



NIILM
University



Geography of India

Subject: GEOGRAPHY OF INDIA

Credits: 4

SYLLABUS

Climate Regions of India

India in the context of southeast & South Asia, India a land of diversities, Physical regions of India, Drainage systems of India, Regional and seasonal variations of climate – The monsoon, western disturbance, nor westers.

Types of Soil Found in India

Soil types of India – Their distribution and characteristics, vegetation types and distribution, Forests, water, minerals and power resources – The status of their use and need of conservation, Spatial distribution of population and density, socio – economic implications of population explosion, urbanization, Changing nature of Indian economy.

Development of Agricultural Growth

Agricultural growth during the plan period, Green revolution Vis-à-vis traditional farming, Industrial development and Indian economy, Industrial regions of India and their industrial structure, Composition of domestic and international trade.

Contemporary Issues

Regional disparity in social and economic development, Poverty, population explosion, globalization, social & ethnic tension, Gender discrimination, Empowerment of women.

Suggested Readings

1. Surya Kant, Administrative Geography of India, Rawat Publications
2. S.A. Qazi, Qazi, Geography of India, APH Publishing Corporation
3. T. C. Sharma, O. Countinho, Economic And Commercial Geography Of India, South Asia Books
4. Alexander Cunningham, The Ancient Geography Of India,

Chapter 1- climate Regions of India

Learning Objectives

- To define the India in the context of southeast & South Asia.
- To explain the diversities of India.
- To explain the Physical regions of India.
- To describe the Drainage systems of India.

1.1 Introduction

The weather of India shows an amazing variety. This is reflected in dissimilar climatic areas, ranging from tropical in the south to moderate and alpine in the Himalayan north where some areas receive continuous snowfall during the winter season. India is also characterized by strong temperature variations in dissimilar seasons ranging from a mean temperature of about 10°C in winter to about 32°C in the summer season.

The India's weather is strongly influenced by the Himalayas in the north and the Thar Desert in the northwest. The Himalayas act as a barrier to the cold winds from Central Asia keeping the bulk of the Indian subcontinent warmer than most locations at similar latitudes.

The overall land areas in the north of the country have a continental weather with severe summer conditions and cold winters with temperatures around the freezing point. In contrast, the coastal areas of the country offer constant warmth with frequent precipitation.

The rainfall pattern roughly reflects the dissimilar weather zones of the country, which vary from humid in the northeast to arid in Rajasthan. The country is influenced by two seasons of rains, accompanied by seasonal reversal of winds from January to July. Nevertheless, there is a large variation in the amounts of rainfall at dissimilar locations. 75 percent of the annual rainfall is received during a four month period between June and September, the monsoon season. Variability in the onset, withdrawal and quantum of rainfall during the monsoon season has profound impacts on water resources, power generation, farming, economics and ecosystems in the country.

1.2 India in the context of southeast & South Asia

India is a giant among South Asian countries. South Asia comprises of the Pakistan, Nepal, Bhutan, Bangladesh, Sri Lanka and Maldives - a total of 7 countries.

South Asia has a total area of about 4-488 million sq. km. Out of this India (3-287 million sq km) occupies 73.2% of the total area of South Asia. It is 4 times larger than Pakistan, which is the second largest in S. Asia and II thousand times larger than the tiniest Maldives.

Pakistan, whose area is 0-803 million sq km, is a poor second area wise, i.e., 17-8% of South Asia. The smallest or the tiny country is Maldives, whose area is a little less than 300 sq km and occupies 0 006% area of S. Asia.

1.2.1 Extent

India is the largest so far as extent is concerned. From Kanyakumari 8°N to 37°N (Approximately), it covers a range of 29° latitudes while from the west (Rann of Kachch) to east (Tri-junction) it covers a range of 29° longitudes. Tropic of Cancer almost bisects India.

The extent of Pakistan is 13° latitudes and 14° longitudes. It is situated in the semi-temperate area. Nearest to the Equator is Maldives, through which 5°N Parallel passes. Other countries are between India and Maldives latitudes.

1.2.2 Relief

Highest relief is found in Nepal and at Nepal-China border lies Mt. Everest (8848 m). The whole country except a few valleys is mountainous. Similar is Bhutan. Physiographically, Maldives is the lowest. It is near the sea-level whose many islands, out of a total of 2,000, submerged at the time of high tide.

India has the largest plain area followed by Pakistan and Bangladesh. India and Bangladesh have the most of marshy areas in their deltas. Rivers criss-cross the plains in India and Bangladesh, while other countries are mostly devoid of this feature.

1.2.3 Climate

All these countries are situated in the monsoon area and hence have tropical weather. Pakistan's northern parts, on account of the height, experience temperate weather. Similar is the case of Nepal and Bhutan.

In fact the weather varies from Equatorial (Maldives) to harsh temperate in the north. Pakistan receives the lowest rainfall in South Asia.

1.2.4 Natural Vegetation

India's natural vegetation is varied from temperate pine, deodars to stunted trees, bushes and grassland. Pakistan, being on the fringe of monsoon regime, is comparatively arid and dotted with stony waste in the west.

Bangladesh is lush green due to heavy monsoon rains. India also has modified type of equatorial forests on the Western Ghats and some in the north-east.

1.2.5 Farming

India is a leader so far as agricultural products are concerned. Wheat production is more than 3 times than that of its second, the Pakistan. Rice production of India is 4 times higher than that of Bangladesh. Other countries of South Asia are agriculturally poor.

In the production of other cereals like maize, barley, millets, etc. India is ahead of other South Asian countries.

In the production of jute, Bangladesh used to lead but presently India is far ahead of Bangladesh. Jute production of India is two times that of Bangladesh. In fact India's raw jute production is the highest and is around 50% of that of the world production.

Bangladesh is second and Nepal is third in jute production. Other countries do not matter. So far as natural rubber is concerned India and Sri Lanka are worth mentioning. India's production of rubber is about 11 times more than that of Sri Lanka.

Among oil seed crops, India is the largest producer of groundnuts in the world, averaging around one-third of the world's production. Countries of South Asia do not find any significant place anywhere. In the production of linseed, soybean etc. India is the front-ranking producer in South Asia.

In the production of beverages, tea and coffee India again leaves other countries far behind. India is the largest producer of tea.

India is a dominant producer of tobacco in South Asia while other countries stand almost nowhere.

India is the leading producer of sugarcane in Asia while Pakistan is a poor second.

1.2.6 Fish Resources

In South Asia, India is the dominant fishing nation. Here the fish is caught along the sea coast, high seas, lakes, rivers and ponds.

A variety of edible fish are caught. It is an important part of the diet of the people of South India. Fishing is an important activity in Bangladesh, Pakistan, Sri Lanka and Myanmar.

Live Stock. India has over 200 million heads of cattle. These are oxen, cows, buffaloes, sheep, goats, camels, donkeys, horses, mules, poultry birds etc.

Pakistan, Bangladesh, Nepal, Myanmar has also a sizeable number of livestock.

1.2.7 Energy Resources

The main resources are coal, petroleum and electricity. The secondary resources are wood, animal waste, tide, wind and solar power countries of South Asia.

India has the largest resources of these while others are very poor. In fact all other countries are fully dependent on imports. India is self-sufficient in coal but has to import about one-third of petroleum in order to meet its requirement.

1.2.8 Industrial Production

The dominant industrial power in South Asia is India. The second one is Pakistan while the remaining five have still to develop and find a position of some significance.

The major industries of India are iron and steel, textile, machine tools, sugar, cement, fertilizers, electrical, electronics, automobiles, armament, cargo and naval ships, oil refining, agricultural machines, petrochemicals, chemicals, railway engines, rail coaches etc.

1.2.9 Transportation

India is the largest country of South Asia and has a very elaborate system of rail, road, air and water transportation while other countries lag behind. Many countries do not have railway lines (i.e., Bhutan & Nepal). Nepal and Bhutan are landlocked countries.

1.3 India a land of diversities

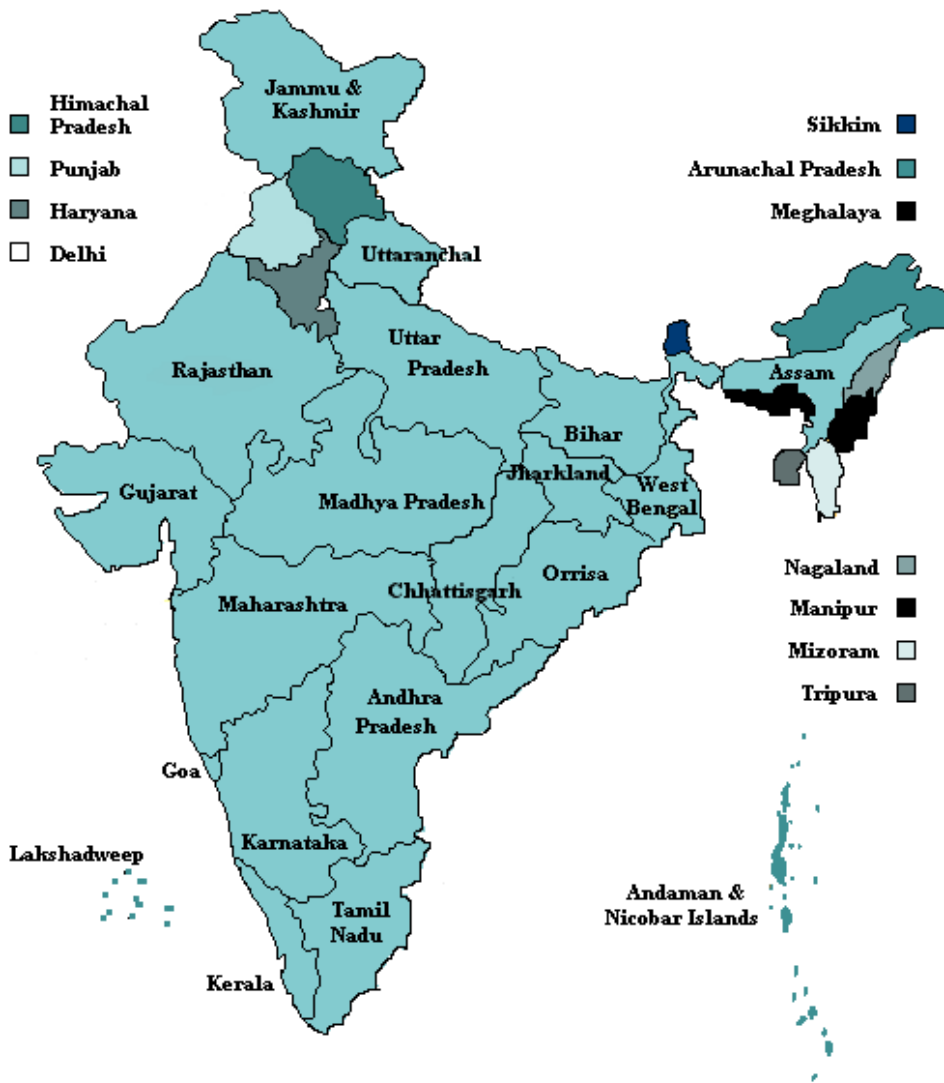
Diversity of people and beliefs, area and religion, custom and tradition, flora and fauna, trades and occupations.

Nowhere in the world can you find a country better known for its unity of all its diversities than India- a land of diversities and an amalgamation of cultural and traditional heritage.

1.3.1 To quote Mark Twain what he said about India:

“The land of dreams and romance, of fabulous wealth and fabulous poverty, of splendour and rags, of palaces and hovels, of famine and pestilence, of genii and giants and Aladdin lamps, of tigers and elephants, the cobra and the jungle, the country of hundred nations and a hundred tongues, of a thousand religions and two million gods, cradle of the human race, birthplace of human speech, mother of history, grandmother of legend, great-grandmother of traditions, whose yesterday’s bear date with the modering antiquities for the rest of nations-the one sole country under the sun that is endowed with an imperishable interest for alien prince and alien peasant, for lettered and ignorant, wise and fool, rich and poor, bond and free, the one land that all men desire to see, and having seen once, by even a glimpse, would not give that glimpse for the shows of all the rest of the world combined.”

Owing to its varied climatic conditions, rich soils and topography it houses a wide variety of flora and fauna. Its richness in flora and fauna is a spectacle for the eyes. For all nature lovers in India is like an eye candy. India is one of the twelve mega diverse nations of the World. Two of India’s great mountain ranges, the Eastern Himalayas and the Western Ghats have been designated among the world’s eighteen ‘*hotspots*’ of biodiversity. Older than the great Himalayan mountain chain, the Western Ghats of India was declared a UNESCO World Heritage Site as they are a geomorphic feature of immense global importance. The Outstanding Universal Value of the Western Ghats is manifested in the area’s unique and fascinating influence on large-scale biophysical and ecological processes over the entire Indian peninsula.



It is home to at least 325 globally threatened flora, fauna, bird, amphibian, reptile and fish species. The snow-laden mighty Himalayas- ‘*the abode of snow*’ cover a vast region along the northern frontiers of India and span five **Indian States — Jammu and Kashmir , Himachal Pradesh, Uttar Pradesh, Sikkim and Arunachal Pradesh** — from west to east. The Himalayas are a storehouse of natural herbs and shrubs, its deep valleys and its snowy mountain glaciers, lakes are epitomes of scenic beauties.

It is popular for its forest vegetations ranging from dense tropical rainforests and Alpine and sub-alpine forests to desert vegetations with awesome and abundant rare plants and animal species. Chirpine, Deodar, Blue pine, spruce, silver fir, and junipers oaks, laurels, maples, rhododendrons, alder, birch and dwarf willows as evergreen forests with lots of bamboo and tall grasses are the pride of Himalayas.

True to its opulence Himalayas are the true confluence of three major religions of Asia viz., Hinduism, Islam and Buddhism where people from dissimilar cultures and custom enjoys their diversity. The infamous Siachen Glacier in the Karakoram Range of the Himalayan Mountains which happens to be the world’s highest battlefield is a place where the Indian army battles the biting cold and checks all infiltration and external aggression so that the country rests in peace.

For ages now Himalayas have been a popular tourist destination for Adventure trekking and mountaineering challenges, thousand expeditions of mountaineers climb for the highest peaks every year. Northern Plains Uttar Pradesh, Uttaranchal & Bihar – At the geographic heart of the lush northern plains of India, running

from the northwest to the east and watered by the holy rivers Ganga and Yamuna, lies Agra, home of the Taj Mahal, and the holy seventh century city of Varanasi, contemporary of Babylon and Nineveh, with its bathing ghats and bazaars of deep antiquity selling rich brocades and embroideries dating to a 2000-year tradition, the Corbett National Park's forested tiger havens and the brooding Buddhist monasteries of Bodhgaya. The agriculturally most productive alluvial silts and clays of the Ganga-Brahmaputra delta lie in north-eastern India. India has a rich variety of wetland habitats. Two sites – Chilka Lake (Orissa) and Keoladeo National Park (Bharatpur) – have been designated under the Convention of Wetlands of International Importance (Ramsar Convention) as being especially significant waterfowl habitats.



The Andaman and Nicobar Islands of India are the paragon of beauty and present a landscape full with scenic and picturesque extravaganza. These islands shimmer like emeralds in the **Bay of Bengal**.

The dense forest which cover these islands and the innumerable exotic flowers and birds create a highly poetic and romantic atmosphere. The Andaman and Nicobar Islands is home to some of the oldest tribes of the world like Negrito and Mongoloid tribes. The Jarawa tribes are the indigenous peoples of the Andaman Islands in India which are still at the hunting - gathering stage of the economy along with the Sentinelese.

The Great Nicobar Biosphere island reserve, whose tropical wet evergreen forest hosts a wealth of animal species and medicinal plants, was recently added to a global list of places named by UNESCO for promoting

sustainable development based on local community efforts and science. Great Nicobar is also home to indigenous Shompen people, semi-nomadic hunters living inland. North East India has numerous tribal communities such as Adis, Apatanis, Angami, Ao, Rengma, Nyishi, Garo, Khasi, Jaintias, Lushais, Kukis, Bodo, Mishng, Karbi, Bhutias, Lepchas, Nepalese, Riang, Trippera and Tripuri. Jharkhand is an important State from the viewpoint of tribal population in India.

There live thirty types of Scheduled Tribes in Jharkhand, viz., Primitives Tribes: Asur, Birhor, Birajia, Korba, Mal Paharia, Sauriya Paharia, Sabar, or Hill Kharia and Parahiya. **Other Tribes:** Biga, Banjara, Bathudi, Bedia, Bhumij, Binjhia, Chero, Chik Baraik, Gond, Gorait, Ho, Karmali, Khadia, Kharwar, Khond, Kisan, Kora, Lohra, Mahali, Munda, Oraon and Santhal. Nilgiris, which is one of the oldest mountain ranges, located at the tri-junction of Tamil Nadu, Kerala and Karnataka is India's first biosphere and also home to the Toda Tribe which is the most ancient and unusual tribe in Tamil nadu.

The toads have their own language. They have their own secretive customs and regulations and known to practice fraternal polyandry. Rolling grasslands, dense shoals, waterfalls, streams, lakes and the violet blossoms of 'cringe' flower enveloping the Nilgiri hills are like a treat to the eyes.

India exports finest quality of Assam and Darjeeling Teas from the finest plantations in the fertile Brahmaputra valleys in Assam which is the world's largest tea-growing area as well second commercial tea production area after China. All over the world the Indian cuisine is famous for its spicy food which contains several spices blended together and the famous black pepper which fascinated the British traders towards India is grown along the Malabar Coast.

Pepper, popularly known as black gold holds a prime position in the world of spices. The distribution pattern of pepper across various states of India showed the dominance of Kerala. Black pepper originated in Kerala. From here it spread to the rest of South and Southeast Asia. Until well after the Middle Ages, virtually all of the black pepper found in Europe, the Middle East, and North Africa traveled there from Kerala in India. Filled with coconut groves, rice paddy fields, secluded beaches, verdant hillside spice gardens and isolated inland waterways, slow and rhythmic Malabar is the essence of authentic India—a secret gem.

More than 500 varieties of mammals, several species of birds and various types of insects and a wide variety of fish, amphibians and reptiles are found in India. Kaziranga, the home to five big mammals, i.e. the Great Indian one-horned Rhinoceros, the Royal Bengal Tiger, Asiatic Elephant, Eastern Swamp Deer and the Asiatic Wild Buffalo is also the habitat of a sizeable population of other rare and endangered species. It sprawls across from east to west along the southern bank of the River Brahmaputra in the central area of North Eastern province of Assam in India. Kaziranga National Park is the only Park which can boast itself to be a World Heritage Site, a Tiger Reserve, and Heaven for Avifauna and Elephant Reserve. It has the world's largest population of Indian One Horned Rhinoceros.

Gir National Park & Wildlife Sanctuary in Gujarat is famous for Asiatic Lions as well as for its deciduous forest interspersed with semi-evergreen and evergreen flora, acacia, scrub jungle, grasslands and rocky hills. Fed by perennial and seasonal rivers and streams. It is amongst one of the major big-cat concentrations in India. Sambar and spotted deer (chital), blue bull (nilgai), chousingha (the world's only four-horned antelope), chinkara (Indian gazelle) and wild boar thrive in Gir.

The little Rann of Kutch in Rajasthan is home to wild ass which is the amongst world's most endangered mammals. Nilgiri Langur, Lion-tailed macaque, Nilgiri mongoose and the Malabar civet declared extinct by the IUCN in 1978 are endemic in the southern hills of Western Ghats. Leopards are found in many forests, Wolves roam the open country. Cheetahs are found in the Deccan plateau.

India where the 'tiger roars' to signify its majesty and peacock outspreads its tail in an ornamental fashion with the sight of the rains. Both Tiger and Peacock are referred to as national animal and the national bird respectively and bear great significance and linkage to the religion and tradition of India. The Bengal tiger and Asiatic Lions both are worshipped by the Hindus as the carriers of Goddess Durga who is the Mother

Goddess- the birth giver, the nourisher, the Shakti of Shiva as well as destroyer of demons. Lord Shiva is often depicted wearing or seated on a tiger skin. It symbolizes power and courage. Apart from mythological significance the famous lion capital on the Ashoka Pillar at Sarnath, Uttar Pradesh which was erected by Emperor Ashoka to mark the site where Lord Buddha delivered his first sermon to his five disciples was adopted as the national emblem of India.

The Sundarbans (of West Bengal) has the world's largest deltaic mangrove forests and is also home to the Royal Bengal Tiger. It is a **UNESCO World Heritage Site** as well as a Biosphere Reserve. The Sundarban Tiger Reserve has the highest tiger population in the world. Sundarban is also known for its extremely rich diversity of aquatic and terrestrial flora and fauna. Sundarban's highly productive ecosystem acts as a natural fish nursery. Peacocks have been used as signifying glory, beauty and joy. It is believed to be the divine vehicle of the Hindu God of War Kartikeya, popularly known as Murugan in south India .

In Christianity, the peacock was also known as the symbol of the '**Resurrection**'. Its feather adorns the crown of Lord Krishna. The figures of the peacock are engraved and its pictures are painted on several monuments and temples of India as well as used in arts and crafts of India.

The art (music and dance) and architecture as well as literature of India are intertwined with its cultural history, its various religious ideologies and philosophies. The Buddhists initiated the rock-cut caves, Hindus and Jains imitated the same form in Ajanta, Ellora, Elephanta and in Badami etc. The Chola period, remarkable for its sculptures and bronzes, is represented by some of the finest figures of Siva in various forms, Vishnu and his consort Lakshmi, Siva saints, etc., created by using the lost wax technique.

The 2nd century BC Ajanta Caves marked the beginnings of cliff paintings in India. During the reigns of the Delhi Sultanate and Mughals both Persian and Islamic art and architecture flourished in India and its masterpieces like Qutub Minar, Red fort, Agra's wonder Taj Mahal, etc. are cynosure for the world's eye. The monuments built during the colonial rule were influenced by European styles. Contemporary Indian art takes influence from all over the world. With many Indian artists immigrating to the west, art for some artists has been a form of expression merging their past with their current in western culture.

The world's largest collections of songs, music, dance, theatre, folk traditions, performing arts, rites and rituals, paintings and writings that are known, as the '**Intangible Cultural Heritage**' (ICH) of humanity are found in India. For every area and for every religion as well as every reason India has a marvel of heritage. The earliest treatise on dance available to us is Bharat Muni's Natyashastra, the source book of the art of drama, dance and music. It is generally accepted that the date of the work is between the 2nd century B.C.E-2nd century C.E. The Natyashastra is also known as the fifth veda. Nurtured for centuries, dance in India has evolved in dissimilar parts of the country its own distinct style taking on the culture of that particular area , each acquiring its own flavor.

Consequently a number of major styles of 'art' dance are known to us today, like Bharatnatyam, Kathakali, Kuchipudi, Kathak, Manipuri, Odissi and Sattriya. Then, there are regional variations, the dances of rural and tribal areas, which range from simple, joyous celebrations of the seasons, harvest or birth of a child to dance for the propitiation of demons or for invoking spirits. Indian folk and tribal dances are an expression of joy. Each form of dance has a specific costume. Most costumes are flamboyant with extensive jewellery.

Bihu, Dandiya, Bhangra, Poikalkuthirai are popular folk dances from various parts of India.

Chhau – a martial dance is a kind of dance where mask used by the dancers, popular in the West Bengal area . The southern state of Kerala is not only a famous tourist destination in India with the backwaters, beaches, Ayurvedic tourism, and tropical greenery among its major attractions but also home to a kind of an Indian martial art called Kalaripayattu which is the oldest fighting systems in existence and dissimilar techniques of Kalaripayattu are applied in the dance forms of Kerala.

India is home to the most sacred Vedas which are known to be the oldest among scriptures/ oldest texts which encompasses religious as well as mind and spiritual teachings. The Indus Valley Civilization which was one of the world's first great and most sophisticated urban civilizations flourished in the vast river plains and adjacent areas in what are now Pakistan and western India. It was the most technically advanced urban civilization which was known for its better town planning, world class drainage systems, dockyards, ports, skilled working population, seal carving, metallurgy etc.

The monuments and temple architectures of India are masterpieces. The world famous Khajuraho temples of Madhya Pradesh in addition to being world heritage sites are pure manifestations of rich carving and erotic architecture and magnificence. Built by the Chandela kings in the 10th Century, just 22 of the original 85 temples still remain. The exquisite **Sun temple of Konark** is a living testimony to Orissa's glorious past. It is regarded as the peak of art and architecture in the ancient Kalinga era. The images carved on the pillars of Sanchi Stupas tell motivating stories from the life of Lord Buddha. The Golden Temple of Amritsar (Sri Harimandir Sahib Amritsar) is a unique temple.

It is not only a central religious place of the Sikhs, but also a symbol of human brotherhood and equality. The temples of south India viz. Tanjavur temple and Mahabalipuram's Shore temples as well as Tirupathi, Andhra Pradesh (which is one of the richest temples, built on the scenic seven hills of Tirumala, at Tirupathi, this south India temple is dedicated to the Lord Venkateswara.) are rich in Dravidian architecture and are marvels of tourists destination worldwide. Guruvayoor Temple, Kerala is also known as the 'Dwaraka of South' or 'Bhooloka Vaikuntam'. Dedicated to the Lord Krishna, this temple is said to be around 1000 years old and its deity more than 5000 years old. The temple conducts a record number of marriage ceremonies and regarded as the most sacred of the Hindu temples in south India. Another famous temple of Kerala is Sabarimala Temple.

India which embodies pluralism, multi-lingual-ism and multi-cultural-ism is a diverse country which is united as a "union of states" and known as Sovereign, Democratic, Secular, Republic which guarantees certain fundamental rights to all its citizens irrespective of caste, creed, colour or gender/economic conditions and follows the principles of social and economic justice while formulating its policies and promotes equality, fraternity, peace and justice among its countrymen.

1.4 Physical regions of India, Drainage systems of India

1.4.1 Physical regions of India

1.4.1.1 Geographical Set Up

India takes its standard time from the meridian of 82 30 E, which is 5 ½ hours ahead of Greenwich Mean time (0 longitude).Pakistan time is 5 hours ahead of GMT and Bangladesh time is 6 hours ahead of GMT.

1.4.1.2 Significance of Location

Barring the plateau of Baluchistan (which form part of Pakistan), the two great ranges of Sulaiman and Kirthar cut it off from the west. Along the north, the great mountain wall formed by the Hindukush, Karakoram and the Himalayas, which is difficult to cross, cuts it off from the rest of the continent. Similarly, the southward of-shoots of the Eastern Himalayas separate it from Russia. The tropical monsoon weather of India, which ensures a fair supply of moisture and forms the basis of farming in India, is also a result of its location in the southern part of Asia. Since the opening of the Suez Canal (1867) India's distance from Europe has been reduced by 7,000km. It thus bridges the space between the highly industrialized nation of the west and the semi-arid, and southwestern Asia and the most fertile and populated areas in the southeast and far-east countries.

1.4.1.3 Physiographic units of India

S.NO	UNITS	AREA KM (Sq) (appro)	% OF TOTAL AREA
01	Northern mountains	578,000	17.9
02	Great Plains	550,000	17.1
03	Thar Desert	175,000	5.4
04	Central Highlands	336,000	10.4
05	Peninsular Plateaus	1,241,000	38.5
06	Coastal Plains	335,000	10.4
07	Islands	8,300	0.3

1.4.1.3.1 The Trans Himalayas or Tibetan Himalayas

The largest glaciers are Hispar and Batura (over 57 km long) of Hunza Valley and Biafo and Baltaro (60 km long) of Shigar Valley. The Siachen of Nubra Valley is the longest with a length of over 72 km. The Purvachal or the Eastern Hills: In the east after crossing the Cihang gorge the Himalayas bend towards south forming a series of hills running through Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and eastern Assam and form the boundary between India and Burma. Brahmaputra rivers divide Himalayas into three sections: the main Himalayas, the northwest Himalayas and the southeast Himalayas. The main Himalayas running from the Pamir Plateau in the northwest to Arunachal Pradesh in the southeast are the youngest mountains in the world. The highest peak of the world, the Mount Everest (8,884m, named after Sir George Everest). There are about 140 peaks in the Himalayas whose elevation is more than the Mount Blanc (4,810m), the highest peak of the Alps. The three mountain ranges: the Himadri in the north (the greater Himalayas) the Himachal in the middle (the lesser Himalayas) and the Siwalik (the Outer Himalayas), facing the plains of India. The Himadri is of great elevations (6,000m) which remains covered with everlasting snows. The Siwalik have some flat-floored structural valleys known as duns. Dehradun is well-known. Between the Himadri and the Himachal are some broad synclinal valleys. We also classify them as Punjab Himalayas, Kumayun, Assam Nepal and Northern.

1.4.1.3.1.1 Significance of Himalayas

(i) Physical Barriers (ii) Birthplace of Rivers (iii) Influence of climate (iv) Flora and Fauna (v) Mineral Resources (vi) Economic Resources (vii) Tourist

1.4.1.3.2 The Great Northern Plains:

Lies between the great Himalayas in the North and the plateau of Peninsular India in the south. Nearly 2400 km long around 250-320 km broad, the most extensive plain indeed. It is said that this area was once a vast depression, filled with silt – brought down by the three Himalayas River, namely the Indus, the Ganga and the Brahmaputra and their numerous tributaries. It contains some of the richest soils. The bhangar refers to the upland formed by deposition of older alluvium in the river beds and the Khadar are lowlands formed by deposition of detritus of new alluvium in the river beds.

Bhabar and Terai: Includes those areas where the Himalayas and other hilly areas join the plains. Coarse sand and pebbles are deposited. Bhabar lands are narrower in the east and extensive in the western and north-western hilly. Water converts large areas along the river into swamps known as Terai.

The Western or Rajasthan Plains: are known as Marusthali of Thar and the adjoining Bagar areas to the west of Aravalli. Luni whose water is sweet in the upper reaches and saltish by the time it reaches the sea. The several salt lakes in the area such as the Sambhar, Degana, Kuchaman and Didwana; from which table salt is obtained. In most of the area shifting sand dunes occur.

The Punjab-Haryana Plain: These plains owe their formation to the Sutlej, the Beas and the Ravi rivers. Many low lying flood plains (called bets) are found here. The Bari Doab between Ravi and Beas rivers, the Bist Doab between the Beas and Sutlej and the Malwa plain are relatively more fertile plain.

The Ganga Plain: The Ganga-Yamuna Doab comprising the Rohilkhand and the Avadh Plain is the tile area that is drained by the tributaries of Ganga.

The North Bengal Plains: the Plains extending from the foot of Eastern Himalayas to the northern limb of Bengal basin cover an area of 23,000km².

Brahmaputra Plains: This is a low level plain, rarely more than 80km broad, surround by High Mountain on all sides except on the west.

Significance of the Great Plains: Riverine area- Fertile soil, favorable weather, flat surface, constructions of roads, extensive system of irrigation.

The Peninsular Plateau: oldest structure of the Indian subcontinent whose slow and steady movement towards the north and northeast has been responsible for the creation of the Himalayas and the Northern Plains in place of the Tethys sea of geological time. It is marked off from the Indo-Gangetic plain by the mountain and hill ranges such as the Vindhya, the Satpura, and Mahadeo, Maikal, and Sarguja ranges with the average height is usually divided into two major subdivisions with the Narmada valley as the line of demarcation. The area north of the Narmada valley is known as the Central Highlands and in the south of the Narmada valley lies the Deccan Plateau.

1.4.1.3.3 The Central Highlands

Old Aravalli Mountain on the west and the Vindhya on the south. This area slopes northward to the Ganga plains. The western part of the Central Highlands are known as the Malwa Plateau. The Central part has a number of small plateaus like those of Rewa, Baghelkhand and Bundelkhand. The eastern part of the Central Highlands comprises the Chotanagpur plateau.

The Deccan Plateau: The Deccan Plateau extends from the Vindhya to the southern tip of the Peninsula. This triangle plateau is at its widest in the north. The Vindhya Range and its eastern extension namely Mahadev hills Kaimuir Hills and Maikal Range form its northern edge. Western Ghats are known by dissimilar regional names such as the Sahyadris in Maharashtra and Karnataka, the Nilgiris in Tamil Nadu and Annamalai and the Cardamom hills along the Kerala and Tamil Nadu border. The elevation of the Ghats increases towards the south. The highest peak, Anaimudi (2,695 m) is in Kerala. The most important gap in the Western Ghats is the Palghat gap which links Tamil Nadu with Kerala. The Bhorghat and the Thalghat are other gaps lying in Maharashtra State.

Eastern Ghats: These hills rise steeply from the Coromandel coastal plain. The Eastern Ghats are well developed in the area between the Godavari and Mahanadi rivers. The Eastern Ghats and Western Ghats converge in the Nilgiri hills. Dodda Betta (2,637 m) is the highest peak in the Nilgiri hills.

Significance of Peninsular Plateau: (i) Geological richness (ii) Sources of Irrigation and hydroelectricity (iii) Agricultural Resources (iv) Forest Resources (v) Rich Fauna

(vi) Cultural Influences.

1.4.1.3.4 THE COASTAL PLAINS AND ISLANDS

The Coastal plains: The Peninsular plateau is bounded by coastal plains on the east and west. There is a wide difference between the eastern and western coastal plain. The west coast is narrower but wet. East coast much wider but relatively dry. A number of river deltas occur on the east coast. The deltas of east coast from the 'granary' of the five southern states- Andhra Pradesh, Tamil Nadu, Karnataka, Kerala and Pondicherry. The western coastal strips which have a large number of lagoons and backwaters on the other hand are noted for spices, Areca nuts, coconut palms etc.

Western coastal Plain: These lies between the Western Ghats and the Arabian seas and stretch from Kutch in the north to Kanyakumari in the south. The Gujarat plain is a broad and flat plain. The Kutch Peninsula, Gulf of Kutch, and the Gulf of Cambay. The Kathiawar Peninsula, also known as Saurashtra which lies to the south of Kutch, is also a plain level area except for some hills rising into Mount Girnar. Sun-divided regionally into the Konkan coast in Maharashtra Canara coast in Karnataka and Malabar Coast in Kerala.

Eastern Coastal Plain: The eastern coastal low lands extend from the mouth of the Ganga to Kanyakumari. The northern half is called Northern Circars or Kalinga coast, while the southern half is known as the Coromandal coast. The border part is the Carnatic area, which is about 480 km wide. They are not suitable for harbours as their mouths being full of silt.

Significance of Coastal plains: (i) Harbours (ii) Specialized crops (iii) Fisheries and Navigation (iv) Economic Influence (v) Historical Importance

1.4.1.3.5 Islands

1. Bay of Bengal Islands: The Andaman & Nicobar group of islands are separated by 10 Degree channel. These islands have been formed by extension of a tertiary mountain chain of Arakan Yoma. The Andaman group of island is divided into 3 major groups viz., North Andaman, Middle Andaman and south Andaman, collectively called Great Andamans. Little Andaman is separated from Great Andamans by Duncan passage. The Nicobar group of islands of which Great Nicobar is largest and southernmost one. Saddle peak situated in Andaman Islands is the highest peak of Andaman & Nicobar group.

2. Lakshwadeep islands: Coral- More Muslim population and have fringing reefs. They are 25 small island groups. The island's north is known as Amindivi and spot is Cannonore island. Extreme south is Minicoy islands which is largest.

1.4.2 Drainage systems of India

The rivers of India play an important role in the lives of the Indian people. The river systems provide irrigation, potable water, cheap transportation, electricity, as well as provide livelihoods for a large number of people all over the country. This easily explains why nearly all the major cities of India are located by the banks of the river. The rivers also have an important role in Hindu mythology and are considered holy by all Hindus in the country.

Seven major rivers (Indus, Brahmaputra, Narmada, Tapi, Godavari, Krishna and Mahanadi) along with their numerous tributaries make up the river system of India. Most of the rivers pour their waters into the Bay of Bengal. Some of the rivers whose courses take them through the western part of the country and towards the east of the state of Himachal Pradesh empty into the Arabian Sea. Parts of Ladakh, northern parts of the Aravalli range and the arid parts of the Thar Desert have inland drainage. All major rivers of India originate from one of the three main watersheds.

- The Himalaya and the Karakoram ranges

- Vindhya and Satpura ranges and Chotanagpur plateau in central India
- Sahyadri or Western Ghats in western India

The rivers of India can be classified on the basis of origin and on the type of basin that they form.

1.4.2.1 Himalayan Rivers

The main Himalayan river systems are the Ganga, the Indus and the Brahmaputra river systems. The Himalayan rivers form large basins. Many rivers pass through the Himalayas. These deep valleys with steep rocky sides were formed by the down-cutting of the river during the period of the Himalayan uplift. They perform an intense erosional activity up the streams and carry a huge load of sand and silt. In the plains, they form large meanders, and a variety of depositional features like flood plains, river cliffs and levees.

These rivers are perennial as they get water from the rainfall as well as the melting of ice. Nearly all of them create huge plains and are navigable over long distances of their course. These rivers are also harnessed in their upstream catchment area to generate hydroelectricity.

1.4.2.2 Peninsular Rivers

The main peninsular river systems include the Narmada, the Tapi, the Godavari, the Krishna, the Kaveri and the Mahanadi river systems. The Peninsular rivers flow through shallow valleys. A large number of them are seasonal as their flow is dependent on rainfall. The intensity of erosional activities is also comparatively low because of the gentler slope. The hard rock bed and lack of silt and sand does not allow any significant meandering. Many rivers therefore have straight and linear courses. These rivers provide huge opportunities for hydroelectric power.

1.4.2.3 The Indus River System

The Indus originates in the northern slopes of the Kailash range in Tibet near Lake Manasarovar. It follows a northwesterly course through Tibet. It enters the Indian territory in Jammu and Kashmir.

It forms a picturesque gorge in this part. Several tributaries - the Zaskar, the Shyok, the Nubra and the Hunza join it in the Kashmir area. It flows through the areas of Ladakh, Baltistan and Gilgit and runs between the Ladakh Range and the Zaskar Range. It crosses the Himalayas through a 5181 m deep gorge near Attock, lying north of the Nanga Parbat and later takes a bend to the southwest direction before entering Pakistan. It has a large number of tributaries in both India and Pakistan and has a total length of about 2897 km from the source to the point near Karachi where it falls into the Arabian Sea. The main tributaries of the Indus in India are Jhelum, Chenab, Ravi, Beas and Sutlej.

1.4.2.3.1 Jhelum

The Jhelum originates in the southeastern part of Kashmir, in a spring at Verinag. It flows into the Wular Lake, which lies to the north, and then into Baramula. Between Baramula and Muzaffarabad it enters a deep gorge cut by the river in the Pir Panjal range. It has a right bank tributary the Kishanganga which joins it at Muzaffarabad. It follows the Indo-Pakistan border flowing into the plains of Punjab, finally joining the Chenab at Trimmu.

1.4.2.3.2 Chenab

The Chenab originates from the confluence of two rivers, the Chandra and the Bhaga, which themselves originate from either side of the Bara Lacha Pass in Lahul. It is also known as the Chandrabhaga in Himachal Pradesh. It runs parallel to the Pir Panjal Range in the northwesterly direction, and cuts through the range near Kishtwar. It enters the plains of Punjab near Akhnur and is later joined by the Jhelum. It is further joined by the Ravi and the Sutlej in Pakistan.

1.4.2.3.3 Ravi

The Ravi originates near the Rotang pass in the Kangra Himalayas and follows a northwesterly course. It turns to the south-west, near Dalhousie, and then cuts a gorge in the Dhaola Dhar range entering the Punjab

plain near Madhopur. It flows as a part of the Indo-Pakistan border for some distance before entering Pakistan and joining the Chenab river. The total length of the river is about 720 km.

1.4.2.3.4 Beas

The Beas originates in Beas Kund, lying near the Rohtang pass. It runs past Manali and Kulu, where its beautiful valley is known as the Kulu Valley. It first follows a north-west path from the town of Mandi and later a westerly path, before entering the Punjab plains near Mirthal. It joins the Sutlej river near Harika, after being joined by a few tributaries. The total length of the river is 615 km.

1.4.2.3.5 Sutlej

The Sutlej originates from the Rakas Lake, which is connected to the Manasarovar lake by a stream, in Tibet. It flows in a northwesterly direction and enters Himachal Pradesh at the Shipki Pass, where it is joined by the Spiti river. It cuts deep gorges in the ranges of the Himalayas, and finally enters the Punjab plain after cutting a gorge in a hill range, the Naina Devi Dhar, where the Bhakra Dam has a large reservoir of water, called the Gobind Sagar, has been constructed. It turns west below Rupar and is later joined by the Beas. It enters Pakistan near Sulemanki, and is later joined by the Chenab. It has a total length of almost 1500 km.

1.4.2.4 The Brahmaputra River System

The Brahmaputra originates in the Mansarovar lake, also the source of the Indus and the Satluj. It is slightly longer than the Indus, but most of its course lies outside India. It flows eastward, parallel to the Himalayas. Reaching Namcha Barwa (7757 m), it takes a U-turn around it and enters India in Arunachal Pradesh and known as dihang. The undercutting done by this river is of the order of 5500 metres. In India, it flows through Arunachal Pradesh and Assam, and is joined by several tributaries.

In Tibet, the river is known as the Tsangpo. There, it receives less volume of water and has less silt. But in India, it passes through an area of heavy rainfall and as such, the river carries a large amount of rainfall and considerable amount of silt. The Brahmaputra has a braided channel throughout most of its length in Assam, with a few large islands within the channel.

The shifting of the channels of the river is also very common. The fury of the river during rains is very high. It is known for creating havoc in Assam and Bangladesh. At the same time, quite a few big pockets suffer from drought.

1.4.2.5 The Narmada River System

The Narmada or Nerbudda is a river in central India. It forms the traditional boundary between North India and South India, and is a total of 1,289 km (801 mi) long. Of the major rivers of peninsular India, only the Narmada, the Tapti and the Mahi run from east to west. It rises to the summit of the Amarkantak Hill in Madhya Pradesh state, and for the first 320 kilometers (200 miles) of its course winds among the Mandla Hills, which form the head of the Satpura Range; then in Jabalpur, passing through the 'Marble Rocks', it enters the Narmada Valley between the Vindhya and Satpura ranges, and pursues a direct westerly course to the Gulf of Cambay. Its total length through the states of Madhya Pradesh, Maharashtra, and Gujarat amounts to 1312 kilometers (815 miles), and it empties into the Arabian Sea in the Bharuch district of Gujarat.

1.4.2.6 The Tapi River System

The Tapi is a river of central India. It is one of the major rivers of peninsular India with the length of around 724 km, and only the Tapi River along with the Narmada river, and the Mahi River run from east to west. It rises in the eastern Satpura Range of southern Madhya Pradesh state, and flows westward, draining Madhya Pradesh's historic Nimar area, Maharashtra's historic Khandesh and east Vidarbha areas in the northwest corner of the Deccan Plateau and South Gujarat before emptying into the Gulf of Cambay of the Arabian Sea, in the State of Gujarat. The Western Ghats or Sahyadri range starts south of the Tapti River near the border of Gujarat and Maharashtra.

The Tapi River Basin lies mostly in northern and eastern districts Maharashtra state viz, Amravati, Akola, Buldhana, Washim, Jalgaon, Dhule, Nandurbar, Malegaon, Nashik districts but also covers Betul, Burhanpur districts of Madhya Pradesh and Surat district in Gujarat as well.

The principal tributaries of Tapi River are Purna River, Girna River, Panzara River, Waghur River, Bori River and Aner River.

1.4.2.7 The Godavari River System

The river with second longest course within India, Godavari is often referred to as the Vriddh (Old) Ganga or the Dakshin (South) Ganga. The name may be apt in more ways than one, as the river follows the course of Ganga's tragedy. The river is about 1,450 km (900 miles) long. It rises at Trimbakeshwar, near Nasik and Mumbai (formerly Bombay) in Maharashtra around 380 km distance from the Arabian Sea, but flows southeast across south-central India through the states of Madhya Pradesh, Karnataka, Orissa and Andhra Pradesh, and empties into the Bay of Bengal. At Rajahmundry, 80 km from the coast, the river splits into two streams thus forming a very fertile delta. Like any other major rivers in India, the banks of this river also have many pilgrimage sites, Nasik, Triyambak and Bhadrachalam, being the major ones. It is a seasonal river, widened during the monsoons and dried during the summers. Godavari river water is brownish. Some of its tributaries include Indravati River, Pranahita (Combination of Penuganga and Warda), Manjira, Bindusara and Sabari. Some important urban centers on its banks include Nasik, Bhadrachalam, Rajahmundry and Narsapur. The Asia's largest rail-cum-road bridge on the river Godavari linking Kovvur and Rajahmundry is considered to be an engineering feat.

1.4.2.8 The Krishna River System

The Krishna is one of the longest rivers of India (about 1300 km in length). It originates at Mahabaleswar in Maharashtra, passes through Sangli and meets the sea in the Bay of Bengal at Hamasaladeevi in Andhra Pradesh. The Krishna River flows through the states of Maharashtra, Karnataka and Andhra Pradesh.

The traditional source of the river is a spout from the mouth of a statue of a cow in the ancient temple of Mahadev in Mahabaleswar.

Its most important tributary is the Tungabhadra River, which itself is formed by the Tunga and Bhadra rivers that originate in the Western Ghats. Other tributaries include the Koyna, Bhima, Mallaprabha, Ghataprabha, Yerla, Warna, Dindi, Musi and Dudhganga rivers.

1.4.2.9 The Kaveri River System

The Kaveri (also spelled Cauvery or Kavery) is one of the great rivers of India and is considered sacred by the Hindus. This river is also called Dakshin Ganga. The headwaters are in the Western Ghats range of Karnataka state, and from Karnataka through Tamil Nadu. It empties into the Bay of Bengal. Its waters have supported irrigated farming for centuries, and the Kaveri has been the lifeblood of the ancient kingdoms and modern cities of South India.

The source of the river is Talakaveri located in the Western Ghats about 5,000 feet (1,500 m) above sea level. Talakaveri is a famous pilgrimage and tourist spot set amidst Bramahagiri Hills near Madikeri in Kodagu district of Karnataka. Thousands of pilgrims flock to the temple at the source of the river especially on the specified day known as Tula sankramana when the river water has been witnessed to gush out like a fountain at a predetermined time. It flows generally south and east for around 765 km, emptying into the Bay of Bengal through two principal mouths. Its basin is estimated to be 27,700 square miles (71,700 km²), and it has many tributaries including Shimsha, Hemavati, Arkavathy, Kapila, Honnuhole, Lakshmana Tirtha, Kabini, Lokapavani, Bhavani, Noyyal and Famous Amaravati.

1.4.2.10 The Mahanadi River System

The Mahanadi is a river of eastern India. The Mahanadi rises in the Satpura Range of central India, and flows east to the Bay of Bengal. The Mahanadi drains most of the state of Chhattisgarh and much of Orissa and also Jharkhand and Maharashtra. It has a length of about 860 km.

Near the city of Sambalpur, a large dam - the Hirakud Dam - is built on the river.

1.5 Regional and seasonal variations of climate

1.5.1 Introduction

India is a country that has a reputation for being hot and sunny. While this can certainly be true, the weather is subject to seasonal variations, and unsurprisingly for such a large country there are geographical and topographical variations, too. While European countries and most of the USA have four distinct seasons, much of India the distinction is not so clear and there is summer, winter and the 'rainy season'. Typically the coolest part of the year will be around December to January, when temperatures as low as 16 to 20°C may be experienced even in southern Indian cities like Bangalore. However, after this brief cooler period, temperatures can mount quickly between February and March, giving some extreme warm weather between March and May with temperatures in the high 30s. In relatively cooler cities such as Bangalore, the temperatures may range from a typical 32 to perhaps 37°C. Bangalore formerly had a reputation as a 'garden city' and a favorite location for the British colonists, with a relatively cool weather resembling a warm summer day in the UK because the city is some 900 meters above sea-level.

While Bangalore is still a tolerable city to live in, the depletion of greenery and unimaginable increase in traffic pollution mean that it can no longer be regarded as having the cooler weather of a hill station, as would the southern Indian town of Ooty, for example, or the northern Indian mountain resort, Shillong. Other cool southern Indian towns that benefit from a high elevation include Coimbatore and the resort of Ercaud, near Salem in Tamil Nadu. However, fewer foreigners are likely to find employment in these cool and cloudy hill stations, although they make a nice place for a day out away from the hot weather. The city of Hyderabad is renowned for dreadfully hot weather in the two hottest months of the year, with temperatures as high as 45°C. Sometimes water shortages may occur at this difficult time of year.

Another city synonymous with heat is Chennai (Madras), which foreigners are advised against travelling to in the worst of the summer heat. However, from October until January these cities are quite tolerable, with temperatures ranging from perhaps the mid-30s in October, down to the high 20s at the coolest. With a sun-hat and some sun-cream in October, even in Chennai, visitors should be able to manage for up to an hour or more outdoors.

By November the weather can be quite comfortable and may even resemble an English or north-European summer's day. Curiously, despite its reputation for dryness, Chennai has suffered major floods in November (notably in 2003) and whether this represents an isolated anomaly or a change in weather patterns, remains to be seen. Being a coastal town, Chennai also fell victim to the tsunami of 2004.

In general, travel by road or rail is inadvisable from March to September, because the hottest months of the Indian year fall within this period. While the popular image of India is one of sunshine, and undoubtedly the subcontinent is blessed with a lot of sunny weather, it also has its fair share of overcast or downright cloudy weather, especially in the monsoon (or rainy) season. Some states, such as the coastal area of Kerala, Goa, Maharashtra and Karnataka, are synonymous with water. The waterways of Kerala might be compared with the canals of Venice. It is not surprising that such areas are often extremely damp and humid. Coastal areas of Orissa and West Bengal are also subject to the capricious effects of coastal storms and cyclones, and flooding can occur at their fringes. On the opposite coast of Orissa and West Bengal, the city of Mumbai (Bombay) in Maharashtra was brought to a standstill by a prodigious tropical storm in 2005. While extreme conditions may prevail on the coast, inland the greatest problem is heat. Kolkata in West Bengal is relatively hot, while farther north, Delhi is a city of extremes, with temperatures ranging from perhaps 40°C down to zero.

When the Indians talk about the rainy season, it really comes in two major instalments. The first makes its way across the country in June to July time, bringing heavy rain, then there is a let-up in the weather before

the receding monsoon brings rain back across the country in the opposite direction from September to perhaps October or November. These dates are somewhat variable and there may be some years in which the rains fail, or are disappointing. During this period there may not always be torrential rain but, on most days at least, there will be one sharp downpour which may often come at a fairly regular time.

While the rain is heavy and an umbrella most welcome, more often than not it will be over in half an hour to an hour and is rapidly dried up by the sunshine. The rains are really refreshing and lift the humidity at very stifling times of the year.

While the foreigner in India may well work in an air-conditioned environment, forays into offices in which a ceiling fan is the only source of weather control will be inevitable. During the worst times of year government or shop workers who do not benefit from air-conditioning may take a long lunch-break, or sometimes what even amounts to a siesta. Small shops may even close from lunchtime until perhaps 3 or 4 pm if the temperature is too uncomfortable, but they compensate by staying open until 9 or 10 pm. In some cities, like Bombay or Chennai, you will even find shops that do business through the night, avoiding the worst heat of the day.

1.5.2 The monsoon

Analyzed according to the Köppen system, the **weather of India** resolves into six major climatic subtypes; their influences give rise to desert in the west, alpine tundra and glaciers in the north, humid tropical areas supporting rain forests in the southwest, and Indian Ocean island territories that flank the Indian subcontinent. Areas have starkly dissimilar —yet tightly clustered—microclimates. The nation is largely subject to four seasons: winter (January and February), summer (March to May), a monsoon (rainy) season (June to September), and a post-monsoon period (October to December).

India's geography and geology are climatically pivotal: the Thar Desert in the northwest and the Himalayas in the north work in tandem to effect a culturally and economically break-all monsoonal regimes. As Earth's highest and most massive mountain range, the Himalayan system bars the influx of frigid katabatic winds from the icy Tibetan Plateau and northerly Central Asia. Most of North India is thus kept warm or is only mildly chilly or cold during winter; the same thermal dam keeps most areas in India hot in summer.

Though the Tropic of Cancer—the boundary between the tropics and subtropics—passes through the middle of India, the bulk of the country can be regarded as climatically tropical. As in much of the tropics, monsoonal and other weather patterns in India can be wildly unstable: epochal droughts, floods, cyclones, and other natural disasters are sporadic, but have displaced or ended millions of human lives. There is widespread scientific consensus that South Asia is likely to see such climatic events, along with their aleatory unpredictability, to change in frequency and are likely to increase in severity. Ongoing and future vegetative changes and current sea level rise and the attendant inundation of India's low-lying coastal areas is other impacts, current or predicted, that are attributable to global warming.

1.5.2.1 History

During the Triassic period of some 251–199.6 Ma, the Indian subcontinent was part of a vast supercontinent known as Pangaea. Despite its position within a high-latitude belt at 55–75° S—as opposed to its current position between 5 and 35° N, latitudes now occupied by Greenland and parts of the Antarctic Peninsula—India likely experienced a humid temperate weather with warm and frost-free weather, though with well-defined seasons. India later merged into the southern supercontinent Gondwana, a process beginning some 550–500 Ma. During the Late Paleozoic, Gondwana extended from a point at or near the South Pole to near the equator, where the Indian craton (stable continental crust) was positioned, resulting in a mild weather favourable to hosting high-biomass ecosystems. This is underscored by India's vast coal reserves—much of it from the late Paleozoic sedimentary sequence—the fourth-largest reserves in the world. During the Mesozoic, the world, including India, was considerably warmer than today. With the coming of the

Carboniferous, global cooling stoked extensive glaciation, which spread northwards from South Africa towards India; this cool period lasted well into the Permian.

Tectonic movement of the Indian Plate caused it to pass over a geologic hotspot—the Réunion hotspot—now occupied by the volcanic island of Réunion. This resulted in a massive flood basalt event that laid down the Deccan Traps some 60–68 Ma, at the end of the Cretaceous period. This may have contributed to the global Cretaceous–Paleogene extinction event, which caused India to experience significantly reduced insolation. Elevated atmospheric levels of sulphur gases formed aerosols such as sulphur dioxide and sulphuric acid, similar to those found in the atmosphere of Venus; these precipitated as acid rain. Elevated carbon dioxide emissions also contributed to the greenhouse effect, causing warmer weather that lasted long after the atmospheric shroud of dust and aerosols had cleared. Further climatic changes 20 million years ago, long after India had crashed into the Laurasian landmass, were severe enough to cause the extinction of many endemic Indian forms. The formation of the Himalayas resulted in the blockage of frigid Central Asian air, preventing it from reaching India; this made its weather significantly warmer and more tropical in character than it would otherwise have been.

1.5.2.2 Areas

India is home to an amazing variety of climatic areas, ranging from tropical in the south to temperate and alpine in the Himalayan north, where elevated areas receive sustained winter snowfall. The nation's weather is strongly influenced by the Himalayas and the Thar Desert. The Himalayas, along with the Hindu Kush mountains in Pakistan, prevent cold Central Asian katabatic winds from blowing in, keeping the bulk of the Indian subcontinent warmer than most locations at similar latitudes. Simultaneously, the Thar Desert plays a role in attracting the moisture-laden southwest summer monsoon winds that, between June and October, provide the majority of India's rainfall. Four major climatic groupings predominate, into which fall seven climatic zones that, as designated by experts, are defined on the basis of such traits as temperature and precipitation. Groupings are assigned codes according to the Köppen climate classification system.

1.5.2.3 Tropical wet

A tropical rainy weather governs areas experiencing persistent warm or high temperatures, which normally do not fall below 18 °C (64 °F). India hosts two climatic subtypes that fall under this group. The most humid is the tropical wet weather—also known as a tropical monsoon climate—that covers a strip of southwestern lowlands abutting the Malabar Coast, the Western Ghats, and southern Assam. India's two island territories, Lakshadweep and the Andaman and Nicobar Islands, are also subject to this weather. Characterized by moderate to high year-round temperatures, even in the foothills, its rainfall is seasonal but heavy—typically above 2,000 mm (79 in) per year. Most rainfall occurs between May and November; this moisture is enough to sustain lush forests and other vegetation for the rest of the mainly dry year. December to March are the driest months, when days with precipitation are rare. The heavy monsoon rains are responsible for the exceptionally biodiverse tropical wet forests in parts of these areas. In India a tropical wet and dry climate is more common. Noticeably drier than areas with a tropical monsoon weather, it prevails over most of inland peninsular India except for a semiarid rain shadow east of the Western Ghats. Winter and early summer are long and dry periods with temperatures averaging above 18 °C (64 °F). Summer is exceedingly hot; temperatures in low-lying areas may exceed 50 °C (122 °F) during May, leading to heat waves that can each kill hundreds of Indians.

The rainy season lasts from June to September; annual rainfall averages between 750–1,500 mm (30–59 in) across the area. Once the dry northeast monsoon begins in September, most precipitation in India falls on Tamil Nadu, leaving other states comparatively dry. The state's normal annual rainfall is about 945 mm (37.2 in), of which 48% is delivered by the northeast monsoon and 32% by the southwest monsoon. Since the state is entirely dependent on rains for recharging its water resources, monsoon failures lead to acute water scarcity and severe drought. Tamil Nadu is classified into seven agro-climatic zones: northeast, northwest, west, southern, high rainfall, high altitude hilly, and the Kaveri delta, the last being the most fertile agricultural zone. The Ganges Delta lies mostly in the tropical wet climate zone: it receives between

1,500 to 2,000 mm (59 to 79 in) of rainfall each year in the western part, and 2,000 to 3,000 mm (79 to 118 in) in the eastern part. The coolest month of the year, on average, is January; April and May are the warmest months. Average temperatures in January range from 14 to 25 °C (57 to 77 °F), and average temperatures in April range from 25 to 35 °C (77 to 95 °F). July is on average the wettest month: over 330 mm (13 in) of rain falls on the delta.

1.5.2.4 Tropical dry

A tropical arid and semi-arid weather dominates areas where the rate of moisture loss through evapotranspiration exceeds that from precipitation; it is subdivided into three climatic subtypes. The first, a tropical semi-arid steppe weather, predominates over a long stretch of land south of the Tropic of Cancer and east of the Western Ghats and the Cardamom Hills. The area, which includes Karnataka, inland Tamil Nadu, western Andhra Pradesh, and central Maharashtra, gets between 400–750 millimeters (15.7–29.5 in) annually. It is drought-prone, as it tends to have less reliable rainfall due to sporadic lateness or failure of the southwest monsoon. Karnataka is divided into three zones – coastal, north interior and south interior. Of these, the coastal zone receives the heaviest rainfall with an average rainfall of about 3,638.5 mm (143 in) per annum, far in excess of the state average of 1,139 mm (45 in). In contrast to norm, Agumbe in the Shivamogga district receives the second highest annual rainfall in India. North of the Krishna River, the summer monsoon is responsible for most rainfall; to the south, significant post-monsoon rainfall also occurs in October and November. In December, the coldest month, temperatures still average around 20–24 °C (68–75 °F). The months between March to May are hot and dry; mean monthly temperatures hover around 32 °C, with 320 millimeters (13 in) precipitation. Hence, without artificial irrigation, this area is not suitable for permanent farming.

Most of western Rajasthan experiences an arid climatic regime. Cloudbursts are responsible for virtually all of the area's annual precipitation, which totals less than 300 millimeters (11.8 in). Such bursts happen when monsoon winds sweep into the area during July, August, and September. Such rainfall is highly erratic; areas experiencing rainfall one year may not see precipitation for the next couple of years or so. Atmospheric moisture is largely prevented from precipitating due to continuous downdrafts and other factors. The summer months of May and June are exceptionally hot; mean monthly temperatures in the area hover around 35 °C (95 °F), with daily maxima occasionally topping 50 °C (122 °F). During winters, temperatures in some areas can drop below freezing due to waves of cold air from Central Asia. There is a large diurnal range of about 14 °C (25.2 °F) during summer; this widens by several degrees during winter.

To the west, in Gujarat, diverse weather conditions obtain. The winters are mild, pleasant, and dry with average daytime temperatures around 29 °C (84 °F) and nights around 12 °C (54 °F) with virtually full sun and clear nights. Summers are hot and dry with daytime temperatures around 41 °C (106 °F) and nights no lower than 29 °C (84 °F). In the weeks before the monsoon temperatures are similar to the above, but high humidity makes the air more uncomfortable. Relief comes with the monsoon. Temperatures are around 35 °C (95 °F) but humidity is very high; nights are around 27 °C (81 °F). Most of the rainfall occurs during this season, and the rain can cause severe floods. The sun is often occluded during the monsoon season.

East of the Thar Desert, the Punjab-Haryana-Kathiawar area experiences a tropical and sub-tropical steppe weather. Haryana's weather resembles other states of the northern plains: extreme summer heat of up to 50 °C and winter cold as low as 1 °C. May and June are hottest; December and January are coldest. Rainfall varies, with the Shivalik Hills area being the wettest and the Aravali Hills area being the driest. About 80% of the rainfall occurs in the monsoon season of July–September, which can cause flooding. The Punjabi weather is also governed by extremes of hot and cold. Areas near the Himalayan foothills receive heavy rainfall whereas those elojned from them are hot and dry. Punjab's three-season weather sees summer months that spans from mid-April to the end of June. Temperatures typically range from –2 °C to 40 °C, but can reach 47 °C (117 °F) in summer and –4 °C in winter. The zone, a transitional climatic area separating tropical desert from humid sub-tropical savanna and forests, experiences temperatures that are less extreme than those of the desert. Average annual rainfall is 300–650 millimeters (11.8–25.6 in), but is very unreliable; as in much of the rest of India, the southwest monsoon accounts for more precipitation. Daily

summer temperature maxima rise to around 40 °C (104 °F); this results in natural vegetation typically comprise short, coarse grasses.

1.5.2.5 Subtropical humid

Most of Northeast India and much of North India are subject to a humid subtropical climate. Though they experience hot summers, temperatures during the coldest months may fall as low as 0 °C (32 °F). Due to ample monsoon rains, India has only one subtype of this weather under the Köppen system: *Cwa*. In most of this area, there is very little precipitation during the winter, owing to powerful anticyclonic and katabatic (downward-flowing) winds from Central Asia.

Humid subtropical areas are subject to pronounced dry winters. Winter rainfall—and occasionally snowfall—is associated with large storm systems such as "Nor'westers" and "Western disturbances"; the latter are steered by westerlies towards the Himalayas. Most summer rainfall occurs during powerful thunderstorms associated with the southwest summer monsoon; occasional tropical cyclones also contribute. Annual rainfall ranges from less than 1,000 millimeters (39 in) in the west to over 2,500 millimeters (98 in) in parts of the northeast. As most of this area is far from the ocean, the wide temperature swings more characteristic of a continental climate predominate; the swings are wider than in those in tropical wet areas, ranging from 24 °C (75 °F) in north-central India to 27 °C (81 °F) in the east.

1.5.2.6 Mountain

India's northernmost areas are subject to a Montane, or alpine, weather. In the Himalayas, the rate at which an air mass's temperature falls per kilometer (3,281 ft) of altitude gained (the dry adiabatic lapse rate) is 9.8 °C/km. In terms of environmental lapse rate, ambient temperatures fall by 6.5 °C (11.7 °F) for every 1,000 meters (3,281 ft) rise in altitude. Thus, weathers ranging from nearly tropical in the foothills to tundra above the snow line can coexist within several hundred meters of each other. Sharp temperature contrasts between sunny and shady slopes, high diurnal temperature variation, temperature inversions, and altitude-dependent variation in rainfall is also common. The northern side of the western Himalayas, also known as the trans-Himalayan belt, is an area of barren, arid, frigid, and windblown wastelands. Most precipitation occurs as snowfall during the late winter and spring months.

Areas south of the Himalayas largely protect from cold winter winds coming in from the Asian interior. The leeward side (northern face) of the mountains receives less rain while the southern slopes, well-exposed to the monsoon, get heavy rainfall. Areas situated at elevations of 1,070–2,290 meters (3,510–7,510 ft) receive the heaviest rainfall, which decreases rapidly at elevations above 2,290 meters (7,513 ft). The Himalayas experience their heaviest snowfall between December and February and at elevations above 1,500 meters (4,921 ft). Snowfall increases with elevation of up to several dozen millimeters per 100 meters (~2 in; 330 ft) increase. Elevations above 5,000 meters (16,404 ft) never experience rain; all precipitation falls as snow.

1.5.2.7 Seasons

The India Meteorological Department (IMD) designates four climatological seasons:

- **Winter**, occurring from December to March. The year's coldest months are December and January, when temperatures average around 10–15 °C (50–59 °F) in the northwest; temperatures rise as one proceeds towards the equator, peaking around 20–25 °C (68–77 °F) in mainland India's southeast.
- **Summer** or **pre-monsoon** season, lasting from April to June (April to July in northwestern India). In western and southern areas, the hottest month is April; for northern areas, May is the hottest month. Temperatures average around 32–40 °C (90–104 °F) in most of the interior.
- **Monsoon** or **rainy** season, lasting from July to September. The season is dominated by the humid southwest summer monsoon, which slowly sweeps across the country beginning in late May or early

June. Monsoon rains begin to recede from North India at the beginning of October. South India typically receives more rainfall.

- **Post-monsoon** or **autumn** season, lasting from October through November. In northwestern India, October and November are usually cloudless. Tamil Nadu receives most of its annual precipitation in the northeast monsoon season.

The Himalayan states, being more temperate, experience an additional season, *spring*, which coincides with the first weeks of summer in southern India. Traditionally, Indians note six seasons or *Ritu*, each about two months long. These are the spring season, summer, monsoon season, autumn (*śarada*), winter (*hemanta*), and prevernal season. These are based on the astronomical division of the twelve months into six parts. The ancient Hindu calendar also reflects these seasons in its arrangement of months.

1.5.2.7.1 Winter

Once the monsoons subside, average temperatures gradually fall across India. As the Sun's vertical rays move south of the equator, most of the country experiences moderately cool weather; temperatures change by about 0.6 °C (1.08 °F) per degree of latitude. December and January are the coldest months, with mean temperatures of 10–15 °C (50–59 °F) in Indian Himalayas. Mean temperatures are higher in the east and south, where they reach 20–25 °C (68–77 °F).

In northwestern India, virtually cloudless conditions prevail in October and November, resulting in wide diurnal temperature swings; as in much of the Deccan Plateau, they register at 16–20 °C (61–68 °F). However, from March to May, "western disturbances" bring heavy bursts of rain and snow. These extra-tropical low-pressure systems originate in the eastern Mediterranean Sea. They are carried towards India by the subtropical westerlies, which are the prevailing winds blowing at North India's range of latitude. Once their passage is hindered by the Himalayas, they are unable to proceed further, and they release significant precipitation over the southern Himalayas.

There is a huge variation in the climatic conditions of Himachal Pradesh due to variation in altitude (450–6500 meters). The weather varies from hot and sub-humid tropical (450–900 meters) in the southern low tracts, warm and temperate (900–1800 meters), cool and temperate (1900–2400 meters) and cold glacial and alpine (2400–4800 meters) in the northern and eastern high elevated mountain ranges. By October, nights and mornings are very cold. Snowfall at elevations of nearly 3000 m is about 3 m and lasts from December start to March end. Elevations above 4500 m support perpetual snow. The spring season starts from mid February to mid April. The weather is pleasant and comfortable in the season. The rainy season starts at the end of the month of June. The landscape lusher green and fresh. During the season streams and natural springs are replenished. The heavy rains in July and August cause a lot of damage resulting in erosion, floods and landslides. Out of all the state districts, Dharamsala receives the highest rainfall, nearly about 3,400 mm (134 in). Spiti is the driest area of the state, where annual rainfall is below 50 mm. The three Himalayan states (Jammu and Kashmir in the extreme north, Himachal Pradesh, and Uttarakhand) experience heavy snowfall; in Jammu and Kashmir, blizzards occur regularly, disrupting travel and other activities.

The rest of North India, including the Indo-Gangetic Plain, almost never receives snow. Temperatures in the plains occasionally fall below freezing, though never for more one or two days. Winter highs in Delhi range from 16 to 21 °C (61 to 70 °F). Nighttime temperatures average 2–8 °C (36–46 °F). In the plains of Punjab, lows can fall below freezing, dropping to around –6 °C (21 °F) in Amritsar. Frost sometimes occurs, but the hallmark of the season is the notorious fog, which frequently disrupts daily life; fog grows thick enough to hinder visibility and disrupt air travel 15–20 days annually. In Bihar in the middle of the Ganges plain, hot weather sets in and the summer lasts until the middle of June. The highest temperature is often registered in May which is the hottest time. Like the rest of the north, Bihar also experiences dust-storms, thunderstorms and dust raising winds during the hot season. Dust storms having a velocity of 48–64 km/h (30–40 mph) are most frequent in May and with second maximum in April and June. The hot winds (loo) of Bihar plain blow during April and May with an average velocity of 8–16 km/h (5–10 mph). These hot winds greatly affect

human comfort during this season. Rain follows. The rainy season begins in June. The rainiest months are July and August. The rains are the gifts of the southwest monsoon. There are in Bihar three distinct areas where rainfall exceeds 1,800 mm (71 in). Two of them are in the northern and northwestern portions of the state; the third lies in the area around Netarhat. The southwest monsoon normally withdraws from Bihar in the first week of October. Eastern India's weather is much milder, experiencing moderately warm days and cool nights. The highs range from 23 °C (73 °F) in Patna to 26 °C (79 °F) in Kolkata (Calcutta); lows average from 8 °C (46 °F) in Patna to 14 °C (57 °F) in Kolkata.

Frigid winds from the Himalayas can depress temperatures near the Brahmaputra River. The Himalayas have a profound effect on the weather of the Indian subcontinent and the Tibetan plateau by preventing frigid and dry Arctic winds from blowing south into the subcontinent, which keeps South Asia much warmer than corresponding temperate areas in the other continents. It also forms a barrier for the monsoon winds, keeping them from travelling northwards, and causing heavy rainfall in the Terai area instead. The Himalayas are indeed believed to play an important role in the formation of Central Asian deserts such as the Taklamakan and Gobi. The mountain ranges prevent western winter disturbances in Iran from travelling further east, resulting in much snow in Kashmir and rainfall for parts of Punjab and northern India. Despite being a barrier to the cold northerly winter winds, the Brahmaputra valley receives part of the frigid winds, thus lowering the temperature in Northeast India and Bangladesh. The Himalayas, which are often called "The Roof of the World", contain the greatest area of glaciers and permafrost outside of the poles. Ten of Asia's largest rivers flow from there. The two Himalayan states in the east, Sikkim and Arunachal Pradesh, receive substantial snowfall. The extreme north of West Bengal centered around Darjeeling experiences snowfall, but only rarely. Parts of Uttar Pradesh are also affected by snowfall of several meters in places. Rainfall in that state ranges from 1,000–2,000 mm (39–79 in) in the east to 600–1,000 mm (24–39 in) in the west.

In South India, particularly the hinterlands of Maharashtra, Madhya Pradesh, parts of Karnataka, and Andhra Pradesh, somewhat cooler weather prevails. Minimum temperatures in western Maharashtra, Madhya Pradesh and Chhattisgarh hover around 10 °C (50 °F); in the southern Deccan Plateau, they reach 16 °C (61 °F). Coastal areas—especially those near the Coromandel Coast and adjacent low-elevation interior tracts—are warm, with daily high temperatures of 30 °C (86 °F) and lows of around 21 °C (70 °F). The Western Ghats, including the Nilgiri Range, are exceptional; lows there can fall below freezing. This compares with a range of 12–14 °C (54–57 °F) on the Malabar Coast; there, as is the case for other coastal areas, the Indian Ocean exerts a strong moderating influence on the weather. The area averages 800 millimeters (31 in) per year, most of which falls between October and December. The topography of the Bay of Bengal and the staggered weather pattern prevalent during the season favors the northeast monsoon, which has a tendency to cause cyclones and hurricanes rather than steady precipitation. As a result the coast is hit by what can mildly be termed as inclement weather almost every year between October and January.

1.5.2.7.2 Summer

Summer in northwestern India lasts from April to July, and in the rest of the country from March to June. The temperatures in the north rise as the vertical rays of the Sun reach the Tropic of Cancer. The hottest month in the western and southern areas of the country is April; for most of North India, it is May. Temperatures of 50 °C (122 °F) and higher have been recorded in parts of India during this season. In cooler areas of North India, immense pre-monsoon squall-line thunderstorms, known locally as "Nor'westers", commonly drop large hailstones. In Himachal Pradesh, Summer lasts from mid April till the end of June and most parts become very hot (except in alpine zone which experience mild summer) with the average temperature ranging from 28 °C (82 °F) to 32 °C (90 °F). Winter lasts from late November till mid March. Snowfall is generally common in alpine tracts that are above 2,200 meters (7,218 ft), especially those in the higher- and trans-Himalayan areas. Near the coast the temperature hovers around 36 °C (97 °F), and the proximity of the sea increases the level of humidity. In southern India, the temperatures are higher on the east coast by a few degrees compared to the west coast.

By May, most of the Indian interior experiences mean temperatures over 32 °C (90 °F), while maximum temperatures often exceed 40 °C (104 °F). In the hot months of April and May, western disturbances, with their cooling influence, may still arrive, but rapidly diminish in frequency as summer progresses. Notably, a higher frequency of such disturbances in April correlates with a delayed monsoon onset (thus extending summer) in northwest India. In eastern India, monsoon onset dates have been steadily advancing over the past several decades, resulting in shorter summers there.

Altitude affects the temperature to a large extent, with the higher parts of the Deccan Plateau and other areas being relatively cooler. Hill stations, such as Ootacamund ("Ooty") in the Western Ghats and Kalimpong in the eastern Himalayas, with average maximum temperatures of around 25 °C (77 °F), offer some respite from the heat. At lower elevations, in parts of northern and western India, a strong, hot, and dry wind known as the Looblow blows from the west during the daytime; with very high temperatures, in some cases up to around 45 °C (113 °F); it can cause fatal cases of sunstroke. Tornadoes may also occur, concentrated in a corridor stretching from northeastern India towards Pakistan. They are rare, however; only several dozen have been reported since 1835.

1.5.2.7.3 Monsoon

India's weather is affected by two seasonal winds - the **Southwest Monsoon and Northeast monsoon**. The northeast monsoon, commonly known as *Winter monsoon* blows from land to sea, whereas south-west monsoon, known as *Summer monsoon* blows from sea to land after crossing the Indian Ocean, the Arabian Sea, and the Bay of Bengal. The south-west monsoon brings most of the rainfall during a year in the country.

1.5.2.8 Southwest Monsoon (Summer monsoon):

During the summer, the continent of Asia heats up more than the surrounding ocean due to the differences in the way land and water heat. The warm surface creates a large area of low pressure over north-central Asia and a smaller one over India. The southwest summer monsoon is attracted to India by a low pressure area that's caused by the extreme heat of the Thar Desert and adjoining areas of the northern and the central Indian subcontinent. Moisture-laden winds from the Indian Ocean rush into the subcontinent to fill up the void, but because they can't pass through the Himalaya area, they're forced to rise. The gain in altitude of the clouds results in a drop in temperature, bringing rain. When the southwest monsoon reaches India, it splits into two parts –

1. *Arabian Sea Branch*
2. *Bay of Bengal Branch*

The **Arabian Sea Branch** of the Southwest Monsoon first hit the Western Ghats of the coastal state of Kerala, thus making the area the first state in India to receive rain from the Southwest Monsoon. This branch of the monsoon moves northwards along the Western Ghats with precipitation in coastal areas, west of the Western Ghats. The eastern areas of the Western Ghats do not receive much rain from this monsoon as the wind does not cross the Western Ghats.

The **Bay of Bengal Branch** of Southwest Monsoon flows over the Bay of Bengal heading towards North-East India and Bengal, picking up more moisture from the Bay of Bengal. The winds arrive at the Eastern Himalayas with large amounts of rain. After the arrival at the Eastern Himalayas, the winds turn towards the west, travelling over the Indo-Gangetic Plain at a rate of roughly 1–2 weeks per state pouring rain all along its way.

1.5.2.9 Northeast Monsoon (Winter monsoon):

During the winter, the flow of air reverses. The continent cools rapidly forming a large area of high pressure over north central Asia, known as the Siberian High, and a smaller area over India. Now the drier, colder air on the continent blows offshore creating the *dry monsoon season*. Many parts of southern India receive the considerable rain from the northeast monsoon. Though the principal rainy season for interior Karnataka,

Kerala and Lakshadweep are the Southwest Monsoon season, rainfall continues till December in this area. TamilNadu, in particular, typically gets nearly half its annual rains during this monsoon. Parts of West Bengal, Orissa, Andhra Pradesh, Karnataka and North-East India also receive minor precipitation from the northeast monsoon.

1.5.2.10 Post-monsoon

During the post-monsoon months of October to December, a dissimilar monsoon cycle, the northeast (or "retreating") monsoon, brings dry, cool, and dense Central Asian air masses in large parts of India. Winds spill across the Himalayas and flow to the southwest across the country, resulting in clear, sunny skies. Though the India Meteorological Department (IMD) and other sources refer to this period as a fourth ("post-monsoon") season, other sources designate only three seasons. Depending on location, this period lasts from October to November, after the southwest monsoon has peaked. Less and less precipitation falls, and vegetation begins to dry out. In most parts of India, this period marks the transition from wet to dry seasonal conditions. Average daily maximum temperatures range between 28 and 34 °C (82 and 93 °F).

The northeast monsoon, which begins in September, lasts through the post-monsoon seasons, and only ends in March. It carries winds that have already lost their moisture while crossing central Asia and the vast rain shadow area lying north of the Himalayas. They cross India diagonally from northeast to southwest. However, the large indentation made by the Bay of Bengal into India's eastern coast means that the flows are humidified before reaching Cape Comorin and rest of Tamil Nadu, meaning that the state, and also some parts of Kerala, experience significant precipitation in the post-monsoon and winter periods. However, parts of West Bengal, Orissa, Andhra Pradesh, Karnataka and Northeast India also receive minor precipitation from the northeast monsoon.

1.5.3 Western disturbance

Western Disturbance is the term used in India, Pakistan, Bangladesh and Nepal describe an extratropical storm originating in the Mediterranean, that brings sudden winter rain and snow to the northwestern parts of the Indian subcontinent. This is a non-monsoonal precipitation pattern driven by the Westerlies. The moisture into these storms usually originates over the Mediterranean Sea and the Atlantic Ocean. Extratropical storms are a global, rather than a localized, phenomena with moisture usually carried into the upper atmosphere (unlike tropical storms where it is carried in the lower atmosphere). In the case of the subcontinent, moisture is sometimes shed as rain when the storm system encounters the Himalayas.

Western Disturbances are important to the development of the Rabi crop in the northern subcontinent, which includes the locally important staple wheat.

1.5.3.1 Importance

Western Disturbance causes winter and pre monsoon season rainfall across northwest India. Winter months Rainfall has great importance in farming, particularly for the Rabi crops. Wheat among them is one of the most important crops, which helps to meet India's food security. During the season, normally 4-5 western disturbances in a month can be seen over northwest India. Some of the western disturbances bring well-distributed and good rainfall, while some pass with negligible rain or sometimes no rain. The Western disturbance affects the day-to-day weather of northwest India especially during winter season. It is usually associated with cloudy sky, higher night temperatures, unusual rain etc. Over the Indo-Gangetic plains, it brings cold wave conditions and occasionally dense fog and cold day conditions. These conditions remain stable until it is disturbed by other Western Disturbances.

1.5.3.2 Western Disturbance before South-West monsoon

When the Western Disturbance moves across northwest India before the onset of the monsoon, a temporary advancement of monsoon current appears over the states including Punjab, Uttar Pradesh, Jammu and Kashmir etc. When it passes across north India, it helps to increase monsoon activity over Punjab and Uttar Pradesh.

The numbers of western disturbances start declining after winter to pre-monsoon season. During the hot weather months of April and May, they move across north India. Monsoon current generally progresses from east to west in the northern Himalayan area of India. But western disturbances follow reverse trend i.e. they move from west to east across north India with consequent rise in pressure carrying cold pool of air. So it helps to activate monsoon in certain parts of northwest India.

During winter, there is an inflow of low pressure depressions called western disturbances in north-west India. These westerly depressions originate in India and enter India after crossing Pakistan, Iran and Iraq and Afghanistan. They intensify over the north west India and move eastwards causing rain in Punjab and Haryana and snowfall in the Himalayan belt. During summer, the whole of the east coast of India comes under tropical depressions (low pressure systems originating in the head of the Bay of Bengal). They cause heavy loss of life and property.

The Western disturbance affects the day-to-day weather of northwest India especially during winter season. It is usually associated with cloudy sky, higher night temperatures, unusual rain etc. Over the Indo-Gangetic plains, it brings cold wave conditions and occasionally dense fog and cold day conditions. These conditions remain stable until it is disturbed by other Western Disturbances.

1.5.4 Norwesters

Norwesters or the Kalbaishakhi is a local thunderstorm which occurs in India and Bangladesh. Kalbaishakhi occurs, with increasing frequency, from March till monsoon establishes over North-East India. Sometimes it might be progressive derechos. During this time, West Bengal, Assam, Bihar, Chhattisgarh, Jharkhand, Bangladesh and North-Eastern states of India are affected by violent thunderstorms. They cause considerable damage to life and property and are known as Kalbaisakhi or the calamity of Baishakhi, the month of April-May in India. Kalbaishakhi is accompanied by strong squalls and sometimes by hail. On extremely rare occasions, tornados may also accompany them too. Flying through these winds can be extremely dangerous. Circumnavigating or penetrating them may be disastrous and pilots avoid them. However, the rainfall in these storms is beneficial for the tea cultivated in Assam and for the jute and rice cultivated in West Bengal.

Review Questions

1. Define the India in the context of southeast & South Asia?
2. Explain the diversities of India?
3. Explain the Physical areas of India?
4. Explain the Drainage systems of India?

Discussion Questions

Discuss the Regional and seasonal variations of climate?

Chapter 2- Types of Soil Found in India

Learning Objectives

- To define the Soil types of India.
- To explain the main resources of India.
- To explain the population distribution of India.
- To describe the Changing nature of Indian economy.

2.1 Introduction

Indian Soil is among the most wide-ranging component in the geography of India. The inhabitants of India largely count on the soil of the country for their survival. Soil is but a layer of decaying organic matter and broken rock particles on the earth's surface, which is necessary for plant growth. Soil bears all vital nutrients which help in the development and growth of trees and plants. Soils are of dissimilar types, and each of them differs in their texture and nature. Several powers of nature, like running water and wind and alteration of temperature, add to the development of soil. Organic and chemical alterations taking place within the soil layer are likewise very essential. The soil may be economized by superior agricultural practices, reducing persistence of grazing and afforestation. India has many types of soil.

The vast size of India, along with the diversity in the natural environment of its various parts gives rise to a vast variety in the soil cover. As we have already described, the formation of dissimilar types of soils are mainly dependent on the nature of parent material, weather, general topography of the particular area and activity of organisms. These factors vary in their degree of operation from one place to the other and thus result a number of soil types in India. While the soils in the Extra-penisular and Indo-Gangetic plains are quite young, those in the Peninsular parts are old and highly matured. Alluvial soils, which are well developed in the Indo-Gangetic plains as well as in the coastal deltaic areas. Regur or black cotton soil, which are concentrated over the Deccan Lava tract that includes parts of Maharashtra, Madhya Pradesh, Gujarat, Andhra Pradesh and some parts of Tamil Nadu. It is highly fertile. Red soils are due to a wide diffusion of iron in ancient crystalline and metamorphic rocks. Red soils cover almost the whole of Tamil Nadu, Karnataka, parts of Andhra Pradesh, Orissa and eastern parts of Madhya Pradesh and southeastern part of Maharashtra. Lateritic soils are commonly found in Karnataka, Kerala, Tamil Nadu, Maharashtra, Madhya Pradesh and the hilly areas of Orissa and Assam. Desert soils are found in Rajasthan. Apart from the above types, the soils in the mountainous areas of the country also forms a significant kind of soil of India.

2.2 Soil types of India – Their distribution and characteristics, vegetation types and distribution.

2.2.1 Soil types of India

2.2.1 .1 Introduction

Soil is a vital natural resource. The soil and land form a precious finite heritage that we must use judiciously according to their potential to meet the demands of the ever growing population. People are dependent on soils and conversely, good soils are dependent on people and the use they make of the land. Soils are natural bodies in which plants grow and they provide the starting point for successful farming . To ensure optimum agricultural production first it is imperative to know the basic facts about our soil and then its management with judicious use of fertilizer to achieve high productivity. We know that the maximum population in India depends on farming and is the base of farming . Nature of soil differs from area to area and so dissimilar types of soils that are seattered throughout the country need a detailed description.

2.2.1 .2 Geographical Situation

India has a geographical area of 327.4 million hectares. The sub-continent lies between 8° – 37° north latitude and 69°- 93° east longitude. The northern boundary of the country has a chain of Himalayas extending all along the northern side, bordering Pakistan on the west and Burma to the east. The remaining south, east and west borders are surrounded by the Indian Ocean, Bay of Bengal' and Arabian sea respectively.

2.2.1 .3 Climate

The weather of India is of monsoon type. There are two distinct periods of rainfall in a year, viz. the south-west monsoon during the months of June-September and the northeast monsoon during the winter months. The weather is influenced by the Himalayan mountains as well as the Indian ocean, the Arabian sea and Bay of Bengal. The Himalayas obstruct the path of entry of cold winds from the north, giving a continental type of weather. The seas produce a hot monsoonic type of tropical weather.

The rainfall is controlled by topography as the high mountains lying across the path of the monsoon winds helps to precipitate their moisture as rain on the windward side. Therefore, the western ghats and the Assam ranges receive high rainfall of about more than 200 mm per annum. As the southwest monsoon is deflected towards upper India by the Himalayas, the Gangetic plains and Punjab and Haryana receive good rainfall. The moisture bearing winds from the Arabian sea pass unobstructed over Rajasthan as the Aravallies lie along their way. This is the cause of scanty rainfall in Rajasthan (around 25 mm/annum).

The south-west monsoon wind enters India, both from the Arabian sea and the Bay of Bengal. The Arabian sea branch is more important for South India. The Bay of Bengal branch benefits the east coast and the northern oceans. The south-west monsoon is followed by the northeast monsoon towards the end of September.

The temperature is equally variable like rainfall. Usually the temperature rises continuously during the summer months (March to June). The air temperature rises to about 45°C in the north and northwestern plains. Higher altitudes in the Himalayas and in the Nilgiris have low temperature. The mean annual temperature in the Indo-Gangetic plains is around 24 degree centigrade. The weather thus varies from extreme aridity to high humidity and from scanty to torrential rainfall. The area between latitudes 20° north and 20° south has been considered tropical.

2.2.1 .4 Physiography

The major physiographic divisions of our country are described here.

1. Northern mountains

They cover the western Himalayas (Kashmir, Himachal Pradesh and Uttar Pradesh areas), Eastern Himalayas and Assam-Burma ranges. They extend all along the northern boundary of the country. They stretch out in a series of parallel or occasional convergent chains, separated by valleys or extensive platforms.

2. The great plains

They consist of the Indus plains (Rajasthan and Punjab plains), Ganga plains and the Brahmaputra Valley. They occur between the northern mountains and the peninsula.

3. The Peninsula

This physiographic zone consists of the central uplands, Deccan plateau (Satpura range), Maharashtra plateau, Karnataka plateau, Telangana plateau), eastern plateau (Bhagelkhand plateau, Chhotanagpur plateau, Garhjat hills, Mahanadi basin, Dandakaranya upland), western hills (North south and central Sahyadri and Nilgiris), eastern hills (Eastern ghats, Tamilnadu upland) and coastal plains (west and east coastal plains).

4. The islands

The islands are small in land area, consist of Arabian sea islands and Bay of Bengal islands.

2.2.1 .5 Vegetation

The natural vegetation of India has been classified into five major groups, viz tropical forests, temperate forests, sub-tropical forests and sub alpine forests. Forests occupy about 20 percent of the total geographical area of the country.

1. Tropical forests

Under tropical forests, dry deciduous forests occupy more region almost along the entire Indian peninsula (29.7 m.ha) followed by moist deciduous forests, (22.4 m. ha), which are present in the foothills of Himalayas, east side of the Western Ghats, Chhotanagpur and Khasi hills. Western side of Western Ghats, upper Assam and Andamans are occupied by evergreen and semi-evergreen forests (6.4 m.ha) and along the coast, littoral and swamp forests are present. Rajasthan and adjoining areas have thorny tropical forests (5.2 m. ha) while Karnatic coast has dry evergreen forests (0.1 m.ha).

2. Subtropical forests

These forests are mostly pine forests occupying an area of 3.7 m.ha in central and western Himalayas, and broad- leaved hill forests (0.3 m.ha) are in the lower Himalayas.

3. Temperate forests

Moist temperate forests are present in the central and western Himalayas (2.7 m.ha) whereas eastern Himalayas have wet temperate forests (1.6 m.ha). Inner range of Himalayas is occupied by dry temperate forests (0.2 m.ha).

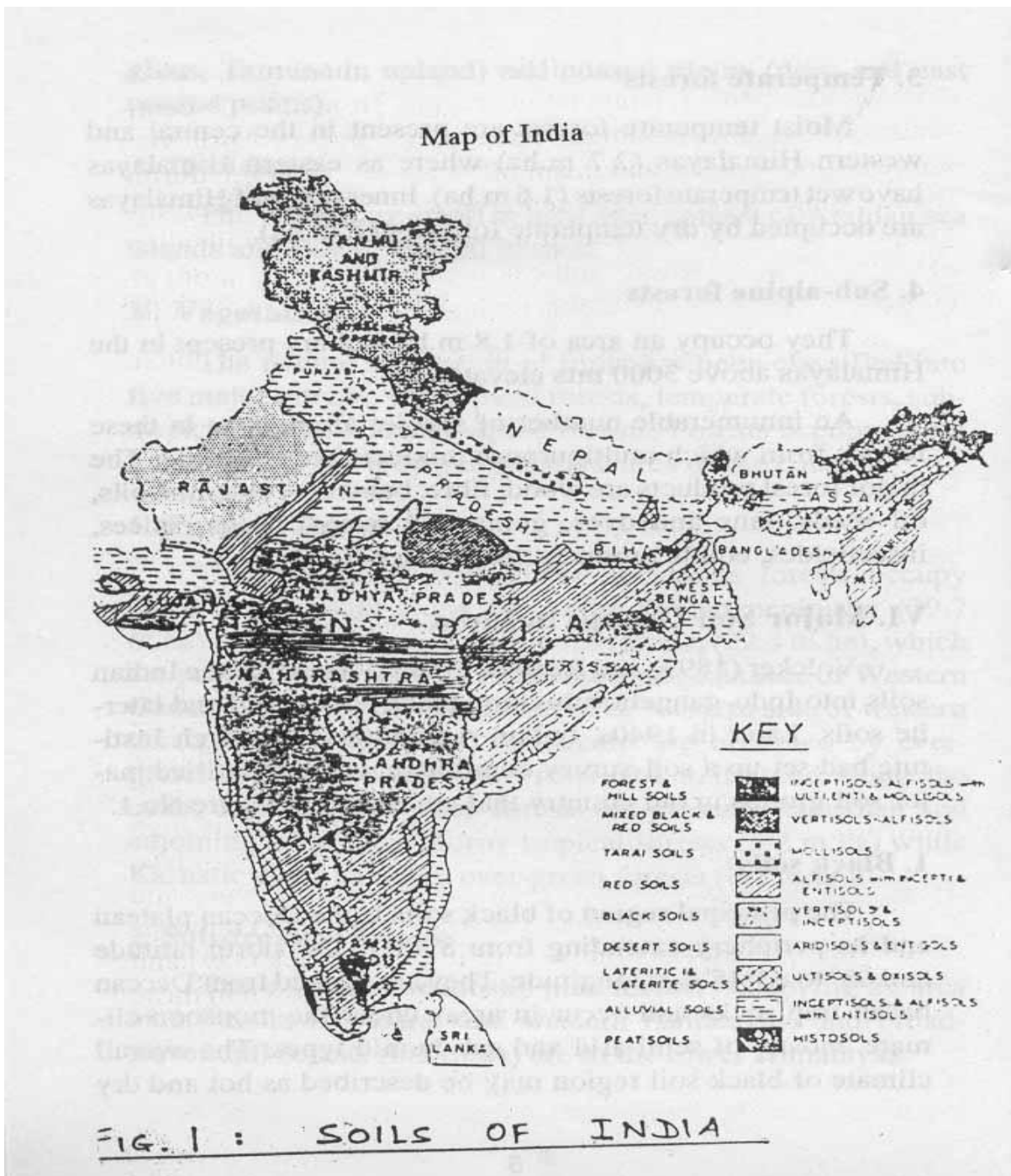
4. Sub-alpine forests

They occupy an area of 1.8 m.ha and are present in the Himalayas above 3000 mgs elevation.

An innumerable number of species are present in these forests from which multipurpose products are produced. The major forest products are wood, fiber, bamboos, essential oils, oilseeds, tans and dyes, gums and resins, drugs, spices, insecticides, edible products, Lac, fodder etc.

2.2.1 .6 Major Soil Groups in India

Volcker (1893) and Reathee (1898), classified the Indian soils into the Indo-Gangetic alluvium, black cotton, red and laterite soils. Later in the 1940s, Indian Agricultural Research Institute had set-up a soil-survey committee which identified major soil groups in our country.



1. Black soils

The principal area of black soils is the Deccan plateau and its periphery extending from 8°45' to 26° north latitude and 68° to 83°45' east longitude. They are formed from Deccan basalt trap rocks and occur in areas under the monsoon weather, mostly of semi-arid and sub-humid types. The overall weather of the black soil area may be described as hot and dry summer, 40-100 cm rainfall per annum, mild to moderate winters and annual temperature ranges from 24-30° centigrade, mean maximum temperature during April-May ranges from 36-42°C arid mean minimum temperature during winter ranges from 15-24° centigrade. Semiarid to sub-humid, tropical to sub-tropical monsoon type weather with alternate dry and wet periods and calcification (formation of calcium carbonate) are favorable to the formation of black soils. The soils are characterized by dark gray to black color with 35-60% clay, neutral to slightly alkaline reaction, high swelling and shrinkage, plasticity, deep cracks during summer and the poor status of organic matter, nitrogen and phosphorus. Impeded drainage and low permeability are the major problems. Black soils. are divided

into shallow black soil of a depth of 30-50 cms, medium black soils of 50-120 cm and deep black soils of more than 120 centimeters. The natural vegetation comprises dry deciduous species, viz palas (*Butes frondosa*), sisam (*Dalbergia sisu*), neem (*Azadirachta indica*) and teak (*Tectona grandis*). Cotton, sugarcane, groundnut, millets, maize, pulses, safflower are the most common crops grown on these soils. Because of their inherent drainage problem, they are prone to salinity and sodicity under irrigated conditions unless proper drainage is ensured. Because of its high water retaining capacity, rain-fed crops like minor millets, pulses like horse gram are vegetables of dissimilar types and citrus fruits can also be grown. These soils are also known as regurs, nullah regadi (a telugu word meaning black clay) and black cotton soils as cotton was the major crop grown in these soils.

2. Red soils

These soils are derived from granite, gneiss and other metamorphic rocks. These soils are formed under well drained conditions. The weather is semi-arid tropical with a mean annual temperature of 25°C and mean annual rainfall of 75-100 cm. The soils are higher textured, friable structure and contains low soluble salts. They are slightly acidic to slightly alkaline, well drained with moderate permeability.

They are generally poor in nitrogen, phosphorus, lime, humus etc. In this soil, lime concretions and free carbonates are absent. The red colour is due to the higher degree of hydration of the ferrioxide in the soils. On the uplands, they are gravelly sandy or stony and porous and light colored on which food crops like Bajra can be grown. On the lower plains and valleys, they are dark, colored fertile loams, irrigated crops like maize, wheat, pulses, potatoes, fruits, millets etc. can be grown. These soils have also been found under forest vegetation. Sometimes they found along with black soils (side by side) and also yellow soils (red and yellow soils).

Excessive gravelliness, surface crust formation and susceptibility to erosion due to high slopes are some of the problems in these soils which can be overcome by adopting suitable measures.

Morphologically the red soils can be divided into red loams which have a cloudy structure and argillaceous soil and red earths with loose friable top soil rich in sesquioxide type of minerals.

3. Laterites and lateritic soils

Laterite is a geological term and means literally a rock. The laterites and lateritic soils have been loosely used in the same sense. The lateritic soils are enriched with oxides of iron and aluminium, under the conditions of high rainfall with alternate dry and wet periods. During rainfall silica is leached downwards and iron and aluminium oxides remain in the top layers.

Laterites are usually shallow and gravelly at higher lands, but are very deep loam to clay soils in the valleys where good paddy crops are produced. Higher Landy soils are poor in nutrient status where as lower level soils are dark and richer in nutrients and organic matter. All lateritic soils are poor in calcium, magnesium, nitrogen, phosphorus and potash. They are generally well drained and porous. The soil reaction is more on the acidic side.

On laterites, as already mentioned, rice is grown at lower elevations and at higher elevations, tea, coffee, cinchona, rubber and cashew nut can be grown under good soil management conditions. On the whole, laterites are poor in fertility and readily respond to manuring and good cultivation. Based on the weather lateritic soils are grouped into high rainfall areas with strongly and weakly expressed dry season and humid zones with pronounced dry & wet periods.

4. Alluvial soils

Alluvial soils, cover the largest area in India (approximately 7 lakh km²) and these are the most important soils from an agricultural point of view. The main features of alluvial soils have been derived as silt deposition laid down by the Indian river systems like the Indus, the Ganges, the Brahmaputra and the rivers like Narmada, Tapti: Mahanadi, Godavari, Krishna and Cauvery. These rivers carry the products of weathering of rocks constituting the mountains and deposit them along their path as they flow down the plain land towards the sea.

Geologically, the alluvium is divided into recent alluvium which is known as Khadar and old alluvium, as bhangar. The newer alluvium is sandy and light colored whereas older alluvium is more clayey, dark colored and contains lime concretions. The soils have a wide range in soil characteristics viz. acid to alkaline sandy to clay, normal to saline, sodic and calcareous, shallow to very deep. The weather ranges from arid to humid sub-tropical.

The following groupings of alluvial soils may be recognised: alluvial soils (Khadar, bhangar and highly calcareous), deltaic alluvium, coastal alluvium, coastal sands, calcareous sierozemic and grey-brown soils.

a. Alluvial soils

The alluvial soils occurring in the Indo-Gangetic plains and the Brahmaputra valley cover a large area. The soils are transported and deposited by the rivers from the parent material. The rivers are the Ganga, Jamuna, Brahmaputra and their tributaries. The soils are deep and hard pans in the subsoil are calcareous (made of calcium carbonate) and acidic. These are deficient in nitrogen, phosphorous and humus, but not in potash and lime. These soils are fertile amongst all the soils of India. They produce a wide variety of crops like rice, wheat, sugarcane, jute and potato. They are distributed mainly in the northern, northwestern and north-eastern parts of our country.

b. Deltaic alluvial soils

They are formed from sediments carried by rivers and deposited in the mouths of rivers joining the sea. The deltas of the Ganga, Brahmaputra, Mahanadi, Godavari, Krishna and Cauvery are the most important ones. In Gujarat, the deltaic alluvial soils which are sandy loam to clay loam are locally called Goradu soils. The Godavari and Krishna rivers pass through basaltic area having black soils and these soils are dark and fine textured. The Cauvery delta soils are significantly clayey and Ganga delta soils show high accumulation of organic matter, as in the Sunderbans of West Bengal, due to swampy vegetation. These soils are fertile and grow a wide variety of crops suited to climatic conditions.

c. Coastal alluvium

Soils developed in coastal alluvium are found along, the sea coasts. Soils are dark colored, coarse textured and poor in fertility. Some soils are saline due to the inundation of sea water. Such soils in the Konkan coast of Maharashtra are called Khar soils.

d. Coastal sands

Sandy soils occur prominently in the coastal area of the Tanjavur district of Tamil Nadu, along the Kerala coast, Bapatla in Guntur district of Andhra Pradesh and Puri district in Orissa. If sandy soils are not saline, plantation crops like coconut, cashew and casuarina can be taken up for cultivation.

Other soils under alluvium are calcareous sierozemes and grey brown soils. Calcareous sierozemes can be seen in the desertic area of Haryana and Punjab. The word 'sierozem' denotes a group of soils having a brownish-grey surface horizon with a sub-layer of carbonates which is developed under mixed shrub vegetation in a-temperate to cool, arid weather. Grey-brown soils as the name itself indicates its nature, can be found in, desert soils of Rajasthan.

5. Desert soils

In the northwestern part of India, desert soils occur over an area of 0.29 million hectares, res, which includes a major part of Rajasthan, south of Haryana and Punjab and northern part of Gujarat. Rainfall ranges from less than 10 cms to 50 cms, mostly contributed during monsoon season.

The area consists of sand dunes and undulating sandy plains. The temperature regime is very high throughout the year and a maximum of 50-60°C is recorded during the summer. Due to high temperature organic-matter built up is very low.

The soils in the plains are mostly derived from alluvium and are pale brown to brown to yellow brown and fine sandy to loamy fine sand and are structureless. The clay contents low and presence of alkaline earth carbonates is an important feature. The nitrate nitrogen and phosphorus makes the desert soils fertile and

productive under proper moisture supply. By increasing the water holding capacity, the productivity of the soils can be increased which involves the addition of organic matter and clay.

6. Tarai soils

The word "tarai" is a hindi word, which means moist. Thus, it is a wet regime having high water table. Tarai soils are foot hill soils and extend in strips of varying widths at the foot of Himalayas in Jammu and Kashmir, Uttar-Pradesh, Bihar and West-Bengal.

Soils under the natural conditions are thickly vegetated and swampy. Several types of grasses and trees from the native vegetation of removal of which the soils become highly productive.

The soils are formed from the materials that are washed down by the erosion of mountains. They are alluvial origin. High soil moisture content all through the year results in luxuriant vegetation dominated by tall grasses. They are neutral to slightly alkaline with significant amounts of organic matter. The texture varies from sandy loam to silty loam. Generally, these soils are fertile and by providing proper drainage, the productivity can be increased.

7. Brown hill soils

These soils are formed under forests mainly in the Himalayas and occur on the hills. They are dark brown, loam to silty clay in texture and acidic to neutral in reaction,

8. Sub-mountain soils

The soils are formed in the sub-Himalayan area under coniferous forests, An annual rainfall of 120-225 cm is recorded in this area. This high rainfall is responsible for the accumulation of organic matter, the absence of free lime and acidity of the soils.

9. Mountain meadow soils

These soils occur at higher elevations in the Himalayas above the zones of tree growth. The soils are shallow with mostly grass vegetation.

10. Peaty and marshy soils

Peaty soils are formed due to the accumulation of organic matter in humid areas. In Kerala, these peaty soils are rich in soluble salts which are known as Kari soils. During the monsoon season, the soils get submerged in water. Soon after the monsoon, the water recedes and rice cultivation is taken up. The soils are black clayey and highly acidic (due to sulphuric acid). They contain 10-40 percent organic matter.

Marshy soils occur on the coastal tracts of Orissa, in the Sunderbans of West Bengal and southeast coast of Tamilnadu.

11. Saline and sodic soils

The soils are salt affected and unless and until reclamation measures are taken up, the soils cannot become productive.

Saline soils are formed due to the accumulation of soluble salts which consists of chlorides and sulfates of calcium and magnesium. Excess salts can be removed by leaching, Sodic soils have high amounts of sodium and about 3 million hectares are affected by this sodicity. These soils can be reclaimed by adding amendments like gypsum.

2.2.1 .7 Soils in Agro- Ecological Areas

Based on weather, vegetation and crops, India has been divided into eight agro-ecological areas. Soil groups in these areas are described here.

1. Humid western Himalayan area

This area consists of Jammu and Kashmir, Himachal Pradesh and the hill divisions of Kumaon and Garhwal of Uttarakhand. The weather varies from hot sub-humid tropical temperate cold alpine and cold arid conditions.

Major soil groups are mountain meadows (sandy loam and neutral to alkaline), sub-montane meadows (acidic and sandy 10 am) and brown hill soils (loam to silty loam in texture).

2. Humid Bengal-Assam basin

This area represents the Ganga-Brahmaputra alluvial plain of alluvium and deltaic deposits. The weather is hot, humid and monsoon type with an annual rainfall of 220-400 cms. During rainy season, floods are common. Predominant soils are alluvial, red, brown hill and coastal. Patches of salt affected soils can be seen in the deltaic tracts.

3. Humid eastern Himalayan area and Bay islands

The states of Meghalaya, Manipur, Tripura, Nagaland, Arunachal Pradesh, Mizoram, Andaman and Nicobar islands constitute this area . Dominant soil groups are brown hill, red and yellow, alluvial and laterite soils.

4. Sub-humid Sutlej-Ganga alluvial plains

Punjab plains of Uttar Pradesh, Delhi and Bihar comes under this area with extremes of weather hot summer and cold winter. Calcareous sierozomes in the south-west, reddish brown chestnut. In the sub-Montane zone, alluvial soils and patches of saline alkali soils are the major soil groups.

5. Sub-humid to humid eastern and southeastern uplands

Orissa, Andhra Pradesh and eastern Madhya Pradesh which is characterized by undulating topography, denuded hills and plateaus, mature river valleys constitute this area . The weather is tropical monsoonic and sub humid to humid. The predominant soil groups are red, black, yellow, red sandy, laterite, riverine alluvial and coastal sandy alluvials.

6. Arid western plains

Predominant soils are alluvial, grey-brown alluvial, black, desert, saline and sodic covering Haryana, Rajasthan, Gujarat and Union territory of Dadar and Nagar Haveli characterized by alluvial plains, sandy plains, sand dunes, saline depressions with scanty rainfall.

7. Semiarid lava plateau and central highlands

The area consists of Maharashtra, western and central Madhya Pradesh, Goa, Daman and Diu. The weather is semi-arid with extremes of temperatures and variable rainfall. The major soil groups are alluvial black and lateritic, mixed red and black and yellow brown soils.

8. Humid to semi-arid western ghats and Karnataka plateau

The area consists of Karnataka, Tamil Nadu, Kerala, Pondicherry and Lakshadweep islands. The four important soil groups are black, red, lateritic and alluvial.

2.2.1 .8 Distribution of Soils in India

Table 1 : Soils Of India

Sl.No	Soil groups	Area (M.ha)	Distribution in the states
1	Red loamy	21.3	AP, TN, KT, KR, MP, O, R
2	Red sandy	33.0	TN, KT, AP, B, WB

3	Laterite	13.0	TN, KR, KT, AP, GJ, O, M, G, A, WB, AN
4	Red & yellow	40.3	MP, O, B
5	Shallow black	3.1	M
6	Medium black	43.0	M, MP, GJ, AP, KT, R
7	Deep black	11.2	M, AP, KT, MP, GJ, R
8	Mixed red & black	16.2	KT, TN, M, MP, AP, B
9	Coastal alluvium	5.4	TN, KR, KT, AP, M, G, WB, AN
10	Coastal sands	0.45	O, TN, AP, PO
11	Deltaic alluvium	8.70	TN, AP, O, WB
12	Alluvial (Recent & old)	35.67	UP, P, B, WB, A, H, AP, GJ, JK, HR, MP, R, D
13	Alluvial (Calcareous)	1.3	UP, B
14	Calcareous sierozemic	4.5	P, H, R
15	Grey brown	10.1	GJ, R
16	Desert	18.2	R, G, H
17	Tarai	2.8	UP, B, WB, AN
18	Brown hill	8.1	UP, S, HP, GJ, JK, KR, P, WB
19	Sub montane	7.6	UP, JK, HP
20	Mountain meadow	5.9	JK
21	Saline and alkali	1.7	UP, H, P, M, KR, TN, GJ, R
22	Peaty	0.27	KR, WB
23	Skeletal	7.9	MP
24	Glaciers & eternal snow	2.9	UP, JK
25	Others	24.9	-

According to these areas of distribution, National Bureau of Soil Survey and Land Use Planning classified the soils and a soil map of India was prepared. As the soil survey program in the country still in process, areas not covered by soil survey are not included in the soil map.

2.2.1 .9 Characteristics

The vast size of India, along with the diversity in the natural environment of its various parts gives rise to a vast variety in the soil cover. As we have already described, the formation of dissimilar types of soils is mainly dependent on the nature of parent material, weather, general topography of the particular area and activity of organisms.

These factors vary in their degree of operation from one place to the other and thus result a number of soil types in India. While the soils in the Extra-peninsular and Indo-Gangetic plains are quite young, those in the Peninsular parts are old and highly matured.

The major soil types in India have been recognized as follows:-

- Alluvial soils, which are well developed in the Indo-Gangetic plains as well as in the coastal deltaic areas
- Regur or black cotton soil, which are concentrated over the Deccan Lava tract that includes parts of Maharashtra, Madhya Pradesh, Gujarat, Andhra Pradesh and some parts of Tamil Nadu. It is highly fertile.
- Red soils are due to a wide diffusion of iron in ancient crystalline and metamorphic rocks. Red soils cover almost the whole of Tamil Nadu, Karnataka, parts of Andhra Pradesh, Orissa and eastern parts of Madhya Pradesh and southeastern part of Maharashtra.

- Lateritic soils are commonly found in Karnataka, Kerala, Tamil Nadu, Maharashtra, Madhya Pradesh and the hilly areas of Orissa and Assam.

Desert soils are found in Rajasthan.

Apart from the above types, the soils in the mountainous areas of the country also forms a significant kind of soil of India.

2.2.2 Vegetation types

2.2.2.1 Introduction

Indian sub-continent exhibits a variety of landscapes and climatic conditions which are noticeable in the types of soils and vegetation. Needless to say that there exists a significant relationship between weather, soils, type of land and vegetation. While preparing for land use plan or a cropping pattern or agricultural or animal husbandry system we should keep in mind the combine effect of weather, soil, land formation, topography and vegetation of the place.

In the past, several attempts have been made to understand and classify the agro-climatic areas as well as the Agro-ecological areas of our country. In the year 1954, Carter divided India into six climatic areas, ranging from arid to perhumid, based on the criteria of the Thornthwhite system of climatic classification. Murthy and Pandey (1978) on the basis of physiography, weather (rainfall and potential water surplus/deficit), soils and agricultural areas identified eight agroecological areas. Though this was a good beginning this system of classification suffered from some limitations. Based on the data of 160 meteorological stations in the country and using the concept of moisture adequacy index Subramaniam (1983) proposed 29 agro-ecological zones with the possible 36 combinations of moisture adequacy index and dominant soil groups following the pattern of FAO/UNESCO. Sehgal et al.(1987) prepared a computerized bio-climatic map of North West India, based on the criteria of dry month (the month having the real moisture deficit of 40% or more of the potential evapo-transpiration- PET). Krishnaft (1988) delineated 40 soil-climatic zones based on major soil types and moisture index.

Planning Commission as part of the midterm appraisal of the planning targets of the VII Plan (1985-1990) divided the country into 15 broad agro-climatic zones based on physiography and weather. They are the following:

1. Western Himalayan Area ,
2. Eastern Himalayan I Area ,
3. Lower Gangetic Plains Area ,
4. Middle Gangetic Plains Area ,
5. Upper Gangetic Plains Area ,
6. Trans-Gangetic Plains Area ,
7. Eastern Plateau & Hills Area ,
8. Central Plateau and Hills Area ,
9. Western Plateau and Hills Area ,
10. Southern Plateau and Hills Area ,
11. East Coast Plains and Hills Area ,
12. West Coast plains & Hills Area ,
13. Gujarat Plains & Hills Area ,
14. Western Dry Area and
15. The Island Area .

The government of India was not satisfied with the classifications done so far. It further entrusted the National Bureau of Soil Survey and Land Use Planning (NBSS&LUP) of Indian Council of Agricultural Research to prepare an agro-ecological area map of the country based on the parameters (rainfall, temperature, vegetation, potential evapo-transpiration) which form the "Bioweather" and parameters (rainfall, potential evapotranspiration, soil storage) which constitutes the "Length of the Growing Period" (LGP) and parameters (soils and physiography) which form the "Soil or Land Scape."

2.2.2.2 Basis of Classification

The parameters taken for the classification agro-ecological areas are the characteristics of: physiographical features, soil characteristics, bio-climatic types and length of the growing period. These are explained one by one briefly.

A. Physiographic features

The major physiographic areas in our country are the Mountainous area, Indo-Gangetic Alluvial Plains, Peninsular or Deccan Plateau and Coastal Plains. These are further divided into 19 broad and basic agro-ecological areas. Each area is represented by a capital letter of the English alphabet as given here.

1. Western Himalayas

This includes Ladakh plateau, Kashmir Himalayas, Punjab Himalayas and Kumaun Himalayas of Uttar Pradesh and is symbolized by "A".

2. Central Himalayas

This includes mainly Nepal Himalayas, and foothills of V.P. Himalayas and is symbolized by "B".

3. Eastern Himalayas

This includes Arunachal Pradesh, Sikkim and Darjeeling Himalayas and is symbolized by "C".

4. North-eastern Hills

This includes Meghalaya plateau, hills of Nagaland, Manipur, Mizoram and Tripura and is symbolized by "D".

5. Western Ghats

This includes northern, central and southern Sahyadris, including Western coastal plain and is symbolized by "E".

6. Eastern Ghats and Tamil Nadu Uplands

This includes Tamil Nadu upland, Eastern Ghat ranges and parts of Karnataka plateau and is symbolized by "H".

7. Central Highlands

This includes Malwa plateau, parts of Bundelkhand upland, Vindhyan Scarplands, Madhya Bharat Plateau, parts of Avavalli range, Gujarat plains and parts of Kathiawar peninsula and is symbolized by "I".

8. Eastern Plateau

This includes Baghelkhand Plateau, Chhota-Nagpur Plateau, Gujarat hills, northern spurs of the Eastern Ghats and Dandakaranya plateau and is symbolized by "J".

9. Deccan Plateau

This includes Maharashtra plateau, northern Karnataka plateau, Telangana plateau and western spurs of the Eastern Ghats and is symbolized by "K".

10. Kachchh and Kathiawar Peninsula

This includes peninsular part of Gujarat and is symbolized by "L".

11. Western Plains

This includes southwestern parts of Punjab and Haryana Plains, Rajasthan Bagar, Marusthali; Kachchh Peninsula (including great ran of Kachchh and northern parts of Kathiawar peninsula) and is symbolized by 'M'.

12. Northern Plains

This includes Western parts of Ganga-Jamuna plains, Punjab Plains, eastern Rajasthan Uplands (including part of Aravalli Range and Central Highlands) and is symbolized by "N",

13. Eastern Plains

This includes north Bihar Plain and parts of-south Bihar Plain and northern parts of Avadh Plain and is symbolized by "O".

14. Gujarat Plains

This includes main lands of Gujarat and is symbolized by "P".

15. Bengal and Assam Plains

This includes Bengal Basins, north Bengal Plains (Teesta Valley) and Assam Plain (Brahmaputra Valley) and is symbolized by "Q".

16. Western Coastal Plains

This includes coastal areas of Saurashtra, Maharashtra, Karnataka and Kerala and is symbolized by "R".

17. Eastern Coastal Plain

This includes coastal parts of Tamil Nadu Plain, Andhra Plain, Utkal Plain and south coastal part of Bengal Basin and is symbolized by "S".

18. Eastern Islands

This includes the Andaman and Nicobar group of islands and is symbolized by "T".

19. Western Islands

This include Lakshadweep group of Islands and is symbolized by "U".

B. Soil characteristics

Soils are the outcome or a combined action of weather and vegetation on parent rocks and are conditioned by the topography over a period of time. Depending on the soil forming factors a variety of soils -are formed. Soils in India are classified into 16 groups which are super-imposed on the physiographic map of India to identify the combined effect of these two in preparing the agro-ecological regional map of India. Therefore soil type number is attached to capital alphabets denoting physiographic areas:

The soil-scapes specifying the soils and their physiography are described as follows.

1. Red loamy soils

These occur in the eastern Himalayas, Eastern Ghats and Tamil Nadu uplands and is represented by "1".

2. Red and lateritic soils

These are observed in eastern plateau, north eastern hills and Western Ghats and in patches, in Eastern Ghats and is represented by "2".

3. Red and yellow soils

These are observed in parts of the eastern plateau adjoining the central highlands and is represented by "3".

4. Shallow and medium black soils (with inclusions of deep phases)

These occur dominantly in Deccan plateau, including central Maharashtra and Karnataka plateau and is represented by "4".

5. Medium and deep black soils (with inclusions of shallow phases)

These observed dominantly in Central highlands and Narmada valley, including Malwa plateau, Bundelkhand up land and Kathiawar peninsula and is represented by "5".

6. Mixed red and black soils

These occur dominantly in parts of the Deccan Plateau, including Telangana plateau, western part of the Eastern Ghats, Anantapur and Bellary area of northern Karnataka plateau and is represented by "6".

7. Coastal alluvium-derived soils

These dominantly occur in the eastern coastal plains and in narrow strips along the western coastal plain and is represented by "7".

8. Alluvium-derived soils

These occur in the western, northern and eastern, including Bengal and Assam plains and is represented by "B".

9. Desert soils

These dominantly occur in southwestern parts of Punjab and Haryana plains, Rajasthan Bagar, Marusthali and Kachchh peninsula and is represented by "9".

10. Tarai soils

These mainly occur in the foothills of central and eastern Himalayas and is represented by "10".

11. Brown and red hill soils

These occur in association with red loamy soils in parts of the eastern Himalayas and is represented by "11".

12. Saline and alkaline soils

These occur in Kathiawar peninsula and in the alluvial plain areas of Uttar Pradesh, Haryana, Punjab and Rajasthan and is represented by "12".

13. Shallow and skeletal soils

These are observed in Ladakh plateau and rugged ranges of Kashmir Himalayas and is represented by "13".

14. Grey brown soils

These occur along the foothills of the Aravallis and is represented by "14".

15. Brown forest and podzolic soils

These are observed in the north-west Himalayas and is represented by "15".

16. Sandy and littoral soils

These occur in Lakshadweep and coastal areas of Andaman and Nicobar Islands and is represented by "16".

Each soil type is demarcated by the specific number.

C. Bio-climatic features

On the basis of the rainfall, temperature, potential evapo-transpiration, altitude and vegetation, Bhattacharjee et al. (1982) prepared bioclimatic map of India using the water balance approach (Thornthwhite & Mather, 1955; Carter & Mather, 1966) and Penman's Potential Evapo- Transpiration (PET) values. The water balance indicates the water surplus or water deficit, determining the moisture index with positive or negative values showing the moist or dry weather depending on the PET, which again indicates the radiation energy

received and the summer intensity. If the rainfall is more than tile PET then the moisture index is positive and if less than PET then it is negative. Ultimately tile moisture index forms the basis for the bioclimatic classification which is given as follows.

1. Per-humid zone

This zone is symbolized by "A" and the moisture. The index is above + 100 cm.

2. Humid zone

This zone is symbolized by "B" and the moisture index is + 80 to +20 cm.

3. Sub-humid zone

This zone is symbolized by "C" and the moisture index is +20 to -33.3 cm.

4. Semiarid zone

This zone is symbolized by "D" and the moisture index is -33.3 to -66.1 cm.

5. Arid zone

This zone IS symbolized by "E" and the tile moisture index is -66.1 to -100 cm..

Thus, we have five bio-climatic zone symbolized by A, B, C, D and E, in order of decreasing soil moisture index.

D. Length of the growing period

The length of the growing period (LGP) simply means the number of days available for crop or plant growth or the number of days during which time there was an optimum range of temperature, day length and moisture. The growing period is calculated following the Food and Farming Organization (FAO) model proposed by Higgins & Kassam (1981). The length of the growing period is also classified into five divisions.

1. LGP class 1

This period is symbolized by the number "1" and the length of growing period is less than 90 days a year.

2. LGP class 2

This period is symbolized by the number "2" and the length of the growing period is between 90 to 150 days a year.

3. LGP class 3

This period is symbolized by the number "3" and the length of the growing period is between 150 to 180 days a year.

4. LGP class 4

This period is symbolized by the number "4" and the length of the growing period is between 180 to 210 days a year.

5. LGP class 5

This period is symbolized by the number "5" and the length of the growing period is above 210 days a year.

Correlating the bio-climatic types and LGP classes it has been observed that the arid zone generally corresponds to LGP of less than 90 days a year, semi-arid area to LGP of 90 to 150 days, sub-humid area to 150 to 210 days and the perhumid zones corresponds to LGP more than 210 days a year.

2.2.2.3 Agro-ecological Areas

Based on the four parameters already explained in the previous section India was divided into 20 Agro-ecological areas. Each area is symbolized by the code "letters and numbers" assigned to each of the four

parameters. These areas are briefly explained here one by one. Thus the symbol A13 E1 means an area in the western Himalayan area (A) having shallow skeletal soil (13) bio-climatically arid zone (E) and having less than 90 day growing period (1).

1. Cold Arid Eco-area with Shallow Skeletal Soils:

The soil is shallow and may be sandy to loamy skeletal, soils with low available water content (A WC). The area is arid with LGP less than 90 days in a year. Millets, wheat, vegetables, fodder, pulses and barley are the seasonal crops grown in patches in this area . Among the fruits apple and apricot are mostly grown. Among the livestock mules are maximum followed by goat, sheep, and yak. The forests are mostly snow covered areas.

The major constraints are the extreme climatic conditions especially the icy cold temperature, short growing period, scanty rains, shallow, sandy and gravelly soils and moderate to highly calcareous soils which are deficient in plant nutrients.

The potentials of this area are the valleys which are good for dry fruits, off-season vegetables and rose cultivation in summer.

2. Hot Arid Eco-area with Desert and Saline Soils: (M9E1)

The area has hot and arid weather characterized by hot summers and cool winters with mean annual precipitation of less than 400 mm covering about 15-20 % of mean annual PET of 1500 to 2000 mm resulting in water deficit of 1500 to 1800 mm per year.

The soil is deep but sandy and coarse loamy, desert type with low available water content or deep, loamy, saline and alkali soils with medium A WC. The LGP is less than 90 days. Drought resistant and short duration crops like pear millet, and pulses are grown in non saline areas. Where irrigation facilities are there to some extent, crops like cotton, sugarcane, mustard, gram and wheat are grown.

The constraints are: drastic reduction of the forest, erratic and scanty rainfall, soil salinity, frequent drought, deficiency of nutrients like nitrogen, phosphorus, zinc and iron.

The potential of this area is: soils are potentially fertile provided irrigation facilities are there.

3. Hot Arid Eco-area with Red and Black Soils: (K6 E1)

The soil-scapes represented by gently sloping, shallow and medium red loamy soils and the topography is leveled to very gently sloping. In some places deep clayey black soils, while in some other places red (loamy) soils which are acidic and non-calcareous are seen. The sub dominant deep, clayey black soils represented by Raichur series are slightly alkaline and calcareous in nature.

Tropical thorny forests are the natural vegetation of the area . In the irrigated areas farmers take sunflower, groundnut, sugarcane and cotton while in rain-fed areas mostly -pearl millets are taken.

The major constraints are high run-off and erosion hazard during stormy rain, prolonged dry spells during the crop growing period and hard subsoil in red soil areas.

4. Hot Semiarid Eco-area with Alluvium Derived soils: (N8 D2)

The weather in this area is characterized by hot and dry summers and cool winters. The annual precipitation in the area ranges between 500 and 1000 mm with an increasing trend from west to east covering about 35 to 42% of mean annual PET of 1400 to 1900 mm having a water deficit of 700-1000 mm per year. LGP ranges between 90 to 150 days.

Soil-scapes in the area vary from moderate to gently sloping, coarse to fine loamy soils. In the northern part of the area the terrain is frequently interrupted by stable sand dunes. The soils in general in this area are deep, loamy alluvium derived soils with medium A WC and shallow to medium to medium sandy to loamy, grey brown soils with low to medium available water content.

The natural vegetation comprises tropical dry deciduous and tropical thorn forests. Almost 65% of the area is under irrigated farming while the remaining part is under rain-fed and traditional farming. The crops grown are rice, wheat, millets, maize, pulses, berseem, mustard, sugarcane, jowar, pigeonpea and soybean.

The constraints in the areas are coarse soil texture, low available water content, over exploitation of ground water, lowering of ground water table, improper drainage and salinity or sodicity problem.

The area has high potential for oil seeds including sunflower

5. Hot Semi Arid Eco-area with Medium and Deep Black Soil: (I5 D2)

The weather is characterized by hot and wet summers and dry winters. The annual precipitation ranges from 500 to 1000 mm covering about 40 to 50 % of the average annual PET of 1600-2000 mm resulting in the water deficit of 800 - 1200 mm. The length of the growing period ranges from 90 to 150 days/year. Parts of the district Banskwa Jhabua, Dhar and Panchmahal Bhavnagar, Amreli are subjected to drought hazard once in three years. Drought during the trap. the period ends in the failure of the crops.

The soil-scapes are gently to very gently sloping, deep, loamy to clayey and deep black soil with medium available water content. In the Malwa plateau the soil is alkaline, calcareous and has swell-shrink properties.

The crop cultivated are sorghum pearl millet, pigeonpea, groundnut, soybean, maize, pulses, safflower, wheat and gram.

The major constraints are droughtiness during the intermittent dry spell periods, imperfect drainage, salinity and alkalinity and inundation by sea in Kathiawar area.

6. Hot Semiarid Eco-area with Shallow and Medium (Dominant) Black Soils: {K4 D2}

The weather is hot and humid summers and mild and dry winters. The precipitation ranges from 600 -1000 mm covering about 40 % of mean annual PET of 1600 -1800 mm leaving a water deficit of 800 -1000 mm. LGP ranges from 90 to 150 days/year. Districts Ahmadnagar, Bid, Solapur, Sangli (eastern parts), Osmanabad and Latur in Maharashtra and Bidar, Gulbarga, Bijapur and Dharward in Karnataka are subjected to drought resulting in crop failure.

The soil is characterized by shallow and medium, loamy to clayey, black soils with low and medium A WC, some parts calcareous and alkaline soils with shrink and swell capacity.

The natural vegetation is tropical dry deciduous and tropical thorn forests. The main crops grown are sorghum, pigeonpea, pearl millet safflower and sunflower. Cotton and groundnut are cultivated if irrigation facilities are available.

Constraints are the prolonged dry spells, high run off in the rainy season and deficiency of nitrogen, phosphorus and zinc.

The potential of this area has high productivity with judicious irrigation with the watershed based management practices.

7. Hot Semi Arid Eco-area with Red and Black soils (K6 D2)

This area covers 16.5 m ha (5.2%) Cuddapah, Hyderabad, Guntur, (noncoastal parts), Karimnagar, Khammam, Krishna (non-coastal parts), Kurnool, Mahaboobnagar, Nalgonda, Nellore (non-coastal parts), Sangareddi, Warangal, and Godavari (non-coastal parts), Prakasam (non coastal parts), Sangareddi, Warangal and Godavari (non-coastal western parts) districts of Andhra Pradesh.

The weather is characterized by hot and moist summers and mild and dry winters. The mean annual rainfall ranges from 600 -1100 covering about 40% of the average annual PET of 1600 -1700 mm leaving a water deficit of 700 -800 mm. The LGP ranges from 90 to 150 days/ year. But the districts of Nalgonda, Mahboobnagar, Kurnool, Prakasam, Nellore and Cuddapah are usually drought prone areas.

The soil-scapes are of moderately to gently sloping red soils grading through gently to very gently sloping to nearly level black cotton soils which are clayey, calcareous, and strongly alkaline in reaction.

The natural vegetation is tropical, dry deciduous and tropical forests. The major crops grown are sorghum, cotton, pigeon pea, rice, groundnut, castor, sunflower, safflower and other oilseed crops.

The constraints are the high runoff during the rainy season, imperfect drainage in the irrigated areas, salinity and sodicity in the irrigated black cotton soil area, deficiency of nitrogen, phosphorus and zinc and frequent drought.

The potentials are the high productivity of the crops when they are grown under watershed based management condition

8. Hot Semi-arid Eco-area with Red Loamy soils (HI D2)

The weather is hot and dry summers and mild winters. The annual rainfall ranges from 600 -1000 mm covering 46 -62 % of the annual mean PET 1300, -1600 mm leaving a water deficit of 400 -700 mm. The LPG ranges from 90 to 150 days per year. Soil-scapes of the area are of moderate to gently sloping grading to gently to very gently sloping. They are shallow to deep, loamy, red soils with low to medium AWC. In some places deep clayey black soils with high AWC are also seen. In some places the soils are calcareous, acidic or moderately alkaline.

The natural vegetation is tropical, dry deciduous and tropical thorn forests. The main crops grown are millets, pulses, oilseeds in kharif season sorghum and oilseeds (safflower) are growing during Rabi season. Rice is grown under irrigated conditions.

The major constraints are high runoff, coarse soil texture and low to medium available water content, severe drought during the-crop season and deficiency of nitrogen, phosphorous and zinc.

9. Hot subhumid (Dry) Eco-area with Alluvium- Derived Soils (N8 C3)

The Weather of this area is characterized by hot summers and cool winters. The area receives mean annual rainfall of 1000 -1200 mm covering about 66.6 -70% of annual mean PET of 1400 -1800 mm leaving a water deficit of 500-700 mm. From February to June the area experiences dry period.

The soils of the area are generally deep, loamy and have developed in alluvium with high A WC. The soil scapes representing the northern plain constitute gently to very gently sloping.

The natural vegetation is tropical dry deciduous forests. The main crops grown are: rice, maize, barley, pigeon pea, jute, wheat, mustard, lentil, sugar cane and cotton.

The main constraints are waterlogging and salinity. But it has the highest potential optimum soil-water-air relationships.

10. Hot Subhumid Eco-area with Red and Black Soils (I6 C4)

The weather in the area is characterized by hot summers and mild winters. The precipitation shows an increasing trend towards the east. The mean rainfall range from 1.000 - 1.500 mm covering about 80% of annual mean PET of 1300 - 1600 mm leaving a water deficit of 500 -700 mm during post rainy and summer periods. The area experience dry period from February to May. The LGP range from 150 -180 days a year. But in some of the eastern districts like Balaghat, Seoni, Mandla, Bhandara and Chindwara have LGP ranging from 180 -210 days a year.

The soil is largely medium and deep clayey black interspersed with patches of red soils having medium to high available water content. But the red soils are poor in A WC. The soil-scapes representing the area are typified by moderately to gently sloping to very gently sloping to nearly level.

The natural vegetation is tropical moist deciduous forest. The major crops grown in this area are rice, sorghum, pigeon pea, soybean, gram, wheat, cotton and vegetables depending on the availability of the irrigation facilities.

The constraints are the cracking clayey soils, difficulty in performing dry and inter tillage, inundation or acute drought, heavy runoff and deficiency of nitrogen, phosphorus and zinc.

This area has high potential for agricultural production when cultivated under watershed management practices.

11. Hot Subhumid Eco-area with Red and Yellow Soils (J3 C3)

The area covers 11.1 m ha (4.3%) and comprises of Surguja (Ambikapur), Bilaspur, Durg, Raigarh, Raipur and Rajnandgaon districts of Madhya Pradesh; Gumla, Hazaribagh, Lohardaga and Palamu (Daltonganj) districts of Bihar and Mirzapur dist. of Uttar Pradesh.

The weather of the area is characterized by hot summers and cool winters. The annual rainfall range 1200 - 1600 mm of which 70 -80 % is received between July and September. The rainfall covers about 60% of the annual mean PET of 1400 -1500 mm leaving a water deficit of 500 -700 mm. From October to June the water deficit is experienced hut from December to May/June the soil remains dry.

The soil is medium and deep, loamy red and yellow with medium to high AWC. The soil-scapes in the area is represented by moderately to gently sloping to very gently sloping.

The natural vegetation is tropical moist deciduous forest. The main crops grown are rice, millets, pigeon pea, moong, black gram, wheat and rice are cultivated depending on the availability of water by rain or irrigation.

The constraints are the severe water erosion, water logging during early stages of crop growth, droughts during the crop season, subsoil gravelliness and coarse texture and low AWC and deficiency of nitrogen, phosphorus, zinc and boron.

12. Hot Subhumid Eco-area with Red and Lateritic soils (J2 C3/4)

The dominant soil-scapes of the area are represented by gently to vary gently sloping. The soil is shallow and medium, loamy, red soils and deep, loamy, lateritic soils with low and medium available water content.

The natural vegetation is tropical dry and moist deciduous forests. The major crops grown are rice, moong, blackgram, pigeonpea, ground nut, wheat and oil seeds depending on the availability of water.

The constraints are the severe soil erosion, seasonal drought, sub-soils gravelliness, coarse soil texture, low AWC, deficiency of nitrogen, phosphorus, zinc and boron and moderate to high phosphorus fixation (especially the red and lateritic soil).

13. Hot Subhumid (Moist) Eco-area with Alluvium-derived soils (08 C4)

This area covers 11.1 m ha (3.4%) and comprises of Begusarai, Chhapra, Darbhanga, Gopalganj, Godda, Khagaria, Katihar, Madhepura, Madhubani, Munger, Muzzaffarpur, Paschim, Champaran (Bettiah), Purnia, Purva~champaran (Motihari), Sitamari, Saharsa, Sahibganj, Samastipur, Siwan and Bhagalpur districts of Bihar; Bahraich, Basti, Deoria, Gonda, Gorakhpur and (northern Tarai parts of) Kheri districts of Uttar Pradesh.

The weather is characterized by hot, wet summers and cool, dry winters. The area receives rainfall of 1400 - 1600 mm which apparently exceeds the mean annual PET of 1300 -1500 mm, but experiences seasonal water deficit of 400 - 500 mm during the period February to May. The LGP ranges from 180 -210 days/year.

The soil is deep, loamy, alluvium-derived soils with medium and high available water content. The soil-scapes in the area are represented by level to very gently sloping. Some areas have calcareous and alkaline soils. The natural vegetation is tropical moist deciduous and dry deciduous forests. The major crops grown are rice, maize, pigeon pea, moong, wheat, lentil, pea, sesamum, groundnut, sugarcane, chillies, turmeric, potato and vegetables.

The constraints are: flooding and improper drainage, salinity and sodicity patches and deficiency of nitrogen, phosphorus and zinc.

14. Warm Subhumid to Humid with Inclusion of Perhumid Eco-area with Brown Forest and Podzolic Soils (A15 C/ B/A4/5)

The area represents warm subhumid to cool humid (with inclusion of perhumid) ecosystem. The weather characterized by mild summers and cold winters. It receives a rainfall of 1000 -2000 mm. In some places the rainfall goes above 2000 mm. The PET demand is lower than the rainfall during most of the month. The length of the growth period is above 210 days a year.

The soil is shallow and medium, loamy, brown forest and podzolic soils with low and medium A WC; and deep loamy tarai soils with high available water content. The organic matter content is rather high in the soils of this area .

The natural vegetation comprises of Himalayan moist temperate, subtropical pine and sub-alpine forests. The main crops that are grown in this area are wheat, millets, maize, rice and horticultural crops.

The constraints are: severe cold weather, high altitude, deforestation, excessive slopes favors soil erosion, soil degradation, landslides, improper drainage, soil acidity especially in the Kangra, and Manali area of Himachal Pradesh resulting in phosphorus fixation, coarse soil structure and drought in the lower hills.

15. Hot Subhumid (moist) to Humid (inclusion) of perhumid Eco-area with alluvium-derived soils (08.BA/C5 & Q8C/BA5)

The weather is characterized by hot summers and mild to moderately cold winters. The rainfall pattern is on the increase in the northern and eastern parts (Bengal basin and Teesta-Brahmaputra plain) as compared with the southern parts (Ganga Plain) of the area . The average rainfall in Ganga Plain ranges between 1400 - 1600 mm while in Barak Basin (Tripura Plain) and Teesta-Brahmaputra Plains it ranges between 1800 -2000 mm. The rainfall exceeds PET from June to October, followed by a period of utilization of the stored soil moisture till mid-February in most of the year. After that for about 90 days the soil remains dry in the Ganga

Plains. But in the Teesta Valley, including Barak Brahmaputra Valley and Kushiara Valley (Tripura Plain) the rainfall exceeds the PET during most of the year except for a short period of seasonal deficit: The LGP is more than 210 days in a year.

The soil is deep, loamy, alluvium-derived soils with medium and high AWC. The soil-scapes of the area are represented by level to very gently sloping.

The natural vegetation comprises tropical moist and dry deciduous forests. In view of the high rainfall a rice based cropping system is followed especially in the Brahmaputra, Teesta and Ganga Plains. Another main crop is jute. In the northern foothills of eastern Himalayas covering Teesta and Brahmaputra area, plantation crops, such as tea and horticultural crops like pineapple, citrus and banana are grown under favorable climatic conditions. During the Rabi season using the stored up moisture in the soil rice, jute, pulses and mustard are grown.

The major constraints of the area are the flooding and water logging, excessive leaching of bases and plant nutrients and soil acidity resulting in the fixation of some of the plant nutrients in the soil making them unavailable to the plants.

The area has high potential for aquaculture and fish culture.

16. Warm Perhumid Eco-area with Brown and Red Hill Soils (C11 A5)

The weather in the area is characterized by warm summers and cool winters. The average rainfall ranges between 2000 -4000 mm per year which is more than the PET which is a little more than 1000 mm/year and practically no water deficit is experienced in this area .

The soil in this area varies from shallow to moderately shallow, loamy to brown forest deep rich in organic matter and moderately base in the reaction.

The natural vegetation comprises of subtropical pine forests, temperate wet evergreen forests and sub-alpine forests. Generally Jhum (shifting) cultivation is practiced with mixed cropping of the steep slopes under rain-fed condition at the interval of 3-4 years. In the lowland rice is the main cultivation though jute and mustard are also cultivated while in the uplands the main crops cultivated are potato, maize, millets, upland paddy, sesamum , pulses, vegetables, sugarcane, sweet potato, mustard, etc. In the hilly area plantation crops like tea, cardamom, horticultural crops like pear, apple, peach, banana, pineapple, citrus and vegetables are cultivated.

The constraints in the area are severe climatic conditions, deforestation and shifting cultivation, severe soil erosion and degradation, high rainfall leading to leaching, excessive moisture and water logging, monocropping and low temperature during monsoon and post monsoon, periods.

17. Warm Perhumid Eco-area with Red and Lateritic Soils (D2 A5)

The weather in the area is characterized by warm summers and cool winters. The average rainfall varies from 2000 -3000 mm which exceeds the average annual PET which is about 1000 -1100 mm. The moisture index 100% most of the period in a year and when there is a deficit it ranges from 100 -150 mm during the post monsoon period. The LGP exceeds 270 days per year.

The soil formation in this area includes shallow to very deep, loamy, red and lateritic and red and yellow soils.

The natural vegetation comprises of wet evergreen and tropical moist deciduous forests. The people in this area follow mostly Jhum (shifting) cultivation system. Rice is the main crop of the area though millets,

maize, potatoes, mustard, black gram green gram, lentil, jute, tea, coffee, rubber and horticultural crops like oranges, pineapple etc. are also cultivated.

The major constraints of the area are: Deforestation and shifting cultivation leading to severe soil erosion, excessive rainfall leading to high leaching and depletion of nutrients, low temperature during and post monsoon period small and marginal holding inhibiting the introduction modern technologies.

18. Hot Subhumid to Semiarid Eco-area with Coastal Alluvium-derived soils (S7 CD2-5)

The weather in the eastern coast extending from Kanyakumari to Gangetic delta experiences a wide range of climatic conditions. The coastal parts between Kanyakumari and south of Thajavur (T.N) and between north of Chennai and the west Godavari (A.P), Orissa and West Bengal receives a mean rainfall of 900 -1100 mm of which 80% is received as winter monsoon (Oct.-Dec.) PET in the area is around 1700 -1800 mm resulting in an annual water deficit of 800 -1000 mm. The LGP ranges from 90 -150 days. This area represents semi-arid climatic conditions.

The remaining part of the eastern coast, that lies between Nagapattinam and Chemlai (Tamil Nadu) and extending to northwestern part of the coastal strip, including part of northwestern Godavari (AP), Orissa and West Bengal receives mean annual rainfall of 1200 -1600 mm of which 80 % is received as the summer monsoon (June to Sept.). The PET varies between 1400 to 1700 mm resulting in an annual water deficit of 600 to 800 mm. The LGP is much higher than the southern parts and varies from 150 -210 days per year. This represents the subhumid (moist) weather type. The soil temperature is higher than 220 and the difference between summer and winter temperature is less than 50 and hence the bio- climatic variations in the eco-system extend from semi-arid to sub-humid, and the length of the growing period ranges between 90 to 210 days or more in a year. In spite of the wide range of climatic variations this area is grouped in one agro-ecosystem because of maritime climatic influences and limited area.

The soil is deep, loamy, coastal and Deltic alluvial soils with medium and high AWC. The dominant soil-scapes representing the area are level to very gently sloping. The soil is mostly clayey but soils in dissimilar places have varying cation exchange capacity indicating that there are differences in their mineralogy.

The natural vegetation is littoral and swamp forests. Both rain fed and irrigated farming is practiced in this area . The main crop is rice. Coconut is a dominant plantation crop of the area . Other crops like black gram, lentil, oilseed crops like sunflower and groundnut are cultivated after the rice crop. Besides farming brackish water fish culture has also practiced in the costal areas.

The major constraints are: imperfect drainage, excessive moisture and water logging, soil salinity (and sodicity in some places) and yearly cyclonic storms.

The area has high potential for aquaculture and fish cum prawn culture. The coastal areas should have shelter belts (trees planted in long blocks almost parallel to the seashore. Tree plantation in the form of social forestry, farm or agro forestry or village forestry are highly suited to these areas.

19. Hot Humid Pemumid Eco-area with Red, Lateritic and Alluvium-derived soils (E2 B/A5)

The weather in the area is characterized by hot and humid summers and warm winters. The mean annual temperature varies between 25° to 28°C. The mean summer and winter soil temperatures differ by less than 50 centigrade. The average rainfall ranges between 2000 -3200 mm which is more than the PET ranging between 1400 -1600 mm. Except a seasonal water deficit of 300 to 400 mm during February to April this area is surplus in water for the rest of the year. The LGP ranges between 150 to 210 days a year. In some places it exceeds more than 210 days.

Soils belong to red and lateritic, alluvium derived coastal plains, deep, clayey, moderately to strongly acidic soils, which are poor in fertility and lower in water retention capacity.

The natural vegetation comprises tropical moist deciduous forests. The major crops cultivated here are rice, pulses, sesamum, vegetables, tapioca, sweet potato, yams etc. among the seasonal crops. This area is also famous for plantation crops like coconut, rubber, cocoa, coffee, cashew nuts and spices.

The major constraints of this area are Excessive leaching of plant nutrients, water logging, poor drainage, steep slopes causing severe runoff and localized saline patches.

If properly managed this area has high potential for extensive and organized cultivation of export oriented plantation crops, like pepper, coffee, tea, cocoa, pineapple, cashew nut, betel-nut etc.

20. Hot Humid/Perhumid Island Eco-area with Red loamy and Sandy Soils (T1 A/B5 & T1 B/a5)

The weather is tropical with no difference between the summer and winter temperatures. The annual rainfall ranges between 1600 to 3000 mm exceeding the average annual PET of 1400 to 1600 mm. Lakshadweep receives about 1600 mm of rainfall to represent humid weather, and the Andaman and Nicobar group of islands receive 3000 mm representing perhumid weather. The rainfall covers the entire demand of PET except for a short seasonal water deficit of 300 to 400 mm during January to March. The LGP is more than 210 days a year.

The soils of Andaman and Nicobar islands show medium to very deep red loamy soils including marine alluvium- derived soils along the coast having low to medium AWC. They are slightly to strongly acidic. The soils of the Lakshadweep group of islands are calcareous and sandy in nature in some places and in some places they are moderate to low in base situation.

The natural vegetation comprises tropical rain (ever green) and littoral and swamp forests. Among the seasonal crops rice is the main crop. However these islands are dominated by coconut, Areca nut, oil palm with or without intercultivation of tapioca, pineapple and pepper. Besides farming, marine fishery is an important means of subsistence for the people.

The main constraints of this area are: degradation of tropical rain forests, severe soil erosion, water logging, saline marshy areas and consequently formation of acid sulphate soils and increase in mangroves indicating the degradation of the coastal areas.

This area has very high potential for going into extensive oil palm and coconut cultivation to meet the oil shortage of our country.

2.2.2.4 Conclusion

What is described so far is the latest classification of the agro-ecological areas of our country and are prepared after extensive study of the various aspects of the physiographic, climatic, soil characteristics and the available moisture/humidity of all the places. The terms agro-climatic and agro-ecological may be bit misleading and confusing to the reader. We must therefore distinguish between the weather, weather, climatic division and ecological area.

Weather is the day to day changes that occur due to the combined effect of the temperature, sunlight, humidity or rainfall of the place. Thus we distinguish between cloudy, sunny, rainy, windy, hot, cold, pleasant day referring to the weather of the day. Weather refers to the combined effect of the same but lasting for several days or months. Thus we distinguish between tropical, subtropical, temperate, cold, dry, arid, semi-arid, humid, sub humid, perhumid weathers lasting for several months. The weather varies with height. So in an area the weather in the plains, at the foothills, in the hills depending on the height it varies. People who have been to hill stations experience a sudden change in the weather as they move from the plains to the hill station or from the hill station to the plains. So in that area we can distinguish several

climatic divisions. Similarly two places of the same height but one is on the seashore and other in the interior. The weather of these two places will vary. Similarly area closer to the natural forests, close to the rivers and lakes etc. all differ in weather. Again the variation in the intensity of the rainfall results into various climatic divisions. The ecosystem is a broader term comprising of the combined effect of the climatic factors as well as the soil, vegetation, and soil moisture availability. Of course the effect of micro-organisms, animal kingdom including man also form part of the ecosystem.

2.3 Forests, water, minerals and power resources – The status of their use and need of conservation.

2.3.1 Forests

Forest Resources in India relate to the distinctive topography, terrain, wildlife, weather and vegetation of the country. Forest resources in India have always been one of the richest resources. Forests provide renewable natural resources and contribute considerably to the economic development of the nation. Forest plantations comprise a vital part of the forest resources. Most of the wood produced in India is obtained from the forest reserves. The forest resources of the country are ancient in nature and composition, since the nation was once covered with dense forests. The history of forest resources in India is evident in all the ancient texts of which have some mention of these forests. The people honored the forests and a large number of religious ceremonies focused on trees and plants. Their early reference dates back to around 4000 years. Agni Purana states that man should protect forest resources to have material gains and religious blessings. Around 2500 years ago, Lord Buddha preached that man should plant a tree every 5 years.

2.3.1.1 History of Forest Resources in India

In the year 1806, Captain Watson was appointed as the commissioner of forest resources in India. He was responsible for organizing the production of teak and other timber appropriate for the building of ships. Forest management in the country was chiefly aimed at producing commercial products like teak timber. Even nowadays, huge territories of forest resources in the country are enclosed with teak plantations. Further, in the year 1855, Lord Dalhousie outlined regulations for protection of forest resources in India. In Malabar hills, Teak plantations were raised and in the Nilgiri Hills, Acacia and Eucalyptus were raised. From 1865 to 1894, forest resources in India were established for protecting material for imperial needs. From the 18th century, scientific forest management systems were engaged to regenerate and yield the forest resources in India to make it sustainable.

2.3.1.2 Importance of Forest Resources in India

During the early 1990s about 17% of forest resources in India land were dense forest land. However, as around 50 % of this land was infertile, total area under productive forests was nearly 35 million hectares that are around 10 % of the total land area of the country. With the increasing demand of the growing population of the country the requirement of forest resources also increased. All these resulted in the continuing demolition of forests around the 1980s, taking a serious toll on the soil. Moreover, around 1990's several forest resources experienced heavy rainfall, and many forests were in areas with a high altitude and some of them were inaccessible. Around 20% of the total area under forests is in the state of Madhya Pradesh, Andhra Pradesh, Arunachal Pradesh, Orissa, Maharashtra and Uttar Pradesh. Forest vegetation is diverse and really large in the country. Like for instance, there are nearly 600 species of hardwoods, Sal and teak. These are the principal species.

National Forest Policy of 1988, concentrated on the importance of forest resources as a significant part of the economy and ecology of the nation. This policy particularly focused on ensuring stability of the environment, maintaining ecological balance and preserving the forests. Further, the Forest Conservation Act of 1980 was also amended in the year 1988 for facilitating stricter protection measures in the country.

Uses of Forest Resources in India

Wood are the main product obtained from Forest resources in India. Wood is generally utilized as fuel and as raw material of dissimilar manufacturing sectors like furniture items, paper, plywood, musical

instruments, packing materials and crates, sports items, toys, vehicle parts, boats, railway sleepers, buildings, bridges, fodder for cattle etc. Bamboo, another type of wood, is extensively used for various purposes. There are also various by-products of Forest resources in India like Rubber, Gums, Tannins, Resins, Camphor, Canes, Fibres, Dyes, Medicines, Essential Oils, Medicines, Flocs and Spices etc. Moreover, various types of products are also obtained from various types of insects and wildlife that take shelter in the forests. Forest resources in India are also a major source of food items.

Forest Resources in India provide protection to the environment and wildlife. It also enhances water holding capacity of soil and rainfall, helps in gaseous cycles of atmosphere, maintains the soil fertility, checks soil erosion, reduces flood disaster etc. Eventually, people have realized the significance of forest resources and the fact that deforestation threatens the ecology. Thus, people have become more interested and involved in conservation of forest resources in India.

2.3.1.3 History of forests in India

There is enough evidence to show that dense forests once covered India. The changing forest composition and cover can be closely linked to the growth and change of civilizations. Over the years, as man progressed the forest began gradually depleting. The growing population and man's dependence on the forest have been mainly responsible for this.

All ancient texts have some mention of the forest and the activities that were performed in these areas. Forests were revered by the people and a large number of religious ceremonies centered on trees and plants. The *Agni Purana*, written about 4000 years ago, stated that man should protect trees to have material gains and religious blessings. Around 2500 years ago, Gautama Buddha preached that man should plant a tree every five years. Sacred groves were marked around the temples where certain rules and regulations applied.

When Chandra Gupta Maurya came to power around 300 BC, he realized the importance of the forests and appointed a high officer to look after the forests. Ashoka stated that wild animals and forests should be preserved and protected. He launched programs to plant trees on a large scale. These rules continued even during the Gupta period.

During the Muslim invasions a large number of people had to flee from the attacks and take refuge in the forests. This was the beginning of a phase of migration to the forest. They cleared vast areas of forests to make way for settlements.

The Muslim invaders were all keen hunters and therefore had to have patches of forests where they could go hunting. This ensured that the trees in these areas were not felled, and the forest ecology was not tampered with. The Mughals showed more interest in gardens and their development. Akbar ordered the planting of trees in various parts of his kingdom. Jahangir was well known for laying out beautiful gardens and planting trees.

During the early part of the British rule, trees were felled without any thought. Large numbers of trees such as the sal, teak, and sandalwood were cut for export. The history of modern Indian forestry was a process by which the British gradually appropriated forest resources for revenue generation. Trees could not be felled without prior permission and knowledge of the authority. This step was taken to ensure that they were the sole users of the forest trees.

But after some time, the British began to regulate and conserve. In 1800, a commissioner was appointed to look into the availability of teak in the Malabar forests. In 1806, the Madras government appointed Capt. Watson as the commissioner of forests for organizing the production of teak and other timber suitable for the building of ships.

In 1855, Lord Dalhousie framed regulations for conservation of forest in the entire country. Teak plantations were raised in the Malabar hills and acacia and eucalyptus in the Niligiri Hills.

In Bombay, the conservator of forest, Gibson, tried to introduce rules prohibiting shifting cultivation and plantation of teak forests. From 1865 to 1894, forest reserves were established to secure material for imperial needs. From the 18th century, scientific forest management systems were employed to regenerate and harvest the forest to make it sustainable. Between 1926 and 1947 afforestation was carried out on a large scale in the Punjab and Uttar Pradesh. In the early 1930s, people began showing interest in the conservation of wildlife.

During World War I forest resources were severely depleted as large quantities of timber were removed to build ships and railway sleepers and to pay for Britain's war efforts. Between the two wars, great advancements in scientific management of the forests were made, with many areas undergoing regeneration and sustained harvest plans being drawn up. Sadly, the emphasis was still not on protection and regeneration but on gaining maximum revenue from the forests. World War II made even greater demand on the forest than World War I had done.

With the independence of India in 1947, a great upheaval in forestry organization occurred. The princely states were managed variably, giving more concessions to the local populations. The transfer of these states to the government led to deforestation in these areas. But some forest officials claim that the maharajas cut down a lot of their forests and sold them. This may have been the case in some instances, but a lot of forest had existed and has been lost since the government took over these states.

The new Forest Policy of 1952 recognized the protective functions of the forest and aimed at maintaining one-third of India's land area under forest. Certain activities were banned and grazing restricted. Much of the original British policy was kept in place, such as the classification of forest land into two types.

The next 50 years saw development and change in people's thinking regarding the forest. A constructive attitude was brought about through a number of five-year plans. Until 1976, the forest resource was seen as a source of earning money for the state and therefore little was spent in protecting it or looking after it.

In 1976, the governance of the forest came under the concurrent list. 'Development without destruction' and 'forests for survival' were the themes of the next two five-year plans, aiming at increasing wildlife reserves and at linking forest development with the tribal economy. But a large gap between aim and achievement exists still.

2.3.2 Water

India is pregnant with an affluent and huge variety of natural resources, including water are regarded as one of the most essential properties. Its improvement and control largely affects in agricultural output. For a stable environment and economic development, management of water resources should be integrated as per the National Water Policy, 2002. An annual rainfall of around 4000 km³ occurs in India. The rainfall in India shows very high sequential and spatial inconsistency, though Mousinram in Cherrapunjee gets the world's highest rainfall, yet it also experiences water shortages during the other seasons.

The Indian rivers receive a total average annual flow of 1953 km³ per year. It is estimated that entire annual usable ground and surface water resources are around 396 km³ and 690 km³. With improvements in standard of living and growing number of the population, demand for water resources has also increased along with reducing the availability of water throughout the nation. Moreover, due to rising pollution levels, the quality of water resources is also declining. Thus the change in climatic conditions, might affect the annual rainfall and the availability of water.

In India, the monsoon period is generally lasts for around three to four months. A vast portion of the nation faces shortage of surface water resources for most part of the year. Even areas like Konkan and Meghalaya, which receive adequate rainfall, face deficiency during winter and summer months. Although in the coastal

and northern plains, water resources are abundant, other areas supply is remarkably insufficient. In general, in particular areas, ground water can be drained from a depth of almost 15 meters. Even water resources that are safe for ingestion can not be provided to most of the villages in the rural areas. Furthermore, villagers have to cover vast distances to gather water. Thus the supply of water for irrigation and farming is also inadequate. Total water resources are around 167 million hectare-metres in India, which has been derived after considering the total area and the average annual rainfall around 50 cm. out of this, only 66 million hectares-meters are available for irrigation.

In 1954, surface water exploration program was instigated and drilling actions were undertaken in river basins and in lower Himalayan areas. This program has gained further momentum during the 1990s, with the introduction of open-hole drilling equipments. The drilling was carried on in areas of Arunachal Pradesh and Jammu and Kashmir. Around 27,500 wells have been established by drilling around the nation. Moreover, numerous wells were drilled to counter water deficiency, particularly in drought prone areas. These are well managed by the State Governments for providing water to the public.

Moreover, canals, rivers, ponds, reservoirs, tanks and other small water bodies from Inland Water resources in India. These are mostly present in the areas of Uttar Pradesh, Madhya Pradesh, Jammu and Kashmir, Tamil Nadu, Andhra Pradesh, Karnataka, Rajasthan, West Bengal, Gujarat, Maharashtra and Orissa, amongst others. The entire length of canals and rivers are 31.2 thousand km in Uttar Pradesh and Orissa has the highest total area for salt water bodies.

Around 9.7 million hectares-meters of water were available for agricultural reasons before 1951. But by 1973, almost 18.4 million hectares-meter of water resources was being supplied for farming and irrigation. In India, the utilisable ground water resources are considered to be approximately around 40 million hectares-meters. Yet only 10 million hectares-meters are being utilized currently. The residual 30 million hectare-metres are stocked in pipelines for employment.

The Indian water resources are key natural resources, a fundamental human requirement and a valuable asset for the nation. This great importance should be given to the proper improvement and competent utilization of such water resources. Few programs and policies, such as, policy guidelines, technical examination, sectoral planning, techno-economic appraisal and coordination of projects, have been undertaken by the Government for regulation and the growth of water resources. These support particular projects, facilitate exterior assistance and help in solving regional disputes related to water, provide assistance in the formation of policies and management of irrigation and expansion and improvement of water resources in India.

2.3.2.1 Important facts on Water Resources of India

Water is an important resource. India has plenty of fresh water. Most of the fresh water is received during monsoon months unlike land; availability of water varies from place to place and time to time. Bulk of rainfall, is confined to a brief period of 3-4 months and this large part of the country takes, supply of water for a greater part of the year.

2.3.2.2 Water Resources: Indian Scenario :

India is a country of vast biological, geographic, and climatic diversity. It has a total geographic area of 329 Mha; excluding bodies of water, India's total land area is estimated at 297 Mha.

India is bordered in the north by the 2,500- kilometer long Himalayan Mountains. Melting snow and glaciers provide a continuous flow for numerous rivers running south from the Himalayas into the vast Indo-genetic Plain, which is dominated by the Ganges River and its tributaries. Heavy rains are typical in the Himalayas during the monsoon months between June and October, causing frequent floods. Southern India consists largely of the Deccan Plateau, which is flanked by the Western Ghats running along the west coast and the smaller Eastern Ghats on the east coast. The Deccan Rivers are rain fed and fluctuate in volume; many of these rivers are not perennial.

India receives average annual precipitation of 4000 km³, out of which 700 km³ is immediately lost to the atmosphere, 2150 km³ soaks into the ground, and 1150 km³ flows as surface runoff.

India is one of the few countries in the world endowed with abundant land and water resources. Average annual precipitation including snowfall over the country is 4000 billion cubic meters (BCM). In addition, it receives another 200 BCM from rivers flowing in from other countries. Average annual water resources in various river basins are estimated to be 1869 BCM, of which the utilizable volume of water has been estimated to be 1086 BCM including 690 BCM of surface water and 396 BCM of ground water. The rest of the water is lost by evaporation or flows into the sea and goes waste. The utilization of water is expected to be 784 to 843 BCM by the year 2025. Though the present utilization level is only about 50%, the availability of water is highly irregular. It is not available in places of need, at times of need and required quantities.

In the major part of the country, rainfall is the only sources of water which is available mainly during the monsoon season lasting for less than 3 months. Due to tropical weather and its geographical, location, the country experiences vast spatial and temporal variation in precipitation. About one- third of the country's area is drought prone. The south and western parts comprising the states of Rajasthan, Gujarat, Andhra Pradesh, Madhya Pradesh, Maharashtra, Tamil Nadu and Karnataka are the drought prone states. On the other hand, north and northeastern areas including the states of Uttar Pradesh, Bihar, West Bengal and Assam (Asom) subject to periodic flooding.

2.3.2.2 Water resources are as follows:

(1) Surface Water:

In India, surface flow takes place through 14 major river systems. Between them they share 83% of the drainage basin, account for 85% of the surface flow and house 80% of the total population of the country. In addition to major rivers there are 44 medium and 55 minor systems. These are fast flowing and monsoon fed. The surface flow is further enlarged by the addition of about 450 cubic kms. Fresh water from ground water flow while about 50 cubic kms are added to runoff from irrigated areas. Out of this surface water flow about same amount of water percolates down to the ground water deposits.

(2) Ground Water:

Ground water resources are abundant only in the northern and coastal plains. Underground reservoir of fresh water is called aquifers. Ground water is continuously recharged through infiltration, seepage and evatranspiration. Presently about 25% of the ground water is being used by man. Farming uses the maximum amount of ground water.

It has been found that excessive use of ground water depletes aquifers, lowers the water table and may lead to salination, water logging and equalization of the soils. According to the initial estimates of the Central Ground Water Board an additional quantity of about 10,081 km³ of static ground water can be exploited.

Generally static water is not regularly replenished on an annual basis; its one time use is only possible as a short time strategy. Further experience indicates that large scale use of static water or its mining is usually associated with surface settlement which may cause heavy damages to properties of land and soils and may, possibly, trigger seismic activities. Therefore, any appreciable use of static ground water on a regular basis is not foreseen till the middle of the 21st century.

(3) Rain Water :

India receives about 3 trillion M³ of water from rainfall. This is a huge resource and perhaps the largest in the world. However, almost 90% of this precipitation fall between mid June and October, out of which India utilizes only 10%.

2.3.3 Mineral Resources in India

Mineral resources in India are adequately rich, widespread and are of huge varieties which provide the nation with a strong industrial base. The most important mineral resources which India possesses include Manganese Ore, Coal, Bauxite, Mica, Iron, Monazite, and Salt. Further, there are other varieties too that are not found in abundance. For instance, Petroleum, Chromites, Gypsum, Tin, Mercury, Copper, Nickel, Lead and Zinc are not found in sufficient amount. India is mostly rich in iron resources. Iron and coal, actually forms the basis of the machine age. As per estimation, India possesses the virtual world's one fourth of iron ore resources. Its capital is rich not only quantitatively but also qualitatively. A further significant mineral required by the ferrous industries is manganese, and it is also found in abundance in India. It is used to manufacture steel alloys.

The country's coal reserves are substantial. Coal is abundantly available in West Bengal, Orissa, Madhya Pradesh and Andhra Pradesh but unfortunately the quality coal that is required for raising coke as an important input in steel industries is rather inadequate. However, the closeness of coal and the iron deposits has resulted in this shortcoming to a certain extent.

Limestone, another input in the steel industry, is also abundant and prevalent. India is also affluent in Bauxite, the ore for Aluminium and Mica used for electrical industries. India, on the other hand, is poor in non-ferrous minerals like Zinc, Lead, Copper and Gold. It is also lacking in sulphur which forms the foundation of modern chemical industry. At certain point of time, India was insufficient in the manufacture of mineral oil and natural gas. However, persistent efforts, supported by modern technology, have helped everybody to trace considerable reserves that may last for at least another 30 to 40 years. The water power resources and atomic minerals, however, can be depended upon. Iron, Manganese, Bauxite, Mica, Copper and Gold are some of the important mineral resources in India. India has only one Diamond producing area, the Panna Diamond Belt, which spreads across the areas of Panna District, Satna, Chhatrapur district in Madhya Pradesh. Banda, Uttar Pradesh is also covered under this area.

Petroleum is perhaps the most valuable mineral resources in India and it is rightfully called Liquid Gold as Industry, farming and transport system largely depend on it. Petroleum is transported from the field areas to other parts by various methods. There are many pipelines through which oil flows from the oil fields to the refineries. In recent years, a number of pipelines have been lately constructed to connect the vital oil fields with refineries. Road tankers are also used for transporting oil to the local places. Coastal tanks and large freight are used to transport oil across the sea-water.

2.3.3.1 Types of Mineral Resources in India

Mineral resources in India can be categorized into 2 groups, namely metallic minerals and non-metallic minerals. Metallic mineral resources are the ones, which have the properties of luster, solidity and hardness. These metals can be melted, drawn into wires and rolled into sheets. Usually metals exist as compounds in chemical combination with other minerals. Only a few of these minerals occur in a pure state. Gold, silver and copper are examples of such minerals. Metallic minerals are extracted from the earth in the raw state, called as mineral ore. The major metallic minerals found in India are iron, copper, lead, zinc, tin, silver and gold. On the other hand, there are some minerals that do not contain metal in them and are used for the extraction of non-metals like Sulphur, Phosphorous, Carbonate and so on. Limestone, Antimony, Mica and Gypsum Salts are some of the significant nonmetallic minerals that are found in abundance in India. Madhya Pradesh, Bihar, Orissa, Goa, Karnataka, Andhra Pradesh, Maharashtra, Kerala, Tamil Nadu and Rajasthan are the major producers of iron ore in India.

2.3.3.2 Distribution of Mineral Resources in India

The coal deposits in India mostly belong to the Gondwana age. Nearly three-fourths of the coal deposits in the country are situated in the Damodar River Valley. The places that are well connected with coal deposits are Jharia, Giridih, Raniganj, Bokaro and Karanpura. Minerals are basically exhaustible sources and thus they need to be preserved. The proficient utilization, recycling as well as application of enhanced technology for withdrawal and refinement will help in preserving minerals. The other river valleys in India that are connected with coal deposits are Godavari River, Mahanadi River, Son River and Wardha River. Other significant coal mining areas of the country are in the Satpura mountain range and in Chhattisgarh plains of Madhya Pradesh. The coal-fields of Singreni in Andhra Pradesh, Chanda in Maharashtra and Talcher in Orissa are also very large.

In India, Petroleum is found in Gujarat, Assam and Bombay High. Other areas like Manipur, West Bengal, Kutch, the Andamans, Tamil Nadu and Punjab are also considered as potential oil bearing areas. In Assam the major oil producing areas are Digboi, Sibsagar, Naharkatiya, Rudrasagar, Badarpur, Masinpur and Pallharia. Ankleshwar, Kheda, Vadodara, Khambat, Broach and Kalol are the chief areas in Gujarat. Moreover, oil has recently been unearthed in Godavari and Krishna basin, Khambat basin, Kaveri basin, etc.

2.3.4 Bauxite

High grade bauxite is found in abundance in India. Bauxite is widely distributed as surface deposits in those areas where laterite soil is found. This mineral is the ore of aluminium metal that is used largely in the manufacture of special alloys, aluminium powder, utensils and electric cables. Aluminium alloys are used in the manufacture of automobile engines because of its light and tough. Bauxite is used in the manufacture of cement and chemicals.

Bauxite is mined in several places in the country. The major deposits of bauxite are situated in Ranchi, Jamnagar, Jabalpur, Kohlapur and Shevaroy Hills. Apart from these areas, the other places where its chief deposits are found include Poonch and Riasi in Jammu and Kashmir, Balaghat in Madhya Pradesh and more. Moreover, in Kutch district in Gujarat too large deposits of Bauxite are found. Of late, deposits in Orissa have been developed and the biggest plant of its kind in Asia has been constructed to produce alumina and aluminium. It utilizes the latest French technology, which economizes on the use of electricity. Bauxite ore is exported to Japan and European countries. In Orissa, there are two very big high grade deposits of Bauxite. The first one at Panchpatmali is regarded as the largest in the country and the second one is at Gandhamardan bauxite deposit. Interestingly, production of bauxite is registered particularly in those areas that supply alumina plants with this ore.

Bauxite ore has benefited in importance because aluminium-a very light but exceedingly functional metal, is made from it. It is a must for air craft engineering. It is now also being increasingly used in day-to-day life. But the manufacture of alumina and aluminium depends fundamentally on the handiness of cheap and ample generation of electricity. Bauxite deposits in India are extensively distributed. Orissa, Andhra Pradesh, Madhya Pradesh, Gujarat, Maharashtra and Bihar are the foremost states where bauxite reserves are predominately located. The total reserves are approximated to be more than 2462 million tonnes. Major reserves are centralized in East Coast Bauxite deposits of Orissa and northern Andhra Pradesh.

Aluminium is obtained from bauxite in two stages. In the first stage bauxite is refined and transformed into alumina by a chemical process and in the second stage aluminium metal is obtained by the electrolysis of alumina. Of the total bauxite produced in the country, the major portion is used for making aluminium metal. A small quantity of it is exported to other countries.

2.3.5 Iron Ore in India

India is one of the richest sources of iron ore deposits in the world. Iron ore, which is also known as hematite, occurs in abundance in the country. Iron ore reserves account for almost two-third of the entire iron ore reserves in India. Interestingly, India holds a leading position in the list of leading iron ore reserve countries. Moreover, the iron ore reserves are easily accessible and also high grade. They are also good for smelting as they are free from impurities like phosphorous and sulphur. Iron ore is vastly distributed throughout the country but its huge deposits are concentrated only in a few selected districts.

Of the total iron ore reserves in the country, Chikkamagaluru in Karnataka, Singhbhum in Jharkhand, Sundargarh and Kendujhar in Orissa, Bellary District, Shimoga and Goa accounts for a major portion. Further, in Bihar and Orissa, huge deposits of iron grade iron ore occur as huge masses that rise above the adjoining plains. Some of them are located within a close proximity to the coal fields. Iron ore generally occur near the top of the hills and thus aerial roadways are used by the iron ore companies to bring down the ore and for pumping it directly into the railway carriages. Singhbhum district in Bihar and the neighbouring districts of Mayurbhanj, Sundargarh and Keonjhar constitute the richest high grade iron reserves. In India, the chief mining centers are Sulaipat and Badampur in Mayurbhanj District in Orissa and Goa and Noamundi in Singhbhum district in Jharkhand. The iron ore from these mines is supplied to the iron and steel works located at Jamshedpur, Durgapur, Asansol and Raurkela. The Rajhara and Dhali Hills located

south of Bhilai Steel Works are other major sources of iron ore with huge iron content. These hills provide iron ore to the Bhilai Steel Works. Moreover, apart from these places, there is a large high-grade iron ore deposit at Kemmangundi in the Bababudan Hills of Chikmagalur district in Karnataka. This deposit is used for supplying iron ore to steel plant located at Bhadravati.

Interestingly, iron ore found in Goa is basically of high grade and is situated in close proximity to the port of Marmagao. Rich deposits are also found in other areas of the country. Like for instance, the eastern area of Madhya Pradesh and adjacent districts of Maharashtra, rich deposits of iron ore or hematite occur in a number of places. Hematite occurring in areas like Rowghat and Bailadila in Bastar District and Lohara and Pipalgaon in Chandrapur District are generally very large. After the iron belt of Orissa and Bihar, Bailadila and Rowghat constitute the richest high grade iron ore area.

Mining of iron ore on modern lines has been started in the country. Mines in dissimilar places have been made fully mechanized and also export oriented. The mines are fully equipped with modern machinery. Other areas with sizeable deposits of iron ore occur are the Salem and Ratnagiri districts Kudremukh in Chikkamagaluru district. These areas consist of low grade magnetite iron ore. Iron ore mines in Kudremukh hills are very developed. Few places in Andhra Pradesh like Kurnool and Anantapur districts and Palamau in Bihar also produce a small proportion of iron ore. Production of iron ore in the country has also increased with the passage of time.

2.3.6 Copper

Copper in India is chiefly used for the production of electrical machinery. As an industrial metal, copper stands second only to steel. It is measured as the best conductor of electricity. Copper is also used in producing brass and bronze, castings and pipes. Further, for the refining of copper, cheap and abundant electricity is required. India manufactures only a little amount of copper and it imports a huge quantity of this mineral resource annually to meet domestic needs. At present, most of the copper ore is mined in the districts of Singhbhum (**Jharkhand**), Baiaghat (Madhya Pradesh) and Jhunjhunu District and Alwar in Rajasthan. The small producers of copper include the Khammam District of Andhra Pradesh, Dhitradurga and Hassan District of Karnataka and also in some parts of Sikkim.

The smelter at Ghatsila in Singhbhum district is very old. It receives copper ore concentrates from Mosabani. Interestingly, up to the year 1971, the smelter at Ghatsila was the only producer of copper in the country. It also produced huge tonnes of copper annually. On the other hand, the smelter situated at Khetri in Jhunjhunu district of Andhra Pradesh also has a huge capacity. In the year 1970, this smelter started producing copper on an experimental basis. The smelter was commissioned for the production of electrolytic copper on a real large scale in the year 1974. This smelter gets copper ore from the copper ore mines at Khetri, Chandmari, Dariba and Kolihan. All these places are located within close proximity from Khetri.

With the increase in the copper smelting capacity of India, production of this mineral resource started an upward trend long time back after 1971. Further, production has risen further since then. India is quite able to meet nearly more than half of the annual domestic requirements of copper. In India, several copper projects are being developed in order to augment the production of copper.

2.3.6.1 Copper Ore in India

Copper ore deposits are found in several places of India. Copper is considered as the most important metal used in the country next to iron. Copper is used broadly in the manufacture of electrical machinery, cables and wires as it is a good conductor of electricity. This metal is also used for making brass and other similar alloys, coins and utensils. Defence as well automobile industries too use a huge quantity of copper and its alloys. However, it is the electrical industry that consumes an appreciable bulk of the total amount of copper produced in the world.

In India, copper ore belts are found in several areas. Like for instance, a copper ore belt is situated in Singhbhum district of Jharkhand and is being mined for copper ore. Rakha and Mosabani areas are the major mining areas. Further, in the Himalayan mountain ranges, rich deposits of copper ore are found. It is basically found near Rangpo in Sikkim and in Garhwal of Uttar Pradesh. However, even if the deposits of

copper ore are found in some areas in huge quantity, they are not exploited in some areas because of poor transportation means and non-availability of electricity.

Promising deposits of copper ore occurs near Khetri town located near the Aravalli Mountain Ranges. It is a huge copper ore belt in the country with a heavy reserve. Other copper ore belts are found at Agnigundala in Guntur district, at Dariba in Alwar District, in Chitradurga, Kalyadi and Thinthini in Karnataka and at Dikchu in Sikkim. Further, with the opening of new mines, the production of copper ore has increased tremendously in the recent times. Few more areas in India where copper ore are found include Sirohi in Rajasthan, Chandrapur district in Maharashtra, Chitorgarh district and also in Phek district of Nagaland. Of the total production of copper ore in India, Karnataka, Rajasthan, Bihar and Madhya Pradesh account for a major output.

2.3.6.7 Manganese

Ferro-alloys are amalgamated metals with iron as the base. These are valued for their strength, and as a result they have become pretty significant in the age of commanding giant machines. Manganese is used for this purpose and hence its escalating importance.

The total recoverable stockpiles of manganese ore are 167 million tonnes. The primary reserves are located in Karnataka, followed by Orissa, Madhya Pradesh, Maharashtra and Goa. In 1997-98, production of manganese ore was 1.6 million tonnes.

2.3.6.8 Mica

Mica is produced in huge proportion in India. In fact, India is one of the leading suppliers of mica to the world. India alone accounts for a major portion of the world's export of block mica and mica splitting. Mica can withstand high temperature as it is a bad conductor of electricity. Moreover, it can also be split up into thin films. These unrivalled properties of mica have actually made it indispensable for the production of several electrical equipments. India produces approximate 90 % of the world's mica. It is an indispensable component of the electrical industry. India accounts for 60 % of mica embarking in international trade.

Mica gets its name from the Latin word Mica which literally means "a crumb" and is assumed to be influenced by the word Micare, meaning "To shine or glitter. Mica is known as Abharak or Abhrak in Hindi. Mica has been used in India since ancient times. Finely powdered Mica has been utilized for various applications, like for decoration. During the Indian festival of Holi, colored Gulal or Abeer used by Hindus in various parts of the country consists of fine minute crystals of mica. The majestic Padmanabhapuram Palace, 65 km from Trivandrum in India, has colored mica windows.

There are two types of Mica available in the world, dioctahedral and trioctahedral mica. In Trioctahedral mica, the most common types found are Muscovite, Zinnwaldite, Biotite, Lepidolite, and Phlogopite. Where as Clintonite is Brittle mica.

Mica is widely available and distributed in sedimentary, metamorphic and igneous regimes. Large sized mica crystals, utilized for various purposes, are usually mined from granitic pegmatites. In India, Mica is widely available in Karnataka, Bihar, Kolkata, Rajasthan, Gudur and Andhra Pradesh. Hazaribagh, Gaya and Munger districts of Bihar account for a huge proportion of the total production. These districts lie on the northern fringe of the Chota Nagpur Plateau. The remaining half is evenly divided between Nellore District in Andhra Pradesh and Bhilwara District in Rajasthan. Mica is also mined in small quantities in Udaipur, Sikar, Tonk and Ajmer districts of Rajasthan. Moreover, a small proportion is also mined in small quantity in Nilgiri district. Production has been worsening due to artificial replacements.

In India, mica belt is located along the northern fringe of the Bihar Plateau as to include parts of Hazaribagh and Gaya districts. Mica belt generally occurs in the veins of the metamorphic rocks. The mica belt in this area runs in the east-west direction. Giridih, Domchanch and Kodarma are the principal collecting centers where it is processed. This particular mica belt produces more than half of the total mica production of the country.

Muscovite and Phlogopite are the most commercially significant micas that have several uses. Mica's value is based on several of its unique physical properties. The crystalline structure of mica forms layers which can be split into thin sheets. The sheets are usually chemically inert, elastic, dielectric, hydrophilic, flexible, insulating, platy, lightweight, reflective, resilient, refractive, and range in opacity from transparent to opaque. Due to the unique combination of physical, chemical and thermal properties, low power loss factor, dielectric constant and dielectric strength, Mica is precious in the electrical industry. The properties like low power loss factor and dielectric constant make mica ideal for use in condensers, the basic function of which is to store electrostatic energy in the dielectric field momentarily perhaps one-Millionth part of a second and then to re-deliver it with the minimum possible loss. The quality of Mica for commercial use depends largely on the amount of staining, air inclusions, the degree of flatness, and the color.

Sheet mica is utilized in numerous electrical and electronic appliances in dissimilar shapes and sizes. Mica is used in equipments like condensers, sheostats, transformers, electronic tubes, and radio and radar circuits as an insulating material. Mica is also used in the form of washers, discs, tubes and plates. Nowadays mica is finding increasing use in equipment that encounters very high temperatures like rockets, missiles and jet engine ignition system. Hlogopite is used in spark plugs. Mica films are used in alternate layers of binding materials like shellac, alkyl, or silicone resin and then pressed and baked.

In the electronic-field, natural mica is mainly used in the manufacture of capacitors such as bridge-spacers in electronic valves and as panel-board where heat-resistance and low-loss properties at high frequencies are required. The scrap mica obtained during the processing of crude mica, is utilized in the manufacture of mica bricks for heat insulation, mica powder for use as filler in rubber goods, plant, lubricant and to some extent in plastic industries. It is also used in the manufacture of roofing material, welding rod, wall-paper, lamp chimneys, shades etc.

A small quantity of this mineral resource of the country is also used for the production of mica powder and mica bricks. Mica powder is used in the production of rubber goods and paints. Mica bricks are used as an insulating material in steel and thermal power plants and petroleum refineries. Interestingly, the production of mica depends on foreign demand to a great extent. Huge amount of Mica in India is exported. Countries like the United States, Japan and United Kingdom are the major buyers of mica.

Perlite, diatomite and vermiculite may be substituted for ground mica when utilized as a filler. Ground synthetic fluorophlogopite may replace natural ground mica for uses that require thermal and electrical properties. Many materials can be substituted for mica in numerous electrical, electronic, and insulation uses, like cellulose acetate, acrylate polymers, fishpaper, fiberglass, phenolics, nylon, polyester, polycarbonate, styrene, vulcanized fiber and vinyl-PVC. Mica paper, obtained from scrap mica can be substituted for sheet mica.

2.3.6.9 Gold

Gold is a precious metal but in India at present the reserves of gold ore are low. Gold mining in India has a long history and official records have confirmed that old gold mine sites are found which are of two hundred years old. Presently, gold is mined Hutti mines in the Raichur district of Karnataka. The other mine is located in the Anantpur district of Andhra Pradesh. Pure gold has a bright yellow color and luster traditionally considered attractive, which it maintains without oxidizing in air or water.

India is the largest importer and consumer of Gold but Gold mining remains at a low level. India's domestic gold production was at 3.05 tonnes during the financial year 2006. The low production of gold has adversely affected the economy of the country and the government has asked domestic gold miners to actively survey joint venture with foreign companies to speed up the exploration of the yellow metal within the country. The Geological Survey of India and the Mineral Exploration Corporation of India are two of the major government agencies that carry out verification surveys on gold mining in India. In India, identification of gold bearing zones is done by gathering rock chip specimens from favorable places for gold mineralization while panning the geological chart of the area . In case the rocks are not exposed stream sediment sampling method is implemented to spot the gold anomalous areas. Geophysical methods can also be arranged to situate any conductive bodies below the soil cover. Three dimensions sampling of gold bearing zones are carried out by reverse circulation drilling and diamond core drilling. Based on this three dimensional

sampling of the gold-bearing zone, a global resource of the gold deposit is estimated. The global resource is again worked upon by close spaced diamond core drilling along the length and dip of ore body and sampling to develop the dependability of the global resource approximation.

The Hutti gold mines, which is owned by the government of Karnataka expects its gold production to touch 3.5 tones in three to five years from now, from the current 2.8 tones. It is the only company in India which produces gold by mining and processing the gold ore. Present gold-producing centers of India have observed very old and modern mining activities.

2.3.6.10 Power

With the dawn of the industrial era, in India the sources of energy to run giant machines suddenly came into prominence. Wood fuel was confined only to domestic use and that too in the rural area. Coal, which was already in use, became a highly priced commodity. It was then supplemented by natural oil. Likewise, the use of hydroelectricity gained currency in the areas where running water and needed technology was readily available. After the World War II yet another source of energy was added. It was the nuclear energy. It called for a very sophisticated level of technology. All these sources of energy are known as conventional sources of energy.

These sources of energy, like minerals are exhaustible. Hence they need to be used judiciously and conserved for future use. Among the conventional sources, the coal still occupies a prominent position.

2.3.6.11 Coal:

Apart from being the prime source of energy, coal is also a raw material and is an indispensable part of the steel and chemical industry.

2.3.6.12 Oil and Natural Gas

India has a very large proportion of tertiary rocks and alluvial deposits particularly in the extra-peninsular India. These sedimentary rocks, which were once under the shallow seas, hold the possibility of harboring oil and gas deposits. Hence, this oil and natural gas happens to be one of the main power resources in India.

2.3.6.13 Thermal Power

The modern world is well aware of hydroelectricity. It is derived from a source, which is plentiful and above all renewable and is reckoned as one of the main natural resources of India.

2.3.6.14 Nuclear Power

India has been a leader in making peaceful use of atomic energy fields like medicine and farming . Quite ideally therefore India is rich in certain atomic or nuclear minerals.

2.3.6.15 Power Grids

The power generated from every possible source is fed into five regional grids. All the regional grids are expected to be connected into a single national grid to serve all the areas better even in adverse conditions.

2.4 Spatial distribution of population and density, socio – economic implications of population explosion, urbanization.

2.4.1 Spatial distribution of population

Indian demography entails the population, ethnicity and status of the people, living in the diverse states of the nation. India is a country of great diversity with a wide range of landform types, including prime mountain ranges, deserts, loaded agricultural plains, and hilly jungle areas. Indian demography in a vast canvas includes population density, ethnicity, education level, and health of the population, economic status, religious affiliations and other aspects of the population. However, the great variation that occurs across this population on social parameters such as income and education are also factors that determine Indian

demography.

Indian subcontinent appropriately describes the massive extent of the earth's surface that India occupies, and any effort to generalize its physiography is inaccurate. Diversity is also evident in the geographical distribution of India's ethnic and linguistic groups. The demographics of India are remarkably diverse. Moreover, India has more than two thousand ethnic groups, and every major religion is represented in this nation, as are the four major families of languages, namely the Indo-European, Dravidian, Austro-Asiatic and Tibeto-Burman languages, as well as a language isolate, the Nihali language that is spoken in parts of Maharashtra.

Indian demography states that the nation occupies 2.4% of the world's land area and supports over 17.5% of the world's population. India has more arable land area than any country except the United States. Indian lifestyle therefore revolves mostly around farming and associated activities in small villages. According to the 2001 census, 72.2% of the population live in about 638,000 villages and the remaining 27.8% populates over 5,100 towns and over 380 urban settlements.

The **demographics of India** are inclusive of the second most populous country in the world, with over 1.21 billion people (2011 census), more than a sixth of the world's population. Already containing 17.5% of the world's population, India is projected to be the world's most populous country by 2025, surpassing China, its population reaching 1.6 billion by 2050. Its population growth rate is 1.41%, ranking 102nd in the world in 2010. Indian population reached the billion mark in 2000.

India has more than 50% of its population below the age of 25 and more than 65% below the age of 35. It is expected that, in 2020, the average age of an Indian will be 29 years, compared to 37 for China and 48 for Japan; and, by 2030, India's dependency ratio should be just over 0.4.

India has more than two thousand ethnic groups, and every major religion is represented, as are four major families of languages (Indo-European, Dravidian, Austroasiatic and Tibeto-Burman languages) as well as two language isolates (the Nihali language spoken in parts of Maharashtra and the Burushaski language spoken in parts of Jammu and Kashmir).

Further complexity is lent by the great variation that occurs across this population on social parameters such as income and education. Only the continent of Africa exceeds the linguistic, genetic and cultural diversity of the nation of India.

India occupies 2.4% of the world's land area and supports over 17.5% of the world's population. Per the 2001 census, 72.2% of the population lives in about 638,000 villages and the remaining 27.8% lives in more than 5,100 towns and over 380 urban agglomerations.

India's population had exceeded that of the entire continent of Africa by 200 million people., however, Africa's population growth being nearly double India's, is expected to surpass both China and India by 2025.

According to the Indian demography, around 38 percent of all Indians were officially listed as living below the poverty line. This number represented an increase from the low mark of 26 percent in FY 1989. Although family planning programs have become integrated with the programs of urban and rural health clinics, no official birth control programs have widespread support in India. Improvements to the education system overall the nation have been substantially since 1947. In the mid-1990s, however, only about 50 percent of children between the ages of six and fourteen were enrolled in schools. Important achievements have been made in the domain of Indian demography, however, with the implementation of the non-formal education system and adult education programs. High standards are maintained among the elite institutions in the higher education system.

According to the religious demographics of India, 80.5% of the Indians are Hindus, with 13.4% of the population Muslim, making India home to the third-largest Muslim population in the world. The Indian

demography as per linguistics state that 40% of the Hindus speak Hindi while the rest speak Bangla, Telugu, Marathi, Tamil, Gujarati, Kannada and other languages. Almost 70% of the Muslims speak Urdu while the rest speak Kashmiri, Telugu, Malayalam, Bengali, Tamil, Gujarati and other languages. Altogether, there are 1,652 languages and dialects spoken in India.

2.4.1.1 Distribution of Population Among Indian Males and Females

Males and females are the mandatory and equivalent partners for the prolongation of their respective species. Human population is by no means an exemption to this law of nature. On March 1, 1991, the total population of India was 846.3 million. Of these, 439.2 million were males and 407.1 million were females, which illustrates that males had outnumbered females by as much as 32.1 million. It is twice over the sum total of Australian population. One can just envisage the magnitude of this disproportion between the numbers of the two.

This detail becomes more evident with the help of a ratio between males and females. In India this ratio is conveyed in terms of the number of females per every 1000 males. In 1901 there were 972 females per 1000 males. The sex-ratio in India has been gradually reduced over the decades. In 1991, it was as low as 927 females per 1000 males. This unrelenting critical trend is adverse for the Indian females. In fact, as a rule, the developed countries of the world demonstrate that females enjoy greater longevity compared to their male equivalents. For example, in Japan sex ratio is 1038 per 1000 males. The Japanese female has an average longevity of 84 years, as compared to merely 77 for males. Even in Kerala, known for the superior status of women, the sex ratio is almost similar to Japan.

In India, the undesirable or critical sex ratio is a perfect suggestion and an outcome of very low social, economic and political position of women. The miserable literacy figure for females is yet one more confirmation, as well as a conducive cause of their overall low standing. It is only in recent times that female life expectancy has improved by the borderline, compared to that of males. If this tendency prolongs and gets emphasized, the sex ratio may start to pick up, though very slowly.

The sex ratio in rural areas is fairly higher compared to the urban areas. This is due to the recent inclination of relocation of labor from rural to urban areas. It is a male who generally migrates to another place in search of a job, leaving behind the family, while he earns his livelihood in the town or city. He sends portions of his earnings to his family living in villages.

Women in India also call for an equivalent status along with males in the family and society. Just as educated women start to involve themselves in organized labor force- outside the home and farm, they would be liberated and better propelled to have a small family, so that every child in the family is looked after with appropriate love, fondness and possibilities to mature to their utmost, guaranteeing an all-sided intensification of their personality.

2.4.1.2 Distribution of Population in Urban and Rural India

Distribution of population in urban and rural India is unequal and has differences. India is primarily an agrarian society, where the majority of the population is dependent on farming and allied activities in rural areas. In the urban areas of the country, people are not dependent on farming. Normally an urban area is one in which 75 percent of the population lives by non-agricultural occupations but in the beginning of the 20th century this was not the case in India. In 1901, only 1 out of every 9 Indians lived in towns or cities. Today, after so many decades the situation is experiencing remarkable changes. Today every fourth Indian is a city-dweller. In 1901, the sum total of people living in urban areas was around 26 million. The number of people living in urban areas has escalated more than 218 million. This figure far surmounts the total population of Russia, Canada and Australia has taken together. More alarming is the fact that two third of India's total urban population lives in metropolitan and developing cities that have a populace of several lakh people. This ever increasing population exerts terrific pressure on the existing brittle civic, social and sanitary services.

According to the 2001 census, the total population in rural areas of India is 742,490,639, which is 72.2% of

the total population. Whereas total urban population is 286,119,689, which is 27.8% of the nation's entire population. The population in the metropolitan cities of India is 16,368,000 in Mumbai, 12,791,000 in Delhi, 13,217,000 in Kolkata and 6,425,000 in Chennai as per the 2001 census.

At present in India, the ten leading populated urban districts include Kolkata, Chennai, Mumbai, Hyderabad, Delhi, Chandigarh, Pune, Bengaluru, Ahmedabad and Kanpur. These ten city districts alone account for more than 5 percent of the total population of the country. The average density of these districts is around 6888 persons per sq km. Among the large states like Maharashtra, Gujarat and Tamil Nadu are considered as the most urbanized states. More than 35 percent of the total population of these states lives in cities. Another fact of enormous significance is the fast development of major cities. Each of such cities has more than one million people. In 1981, there were 12 such cities. However, their number had risen to 23.

The rural population in India comprises the core of Indian society as almost 70% of the population lives in the 6, 27,000 villages of rural India. Religion, caste and language are considered the major determinants of social and political organization in rural India. More than 80% of the total rural population in India is Hindu and the other major religious communities include the Muslims, Buddhists, Jains, Christians, Sikhs, Parsis, etc. Tribal or adivasis are an integral part of the rural population as well. The State and Central Governments are taking various steps and measures to improve quality of life and provide adequate basic amenities like proper accommodation, food, clear drinking water, health care, sanitation and most importantly education. Banks have also been invited by the Government to provide support in rural development.

Over a period of 90 years, the rural population has barely increased. During the same time, urban population had amplified by more than eight times. Today's urban population in India is even greater, compared to the total rural population of India, as it was in 1901. When population in India was expanding very swiftly, the percentage of young population accounted for as much as near about 44 percent of the whole population. However, it had declined over the years. The older population over the last decade has enlarged from around 6.2 percent to 6.76 percent. This is a hint that due to propagation of education and magnified and bettered health services, the normal longevity has been increasing steadfastly. The average life expectancy has now nearly doubled since 1951 for both males and females.

Education, health and medical care of the young and the old make an imperative demand on the resources of the economically dynamic population. Furthermore, both the groups are dependent on the population of the middle-age group. The dependency ratio is measured by dividing the dependent population by the active population and multiplying it by 100. Another important aspect regarding the distribution of population is that traditional rural-urban migration prominently exists in India.

2.4.1.3 Density

Population Density is defined as the number of persons per square kilometer. Population density is one of the important indices of the density of population. The population density of India in 2001 was 324 persons per square kilometer. There is a large variation in population density across India. It varies from 13 persons per sq. Km in Arunachal Pradesh to 9294 in Delhi. Among major states, West Bengal is the most thickly populated with a population density of 904.

State / Union Territory (U.T.)	Population Density (per sq. km)
Jammu & Kashmir	99
Himachal Pradesh	109

Punjab	482
Chandigarh (U.T.)	7903
Uttaranchal	159
Haryana	477
Delhi (U.T.)	9294
Rajasthan	165
Uttar Pradesh	689
Bihar	880
Sikkim	76
Arunachal Pradesh	13
Nagaland	120
Manipur	107
Mizoram	42
Tripura	304
Meghalaya	103
Assam	340
West Bengal	904
Jharkhand	338
Orissa	236
Chhatisgarh	154
Madhya Pradesh	196
Gujarat	258
Daman & Diu (U.T.)	1411
Dadra & Nagar Haveli (U.T.)	449
Maharashtra	314
Andhra Pradesh	275
Karnataka	275
Goa	363
Lakshadweep (U.T.)	1894
Kerala	819
Tamil Nadu	478
Pondicherry (U.T.)	2029
Andaman & Nicobar Islands (U.T.)	43

2.4.1.4 Socio – economic implications of population explosion

The population explosion is the most serious problem facing our country today. With 16 per cent of the world's population, India is today the second largest population's country in the world. The population growth has been extremely rapid in the last 50 years. The phenomenal growth is now more appropriately termed as "population explosion".

The phenomenal growth rate in population is largely because of the industrial and technological revolutions that had taken place in the recent times. The new technologies have not only brought down the death rate because of the vastly improved Medicare resulting in increased life expectancies, but had also facilitated increased food production to take care of the food needs of the increasing population.

Though the population explosion is a major problem being faced by several other countries too, with the world population estimated to reach 7 billion by the beginning of the 21st century, the problem is much more severe in India because of the increasing pressure on the limited resources of the country. With the growth of food grains not keeping pace with the increase in population during some years because of the unfavorable weather conditions, the specter of hunger hunts millions of households in the country.

Even when the country is fortunate enough to have a bumper crop, these hungry households do not have the economic strength or purchasing power to buy the required food grains. The phenomenal population growth exerts immense pressure on other basic necessities like education, health, housing, clothing, employment opportunities etc.

With employment opportunities in the rural areas becoming scarce, the population explosion is resulting in an increasing migration of the rural poor to the urban areas in search of jobs. The increasing pressure on the urban areas is giving rise to number of slums and this is multiplying the problems in the urban areas as health is the first casualty in slums.

To check ill-effects of population growth on the socioeconomic front, the Indian government had launched the Family Planning Program in 1951. This was later rechristened as the Family Welfare Program. This program promotes on a voluntary basis, responsible Planned Parenthood, through independent choice of family planning methods best suited to the people.

Though the Family Welfare Program has resulted in significant declines in death rates and infant mortality besides almost doubling life expectancy, a lot more needs to be done if the population explosion is to be effectively checked. For this, we have to improve the literacy rate, female education and the socioeconomic status of the families as population growth is directly linked to these factors. The fact that Kerala could make a lot of progress in checking population growth testifies to the impact of literacy on the population explosion.

The government should also intensify its efforts to educate the people on the adverse effects of population explosion. The population explosion can be effectively checked only when the people are inclined towards smaller families. With the increasing literacy rate and improved socioeconomic status, the people can be educated to adopt a favorable attitude towards smaller families. When this happens, the population explosion can be checked.

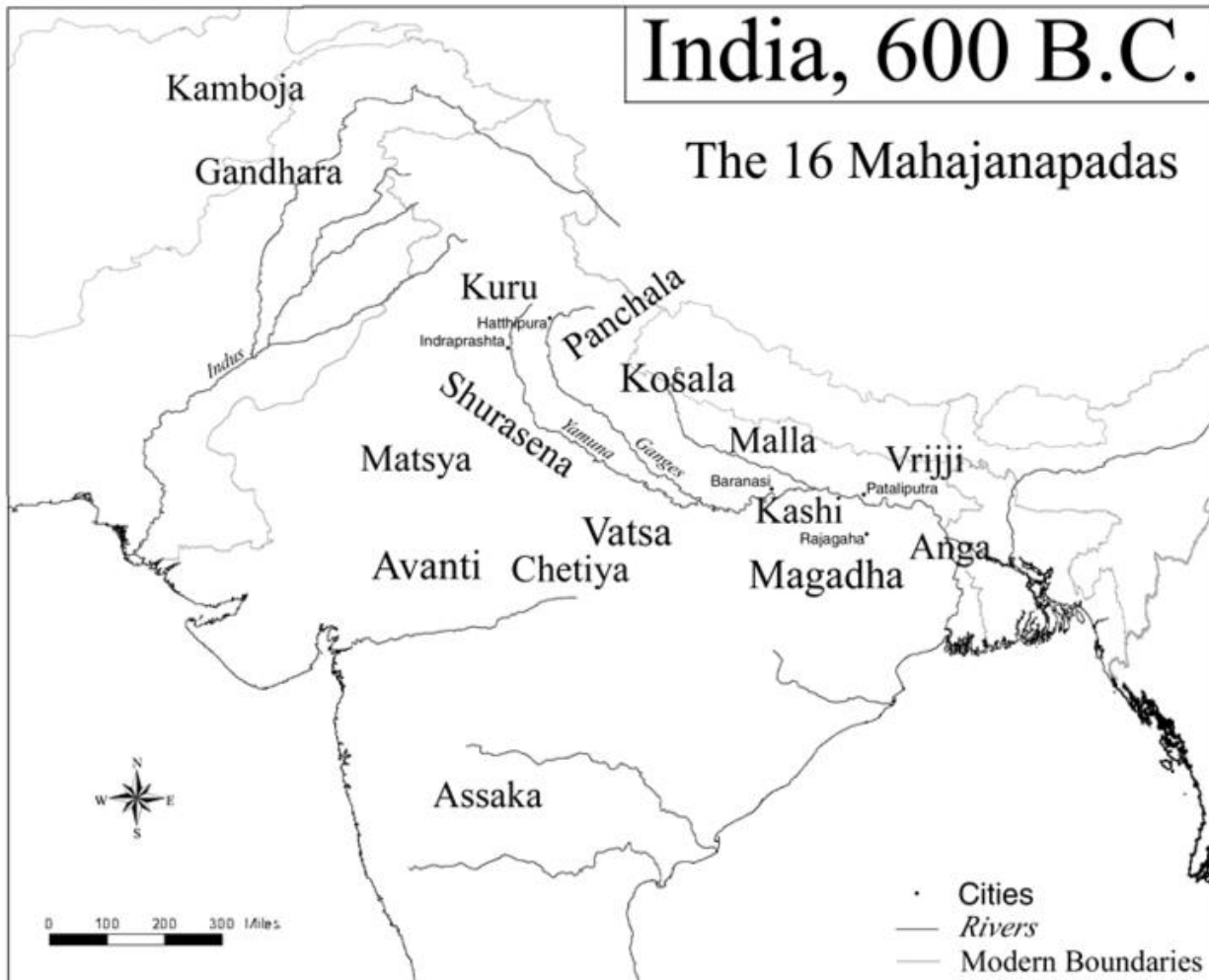
2.4.1.5 Urbanization

Urbanization in India was mainly caused after independence, due to the adoption of a mixed system of economy by the country which gave rise to the development of the private sector. Urbanization is taking place at a faster rate in India. Population residing in urban areas in India, according to the 1901 census, was 11.4%. This count increased to 28.53% according to the 2001 census, and crossing the 30 % as per 2011 census, standing at 31.16%. According to a survey of UN State of the World Population report in 2007, by 2030, 40.76% of the country's population is expected to reside in urban areas. As per World Bank, India, along with China, Indonesia, Nigeria and the United States, will lead the world's urban population surge by 2050.

Mumbai saw large scale rural-urban migration in the 21st century. Mumbai accommodates 12.5 million people, and is the largest metropolis by population in India, followed by Delhi with 11 million inhabitants. Witnessing the fastest rate of urbanization in the world, as per 2011 census, Delhi's population rose by 4.1%, Mumbai's by 3.1% and Kolkata's by 2% as per 2011 census compared to 2001 census. Estimated population, at the current rate of growth, by the year 2015, Mumbai stands at 25 million, Delhi and Kolkata at 16 million each, Bangalore and Hyderabad at 10 million.

2.4.1.5.1 History

2.4.1.5.1.1 Pre-modern India



The Mahajanapadas

The first appearance of cities and urban development in India was around 2600 BCE with the advent of the Indus Valley Civilization. The settlement displayed a level of sophistication superior to contemporary development with its unique Grid plan city layout. During its peak, the city had a novel sanitation system with a water supply and sewerage system in place. Trading helped the city to flourish and it had significant trade routes with Central Asia and the Middle East. The city had its unique system of weights and measures, script, religion and a flourishing crafts industry.

The decline of the Indus Valley Civilization due to weather change and drought led to a migration towards northern India in the advent of the Iron Age better known to the Vedic Civilization. The epic Mahabharata of this time describes the city of Indraprastha which stood at the present location of Delhi and served as the capital of the Pandavas. This period and its later years saw the rise of various powerful city kingdoms or republics, known in popular literature as the 16 Mahajanapadas, such as Kashi, Magadha and Avanti, whose capital cities became powerful through trade and being notable centers of learning. The most prominent among them being Varanasi, Pataliputra (modern day Patna) and Ujjayini among others.

The later period, from 399 BCE, became famous with the Maurya empire. A detailed account of life during the time of Chandragupta Maurya is given by the Greek ethnographer Megasthenes in his book the *Indica*.

The book described the caste system prevalent at the time that has been deeply rooted in the present day Indian community, both rural and urban. Cities like Takshashila became renowned in the old world as a center for higher learning, probably best known for its association with the strategist and adviser Chanakya who aided the emperor. Takshashila was the terminus of several major islands, connecting India and Central Asia. In the south, the Pandyan Dynasty established its capital at Madurai, one of the oldest continuously inhabited cities in the world, and boasting a rich cultural and architectural heritage. Port cities such as Muziris and Tyndis thrived with trade with the Roman empire.

2.4.1.5.1.2 The transition period

After independence, India faced poverty, unemployment and economic backwardness. The first Prime Minister of India, Pandit Jawaharlal Nehru, focused on the domain of science and technology, for economic development. The *mixed economic* system was adopted, resulting in the growth of the Public sector in India.

2.4.1.5.1.3 Modern India

The contribution of the agricultural sector to the GDP of India started to decline and the percentage contribution from the secondary sector increased. The period after 1941, witnessed rapid growth of six metropolitan cities in India, which were Kolkata, Delhi, Mumbai, Bangalore, Chennai and Hyderabad. The nation's economy saw a rise due to the industrial revolution and the invention of new technologies increased the standard of living of people living in urban areas. The growth of public sector resulted in the development of public transport, roads, water supply, electricity, and hence the infrastructure of urban areas.

Maharashtra was the most urbanized state in India till 1991, but stood behind Tamil Nadu in 2001, with the urban-total state population ratio. However, Maharashtra's urban population of 41 million, far exceeds that of Tamil Nadu which is at 27 million, as per the 2001 census.

2.4.1.5.2 Causes of urbanization in India

The main causes of urbanization in India are:

- Expansion in government services, as a result of Second World War
- Migration of people from Pakistan after partition of India
- The Industrial Revolution
- Eleventh five year plan that aimed at *urbanisation* for the economic development of India
- Economic opportunities are just one reason people move into cities
- Infrastructure facilities in the urban areas
- Growth of private sector after 1990 .

2.4.1.5.3 Consequences of urbanization

Rapid rise in urban population, in India, is leading to many problems like increasing slums, decrease in standard of living in urban areas, also causing environmental damage.

The Industrial Revolution in the 18th century caused countries like the United States and England to become superpower nations but the present condition is worsening. India's urban growth rate is 2.07% which seems to be significant compared to Rwanda with 7.6%. India has around 300 million people living in metropolitan areas. This is greatly causing slum problems, with so many people over crowding cities and forcing people to live in unsafe conditions which also includes illegal buildings. Water lines, roads and electricity are lacking which is causing the fall of living standards. It is also adding to the problem of all types of pollution.

Urbanization also results in an Imbalance in the market, owing to the large demands of the growing population and the primary sector struggling to cope with them.

2.5 Changing nature of Indian economy

The Indian economy is diverse and embraces a huge area, including farming, mining, textile industry, manufacturing and a vast array of other services. There is an enormous shift from what the economy used to be in the distant past. Indian economy is the third largest in the world, as measured by "purchasing power parity" (PPP). Still now two thirds of the population thrive on farming directly or indirectly. Indian economy is somewhat socialistic in its approach though nowadays there is a change that has taken place and we see India on the run with other capitalist countries.

2.5.1 Pre-Colonial History:

Pre-colonial implies to the period before the advent of the British. In this context, Indus Valley Civilization is considered to be the first of the permanent settlements in the urban areas. They usually practiced varieties of trades, which included farming, the domestication of animals, making sharp weapons from copper, bronze and tin and intercity trading. Barter system was commonly in use in these times although many kings issued coins and revenues were also paid to the rulers.

Calicos, muslin, shawls, pepper, opium, cinnamon and indigo were exported to Europe, the Middle East and South East Asia in exchange of gold and silver.

India was predominantly agrarian in economy with some dependence on obsolete technology until the British took over. The rise of the Maratha Empire after the fall of the Mughals, marked the decline of political stability affecting Indian economy.

2.5.2 Colonial History:

Colonial rule brought along with it enormous changes in the economic structure of the country. The whole process of taxation was revised, with adverse effect on the farmers, a single currency system with fixed exchange rates, standardized weights and measures, free trade was encouraged and a kind of capital structure in the economy introduced. In the west there was already an industrial revolution gearing up which also had its silhouette over India as well. Basically the raw materials and manpower was exported back to their home country and this caused a setback among the millions of teeming Indian population for whom the policies were not much favorable.

The finished goods were then brought back to India and sold at high rates among the well to-do people. Other developments in transport and communication like the introduction of railways, telegraph and soon was made which in a way affected the economy.

Towards the end of the colonial rule it was seen that development in the Indian economy was hampered and it was reduced down from its glorious strong economic background.

2.5.3 Post Independence History:

There was a basic stress on a few things like protectionism, import substitution, industrialization, a large public sector, business regulation, state intervention in labor and financial markets and central planning.

The economy of the country shifted from predominantly agricultural, forestry, fishing and textile manufacturing in 1947 to major heavy industry, telecommunications and transformation industries by the late 1970s.

In the 1950s the Indian government undertook a chain of plans for the economic development. These plans functioned profitably for a while but then again in the long run they showed less development. Since 1950s trade deficit problems arose leading up to a problematic situation in the 1960s like inflation. 3.1 percent was the average rate of growth a year in constant prices from FY 1951-FY 1979. Economic doldrums were a result of structural inadequacies, wars with China in 1962, with Pakistan in 1965 and 71, currency devaluation in 1966, first world oil crisis and few natural calamities.

2.5.4 Contemporary Economic

Reforms in the economy were being made, which included the pro-business measures of 1980, initiated by Rajiv Gandhi, relieved restrictions on capacity expansion of incumbents, removal of price controls and reduced corporate taxes. 1991 marked the economic liberalization initiated by the then Indian prime minister P. V. Narasimha Rao and his finance minister Manmohan Singh which was in response to a balance-of-payments crisis. Other changes like the abolition of the License Raj, public monopolies, allowance of automatic approval of foreign direct investments in many sectors. 1990 onwards we see the emergence of India as one of the wealthiest economies of the world with a constant growth of economy with only a very few major knocks backs. More private sector initiatives were taken up during during 1980s and 1990s.

At present India has a modern stock exchange instead of an outdated one. There has been a rise in the IT sector lately, the setting up of the Indian Institutes actually led to the influx of highly qualified manpower resources harnessing the economy of the country. There seems to be no sign of balance of payments crisis in India from a superficial level. Having a reserve of \$130 billion, there is huge optimism in India. Finally it has got some ground in the world economy and the growth is on the move.

State planning and the mixed economy: Indian economy works on the basis of 5 year Plans which enables an effective and equal distribution of national resources for a balanced economic development.

Mixed economy is a merger of the socialist and capitalist economy. India's mixed economy has switched roles embracing capitalist economy to a greater extent over the past decade. In India the public sector covers the railways and postal services. Nationalization of banks has also taken place, recently phases of privatization are on the run.

Public expenditure: Public expenditure in India basically constitutes capital and revenue expenditure. These are included in central plan expenditure, central assistance and non-development expenditure.

Central plan expenditure is in the allocation of resources in development schemes given in plans of the central government and public sector undertakings. Central assistance is the aids provided for plans of state governments and union territories. Capital defence expenditure, loans for public enterprises, states and union territories and foreign governments fall under non-development capital expenditure. Whereas non-development revenue expenditure consists of revenue defence expenditure, subsidies, postal deficit, administrative expenditure, pensions, debt relief to farmers etc.

Public receipts: Tax system has undergone serious changes or reforms over the years. The Union government levies income tax, sales tax, custom and excise duties, the State government levies sales tax on intrastate sale of goods, entertainment, alcohol, transfer of property etc., and local government extract taxes from property, public utility services, etc. Therefore more than a quarter of the union government's tax revenue is commonly used by the state governments. Central government receives non-tax revenues from fiscal services, public sector dividends etc, whereas state government's non-tax revenues come from grants, interest receipts, and other economic and social services.

General budget: The general budget of India is presented by the Finance Minister in the Parliament which is passed by the Lok Sabha. It comes into effect on April 1, and the budget is presented on the last working day of February. An economic survey is conducted after the budget which involves various NGOs, business people, women's organizations and so on.

Rupee: Indian currency 'rupee' is derived from Sanskrit meaning silver and was first introduced by Sher Shah Suri during his reign from 1540-1545 CE as history puts it. Since the British period this coin has been used as a standardized currency for economic purposes. These days Rupee currency comes in denominations of 1, 2, 5, 10, 20, 50, 100, 500 and 1000. The rupee is the only payment of debt accepted in India.

Natural resources: India has rich reserves of natural resources. The water surface area is 314,400 km² out of which 92 percent of water is utilized for irrigation purposes, this is supposed to rise by the year 2025. Being the 5th largest producer of fish in the world, India's inland water resources constituting canals, rivers, lakes, ponds etc. of the Indian Ocean, gulf and bays offer employment to almost 6 million people in the

fisheries sector.

Other natural resources in India include mineral resources. Coal, iron ore, mica, manganese, bauxite, natural gas, chromite, petroleum, diamonds, limestone and thorium (world's largest along Kerala's shore) are the major availabilities of minerals here. Of which India has the 4th largest reserve of coal in the world.

Financial institution: The Reserve Bank of India, Bombay Stock Exchange and the National Stock Exchange is located in Mumbai which is the commercial capital of India. To offer tax benefits and better infrastructure for setting up a business, Special Economic Zones and software parks has been set up by India.

India's regulator, authority and supervisor of the financial organization is the Reserve Bank of India, which is the country's central bank. The RBI issues currency and is also the manager of exchange control.

The BSE Sensex is a 'value-weighted' index formed of 30 companies, which are representative of various sectors on the Exchange. The BSE is referred to as the 'barometer' of the Indian stock markets.

The National Stock Exchange is the world's third largest stock exchange in terms of transactions, and the mammoth and most advanced stock markets in India. The stock markets and other security markets of India are regulated by The Securities and Exchange Board of India.

2.5.5 Sectors

farming : India was predominantly an agricultural economy until in the past years it somewhat transformed according to world economies. India occupies the second position in the world in terms of farm output. 18.6% of the GDP in 2005 was contributed by farming and related sectors like fishing, forestry and logging and provided employment for 60% of the total workforce. Since 1950, per unit area of production has increased due to the five year plans and improvements in irrigation, modern agricultural practices, technological advancements, subsidies and agricultural loans since the 'green revolution'.

Industry: With time there has been enormous reforms made in the industrial sector. There has been privatization of certain public sector industries which led to the expansion in the production of consumer goods. The industrial sector involves the transport, provision of a service, such as in pest control or entertainment, distribution and sale of goods from producer to a consumer as may happen in wholesaling and retailing, etc.. India ranks 14th in the world in factory output, accounting for 27.6% of the GDP and employing 17% of the total working force.

Services: The service industry in India provides employment for 23% of the workforce. It has a massive share in the GDP, amounting to 53.8% in 2005 up from 15% in 1950. India takes the 15th position in services output. Information technology, business process outsourcing its fall among the briskly growing sectors adding up to one third of the total output of services in the year 2000. The service sector in India is provided with a very good infrastructure and reduced communication cost, making it pretty powerful in this sector.

Banking and Finance: The banking system in India is broadly organized and unorganized. Among the organized sector it incorporates public, private, foreign owned banks, and the unorganized sectors comprise of individual/family owned bankers or money lenders, and also non-banking financial companies (NBFCs). There has been an increase in the number of bank branches, including rural areas.

Reserve Bank of India is the agency for all policy matters, and is very important in terms of strengthening Indian economy.

Liberalization gave way for reforms in the banking system. These reforms were made in the nationalized banks as well as in the insurance sectors, private and foreign concerns.

Major public sector banks in India are Allahabad Bank, State Bank of India, Andhra bank, Bank of India etc. Private sector banks include UTI bank, Bank of Punjab, HDFC bank etc. Standard Chartered Bank, ABN AMRO bank and such others are the multinationals in India.

Review Questions

1. Define the Soil types of India?
2. Explain the main resources of India?
3. Explain the population distribution of india?
4. Explain the Changing nature of Indian economy?

Discussion Questions

Discuss in details the different types of soil in India?

Chapter 3- Development of Agricultural Growth

Learning Objectives

- To define the Agricultural growth during the plan period.
- To explain the Green revolution.
- To explain the Industrial development.
- To describe the international trade of India.

3.1 Introduction

Farming is the principal occupation of the people of India. More than 70 per cent of the working population derives their livelihood by cultivation. Moreover, in India farming is the basis of the economic structure of India, for it is not only the source of raw materials for the principal industries of India such as jute textiles, sugar and cotton but it also accounts for the maximum portion of the total income. Indian farming has been taking a special place in the lifestyle of the Indians. Moreover, with the passing decades, Indian farming has earned multi-functional success in generating employment, food, livelihood, nutritional and ecological security. Farming and associated activities contribute about 30% to the gross domestic product of India. Food grain crops are dominant everywhere and they cover as much as three fourth of the total cropped area in India.

Arable land areas in India is about 168 million hectares and this country ranks second only to the United States in regards to agricultural activities. A well-developed agricultural research system, a significant area of almost 60 million hectares under irrigation and an increasing productivity in major crops has enabled Indian farming to become a globally competitive participant. Indian Farming by its complete size and quantum of the activity can control the global markets directly and indirectly. The majority of the rural population in India still depend on farming for their living and over 600 million farmers are involved in the farming related activities. India farming has the advantage of 52 per cent of cultivable land and a plethora of climatic conditions. India enjoys sunshine round the year it is the world's best country to grow crops throughout the year. Due to urbanization and rapid growth in the metropolis there is increased demand in the food supply.

The history of Indian farming dates back to ten thousand years. Indian farming began during 9000 BCE as a result of early cultivation of plants, and domestication of crops and animals. The middle ages in India saw irrigation channels that reached a new level of sophistication in India. Land and water management systems were developed with an objective of providing uniform growth. Today, India ranks second in the whole world as an agricultural country. The Indian agricultural sector employed 60 percent of the total workforce, despite a steady decline of its share in the GDP, it is still the largest economic sector, and Indian farming

plays a significant role in the overall socioeconomic development of India.

India is a large country with unevenly distributed rainfall, varied soils and marked seasons - mildly cool winters and hot summers in north India. Such regional contrasts favor diversity in crop production. In areas of perennial supply of water, two or even more crops are raised a year. However, in India crop yield per hectare are among the poorest in the world. Uncertain rainfall, floods and droughts sometimes ruin crops. Indian soils are universally deficient in nitrogen. That is why the usage of chemical fertilizers for making up the deficiency of important nutrients like nitrogen, phosphorus is quite popular among the farmers. As a very large area of the country is under crops, India produces large quantities of rice, tea, jute, cotton, wheat and sugar cane despite low per hectare yields. India leads the world in the production of jute and tea.

3.2 Agricultural growth during the plan period

3.2.1 Introduction

Farming is the key indicator for the progress of our country. It is the means of livelihood for two-thirds of our population and are an important source of raw materials for several industries. The Indian farming has witnessed profound changes during successive decades of its planning, more particularly in the wake of new agricultural strategies adopted in the mid sixties.

With the initiation of each successive Five-year Plan the tempo of industrialization is being built up and efforts are being made to raise agricultural output so as to meet the raw material requirements of agro-based industries as also to provide not only better nutritional standards but also to meet the demand for various food items on levels of income improve.

Farming occupies a key position in the Indian economy because of its contribution to overall economic growth through the food supplies, raw materials and exports. It is a source of livelihood for a majority of the population and provide a large market for non-agricultural goods and services. Therefore, farming has remained one of the important sectors in the various five year plans designed by India's Planning Commission.

3.2.2 Agricultural Sector: Objectives for Five-year Planning

In order to develop the agricultural sector, the Planning Commission has outlined four broad objectives.

1. Increase agricultural production

The primary aim for this is to bring more land under cultivation, raise the per hectare yield through intensive application of such agricultural inputs as irrigation, improved seeds, fertilizers, etc. and hence bring about increased agricultural production.

2. Increase employment opportunities

Besides an increase in production, the agricultural sector should generate additional employment opportunities and provide scope for increasing the incomes of the poorer sections in the villages.

3. Reduce the pressure of population on land

Another basic objective of planning in the agricultural sector is to reduce the number of people working on the land. The surplus labor on land should be shifted to the secondary and tertiary sectors, preferably in rural and semi-rural areas.

4. Reduce inequality of incomes in rural areas

It is desired that the government should make efforts to remove the exploitation by tenants, and also should distribute surplus land among small and marginal farmers in such a way so that there would be some degree of equality and justice in the rural areas.

It is important to note that all these objectives are being followed in all our plans but in practice, agricultural planning has come to mean the increase in production, namely, the achievement of the first objective, while all other objectives seem to have been ignored.

3.2.3 Farming Under the Five-year Plans

Before the planning period, farming was in a deplorable condition. The farmers were generally in heavy debt to the village moneylender. They were having small and scattered holdings. They had neither the money nor the knowledge to use proper equipment, good quality seeds and chemical fertilizers. Except in certain areas, they were dependent upon rainfall. Productivity of land as well as of labor had been declining and was lowest in the world. In spite of the fact that nearly 70% of our working population were engaged in cultivation, the country was not self-sufficient in food grains but had to depend on food imports. Table 1 gives the total outlay for each plan and correspondingly the outlay on farming and irrigation had also increased with every plan.

Table 1: Pattern of outlay given for farming in the plans

Sl.No		Total plan outlay (Rs in crores)	Outlay on Agr. & irrigation (Rs in crores)	Percentage of total outlay
1	First plan	1960	600	31
2	Second plan	4600	950	20
3	Third plan	8600	1750	20
4	Fourth plan	16,160	3300	21
5	Fifth plan	39,300	8080	21
6	Sixth plan	97500	24700	25
7	Seventh plan	1,80,000	29,770	22
8	Eighth plan	4,34,100	89,418	21

Various programs for increasing agricultural production such as irrigation, soil conservation, dry farming and land reclamation, supply of fertilizers and manures, better ploughs and improved agricultural implements, adoption of scientific practices, etc. were specified by the government.

Table 2 gives the achievements in the agricultural sector in terms of total food grains, oilseeds, sugarcane, cotton and jute under the various five year plans. However, achievements in each plan have been discussed separately in the following pages.

Table 2: Agricultural production in the various plans

Sl. No		Food grains		Oilseeds		Sugarcane		Cotton		Jute & mesta	
		Target	Achievement	Target	Achievement	Target	Achievement	Target	Achievement	Target	Achievement
1	1 st plan	62	67	5.5	5.6	63	60	4.2	4.0	5.4	4.2
2	2 nd plan	81	80	7.6	6.5	78	104	6.5	5.4	6.5	4.0
3	3 rd plan	100	72	9.8	6.4	100	127	7.0	4.6	6.2	4.5
4	4 th plan	129	104	10.5	8.7	150	140	8.0	5.8	7.4	6.2
5	5 th plan	125	126	12.0	8.9	165	165	8.0	7.1	7.7	7.1
6	6 th plan	154	146	11.1	13.0	215	170	9.2	8.5	9.1	7.8
7	7 th plan	180	172	18.0	17.0	217	210	9.5	10.5	9.5	7.9
8	8 th plan	210		23.0		275		14.0		9.5	

1. Production of food grains, oilseeds and sugarcane in million tonnes
2. production of cotton in million bales of 180 kgs each
3. production of jute in millions of bales of 170 kgs each

It is clear from the table 1 that though the total allocation to farming and irrigation is increasing in every successive five year plans the percentage allocation is on a decreasing trend, the allocation being 20-25% of the total.

3.2.3.1 Farming in First Five-year Plan (1951-56)

The First Five-year Plan aimed at solving the food crisis in the country. The total plan outlay in the first plan was laid for Rs. 1,960 crores. Accordingly, it gave the highest priority to farming by allotting 31 % of the total outlay, on farming, but it fixed rather modest targets of production. As a result of favorable weather conditions and also as a consequence of the successful implementation of the various projects included in the First Plan, the production targets in the agricultural sector were exceeded for instance, as against the target of about 62 million tonnes, actual production of food grains came to nearly 66 million tonnes. Thus it can be seen that the percentage of the outlay on farming and irrigation to total outlay was the highest in the first plan.

3.2.3.2 Farming in Second Five-year Plan (1956-61)

During the Second five year plan, out of the total outlay of Rs. 4,600 crores, a sum of Rs 950 crores was spent on farming. This in turn accounted for about 20 per cent of the outlay; Despite the percentage reduction in plan outlay in farming, the planning commission had fixed targets for agricultural production. The progress on the agricultural front was significant. The actual output at the end of the second plan (1960-61) was much more than the actual output at the beginning of the second plan (1955-56). For instance, food grain production recorded nearly 80 million tonnes in 1960-61, as compared to 66 million tonnes in 1955-56. Similarly, the production of oilseeds, sugarcane and cotton was much more in 1960-61 than in 1955-56.

The Planning Commission was blamed for the failure of the agricultural front on the ground that it did not give sufficient emphasis to agricultural development and instead paid attention to the development of heavy and basic industries.

3.2.3.3 Farming in Third Five-year Plan (1961-66)

Achieving food self-sufficiency was the major objective of the third plan. In the scheme of development during the Third Plan the first priority belonged to farming. Experience in the Second Plan has shown clearly that the rate of growth in agricultural production was one of the main limiting factors. Hence, it was realized, that agricultural production has to be increased to the largest extent feasible, and adequate resources have to be provided under the Third Plan for increasing the agricultural production. However, an amount of Rs. 1750 crores, 20% of the total outlay was invested in the agricultural sector.

The agricultural programs were given greater emphasis as the Government felt that the success of the agricultural sector was an essential condition for the success of the whole plan itself. During the Third Plan, the government introduced the new agricultural technology known as Intensive Agricultural District Program (IADP). This was soon followed by a program by using improved seeds, namely, High Yielding Varieties Program (HYVP). The new agricultural technology was to have an agricultural breakthrough and hence, the introduction of the green revolution. However, as a result of the extensive and serious drought conditions during 1965-66, agricultural production had been adversely affected. As a result, the targets for the production of food grains, oilseeds, sugarcane, cotton, etc. Could not be achieved. As a consequence of the shortfall in food production and serious famine conditions in many parts of the country, the government was forced to import food grains extensively, which seriously affected the position of the foreign exchange.

3.2.3.4 Farming in Fourth Five-year Plan (1969-74)

The experience of the Third Plan made the Planning Commission realize the need for a rapid increase in the agricultural production. Accordingly, the Planning Commission assigned high priority to farming in the Fourth Plan. Even in the case of industries, the Commission emphasized those industries, which supply fertilizers, agricultural machinery, etc. The approach to the Fourth Plan, emphasized the necessity to create favorable economic conditions for the promotion of farming, a systematic effort to extend the application of science and technology to farming, and in general, intensify agricultural programs to the maximum possible extent in the selected areas.

In the fourth five year plan, the outlay on farming was Rs. 3,300 crores out of total plan outlay of Rs. 16,160 crores. However, table 2 shows clearly that none of the targets fixed in agricultural production in the Fourth Plan were achieved. The target for food grains was 129 million tonnes for 1973-74 but the actual production in the year was only 104 million tonnes. The highest level of production was 108 million tonnes in 1970-71.

The basic strategy of the Fourth Plan in terms of food grains was the extension of the high-yielding varieties and multiple cropping programs. Agricultural production showed a healthy trend in the first two years of the Fourth Plan but on account of adverse weather conditions, the upward trend was reversed. The overall rate of growth of agricultural production during the Fourth Plan period was only 2.8% per annum as against the targeted five per cent. The unsatisfactory performance of the agricultural sector was the root cause of the stagnation of the food economy.

3.2.3.5 Farming in Fifth Five-year Plan (1974-79)

The revised Fifth Plan provided Rs. 8,080 crores for agricultural development and irrigation, i.e., 21 per cent of the plan outlay of Rs. 39,300 crores.

There had been a steady increase in the use of agricultural inputs during the Fifth Plan, that is, in the coverage under the high-yielding varieties, creation of additional irrigation potential and significant expansion in total fertilizer consumption. Agricultural production during the period 1974-78, however, has been fluctuating widely. For instance, production of food grains reached a level of 121 million tonnes in 1975-76, but slumped to 112 million tonnes during 1976-77 a bad weather year. With better monsoons during 1977-78, it touched a high-level of 126 million tonnes in that year. The relatively poor performance of farming during the Fifth Plan period (1974-78) was partly due to poor and unreliable weather conditions and partly due to planning failures.

3.2.3.6 Farming in Sixth Five-year plan (1980-85)

The Sixth Five-year Plan, implemented during the year 1980-85, allocated 25% of the total outlay on farming and irrigation. This expenditure which was of the order of Rs. 8,080 crores in the Fifth plan (1974-78) rose to Rs. 24,700 crores during the sixth plan. The targets of increase in the inputs such as fertilizers, irrigation, etc. ranged between 25 to 200 percent. The sixth plan aimed at bringing an additional 13.6 million hectares under irrigation. The Sixth Plan was officially hailed as a great success, particularly because of the success on the agricultural front. The following targets of crop production were laid down in sixth plan.

Table 3: Targets of Crop Production in Sixth plan

Sl.No	Crop	Assumed base level (1979-80)	Plan target (1984-85)	Actual prod (1984-85)
1	Total food grains (M.tonnes)	128.0	154.0	146.0
2	Oilseeds (M.tonnes)	9.3	11.1	13.0
3	Sugarcane (M.tonnes)	176.0	215.0	170.0
4	Cotton (M.bales)	7.3	9.2	8.5
5	Jute & Mesta	7.4	9.1	7.8

Note: The base level numbers for 1979-80 were worked out on the basis of trend line compound growth rate of production for the period 1967-68 to 1978-79.

The record food grain production of 152 million tonnes in 1983-84 and the output of 146 million tonnes in 1984-85, the last year of the Sixth Plan (despite widespread failure of monsoons) were regarded as marked achievements for India. Apart from food grains and oilseed, production targets in other major crops were not achieved. While the first green revolution of 1967-68, was confined mainly to Punjab, Haryana and Western U.P., the second green revolution has spread to eastern and central states including West Bengal, Bihar, Orissa, Madhya Pradesh and eastern Uttar Pradesh. These states have made tremendous progress. In later years, in the areas under irrigation and increased use of high yielding varieties of seeds and fertilizers, as a result of these developments, not only a huge stock of food grain was built up though not real self sufficiency in food rains, but also significant possibilities were opened up for further growth of farming through modernization.

3.2.3.7 Farming in Seventh Five-year Plan (1985-90)

The agricultural programs of the Seventh Plan (1985-90) were formulated after the Planning Commission made a thorough evaluation of the weaknesses of Indian farming observed till that time. The Seventh Plan allocated Rs. 39,770 crores for farming out of a total plan outlay of Rs. 1,80,000 crores, which came to 22 per cent. The major program thrusts in the fields of farming were: a special rice production program in the eastern area, a national watershed program for oriented farming, national oilseeds development project, social forestry, etc. Production targets were fixed for the various crops. Though India suffered from poor monsoons and extensive drought conditions during the first three years of the Seventh Plan, it could make up considerably in the last two years of the Plan which were the excellent years from the point of view of agricultural production. Overall, the Seventh Plan was successful as the targets were broadly fulfilled. Outlay on farming and irrigation in the seventh plan is shown in table 4.

Table 4: Outlay on farming and irrigation in the seventh plan (1985-90)

Sl.No		Amount (Rs in crores)	% of total plan outlay
1	Farming	10,570	6
2	Rural development & special area programmes	12,220	7
3	Irrigation and flood control	16,980	9
4	Total	39,770	22
5	Total plan outlay	1,80,000	100

The first three years of the Seventh Plan were periods of poor monsoon conditions and declining agricultural production. This was followed by two years of excellent monsoon conditions and good agricultural production. The 1989-90 out-put was much higher than the actual production at the end of the Sixth Plan. However, the Seventh Plan targets, were not fully achieved. Table 5 gives the area, yield and production achieved at the end of the Seventh Five-year Plan (1989-90).

Table 5: Area, yield and production at the end of seventh plan (1989-90)

Sl.No	Crop	Type of area	Area (m.ha)	Average yield kg/ha	Production (M.tonnes)
1	Rice	Irrigated	21.5	2237	48.10
		Unirrigated	22.5	1151	25.90
		Total	44.0	1682	74.00
2	Wheat	Irrigated	22.9	2210	50.60
		Unirrigated	5.1	1059	5.40
		Total	28.0	2000	56.00
3	Coarse cereals	Irrigated	4.6	1478	6.80
		Unirrigated	35.5	766	27.20
		Total	40.1	848	34.00
4	Pulses	Irrigated	2.3	1130	2.60
		Unirrigated	23.4	573	13.40
		Total	25.7	623	16.00
5	Total foodgrains	Irrigated	51.3	2107	108.10
		Unirrigated	86.5	831	71.90
		Total	137.9	1306	180.00

Among the food grains, the growth prospects of the Seventh Plan are found to be better in respect of rice, wheat and coarse cereals, which in the case of pulses are not favorable. For food grains, as a group, however, the prospects seem to be better. Despite poor prospects for pulses, the overall targeted growth of food grains can be understood through larger reliance on rice, wheat and coarse cereals, the past performance for which is noticeable.

3.2.3.8 Farming in Eighth Five-year Plan (1992-97)

The Eighth Plan was formulated when the country passed through difficult circumstances during the last couple of years. The growing and the sudden depletion of foreign exchange resources created a situation which puts severe strain on the economic system. The planning Commission stated that farming sector is expected to grow at the rate of 3% per annum. This can be considered to be a good growth rate for the sector, though it is somewhat lower than the average achieved during the eighties.

The Eighth Plan provided Rs. 89,418 crores for agricultural development and irrigation, that is 21 % of the plan outlay of Rs. 4,34,100 crores. For agricultural development the Eighth Plan aimed at generating surplus for exports in food grains and attaining self-sufficiency in terms of pulses and oil seeds. The agricultural sector is expected to grow at an annual average rate of 4% in terms of gross value of output and 3% in terms of value added. In the Eighth Plan a major effort was proposed in raising the production of rice, pulses and oilseeds. For the first time, the country made a bold effort to plan for export in food grains and self-sufficiency in pulses and oilseeds. The targets of crop production as well as the area of principal crops or groups of crops are given in table 6.

Table 6: Area, production and yield of the principal crops during the eighth plan

Sl.No	Crop	1991-92			1996-97		
		Area (M.ha)	Prod. (M.ton)	Yield (kg/ha)	Area (M.ha)	Prod. (M.ton)	Yield (kg/ha)
1	Rice	42.50	72.50	1706	43.50	88.00	2023
2	Wheat	23.50	56.00	2383	24.25	66.00	2722
3	Coarse grain	37.50	30.00	800	37.75	39.00	1033

4	Pulses	23.50	14.00	596	24.50	17.00	694
5	Total food grains	127.00	172.50	135	130.00	210.00	1615
6	Oil seeds	23.50	17.50	74	24.50	23.00	939
7	Sugarcane	3.70	235.00	63514	3.90	275.00	70513
8	Cotton	7.40	10.50	241	7.50	14.00	317
9	Jute & Mesta	1.00	9.00	1620	1.00	9.50	1710
10	Other crops	19.60	-	-	23.70	-	-
11	All crops	182.20	-	-	190.60	-	-

The most important achievement of planning in the post Independence period is our self sufficiency in food grains. (The self sufficiency in food grain is only a semblance, not actual) The production of food grains increased from 67 million tonnes in 1950-51 to 172.5 million tonnes in 1990-91. (But the population and food demands have increased even more).

The strategy for obtaining this desired growth required emphasis on dry land farming in the unirrigated and largely rain-fed areas, and emphasis on spreading the benefits of the green revolution to other parts of the country with adequate rainfall and fertile soil.

Thus, the Eighth Plan started with a number of objectives. It aimed to reconcile the goals of production and employment.

3.2.4 Plan Strategy in Agricultural Sector

For bringing about an increase in the agricultural production and also increase in employment, the Planning Commission has made use of various programs such as Community Development Programs and Agricultural Extension Services throughout the country, and adopted improved irrigation facilities, better methods of fertilizer, and pesticide applications, agricultural machinery, seeds of high yielding varieties and other infrastructural facilities related to transportation, power, and marketing.

In Indian conditions, there have been the problem of population pressure on land. In order to reduce this pressure of population on land, the strategy used was to set up agro- based industries and handicrafts in rural areas, to promote rural transport and communications and also to encourage the movement of people from farming to industries and service sectors.

Finally, for bringing about equality and justice in rural India, the strategy used was land reforms which included the removal of intermediaries, the protection of tenants through tenancy legislation, ceiling of land holdings and distribution of surplus land among landless laborers and small and marginal farmers.

The pattern of investment in the agricultural sector in dissimilar Five-year Plans vary. The total outlay in each plan had been found to increase and, correspondingly, the , outlay on farming and irrigation had also increased with every plan. However, the percentage of the outlay on farming and irrigation to total plan outlay was the highest in the First Plan, that is, 31% and was between 20% to 25% in all other Plans.

The Planning Commission had specified the various programs for increasing agricultural production such as irrigation, soil conservation, dry farming and land reclamation, supply of fertilizers and manures, better equipments and agricultural practices, etc. The government gave considerable attention to institutional changes such as the setting up of community development programs and agricultural extension programs and agricultural extension services throughout the country, the use of land reforms, expansion of transportation, power, marketing and other basic facilities, improvement of the system of co-operative credit, etc. From the Third Plan onwards, the greatest emphasis was laid on the new fertilizer seed technology,

3.2.5 Causes For Slow Growth Rate in Farming

There has been observed an upward trend in agricultural growth during the first two Plans at an annual growth rate of 4 per cent. This trend was reversed because of bad weather and climatic conditions during the last year of the Third Plan.

Even then, the growth rate in farming between 1951 and 1981 worked out to be nearly 3 per cent. Since, 1970-71, the area under food grains had increased only by 4%, but the increase in production had been quite commendable, considering the periodic failure of crops due to droughts and floods in the country. There were always shortfalls in achievements in every plan and as a result, the progress in the agricultural sector was much lower than that was actually planned. The slow growth of farming under the five year plans can be attributed to the following reasons.

1. Fluctuation in the monsoons

Despite 40 years of planning, farming in India has continued to fluctuate with the monsoon, that is, failure of rainfall in some parts of the country and excessive rains and consequent floods in certain other areas of the country.

2. Limited use of new agricultural technology

Ever since, 1961, the emphasis had been on the use of seed- fertilizer -water technology, which is known as the new agricultural strategy. But the new strategy or the green revolution succeeded only in wheat and rice but other food and non-food crops did not show perceptible improvement in production. Dry land cultivation was not touched at all by the new agricultural strategy.

3. Failure of land reforms

Until mid-1970, the government hoped to implement land reforms, specially tenancy legislation and ceiling on land holdings. The government failed to implement the land reforms measures and there was very little of land redistributed in favor of marginal farmers and landless laborers or the protection of tenants from exploitation or from eviction. The government reconciled itself to its failure to push forth progressive land reforms and shifted the emphasis to technological changes. In the Seventh Plan, for instance, there is almost no mention of land reforms.

4. A decline in private investment

In the early years of the technological breakthrough, there was a remarkable increase in private investment in farm as- sets like tractors, irrigation pumps, tube wells, etc. This in- crease in private investment was concentrated in the northern area of the country but other areas, particularly eastern area , were unaffected. However, there has been evidence of the private investment slowing down in the recent years.

5. Growing exploitation of the tenants

From the very beginning, the growth prospects of Indian farming were vitally dependent on the role of public investment in irrigation, drainage and flood control, inland shaping and land consolidation, in the prevention of soil erosion and salinity, in the development of a widespread research and extension network and in rural electrification and provision of institutional credit. But technological change is not a substitute for institutional change in farming . It is only a fusion of technology and institutional changes, that can optimize the process of agricultural growth, so that, agricultural growth can be enhanced and the production will be at the maximum. However, this has not taken place, till date, as a result of which the technological progress in the agricultural sector has been accompanied by the growing inequality. Although, as a consequence of rapid agricultural growth, the wages of agricultural laborers have arisen in the green revolution areas of Punjab and Haryana.

6. Failure to control increases in population

The government failed to control the rapid growth of population in rural areas and also to create non-agricultural employment in the rural sector so that those who could not be provided land in the program of land redistribution could be provided non-agricultural work to manage their lives. A program of enlarging

non-agricultural employment, if it could grow faster than the increase in total labor force could, over a period of time help to reduce the excessive pressure of population on land.

4.3 Green revolution Vis-à-vis traditional farming

4.3.1 Green Revolution in India

An increase in food production, especially in underdeveloped and developing nations, through the introduction of high-yield crop varieties and application of modern agricultural techniques. The introduction of high-yielding varieties of seeds and the increased use of chemical fertilizers and irrigation are known collectively as the **Green Revolution**, which provided the increase in production needed to make **India** self-sufficient in food grains, thus improving farming in India. High-yielding wheat was first introduced to India in 1968 by American agronomist Norman Borlaug. Borlaug has been hailed as the Father of the Green Revolution but M.S. Swaminathan is known as the "Father of the Green Revolution in India". The methods adopted included the use of high yielding varieties (HYV) of seeds.

The production of wheat has produced the best results in fueling self-sufficiency of India. Along with high yielding seeds and irrigation facilities, the enthusiasm of farmers mobilized the idea of the agricultural revolution and is also credited to M. S. Swaminathan and his team had contributed towards the success of green revolution.

4.3.2 Measures Adopted in Green Revolution

- Use of high yielding varieties (HYV) of seeds
- Irrigation
- Use of insecticides and pesticides
- Consolidation of holdings
- Land reforms
- Improved rural infrastructure
- Supply of agricultural credit
- Use of (chemical) fertilizers
- Use of Sprinklers or Drip Irrigation

4.3.3 Impacts of Green Revolution

4.3.3.1 Positive Impacts

1. Increase in production / yield.
2. Advantage to farmers: this includes their economic situation improving, even small and marginal farmers (although they were late in joining) getting better yield, control on many insects and pests, mechanizing improved working conditions.
3. Better land use by employing two and three crop pattern.
4. A better scientific methods applied as per requirement of farms.
5. New seeds have been developed with better yield and disease fighting capability.
6. Good earning by farmers.
7. Improves country's economic development.

4.3.3.2 Negative Impacts

1. Degradation of land: Due to changes in land use pattern and employing two and three crop rotation every year land quality has gone down and yield has suffered. Also due to heavy chemical fertilizer inputs land has become hard and carbon material has gone down.
2. Weeds have increased: Due to the heavy crop rotation pattern we do not give rest to land nor we have time to employ a proper weed removal system which has increased weeds.

3. Pest infestation has gone up: Pests which we used to control by biodegradable methods have become resistant to many pesticides and now these chemical pesticides have become non effective.
4. Loss of Bio Diversity: Due to heavy use of chemical pesticides, insecticides and fertilizers, we have lost many birds and friendly insects and this is a big loss in the long term.
5. Chemicals in water: These chemicals which we have been using in our farms go down and contaminate ground water which effect ours and our children's health.
6. Excess use of fertilizers has made the soil infertile.
7. Overuse of chemical fertilizers may affect human health.

4.3.4 How a green revolution helps to remove the flaws of farming

4.3.4.1 Low Irrigation Facility

The well irrigated and permanent irrigated area was only 17% in 1951. The major part of the area was dependent on rainfall and, consequently, farming suffered from the low level of production.

4.3.4.2 Frequent Occurrence of Famines

Famines in India were very frequent during the period 1940s to 1970s. Due to faulty distribution of food, and because farmers did not receive the true value of their labor, the majority of the population did not get enough food. Malnutrition and starvation were a huge problem.

4.3.4.3 Lack of Finance (credit)

Small and marginal farmers found it very difficult to get finance and credit at cheap rate from the government and banks, hence, fell an easy prey to the money lenders.

4.3.4.4 Self-sufficiency

Due to the traditional agricultural practices, low productivity, and to feed a growing population, often food grains were imported that drained away scarce foreign reserves. It was thought that with the increased production due to Green Revolution, government can maintain buffer stock and India can achieve self-sufficiency and self-reliability.

4.3.4.5 Marketing Farming

Farming was basically for subsistence and, therefore, the least amount of agricultural product was offered for sale in the market. Hence, the need was felt to encourage the farmers to increase their production and offer a greater portion of their products for sale in the market. The new methods in farming increased the yield of rice and wheat and this made the country attains food self-sufficiency.

4.3.5 Green revolution Vis-à-vis traditional farming.

Organic farming has been envisaged to be a solution for resource scarcity and environmental contradictions that input intensive conventional farming often runs into. With minimal use of chemical inputs, organic methods of cultivation help in the conservation of water and soil nutrients. In the case of food products, the quality of the end products is also held to superior in case of organically produced items with negligible use of chemicals. It is being increasingly recognized that organic farming has significant benefits in terms of environmental problems, conservation of non-renewable resources and food quality.

The challenge before the expansion of organic farming is to make this cultivation method economically sustainable. The lower yields associated with organic cultivation relative to the more prevalent conventional farming prevents farmers from readily shifting to organic farming. A premium price, which compensates for

the lower yields, is required for organic farming to be a viable enterprise. This restricts organic products to smaller niche markets and is a barrier to organic cultivation practices being adopted on a larger scale. Also, organic cultivation is labor-intensive compared to conventional techniques. While in economies with high labor cost, this can further reduce the viability of organic farming, in economies with higher unemployment and lower agricultural wages, this can be a more suitable form of cultivation practice from a developmental point of view.

According to the FiBL survey, 2008 conducted by the Research Institute of Organic Farming, Switzerland, around 30.4 million hectares are managed organically by more than 7,00,000 farms in 2006. The largest proportion of organic land is found in Oceania (42 percent), followed by Europe (24 per cent) and Latin America (16 per cent). India with her existing bio-diversity has quite some potential to adopt organic farming. By 2010, there were about 2.8 million hectares of certified organic land, of which one million hectares is under cultivation and the rest under forests.

Charyulu and Biswas examine the economic viability and efficiency of organic farming presently in India. The study is based on farm production data from the four provinces- Punjab, Uttar Pradesh, Gujarat and Maharashtra. A field survey was conducted in 2009-10 among 120 farmer households, 15 organic and 15 inorganic farmers in each province. The crops covered are paddy, wheat, cotton and sugarcane. The authors also conduct a Data Envelope Analysis (DEA) analysis using per acre numbers of gross value of output and four input costs (seeds, fertilizers, pesticides and inter-culture to measure the efficiency of organic and conventional farming for the sample.

The findings reveal that for paddy cultivation, the organic method is less profitable than the conventional paddy farming. The net returns per acre were less for organic paddy by 15 percent in Punjab and 33 percent in Uttar Pradesh than that for conventional input-intensive paddy cultivation. In Punjab, the cost of cultivation of organic farming was higher than its conventional counterpart though it was compensated to some extent by premium prices for organic paddy. In contrast, the organic paddy cultivation in Uttar Pradesh had a lower unit cost of cultivation but the lack of premium prices rendered it less attractive than conventional cultivation.

In both cases, the physical yield was lower for organic farming. In contrast, wheat cultivation is more remunerative when done organically than using conventional methods. In both Punjab and Uttar Pradesh, the net returns per acre were higher in organic farming, mainly due to the much higher output prices that organic wheat fetched in the markets.

The study of organic cotton cultivation in Punjab and Gujarat yielded dissimilar results. The cost of cultivation per acre of organic cotton was as much as 56 percent lower in Punjab, while the physical yields were lower by 27 percent.

However, lack of premium prices for organic cotton in this province meant that the net returns were still lower for organic than conventional grown cotton by 10 percent. However, in Gujarat, organic cotton fetched 27 percent higher net returns than conventional cotton owing to both lower costs and premium output prices.

Sugar cane was the only crop for which organic farmers seemed to be more profitable even in the absence of premium prices. The yields for organic sugar cane were higher than conventional sugarcane in Uttar Pradesh while they were at par in Maharashtra. Cost of cultivation was lower for organic sugarcane in both provinces.

It was observed that usually organic farming of the studied crops revealed lower plant protection costs and higher weeding costs compared to conventional methods of cultivation. The efficiency analysis, however, shows that except for organic cotton cultivation in Punjab, all organic crops had a lower efficiency than their conventionally cultivated counterparts. The organic farmers were generally found to function well within their production possibility frontiers.

The study noted that except for sugarcane, all other organic crops were crucially dependent on premium prices for their viability. Government intervention for better marketing facilities for organic crops and assurance of premium prices for staple organic food crops are required to expand the cultivated area under organic crops. It was concluded that specific input subsidies and more research on organic cultivation that can substantially raise yields closer to the levels of conventionally grown crops can go a long way in making organic farming sustainable and a viable option for farmers in India.

4.4 Industrial development and Indian economy.

In this twentieth century when science and technology have gained unquestionable supremacy, the level of the 'industrial development of a country has become the yardstick to be applied to judge its actual development. All other progress has become meaningless; if a country is technologically backward, it is backward irrespective of any other excellence it might have acquired.

It is a well-known fact that British Government never intended to develop the industries in our country during pre-independence period. After independence the people of this country entertained high hopes for the government for the betterment of their life it is the industrial development which provides basic infrastructure necessary for the development of the economy as a whole. Industrial Policy, 1948 and the Industries (Development and Regulation) Act, 1957 gave an idea of the attitude of the Government with regard to the development of industries. But, it was only the adoption of planning in 1951 which created a favorable atmosphere for the development of industries.

The history of organized industry in India may be traced to 1854 when the real beginning of the cotton mill industry was made in Bombay. The foundations of jute industry were laid near Calcutta in 1855, Coal-mining also progressed about this time. There were the only major industries which had developed substantially before the First World War. During and after World war I and II, a somewhat more liberal policy was adopted by the authorities, such as, a discriminating protection policy, which gave impetus to industrial development. Several industries developed and a number of new industries came up but their production was neither adequate nor diversified in character.

The development of the economy can be measured with the help of dissimilar criteria, such as the growth rate in industrial output, the industry's contribution to national income, and industry's contribution to employment. A close application of these criteria divides the planned period into two distinct phases, the first lasting till 1965-66 and the second following there from. The economy took rapid strides during the first three Five-year Plans but slowed down later. The Seventh Plan envisages a growth rate of 8 percent with some segments of industry registering a higher growth rate, but only time can unfold the future achievement. Since the industry's contribution to national income and its capacity to generate employment have displayed similar trends, we cannot describe our industrial development as spectacular though there has been a spurt of new industrial complexes all over the country.

The pattern of our industrial growth was determined by the state of the economy in which the British left us. The British had used India as a source of cheap raw material and a lucrative market for finished products and they had not made any effort to develop the infrastructure. After getting independence, India immediately felt the need of capital goods and it was decided to promote the rapid growth of capital goods industries. Almost till the end of the Third Five-Year-Plan, India had to import a variety of capital goods including iron and steel, transport equipment and various kinds of machinery. But the situation has radically changed now. India is now in a position to export these capital goods even to the technologically advanced countries of Western Europe, America, Soviet Union etc.

A significant feature of our industrial development has been the phenomenal growth of the public sector. This sector comprises public utility services like the railways, road transport, post and telegraph, power and irrigation projects, departmental undertakings of the Central and State Governments including the defense production establishments, and a number of other industrial undertakings which are wholly supported by the Central Government. The public sector now contributes about one-fifth of the share of the industrial sector

in the national income and the surpluses earned by its form an important source of non-tax revenue of the Government. It also offers job opportunities to a large number of people.

If we aim at an accurate assessment of our achievement, we should either compare our industrial growth with the growth in other countries during the corresponding period or, we should measure our achievement in terms of our targets. Another yardstick can be to compare our achievement with our needs. This kind of assessment can be quite revealing. In 1947, Japan was in no better a position than India. If India had been ruthlessly exploited by the British and fiercely rocked by communal hatred; violence and bloodshed in the wake of partition, Japan was laid waste by atom bombs during the Second World War. But today, Japan is technologically one of the most advanced countries of the world. Our achievement has also fallen short of the targets laid down in the Five-year Plans. If we compare our performance with our needs and targets it is obvious that what we have achieved is too inadequate to meet them.

Industrialization in India suffers from a few obvious drawbacks. Though the aim of industrialization has been to bring amelioration to the miserably poor millions, somehow economic power and wealth have been concentrated in a few hands and the masses have, by and large, been left un-benefited. The industrial licensing policy which is only an adjunct to the industrial policy has given rise to many evils, economic, social and political. This breeds unrest among the poor, and the laborers employed in big industrial houses often resort to strikes and lockouts, giving a serious blow to the productivity of the system. Finally, regional disparities and imbalances that should have been eliminated by now still persist. There exists in India a few pockets that have registered rapid economic development while a few areas find themselves utterly neglected.

Almost every plan has revealed that industrial production fell short of the target by a wide margin, but then, there are some inherent shortcomings in our planning system. It need not be emphasized that planning has widened the horizon of industrial sector and opened new vistas of industrial growth.

4.5 Composition of domestic and international trade

4.5.1 Economy, Industry & Trade

The New Economic Order & Industrial growth, Globalizing of Trade & Telecommunications

4.5.2 A New era

Though farming has been the main preoccupation of the bulk of the Indian population, the founding fathers saw India becoming a prosperous and Modern State with a good industrial base. Programs were formulated to build an adequate infrastructure for rapid industrialization.

Since independence, India has achieved a good measure of self-sufficiency in manufacturing a variety of basic and capital goods. The output of the major industries includes aircraft, ships, cars, locomotives, heavy electrical machinery, construction equipment, power generation and transmission equipment, chemicals, precision instruments, communication equipment and computers. Early planners in free India had to keep in mind two aims: all-round development and generation of large-scale job opportunities. Economic development strategies were evolved with an eye on these twin objectives.

4.5.3 New International Economic Order

As a responsible and progressive member of the international community, India is continuing her untiring efforts to bring about a constructive dialogue between the developed and developing countries in their quest for a cooperative approach towards a new International Economic Order. India is convinced that the establishment of an equitable International Economic Order involving structural and other, changes is the only answer to the various economic ills and problems of development confronting the world today.

4.5.4 Economic Restructuring

The international confidence in India's economy has been fully restored.

The reforms launched have made India an attractive place for investment. Duties have been lowered, repatriation of profit made liberal and levels of foreign equity raised considerably, 100% in the case of export oriented industry.

While several multinational companies have entered the Indian market, some Indian companies have also begun to gain international recognition. In the field of computer software, India is among the major exporting nations with an overflow of scientists in the field.

With the conclusion of the Uruguay Round of Multilateral Trade Negotiations, India decided to join the new World Trade Organization, the successor to GATT. India hopes that developing countries will not suffer on account of any protectionism.

On its part, India has opened several sectors hitherto restricted to the public sector. The rupee is convertible on the trade account. In 1994, exports grew by 17%. The numbers for 1995-96 show that exports grew at a rate of 28.8%. About 90% of India's import is financed by export earnings. The Non-Resident Indian (NRI) enjoys special incentives to invest in India like tax exemption and higher interest rates on deposits.

4.5.5 NRIs

The government acknowledges the great role that the vast number of Indians living and working abroad, the Non-Resident Indians, can play in accelerating the pace of development in the country. In the 1980s, the NRIs contribution through their remittances was instrumental to a large extent in stabilizing the balance of payment situation. Several initiatives have been taken to attract NRI investments - in industry, shares and debentures. The NRIs is allowed 100% investment in 34 priority and infrastructure facilities on non-repatriation basis. Approval is given automatically on investment in certain technical collaborations. They can buy Indian Development Bonds and acquire or transfer any property in India without waiting for government approval. The Foreign Exchange Regulation Act has been amended to permit NRIs to deal in foreign currency and they can also bring in five kg of gold. There are programs to utilize the scientific and technical talents of the NRIs with the help of the Council of Scientific and Industrial Research.

4.5.6 Infrastructure

In view of their crucial importance, power, transport and other infrastructure industries are owned by the State. As a result of special attention given to the area in recent years, the infrastructure industries have been growing at the rate of 9 to 10 percent annually.

Power: The generation of power has increased impressively in recent years. In 1990-51, India generated 6.6 billion-kilowatt hour of electricity, in 1995-96 the figure was 380.1 billion-kilowatt hour. The installed capacity, which was 1400 MW at Independence in 1947, has crossed 83,288 MW. The policy of inviting private sector has been well received; about 140 offers that can generate over 60,000 MW of power have come in.

Coal: Coal is the primary source for power generation in India. The country has huge reserves of coal approximately 197 billion tons. A sufficient amount of lignite (brown coal used in thermal power stations) is also available.

India produced about 270 million tons of coal in 1995-96. The government now welcomes private investment in the coal sector, allowing companies to operate captive mines.

Petroleum and Natural Gas: The recent exploration and production activities in the country have led to a dramatic increase in the output of oil. The country currently produces 35 million tons of crude oil, two thirds of which is from offshore areas, and imports another 27 million tons. Refinery production in terms of crude throughput of the existing refineries is about 54 million tons.

Natural gas production has also increased substantially in recent years, with the country producing over 22,000 million cubic meters. Natural gas is rapidly becoming an important source of energy and feedstock for major industries. By the end of the Eighth Five-Year Plan, production was likely to reach 30 billion cubic meters.

Railways: With a total route length of 63,000 Km and a fleet of 7000 passenger and 4000 goods trains, the Indian Railways is the second largest network in the world. It carries more than 4000 million passengers per year and transports over 382 million tons of freight every year. It is well equipped to meet its demands for locomotives, coaches and other components.

Lately, the Railways have launched a massive gauge conversion drive as about a third of the track is meter or narrow gauge. With improvement in tracks, plans are afoot to introduce faster trains. Very soon, certain prestigious long distance trains will be running at 160 Km per hour.

The Railways have also started a scheme to privatize several services that will include maintenance of railway stations, meals, drinking water and cleaning of trains.

Road Transport: The roadways have grown rapidly in independent India. Ranging from the cross-country link of the national highways to the roads in the deep interiors, the country has a road network of 2.1 million-km. India also manufactures most of its motorized vehicles -cars, jeeps, trucks, vans, buses and a wide range of two-wheelers of various capacities. While Indian scooters have established a good foreign market, the car industry is also looking up with several foreign companies setting up plants in India.

Shipping: The natural advantage of a vast coastline requires India to use sea transport for the bulk of cargo transport. Following the policy of liberalization, the Indian shipping industry, major ports, as also national highways and water transport have been thrown open to the private sector.

Shipping activity is buoyant and the number of ships registered under the Indian flag has reached 471. The average age of the shipping fleet in India is 13 years, compared to 17 years of the international shipping fleet. India is also among the few countries that offer fair and free competition to all shipping companies for obtaining cargo. There is no cargo reservation policy in India.

Aviation: India has an aviation infrastructure, which caters to every aspect of this industry. Hindustan Aeronautics Limited (HAL) is India's gigantic aeronautical organization and one of the major aerospace complexes in the world.

India's international carrier, Air India, is well known for its quality service spanning the world. Within the country, five international airports and more than 88 other airports are linked by Indian Airlines. Vayudoot, an intermediate feeder airline, has already linked more than 80 stations with its fleet of turboprop aircraft and its plans to build and expand its network to over 140 airports in the far-flung and remote areas of the country. Pawan Hans, a helicopter service, provides services in difficult terrain.

The Government has adopted a liberal civil aviation policy with a view to improving domestic services. Many private airlines are already operating in the country.

Pipelines: Oil and natural gas pipelines form an important transportation network in the country. The country completed recently, on schedule, one of its most ambitious projects, the 1700 km Hazira-Bijaipu Jagdishpur pipeline. Costing nearly Rs. 17 billion, the pipeline transports liquid gas from the South Basin offshore field off Mumbai to Jagdishpur and Aonla, deep in the mainland in Uttar Pradesh. Besides, India has nearly 7,000 km of pipeline mainly for the transportation of crude oil and its products.

Telecommunications: With rapid advances in technology, India now uses digital technology in telecommunications, which derives advantage from its ability to interface with computers. The present strategy focuses on a balanced growth of the network rapid modernization, a quantum jump in key

technologies, increased productivity, and innovation in organization and management. Moving towards self-reliance, besides establishing indigenous R&D in digital technology, India has established manufacturing capabilities in both the Government and private sectors.

The private sector is expected to play a major role in the future growth of telephone services in India after the opening of the economy. The recent growth in telecommunications has also been impressive. Till September 1996, the number of telephone connections had reached 126.1 lakh (12.6 million). Soon every village Panchayat will have a telephone. By 1997, cellular services in most major urban areas were functional, and telephone connections were available on demand. India is linked to most parts of the world by E-mail and the Internet.

4.5.7 Key Industries

Steel: The iron and steel industry in India is over 122 years old. However, a concerted effort to increase the steel output was made only in the early years of planning. Three integrated steel plants were set up at Bhilai, Durgapur and Rourkela. Later two more steel plants, at Bokaro and Vishakhapatnam, were set up. Private sector plants, of which the Tata Iron and Steel Company (TISCO) is the biggest, have been allowed to raise their capacity. The Steel Authority of India (SAIL), which manages the public sector plants, has undertaken a Rs. 40,500 crore program to modernize them. During 1995,96, production of saleable steel in the country was about 21.4 million tons. The five SAIL plants accounted for over half of this: The export of iron and steel jumped from 9.10 lakh tons in 1992-93 (valued at Rs.'708 crore) to over 20 lakh tons (Rs. 1940 crore).

TISCO and a large number of mini steel plants in the country contribute about 40% of the steel production in the country. The Government has given a push to sponge iron plants to meet the secondary sector's requirement of steel scrap.

Engineering and Machine Tools: Among the Third World countries, India is a major exporter of heavy and light engineering goods, producing a wide range of items. The bulk of capital goods required for power projects, fertilizer, cement, steel and petrochemical plants and mining equipment are made in India. The country also makes construction machinery, equipment for irrigation projects, diesel engines, tractors, transport vehicles, cotton textile and sugar mill machinery. The engineering industry has shown its capacity to manufacture large-size plants and equipment for various sectors like power, fertilizer and cement. Lately, air pollution control equipment is also being made in the country. The heavy electrical industry meets the entire domestic demand.

Electronics: The electronics industry in India has made rapid strides in recent years. The country produces electronics items worth over Rs. 200 billion annually. Exports are also rising; in 1995-96 they reached Rs. 4.5 billion. The software export during the same year reached Rs 2.5 billion. Compared to 1994-95, the software export growth in 1995-96 rose by an impressive 70%. The Software Technology Park scheme for attracting investments has proved successful. The relative low cost of production in India makes items made in India competitive in the world market.

Some of the major items manufactured in India are computers, communication equipment, broadcasting and strategic electronics, television sets, microwave ovens and washing machines.

The compound growth of the computer industry had been 50% during the last five years. Almost the entire demand for floppy disk drives, dot matrix printers, CRT terminals, keyboards, line printers and plotters is met from indigenous production. With the availability of trained technical manpower, computers have been identified as a major thrust area. Special emphasis has been given to software export.

The Indian software industry has developed skill and expertise in areas like design and implementation of management information and decision support systems, banking, insurance and financial applications, artificial intelligence and fifth generation systems.

Recognition for the Indian computer software industry has been global. Indian software enterprises have completed projects for reputed international organizations in 43 countries.

Textiles: Textiles, the largest industry in the country employing about 20 million people, account for one third of India's total exports. During 1995-96, textile exports were estimated at Rs. 35,504.6 crore which was 13.3% more than the 1994-95 figure. In recent years, several controls have been removed and in October 1996, a new long-term Quota policy was announced to boost exports over the next three years, till 1999.

Public Sector: The public sector contributed to the initial development of infrastructure and diversification of the industrial base. It is now being exposed to competition. Part equity of some units is being disinvested. But many core and strategic areas, important for the economy and self-reliance, will remain in the public sector.

4.5.8 Research and Development

Research and Development activities are supported by the governments at the Center and the states as well as by public and private sector undertakings. The Department of Scientific and Industrial Research recognizes over 1200 in-house R & D units. About 200 research laboratories exist in government departments and agencies. The benefits of the R & D works are reaching various fields like industry, farming and commerce.

4.5.9 Planning for Development

The Planning Commission headed by the Prime Minister, draws up five-year plans under the guidance of the National Development Council to ensure growth, self-reliance, modernization and social justice. Its role has been redefined in the eighth plan document: from a centralized planning system, India is moving towards indicative planning which will outline the priorities and encourage a higher growth rate. The Rs. 4,000 billion eighth plan envisaged a growth rate of 5.6%.

4.5.10 Traditional Industry

Indian handicrafts have withstood competition from machines over the years. The skills are passed on from one generation to the next. The handicraft and handloom sector is a major source of rural employment and earns substantial foreign exchange. Traditional textiles are as popular abroad as they are within the country. The major export items include hand-knotted carpets, art Metalware, hand-printed textiles and leather, wood and cane wares.

4.5.11 Composition of India's Foreign Trade

The composition of India's foreign trade, i.e., the pattern of imports and exports over the years, has changed in many ways.

4.5.11.1 Composition of Imports :

The principal imports of India may be classified into four major groups as follows: (i) Food and allied products; (ii) Raw materials and intermediate manufactures; (iii) Capital goods; and (iv) Other goods.

Due to the industrial growth in the country, there has been structural changes in imports since 1951 as under:

1. Increasing imports of capital goods and raw materials.
2. Declining imports of foodgrains and consumer goods.

The following observations are made in this regard:

4.5.11.1.1 Food and Allied Products:

Import of food and allied products claimed a share of 19 per cent in the total imports in the year 1960-61. Large imports of foodgrains were required to meet the domestic need of the country. In 1970-71 imports of food and allied items shared nearly 15 per cent of the total imports. The situation has improved in the food economy of India during the eighties. As such, in 1980-81 the imports of food items constituted just 3 per cent of the total imports.

4.5.11.1.2 Raw Materials and Intermediate Manufactures:

This group includes various items such as edible oil, petroleum oil and lubricants, fertilizers, iron and steel, non-ferrous metals, pearls and precious stones, etc. The share of imports of all these items together in the total imports has sharply increased from 47 per cent in 1960-61 to near 78 percent in 1980-81.

4.5.11.1.3 Capital Goods:

This group includes non-electrical machinery, electrical machinery, locomotives and other transport equipments, etc. In 1960-61, imports of capital goods claimed nearly 32 per cent share in total imports. This has gradually declined and came down to about 21 per cent in 1992-93.

4.5.11.1.4 Petroleum Oil and Lubricants (POL):

India's import expenditure on POL imports has substantially increased over the years. It was 6.1 per cent of the total import expenditure in 1960-61. This had increased to 8.3 per cent in 1970-71 and thereafter increased dramatically to nearly 42 per cent in 1980-81. Such a sharp rise is attributed to two hikes in oil prices in the seventies - first in 1973-74 when the Oil and Petroleum Exporting Countries (OPEC) raised the price of oil from \$2.50 to \$3.0 per barrel to \$11.65 per barrel and the second in 1978-89 when the price of oil was further raised to \$35 per barrel.

During the eighties, however, the country made successful efforts to increase domestic oil production. Besides, there was a decrease in international oil prices. As a result, the share of POL I imports bill in the total import expenditure declined to 25 per cent in 1990-91.

During the fifties and sixties, India's imports were largely determined by the stance of import substitution. In the seventies, the country's imports were greatly influenced by the goal of reaping efficiency gains in the export sector through imported inputs. During the eighties, import expenditure on petroleum, oil and lubricants (POL) was sizeable; besides the crucial import of trade liberalization in changing India's import structure.

4.5.12 .1Domestic trade

Under a nationwide scheme launched in 1979 for the distribution of essential commodities, goods are procured by the central government and then supplied to citizens. Each state has its own consumer cooperative federation; all of these groups are under the aegis of the National Cooperative Consumers Federation with the Minister of Consumer Affairs and Public Distribution. By 2000, more than 26,000 cooperatives and 681 wholesale stores shared in the distribution of sugar, edible oils, and grains in rural areas.

With the government's new emphasis on growth in private enterprise since the late 1980s, the expansion of privately-owned retail outlets have competed with the cooperative sector. Most private commercial enterprises are small establishments owned and operated by a single person or a single family; retail outlets

are often highly specialized in production and usually very small in quarters and total stock. Often the Indian retail shop is large enough to hold only the proprietor and a small selection of stock; shutters fronting the store are opened to allow customers to negotiate from the street or sidewalk. There are no major national chains but foreign franchises do exist. In most retail shops, fixed prices are rare and bargaining is the accepted means of purchase. Some department stores and supermarkets have begun to appear in shopping centers in major cities. These shopping centers usually offer entertainment and leisure activities as well.

Review Questions

1. Define the Agricultural growth?
2. Explain the Green revolution?
3. Explain the Industrial development?
4. Explain the international and domestic trade of India?

Discussion Questions

Discuss the development of Indian Agriculture?

Chapter 4- Contemporary Issues

Learning Objectives

- To define the Regional Imbalance in India..
- To explain the main problems in India.
- To explain the Gender discrimination.
- To describe the Empowerment of women.

4.1 Introduction

Since India's Independence in 1947, the South Asian nation has faced several **social and economic issues**. One-third of India's population (roughly equivalent to the entire population of the United States) lives below the poverty line and India is home to one-third of the world's poor people. Though the high class has gained from recent positive economic developments, India suffers from substantial poverty. According to the new World Bank's estimates on poverty based on 2005 data, India has 456 million people, 41.6% of its population, living below the new international poverty line of \$1.25 (PPP) per day. The World Bank further estimates that 33% of the global poor now reside in India. Moreover, India also has 828 million people, or 75.6% of the population living below \$2 a day, compared to 72.2% for Sub-Saharan Africa. One of the serious problems faced by India's economy is the alarming growth rate of regional differences between India's dissimilar states and territories in terms of per capita income, socioeconomic development, poverty and availability of infrastructure. Economic Imbalance is easily visible in the country by the fact that 40-50% of the populations in Bihar and Orissa live below the poverty line while states such as Delhi and Punjab exhibit very low poverty ratios. Despite the positive developments for women in India -- increased visibility in the public sphere, the presence of women in the labor force across international borders and lower fertility rates--gender discrimination not only persists but also has seen a little decline. Over the past century there has been much to rejoice about the positive development of women in India: increased visibility of women in the public sphere, closing of gender gaps in primary and secondary school enrollment, the presence of women in the labor force across international borders, and lower fertility rates. In addition, women's organizations have been able to raise issues such as sexual and reproductive health and rights, violence against women, and inequality of power in gender relations, and make these the pivotal issues of debate in national and global arenas.

4.2 Regional Imbalance in social and economic development.

4.2.1 Historical Trends

India has had a glorious past. Our cultural heritage is comparable to that of China or Egypt. We had great kings and kingdoms. Half of the major world religions had their origin in India. We had produced great thinkers and philosophers who contributed to several branches of knowledge.

But most of our history before 1500 AD is in oral traditions. Indians, largely, were not good at record keeping. This is especially true about hard facts and data relating to various aspects of life. Even for the period 1500 to 1750 AD data are rudimentary.

4.2.1.1 Mughal period (1500-1750)

India during Akbar's time was considered as prosperous a country as the best in the world. Though mainly agrarian, India was a leading manufacturing nation at least at par with pre-industrial Europe. She lost her relative advantage only after Europe achieved a revolution in technology.

The economy was village-based. Though under Muslim rule for over 500 years, the society continued to be organized in Hindu traditions. The caste system was intact. The social imbalance often added another dimension to economic exploitation. While the Jajmani system ensured social security, the caste system ensured social immobility.

However, the flexibility of the Jajmani system ensured that the artisans working under it were not completely cut off from the market. They were free to sell outside the village the surplus goods left after the fulfillment of community obligations. The traditional economic system based on farming and small-scale industries was not disrupted either by the activity of native capital or by the penetration of the foreign merchant capital.

There is historical evidence to indicate that there were food surplus and deficit areas as trade in foodgrains between areas took place. This contradicts the postulate that a uniform pattern of self-sufficiency for the entire sub-continent existed. For example, rice was being purchased from the Konkan coast to be transported through the sea to Kerala. Similarly, Bengal rice was sent up the Ganges to Agra via Patna, to Coramandel and round the Cape to Kerala and the various port towns of the West Coast. The best mangoes in Delhi's Mughal Court came from Bengal, Golconda and Goa. Salt to Bengal was imported from Rajputana.

Domestic trade was facilitated by a fairly developed road network. Sher Shah Suri during his short regime laid the foundation of a highway system in India. He alone had built 1700 sarais for the convenience of travellers, mainly traders, on the highways.

India exported common foods like rice and pulses, wheat and oil, for which there was considerable demand abroad. Bengal, Orissa and Kanara Coast north of Malabar were the major grain surplus areas. Besides, Bengal exported sugar and raw silk, Gujarat exported raw cotton, while Malabar sent out its pepper and other spices.

The Indian merchant lived in a keenly competitive world but he accepted important social limits to compete. Business was organized around the family with an occasional trading partner from the same social group.

Agra during Akbar and Delhi during the reign of Shahjahan were no lesser cities than London and Paris of those days. Foreign travellers who visited India during the Sixteenth and Seventeenth centuries present a

picture of a small group of ruling class living in great luxury, in sharp contrast to the miserable condition of the masses. Indigenous sources do not disagree; they often dwell on the luxurious life of the upper classes, and occasionally refer to the privations of the ordinary people. Such sharp inequality in living standards was not peculiar to India; it existed in a greater or lesser degree everywhere, including Europe.

The Indian village was highly segmented both socially and economically. There was significant inequality in distribution of farm land, though there were plenty of cultivable wastelands available which could be brought under plough if capital, labor and organization were forthcoming.

The share of produce retained by dissimilar classes of peasants varied. The general Mughal formula for the authorized revenue demand was one-third or one-half. The precise share depended on a number of factors—nature of the soil, the relationship of the peasant with the Zamindar of the area, traditions, etc. Caste might have also played a role. For instance, in some parts of Rajasthan, members of the three upper castes—the Brahmans, the Kshetriyas or Rajputs and the Vaishyas or Mahajans paid land revenue at concessional rates. Because of these factors one would expect considerable inequality within the village. In any case the class and caste distinctions superimposed on each other made the rural society extremely complex and unequal. In comparison to the rural rich, the urban rich especially the merchants in coastal towns were much wealthier. Some of the merchants of Bengal and Gujarat had stupefying wealth. The pattern of life of the nobility and the upper class in Mughal India has become a byword for luxury and ostentation. There is hardly any evidence to show that the puritan style set up by Aurangzeb had any marked effect on the lives of the nobility. Of course, this consumerism created demand for a horde of luxury items which generated employment, income and general prosperity.

4.2.1.2 The British Period (1757-1947)

The debate concerning the level of India's economic development in the pre-colonial era is unlikely to ever reach a satisfactory conclusion as the basic quantitative information is absent.

Dadabhai Naoraji was the first one to make an attempt to estimate national and per capita income in India. He placed per capita income of India at Rs.30 in 1870 compared to that of England of Rs.450. However, since necessities in India cost only about one-third as compared to England at that time, the real difference in terms of purchasing power parity was not fifteen times but only five times.

The statistical reporter of the 'Indian Economist' ran a series of articles on the standard of living in India in 1870. One of the items which was given area wise was the value of per capita agricultural output for 1868-69. According to that it varied from Rs.21.7 in Central Province to as low as Rs.11.1 in Madras. Others were Bombay (Rs.20.0), United Provinces (Rs.12.1), Punjab (Rs.17.4) and Bengal, including Bihar and Orissa (Rs.15.9).

Area wise birth rates, death rates and life expectancy at birth are given in the table below for the period 1901-1911 :

Table 1

Area	Birth rate	Death rate	Life expectancy	
			Male	Female
East	52.8	45.8	22.4	22.8
West	48.1	42.1	24.8	23.8
Central	46.6	31.3	31.7	32.7
North	48.6	48.7	21.7	19.2
South	40.3	32.2	29.8	32.3
All India	47.7	41.7	24.7	24.4

In 1901, there were 2093 towns in the Indian Sub-continent and about ten per cent of the population was urban. There was considerable variation in the level of urbanization across the country, it varied from 18.8 per cent in Bombay Presidency to five per cent in Bengal Presidency, including Bihar and Orissa.

The dependence on farming for livelihood varied considerably across the areas. While the share of cultivators in the male working force in Assam, Bihar, Orissa and Uttar Pradesh was 55 per cent or more, it was less than 40 per cent in Gujarat, Maharashtra, Kerala and West Bengal in 1911.

Industrialization in India, from the beginning, had been experiencing a duality. European entrepreneurs invested more and more in industries which were mainly exported-oriented whereas Indian entrepreneurs concentrated on industries mainly in the Indian markets. Thus jute, tea, etc. were mainly in European hands whereas textile, sugar, etc. were mainly Indian. Apart from other factors, one main reason was that Indian market offered higher profit margins which Indian industrialists found easier to penetrate. Not surprisingly this tendency continues even today.

The benefit of irrigation development was mainly concentrated in northern, western and southern provinces during British period. Central and Eastern India were relatively neglected. This has had serious implications in the post-independence period also. While the former areas were ripe for benefiting from the green revolution package, the latter could not.

From its beginning in 1853, India's railway system expanded rapidly to become, by 1910, the fourth-largest in the world. This network which covered most of the Sub-continent, radically altered India's transportation system.

Railways vastly increased the speed, availability and reliability of transportation, reduced the cost, allowed regional specialization and expansion of trade. For attracting private investors, Government of British India

assured guaranteed return. Under this scheme, which was used in other parts of the world to build railways, if a company did not attain a minimum rate of return of five per cent, it received compensation for the difference from the Government. Stimulated by an assured rate of return, British investors swiftly made their capital available to the private railway companies. By 1947 all but a few remote districts in far-flung remote areas were served by railways.

The fiscal system during the British rule gradually evolved into a federal system from a highly centralized control. Over the years relations between the center and the provinces were made more elastic but not much more systematic. In particular, there was no attempt to equalize provincial levels of public services, or the tax burdens on similar classes of taxpayers in dissimilar States. There were enormous differences in tax incidence and standards of public services in the beginning, and these differences were perpetuated since precedent was followed rather than any principle.

The main source of differences in tax burdens was the variation in the system of land revenue, the largest source of public revenue. This also explained one source of difference in expenditure. Bombay spent much more per head on nearly every head of expenditure than the others. The other provinces clamoured for less inequality but to little effect. Bombay continued to spend far more on every major head than the other provinces, and Bihar and Orissa far less. The poverty of these provinces became evident when they were separated from Bengal in 1912-13.

Table 2

Relative Provincial Expenditure per head on selected services

1876-77 and 1927-28, Bengal = 100

Province	General Administration		Education		Health	
	1876-77	1927-28	1876-77	1927-28	1876-77	1927-28
Bombay	374	411	325	345	285	141
Central	185	169	197	131	142	53
Madras	159	193	112	166	139	98
Punjab	244	103	145	199	135	126
United	140	103	110	123	78	51

Bengal	100	100	100	100	100	100
Assam	159	136	117	120	82	121
Burma	470	292	295	276	260	201
Bihar and Orrisa	---	75	---	83	---	51

Many critics also argued that the system had not even encouraged economy, but rather extravagance, since the actual expenditure in one period formed the basis of allocations from the center in the next. For the same reason, the provinces had little incentive to try to raise their tax revenues. A more or less similar situation exists in India even today when the Finance Commissions assess the revenue gaps of the States and try to fill such gaps by increased transfers.

4.2.1.3 Post-Independence Period

Government's economic policies during the colonial period were more to protect the interests of the British economy rather than for advancing the welfare of the Indians. The primary concerns of the Government were law and order, tax collection and defence. As for development, the Government adopted a basically laissez-faire attitude. Of course, railways, irrigation systems, road network and modern education system were developed during this period. Railways and road network were more to facilitate the movements of goods and defense personnel and to facilitate better administrative control. Irrigation canal system was mainly to fight repeated droughts and famines and to boost land revenue. Education, to begin with, was developed mainly to train lower-ranking functionaries of the colonial administration.

Particularly lacking was a sustained positive policy to promote the indigenous industry. Indeed, it is widely believed that government policies, far from encouraging development, were responsible for the decline and disappearance of much of India's traditional industry.

Altogether, the pre-independence period was a period of near stagnation for the Indian economy. The growth of aggregate real output during the first half of the twentieth century is estimated at less than two percent per year, and per capita output by half of a per cent a year or less.

There was hardly any change in the structure of production or in productivity levels. The growth of modern manufacturing was probably neutralized by the displacement of traditional crafts, and in any case, was too small to make a difference to the overall picture.

Along with an impoverished economy, independent India also inherited some useful assets in the form of a national transport system, an administrative apparatus in working order, a shelf of concrete development

projects and a comfortable level of foreign exchange. While it is arguable whether the administrative apparatus built by the British helped or hindered development since 1947, there is little doubt that its existence was a great help in coping with the massive problems in the wake of independence such as restoring civil order, organizing relief and rehabilitation for millions of refugees and integrating the Princely States to the Union.

The development projects initiated in 1944 as a part of the Post-war Reconstruction Program was of particular value to the Independent India's first government. Under the guidance of the Planning and Development Department created by the Central Government, a great deal of useful work was done before Independence to outline the broad strategy and policies for developing major sectors and to translate them into programs and projects. By the time of Independence several of these were already underway or ready to be taken up. They included programs and projects in farming, irrigation, fertilizer, railways, newsprint and so on. Though the first Five Year Plan began in 1950-51, with the establishment of the Planning Commission, a well-rounded planning framework was in place only with the second Five Year Plan after five years. By and large, the basis of the first Five Year Plan was the groundwork done before independence. Most of the principal projects were continuations and major efforts were made to complete them early.

4.2.2 Recent Trends

The Indian economy has experienced an average annual growth rate of around 6 per cent during the last two decades. Though, moderate compared to the performance of several East Asian economies during the same period, this was quite impressive compared to the performance of the Indian economy during the preceding three decades when the average growth logged 3.5 per cent per annum. Even the growth rate of 3.5 per cent experienced during the first three decades of the republic had been spectacularly better than the virtual stagnation of the Indian economy during the first half of the Twentieth Century. In terms of per capita income, the improvement has been even more remarkable - around 4 per cent per annum in the recent period as compared to less than 1.5 per cent in the earlier period. Further, during the recent period, there has been a steady acceleration in the growth performance over the years. The average compound growth per annum was 5.7 per cent during the Sixth Five Year Plan (1980-85), 6.0 per cent during the Seventh Plan (1985-90) and 6.6 per cent during the Eighth Plan (1992-97). While the growth rate dropped to 3.1 per cent during the two-year period 1990-92 in the wake of the international payment crisis and the introduction of major economic reforms, the growth process picked up fast in the subsequent years. Indeed, the growth averaged about 7.5 per cent during the three-year period ending 1996-97, which is impressive by any standards. The growth rate has been somewhat lower in the subsequent three years. In contrast to the stagnation/negative growth of most of the East Asian economies India's performances, however, is remarkable. The World Bank and other international agencies have characterized India as one of the fastest growing economies of the world.

As is to be expected, improvement in economic growth and per capita income translated, at least partly, into a reduction in the level of poverty in the country. Though there are differences in the estimates of the percentage of the poor by dissimilar sources, all agree that there has been a secular decline in the share of the poor in the population since the late Seventies. The official estimates of population below poverty line

released by the Planning Commission on the basis of the Expert Group methodology indicates this secular downward trend:

Year	1977-78	1983	1987-88	1993-94	1999-2000
Percentage of poor	51.3	44.5	38.9	36.0	26.10

The last two decades had seen the introduction/expansion of several anti-poverty programs and public intervention policies in favor of the poor including public distribution of subsidized food grains. The reduction in poverty in the recent period is attributed to anti-poverty programs by their protagonists and to accelerate economic growth by market friendly experts.

Along with faster economic growth and a reduction in poverty, there has been accelerated improvement in various indicators of human development since the early Eighties whether it is in the case of demographic characteristics or social development indicators. During the last two decades, the country has made major strides in health and education sectors. The economy got diversified significantly and the share of the service sector in employment and incomes improved considerably. While there is a broad consensus on the overall improvement of the economy and quality of life during the period under consideration, there are significantly differing perceptions about the distributional impacts of these gains.

Disparities in economic and social development across the areas and intra-regional disparities among dissimilar segments of the society have been the major planks for adopting planning process in India since independence. Apart from massive investments in backward areas, various public policies directed at encouraging private investments in such areas have been pursued during the first three decades of planned development. While efforts to reduce regional disparities were not lacking, achievements were not often commensurate with these efforts. A considerable level of regional disparities remained at the end of the Seventies. The accelerated economic growth since the early Eighties appears to have aggravated regional disparities. The on-going economic reforms since 1991 with stabilization and deregulation policies as their central pieces seem to have further widened the regional disparities. The seriousness of the emerging acute regional imbalances has not yet received the public attention it deserves.

Most of the studies on inter-country and inter-regional differences in levels of living and income are done within the theoretical framework of neoclassical growth models. These models, under plausible assumptions demonstrate convergence of incomes. Three notable recent studies, however, indicate that in the Indian context these convergence theories do not explain the ground realities.

The scope of analysis in this section is restricted to a comparative analysis of the emerging trends in fifteen major States in respect of a few key parameters which have an intrinsic bearing on social and economic

development. The variables chosen for examination include those which have a bearing on gender and equity issues. The fifteen States together account for 95.5 per cent of the population of India. The remaining 4.5 per cent of the population is spread out in 10 smaller States and seven Union Territories including the National Capital Territory of Delhi. Leaving out these States and UTs from detailed study is mainly due to non-availability of all relevant data and also to keep the data sets analytically and logistically manageable. The fifteen States taken up for the detailed study have been grouped into two - a forward group and a backward group. The forward group consists of Andhra Pradesh, Gujarat, Haryana, Karnataka, Kerala, Maharashtra, Punjab and Tamil Nadu. The backward group comprises of Assam, Bihar, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh and West Bengal.

Geographically, the forward group of States falls in the Western and Southern parts of the country and are contiguous except for Punjab and Haryana which are separated from Rajasthan from the rest of the States in this group. The group of backward States are in the Eastern and Northern parts of the country and are geographically contiguous. Another notable geographical feature is that while six out of eight States, except Haryana and Punjab, in the first group have vast sea coasts, only two out of the seven in the second group viz., Orissa and West Bengal are littoral. While the forward group of States accounts for about 40.4 per cent of the national population, the backward group accounts for as much as 55.1 per cent of the population of the country according to 2001 census. In terms of natural resources including mineral wealth, water resources and quality of soil, the latter has a definite edge over the former.

A limitation of inter-regional analysis using States as units is the fact that this may not be able to capture the significant intrastate disparities in economic and social development, which exists today. The larger States in both the groups have areas within themselves, which are vastly dissimilar in terms of various indicators of development. There are identifiable distinct areas, at dissimilar stages of development, in several States.

4.2.2.1 Demographic and Social Characteristics

As noted earlier, the group of eight forward States together accounted for 40.4 per cent of the population of the country whereas the group of seven backward States together accounted for as much as 55.17 per cent of the population of the country according to 2001 census. However, the contribution of the group of forward States to the country's population growth during the last decade was much higher at 59.2 per cent. On the other hand, the contribution of the group of backward States was as low as 33.8 per cent. All the States, except Assam and Orissa, in the backward group had a higher contribution to population growth than their share in the population. Thus, Uttar Pradesh's contribution to population growth was 18.8 per cent against its population share of 16.2 per and Bihar's contributions was 10.1 against its share of the population of 8.17 per cent.

In contrast, out of the eight States in the forward group, all except Maharashtra, Gujarat and Haryana had a lower contribution to population growth during the last decade than their respective shares in the population. Indeed, Kerala's contribution to population growth was as low as 1.5 percent against its share in the population of 3.1 per cent and Tamil Nadu's contribution to population growth was as low as 3.4 percent against its share in the population of 6.1 per cent.

To broadly characterize, the two groups of States are at dissimilar stages of demographic transition. States like Kerala and Tamil Nadu which have already reduced their birth rates to levels which are comparable to those of developed countries and achieved the replacement level of total fertility rate (TFR) of 2.1. All the remaining six States of the forward group are expected to reach the replacement level of TFR by 2025, one year in advance of the projected year of attainment of replacement level of TFR by the country. On the other hand, the seven States in the backward group are at dissimilar stages of demographic transition. Some of them like Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan continue to experience the highest rate of birth rates and fairly low levels of death rates and a significantly high level of TFR. On the other hand, States like Assam, Orissa and West Bengal have somewhat moderate birth and death rates and relatively moderate TFR. These three States are expected to reduce their TFR to replacement level well before the country's TFR comes down to that level. As against this, Bihar is expedited to reduce TFR to replacement level by 2039, Rajasthan by 2048, Madhya Pradesh by 2060 and Uttar Pradesh beyond 2100.

According to the 2001 census, the literacy rate for the country is 65.4 per cent. All States in the forward group, except Andhra Pradesh, have literacy rates above the national average. Their rates vary from 90.9 per cent in Kerala to 67.0 per cent in Karnataka. The level of literacy in Andhra Pradesh is only 61.1. In the backward group, all except West Bengal have literacy rates below national average. They vary from 64.3 per cent in Assam to as low as 47.5 in Bihar. The level of literacy in West Bengal is 69.2 per cent.

Census 2001 indicates that the gender gap in literacy has come down to the country from 24.8 percentage points in 1991 to 21.7 percentage points in 2001. Now the male literacy is 76.0 per cent and female literacy is 54.3. On the whole, the literacy gap is lower in the forward group of States as compared to the backward group of States. Six out of eight States in the first group, except Haryana and Gujarat, have literacy gaps below the national average. On the other hand, all States except Assam and West Bengal have a gender gap in literacy higher than the national average. The gender gap in literacy is as low as 6.3 percentage points in Kerala and as high as 32.1 percentage points in Rajasthan. There appears to exist a strong inverse relationship between the gender gap in literacy and the status of women in society. Also, there is a fairly well-established inverse empirical relationship between the female literacy and TFR. The national as well as international experience is that with the higher female literacy rate, birth rate come down irrespective of the social backgrounds, religious beliefs and income levels.

The group of backward States accounts for 63.3 percent of the illiterate females in the country, a share which far exceeds its population share. On the other hand the group of forward States accounts for only 34.4 percent of the illiterate in the country, a share far less than its population share. In this group, Andhra Pradesh is the only State where the share of illiterate females is higher than the share of the population.

4.2.2.2 Income and Property

The most common indicator of the economic development of a society is the per capita annual income generated by it. The level of poverty or the share of population which do not have minimum income to meet its basic requirements is an indicator of the level of economic development as well as the inequality in the income distribution.

Per capita gross state domestic product (GSDP) as a percentage of per capita GDP of the country at four time periods since 1980-81 for forward and backward group of States are presented in the table below:

Table 3

Per capita GSDP as a percentage of GDP
(Three-year average of incomes at current prices centered on)

States	1981-82	1985-86	1990-91	1997-98
Forward group				
Andhra Pradesh	87.4	82.4	92.5	92.9
Gujarat	125.3	124.4	118.8	137.4
Haryana	146.5	139.9	146.6	139.4
Karnataka	92.8	93.7	95.4	107.2
Kerala	90.5	90.9	87.8	116.4
Maharashtra	143.0	134.7	144.7	167.5
Punjab	168.6	165.0	169.7	146.5
Tamil Nadu	92.8	97.0	100.0	119.5
Backward group				
Assam	83.6	92.1	83.1	62.2
Bihar	58.8	60.6	53.5	44.2
Madhya Pradesh	80.8	74.8	78.1	73.5
Orissa	75.0	74.7	66.9	61.8
Rajasthan	76.6	74.0	79.3	81.1
Uttar Pradesh	75.8	71.9	70.6	64.4
West Bengal	103.3	102.9	91.7	85.1
All India	100	100	100	100

This table is based on table 2 in Saumitra Chaudhuri.

The table sharply focuses the dissimilar growth in per capita incomes of the two groups of States over the last two decades, especially during the last decade. All the States in the forward group, except Haryana and Punjab have improved their relative position over the last two decades. Further, these improvements were more spectacular since 1990-91, especially in Gujarat, Kerala, Maharashtra and Tamil Nadu. It is noteworthy that the relative decline in per capita incomes of Haryana and Punjab was a phenomenon of the 1990s. Per capita incomes of four out of eight States in the group were below the national average in the eighties. But by late nineties, all except Andhra Pradesh, have gone above the national average.

In contrast, all the States except Rajasthan in the backward group experienced relative deterioration in terms of per capita income. And the deterioration was more marked after the reforms. This especially is true of Assam, Bihar, Orissa, Uttar Pradesh and West Bengal. Indeed, West Bengal was the only State in this group, which had above national average per capita income to begin with. Though that State experienced significant growth in farming, especially in the eighties, because of the deterioration of industrial sector in the State the overall relative performance came down in the nineties.

Table 4 below presents the trend in percentage share of the poor in the two groups of States individually and collectively.

Table 4

States	1983-84	1987-88	1993-94	1999-2000
Forward Group				
Andhra Pradesh	5.10	5.22	4.81	4.57
Gujarat	3.65	3.98	3.28	2.61
Haryana	0.92	0.83	1.37	0.67
Karnataka	4.64	5.17	4.88	4.01
Kerala	3.31	2.88	2.39	1.58
Maharashtra	9.01	9.65	9.53	8.76
Punjab	0.89	0.82	0.78	0.56
Tamil Nadu	8.05	7.53	6.31	5.01
Total for forward States	35.57	36.08	33.35	27.77
Backward Group				
Assam	2.41	2.47	3.01	3.63
Bihar	14.31	13.71	15.40	16.36
Madhya Pradesh	8.61	8.61	9.32	11.47
Orissa	5.62	5.40	5.01	6.50
Rajasthan	3.93	4.65	4.01	3.14
Uttar Pradesh	17.24	17.47	18.87	20.36
West Bengal	9.87	9.24	7.95	8.20
Total for Backward States	61.99	61.55	63.57	69.66
All India	100.00	100.00	100.00	100.00

Source: Planning Commission, Govt of India

The sharp decline in the share of poor in the forward States since 1987-88, especially after 1993-94 is commendable. We have already noted that there was a steep fall in the share of the poor in the country during the nineties. The two together imply that the main beneficiaries of the overall decline in poverty in the country have been the fastest growing States in the forward group. This, in a sense, unequivocally establishes the close positive relationship between poverty reduction and economic growth.

In contrast, the share of the poor in the seven States in the backward group has gone up significantly. Now they account for about 70 per cent of the poor in the country. As the table indicates, each one of the States in this group, except West Bengal, experienced a considerable increase in the share of the poor. West Bengal's exceptional experience was mainly on account of the fast growth in agricultural production and the associated rural prosperity. Again, the positive association between poverty reduction and economic growth, especially agricultural growth is to be noted. It may, however, be mentioned that since the overall poverty in the country has come down substantially in the nineties, an increase in the State share in poverty need not imply an increase in the number of poor. Indeed, between 1993-94 and 1999-2000, the absolute numbers of poor in all the States have come down.

4.2.2.3 Resource Transfer from the Centre to the States

There is an inbuilt imbalance between the expenditure responsibilities and the revenue sources of the State governments. The founding fathers of the Indian Constitution were aware of this fact and ensured a comprehensive scheme of devolution of Central Tax revenues through the mechanism of Finance Commissions. The sharing of Personal Income Tax and Excise duties collected by the Centre with the States is periodically reviewed by the Finance Commission appointed every five years. The Commission also decides the principles and the formula by which the allocable funds are to be distributed among the States.

An important aspect of the devolution of Central tax revenues under Finance Commission dispensation is that it has an inbuilt bias in favor of fiscally weak States. Population and per capita income of the State get higher weight-age in the distribution formula. A State with larger populations and lower per capita income gets a higher share in the Central tax revenues. The gap between revenue receipts (other than the Central tax revenues) and revenue expenditure is another parameter, which decides the level of a State's share. As a result the Central tax share constitutes a major revenue source for the backward States. While it constitutes about one-third of the total tax revenues of all the States taken together; it accounts for more than 50 per cent of the total tax revenues of less developed States like Bihar and Orissa; but its share is less than 15 per cent of the total tax revenues of more developed States like Gujarat, Haryana, Maharashtra and Punjab.

A second channel of resources flow from the Centre to the States is Planning Commission, which provides Central Assistance for State Plans. The State plans are financed partly by States own resources and the balance by Central Assistance. Central assistance is provided as a block assistance of which 30 per cent is granted and the remaining 70 per cent is a long term loan. The rationale for this grant-loan proportion is imbedded in the fact that about 30 per cent of the plan expenditure was of revenue nature and 70 per cent were of capital nature when this proportion was decided in the late Sixties. Since plan expenditure of

revenue nature is not expected to yield any financial returns for servicing the loan, this share was provided as a grant by the Centre.

The distribution of Plan assistance to the States has been governed by 'Gadgil Formula' since the Fourth Five Year Plan (1969-74). As in the case of Finance Commission devolution, 'Gadgil Formula' which is administered by the Planning Commission also has its built in bias in favor of backward States. Population and per capita income together account for 85 per cent of the weight in the formula. The remaining 15 percent weight-age is equally divided between State performance in the achievement of certain priority national objectives and the special problems of the States. Central assistance constituted about 45 per cent of the State Plans when all States are taken together. While the share of Central assistance constitutes less than 25 per cent of the Plan finances of the most developed States, it accounted for the major share of Plan finances of the backward States. Indeed, the Plans of the most backward States, especially the Special Category States, have been fully financed by Central Assistance.

In the wake of the foreign exchange crisis in the early nineties, the Centre has been encouraging States to seek and absorb more and more external aid for development projects. The external aid to the States is routed through the Central budget and devolved as an additional Central Assistance for State plan on the same terms and conditions as the normal Central assistance to the State Plans. Since the early Nineties, there has been a substantial increase in aid flows to the States. However, the major share of such flows has been absorbed by a few developed States. As a result, during the nineties, there has been an apparent increase in the Central assistance to the more developed States. While 'Gadgil Formula' based normal Central assistance continued to be positive discriminating towards backward States, additional Central assistance for externally aided projects was skewed towards the better of the States. Indeed, external aid accounted for 40 to 60 per cent of Central Plan assistance to some of the developed States, while such assistance contributed less than 10 per cent of the Central Plan assistance to most of the backward States. Table 5 below presents the total number of external aid flowing to the States year-wise and the shares of a few States which accounted for the lion's share of such resource flows.

Table 5

External Assistance : Relative shares of States

States	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99
All States (Rs. crore)	1887	3326	3741	3447	3832	3872	5252	5096	6356
Percentage share of:									
Andhra Pradesh	9.0	11.1	19.0	17.1	11.9	11.8	10.0	16.3	16.2

Gujarat	12. 2	8.6	12. 0	3.0	1.7	2.2	7.8	3.9	4.6
Karnataka	5.9	7.7	6.5	7.7	6.8	3.3	3.6	3.4	4.8
Maharashtra	11. 2	10. 2	13. 0	15. 3	16. 4	21. 4	19. 2	12. 7	9.2
Tamil Nadu	9.3	8.7	10. 3	11. 6	15. 8	10. 6	7.8	6.0	5.1
Uttar Pradesh	24. 5	23. 1	10. 1	12. 8	5.5	7.9	11. 4	10. 6	7.7
West Bengal	3.4	3.4	2.4	2.1	1.9	1.4	4.6	11. 0	15. 1
Total share of the seven States	75. 5	72. 8	73. 3	69. 6	60. 0	68. 6	64. 4	63. 9	62. 7

Source: Controller of Aid Accounts, Ministry of Finance, Govt of India.

From table 5 it is evident that the total aid flows to the States have been showing a more or less steady growth in the last decade. However, there are heavily biased in favor of seven States, of which five belong to the forward group. In four out of nine years, the highest share went to Andhra Pradesh and in another three years it was the turn of Maharashtra. A redeeming trend indicated by the last row of the table is that the share of seven States has been squarely declining over the period.

As noted in the preceding paragraphs, resource flows through the Finance Commission and Planning Commission account for a substantial share of State resources. Though their overall effects are highly beneficial to the fiscal health of the States, there are certain adverse effects of such flows on the State finances. First, since the Finance Commission approach to revenue deficit is basically a gap-filling approach, this diminishes the incentive of the States to raise revenue receipts and reduce revenue expenditure. In other words, there is an implicit premium on fiscal profligacy. Second, continuing expenditure on plan schemes beyond the Five Year Plans became the committed expenditure of the States and add to their fiscal burden. Since there is a premium on plan expenditure, State governments have a tendency to under-fund maintenance expenditure to inflate the plan size. This results in poor maintenance of public assets created in the past and poor quality of public services, which are outside the plan. A further complication is due to steep increase in the revenue component of plan expenditure over the years. While the grant-loan ratio of Central assistance is still 30:70, the revenue share of State Plan expenditure has reached almost 60 per cent. As a result, the debt-servicing burden of the States has gone up significantly.

4.2.2.4 Pattern of Private Investment

In the wake of economic reforms initiated in 1991, the role of private investment has acquired a special significance in the context of economic development of various States of the Indian Union. Indeed, there has been an element of competition among States ever since for attracting private investment, both domestic and foreign. Some of the States have been offering various tax concessions and other special facilities to new investors on a competitive basis. We present State-wise data on investment proposals, assistance by all India financial institutions and assistance by State financial corporations in Table 6.

Table 6

Investment Proposals and Disbursal of

Financial Assistance for Investment

Sl. No.	State	Percentage share of investment proposals between August 1991 and March 2000	Cumulative share of financial assistance disbursed by all India Financial Institutions (upto March end 1999)	Cumulative financial assistance disbursed by State Financial Corporations (upto March end 1999)
	(1)	(2)	(3)	(4)
1	Andhra Pradesh	7.5	7.2	7.8
2	Gujarat	17.3	13.5	9.3
3	Haryana	3.4	2.5	4.8
4	Karnataka	4.5	6.1	15.5
5	Kerala	1.1	1.7	4.4
6	Maharashtra	21.7	21.0	11.5
7	Punjab	4.4	2.4	3.6
8	Tamil Nadu	6.8	9.0	10.6
Sub-total (1 to 8)		66.7	63.4	67.5
9	Assam	0.7	0.5	0.5
10	Bihar	1.1	1.4	2.0
11	Madhya Pradesh	7.2	5.1	3.2
12	Orissa	2.6	1.8	3.7
13	Rajasthan	3.8	4.5	6.1
14	Uttar Pradesh	8.5	7.9	11.1
15	West Bengal	3.5	3.9	2.5
Sub-total (9 to 15)		27.4	25.1	29.1
All India		100 (Rs.908888 crore)	100 (Rs.312502 crore)	100 (Rs.20896 crore)

Source: 1. Annual Report 1999-2000, Ministry of Industry, Govt of India

2. RBI, Report on Currency and Finance 1998-99, Vol. 1

Notes: 1. Investment proposals include Industrial Entrepreneurial, Memorandum (IEM) Filed for items under delicensed sector and letter of indent in respect of items under licensed sector.

2. All India Financial Institutions include IDBI, IFCI, ICICI, UTI, LIC, GIC, IRBI and SIDBI.

The total investment proposals received by all the States and UTs since the inception of economic reforms in August 1991 till the end of March, 2000 are worth Rs.908, 888 crore. The percentage share of dissimilar

States in these investment proposals is given in column 2 of Table 6. The disparities are obvious. The group of forward States accounted for two-third of the amount while the group of backward States accounted for just over 27 per cent of the amount. Indeed, Gujarat and Maharashtra together accounted for 39 per cent of the investment proposals, which is significantly more than the total investment proposals received by all the States in the second group. While Gujarat which accounted for less than 5 per cent of the population of the country, received over 17 per cent of the private investment proposals; Bihar which accounts for more than 10 per cent of the population of the country, received just a little over one per cent of such proposals. This is a clear pointer to the direction of private investment in the coming years.

The cumulative share of financial assistance disbursed by all India Financial Institutions upto March end 1999, State-wise, are given in column 3 of Table 6. The great divide between forward and backward States is clear. Maharashtra alone received almost as much financial assistance as all the States in the second group put together. It may, however, be noted that Mumbai is the headquarters of a large number of private companies in the country, it is possible that some of the financial assistance accounted for as Maharashtra's may be actually flowing into other States for actual investment. Here again, the shares of States like Assam, Bihar and Orissa are far below their respective population shares. These numbers give a clear indication as to where the resources mobilized through the all India financial institutions are flowing into.

The last column of Table 6 gives the share of cumulative financial assistance provided by the State financial corporations during 1991-99. The pattern is not any dissimilar from the other sources of financing private investment as far as the State-wise distribution is concerned. While over two-thirds of such assistance are provided by the financial corporations in the forward States, just 29.1 per cent is accounted for by all the States in the backward group.

The State-wise details of banking operations in the country as on March 31, 2000 are presented in Table 7. Column two gives the State-wise distribution of bank branches in the country. It is obvious that, by and large, the bank branches are fairly distributed across the States without any major bias towards the group of forward States. It may need to mention that this could be attributed to the banking sector policies pursued after nationalization of the major commercial banks in the country in 1969.

Table 7

Bank Branches, Deposits and Bank Credit

(As on 31st March, 2000)

Sl. No.	State	Bank Branches	Share of bank deposits	Share of bank credit	Credit-deposit ratio
1	2	3	4	5	6
1	Andhra Pradesh	5102	5.3	6.9	63.8
2	Gujarat	3626	5.9	5.1	49.8
3	Haryana	1492	2.1	1.6	41.4
4	Karnataka	4697	5.4	6.6	61.0
5	Kerala	3231	4.6	3.7	42.3
6	Maharashtra	6205	19.9	25.9	83.8
7	Punjab	2498	4.6	3.2	39.1
8	Tamil Nadu	4736	6.6	11.5	88.0
Sub-total (1 to 8)		31587 (48.3)	54.4	64.5	
9	Assam	1229	1.0	0.6	31.5
10	Bihar	4992	4.3	2.1	22.5
11	Madhya Pradesh	4472	3.9	3.6	49.2
12	Orissa	2216	1.5	1.2	39.8
13	Rajasthan	3306	2.8	2.4	46.7
14	Uttar Pradesh	8855	9.9	5.1	27.5
15	West Bengal	4382	7.5	6.2	45.2
Sub-total (9 to 15)		29452 (45.1)	30.9	21.2	

All India	65340	100	100	57.1
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Source: RBI, Report on Trend and Progress of Banking in India, 1999-2000.

The shares of dissimilar States in bank deposits as on March 31, 2000 are given in column 3 of Table 7. The interstate and regional disparities are obvious from these data. The group of forward States accounts for over 54 per cent of the bank deposits while the group of backward States accounts for only about 31 per cent of the bank deposits. Maharashtra alone accounts for about 20 per cent of the bank deposits.

The distribution of bank credit across the States given in column 4 of Table 7 shows that bank credit distribution is even more skewed than bank deposit distribution. This implies that a part of the deposit mobilized in the backward States is getting transferred to the advanced States. While the first group of States accounted for about 65 per cent of the bank credit, the second group of States could receive only about 21 per cent of the bank credit. Indeed, Maharashtra alone accounted for more bank credit than all the seven States in the second group put together. Similarly, all the States in the second group, except Uttar Pradesh and West Bengal, put together received less bank credit than Tamil Nadu. The implications of such skewed distribution of bank credit across the States on economic growth and income distribution in the coming years are obvious. The fact that Maharashtra and Tamil Nadu have major metros in them might have helped them to get a higher share of bank credit. Having Calcutta as the State capital might have helped West Bengal also somewhat. In this connection, it may be of interest to note that all the 15 States considered together which account for 96.5 per cent of the population of the country accounted for only around 85 per cent of bank deposit and bank credit. The fact that the remaining 15 per cent have gone to the minor States and UTs may be somewhat surprising. This, however, is because of NCT of Delhi accounting for over 10 per cent of bank deposits and bank credit.

The last column of the Table gives the credit-deposit ratios for dissimilar States. Credit-deposit ratio captures the discrepancy in credit absorption vis-a-vis deposit mobilization. Exceptions apart, credit-deposit ratios are much more favorable to the group of forward States as compared to the backward States.

4.2.3 Intrastate Disparities

In the foregoing sections, we have examined the various dimensions of interstate disparities. An important aspect of regional disparities in India, which could not be covered by this approach, is the significant level of regional disparities, which exist within dissimilar States. An important cause of regional tensions which lead to popular agitation and at times militant activities is such regional disparities in economic and social development which exist within some of the States. Indeed, creation of some of the States in the past was in the wake of popular agitation based on perceived neglect of certain

backward areas in some of the bigger States. The best examples of such cases are the creation of Andhra Pradesh and Gujarat in the Fifties and creation of Punjab, Haryana and Himachal Pradesh in the Sixties. The latest example is the creation of three new States carved out from an existing larger State viz., Madhya Pradesh, Bihar and Uttar Pradesh respectively. The past experience, by and large, is that when two or more States are carved out from an existing one or a new State is created by combining parts from more than one State on the basis of some homogeneity criterion like language or some other common heritage, the newly created States develop faster than the pre-partition States.

A number of States included in our analysis have clearly identified areas which are at dissimilar stages of development and which have distinct problems to tackle. Creation of new States, certainly, may not be a solution to such regional disparities. At the same time, it is important to recognize such intrastate regional disparities explicitly and tackle them through special efforts. As we have noted in an earlier section, Maharashtra is a typical example of a State where overall development is quite good in terms of almost all indicators, but extreme regional disparities exist. Andhra Pradesh has three distinct areas which are at dissimilar stages of socioeconomic development, viz. Coastal Andhra, Telangana and Rayalaseema. Similarly, North Bihar and South Bihar before the State reorganization in 2000 were at dissimilar stages of development with entirely dissimilar problems. Uttar Pradesh, even after carving out Uttaranchal, has at least three areas with varying problems and dissimilar levels of socioeconomic development. Other States like Gujarat, Karnataka, Madhya Pradesh, Orissa, Rajasthan and West Bengal also have areas with distinct characteristics of backwardness.

A closer examination of the nature of backward areas in each State will indicate specific reasons for their backwardness. The major cause of backwardness of Vidharba and Marathwada in Maharashtra, Rayalaseema and Telangana in Andhra Pradesh and Northern Karnataka is the scarcity of water due to lower precipitation and lack of other perennial sources of water. On the other hand, the backwardness of certain areas in Gujarat, Madhya Pradesh, Bihar and Orissa can be associated with the distinct style of living of the inhabitants of such areas who are mostly trivial and the neglect of such areas by the ruling elite. Topography of a area could also constrain the development of that area ; the desert area of Rajasthan is an example of such a case. Historical factors like the attitude of rulers of the former Princely States towards development could have significantly affected the development of an area . For example, the distinctly higher level of social development of the Travancore and Cochin areas of Kerala can be traced back to the enlightened attitude of the former rulers of the Princely States of Travancore and Cochin. On the other hand, the poor social development of a Telangana area of AP and certain other parts of the Deccan could be traced back to the absence of visionary rulers in the respective princely States.

An important question, however, is why after 50 years of planned development efforts, such intrastate disparities remain unattended? Often, the answer depends on whether it is given by people who are the victims of underdevelopment or not. The representatives of the backward areas often attribute the cause of their backwardness as neglect on the part of the rulers of the State, who are often from the well heeled areas. The ruling class may come up with any number of explanations for the underdevelopment of backward areas, which are beyond their control. Indeed, there are specific institutional arrangements for development of backward areas in some of the States. Maharashtra and Uttar Pradesh (before State reorganization) are two such examples. In Maharashtra, there are separate regional plans for the backward areas. In Uttar Pradesh, there was a separate regional plan for the hill area which is characterized as Uttarkhand.

Besides the State-specific efforts for reducing intrastate regional disparities, a number of Centrally Sponsored Programs have been in operation for the last two to three decades for taking care of specific aspects of backwardness of such areas. The Tribal Development Program, the Hill Area Development Program, the Western Ghat Development Program, the Drought Prone Area Program and Desert Development Program are examples of such ongoing efforts. The evaluation studies of some of these programs have indicated clearly identifiable benefits of such programs, though at the same time criticized these programs for their cost-ineffectiveness due to various drawbacks in their design, planning and implementation. Often they are conceived, planned and implemented by the bureaucracy without any involvement of the local people. More often, discontent and agitation on the basis of perceived neglect of the backward areas by the rulers at the State level and at the Centre are led by local leaders who demand some form of autonomy to determine their own destiny. Even those who demand separate State for their area are often willing to settle for autonomous areas within the existing State with considerable financial and administrative powers. The problem, however, is that the State level rulers are generally unwilling to part with their own power of patronage. Those who demand more autonomy for the States from the Centre are often unwilling to share power, either administrative or financial, with the elected local bodies. Indeed, with the 73rd Amendment Act of the Constitution, the Panchayat Raj Institutions were expected to function as local governments with sufficient finances and functions to take care of most of the developmental functions. If they are allowed to function as responsible self-governing local governments, considerable ground can be covered to reduce the regional disparities within the States.

Before concluding this Section, we may mention a few successful cases, where intrastate regional disparities have been reduced considerably through public policies. First, in 1956 when Kerala was formed at the time of State re-organization, there was substantial Imbalance in the social development of the Malabar area vis-a-vis the Travancore-Cochin area. Over the last four decades, there has been remarkable improvement in the social indicators of Malabar to catch up with the rest of Kerala as a result

of appropriate public policies. The development of the drought prone districts of Haryana through irrigation is another remarkable example of reduction in economic disparities across the areas within a State. Provision of education, health and communication facilities even in the remotest villages of Himachal Pradesh is a third example of successful public policies in reduction of regional disparities within a State. Overall, Tamil Nadu could be considered as one State which is most successful in reducing regional disparities in economic and social development even when there was substantial variation in the natural endowments in dissimilar parts of the State. This was achieved by a combination of public policies and private initiatives. In other States, especially in Maharashtra, Gujarat and Rajasthan, there are a number of successful cases of NGOs which succeeded in transforming pockets of destitution into areas enjoying very high levels of socioeconomic development.

4.2.41 Profile of Regional Disparities for Dissimilar Growth Scenarios 2025

An analysis of the historical trends, especially the more recent trends, leads to the inevitable inference that regional disparities are bound to aggregate in the coming decades. Areas, which are characterized as backward in our foregoing discussions, have very weak growth impulses.

Their demographic disadvantage is implicit in the fact that major States in this area, viz., Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh are likely to have fertility rates exceeding the replacement level well beyond 2025, a level which some of the forward States like Kerala and Tamil Nadu have already achieved and others are expected to achieve within a decade or so. We have noted that if the current trend is projected, Madhya Pradesh will reach replacement level only by 2060, and Uttar Pradesh only by 2100.

The implications of these divergent demographic trends on population density, employment opportunities, social sector investments and the overall development can be extremely grave. One of the major objectives of development planning initiated immediately after Independence has been, among others, reduction of regional disparities in social and economic development. Direct investment by the Central Government and Centrally directed investment of the private sector have been two powerful instruments to achieve this objective.

During the first four decades of development planning, most of the larger units in basic and heavy industries were set up in the public sector in a regional well-balanced manner. Indeed, their location, other things being equal, was biased towards backward areas as natural endowments such as mineral deposits were concentrated in those areas. Massive public investments have been made to provide economic and social infrastructure in the backward areas to accelerate their overall development.

The natural tendency of the private sector is to set up industries and other related activities in developing areas. To counterbalance this tendency, various incentives and disincentive schemes have been

introduced as public policies to direct private investments to backward areas. The freight equalization scheme has been just one of them.

The efforts of the first four decades of planned development to reduce various imbalances across the areas have been only partially successful. At best they have ensured that regional disparities in terms of various indicators of development are not aggravating. Of course, even this is no mean achievement.

Economic reforms initiated in 1991 implied among, other things, that the private sector would be the principal engine of economic growth. Most of the restrictions on private investment have been removed. The mounting debt burden of the government has imposed a cap on public investment. As a result, while there was a significant increase in the quantum of private investment, there was a sharp fall in the public investment over the last decade.

The flow of private investment, both domestic and foreign, has been extremely biased in favor of the more developed areas of the country. This has enabled the developed areas to achieve accelerated economic growth during the 1990s. On the other hand, backward areas of the country, which were unable to attract any significant private investment flows, experienced decelerated economic growth during this period.

The net result of this divergent growth performance of the developed and backward areas has been a widening of the regional disparities in the country in terms of per capita income and other indicators of well-being of the people.

The ability of the governments at the Centre and in the States to counter this trend by effecting countervailing public investment also has been reduced considerably. In the context of macro-economic stabilization policies initiated in 1991, the ability of the Centre to finance public investment by borrowings has been severely constrained. Revenues of the Centre also experienced reduced buoyancy in the wake of tax reforms especially due to reduction in customs tariff to levels comparable to those of our trading partners.

The factors which attracted more and more private investments to developed areas have been their better developed economic and social infrastructure as well as more efficient and investor friendly State governments. The backward areas, to be attractive to the private investors, have to improve their infrastructure facilities, both economic and social, considerably. This needs substantial public investment. The State governments in the backward areas are, however, strapped for funds even to meet the current expenditure.

Almost all the State governments in the backward areas find that their entire revenues are not sufficient to meet even the committed revenue expenditure like interest liability, salaries and pensions. A sizable share of their borrowings is diverted to fill the gap between the revenue receipts and revenue expenditure.

The adverse impacts of the deteriorating State finances are much more severe for the backward States as compared to the developed States, where investments of the past have created adequate social and economic infrastructure to attract private investments. The backward States are facing multiple dilemma. They are not able to attract investments due to lack of infrastructure. They are not in a position to provide these facilities on their own due to lack of investible funds. Unlike in the past, the Centre is not in a position to help them either as the Centre itself has a serious fiscal constraint.

Along with social and economic infrastructure, efficiency of administration and the quality of governance including law and order situation are important factors in attracting private investment. Studies conducted by NCAER and some of the apex associations of industries have indicated that prospective investors give higher weight-age to these factors than various incentives, including fiscal incentives offered by the State governments. Indeed, there are enough evidences to the effect that the investors don't mind paying speed money to get things done fast. In other words, a corrupt but efficient regime is preferred to an honest but inefficient regimes in the context of investment decisions. Other aspects of governance like the law and order situation, trade union activism, etc., are also important factors affecting the flow of private investments.

On almost all indicators of governance discussed above, the backward States are at a disadvantage. Indeed, even perceptions about the governance issues based on past may haunt the States in such matters. The cases of Kerala and West Bengal are typical in this regard. All the efforts of these two States during the last decade to woo the investors, both domestic and foreign, have not yielded any significant results. This was mainly on account of the general perception of investors that these States are dens of militant trade union activism, though in reality such militancy, of late, has been significantly subdued in these States.

To conclude this, it will be appropriate to state that there are hardly any signs of reversing the recent trend of accentuating regional disparities in the country in the coming decades. Indeed, almost all the relevant forces are such that the disparities are likely to widen deriving the next quarter century. It will require Herculean tasks on the part of the Centre and the leadership in the concerned areas to ensure that the gap does not widen further.

4.2.5 Impact on political, social and economic stability

It comes out clearly from the discussions in the preceding section that if the past trends, especially those of the recent past continued for the next two decades or so; India will be a highly uneven nation in terms of various dimensions of public life. Incomes and living standards will vary considerably across the nation. People in most of the southern and western parts of the country will be enjoying fairly high per capita incomes, which may be comparable to those of middle income developed countries today. More than half of the people in this part of the country will be living in cities and towns with all modern facilities. Even in rural areas amenities of modern life and reasonably efficient civic facilities will be available. Almost all the children of school-going ages will be attending school. There will be hardly any difference between boys and girls in school. The gender difference in literacy will have almost disappeared. Population growth might have come down below replacement level in all the States in this area. A few States like Kerala and Tamil Nadu might have reached stable population level. The average health and nutrition level might have increased significantly. Life expectancy in all States of this area might have crossed 70, both for men and women.

The sectoral employment and incomes will have changed considerably. The share of farming in the State domestic product will be 10 to 20 per cent in dissimilar States and the population dependent on farming will be 20 to 40 per cent. The share of tertiary sector in employment and income will have increased significantly and accounting for 30 to 40 per cent of employment and 50 to 60 per cent of income. Secondary sector will account for the balance.

On the whole, the productivity of labor will be increased substantially in all the sectors mainly on account of new technologies and skill-endowed labor forces. As a result of secular economic growth of 8 to 10 per cent for over two decades and negligible population growth, per capita incomes in the area will have nearly quadrupled as compared to today. Even in farming, which would have been highly diversified and market-oriented, incomes will have gone up significantly. Also, because of effective watershed management, even in the drought prone areas, yearly fluctuations of agricultural output will have been minimal.

Abject poverty and deprivations will be unheard of. An effective food security and social security administered by the village Panchayats takes care of the needs of the poor. The Panchayats will administer most of the civic facilities as well as social and economic infrastructure and services. A similar situation will prevail in the urban areas also. One of the major problems in the larger cities,

however, will be ensuring civic facilities and housing for the migrant labor from the other parts of the country.

4.2.2.6 Policy initiatives for balanced regional growth

We shall initiate the discussion on initiatives for balanced regional growth by illustrating two instances of initiatives in the past. One relates to farming and the other relates to industry, the two most important sectors of our economy. The strategy to boost agricultural production and to ensure food security was evolved in the mid-Sixties when the country faced a grim situation following two consequent years of severe drought. The strategy consisted of various incentives to farmers to adopt high yielding seeds of wheat and paddy along with complementary inputs, assured minimum support prices for the output, buffer stocking of the food grains and supplying the same to the States to distribute through the public distribution system (PDS) to the consumers, especially in the deficit areas. To back up this strategy, institutions like Agricultural Prices Commission (APC), Food Corporation of India (FCI) and Warehousing Corporation of India and other ancillary institutions were established. Arrangements were made to spread the message of high yielding seeds and the associated package of inputs and practices.

The above strategy ushered in a green revolution, which resulted in doubling of wheat and rice production in the country over a short period. Adequate foodgrains surpluses were generated to build up the needed buffer stock. India was no more a 'basket case'.

The initial success of the green revolution strategy was restricted to Punjab, Haryana and western Uttar Pradesh where assured irrigation networks already existed. Subsequently it was extended to a few irrigation commands in the South and West also. It was, however, expected that with the expansion of assured irrigation the green revolution would spread to other parts of the country soon. In the event this did not happen. Even today almost the entire foodgrain surpluses are generated by the small area, which benefited initially. Though massive public funds are spent on food subsidies, very little is spent on spreading irrigation. Besides food subsidies, large implicit subsidies to farmers for power, diesel, canal irrigation, fertilizer and credit are born by the public exchequer at the Centre and in the States.

Agricultural Price Policy which was evolved by APC to ensure adequate protection to the interests of the producers and consumers has been 'hijacked' to serve the interests of the large farmers who produce for the market. It hardly serves the interests of farmers in the emerging surplus areas. The distinction between support price and procurement price is no more there. Similarly, the Food Corporation of India and the associated procurement agencies operate, by and large, only in the traditional surplus areas and farmers in newly emerging surplus areas almost invariably end up selling their surpluses in distress.

Today the foodgrain management and the food security system are near collapse. As against a total requirement of 24 million tonnes of foodgrain for buffer stock and PDS together, the public stock is over 60 million tonnes as on July 1,2001. A substantial share of this is not even properly stored and may not be suitable for human consumption. On the other hand due to severe drought conditions large scale unemployment and hunger are reported from several States. Per capita net availability in the market has come down. PDS system has virtually collapsed. Poor people cannot afford the 'so called economic price' of food grains available in the PDS shops.

This is a classic case of a public policy evolved with much thought and resulted in significant gains in the country, as a whole, for several years initially but gone sore subsequently. Instead of adjusting the agricultural and food security policies to expand the scope of green revolution technology to the other areas of the country, they were allowed to be hijacked by vested interests.

The other example of a major public policy, which had gone sour after initial success is the industrial policy. In the Fifties, when India initiated a policy of import substitution by starting various industries in key sectors there were very few critics both within the country and abroad. Indeed, the industrial policy embedded in the second Five Year Plan, giving emphasis to basic and heavy industries, was lauded equally by Russian experts as well as western experts. That policy enabled the country to lay the foundations of an industrial base.

Gradually the ills of public sector undertakings and the stifling effects of a market without competition became more and more evident. By late Sixties and early Seventies, several perceptive observers noted that there was a need to deregulate the industrial sector to allow competition. The government, instead, went ahead with the nationalization of more and more key sectors of the economy and also further throttling of the private sector to control concentration of wealth and industrial power. The result was further retrogression and immiserization of the economy.

The above two examples have been described in some detail to make the important point that major public policies initiated with thought and foresight and which initially yielded results, subsequently generated into a fiefdom of powerful vested interests who will try all the triads in their trade to frustrate corrective measures. Kulaks and the so-called 'Deshi' industrialists who benefited from 'license-permit raj' are not the only vested interests who stand in the way of programs and reduction in regional disparities. The list includes politicians, trade unions, bureaucracy, various monopolists in the economy and the educated intelligent who occupy positions of power and patronage. Most of them collect one kind

of 'rent' or other which they are not willing to give up only when there is a crisis they will loosen their stranglehold, that too only a few which will suffice to defuse the crisis.

The economic reforms initiated in 1991 were also essentially a crisis driven. It was the international payment crisis which forced the country to carry out deregulation of trade and industry. Again, once the crisis was overcome reforms also slowed down. There are several vital areas of reforms, which we were talking about for the last one decade without doing much—public sector reforms, reform of labor laws, reform of the legal system, establishment of effective regulatory bodies and so on. Again, it is the politicians, the bureaucrats, the 'Deshi' industrialists and the trade union leaders who are standing in the way. They do not want to give up the powers, perks and monopoly profits, which they have been enjoying.

The main interest of the foreigners in India is its large potential market. Unless the rural incomes grow, especially in the backward areas this potential market will not be realized. Corporate India must realize that its future lies with the masses. Raising rural incomes should no longer be looked upon only as a philanthropic objective.

Also reduction of regional disparities should be looked upon as a national objective. The strength of a building depends on the strength of its weakest pillar. In a similar way the strength of the Indian economy depends on the strength of the economy of Bihar. Similarly, the bottom line of India's human development will depend on the incomes and social-demographic indicators of development in northern and eastern India.

While the development of depressed areas is a national responsibility, the solution mainly rests with the local leadership. Unless the local leadership—political, bureaucratic and intellectual—resolve to usher in development based on sharing the gains on an egalitarian basis with the masses, results will be hard to come by. Resources are not the real constraint. It is the way resources are spent. Large sums are spent on education and health care in the backward States. But the results are not there. This happens because the teachers and medical personnel who are expected to provide the requisite services draw their salaries but provide poor services or no services. Unless this kind of work culture in public service changes, funds alone will not solve the problems.

Lastly, with divergent trends in various sectors of development, there emerges a resistance to vertical and horizontal fund transfers to the backward areas by forward areas. Immediately after the report of the Eleventh Finance Commission there was an uproar from the so-called 'performing States' against

increased tax revenue devolution to the backward States. One of the main arguments was that non-performing States are rewarded for their non-performance. It is imperative that the Centre and the leadership of the backward States should evolve institutional arrangements to ensure that funds transferred resulting in the best use in terms of development.

4.3 Poverty, population explosion, globalization, social & ethnic tension.

4.3.1 Poverty

Poverty is a social phenomenon and can be defined as a situation in which a section of the society is unable to fulfill even its basic minimum requirement of life. The poverty has two concepts: (a) absolute poverty and (b) relative poverty.

In case of absolute poverty we include the people who have not reached a certain minimum standard of consumption and are regarded as poor.

On the other hand, relative poverty is a comparative concept in which a section of people are relatively poor in comparison to another section of the society. It deals with inequality in the distribution of wealth. The countries of the Third World show the existence of mass poverty, although pockets of poverty are also found in the developed countries.

4.3.1.1 Measurement:

The Planning Commission set up a Study Group in July 1962 to examine the question of poverty in the country. The Study Group suggested a private consumption expenditure of Rs. 20 (at 1960-61 prices) per capita per month as a basic minimum requirement of life, below which are regarded as poor.

In 1979, following the recommendation of the Task Force on Projection of Minimum Needs and Effective Consumption Demand, the poverty line is defined as "the per capita monthly expenditure needed to obtain the consumption of 2,400 calories per-capita per day in rural areas and 2,100 in urban areas in the base year 1973-74." The poverty line so definitely was Rs. 49.10 for rural areas and Rs. 56.60 for urban areas. The same poverty line was updated for subsequent years using stable indicators of changes in the cost of living.

4.3.1.2 Causes of Poverty:

The basic causes of poverty in India are as follows:

(1) Colonial Exploitation:

During the British administration, the industrial sector of the economy was completely destroyed. The people were bound to depend on farming. The man-land ratio declined giving rise to widespread underemployment and disguised unemployment.

Further the Britishers compelled the poor farmers to sell their product at a lower price and sold the British industrial product at a higher price in Indian soil, and accordingly exploited the Indians. Gradually the country became pauperized and the extent of poverty increased with the passage of time during colonial administration.

2. Under development:

Due to under-development and non-economic utilization of natural and human resources, people in the country are not able to get a square meal per day.

3. Inequality:

Inequality in the distribution of wealth and income is another factor responsible for the abject poverty situation in the country. While large sections of the people are poor, wealth and productive assets have been concentrated in a few hands.

4. Unemployment:

Lack of employment opportunity is one of the basic causes of poverty. Due to unemployment, there is a lack of purchasing power, effective demand by the people. This in turn results in low investment, low production and again in low income. So Nukes have rightly said: "A country is poor because it is poor."

5. High Growth Rate of Population:

Growth of the population is another factor responsible for poverty in India. The slow growth of income accompanied by a higher population growth reduces the per capita income and consumption expenditure and thus increases poverty.

6. Regional Imbalance:

There are extreme regional disparities leading to a grinding poverty situation against the prosperity of others. States like Punjab and Haryana are richer in comparison to Bihar, Orissa and Madhya Pradesh.

7. Capital Deficiency:

Due to shortage of capital, better technique of production could not be implemented in the economy. Consequently the productivity and efficiency of labor became less leading to low income and poverty situation.

8. Low technology:

Due to the adoption of a low level of technology, the volume of production and productivity is also equally low, leading to a mass poverty situation.

9. Social factors:

Due to socio-cultural factors, people in India spend a large portion of their income extravagantly. Expenditure on marriage, religious ceremonies etc. forces them to borrow from non- institutional sources

at a higher rate of interest. The early marriage system, joint family system, low level of education also account for the mass poverty situation.

4.3.1.3 Poverty Alleviation Programs:

The authorities in the country have tried to reduce the incidence of poverty in the country even since independence. A large number of programs have been experimented in the Indian soil to combat with poverty. Beginning with Community Development Programs in 1950s and traversing through farming - oriented programs (HYVP, MYGP, IADP) and target-oriented programs (SFDA, MFAL, PIDEP, ITDP), programs knows no bound. The most of the programs have been designed either according to the suggestion of the ILO or World Bank. Some of the major programs recently undertaken are as follows:

1. IRDP:

The Integrated Rural Development Program was implemented in the country during 1979, in this program development is the objective, integration is the approach and the rural poor are the focus of attraction. The program aimed at

- (i) Bringing integration among dissimilar sectors (farming , industry, service) of the economy;
- (ii) Bringing an integration among dissimilar areas (rural-urban) of the economy; and
- (iii) Bringing integration among dissimilar governmental departments (education. health, farming) of the Govt. in order to provide systematically the gains from development to the rural poors.

The program has been evaluated by dissimilar independent research institutions and also through CES (Concurrent Evaluation Studies) and necessary steps has been taken to increase its efficiency.

2. TRYSEM:

TRYSEM was also introduced in 1979 to provide technical skills and to upgrade traditional skills of rural youth belonging to rural families. The objective was to make the rural youth able to get self-employment through increased skill and efficiency.

3. NREP:

The National Rural Employment Program was launched in October 1980 to increase rural employment. It started as a centrally sponsored scheme with Centre providing 50% of expenses and the remaining half to be provided by the State in order generate gainful employment opportunity. Create durable community assets and to improve overall quality of the life of the people.

4. JRY:

Jawahar Rozgar Yojana started in 1989 by merging the NREP and RLEGP programs. The basic objective of the program is to generate additional employment opportunity in the countryside, strengthening the rural infrastructure and to have a steady rise in income of the people of rural areas.

5. PMRY:

The Prime Minister's Rozgar Yojana was launched in 1993-94 to provide employment to more than one million persons by setting up seven lakh micro-enterprises during the 8th Plan in industry, service and business. The scheme covered urban areas in 1993-94 and was subsequently extended to the rural areas. The scheme of Self-Employment for Educated Unemployed Youth (SEEUY) has been integrated with PMRY. The scheme provides concessional loans and training for the small entrepreneurs of the country.

6. Development of Women and Children:

Several programs have been undertaken for the development of children and women in the economy. Their basic objective is to increase the employment for women and a better working condition for them. The schemes include Support to Training and Employment Program for women (STEP), Integrated Child Development Services (ICDS), and etc.

4.3.2 Population explosion

India's population has already crossed the billion marks. Thus, the country having only on 2.4 per cent of the globe's area has come to hold 16 per cent of globe's human beings. Its current annual increase of 16 million is the highest in the world. Soon we may achieve the dubious distinction of becoming the most populous country in the world.

The debate about population explosion in India is now over half a century old. It acquired a new perspective when the 2000 National Population Policy (NPP) was drafted. There was a marked shift from the target-oriented approach of the 70's and 80's to the one that envisioned the 'development is the best pill' outlook.

The demographics experts, women's groups, health organizations, social activists and academicians were able to convince the policy makers that in order to achieve the socio- demographic goals for the reduction of inequalities, provision of education, services and creation of awareness were to be taken on a priority.

The main causes of big size and high growth of population can be broadly categorized into social and economic causes which are as below:

- (i) Marriage is almost inevitable among men and women;
- (ii) Motherhood is nearly universal among married women;
- (iii) The custom of early marriage followed since many centuries has facilitated a wider range of reproductive period;
- (iv) The Net Production Rate (NPR) is greater than one, which means that women replace themselves by giving birth to more than one daughter which leads to constant rise in birth rate;
- (v) Wide-spread illiteracy among people, especially woman is also a major contributor.

It has been proved that there is a direct relation between illiteracy and fertility; (vi) Superstitious beliefs and myths that a male child is a must for salvation, social security and continuation of the family tree; and (vii) Misconceptions that the use of birth control measures lead to diseases, defects or general weakness.

The economic causes include (i) Children are considered to be an asset not a liability by the poor who look at them as a source of income; (ii) Statistics also prove that the cost benefit ratio for a child is favorable to the poor; (iii) Lack of proper medical facilities and high mortality rate of infant to want more children; and (iv) There is also a total lack of economic security for widows and elderly people which makes people go for children as economic security.

There are other reasons which cannot be classified as either social or economic reasons like lack of proper family planning techniques and facilities, high birth rate and low death rate.

Overpopulation has far-reaching consequences on every aspect of life of a country. These consequences will have to be studied at length before we can find appropriate measures to stem the root.

Overpopulation not only leads to but also perpetuates poverty. The economists are of the opinion that there are four main factors that make a country rich or poor:

1. National factors like location features and mineral resources available in the country.
2. Historical factors, i.e. whether a country has remained a colony of some other country and has suffered long economic exploitation, e.g. India under British rule.
3. Demographic factors, i.e. the size and growth of population.
4. Economic factors, i.e. availability of capital, technology, infrastructure, etc.

The demographic factors assume greater importance because natural factors remain constant and history cannot be changed. The large size of the population means the employment of the lion's share of the resources for the production of goods for the satisfaction of the basic needs of food, clothing and shelter. The high rate of growth of population means continuing additional burden on these resources.

It is only due to unfavorable demographic factors that poor countries remain in perpetual poverty. The per capita income which is the indicator of richness of a country does not increase even with an increase in total income because the population which is a divisor in this equation also increases. The economists affirmation that surest way for a poor country is to increase its productive capacity by producing more capital goods like machinery. But as the overpopulated countries need consumer goods in large quantities to satisfy people's wants it becomes difficult for them to employ their resources for the producing 'producer' goods and thus they remain under the vicious circle of poverty.

Another drawback of population explosion is that it makes all plans made for development of the country go haywire. Our own country created an autonomous Planning Commission and started a series of Five-Year Plans from the year 1951-52. But we have not been able to bring rapid development because our population which was 36.11 crore in 1951 has grown about three times today at approx. 108 crores. Naturally any development plan made for one person cannot be adequate for three.

The age composition of our population is also not favorable. It has been found that the working age group constitutes 60% of the total population falls in the dependent age groups of a high dependency ratio of 67% calculated as follows:

If we take into account the unemployment disguised unemployment and quasi unemployment into factor this would present a gloomier picture of our economy. Still further, if we consider that a high portion of those who are engaged in some type of work or the other are not technically trained and fall in the category of unskilled labor, we shall realize that our productive capacity is quite low. Under such conditions a high growth of population adds to the burden of our economy.

The large size of the population also has an adverse impact on our natural resources. Coal, petroleum, natural gas, minerals and forests are being excessively used to set up more industries to manufacture various consumable articles to satisfy ever-increasing wants. As these resources are limited and exhaustible, they have been dwindling so drastically that soon they would exhaust completely. Forests are being cleared to bring more land under cultivation to provide food for the increasing population and to make more settlements for their living.

Burning of fossil fuels in factories, vehicles and households has created another menace of environmental pollution. Injudicious use of water resources like rivers, like ponds, wells, streams and even oceans have caused water pollution. Many diseases have arisen to afflict human beings and affect vegetation as it is, the deforestation is likely to continue unabated which would further aggravate the problem.

Yet another problem is the migration of rural people to urban areas in search of better earning opportunities. The statistics show an alarming increase of 57% from 34% after independence. The crowding of urban localities demands more infrastructure, civic services, transport, health, sanitation and educational facilities providing which is not only a challenging task but also means an additional burden on the already inadequate economic resources.

As the stabilization of population is the most significant task ahead of us, stringent measures are required in this direction. Some countries have sought to enforce legal remedies for this chronic malady. For example, China has applied the one child norm. Some Indian states has barred the candidates having more than two children from any election. Such strict measures may work but their side effects may outweigh their benefits to society and the country.

We need to address the problem of overpopulation in the broader sense and in a socially controlled way. This can be done by creating awareness among people and providing them the required means.

4.3.3 Globalization

In the heyday of the Industrial Revolution slogan raised by the British was 'Industrialize or Perish'. Now, in the era of globalization the slogan has been changed into 'Globalise and Perish'. There is a TINA (There is no alternative) syndrome. Countries know that by globalizing they will suffer, their problems will mount up but they feel that there are no choices or alternatives.

In this context one has to analyze 'globalization'. The idea became popular when media pundit Marshal McLuhan spotted the global village on the horizon. It was a destination to be reached. At that time many welcomed and few dreaded the prospect. Since then a phenomenal change has taken place in the world as well as in India.

India is one of the civilized countries in the world. It has a rich cultural heritage. It has seven cultural zones and fifty eight sub-cultural zones. Language changes every twenty miles in India. All the major religions of the world peacefully co-exist in India. The socio-cultural backbone of the country was broken due to more than a thousand years of foreign rule. Though the British were the last to rule the country, they have made both positive and negative contributions. Political integration was possible because of rule British rule and we could also learn about the nuances of modern democratic order. But the British colonial policy also weakened us. The drain of resources kept us impoverished. Its policy of divide and rule spread the culture of violence and made us vulnerable to the never-ending threat of communalism.

The modern state in India was born during British rule. After independence the modern state was built mostly on the western models. Though the people of India had a launched a very well organized nationalist struggle the ethos of the struggle got era led by the new rulers tasting power and privilege in free India.

The challenges of new India could not be perceived by an organized political community but by political opposition only. Civil Society is a political community having civic virtues. Civicness makes society civil. A sense of group living, group engagements and interactions among individuals for their common interests constitute the major features of civil society. It is the sphere in which a community enjoys

independence and acquires the strength to organize itself to realize common good, in fact civil society is defined as the capacity of a political community to organize itself independent of specific directions of state power. Thus civil society is more dependent upon the political culture and the character of a society. Since it is a group conduct the civil society has associational roots. It stands outside the boundary of the state. The state is rather a product of it. The relationship between the state and civil society is a mutual one. The attitude of the state towards civil society provides recognition of such group action and formation. The state also depends upon civil society. The political reforms of a state can yield better results when these are jointly carried out by the state and civil society According to Tocqueville, governmental bodies with a firm footing in the local community make an ideal breeding ground for democratic civil endeavors. The state cannot be abstracted from civil society and vice-versa.

Civil society combines in itself social capital, civic engagements and voluntary associations which share common concerns. Both civil society and the state are complimentary to each other-Each has to care for the other. But in the contemporary world we perceive conflict between the state and civil society. It is because of the intrusion of the state into the sphere of civil society. If the interests of the majority of civil society are ignored because of authoritative allocation of values in the political system, a situation of conflict between civil society and the state arises. Civil society reacts against decisions made and policies formulated by the apparatus of the state. It actively exerts pressure upon the state to change its decision which is inimical to the interests of the community. Without such alertness the state cannot survive. Civil society is expected to keep a vigil on the growing encroachments made or attempted by the state. The need for the right to Information, accountability and transparency is stressed. Thus a democratic state needs a democratically organized civil society in order for it to succeed. With this hope had new India started forming a government by consent.

The political economy of public policy making in India is a peculiar one. It adopted both Community Development and planned economic development as methods to achieve the twin objectives of growth and social justice. During the Nehruvian era it pursued a policy of welfare, which was centered on subsidy. When Mrs. Gandhi came to power, the welfare approach was replaced by development. This created a functioning state everywhere. But due to the absence of proper civil society consciousness led to bureaucratisation and corruption. Rajeev Gandhi replaced development by empowering, which aimed at giving power to the people. The old gram Panchayat system was revived in order to provide both planning and implementation to the democratically organized lower echelons of the society.

The power to the people is a welcome approach. It is what civil society was striving for. But the background to this approach was mysterious. The failure of centralized planning and rise of theoretical approaches to rural development prompted the think-tank of the policy making apparatus for policy ramification.

At this juncture globalization comes both as a threat and benefit. When globalization is viewed from its role it is observed that there is both interpenetration and integration. At the same time ethnic formations are also observed. This syndrome can be talked as a dual transformation. Supra-national integration and sub-national disintegration. The terminology is better understood as 'GLOBALISATION'.

Let us examine the impact of globalization on India's society. Polity and Economy. India in early 1990s was in deep debt crises. Its credibility was very low. The political process was in turmoil. The society was divided due to MANDIR-MANDAL controversies.

The New Economy and Industrial Policies adopted during this crisis period opened the doors for foreign loan and investment. This created stiff opposition and acute competition in India. The success of India's producing class was at stake. The policy was commented as anti-farming as it would bring disaster. The

Structural Adjustment Program which is otherwise the name for the new policy gave a stronger market orientation to farming by reducing export subsidies and converting all non-tariff barriers to tariff. This precluded the farming community of India to compete with foreign producing giants. This caused failure in production and supply of food grains particularly of course cereals consumed by the poor leading to rise in food grain prices. This caused tension among the majority of India's population who are poor.

Globalization should be viewed from another angle. In mid 1970s there was a need for liberalization. It was about reducing the restrictive and complex feature of the previous policies adopted in India. The failure of the Nehruvian model of development through planning and public sector dominance warranted such thinking. Though Nehruvian policy caused creation of good industrial base its continuation was treated as a drug in further growth of the economy.

India has twin problem of poverty and unemployment. The market economy is not a panacea for these challenges. India needs both growth and social justice. Without Human Resource Development India cannot achieve the twin objectives. The poorer social development in India because of lack of investment in education. India invests less in education for which human resources development suffers.

Further if there is more investment in human resource development funds may not be available for crucial sectors like defence and development. The world is globalized but conflict is localized. Hence defence cannot be given low priority in India as it is encircled by hostile nuclear neighbours.

India is one of the successful democracies and a prominent industrial power. The policy of globalization with its approach of liberalization and privatization have merits and demerits for our society. India cannot be equated with any developed European society as the population, poverty and philosophy of India are dissimilar from that of those countries. India has to think globally but will be required to act locally.

4.3.4 Social & ethnic tension

India is characterized by more ethnic and religious groups than most other countries of the world. Aside from the much noted 2000-odd castes, there are eight "major" religions, 15-odd languages spoken in various dialects in 22 states and nine union territories, and a substantial number of tribes and sects.

Three ethnic or religious conflicts have stood out of late: two occurred in the states of "Assam and Punjab; another, the more widely known Hindu-Muslim conflict, continues to persist. The Assam problem is primarily ethnic, the Punjab problem is based on both religious and regional conflicts, while the Hindu-Muslim problem is predominantly religious.

4.3.4.1 Ethnic conflict in Assam

Of the three conflicts mentioned, Assam has attracted the largest attention of late. Not since the 1947 partition of India have so many people were killed and uprooted as a result of ethnic or communal violence. By most available reports now, mob violence has claimed four thousand lives, rendered about 200,000 homeless, and forced a large number to leave the state for protection elsewhere. The immediate occasion of this bloodshed was the election held in February, though conflict and tension were present for the last three years. In Assam, three cultural disparate groups have been in collision: the Assamese, the Bengalis (both of which have segments of Hindus and Muslims) and the tribes, which are localized communities.

4.3.4.2 Historical Pattern of Migration

Assam has had the highest rate of population growth in India since the beginning of this century. Migration into the state accounts for a substantial part of this growth. Most migrants came from Bengal, including what is now Bangladesh (known as East Bengal before the 1947 partition and East Pakistan from 1947-71). Bengali migrants were both Hindus and Muslims. Bengali Hindus started arriving after the British created tea plantations in the middle of the nineteenth century. Because of their educational advantage over Assamese, they were better suited to man the growing administrative and professional machinery.

Bengali Muslims on the other hand, were mainly peasants. They originated predominantly in East Bengal, a highly populated area with low agricultural productivity and a fragmented landholding pattern incapable of supporting large families. In contrast, Assam was less populated, many areas were unsettled, and there was less pressure on the land. Bengali peasants made large tracts of waste, flooded and forested land habitable and productive along the southern bank of the Brahmaputra River, an area that is also populated by indigenous tribal groups, especially the Lalung.

Overall Bengali dominance began to manifest itself in various ways. They held urban professions, their language was more developed and widely used in Assam, and their education and even numerical superiority became more than evident. With the halting spread of education in the twentieth century, the Assamese middle class slowly emerged, and with the growth of the Assamese middle class, the seeds of what has been called "little nationalism" were sown in Assam.

4.3.4.3 Post-Independence Developments

After the partition of 1947 and the transfer of a very large Bengali Muslim district of Sylhet in East Pakistan, the Assamese middle class came to power for the first time in about a century. Through expanded educational programs and the use of Assamese as a language in the university, this newly acquired power, electrically buttressed, was used to consolidate the position of the Assamese middle class against the Bengali dominance in administrative services and professions.

On the other hand, the various tribes on the lower ranges were less developed than both of these contending communities. Depending on the preponderance of one or the other in their local context, they felt pressured, even exploited, culturally, economically and politically by both groups.

Despite the existence of an international border, the migration from East Pakistan continued alongside migration from West Bengal. There is considerable dispute over the actual magnitude, but the most comprehensive estimate shows that between 1961 and 1971 the proportion of Assamese declined for the first time and that of Bengali speakers increased; between 1971 and 1981 itself, as many as 1.2 million migrants were added to a population of 14.6 million in 1971. Moreover, the number of registered voters increased dramatically from 6.5 million in 1972 to 8.7 million in 1979, a rise which cannot be totally attributed to the coming of voting age to the previously ineligible. This last discovery of the Election Commission was, in fact, the starting point of the present phase of the organized student movement supported by large sections of the Assamese middle class. The movement has wide-ranging demands including development of Assam and greater share of benefits from its rich national resources, including oil, for the Assamese. Why the issue of deportation of "illegal aliens" has come to be the focus of the movement needs some explanation.

Despite the general anti-Bengali sentiment, the expulsion of migrants that came from West Bengal - these migrants are predominantly Hindus - could not be brought about legally or politically. Interstate movement and residence are perfectly legal in India, and the Assamese economy and society, despite the antagonism, are inextricably linked with West Bengal.

On the other hand, the "post-1947 place of origin" of migrants from Bangladesh, largely Muslim, makes them "aliens" and their migration, for political purposes, can be called "illegal." The students thus found a ground for demanding their expulsion. Additionally, these Muslim migrants provided unstinted support to the Congress Party, now represented by Mrs. Gandhi, and the party in turn patronized them, so much so that local politicians of the Congress Party seem to have put aliens on the electoral rolls irrespective of whether or not they had Indian citizenship.

It is in this atmosphere that the elections were called. Mrs. Gandhi has been heavily criticized in India for her decision to call the elections. Two considerations seem to have gone into her decision: her need for an electoral victory due to the reverses her party had suffered in recent state elections, and her intention to negotiate with a new set of elected leaders who would possibly be more pliable than students on the issue of "aliens."

Large-scale violence and destruction of lives, property, bridges, and various other resources resulted. In addition to the predictable attacks on Bengalis in the towns, there were massacres in which first pro-election Boro tribes attacked Assamese villages at Gohpur and later, in the worst massacre witnessed in independent India, another tribe, the anti-poll Lalung, reportedly with Assamese support, killed scores of Bengali Muslims in Nellie.

The spread of urban conflict to villages seems to be partly a result of the emergence of support for leftist parties in the previous elections. The land reform-oriented agrarian program of the left and its attempt to create a base in the Muslim peasantry seems to have antagonized the Assamese landlords and wealthier peasantry. The most popular party of the left, the Communist Party Marxist (CPM), is in power in West Bengal and therefore is associated with Bengalis. Moreover, tribals seem to be involved in the struggle over land, attacking whichever community, Assamese or Bengali, in possession of most of the land in their respective local situations.

Hold over government, struggle for jobs, land scarcity, and population influx have thus intensified the historical differences between Assamese and Bengali into violent ethnic antagonisms in Assam. All of this took place in a context of acute underdevelopment of Assam and slow economic growth. The anti-aliens agitation is an expression, among other things, of the Assamese fear of becoming politically swamped by an ever larger Bengali presence in the state.

4.3.4.4 Sikh-Hindu conflict in Punjab

Starting in August 1980, mounting communal tension between Hindus and Sikhs in the state of Punjab led to violent clashes, in the last year in particular. Unlike Assam, Punjab is a state with the highest per capita income. It is the seat of the Green Revolution in India, whose biggest beneficiaries have been the rich Sikh peasants. In Punjab, Sikhs are a majority, Hindus, a minority.

Although religious symbols have been used for the mobilization of Sikhs and the secessionist slogan of Khalistan (a sovereign state of Sikhs) has been raised, the Sikh's charter of demands, drawn from the Anandpur Sahib Resolution, has strong economic and political components, unlike in Assam where the issue of aliens has sidelined economic demands.

The "major" religious demands by the Sikhs, including greater radio time for religious broadcasts over federally controlled radio, and a separate legislative act for Sikh religious shrines, were granted by New Delhi this past February. The major political demands are greater powers, including financial, for the states vis-a-vis New Delhi. A commission has been appointed to review these demands.

The economic demands include a greater share of river waters for irrigation and larger central investment in the industrial sector of Punjab. The territorial and the water issues are the only unsettled points left. Other demands, minor at present, may later assume importance. The agitation continues unabated.

4.3.4.5 Classes, Religion and Green Revolution in Punjab

According to the 1971 census, Sikhs constituted 60.2% of Punjab's population and Hindus 37.5%. In the villages, the Sikh majority was even greater, constituting 69.4 % of the total rural population as opposed to 28.6% Hindus. In the urban areas, however, Hindus formed the majority, 66.4 % against 30.8 % Sikhs. Trade and services, rather than manufacturing, are the main sectors of urban economy in Punjab, and Hindu traders are dominant in both. The agricultural sector is dominated by the Sikh cultivating castes, known as jats.

Green revolution, based as it was on biochemical and mechanical inputs in farming and surplus production for market, deeply linked trade with farming and made the latter dependent on the market. Both for buying modern inputs and selling surplus produce, the richest Sikh farmer has to go through the urban market, dominated by the Hindu trader. So long as the economic pie kept increasing, this incongruity did not much matter, but when prices of food grain and other crops stopped increasing, a clash of interests between the Sikh farmer and the Hindu trader was created.

Irrigation problems have worsened the situation. That Punjab has the best irrigated farming in the country is not enough for the rich peasant; while 1.4 million hectares in Punjab are canal-irrigated, two million hectares are dependent on tubewells. Due to its power and diesel needs, tubewell irrigation, is "three to nine times more costly" (India Today). The prosperity of the rich peasantry thus slackened.

Other developments have occurred. Landlessness has increased from 17.3 percent in 1961 to 32.1 percent in 1971 and later. The landless, mostly Untouchables and low caste Hindus and Sikhs, have also become politicized by the leftist Agricultural Labor Union. Sikhs in urban trades are neither economically nor numerically as dominant as the Hindus. And finally, the proportion of Sikhs in the Army has fallen from 35 percent to 20 percent.

Amid these mounting uncertainties, religion both divides and unites.

For the rich Sikh peasantry, faced with Hindu traders on the one hand and politicized labor on the other, religion performs a useful role. It unites the Sikh trader, who is also opposed to the Hindu trader, and the low caste Sikh laborer by dividing the agricultural labor into lower caste Sikhs and low caste Hindus or Untouchables. Religious slogans appeal to the religiosity of the insecure small Sikh peasant and the unpoliticized Sikh laborer.

4.3.4.6 Power, Electoral Politics and Religion

It is unlikely that these links would have automatically led to political action without the mediation of political parties. This mediation did not simply reflect the emerging socioeconomic divisions; it deepened them. The two main rural parties, the ruling Congress and the Akali Dal, a party dominated by the rich Sikh peasantry, has contributed much towards this deepening. Scholars have noted the schizophrenic character of Punjab politics. It has a "dual political system and a dual political area," one secular and the other religious and confined to Sikhs.

Since the exhaustion of the green revolution in Punjab, this is the first time that Akalis have not been in power. Although they had their first relatively stable rule from 1977 to 1980, Congress returned to power

in 1980. The Akali elite, when in power, did not take up any of its present demands with New Delhi where its partner in electoral alliance, the Janata Party, ruled, but soon after the rival Congress returned, agitations were launched in support of the demands. The power implications seem reasonably clear: unless the enhanced economic power of the rich Sikh peasantry is matched with political power, peace will be difficult to maintain in Punjab. Either political power should compensate for the halt in its economic prosperity, or greater economic incentives must return as expressed in the river waters issue. The interests of the Akali political elites have thus coincided with those of the discontented peasantry..

4.3.4.7 The Hindu-Muslim problem

Of all the religious and ethnic issues in contemporary India, history has cast its deepest shadow on Hindu-Muslim relations. The most critical contemporary phase of this history was the partition of 1947. A Muslim sovereign state of Pakistan was born amidst ghastly communal violence but almost as many Muslims as there were in the new constituted Pakistan, for various reasons, stayed in India. The partition did not solve the Hindu-Muslim problems; it caused the situation of the Muslims in India to deteriorate. They were blamed for the division of the country, their leadership had left and their power was further weakened by the removal of all Muslim-majority areas except Kashmir. Most of all, the conflict between India and Pakistan kept the roots of the communal tension perpetually alive and pushed Muslims into the unfortunate situation of defending their loyalty to India. Even 36 years after independence, the problem has not been overcome; Hindu-Muslim riots have in fact increased in the last few years.

It would be wrong, however, to conclude that the entire Muslim community in India has been under pressure. First, even though a minority (according to the 1971 census, 11.2 percent of the Indian population was Muslim as opposed to 61.2 percent caste Hindus), Muslims are in a majority in one state and constitute 13.5 to 24 percent population in five states. There are 39 districts in India in which they comprise from between 20 percent to 94 percent of the population. Many cultural differences exist among them. Only 45 percent speak Urdu and there are caste and sect divisions. As many as 73 percent live in villages; only 27 percent are urban. This is particularly important, after 1947 the Hindu-Muslim riots occurred for the most part, in urban centers. Most of these towns are modernizing, middle-size towns such as Aligarh, Moradabad, Meerut, Ranchi, Baroda, Hyderabad, Trivandrum. In the big and/or industrialized cities such as Bombay, Delhi, Ahmedabad, the communal fury, whenever it has erupted, has remained confined to the older parts of the city. Villages have remained largely undisturbed. Acute communal consciousness occurs largely in the middle class; its most fertile bases lie in the lower middle classes of growing middle size towns with sizeable Muslim populations.

Discrimination exists at other levels in other parts of the country. Decline in the status of Urdu in north India, widespread use of Hindu mythologies and symbols in school textbooks and continuing controversy over the foremost educational institution of Muslims, the Aligarh University, have indeed done much to provoke Muslim fears. Evidence that the police and administrative machinery in recent riots have sided with violent Hindus has further deepened widespread feelings of discrimination.

The emerging character of electoral politics has made matters worse. Communal Hindu parties apart, even the ruling Congress Party, professedly secular, has, since independence, had an dualistic character. The secular strain in the Congress was represented by Nehru but the communal strain was also present in the form of Patel, India's First Deputy Prime Minister, and was more pronounced at the provincial level. Nehru's stature kept the communal strain in check, but in the seventies, the party machinery has been taken over by the new generation of leaders, whose power and mobilization is based less on secularism or socioeconomic programs and more on exploiting caste and religious divisions at the local levels.

If Nehru showed the integrative potential of democratic politics, the new leaders have shown its divisive potential. Muslims are the largest minority. Their votes can swing political fortunes. The parties have not hesitated to fan communal flames for electoral gains. The most recent example of this was the openly communal campaigning by the Congress in the violence-torn Assam elections. This new mode of realpolitik has been adopted by the new provincial and local leaders of most parties. The higher recent incidence of Hindu-Muslim riots has a good deal to do with this new phenomenon.

4.3.4.8 Conclusion

It is easier to outline these problems than suggest what should be done about them. In a situation of mutual distrust, almost any solution will generate controversy. Still, three solutions seem plausible. First, further decentralization of power to states would be of considerable help. This would partly address the problems in Punjab and Assam, both of which have complained of the gap between the resources they are entitled to and the resources they actually process. Second, a conscious attempt needs to be made to improve the educational attainment and economic level is easily demonstrated of Muslims whose socioeconomic backwardness is easily demonstrated. The Muslim elite could do much in this respect. Special educational privileges are constitutionally sanctioned but they ought to be worked on. Modern liberal, as opposed to religious, education would be of great help. The government, for its part, could allay the apprehensions of the Muslim community by better representing Muslims in the police and paramilitary forces. Third, the secular leaders, to the extent that they exist, must make a sustained effort to reintroduce and deepen secular, socioeconomic concern in democratic politics. Partisan communal leaders and communal electoral mobilization, both within and outside the communal parties, but particularly within the ruling party, should be exposed. Aware leadership - political, social and intellectual - has to work for this political reconstruction. Definitive resolution of problems may be inordinately difficult but substantial alleviation is not.

4.4 Gender discrimination

In Sociology the word gender refers to the socio-cultural characterization of man and woman, the way societies make a distinction between men and women and assign them social roles. The distinction between sex and gender was introduced to deal with the general tendency to attribute women's subordination to their anatomy.

For ages it was believed that the dissimilar characteristics, roles and status accorded to women and men in society are determined by sex, that they are natural and therefore not changeable.

Gender is seen closely related to the roles and behavior assigned to women and men based on their sexual differences. As soon as a child is born families and society begins the process of tendering. The birth of the son is celebrated, the birth of a daughter filled with pain; sons are showered with love, respect, better food and proper health care.

Boys are encouraged to be tough and outgoing; girls are encouraged to be homebound and shy. All these differences are gender differences and they are created by society.

Gender inequality is therefore a form of inequality which is distinct from other forms of economic and social inequalities. It dwells not only outside the household but also centrally within it. It stems not only from pre-existing differences in economic endowments between women and men but also from pre-existing gendered social norms and social perceptions.

Gender inequality has an adverse impact on development goals as reduces economic growth. It hampers the overall well being because blocking women from participation in social, political and economic activities can adversely affect the whole society. Many developing countries including India have displayed gender inequality in education, employment and health.

It is common to find girls and women suffering from high mortality rates. There are vast differences in education level of two sexes. India has witnessed gender inequality from its early history due to its socioeconomic and religious practices that resulted in a wide gap between the position of men and women in the society.

The origin of the Indian idea of appropriate female behavior can be traced to the rules laid down by Manu in 200 B.C.: "by a young girl, by a young woman, or even by an aged one, nothing must be done independently, even in her own house". "In childhood a female must be subject to her father, in youth to her husband, when her lord is dead to her sons; a woman must never be independent."

Women's lives are shaped by customs that are centuries old. "May you be the mother of a hundred sons" is a common Hindu wedding blessing. Statistics reveal that in India males significantly outnumber females and this imbalance has increased over time. The sex ratio according to a 2001 census report stands at 933 per 1000 males. Out of the total population, 120 million are women who live in abject poverty. The maternal mortality rate in rural areas is among the world's highest.

From a global perspective India accounts for 19% of all live births and 27% of all maternal deaths.! The deaths of young girls in India exceed those of young boys by over 300,000 each year and every 6th infant death is specifically due to gender discrimination. Women face discrimination right from the childhood. Gender disparities in nutrition are evident from infancy to adulthood.

In fact, gender has been the most statistically significant determinant of malnutrition among young children and malnutrition is a frequent, direct or underlying, cause of death among girls below age 5. Girls are breast-fed less frequently and for a shorter duration in infancy.

In childhood and adulthood, males are fed first and better. Adult women consume approximately 1,000 fewer calories per day than men according to one estimate. Nutritional deprivation has two major consequences for women they never reach their full growth potential, and suffer from anemia, which are risk factors in pregnancy.

This condition complicates childbearing and results in women and infant deaths, and low birth weight infants. The tradition also requires that women eat last and least throughout their lives even when pregnant and lactating. Malnourished women give birth to malnourished children, perpetuating the cycle. Women receive less healthcare facilities than men.

A primary way that parents discriminate against their girl children is through neglect during illness. As an adult they tend to be less likely to admit that they are sick and may wait until their sickness has progressed far before they seek help or help is sought for them. Many women in rural areas die in childbirth due to easily preventable complications.

Women's social training to put up with suffering and their unwillingness to be examined by male personnel are additional constraints in their getting sufficient health care.

The Constitution of India ensures gender equality in its preamble as a fundamental right but also empowers the state to adopt measures of positive discrimination in favor of women by ways of legislation and policies.

India has also ratified various international conventions and human rights forums to secure equal rights of women," such as ratification of the Convention on elimination of all forms of discrimination against women in 1993. Women have been finding places in local governance structures, overcoming gender biases. Over one million women have been elected to local Panchayats as a result of 1993

Amendment to the Indian Constitution requiring that 1/3 rd of the elected seats to the local governing bodies be reserved for women. The passing of the Pre-natal Diagnostic Tech Act in 1994 also is a step in removing gender discrimination.

This Act seeks to end sex- determination tests and female foeticide and prohibits doctors from conducting such procedures for the specific purpose of determining the sex of the fetus. The Government also announced the National policy for empowerment of women in 2001 to bring out advancement, development and empowerment of women.

The Government has also drawn up a draft National policy for the empowerment of women which is a policy statement outlining the state's response to the problems of gender discrimination. As a persistent gender inequalities continue we need to rethink concepts and strategies for promoting women's dignity and rights. UN Secretary General Kofi Annan has stated, "Gender equality is more than a goal in itself.

It is a precondition for meeting the challenge of reducing poverty, promoting sustainable development and building good governance." There is a need for new kinds of institutions, incorporating new norms and rules that support equality and just relations between women and men. These days women are organizing themselves to meet the challenges that are hampering their progress.

4.5 Empowerment of women

Women's empowerment and what it means in India's context. Women in India can broadly be categorized under the urban and the rural. While women's empowerment may mean a lot to the urban women of India, it may not even strike a chord for the countless women folk of rural India who by far outnumber women living in urban India.

While the women living in metropolitan cities as well as smaller cities can definitely identify themselves with any women linked program or join a movement connected with women, and can hope to participate in that for their benefit, the rural urban divide and disconnect in India prevents the same benefits from reaching the women folk living in our villages.

Another major drawback and difference between both the categories of women is that majority of women in rural India presently, in the age bracket of 35 – 65 years have been kept away from any form of formal education. The scene is changing rapidly for the better for the present younger generation where a large number of young girls from villages are seen to be attending schools and even colleges, but this was not so earlier.

Thus lack of basic education has indeed prevented the girls in rural India in comprehending what their basic civil liberties are. Their real empowerment is thus confined within the four walls of their homes, and there too they are a shadow of their own self and have to follow the wish of their menfolk.

On the other hand, the urban woman is far more educated, sophisticated, demanding, and aware of her own rights and liberties and generally more well equipped to take care of her own self. Even among the urban women we have a divide; the rich and novae rich and the poor and the middle class. The rich and super rich class of women in India get the maximum advantage of women's rights, civil liberties, the programs beneficial to women and are generally in command of their situation both at home and at their workplace. This is generally the situation of urban women belonging to the upper strata in India across bigger metros as well as smaller cities.

However the situation is not so rosy within the women comprising the upcoming growing middle class in India. This stratum of society generally forms the bulk of women in urban India spread across big and smaller cities as well as the metros. The women in this group are basically stuck between their homes and the office routine as most of them are in gainful employment either in the vast majority of Government offices or in private workplaces. They don't have sufficient time or freedom on their hands to put into practice the various benefits emanating from other schemes of social welfare or women oriented schemes announced by either Government or the private sector.

The last affected in this category of urban women, which ultimately succeed in forming a bridge between the urban poor are the women who come looking for jobs in the city from a rural background. These urban women are from poorer stratum and fed up of the life of squalor and misery in their villages, take flight to the cities of urban India in the hope of getting a far more satisfactory lifestyle. In fact they are attracted by the alluring lifestyle and glamour promised sometimes by the touts and pimps of the city who are constantly roaming around the villages scouting for their prey. Invariably they succeed in luring away to the city a large number of women who either end up as sex slaves in a sick brothel or get some menial jobs as maid servants in the bigger cities of India where household chores are generally looked down upon and frowned by the upper stratum of women.

When we talk about women's empowerment or movements like 'one billion rising' we have to keep in mind the status of women prevalent in all these above categories of both urban and rural India mentioned above.

If we feign ignorance about the majority of the womenfolk in the villages of India, as well as those belonging to the poor and middle class working women in urban India, as and when we talk about women's empowerment, we could end up doing a great disservice to these women. It is in fact these women who remain mostly ignorant of their basic human rights, who need to be awakened from their stupor. It is in fact this class and stratum of society of women who need to unshackle themselves from the ignorance of backwardness and get acquainted with the promised life unfolding before them. These women both in the urban and the rural sector, in fact account for at least 70% of the total women force who are denied their basic rights available to them. It is this stratum of women in India who need to be really awakened, and made aware of what can unfold for them. These women if made to come up to their real potential can really redefine the meaning of women's empowerment in a developing Country like India. A Country where women are cherished and worshiped in the form of Goddesses' like Sita, Durga and Lakshmi is really struggling to make its women aware of their simple basic human rights.

A woman in most parts is looked upon more as an object of glamour or a mere sex object rather than somebody who can share and shoulder the equal and sometimes dominant responsibilities of decision making in the home and at work place. Although things are slowly changing for most women in India, but the change is so slow and subtle that it is hardly noticeable. The core areas concerning women are still in the process of being discovered and opened up for them. Till that happens it's an uphill task for the majority of the women in both rural and urban India.

In fact it becomes the pious and solemn duty of those women who have understood the power of complete women's empowerment, to come forward and willingly educate and embolden the fortune of the less fortunate and underprivileged section of Indian women. This would prove to be a real test of their character and magnanimity towards the less fortunate of their own. Till this happens, women in India will continue to suffer in silence. The time has come to break this chain, and free the women from their shackles and bondage from which society has constantly sought to bind them. Cheers for the awakening of all women!

4.5.1 Legal Empowerment Of Women in India

In today's liberalized scenario, women form an indispensable part of the Indian workforce. In such an environment, the quality of women's employment is very important and depends upon several factors. The foremost being equal access to education and other opportunities for skill development. This requires empowerment of women as well as creation of awareness among them about their legal rights and duties. In order to ensure this, the Government of India has taken several steps.

It has been implementing many programs which aim at providing access to education and vocational training for women. The most important being, the 'Women's Vocational Training Program' launched under the Directorate General of Employment & Training (DGE&T) in the Ministry of Labor. The program attempts to promote the women's employment in industry (mainly organized sector) as semiskilled, skilled and highly skilled workers by increasing their participation in skill training facilities. Under this program, a separate 'Women's Training Wing' has been set up at DGE&T Headquarters, which is responsible for designing and pursuing long term policies related to providing vocational training to women in the country. Also, as part of the program, in the Central Sector, one National and ten Regional Vocational Training Institutes have been set up in dissimilar parts of the country. While, in the State Sector, a network of exclusive 'Women Industrial Training Institutes (WITIs)' has been set up under the administrative control of the State Governments. These institutes provide basic skill training to women.

Also, the Government has been making efforts for creating a congenial work environment for women workers. For this purpose, a separate 'Cell for Women Labor' has been set up in the Ministry to focus attention on the condition of working women and bring about an improvement therein. The Cell has the following functions:-

- Formulation and coordination of policies and programs for the female labor force within the framework of national manpower and economic policies.
- Maintaining liaison with other Government agencies to secure effective implementation of the programs in respect of women workers.
- Monitoring the implementation of the Equal Remuneration Act, 1976.
- Setting up of an Advisory Committee under the Equal Remuneration Act, 1976.
- Giving grants-in-aid to Non-Governmental Organisations/ Voluntary Organisations to formulate and execute action oriented projects for women workers.

Moreover, a number of protective provisions have been incorporated in the various laws enacted for equality and empowerment of women, the proper enforcement of which will create an enabling environment for women workers.

Review Questions

1. Define the Regional disparity in India?
2. Explain the main problems in India?
3. Explain the Gender discrimination?
4. Explain the Empowerment of women?

Discussion Questions

Discuss the causes of Regional disparity in India?

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