production. Most of the iron and steel plants of India such as Jamshedpur, Burnpur, Durgapur, Rourkela, Bhilai and Bokaro are located in Jharkhand, West Bengal, Orissa and Chhattisgarh. The other raw materials used in this industry are manganese, limestone, dolomite, chromite, silica, etc.

Steel products of an integrated steel plant are quite bulky and it has been estimated that the transport cost per tonne-kilometre of steel product is about three times more than that of coal or iron ore. Thus, following the theory of minimum transportation cost many centres of iron and steel production tend to be attracted by market. The use of scrap as raw material on a large scale is yet to pick up in India. The geographical coincidence of any

two of the three factors would easily determine the site of the steel plant's.

Large Integrated Iron and Steel Plants

1. Tata Iron and Steel Company (TISCO). This is the oldest iron and steel centre of India. It was established in 1907 by Jamshed ji Tata at Sakchi in Singhbhum district of Jharkhand. Currently it produces about 3 million tonnes of saleable steel. Following facilities are available to this centre.

1. Coal is available from Jharia and Raniganj coal mines located 160 to 200 km from Jamsged ji Tata.
2. Manganese comes from Joda mines of Kendujhar district in Orissa.
3. Sufficient water for cooling purpose is obtained from Subarnrekha river.
4. Jamshedpur is well connected with Kolkata, Mumbai and Chennai by road and rail and enjoys good transport facilities.
5. Densely populated regions of Jharkhand, Bihar and Orissa provide cheap labour.

Dubari Steelworks. TISCO to locate a second steelworks at Gopalpur in Orissa, about 170 kms south-east of Bhubaneshwar. The favourable factors are coastal location, proximity to a rich iron ore belt, availability of sparcely settled land for the project, a nearby source of fresh water in the form of a rivulet. Consequently the Tata Steel decided to build a six million tonne plant at Duburi. The project is a part of Tata Steel's plan to reach 15 million tonne capacity by 2010.

2. Indian Iron and Steel Company (IISCO). Three plants at Kulti, Hirapur and Burnpur in West Bengal were set up in 1864, 1908 and 1937 respectively. These plants have been merged together and are known as Indian Iron and Steel company (IISCO). The three plants are linked by Kolkata-Asansol railway line. IISCO enjoys the following advantages :

(i) Iron ore is available from Guna mines in Singhbhum.

(ii) It used to receive coal from Jharia.

(iii) Dolomite and limestone are obtained from Sundargarh.

(iv) Cheap labour is readily available from the neighbouring areas. Currently it produces over 4 lakh tonnes of pig iron.

3. The Visweswaraya Iron and Steel Ltd. It was established as Mysore Iron and Steel company (MISCO) in 1923. This plant was brought under state control in 1962 and was renamed as Visveswaraya Iron and Steel Ltd. This centre enjoys the following advantages.

(i) Bhadravati valley is 13 km wide as a result of which enough land is available.

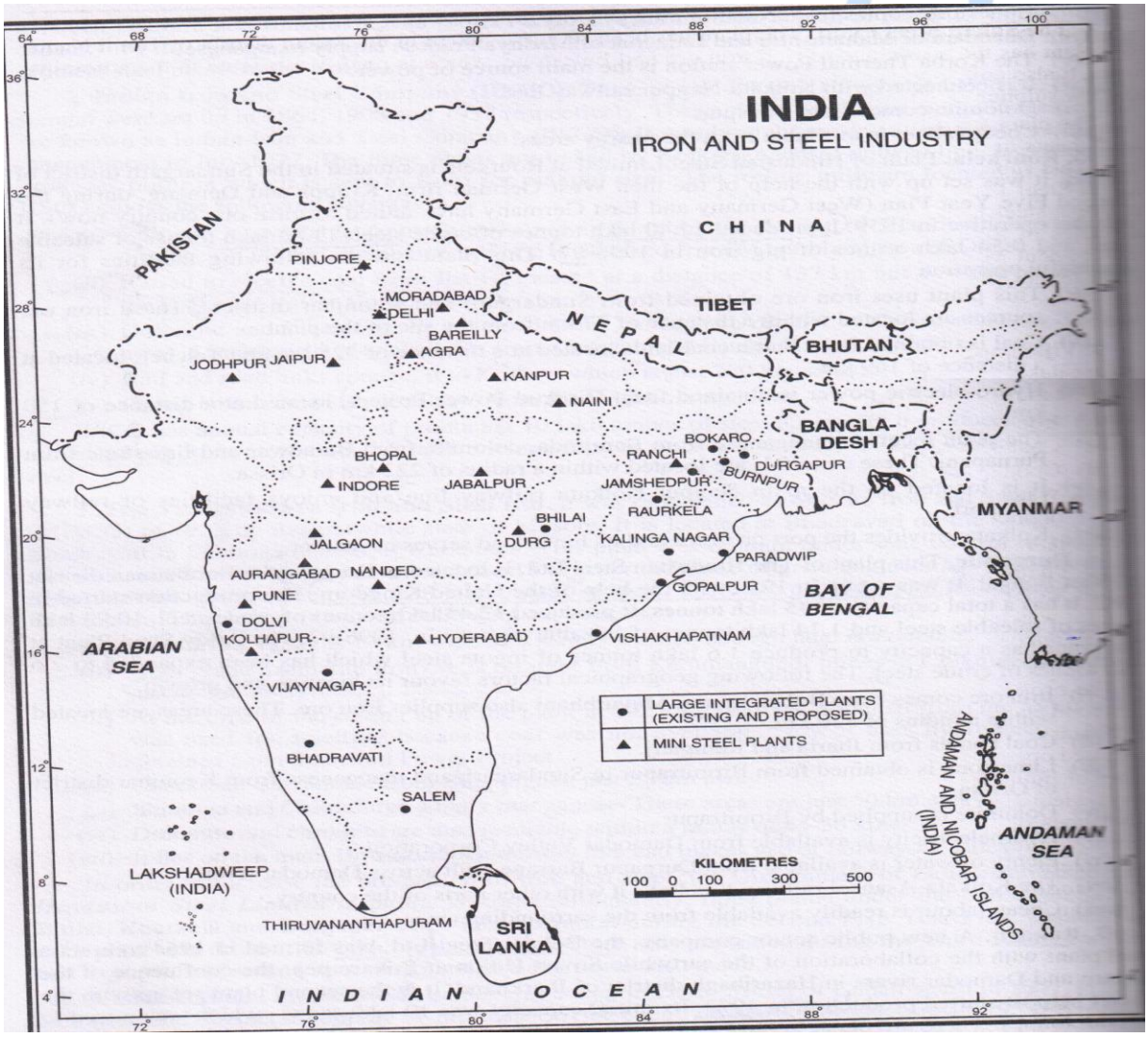
(ii) High grade haematite iron ore is brought form Kemmangundi mines in Chikmaglur.

(iii) Limestone is available from Bhundiguda just 25 km away.

(iv) Shimoga and Chitradurga supply manganese.

(v) Dolomite and Chromite are also available within a radius of 45-50 km.

The Hindustan Steel Limited in public sector consequently, three plants under the public sector, i.e. Bhilai, Rourkela and Durgapur came into operation during the Second Five year Plan.



Source: D.R. Khullar

4. Bhilai. Bhilai iron and steel centre was set up in Durg District of Chhattisgarh in 1957. This plant produced 41.87 lakh tonnes of crude steel, 38.32 lakh tonnes of saleable steel and 2.43 lakh tonnes of pig iron in 1996-97. It enjoys following geographical advantages

(i) It procures rich haematite iron ore from Dalli-Rajhara range.

(ii) Coal is obtained from Korba and Kargali fields of Chhattisgarh.

(iii) Limestone comes from Nandini mines.

(iv) The Korba Thermal power station is the main source of power.

(v) It is connected with Kolkata-Nagpur railway line.

(vi) Cheap labour is available from the nearby areas.

5. Rourkela. Plant of Hindustan steel ltd at Rourkela is situated in the Sundargarh district of Orissa. It produced 12.40 lakh tonnes of crude steel, 11.80 lakh tonnes of saleable steel and 0.54 lakh tonnes of pig iron in 1996-97. This plant has the following facilities for its successful operation:

(i) This plant uses iron ore obtained from Sundargarh and Keonjhar districts.

(ii) Coal is obtained from Jharia coalfields.

(iii) Hydro-electric power is obtained from Hirakud Power Project.

(iv) The plant receives manganese from Barajmda, dolomite from Baradwar and limestone from Purnapani.

(v) It is located on the main Nagpur-Kolkata railway line.

(vi) Kolkata provides the port facilities and its hinterland serves as market.

6. Durgapur. This plant of The Hindustan Steel ltd. is located at Durgapur. It was set up in 1959 with the help of the United Kingdom. The Alloy Steel plant at Durgapur has a capacity to produce 1.6 lakh tonnes of ingots steel which has been expanded to 2.6 lakh tonnes of crude steel. The following geographical factors are favorable for its location and growth.

(i) Iron ore comes from Bolani mines.

(ii) Coal comes from Jharia and Raniganj.

(iii) Limestone is obtained from Birmitrapur in Sundargarh.

(iv) Dolomite is supplied by Birmitrapur.

(v) Hydroelectricity is available from Damodar Valley Corporation.

(vi) The Kolkata-Asansol railway line links it with other parts of the country.

(vii) Cheap labour is readily available from the surrounding areas.

7. Bokaro. The Bokaro Steel Ltd. Started production in 1972. It is the second plant set up with the Soviet help. It produced 36.44 lakh tonnes of crude steel, 30.46 lakh tonnes of saleable steel and 2.6 lakh tonnes of pig iron in 1996-97. This achievement has been made possible due to following few geographical factors :

(i) It receives iron ore from Kiriburu mine in Orissa.

(ii) Coal is obtained from Jharia coalfields located at a distance of 65 km.

(iii) Limestone comes from Palamu district of Jharkhand.

(iv) Hydroelectricity is obtained from Damodar Valley Corporation.

(v) Kolkata is just 300 km from here and provides port facilities.

8. The Salem Steel Plant. The plant has been set up at Salem. The plant has the advantage of rich iron ore and limestone. The iron ore available here has low sulphur and phosphorus content and is suitable for producing special grade iron and steel.

Today the Salem Steel Plant is a major producer of world class stainless steel and is in a position to export stainless steel to some of the advanced countries such as the USA, Mexico, Australia and some countries of South-East Asia. This plant produced 48 thousands tonnes of saleable steel in 1995-96.

9. Vishakhapatnam Steel Plant (VSP). This integrated steel plant has a unique location on the sea port. In fact, it is the first shore based steel plant in the country. The project has been completed in two stages: the first stage was completed by March 1992 and the second and final stage by July 1992. This is the most sophisticated modern integrated steel plant in the country. It exported 10.23 lakh tonnes of iron and steel worth Rs. 702 crore, mainly to China and South-east Asian countries. Presently it is the second largest producer of iron and steel in the country and the present annual capacity of three million tonnes of liquid steel can be raised to 5 million by 2006-07 and to 10 million tonnes by 2010. The natural gas requirement is placed at one billion cubic metres (BCM) a year and negotiations are in progress with the Reliance Group in this connection. The plant has the following advantages:

(i) The coastal location facilitates import of coal and export of iron and steel.

(ii) It is well connected to coal fields of Damodar valley in Jharkhand.

(vii) High quality rich iron ore deposits are available in the Bailadila area of Chhatisgarh.

(viii) Most of the requirements of limestone, dolomite and manganese are met by suppliers from Chhattisgarh: Madhya Pradesh and Orissa.

Problems of Indian Iron and Steel Industry

1. Capital: Iron and steel industry requires large capital investment which a developing country like India cannot afford. Many of the public sector integrated steel plants have been established with the help of foreign aid.

2. Lack of Technology: Throughout the 1960s and up to the oil crisis in mid-1970s,

Indian steel industry was characterized by a high degree of technological efficiency. This technology was mainly from abroad. But during the following two decades after the oil crisis, steep hike in energy costs and escalation of costs of other inputs, reduced the margin of profit of the steel plants. This resulted in lower levels of investment in technological developments. Consequently, the industry lost its technology edge and is now way behi9nd the advanced countries in this regard. Material value productivity in India is still very low. In Japan and Korea, less than 1.1 tonnes (and in several developed countries 1.05 tonnes) of crude steel is required to produce a tonne of saleable steel. In India, the average is still high at 1.2 tonnes. Improvement in the yield at each stage of production, particularly for value added products will be more important in the coming years.

3. Low productivity. The per capita labour productivity in India is at 90-100 tonnes which is one of the lowest in the world. The labour productivity in Japan, Korea and some other major steel producing countries is about 600-700 tonnes per man per year. At Gallatin steel a mini mill in the U. S. there are less than 300 employees to produce 1.2 million tonnes of hot rolled coils. A comparable facility in India employs 5,000 workers. Therefore, there is an urgent need to increase the productivity which requires retraining and redevelopment of the labour force.

4. Inefficiency of public sector units. Most of the public sector units are plagued by inefficiency caused by heavy investment on social overheads, poor labour relations, inefficient management, underutilization of capacity, etc. This hinders proper functioning of the steel plants and results in heavy losses.

5. Low potential utilization. The potential utilization in iron and steel is very low. Rarely the potential utilization exceeds 80 per cent. For example, Durgapur steel plant utilizes only 50 per cent of its potential. This is caused by several factors, like strikes, lockouts, scarcity of raw materials, energy crisis, inefficient administration, etc.

6. Heavy Demand. Even at low per capita consumption rate, demand for iron and steel is increasing with each passing day and large quantities of iron and steel are to be imported for meeting the demands. Production has to be increased to save precious foreign exchange.

7. Shortage of metallurgical coal. Although India has huge deposits of high grade iron ore, her coal reserves, especially high grade cooking coal for smelting iron are limited. Many steel plants are forced to import metallurgical coal. For example, steel plant at Vishakhapatnam has to import coal from Australia. Serious thought is now being given to replace imported coal by natural gas from Krishna-Godavari basin.

8. Inferior quality of products. Lack of modern technological and capital inputs and weak infrastructural facilities leads to a process of steel making which is more time

consuming, expensive and yields inferior variety of goods. Such a situation forces us to import better quality steel from abroad. Thus there is urgent need to improve the situation and take the country out of desperate position.

Chapter 9
Resources

Q.1 Explain the meaning of resources and its classification.

Ans: Man lives in close relationship with his environment and be continues to interact with it all through his life. He, in a way, is himself a constituent of his environment. Man finds his environment in a dynamic form. It is not a static thing. It is a functional entity with which he continues to live and finds meaning to his life. Environment appears to him in two ways – (i) Natural (ii) Human. Both aspects present challenges and also a means to realize his wishes.

The Natural Environment. It constitutes Atmosphere, Hydrosphere, Lithosphere and Biosphere. This environment gives him food to eat, water to drink, air to breathe, house to live and material both living and non-living, to translate his wishes into reality. The Human Environment. It includes all human beings in their various groups. The human society which spreads far and wide on this earth sometimes puts hindrances in the realization of his urges and sometimes cooperates in his various endeavors.

There are certain objectives of culture which make his life worth-living and provide the basis to live and make his life rich. The following are the four main objectives:

1. To provide basic needs. Man makes all possible efforts to provide a continuous supply of his basic needs in respect of food, water and accommodation to live and work.
2. To provide for comforts. Man not only wants to provide for his basic needs alone but also seeks to acquire comforts in their various forms.
3. To search for values of life. Man differs from animals in the sense that man conceives certain values of life for which he makes efforts. He lives and dies for them.
4. To make efforts for human survival. Man in the quest for satisfying his needs and aspirations sometimes conspires to destroy a part of humanity but he knows that his own survival depends upon survival of the human society.

It is, therefore, clear that man in order to realize his objectives makes two pronged efforts – (i) to change the material into new forms and (ii) to make changes in his techniques, processes and desires. Hence the natural and human elements whom man changes in order to fulfill his desires are called Resources.

Examples, Man used forests as resources in the beginning for getting their fruits for food, their branches and stems as fuel and later for house building and as weapons for killing animals and his enemies. As new wishes went on generating in the mind, man converted the wood into furniture, objects of art, paper and synthetic clothes and into thousands of things as technology developed. As there is no end of wishes, there is no end of processes and hence no end of resources.

Definition of Resources

(i) Based on Origin of the word. The meaning of the word 'Resources' gives some insight to the idea of resource. Resource = Re + Source i.e., Source – the place from which some things comes and Re mans again,.

(ii) Based on Dictionary Meaning. The dictionary meanings of resource are (a) that which can be depended upon for supply.

It means that Resource is that which is helpful to satisfy certain, wants, useful for utility and which can be depended upon in difficulties.

(iii) Based on Ordinary Understanding. 'Resources is that material substance which is used for fulfilling the wants of man.'

(iv) Based on Comprehensive Understanding. Only tangible resources like coal, petroleum, soils, etc. are not the only ones which fulfill the desires of man. Mental abilities, experience, technical excellence, human ingenuity, initiatives etc. are certain intangible resources which usually prove more useful than tangible resources.

(v) Based on Statical Concepts. Some people have a statical concept regarding resources. It means that man makes use of the resources and if a certain resource can't be used, it goes out of the meaning of resources. Machines produced from steel, paper produced from wood, cloth produced from cotton, etc, are all resources. However, this concept of resources is static but the resources are not static. Their use changes according to man's ingenuity.

(vi) Based on 'Dynamic Concept'. This concept regards the natural substances as neutral stuff i.e., certain substances neither put obstacle to man's desire for change nor positively help the man. It is the culture of man that decides if a particular thing or the natural stuff will resist human utilization or become a

resource. Petrol provides a good example. Cars, trucks, aeroplanes, etc. are dependent upon petroleum. Besides, a large number of chemicals are produced from petroleum. This led Zimmermann to say – 'Man is the mother of all resources.'

Peach and Constantine defined resources as below:

" Resources are not, they become, Resource are living phenomena, expanding and contracting in response to human efforts and behaviour….to a large extent they are man's own creation."

In other words, the substances of our environment are neither obstacles nor resources. These are all neutral stuff. If man is able to utlize them, they become resources. In fact resources are what are able to make of them.

Examples. Brazil is the home of rubber. It grows in its natural environment in the Amazon basin. It was a neutral stuff but when the Americans found out that it can be used to make tyres for automobiles, the neutral stuff turned into a much sought-after resource material. Chemists found out a chemical method to produce rubber in factories from petroleum. The importance of plant-rubber as a resource decreased. As petroleum became costly because of Arab countries using it as a political weapon, the importance of plant rubber as a resource again became important. 'Resources are not things but functions or operations with which man fulfils his desires.

(vii) Based on Zimmermann's definition. He says-'Resources are in reality the expression of human appraisal. It is not necessary that the resources exist outside of man; they also exist in his mind and its function. For Example, the water-falls had existed for millions of years and man looked at them with awe and reverence. When man devised a technique for converting the energy of water-falls into electricity, he really converted them into useful resources.

(viii) Based on Cook' definition. Cook is of the view that resources are not static or fixed entities. He believes in human concepts which see natural objects into new forms of greater or different uses to human beings. He is very repressive when he says that 'Resources are not, they become.'

Characteristics of Resources

The resources have certain characteristics which distinguish them from the natural substances.

1. The main Bases. Our environment is the main base of the resources. It is from it that we procure metal ores, soils, forests, animals, etc. and use them according to

our desires. Those countries which are poor from this aspect remain backward. The 'neutral stuff' has to be there for conversion into resources.

2. Human desires, techniques and the abilities to Procure. China had a lot of neutral stuff but remained resourceless because the abilities to think and capacity to create resources were almost non existent. Japan did not have even neutral stuff in the traditional sense but the human ingenuity and the capacity to work made it import-material from other countries and changed them into new resources.
3. The dynamic nature of Resources. The resources are not static i.e., no substance is incapable of becoming a resource. The plant of quinine was considered to be of no significance but the moment scientists found out that its extract cures malaria, it immediately became a resource.
4. Product of Culture. Man is a thinking animal. He goes on creating new desires and makes efforts to fulfil. The changes that he brings about in transforming substances and ideas are called culture. The resources are, therefore, the product of culture and bear their impress on them.
5. Man-The Greatest Resource. In fact it is the man who is the greatest resource. It is in his mind that new resources take birth. It is the human ability to innovate and make improvement in manipulating things that resources are created. Without man, this world would have remain neutral and of no value.
6. The Trinity of Resources. The trinity of Resources is Man-the creator, nature the thing on which man works the intraction between man and nature.
7. The Interdependence of Nature, Man and Culture. Man is really free in his flight of imagination but when it comes to practically translating his desires into reality he finds himself working within the parameters of nature. His culture is mainly adaptive as he has to overcome the resistance. Zimmermann has very aptly expressed this relationship.

Classification of Resources

Resources have bee categorized depending upon the purpose. Some important classification are as under :

I. Stinger's and Davis's classification. Stringer, E. and Davis, J.S. have put forward a classification in which resources have been categorized into a classification:

(A) Natural Resources. It includes all the substances, material objects, elements, etc. which constitute the environment of man. For example (i) metallic ores-Ores of iron, Copper, zinc, Tin, Uranuim, Thorium, (ii) Fuels-Coal, Petroleum, Natural Gas, (iii) Soils-the crust of the earth contains limestone, sandstone, granite, slate, sand, etc. and these in a mixed form when impregnated by water, vegetation and

animal wastes, make soil, living world. The soil produces grass, forests and various crops and supports animals and men. (iv) Water and gaseous envelope – Without water and the envelope of gases no living things would have survived.

All the things are called 'Gift of Nature'. Man utilizes these gifts to make his life rich and worth living.

(**B) Human Resources.** These resources include man, his society and his mental and physical activities. These resources can be divided into two groups:

(i) Quantitative Aspect of Human Population. It includes total population, structure, age group, age and sex structures, class structures, the percentages of people engaged in various occupations, etc.

(ii) Qualitative Aspect of Population. This aspect includes the literacy, education, efficiency, aims, human personality, values of life, etc. This aspect is distinguishable in developed and developing societies.

II Classification Based on Living and Non living. Ginsberg has divided resources into two groups:

(i) Physical Resources. These include all the non-living parts of human environment i.e., rocks, minerals, land forms, the non-living parts of the soil, water air, etc.

(ii) Biotic Resources. These resources are those which affect the economic activities of man and are also affected by the human activities. In favourable conditions these resources get enriched but in adverse conditions these resources get degraded.

III Conservational Classification of Resources. Renner, G.T. prepared a classification on the basis of conservation of resources. On this basis the resources are divided into two classes:

(A) Exhaustible and (B) Inexhaustible

(A) Exhaustible Resources. These resources if used without care will be exhausted and will never be created again. These are petroleum, coal, natural gas, metallic ores, etc.

(B) Inexhaustible Resources. Which are further sub-divided into two smaller divisions:

(i) Immutable, which can't be changed

(ii) Misusable

1. Inexhaustible and Immutable Resources. Solar radiation, wind power, gravity of the earth, ocean water, climate, etc. belong to this group. It is believed that as long as the relationship between the sun, the earth and other planets remains the same or does not change perceptibly, the resources will not be exhausted and there will not be any change in their capacities.
2. Inexhaustible and Misusable Resources. These include areas, surface water, etc. These resources are capable of being misused.
3. Exhaustible, Mainintainable and Renewable. These include wood from forests, the fertility of soil, human population, etc. These resources can be exhausted with the passage of time and with the spread of economic activities but these resources can be renewed.

IV Classification Based on Distribution and Frequency of Occurrence. Zimmermann, on the above basis has divided the resources into four classes :

(1) Ubiqities: These are formed almost every where. Rocks, air, etc. are some examples.
(2) Commonalities: These are usually found like cultivable land, human population, etc.
(3) Rarities: Thorium, uranium, tin, etc.
(4) Uniquities: These are found in one place like cryolite.

Trilogy of Resources

In fact if we study carefully we find a trilogy in them. The trilogy consisting of (i) Natural, cultural and human resources. It may also be perceived as the trilogy of Land, Labour and Capital.

1. Natural Resources. These resources are those substances which are available to us in our environment, i.e., water, soil, forests, wild animals, minerals, etc. All these substances really form a neutral stuff and have been placed, so as to say, in the Earth's bag. Depending upon the desires, abilities, techniques developed by human beings these substances become the resources of man.
2. Cultural Resources. These resources are those which man has created from the natural environment with the help of his techniques expressly with the nature's 'aid, consent and advice.'
3. Human Resources. In fact it is the man who creates resources and uses them himself. Man is creator of culture. From this point of view, man is the greatest of the resources. Techniques, thinking, freedom ingenuity, inventiveness and the tenacity with which he fights the resistance of resources are some of the main resources which can be called human resources.

These days man has become so dynamic and he interferes so much in the natural resources that it has become well nigh impossible to distinguish between natural, cultural and human resources. For example, the fertility of soil is a natural resource but these are the very areas man has left the soil undisturbed. He has cut down forest areas and converted the area into agricultural land, grazing fields for animals, human settlements, etc. He has changed the fertility of the land. Now it has become difficult to distinguish.

Q.2 Explain the importance of water resource in India.

Ans: Water is one of the most precious natural resources and a key element in the socio-economic development of a country. It is used form drinking, bathing, washing, irrigation, industries and a host of other purposes. About 71 per cent of the earth's surface is covered by water and that is why our earth is called the 'watery planet'. In fact earth is the only planet in the entire solar system which contains water and sustains life.

India's water Resources

Rainfall is the main source of fresh water in India. From precipitation alone (including snowfall), India receives 4,000 km (Bllion Cubic Metre – BCM water). Large part of water percolates into the ground and is available to us in the form of ground water.

Due to various constraints of topography and uneven distribution of water resource over and time, the total utilizable water resource is assessed as 1,122 km out of which 690 km is surface water and 432 km is ground water. Obviously water is available in two different forms, viz., (1) surface water, and (2) ground water.

Earth's Water Resources

Distribution of Water on Earth		Use of Water	
Oceans, saline lakes	97.20%	Agriculture	93.37
Ice caps, glaciers	2.15%	Municipal and Rural water supplies	3.73
Lakes, rivers, streams	0.0085%	Industries and power generation	1.26
Atmosphere, biosphere	0.00015%	Livestock	1.08
Ground water	0.64%	Others	0.56
		Total	**100.00**

Source: D.R. Khullar

Surface water

Surface water is available on the surface of the earth in the form of rivers, lakes, ponds, canals, etc. India is blessed with a large number of major, medium and small size rivers, As many as 14 of them are classified as major rivers whose total catchment area is 252.8 million hectares (m. ha). This is about 83 per cent of the total area of all drainage basins. The other major rivers with catchment area more than 10 m. ha are those of the Indus (25.9 m. ha.), Godavari (31.3 m. ha.), Krishna (25.9 m. ha.) and Mahanadi (14.2 m. ha.). It is worth mentioning that about 40 per cent of utilizable surface water resources are in the Ganga-Brahmaputra-Meghna system.

Interlinking the Rivers

Although India has vast surface water resources, the same are very unevenly distributed over time and space. While some river basins have vast catchment area and carry enormous quantity of water, others are small and have comparatively small quantity of water. Most of the Himalayan rivers are large and originate in the snow covered high altitude areas of the Himalayan ranges. Thus much of precious water is wasted and is not available for use. As against this most rivers have insufficient flow of water during the dry season and acute scarcity of water is felt in almost all parts of the country. Even dry areas like Rajasthan and Gujarat may have floods and wet areas like West Bengal may confront a situation of drought. Keeping these and many more problems in mind, the idea of interlinking rivers through inter-basin linkages or through national

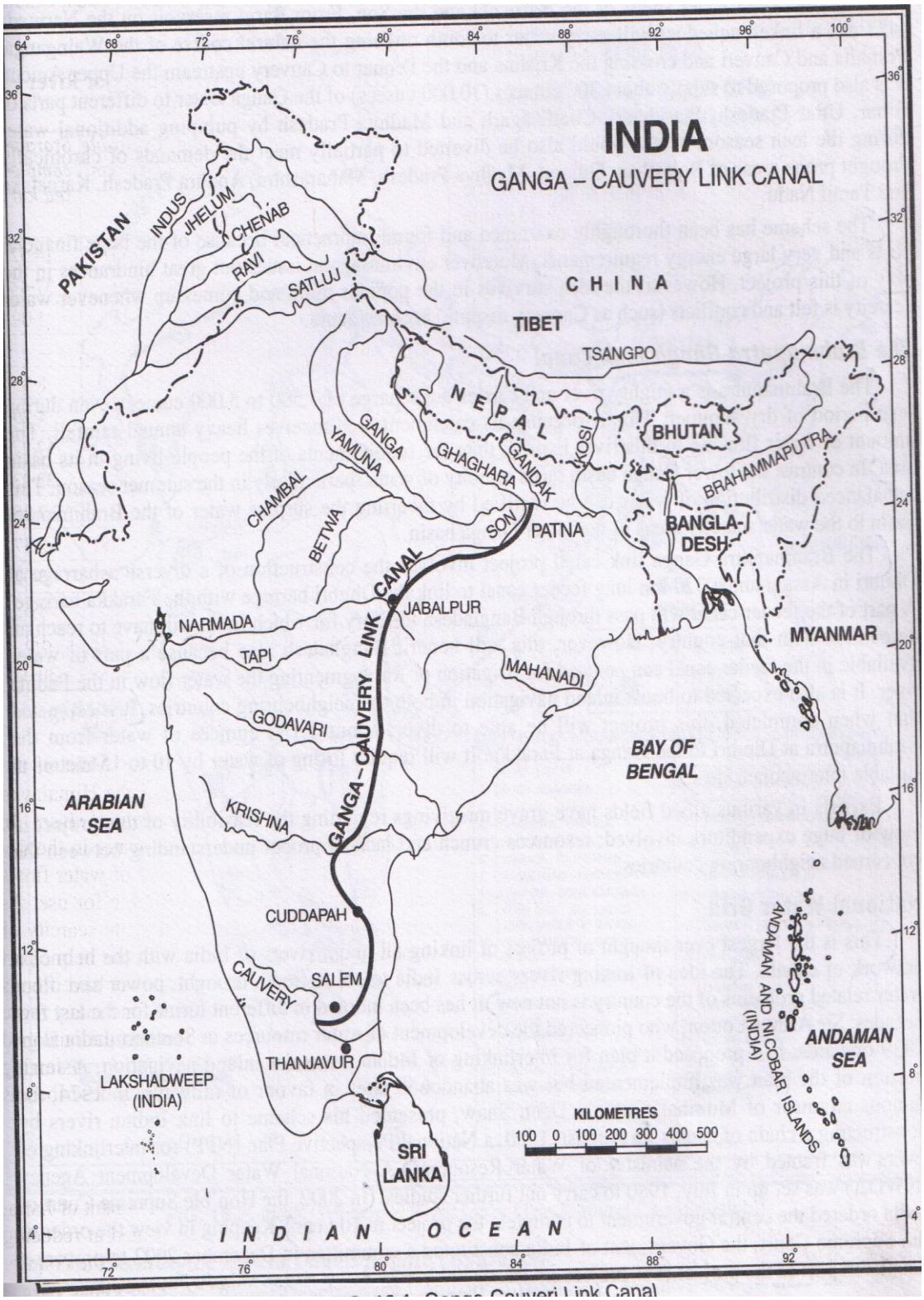
grid has been mooted.

The Ganga-Cauvery Link Canal

This project was prepared by the united Nations team at the request of the govt of India. It was proposed by the irrigation minister Dr. K.L. Rao in 1950s. The project aimed at reducing the impact of floods in the Ganga basin and supply water to central and eastern parts of the country which suffer from chromic problem of water shortage. This link canal was to take off near Patna, pass through the basins of the Son, the Narmads, the Tapi, the Godavari, the Krishna and the Pennar rivers, and join the Cauvery upstream of the Grand Anicut. Flood waters of the Narmada and the Godavari could also be used. The proposed Ganga-Cauvery Link Canal was to have been 2,640 km long, withdrawing 60,000 cusecs, from the flood flows of the Ganga for about 150 days in the year, and would have involved a lift of a substantial part of water over 450 meters. The scheme has been thoroughly examined and found impractical because of the huge financial costs and very large energy requirements.

The Brahmaputra-Ganga Link Canal

The Brahmaputra is a mighty river and carries a discharge of 3,500 to 5,000 cumecs even during lean period of dry summer. This is because its catchment area receives heavy annual rainfall. The amount f water flowing in this river is more than the requirements of the people living in its basin area. The Brahmaputra-Ganga link canal project involves the construction of a diversion barrage at Dhubri in Assam and a 320 km long feeder canal to link the Dhubri barrage with the Farakka barrage. It is estimated that when completed, this project will be able to divert about 1,150 cumecs of water from the Brahmaputra at Dhubri to the Ganga at Farakka. It will require lifting of water by 10 to 15 metres at suitable intermediate sites.



Source: D.R. Khullar

National Water Grid

This is the largest ever thought of project of linking all major rivers of India with the help of a network of canals. The idea of linking rivers across India to solve flood, drought, power and other water related problems of the country is not new. In August, 1980, a National Perspective Plan for interlinking of rivers was framed by the Ministry of Water Resources. In 2002, the Hon'ble Supreme Court of India ordered the central government to complete the project in 10 year. The project envisages linking 26 major rivers of India by constructing 30 different link canals. The National Perspective Plan as well as the NWDA studies have two components of the project viz., (a) Himalayan Rivers Development Component and (b) Peninsular Rivers Development component. The two can be linked on the Mahanadi.

(a) The Himalayan Rivers Development Component

The Himalayan Rivers Development Component envisages construction of storage reservoirs on the principal tributaries of Ganga and Brahmaputra in India, Nepal and Bhutan alongwith interlinking canal systems to transfer surplus flows of the eastern tributaries of the Ganga to the west, apart from linking of the main Brahmaputra and its tributaries with the Ganga and the Ganga with the Mahanadi. The Himalayan Component is based on multi-purpose storage giving, benefits of hydropower and flood control, besides diverting water to downstream links. NWDA have taken up 11 Himalayan links for study. Other lines proposed are Kosi-Ghaghara, Gandak-Ganga, Ghaghara-Yamuna and Sarda-Yamuna to supplement the supplies of the Ganga and the Yamuna and further transfer water west to Rajasthan and Gujarat.

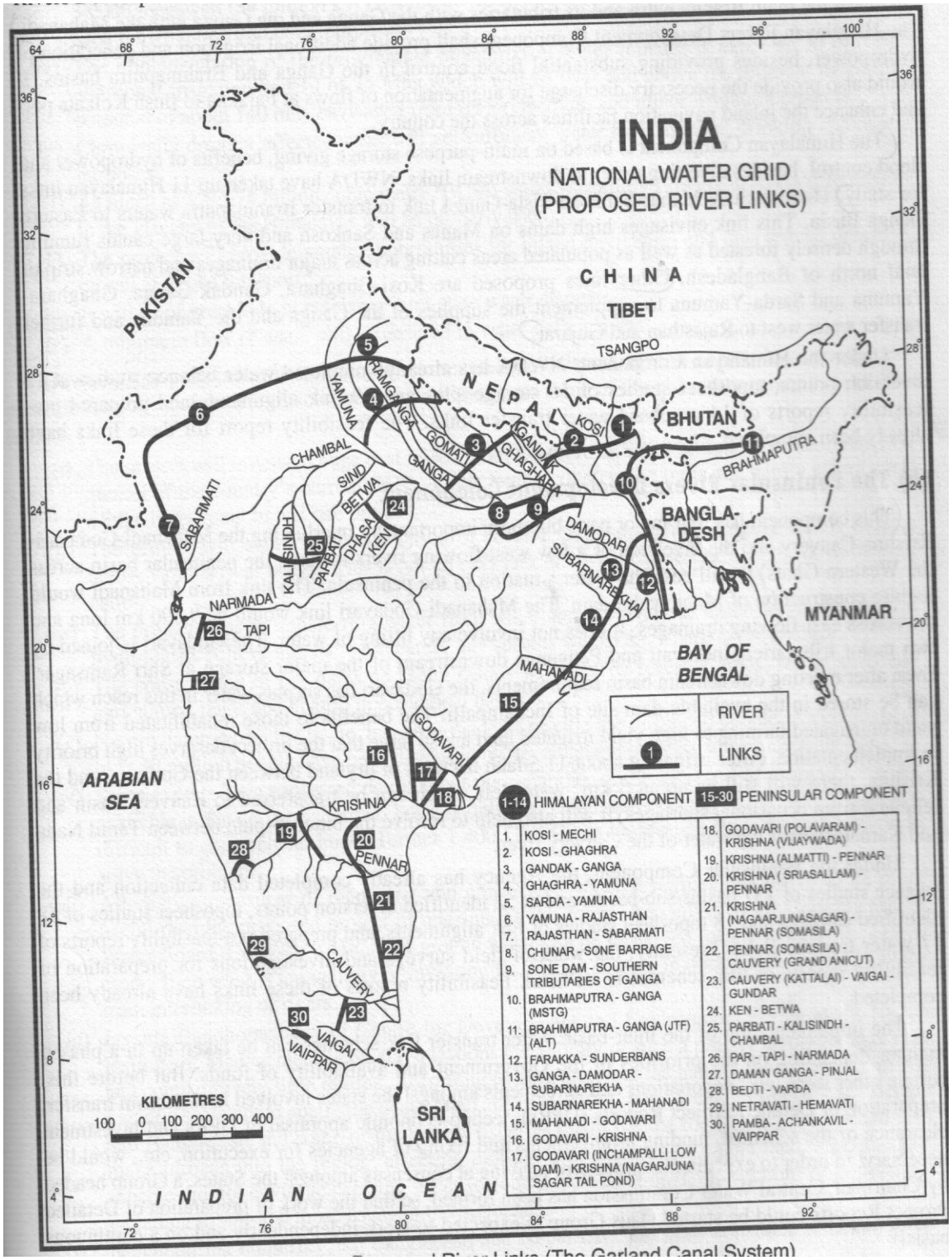
(b) The Peninsular Rivers Development Component

This component has four major parts but more important are interlinking the Mahanadi-Godavari, Krishna-Cauvery and the diversion of a few west-flowing rivers towards the peninsular basin across the Western Ghats. The Mahanadi-Godavari link would be 9,390 km long and cut across east-flowing drainages. The Godavari is joined by two major tributaries, Indravati and Penganga downstream of the major storage at Shri Ramasagar. After irrigating about 11.5 lakh hectares of dryland between the Godavari and the Krishna, there will still be about 3 km water left which can be transferred to Cauvery basin and relieve it from

occasional shortages. The implementation of the inter-basin water transfer link schemes can be taken up in a phased manner depending on the priorities of the government and availability of funds.

If and when completed, this project will give following benefits :

1. Surplus water from the eastern rivers will be transferred to water deficit areas of central, south and western parts of the country.
2. Flood problem, particularly in Bihar and Assam will be solved to great extent.
3. 34,000 megawatt (34 million kw) hydroelectricity would be produced. This electricity will be used for irrigation and other purposes.
4. The project will provide ample opportunities for inland navigation and thus reduce pressure on rail and road transport.
5. It will be of great help in resolving inter-state water disputes.
6. A minimum flow of water will be ensured in water deficit rivers.



Source: D.R. Khullar

Ground Water

A part of the rain water percolates in the rocks and soils and is available to us as ground water. The assessment of water resources in India dates back to 1949. Dr. A.N. Khosla (1949) estimated the total average annual run-off of all river systems in India as 167.4 m, ha m (million hectare metre) based on empirical formula which included both surface and ground waters. The first attempt to estimate the ground water resources on scientific basis was made in 1979 when a High Level Committee, known as Ground Water Over Exploitation Committee was constituted by Agriculture Refinance and Development Corporation (ARDC). The methodologies adopted for computing ground water resource are generally based on the hydrological techniques.

According to the planning Commission, the total water resources are about 178 million hectare metres but because of limitations of physiography, topography, geology, dependability, quality and the present state of technology, only a fraction of it could be utilized. The demand for water for irrigation is increasing rapidly due to rapid increase in population and new technology will have to be developed for making optimum use of the available water resources.

Basin-wise Ground Water Resource Potential

Sl. No.	Basin	Total replenishable Ground water resource (Million hectares metre per year)	Utilisable ground water for irrigation (Million hectares metre per year)	Level of ground water development (per cent)
1.	Indus	2·55	2·17	79·29
2.	Ganga	17·17	14·59	30·79
3.	Kuchchh and Saurashtra composite	1·39	1·14	39·75
4.	Khambat Composite	0·79	0·67	30·21
5.	Narmada	1·19	1·01	15·31
6.	Tapi	0·82	0·67	20·19
7.	Subaranrekha	0·22	0·19	8·81
8.	Brahmani with Baitarni	0·59	0·50	5·16
9.	Mahanadi	2·13	1·81	4·32
10.	North-East composite	2·28	1·94	13·53
11.	Godavari	4·68	3·94	14·98
12.	Krishna	2·66	2·23	29·11
13.	Penner	0·50	0·43	31·52
14.	Madras composite and south Tamil Nadu composite	2·09	1·78	45·94
15.	Cauveri	1·36	1·16	44·72
16.	Western Ghat composite	1·83	1·54	19·61
17.	Brahmaputra	2·79	2·37	2·12
18.	Meghna	0·18	0·15	3·21
	Total	**45·22**	**38·28**	**27·82**

Source : India 1992 : A Reference Annual, p. 419.

Source: D.R. Khullar

According to the latest data published by the Central Ground Water Board in 2003, the total replenishable ground water resource in the country is more than 443 BCM/year, of this, the ground water available for irrigation is about 362.4 BCM/year. Provision for other uses including domestic and industrial purpose is about 71.2 BCM/year. The level of ground water development is 41.57 per cent.

There are large variations at the level of states/union territories so far as total replenishable ground water resource is concerned. It varies from 81.12 BCM/year in Uttar Pradesh to 0.07 BCM/year in Sikkim. In addition to Uttar Pradesh, Andhra Pradesh, Madhya Pradesh and Maharashtra are some of the large states which have total replenishable ground water resource more than 30 BCM/year. Among the other large states are Assam, Bihar, Gujarat, Orissa, Tamil Nadu and West Bengal which have 20 BCM/year or more replenishable ground water

resource.

The change in cropping pattern has further increased demand for ground water to irrigate the fields. The region is climatically more suited to wheat but farmers' preference to rice crop has changed the entire scenario. This has led to over exploitation of ground water resources and ground water level is falling rather alarmingly.

Haryana's ground water resources will be exhausted soon and the state will be left with no ground water in future. The situation in the neighbouring state of Punjab is no better. The level of ground water development in this state is 97.66 per cent and the future of the state is very bleak with respect to ground water resources. Uttar Pradesh and Bihar have developed over 46 per cent of their ground water resources. West Bengal is comparatively better placed with respect to rainfall and is less dependent on ground water resources. In the south, Tamil Nadu also has high level of 64.43 per cent of ground water development. Here, ground water is primarily used to irrigate the rice crop.

Most of the peninsular plateau area is composed of hard rocks and is not muct favourable for exploiting ground water resources. Most of the states located in the peninsular plateau area have moderate level of ground water development which varies from 20 to 40 per cent. It is estimated that in India, 85 per cent of rural and over 50 per cent of urban water supplies depend upon ground water for meeting drinking and domestic water needs. Increasing demand for water in agriculture sector puts heavy strain on our water resources and ground water resources are over-exploited.

Hydrological Situation

India is a vast country having diversified geological, climatological and topographic set up, giving rise to divergent ground water situations in different parts of the country. Variations of land forms varying from the rugged mountainous terrain of the Himalayas to the flat and featureless alluvial plains of the northern river valleys and coastal tracts, and Aeolian deserts of Rajasthan are no less important. The topography and rainfall virtually control runoff and ground water recharge.

The high relief areas of the northern and north-eastern regions, the Aravali range

of Rajasthan, and peninsular regions with steep topographic slope and characteristic geological set-up offer high run-off and little scope for rain water infiltration. The large alluvial tract in the Indus-Ganga-Brahmaputra plains, extending from Punjab in the west to Assam in the east, constitutes one of the largest and the most potential ground water reservoir in the world.

Almost the entire peninsular India is occupied by a variety of hard and fissured formation with patches of semi consolidated sediments in narrow intracratonic basins. Rugged topography, compact and fissured nature of the rock formation, combine to give rise to discontinuous acquifers with limited to moderate yield potentials. The coastal and deltaic tracts in the country form a narrow linear strip around the peninsular plateau. The eastern coastal and deltaic tract and the estuarine areas of Gujarat are receptacles of thick alluvial sediments. Though highly productive aquifers occur in these tracts, salinity hazards impose quality constraints for ground water development.

Water Scarcity

While water is a renewable resource, it is at the same time a finite resource. The total quantity of water available on the globe is the same as it was two thousand years ago. It is important to appreciate the fact that only 3 per cent of the world's water is fresh and roughly one-third of it is inaccessible. The rest is very unevenly distributed and the available supplies are increasingly contaminated with wastes and pollution from industry, agriculture and households. It is the human nature that we value things only when they are scarce or are in short supply. As such we appreciate the value of water once the rivers, reservoirs, ponds, wells, etc. run dry. Our water resources have now entered an era of scarcity. It is estimated that thirty years from now, approximately once-third of our population will suffer from chronic water shortages.

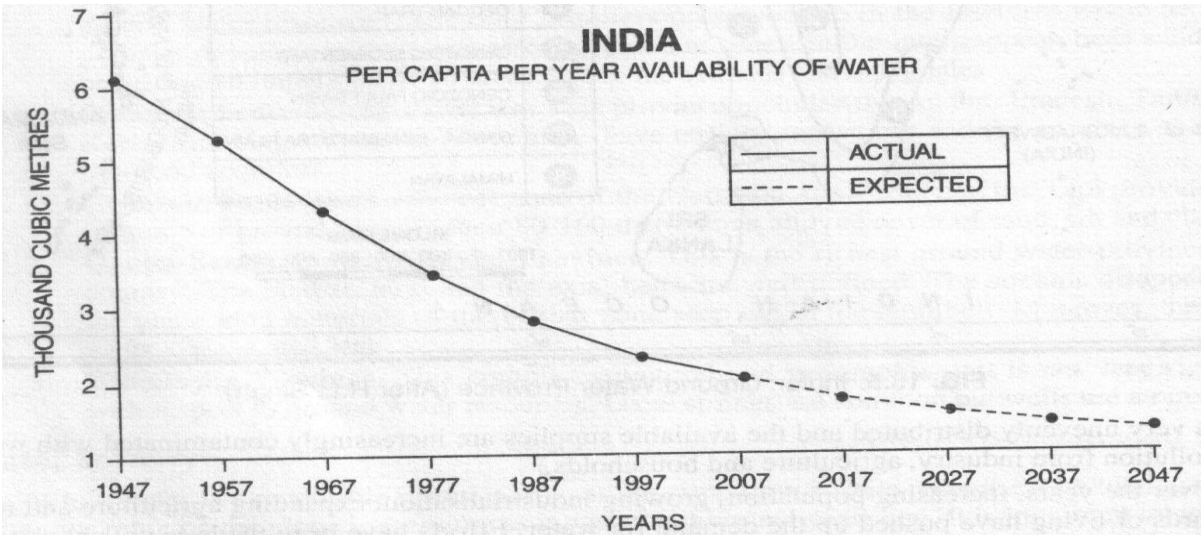


FIG. 16.6. India : Declining availability of water

Source: D.R. Khullar

The consequences of scarcity will be more drastic in arid and semi-arid regions. Water shortage will also be felt in rapidly growing coastal regions and in big cities. Several cities are already, or will be, unable to cope with the demand of providing safe water and sanitation facilities to their inhabitants. Indicators of water stress and scarcity are generally used to reflect the overall water availability in a country or a region. When the annual per capita of renewable fresh water in a country or a region falls below 1,700 cubic metres, it is held to be situation of water stress. If the availability is below 1,000 cubic metres, the situation is labeled as that of water scarcity. And when the per capita availability falls below 500 cubic metres, it is said to be a situation of absolute scarcity.

The problem of water shortage is further complicated when we look at the areal distribution of water resources with reference to population. From as high as 18,414 cubic metres in the Brahmaputra valley, per capita water availability comes down to a low of 411 cubic metres in the east-flowing rivers between Pennar and Kanniyakumari. Even within the Ganga basin, the availability varies from 740 cubic metres in the Yamuna to 3,379 cubic metres in the Gandak (Chitale, 1992).

Nearly 40 per cent of water demand in urban India is met by ground water. So ground water tables in most cities are falling at alarming rate of 2-3 metres per

year. Another factor is water leakage. Delhi loses at least 30 per cent of its water due to leakages in its 83.0 km long pipeline network. Mumbai loses about 20 per cent of its water due to leakage.

Water Disputes and Conflicts

Any commodity which is in short supply is likely to cause disputes and conflicts and water shortage is no exception. Water disputes and conflicts are taking place at the national (inter-state) and international levels in the present day world. Experts believe that the biggest potential destabiliser in the world is water scarcity. Potential conflicts are likely where rivers and lakes are shared by more than one country. The Nile, the Jordan, the Indus, the Ganga, the Brahmaputra and the Mekong are some of these. In times of water stress and shortages, regions will face water refugees from one region to the other within the country or between two countries.

With mismanagement of water resources, mighty rivers can become mere rivulets, unable to reach the sea. With taps run dry and crops wither away, there would be upheavals – mixed as they would be with regional, caste, sectarian and communal colour. All this may be difficult to imagine, but this is calamity about to happen. It is nightmare about to come true.

Inter – state River Water Disputes in India

Most rivers of India are plagued with interstate disputes. Almost all the major rivers of the country are inter-state rivers and their waters are shared by two or more than two states. Following interstate river water disputes are worth mentioning:

(i) Cauvery water dispute between Tamil Nadu, Karnataka and Kerala.
(ii) The Krishna water dispute between Maharashtra, Karnataka and Andhra Pradesh.
(iii) The Tungabhadra water dispute between Andhra Pradesh and Karnataka.
(iv) The Aliyar and Bhivani river water dispute between Tamil Nadu and Kerala.
(v) The Godavari river water dispute between Andhra Pradesh, Madhya Pradesh, Chhattisgarh, Orissa and Karnataka.

(vi) The Narmada water dispute between Gujarat, Maharashtra, Madhya Pradesh and Rajasthan.
(vii) The Mahi river dispute between Gujarat, Rajasthan and Madhya Pradesh.
(viii) The Ravi and Beas river water dispute between Punjab, Haryana, Himachal Pradesh, Rajasthan, Jammu and Kashmir and Delhi.
(ix) The Satluj-Yamuna Link canal dispute between Punjab, Haryana and Rajasthan.
(x) The Yamuna river water dispute between Uttar Pradesh, Haryana, Himachal Pradesh, Punjab, Rajasthan, Madhya Pradesh and Delhi.
(xi) The Karmanasa river water dispute between Uttar Pradesh and Bihar.
(xii) The Barak river water dispute between Assam and Manipur.

Efforts are made to resolve disputes through negotiations amongst the basin states with the assistance of the Central Government. Adjudication through appointment of water disputes tribunals in also resorted to as and when required. So far, the following tribunals have been appointed to resolve inter-state disputes:

1. The Godavari Water Disputes Tribunal.
2. The Krishna Water Disputes Tribunal
3. The Cauvery Water Disputes Tribunal.
4. New Krishna Water Disputes.

The first three Tribunals have given their final reports.

In developing country like India, the inter-state river water disputes have to be resolved quickly and amicably. This is most urgent for the proper utilization of water resources and economic growth.

Conservation of Water Resources

Water is an important natural resource and is the very basis of our life. Water is a cyclic resource which can be used again and again after cleaning. The best way to conserve water is its judicious use. Wasteful use of water should be checked. Sprinkler irrigation and drip irrigation can play a crucial role in conserving scarce water resources in dry areas. Drip irrigation and sprinkles can save anywhere between 30 to 60 per cent of water. Only 0.5 per cent – nearly half of this in Maharashtra – is under drip irrigation and 0.7 per cent under sprinklers. There is large-scale pollution of water as a result of industrialization and urbanization. This trend has got to be checked. Although one-eight of India is declared as food prone, there are several thousand villages in India which do not have potable

drinking water. The basins should be treated as one unit for planning water utilization. Dry farming should be practiced in dry areas. The experimentation under the National Watershed Development Programme for Rainfed Agriculture is being carried on since 1986-*87.

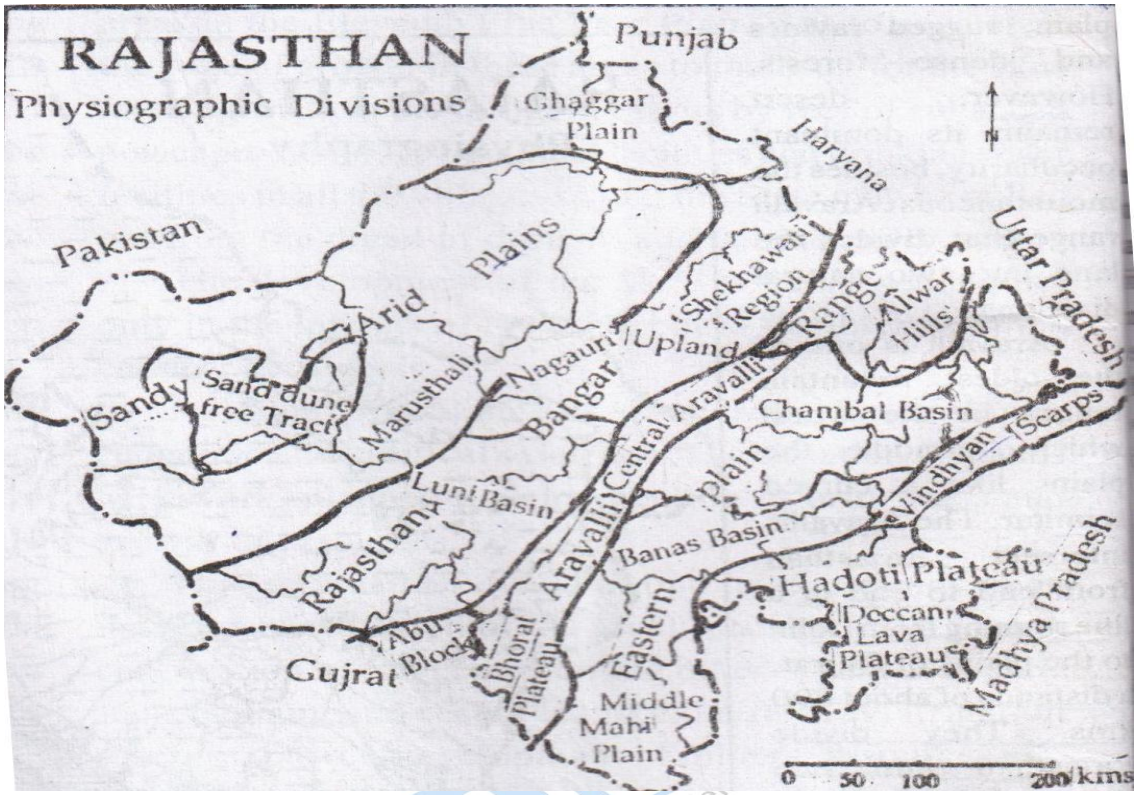
There is a great demand of water in industries and the industrial sector offers great opportunities to conserve water. The economy in water-use in this sector will have two benefits. Firstly, the saved water may be used to meet the demand in other sectors. Secondly, the affluents thrown in the water bodies will be less. By using the recycled water over and over again, fresh water can be conserved. Demand of water for domestic use can also be reduced. Water used in kitchen sink, wash basin and in bathroom can be collected into a tank and reused for flushing toilet and gardening also.

Chapter 10
Rajasthan

Q.1 Describe about western sandy plain of Rajasthan.

Ans This plain includes the Marusthali (eastern portion of the thar) and the adjoining Bangar (steppe land) to the west of the Aravallis. The western sandy plain is a wide expanse of wind blown sand, poorly watered and sterile. The eastern portion of this is known as the Thar Desert, which is perfectly dry and desolate with the patches of prickly grass and other desert plants. The region comprises Bikarner, Barmer, Churu, Jodhpur, Jaisalmer, Nagaur, Hanumangarh, Sriganganagar, Pali, Sirohi, Sikar & Jhunijunu districts and contains about 58 per cent of the area and 30 per cent of the population of the entire state. It covers area of about 1, 96,747 sq. km. and extending for 640 kms. from N.E. to S.W. with an average width of 300 km. from west to east.

This region is mostly a sand covered peneplain in which rocky outcrops appear through the sand. In the heart of the sand covered area, the bare dune free tracts of Barmer. Jaisalmer and Bikaner present an anomaly and is a problem that warrants investigation. The region slopes, generally, from east to west and north to south. The north-eastern part of the region has a general elevation of about 300 metres, but towards the south the elevation is a about 150 metres excepting the Jalore-Siwana upland which lies above 300 metres. The most important river flowing in the region is the Luni which rises in the Aravallis south-west of Ajmer and flows towards the south-west. It has several tributaries coming from the Arawallis, the most important ones being the Sukri and the Jawai.



Source: Dr. L.R. Bhalla

The Extent & Amount of Sand-dunes in Western Rajasthan

Extent of the Dunes	**Area Sq. kms.**	**% total Area**
No. Dunes	85,660	41.50
0 to 20% Area Affected	24,856	11.50
20% to 40% Area Affected	10,165	4.80
40% to 60% Area Affected	34,322	14.70
60% to 80% Area Affected	39,782	18.60
80% to 100% Area Affected	18,903	8.90
Total	**213688**	**100.00**

The western sandy plain is sub-divided into two units: (a) Sandy Arid Plain, and (b) Semi Arid Plain.

(a) Sandy Arid Plain

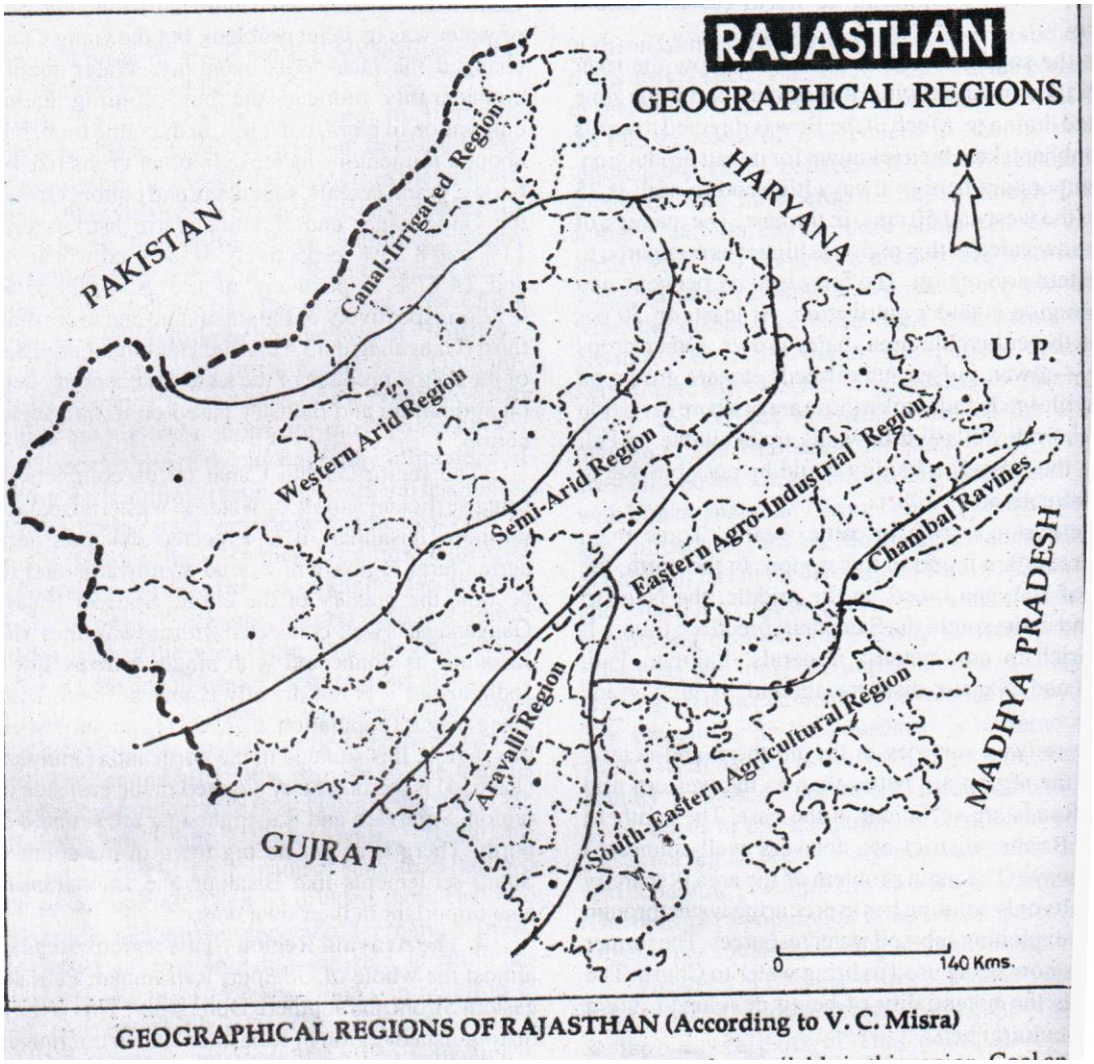
There are vast stretches of sand and rock outcrops are common features. The outcrops mainly of Aravalli gneiss, schists, Malani granite and Vindhyans are exposed in the Thar area. The erosional topography is evident in Barmer, Jaisalmer, Bikaner and

other areas where rock outcrops are exposed at the surface. It is further subdivided into two regions of third order :

(i) Marusthali : The marushthali covers Bikaner, Jaisalmer, churu, some parts of western Nagur and western two thirds of Barmer and Jodhpur districts. There is multiplicity of types of dunes and of dune agglomeration in different parts of the Marusthali. On the basis of their shape, size, wind direction and vegetable cover, different types of dunes have been recognized in this region, namerly, (i) Longitudinal dunes (seif of Sahara or Urg of Arabia) (ii) crescent-shaped dunes (Barchans) of turkistan; and (iii) Transverse dunes.

The Thar is essentially a flat plain formed of the alluvium deposited by rivers originating in the Himalayas as well as the Aravallis. The plain has an average elevation of 200 m. No significant hill range traverses the desert. The Thar is the most densely populated desert in the world and its population like that of the rest of India is steadily increasing.

(ii) Dune Free Tract of Jaisalmer-Barmer-Bikaner – Next comes the rocky, comparatively dune free tract of Jaisalmer-Barmer-Bikaner and it covers nearly 65 sq. km. around the Jaisalmer town, half of the Pokaran tehsil, western and southern parts of the Phalodi tehsil of Jodhpur district. The limestone and sandstone rocks exposes here belong to Jurassic and eocene formations. To the north of Jaisalmer and south of Pokaran a number of playa lakes occur in basins bordered by low scarps. These lakes, through fed by centripetal drainage, remains dry for the greater part of the year. Grid conglomerate, gneiss, schist and granite rocks are also exposed at places.



GEOGRAPHICAL REGIONS OF RAJASTHAN (According to V. C. Misra)

Source: Dr. L.R. Bhalla

(b) Semi-Arid Plain or Rajasthan Bangar –

In the eastern most part lies the semi-arid Bagar land drained by the Luni in its south-eastern portion. In this part the older rocks protrude above the surrounding sandy surface. The western boundary is marked by the 25 cm isohyte line and the eastern by the western edge of the Aravalli range upto the northern part of Udaipur while further north the 50 cm isohyctal line is the eastern limit. Towards the north lies the Shekhawati tract which is semi-arid transitional plain characterized by inland drainage and stream with salt lakes such as Didwana, Kuchaman, Degana and great Sambhar, etc. In the extreme north lies the Ghaggar plain.

The Semi-arid plain or Rajasthan bangar is further divided into following sub units:

(i) **Luni Basin –** This basin includes Parbatsar, Merta, Degana tehsils of Nagaur district, Bilara and Jodhpur tehsils of Jodhpur districts, eastern part of Barmer district, Pali and Jalore districts. The recent formations of western sandy plain is undoubtedly the blown sand with which, very large portion of the region is covered. The topographic features of this area lying south of Luni river suggest that the initial geomorphic processes were fluvial which dissected the sedimentary rocks of this area. At present, the wind action is more predominant although occasional floods are also caused in these streams. The alluvial plain between the Luni river and the foot-hills of the Aravalli range is covered with aeolin sand deposits. The luni river rises from the Aravalli hills near Ajmer and flows towards the south-west. Most of these streams follow the domal structural trend of the sub-surface rocks which is formed by granite and rhyolite rocks. The Luni basin covers the fertile area between the foot of the Aravallis and the Luni river. The water lies near the surface where well irrigation is possible.

(ii) **Shekhawati Region –** A range of the aravalli hills runs though this region from south to north, cutting into almost two halves forming a natural boundary between the sandy desert tract of Shekhawati to the north and the fertile plains of Jaipur proper to the south and south-east. There is only one seasonal river Kantli and that too is lost in the sandy terrain, when it enters the Churu district. Thus, the region is either an area of inland drainage or of no rivers.

(iii) **Nagauri Upland –** The whole region comprising Ladnu, Didwana, Nagaur and Jayal tehsils is stcrile and sandy. There are no hills except tehsil Parbatsar. The rainfall in this area is between 25 cm in the west to 50 cm in the east. After the rare, heavy showers, rain water is accumulated in innumerable local depressions amongst the sand hills. The important salt lakes in the region are the lakes of Sambhar. Degana and Deedwana, Apart from these lakes, the whole area is full of several salt deposits.

(iv) **Ghaggar Plain –** This region covers the three-fourth area of the Ganganagar district. There is no stream or river except the Ghaggar Nali which flows though the ancient bed of the Ghaggar river which is now extinct, and hence, this region is known as 'Ghaggar Plain'. The northern half of this region is fully canalled and thus is made productive. The south-western portion is the admixture of snady and semi-canalled area while the south eastern portion of this region is still a desert area. Semi-arid portion rocks exposed above the surface in hills

bear enough evidence of wind erosion. The wind-ward sides of the hills are full of small hollows casued by wind blown sand attrition whereas the leeward sides have no such traces. There is mass of boulders capping the hills and accumulated on the hill sides because of lack of heavy rain, the boulders and the rocks, thus being subjected only to weathering.

Q2 Explain the Aravalli region of Rajasthan.

Ans: The Aravalli range running across the Rajasthan like a curve scimitar from S.W. to N.E. is the principal and the dominant landform of the region. This range though not of uniform width extends for about 692 kms. From Palanpur in Gujrat to Delhi. The Aravalli range is remarkable in being perhaps the oldest folded mountain range not onlyin India, but in the world. The ridges are highest and widest in the south. Many of the isolated hills are mere prominences left standing while the surrounding parts have been denuded and washed away. The average elevation of this range is more than 600 m. above sea-level. From Ajmer to Beawar, the Aravalli is squeezed in a 50 km. wide range much indented by several wind gaps. This is the midland country of Rajasthan from where the Aravalli fans out towards the plateauof Sirohi, the highlands of Mewar and the rugged country of straggering hills in Dungarpur and Banswara.

On the basis of these general characteristics and on the similarity of form elements such as dimension, relief, slope and drainage pattern, the Aravalli Range and Hilly Tract can be sub-divided into the following physiographic sub-units:

(a) The North Eastern Hill Tracts or the Alwar Hills

(b) The Central Aravalli Range

(c)The Mewar rocky Region and Bhorat Plateau

(d) Abu Block Region

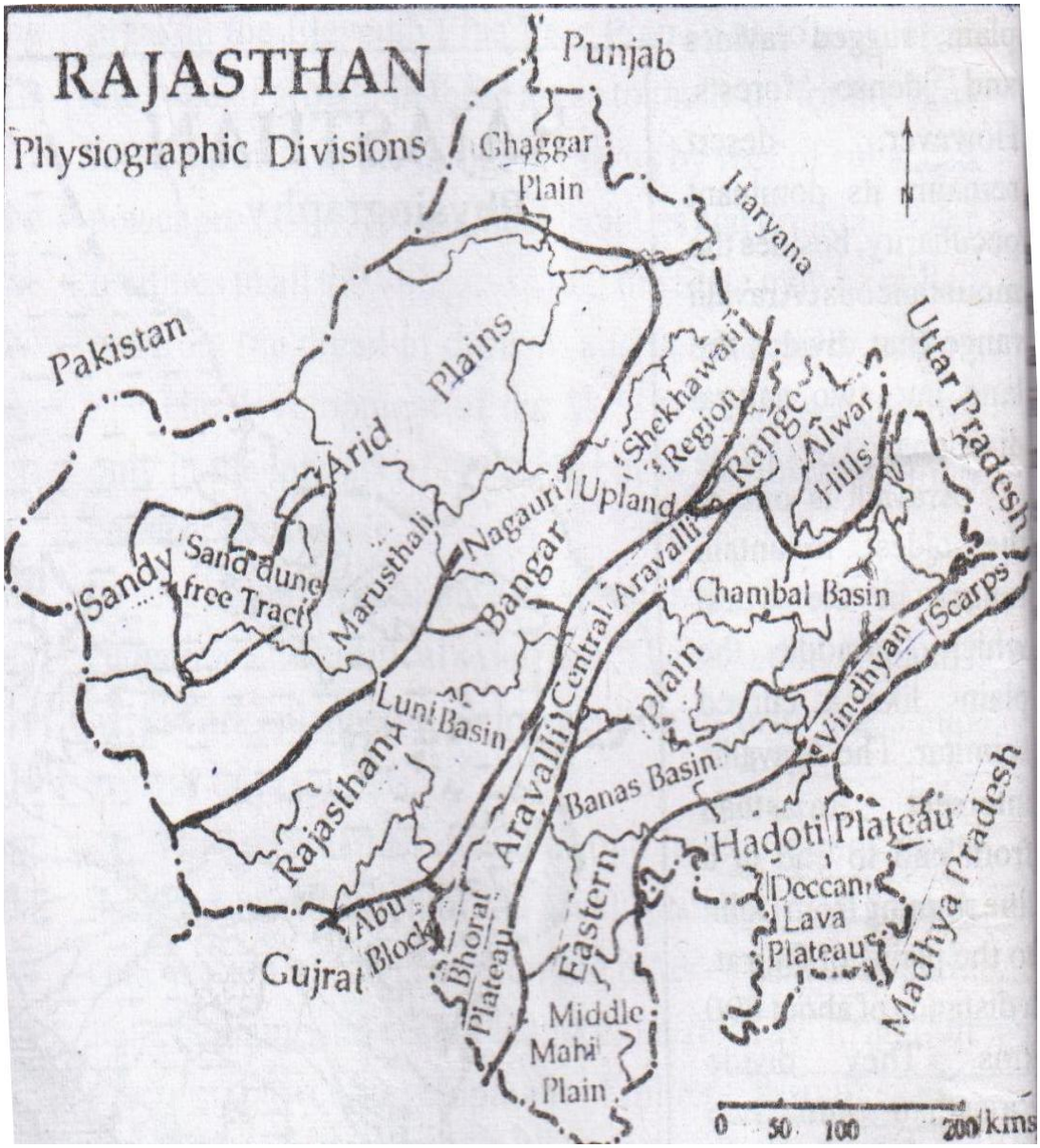
(a) North Eastern Hilly region or Alwar Hills –

The North-eastern hilly region stretches from the low ridges of Delhi to the isolated hills of Alwar and Jaipur. The offshoots of the ridges and hills to the west are found in Sikar, Shri-madhopur, Neem ka Thana and Khetri tehsils. Its average elevation varies between 300-670 m. though Bharaich (792 m.) and Kho (920 m.) in

Jaipur and Raghunathgarh (1055 m.) in Sikar are some of the peaks more than 700 m. Between Beawar and Lake Sambhar, the ridge and valley section of the central Aravallis breaks down to isolated hills which are still oriented NE to SW. East and southeast of the Torawati complex are a group of hills of steeply dipping Alwar quartzites. The upper surface of the Delhi ridge appears flat and even crested from a distance.

(b)The Central Aravalli Range –

Central Aravalli Region (20,919 sq. km.) comprises of the districts of Ajmer, Jaipur and south western part of Tonk. The upland with scattered ridges in the western part is bounded by Sambhar basin in the west, Alwar hills and plains in the north, the Karauli Table land in the east and the Banas plain in the south. The Central Aravalli extends from Sambhar lake to the Bhorat Plateau, south of Deogarh peak. The approximate level of valleys is 550 m. and of hills of 700 m. The characteristics of this region are (i) a sharp and well defined boundry in the west followed eastward by (ii) a system of two to three parallel ridges rising to an average altitude of 600 m. (iii) the edge of the Mewar plateau represented in large sections by a prominent scarp that is often coincident with the shear zone and (iv) the S.E. – N.W. directed transverse drainage.



Source: Dr. L.R. Bhalla

© The Mewar Rocky Region and Bhorat Plateau –

The Mewar hills cover whole of the Udaipur district except these eastern tehsils (Maoli, Rajsamand and Vallabhnagar), south-eastern margin of pali district and parts of Gujrat state situated between Banas plain and Abu Block, it is the most distinctive hilly region covering 17007 sq. km. The highest portion of the Aravalli range except the Abu Block, lies north-west of Udaipur between the fort of Kumbhalgarh and Gogunda,in the form of a plateau, locally known as 'Bhorat'.

North-eastwards from Bhorat Plateau, the Aravalli range merges imperceptibly with rolling high plains (500 m.) and to the north, it gradually loses its width to become Merwara Hills near Todgarh. The rest of the Mewar hills are comparatively insignificant. East of Chittorgarh is a series of hills (600 m.) all running north-south and forming narrow confined valleys parallel to each other.

(d)The Abu Block –

The Abu Block (5180 sq. km.) covers almost the whole of Sirohi district and except the west margin. It is entirely hilly. Its eastern part is crowned with Mt. Abu as an irregular plateau (about 1300m.). Mt. Abu is a 19 kms. Long and 6 kms. Narrow platear, nearly 1200m. above sea level. It is an irregular plateau surrounded by several projected peaks. Attached to Mt. Abu is Oria plateau about 160 m. higher than Abu and lies below the main peak of Guru-Sikhar, a great granitic mass-transliterated by James Tod as the Saint's pinnacle with the towering elevation of 1722 m. is the loftiest peak between the Himalaya and the Nilgiris. Other prominent peaks adjoining Guru Sikhar are one near village Ser (1,597 m.). Achalgarh (1,380 m.) and the three peaks west of Dilwara. To the west of Mt. Abu are Abu-Sirohi ranges the lower skirts and outlying spurs of the Aravalli range, much lower than the Abu ranges.

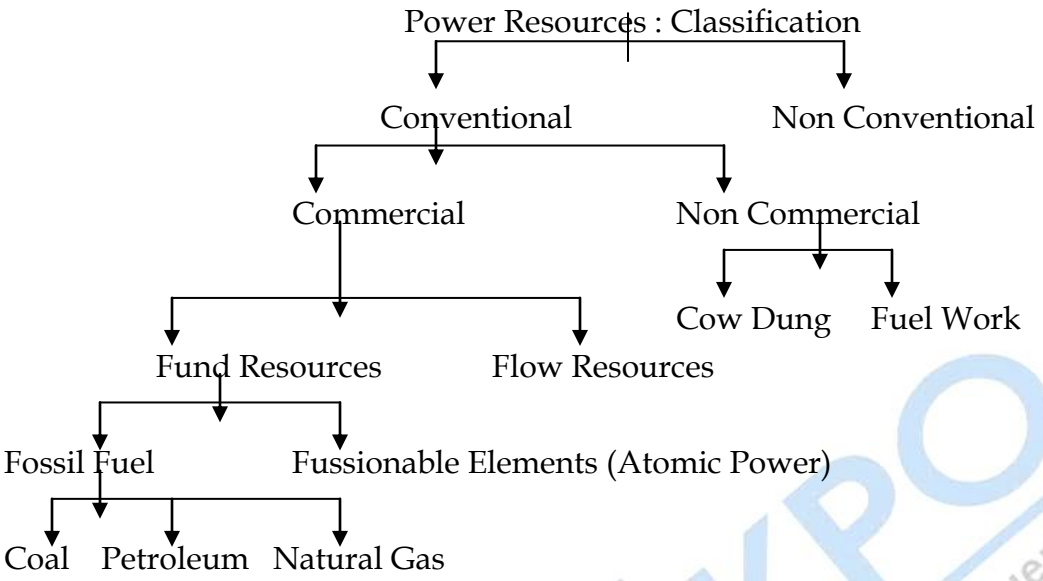
Q.3 Describe the power resource of Rajasthan.

Ans: The power resources and their development of any region or state is the first pre-requisite for its overall development. In these days of intensive mechanization, power is the most important determinant governing the pace of industrial development. But its qualitative superiority manifest chiefly through its greater flexibility and divisibility, electricity has made it possible to introduce far reaching innovation in face to create whole industries unthinkable without it. Rajasthan is chronically power hungry.

On the other hand, increasing population and industrialization have enhanced deforestation and environmental polluation. In this context, the state has a great potentiality of non-conventional new and renewable power resources like solar power, wind power, biogas, bio-mass etc. Although, the state and central government have taken various steps for the conservation and development of power resources, still there are serious internal and external problems which should be solved urgently.

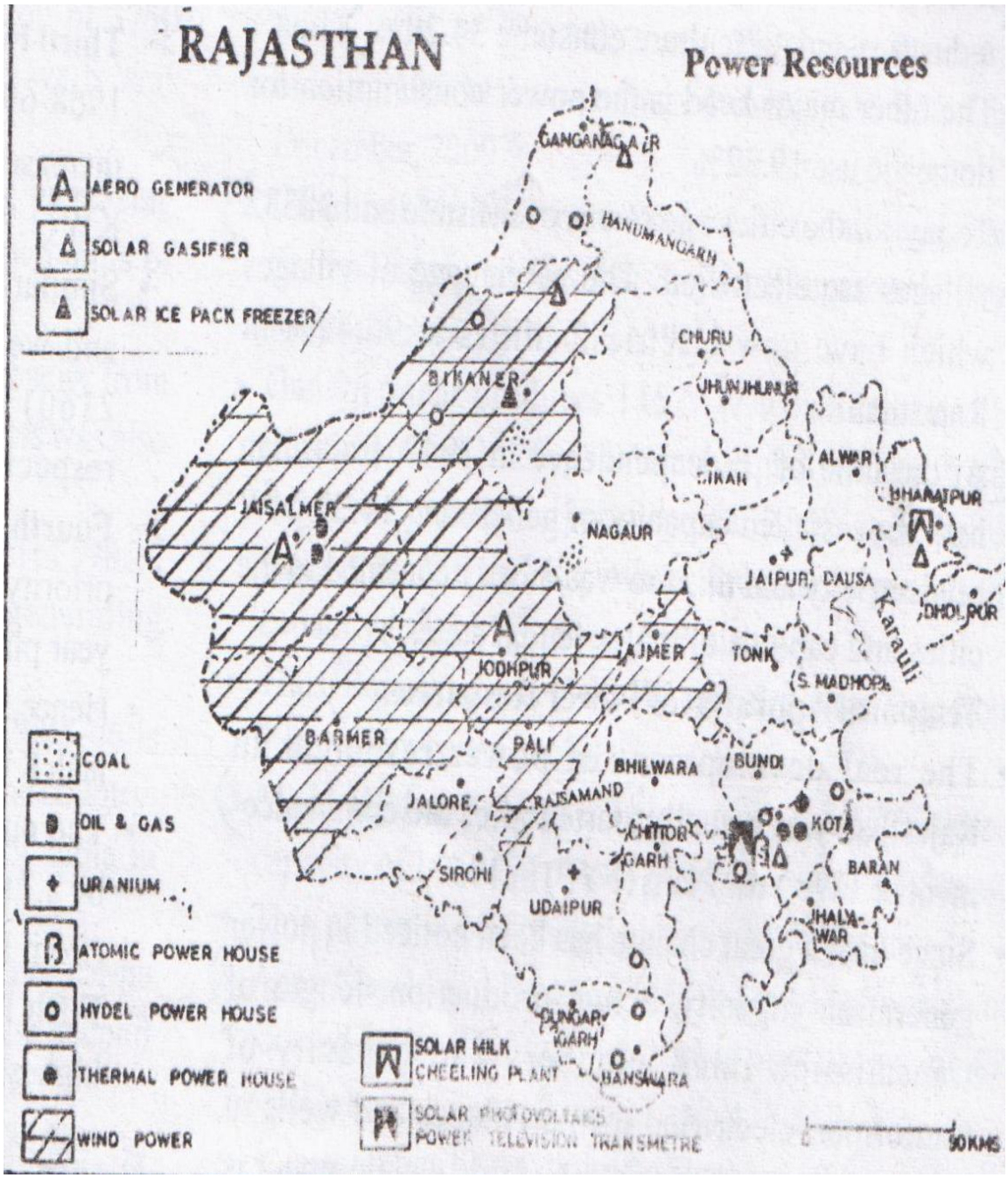
Power resources of Rajasthan play a key factor in the modern agricultural, industrial and economic development. These resources are the major source of industrial power and fuel, transportation power, agricultural power, valuable by-products (from coal and petroleum) and domestic fuel. The non-conventional new and renewable power sources having characteristics of low production cost and easy to use without generating pollution.

Classification : The following chart shows detail classification of power resources.



Broadly, these resources can be divided into two groups conventional and non-conventional (new and renewable). Conventional power resource are further divided into commercial having coal, petroleum, natural gas, atomic power (all are fund resources) and hydro-electricity (flow resource). Non commercial resources contain cow-dung and fuel wood. The non-conventional (new and renewable power resources) are divided into eleven major types, out of which first eight have a good potentiality of development in Rajasthan.

Non Conventional



Source: Dr. L.R. Bhalla

Position of Rajasthan with regards to coal and natural gas reserves in India

Rank state	Coal Reserves (in	Rank state/Area	Natural gas
1. Bihar	55,700	1. Bombay high	380
2. Orissa	29,500	2. Assam	80
3. West Bengal	27,750	3. Gujarat	19

4. M.P.	23,250	4. Tripura	1
5. Andhra Pradesh	8,500	5. Maharashtra	Neg.
6. Tamil Nadu	3,380	6. Rajasthan	Neg.
7. Maharashtra	3,180		
8. Meghalaya	509		
9. Assam	280		
10. Gujarat	160		
11. Rajasthan	105(0.07%)		

In general, position of Rajasthan with respect to power resources can be stated as under :

1. Power resources in which the state is very much deficient: coal, petroleum, natural gas, hydro-electricity.
2. Power resource, in which the state has a moderate position: atomic power.
3. Power resources in which the state has a good potentiality: solar, wind, bio-gass, bio-mass etc.

Spatial Distribution

Spatial distribution of major power resources of Rajasthan is shown in the map. Their detail description is given below:

COAL

Rajasthan is very much poor in coal deposits. Only lignite coal of tertiary era having high sulphur content with low carbon per cent (35-5.5%) is mainly found in Bikaner district. In Bikaner district, the most dominant mine is located at Palana, 23 km SW from Bikaner city with estimated reserves of 21 million tonnes. Other mines in the district are located at Kheri Channeri, Mund, Kaisardaisa etc. Jodhpur (Ganga Sarovar) and Jaisalmer districts have also some reserves. Recently, new reserves of lignite is found at Merta Road (3 crores tonnes) in Nagaur district and Kapurdi, (6 crores tonnes) in Barmer district.

(i) Palana Lignite Deposits :

The main lignite producing belt in Rajasthan is located in Bikaner division which stretches east-west, just south Bikaner city. The depth varies from 40 to 70 metre

and the thickness of seams varies from 50 cm to 80 cm. it contains about 36% moisture, 42% fixed carbon 8% ash and 3.4% sulpher. The presence of coal in this area was discovered in 1898 by some villagers when they were sinking a well. At present, the lignite is discovered from the mines by understand and stall method. The estimated reserves of Palana lignite are 23 million tons of which 12 million tons are mineable. Deshnokh is another area where about 15 million tons of lignite are known to exist.

(ii) Kapurdi (Barmer) :

Recent surveys indicate that this area has about 32 million tons of good lignite reserves. The minerl is at a depth of 10 metres in seams which are 1 to 3 metres thick. It is propsed to establish a lignite based thermal plant at Kapurdi also.

(iii) Merta (Nagpur) :

These lignite deposits have been discovered in the last decade. The mineral in seams of 4 meters thickness, exists about 100 meters deep near Merta Road, Indawar, Kasnau and Igyar areas.

Old and Natural Gas

Jaisalmer is the most important district. Here, the principal oil wells are located at Ramgarh, Ghotaru, Sadewal, Manihari – Tiba, Deva, Longewal, Jhunde etc. The other potential districts are Jodhpur, Bikaner and Ganganagar.

Kamli Tal, located near Manhihari Tiba, NW of Jaisalmer city is the dominant natural gas region of the state founded by ONGC in 1966, having reserves of 20 corers cubic metre gas. Some natural gas deposits have been discovered near Ghotaru, Ramgarh and Tannot, all of which are near the Indo-Pak border. The natural gas found in these areas has more of helium, hydrogen, hydrocarbons and methane and that can be used in making liquid petroleum gas also.

Electricity

Hydro-electricity is a good alternative source of power with characteristics of cheapness, cleanliness, pollution free and help in decentralizing industries in remote areas. Electricity is the main source of power in Rajasthan today. The largest share of electricity is consumed by industry and mining activities.

Rajasthan Power Consumption Pattern 2007-08

S.No.	Head	Consumption (MU)	% age
1.	Domestic	4596.83	19.32
2.	Commercial	1530.07	6.43
3.	Industry	7880.87	33.13
4.	Agriculture	8136.12	34.20
5.	Others	1641.92	6.90
	Total	23785.81	100%

It is obvious that 33.13% of power consumptions is in industries and agriculture consume 34.20%. At the time of independence in 1947, Rajasthan had the installed capacity of generating 13.27 MW of electricity and this too was mostly confined to the cities and capitals of major feudal states.

Power Generation Capacity

As on Dec., 2009 the total installed capacity of power generation was 7716.63 MW. Out of the total capacity the maximum capacity (50%) was for inter-states projects followed by projects under Central Government (34%) and RSEB (16%), with respect to structure of power genearation capacity, hydro-power is dominant (45.25%) followed by steam (30.3%), atomic (24.4%) and diesel (0.5%). The net power consumption is likely to be 3005.076 crore units during the year 2009-10 upto December, 2009 as against 3646.04 crore units consumed during 2008-09.

Power Plant & Projects of Rajasthan

Rajasthan has developed its own power resources whch are the thermal, hydro and nuclear. Still the State has to depend to a large extent on adjacent State for power supply and due share has been allocated to Rajasthan from their power stations.

1. Kota Thermal Power Plant : Located on the banks of the Chambal river, near Kota the KTPP produces 1240 MW of electricity having 2 units of 110 MW and 3 units of 210 MW each. This sixth & seventh unit of 195 MW was started in August 2004 and December 2009.

2. Chambal Multipurpose Project : Gandhi Sagar, Rana Pratap Sagar and Jawahar Sagar all together have an installed capacity of 386 MW. Rajasthan gets 193 MW of hydro-electricity from this multipurpose project.
3. Mahi Hydro Project : This project has an installed capacity of 140 MW phase – I 2x25 mw & II 45x2 mw.
4. Anta Gas-based power : This gas based power plant located at Anta in Baran district is now producing 88 MW whereas its total capacity is 419 MW.
5. Rajasthan Atomic Power Project : Rawat Bhata has the installed generated capacity of 1280 MW.
6. Anupgarh Hydro Station : This small hydro power plant produces 9 MW of electricity and the entire power is used for Rajasthan.

Earlier, Rajasthan state electricity Board (RSEB) was the prime agency for generation, transmission and distribution of electricity in the state. Now with effect from 19th july 2000, the RSEB has been restructured into five companies to strengthen the existing infrastructure and to provide good quality of supply to the consumers. These Companies are as follows :

1. Rajasthan Rajya Vidyut Prasaran Nigam Ltd.
2. Rajasthan Rajya Vidyut Utpadan Nigam Ltd.
3. Jaipur Vidyut Vitran Nigam Ltd.
4. Ajmer Vidyut Vitran Nigam Ltd.
5. Jodhpur Vidyut Vitran Nigam Ltd.

At the of Dec. 2009, the installed capacity in the State was 7716.63 MW. Under Rural Electrification Programme, out of total 39753 villages in the state, 38332 village have been electrified and 9.47 lakh wells energized by the end of December 2009.

Non-conventional Source of Power

Looking into the inceassant depletion of fossil fuels and the massive construction costs of hydro and thermal power projects, it is essential to develop the non-conventional source of power and to depend upon them. They are also useful in villages where costs of transmission can be minimized by local production of power.

Rajasthan Energy Development Agency (REDA)

REDA has been merged with the New company Rajasthan Renewable Energy

Corporation Ltd. (RREC).

Solar Power

Rajasthan has a tropical climate where solar radiation intensity is very high for most parts of the year. Estimates show that for 300 to 325 days in a year the sky is clear and the sunshine is abundant. The solar insulation is more than 600 Kcal/sq. cm in most of region. This energy can be used to generate power.

The major fields of solar energy development are road lighting, solar power pack (SPP), solar water heating system, solar cooker, solar water pump, battery generated electric vane, solar gasifier, solar ice park freezer, solar milk chilling plants and solar photovoltaic power television transmitter.

BIO-GAS

Rajasthan has a very large number of domestic animals. Hence, bio-gas (which is also called as green revolution) can be good source of energy in rural areas. The outcome of investment on bio-gas is manifold. It saves fuel wood and generate high quality of organic fertilizer. This gas can be used for lighting individual houses, preparing and cooking food and using electrical appliances. Nearly 4 lakh biogas plants have been installed in various districts of the state till now.

Five plants with 46.3 MW capacity of power project based on biomass have been installed in the State and another four projects based on biomass totaling to 45.5 MW under implementation.

Wind Power

High speed winds have a great capacity to generate power. Wind mills are used locally in the Netherlands and Denmark for supply of electricity in homes and small flour mills. The velocity of wind in Rajasthan is 10-20 kw/hr. so wind power can be developed easily in the State. Wind will and aero generator are the two sources of wind power.

Urban Waste

Cities produce lot of garbage every day and this can be used to produce

electricity. City Central Government has stated such an electric station at Timarpur (Delhi) which produces 3.75 kw of electricity. Such plants can be set up in big cities of Rajasthan e.g. Jaipur, Jodhpur, Udaipur etc.

Agro-Power Plants

These power plants use husks of rice, wheat, millets and other cereals to generate power in turbines. Such a plant has been started at Jalkheri (Patiala) which produces 1 kw of electricity. These power plants can be efficiently started in rice and wheat producing areas of Rajasthan.

Bio-mass Energy

Exploitation of energy from bio-mass is another non conventional method of power generation. The main source for bio-mass energy in the State of Rajasthan is mustard husk and Julie Flora. Five plants with 46.3 MW capacity of power project based on bio-mass have been commissioned in the State out of which 15 MW capacity has been kept for own captive power purpose and another six projects based on biomass totaling to 72 MW are in progress.

Problems

There are various physical, economical, human, technological and political problem in the development of Power resources of Rajasthan.

1. Physical Problem are related to unequal distribution low, quality and low quantity of power resources.
2. Seasonal rivers are the basic obstacle in hydropower generation.
3. Economical problems are concerned with lack of capital, transportation and suitable infrastructure facilities.
4. Human problems are related to misuse and unauthorized use of power along with lake of awareness and power thefting.

Government Efforts

Various efforts has been made by the state and central government for power development and conservation as listed below :

1. Huge investment has been made for power development during five year plans.
2. Establishment of Energy Department and Energy Board and other institutions like commission for additional source of Energy, Rural Electricity Board (REB),

Inter regional board, central water and power commission and department of Non-conventional Energy sources (DNES).

3. Rajasthan Energy Development Association was formed in January, 1985 for the development of non-conventional sources of energy.

Suggestions

Although the state and central govt. have done various efforts to solve power problems in Rajasthan still there are some lacuna and loopholes for which following suggestions can be helpful:

1. Permission to be given to large industries to produce energy for their use.
2. Reformation in energy management.
3. Preference to complete current power projects and full capacity utilization of energy machinery.
4. More efficient use of available lignite coal in steam power for Bikaner and Ganganagar districts and for making bricks.
5. Mini hydro power projects should be developed wherever feasible.
6. Popularise smoke less fuel efficient chulhas.
7. Greater emphasis on the development and use of non-conventional energy source.

Multiple Choice Questions

1. By which name does the Brahmaputra enter into India?
(a) Manas
(b) Dhansiri
(c) Dihang
(d) Tsangpo
Answer (c)

2. Near the lake Mansarovar in Tibet, the river which has its source is/are:
(a) Indus
(b) Sutlej
(c) Brahmaputra
(d) All of these
Answer (d)

3. The river basin which is called 'Ruhr of India' is:
(a) Damodar
(b) Hooghly
(c) Godavari
(d) Swarnarekha
Answer (a)

5. The longest river of peninsular India is:
(a) Narmada
(b) Godavari
(c) Mahanadi
(d) Cauvery
Answer (b)

6. Which of the following river is known as India's River of Sorrow?
(a) Hooghly
(b) Damodar
(c) Ghaghara
(d) Kosi
Answer (d)

7. In which state is Jog Falls located?
(a) Maharashtra
(b) Karnataka

(c) Tamil Nadu
(d) Kerala
Answer (b)

8. The correct sequence of the eastward flowing rivers of the peninsular India from north to south is:
(a) Subarnarekha, Mahanadi, Godavari, Krishna, Pennar, Cauvery and Vagai
(b) Subarnarekha, Mahanadi, Krishna, Godavari, Cauvery, Vagai and Pennar
(c) Mahanadi, Subarnarekha, Godavari, Krishna, Cauvery, Pennar and Vagai
(d) Mahanadi, Subarnarekha, Krishna, Godavari, Cauvery, Vagai and Pennar
Answer (a)

10. The second largest river basin in India is of the river:
(a) Brahmaputra
(b) Narmada
(c) Krishna
(d) Godavari
Answer (d)

11. Which of the following rivers existed before the uplift of the Himalaya?
(A) Brahmaputra
(B) Sutlej
(C) Indus
(D) Bhagirathi
(a) A and C
(b) B and C
(c) A, B and C
(d) A, B, C and D
Answer (c)

12. Match the following:
City River passing through the city
A. Nasik 1. Krishna
B. Surat 2. Cauvery
C. Ujjain 3. Godawari
D. Vijayawada 4. Shipra
5. Tapti
A B C D
(a) 3 5 4 1
(b) 4 1 3 2

(c) 3 1 4 2
(d) 4 5 3 1
Answer (a)

14. Arrange the following rivers from South to North:
1. Cauvery
2. Krishna
3. Godavari
4. Mahanadi
(a) 1, 3, 2, 4
(b) 3, 4, 1, 2
(c) 2, 4, 3, 1
(d) 1, 2, 3, 4
Answer (d)

15. Consider the following pairs:
Tributary River Main River
1. Chambal - Narmada
2. Sone - Yamuna
3. Manas - Brahmaputra
Which of the pairs given above is/are correctly matched?
(a) 1, 2 and 3
(b) 1 and 2
(c) 2 and 3
(d) 3 only
Answer (d)

16. In the decreasing order of the length of the rivers, the correct sequence is:
(a) Brahmaputra – Ganga – Godavari - Narmada
(b) Ganga – Godavari – Brahmaputra - Narmada
(c) Brahmaputra – Narmada - Godavari - Ganga
(d) Ganga – Brahmaputra – Godavari – Narmada
Answer (a)

17. By what name is the Ganga known in Bangladesh?
(a) Padma
(b) Bhagirathi
(c) Rupnarayan
(d) Nubra
Answer (a)

18. Which of the following peninsular rivers is westward flowing?
(a) Mahanadi
(b) Godavari
(c) Tapti
(d) Cauvery
Answer (c)

19. Two Volcanic islands in Indian territory are—
(A) Kavaratti and Newmoor
(B) Great Andaman and Little Nicobar
(C) Pambam and Barren
(D) Narcondam and Barren
Ans: (D)

20. The Neveli thermal power plant is led by
(A) Gondwana Coal
(B) Teritary Coal
(C) Quartemary
(D) Cambrian Coal
Ans: (A)

21. Where are iron-ore mines located?
(A) Jaduguda, Singhbhum, Kundremukh, Tharia
(B) Singhbhum, Bastar, Mayurbhanj, Keonjhar
(C) Nevely, Bastar, Tharia, Khetri
(D) Bhadravati, Barauni, Nevely, Singhbhum
Ans: (B)

22. Where are the important plants of BHEL located?
(A) Bhopal, Hyderabad, Pinjor
(B) Haridwar, Tiruchirapalli, Srinnagar
(C) Delhi, Bombay (Mumbai), Calcutta (Kolkata)
(D) Bhopal, Hyderabad, Tiruchirapalli
Ans: (D)

23. ISRO is in—
(A) Thumba
(B) Bangalore (Bangaluru)
(C) Trivandrum

(D) Sriharikota
Ans: (B)

24. Which is the group of languages spoken by largest number of people in India?
(A) Indo-Aryan
(B) Dravidian
(C) Austro-Asiatic
(D) Sino Tibetan
Ans: (A)

25. Match the List-I with List-II and select the correct answer using the codes given below:

List-I (Industries)	**List-IL (Industries Centre)**
1. Pune	(A) Pearl fishing
2. Tuticorin	(B) Automobiles
3. Pinjor	(C) Ship building
4. Marmagao	(D) Engineering goods

Codes:

	(A)	(B)	(C)	(D)
(A)	2	1	4	3
(B)	2	1	3	4
(C)	1	2	4	3
(D)	1	2	3	4

Ans: (A)

26. To which group do most of the Indians belong?
(A) Caucasoid
(C) Australoid
(B) Negroid
(D) Mongoloid
Ans: (A)

27. For what is Philadelphia well known?
(A) Ship-building
(B) Dairy industry
(C) Locomotives
(D) Silk textile

Ans: (C)

28. Which are the twin cities?
(A) Delhi and Faridabad
(B) Bombay (Mumbai) and Pune
(C) Hyderabad and Secunderabad
(D) Bangalore (Bengaluru) and Mysore
Ans: (C)

29. Alluvial Soil is fertile mainly because—
(A) It is rich in humus
(B) It is rich in lime
(C) It contains minerals in fine particles which can be absorbed easily by plants
(D) It can be used for both rabi and kharif cropping
Ans: (C)

30. Where is home of the Asiatic Lion?
(A) Gir National Park
(B) Dudhwa National Park
(C) Kanha National Park
(D). Corbett National Park
Ans: (A)

31. What is jhoom?
(A) A type of cultivation
(B) A type of swinging basket
(C) A river valley in a dry region
(D) A tribal dance of MP
Ans: (A)

32. Where is the largest amount of manganese produced?
(A) Madhya Pradesh
(B) Orissa
(C) Bihar
(D) Assam (Asom)
Ans: (B)

33. The largest amount of saffron comes from
(A) Uttar Pradesh
(B) Tamil Nadu

(C) Kerala
(D) Jammu and Kashmir
Ans: (D)

34. What is true about the Second Green Revolution?
I. It aims at increasing production of wheat and rice in the area which have already benefited from green revolution.
II. It aims at extending the technology of high yielding seeds and chemical fertilisers to those areas which did not benefit-from the green revolution.
III. It aims at increasing the yield of crops other than those which were used for the green revolution in the beginning.
(A) I and II
(B) I and III
(C) III only
(D) II and III
Ans: (D)

35. Which one among the following is a major Tobaco-growing state ?

A. Andhra Pradesh
B. Chhattisgarh
C. Kerala
D. Madhya Pradesh
Ans: A

36. Next to Hindi, the largest speaking language in India is:
A. Bangla
B. Marathi
C. Urdu
D. Telugu
Ans: A

37. The State/UT having lowest Sex ration in India is:
A. Haryana
B. Delhi
C.Dadra&NagarHaveli
D. Daman and Diu
Ans: D

38. Which one of the following is the first state to have fully privatized its power distribution network ?
A. Maharashtra
B. Rajasthan
C. Orrisa
D. West Bengal
Ans: A

39. Very high grade iron ore found in India is limited and restricted mainly to:
A. Anantpur district of AP
B. Degana in Rajasthan
C. Hospet area of Karnataka
D. Bailadila Mines of MP
Ans: C

40. Which one of the followin states has the worlds largest fresh water island ?
A.UP
B.Karnataka
C.Bihar
D.Assam
Ans:D

41.Which of the following city do not have refinery ?
A.Chennai
B.Kochi
C.Mangalore
D.Bangalore
Ans:D

42.Tyanyang Gyastso biosphere reserve is located in:
A.ArunachalPradesh
B.Assam
C.Mizoram
D.Sikkim
Ans:A

43.Which one of the following pair is not correctly Matched:
A.MiriHills-ArunachalPradesh
B.MikirHills-Assam
C.LushaiHills-Mizoram

D.Aborhills-Tripura
Ans:D

44. Which one of the following Indian states does not share border with Bhutan
A.Sikkim
B.Meghalaya
C.WestBengal
D.ArunachalPradesh
Ans:B

45. Indian railways factory - Diesel Component Works(DCW) is located at:
A.Varanasi
B.Perambur
C.Patiala
D.Kapurthala
Ans:C

46. The water of which one of the following lakes is used for producing salt ?
A.Barapani
B.Kolleru
C.Lagtak
D.Sambhar
Ans:D

47. Which one of the following rivers originates in Brahmagiri range of western Ghats ?
A.Penneru
B.Kaveri
C.Krishna
D.Tapti
Ans:B

48. Baglihar Hydropower Project is located on which one of the following rivers ?
A.Beas
B.Chenab
C.Ravi
D.Sutlej
Ans:B

49. Who among the following tribes live in the UT of Andaman and Nicobar Island ?
A.Apatani

B.Jarawa
C.Munda
D.Santhal
Ans:B

50.How many India states border Myanmar ?
A.3
B.4
C.5
D.6
Ans:B

51.Which among the following are the southern-most hills ?
A.CardamomHills
B.JavadiHills
C.NallamalaiHills
D.NilgiriHills
Ans:A

52.Which among the following is the western-most city ?
A.Delhi
B.Jhansi
C.Gwalior
D.Agra
Ans:A

51.Which one of the following rivers does Chambal river merge ?
A.Banas
B.Narmada
C.Ganga
D.Yamuna
Ans:D

52.Indus river originates in?
A.Kinnur
B.Ladakh
C.Nepal
D.Tibet
Ans:D

53.Nandadevi park is located in:
A.HimachalPradesh
B.Uttrakhand
C.Jammu&Kashmir
D.Sikkim
Ans:B

54.Gandhi Sagar Reservoir is of the river ?
A.Chamba
B.Narmada
C.Rihand
D.Sutlej
Ans:A

55. Which one of the following district is well known for the cultivation of coffee ?
A.Balasore
B.Chikmagalur
C.Solapur
D.Guntur
Ans:B

56.For which spice is Kashmir famous?
A.Cinnamon
B.Cloves
C.SaffronRight!
D.BlackPepper
Ans:C

57. Which city of India stands on the River Hooghly?
A.Kolkata(Calcutta)
B.Ahmedabad
C.Agra
D.Lucknow
Ans:A

58. Larget capacity Solar power plant of India is:

A.Dhirubhai Ambani Solar Park, Rajasthan
B.Chranka Solar Park, Gujarat
C.Bitta Solar Power Plant, Gujarat
D.Mahindra & Mahindra Solar Plant, Rajasthan

Ans:B

59. Which mountain range of the following is compared with that of the Aplachian Mountain range of America from the point of view of shape and structure?
A. Vindhyachal Mountain range.
B. Aravalli Mountain range.
C. Himalayan Mountain range.
D. Kumayun Mountain range.
Ans. B

60. Where is Asia's second largest artificial lake located?
A. Rajsamand lake
B. Pichhola Lake
C. Balsamand Lake
D. Jai Samand Lake
Ans. D

61. Match the following :

	(River)	(Ending into/Falls into/Joins)
i.	Western Banas	a. Yamuna river
ii	Mahi	b. Chambal river
iii	Luni	c. Yamuna river
iv	Chambal	d. Rann of Kutch
v	Parwati	e. Rann of Khambhat
vi	Banganga	f. Rann of Kutch

	i.	ii	iii	iv	v	vi
A	a	b	c	d	e	f
B	f	e	d	c	b	a
C	b	c	d	a	f	e
D	c	d	e	f	a	b

Ans. B

62. Name the Martyr lady of Jodhpur who sacrificed her life for the protection of forests?
A Amrita Devi
B Sita Bai
C Rameshwari
D None of above
Ans. A

63. Ghotaru where natural gas was found is situated in the district of :

A Nagaur
B Jaisalmer
C Banswara
D Chittorgarh
Ans. B

64. Black Stone is mined :
A Makrana
B Bhainslana
C Kota
D Nimbahera
Ans. B

65. Which one of the following plants may be considered development of the state?
A Satpura Thermal Project
B Kota Thermal Project
C Singarauli Thermal Project
D Rajasthan Atomic Power Centre, Kota
Ans. C

66. A Thermal Project of 240 megawatt capacity in Barsingsar of Bikaner region is being installed by:
A Nevelli Lignite Corporation
B Government of Rajasthan
C Central Electricity Authority
D Rajasthan State Electricity Board
Ans. B

67. The Kapurdi area where new reserved of good quality of lignite are found located i
A Bikaner
B Nagaur
C Barmer
D Ajmer
Ans. A

68. Where is situated a project based on gas in Rajasthan ?
A Sawai Madhopur
B Ramgarh
C Rawat Bhata
D Anta

Ans. D

69. Under whose control, a plant based on helium gas is being installed in Rajasthan?
A Atomic Energy Department
B National Space Centre
C Bhabha Atomic Research Institute
D National Gas and Oil Commission
Ans. C

Key Terms

The Bhabar – is a narrow belt about 8-16 km wide running in East-west direction along the foot of the

Shiwaliks with a remarkable continuity from the Indus to the Tista.

The Tarai – is a 15-30 km wide morshy tract in the south as Bhabar running barallel to it.

The Bhangar – is composed of old alluvium of the Middle Pleistocene age & forms the alluvial terrace above the level as flood plains.

The Khadar – is composed as newer alluvium & forms the flood plains along the river banks.

Climate – as a country includes the study of temperature, rainfall, atmospheric pressure, as well as the direction & velocity as winds over a large period as time.

Monsoon – is a double system as seasonal winds, that is the sum as summer & winter winds.

E1-Nino – is a narrow warm current which occasionally appears off the coast as Peru in December.

La-Nino – after an E1-Nino, weather conditions return to normal.

Soil – is the thin surface layer on the earth, comprising mineral particals formed by the break-down as rocks, decayed organic materials, living organisms, water & air.

Soil Erosion – is the removal as soil by the force as nature, particularly wind & water, more rapidly than the various soil forming processes can replace it.

Desertification – A process by which the biological productivity as the land is so

reduced as to lead to the spread as desert-like conditions in arid & semi-arid reorions.

Hazards – Phenomena that pose a threat to people structures or economic assets & which may cause a disaster. They could be either man made or naturally occurring in our environment.

Disaster – A serious disruption or the functioning as a society, causing widespread human, material or environmental losses which exceed the ability or the affected society to cope using its own resources.

Density of population = Total population/Total Area X 100

Sex ratio = Number as females / Number of males X 100

Migration – is a from of spatial mobility of population between one geographical unit and another involving a permanent change as residence.

Urbanisation – The process of society's transformation from a predominantly rural to a predominantly urban population is known as urbanization.

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